



West Bengal University Of Technology  
Kolkata

## **Tender Document**

for

**Supply, Erection, Testing & Commissioning of Outdoor, Silent Type 500 KVA Diesel Generating Set for West Bengal University Of Technology campus Kolkata**

Tender No.	GEN/FO/UGC/24
Date of Issue of Tender	2-MAR-2011
Last Date of Submission	28-MAR-2011
Date of Opening	28-MAR-2011 at 3:00 pm



West Bengal University Of Technology  
Kolkata

TENDER DOCUMENTS FOR : **“Supply, Erection, Testing & Commissioning of Outdoor, Silent Type 500 KVA Diesel Generating Set for West Bengal University Of Technology campus Kolkata**

Name of the Contractor

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Address

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Date of Submission

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## West Bengal University Of Technology Kolkata

No:-.GEN/FO/UGC/24

Dated :-2/03/2011

### **Notice Inviting Tender**

Tenders in the prescribed forms are hereby invited on behalf of the West Bengal University Of Technology,Kolkata for **“Supply, Erection, Testing & Commissioning of Outdoor, Silent Type 500 KVA Diesel Generating Set for West Bengal University Of Technology Campus Kolkata”**.

Estimated cost of Rs.40,00,000.00.

1. The tender papers consisting of the details plans, complete specifications, the scheduled of quantities of the various clauses of work to be done, and the set of conditions of contract to be complied with by the person whose tender may be accepted can be downloaded from the WBUT website <http://www.wbut.ac.in>
2. The site for the work is available/or the site for the work shall be made available in the parts as specified below.
3. Tenders which should be always be placed in sealed cover, with the name of the work written on the envelope will be received by the Office of the Finance Officer, WBUT section up to 2:00 P.M. of 28-Mar-2011 and will be opened on the same day at 3:00 P.M.
4. The time allowed for carrying out the work will be 3 (Three) Months from the day after the date of written orders to commence the work.
5. The contractor should quote the figures as well as in words the rate and amount tendered by them. The amount for each item should be worked out and the requisite totals given.
6. When a contractor signs a ternder in an Indian Language the total amount tendered should also be written in the same language.

7. Earnest Money, amounting to Rs.1,00,000.00(One lakh Only) in Demand Draft in favour of “ West Bengal University of Technology” payable at Kolkata, must accompany each tender and each tender is to be in a sealed cover superscribed with “**Supply, Erection, Testing & Commissioning of Outdoor, Silent Type 500 KVA Diesel Generating Set for West Bengal University Of Technology Campus Kolkata**” and addressed to the Finance Officer, WBUT. **The application(tender) fee of Rs. 1000/- has to be submitted in the form of demand draft along with the application.**
8. Earnest Money of the successful bidder is to be converted into security deposit, further sum amounting 10% or as applicable will be deducted from your running bill(s)/final bill.
9. The acceptance of a tender, will rest with the authority who does not bind himself to accept the lowest tender, and reserves to himself the authority to reject any or all the tenders received without the assignment of a reason. All tenders in which any of the prescribed conditions are not fulfilled or are incomplete in any respect are liable to be rejected.
10. Canvassing in connections with tenders is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to rejection.
11. All rates shall be quoted on the proper form of the tender alone.
12. On acceptance of the tender, the name of the accredited representative(s) of the contractor who would be responsible for taking instructions from the Engineer-in-Charge shall be communicated to the Engineer-in-Charge.
13. Special care should be taken to write the rates in figures as well as in words, and the amount in figures only, in such a way that interpolation is not possible. The total amount should be written both in figures and in words. In case of figures, the word “Rs.” should be written before the figure of rupees and words “P” after the decimal figures, “e.g., Rs.2.15P” and incase of words “Rupees” should precede and the word “Paise” should be written at the end. Unless the rate is in whole rupees and followed by the words “only” it should invariably be upto two decimal places. While quoting the rate in schedule of quantities, the work “only” should be written closely following the amount and it should not be written in the next line.
14. The University does not bind himself to accept the lowest or any tender and reserve to himself the right of accepting the whole or any part of the tender and the tenderer shall be bound to perform the same at the rate quoted.
15. Sales Tax or any other tax on material in respect of this contractor shall be payable by the contractor and Govt. will not entertain any claim whatsoever in this respect.
16. The contractor shall not be permitted to tender for works in the University in which his near relative is posted as Divisional Accountant or as an Officer in any capacity between the grades of Superintending Engineer and Engineer (Both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to

any Officer in the University. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this University.

17. The contractor shall give a list of University employees related to him.
18. No Engineer of Officer rank or other employees employed in Engineering or Administrative duties in an Engineering Department of the Govt. of India University is allowed to work as a contractor for a period of two years of the retirement from Govt. service University, without the previous permission of the Govt. of India University. This contractor is liable to be cancelled if either the contractor or any of this employees is found at any time to be such a person who had not obtained the permission of the Govt. of India University as aforesaid before submission of the tender or engagement in the contractor' service.
19. The tender for the work shall remain open for acceptance for period of 120 days from the date of opening of the tender. If any tenderer withdraws his tender before the said period or makes any modifications in the terms of prejudice to day other right or remedy be a liberty to forfeit 10% (ten percent) of the said earnest money.
20. The contractors exempted from payment of earnest money/security deposit in individual cases should attach with the tender an attested copy of the University's letter exempting them from the payment of earnest money and security deposit and should produce the original whenever called upon to do so.
21. The tender for the work shall not be witnessed by a contractor or contractors who himself/themselves has/have tendered or who may and has/have tendered for the same work. Failure to observe this condition would render tenders of the contractors tendering as well as witnessing the tender liable to rejection.
22. The Contractor shall submit list of works which are in hand (Progress) in the following form :

Name of WorkName and particulars of Division where work is being executed.	Amount of work	Position of works in progress	Remarks
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23. Rates quoted by the contractors in item rate tender in figures and words shall be accurately filled in so that there is no discrepancy in the rates written in figures, and in word. However, if a discrepancy is found the rates which correspond with the amount worked out by the contractor shall be taken as correct.
24. If the amount of an item is not worked out by the contractor or it does not correspond with the rate written either in figures or in words that the rate quote by the contractor in words should be taken as correct.

25. Where the rate quoted by the contractor in figures and in words tally but the amount is not worked out correctly, the rate quoted by the contractor will be taken as correct, not the amount.

## **GENERAL SPECIFICATION AND CONDITIONS**

1. The work shall be carried out as per National Code or P.W.D. specifications for works at West Bengal or other wise as specified in the Schedule of Quantities for the works.
2. The rates on percentage quoted by the contractors shall be for all leads, lifts, depth etc. unless otherwise specified in the schedule of quantities attached to agreement.
3. The work will be carried out as per instructions given by the Engineer-in-Charge and as per layout plan and the contractor shall be bound to carry out the work in accordance with the revised instruction and /OR modified drawing.
4. The brick shall be second class and / or first class bricks or a specified in the schedule of quantities and shall be of local best available size. To use first class brick only for construction of feeder pillar foundation.
5. All the materials such as stone chips. Sand pipes and other materials to be used in the work shall have to be approved by the Engineer-in-Charge not below the rank of Assistant Engineer.
6. No pipe line shall be covered until the same has been approved by the Engineer-in-Charge.
7. All charges for the Municipal fees and other taxes that may be payable as per local Municipal rules be paid by the contractors and his rates for such items shall be inclusive of all such charges. Nothing extra will be paid on this account by the department.
8. The contractor shall construct suitable go-down at the site of work for storing the materials safe against damage by Sun, Rain, dampness, fire, theft, etc. at his own cost. He shall also employ necessary watch and ward establishment for tools and plant and other materials issued to him at his own cost. No extra payment shall be made on this account.
9. After laying of cable in underground the trench must be strictly mended and duly rammed with a rammer or rolled with a roller.
10. The fences damaged while digging the trench in individual quarters must be mended using barbed wire and bamboo or concrete pillars.
11. All G.I. items mentioned in the entire tender should be or hot dipped galvanization.
12. All light brackets are to be made first as specified in the tender and then hot dipped galvanizations are to perform. No cracks are acceptable on brackets.
13. Empty cable drums are to be deposited to the Section or Store as desired by Site-in-Charge.
14. Any item used while execution of the work, should be duly approved by the department.
15. Prior to commencement of the work Registration from labour enforcement office has to be taken. Also it may be noted that minimum wages as per minimum wages Act must be paid to the contract labours. Currently the minimum wage as per G.O. I norms is Rs.133/- which must be followed.
16. The Site Supervisors should posses supervisory competency certificate and the Electricians should have proper work permits.
17. Safety of materials issued by the Department to the Contractor is the contractors' responsibility.

**Name of Work : Supply, Erection, Testing & Commissioning of Outdoor, Silent Type 500 KVA Diesel Generating Set for West Bengal University Of Technology campus Kolkata.**

Sl.No.	Description of work	Unit	Qty	Rate	Amount (Rs.)
1	Supply, Erection, Testing & Commissioning of Outdoor, Silent Type 500 KVA Diesel Generating Set for West Bengal University Of Technology Kolkata including all civil works related to the foundation of the DG set. Make : Cummins/Kirloskar/Jackson/Mahindra/Cotton and Greaves or equivalent.  Detailed specifications as per Annexure attached.	No.	1		
2.	Supply of 3.5Cx1.1kVx300sqmm AL conductor steel strip armored PVC/XLPE insulated cable	Mtrs	200		
3	Laying of double run of the above cable in underground trench after excavation of soil.Trench size will be 750mmx250mm with box type brick protection with a barrier of brick between each layer and at the sides and covering each cable at the top with a brick(28bricks/m)	Mtrs	100		
4	GI plate earthing(600mmx600mmx3mm) with GI plate and 3.0m long pipe welded to GI plate with 8swg GI earthing conductor strainer and complete chamber with RC cover and CI plate ,soil treatment with salt and charcoal as per IS 3034	Nos	2		
<b>(Rupees in words)</b>					

## Annexure

### **Detailed Specification of Outdoor, Silent Type 1 No. 500 KVA Diesel Generating Sets.**

The one number 500 KVA, 415 Volt Silent type DG Set required for Kolkata Extension Centre shall be self-excited, self regulated, star connected, brush less, water-cooled, silent type and designed as indicated to give required output including the following :-

#### **ENGINE :**

The Diesel Engine shall be water-cooled type and suitable for running at least 72 hours continuously giving the required BHP at 1500 rpm in worst ambient conditions mentioned in the specification. It shall use HSD as fuel. It shall generally be in accordance with BS-5514. The engine shall be capable of taking an overload of 10% for one hour during any 12 continuous hours running. Suitable starting arrangement shall be provided. All tools and tackles required for maintenance of the engine shall be supplied along with the engine. The following items shall be included with the engine.

1. Suitable Turbo charger using waste energy.
2. 24V electric starting system as applicable, complete with starter gear-ring, starter motor and batteries.
3. 24V battery charger with tickle and float charging suitable for drawing power from 230 volt ac supply.
4. Radiator, cooling fan and water circulating pump of high performance for efficient cooling.
5. Instrument panel with the following gauges :-
  - a. Start and stop push button.
  - b. Lubricating oil pressure gauge.
  - c. Water temperature gauge
  - d. Fuel level indicator
  - e. Tachometer-cum-hour meter (mechanical)
6. Flywheel with suitable housing
7. Flexible coupling with safety guard.
8. Centrifuge, gear type pump, filter and cooler for lubricating oil
9. Double bowl fuel oil filter, pre filter, water separator.
10. Fuel injection system complete with injector pump, nozzle, governor
11. Fuel shutdown solenoid 24VDC
12. Air Filter
13. Residential type silencer
14. Engine protection unit with safety control for low lubricating oil pressure and high water temperature. It shall provide audio alarm and visual indication with automatic shutdown. Audiovisual indications for the above shall be provided on the main control panel.
15. Standard oil resistant flexible hoses connection for fuel system.



16. Exhaust flexible pipe with necessary flanges, connection and heat insulation up to 15 mtrs (height of building) as per CBCP and all mandatory statutory norms.
17. Anti vibration mounting pads.

### **ALTERNATOR :**

The AC alternator shall be rated for 3-phase, 4-wire, 415V, 50Hz operating system. It shall be rated for 100 capacity running at 1500 rpm with IP-21 degree of protection. It shall be brush-less type and capable to catering load up to 0.8 (lagging) power factor. It shall be self regulated, self excited, screen protected drip proof and fitted with end shield, ball/roller bearings etc. It shall be provided with class “F” or “H” insulation. The band of voltage regulations shall be limited to + 2.5% of the mean voltage. Required current transformers shall be provided for Differential and REF protection of the generator. The Alternator shall generally confirm to BS:2163/IS:4722.

### **ACOUSTIC ENCLOSURE :**

The Diesel Generating set shall be housed inside a factory built, high quality, ready to use acoustic enclosure. The enclosure shall be so designed that the temperature inside the enclosure shall not be more than 5 degree centigrade above the ambient. The design of enclosure shall be duly approved and guaranteed by the engine manufacturer. The noise level should be reduced to adhere to all mandatory noise regulation norms.

The enclosure shall be fabricated out of mild steel components. Proper clearances in all sides of the DG set shall be provided for easy maintenance. The enclosure shall be duly treated for degreasing pickling, phosphating and passivation. Its surfaces shall be finished with powder coating/epoxy painting. A viewing window shall be provided to monitor the control panel/Instrument panel.

The fuel tank for capacity shall be adequate to store diesel sufficient to run it for 12 hours at full load and placed inside the enclosure. There shall be provision of proper illumination inside the enclosure to facilitate maintenance of the DG Set.

The insulating materials, such as rock wool/mineral wool etc. used for the purpose, shall have high sound absorption quality, high temperature withstand capacity and high fire retardant capability. It shall confirm to IS: 8183. Sound alternators/down stream silencers may be provided at all opening for air inlet/outlet to facilitate flow of air with low noise.

### **CONTROL PANEL :**

The control panel shall be installed inside the acoustic enclosure. It shall be fabricated out of sheet steel and have hinged doors, removable bottom gland plate, bus bar arrangement for incoming & outgoing cable end termination and required protections and metering arrangements. It shall be dust proof, vermin proof, totally enclosed suitable for indoor use with IP:52 class of protection. The cable entry facility shall be provided from bottom.

The control panel shall primarily consist of a 800Amp TP MCCB along with microprocessor release provided for O/C-E/F-S/C having variable time delay facility. Arrangement for termination of adequate number and sizes of PVC insulated PVC sheathed 1100 volt grade armoured aluminium

cable shall be made on the outgoing MCCB. The control panel shall be complete duly factory wired and have facility for Auto START and Auto STOP of DG set without actual transfer of load. Following measuring instruments shall be fitted to the control panel.

1. One number 96 x 96 mm size 0-500 volt AC voltmeter with selector switch and control fuses.
2. One number 96 x 96mm mm size 0-630 Amp AC ammeter with required current transformers and selector switch.
3. One number frequency meter.
4. One number power factor meter.
5. Push buttons for Engine start, Engine stop, reset, ACB open, ACB close, ACB trip,
6. Window fault annunciation for load on main, load on set, set running, DC control on, start failure, overload, DC control ON, low oil pressure, high water temp.

The make of panel component shall be as follows :-

1	MCCB	L&T/ABB/Seimens/Legrand
2	Relays	Alstom/L&T
3	A.C.Voltmeter/Ammeter/Frequency meter/Power factor meter	AE/IMP/MECO/Rishab/Conzerv
4	Selector switch	Kaycee/Saltzer
5	Current Transformers	AE/IMP/MECO/L&T
6	Push button	Esbee/Echnic/Kaycee/L&T
7	Start counter	GUJRAL

### **AUTO MAINS FAILURE**

Auto mains failure facility is to be provided to facilitate immediate starting of the Engine in case of power failure and provisions should be made for Auto changeover facility. The DG set will start automatically when the power fails. It shall then switch the load on to the DG power automatically. On restoration of normal power supply the DG will switch Off automatically after 5 mins. and smoothly transfer the load back to the normal power supply.

## SPECIAL CONDITIONS

- AMF arrangement shall be provided.
- The supplier shall provide all consumable items for installations, testing and commissioning at site free of cost alongwith first fill of fuel and lubricating oil.
- Pre-delivery inspection for the complete DG set assembly as well as acoustic enclosure and control panel shall be conducted at the factory of the manufacturer and witnessed by the purchaser or his authorized representative. In Pre-delivery inspection, the DG set shall be tested without acoustic enclosure and control panel. Besides other tests, the fuel consumption at different loading i.e. 25%, 50%, 75%, 100% and 110% shall be tested for 1 hr interval (each).
- After completion of the installation, testing and commissioning, the supplier shall conduct minimum 8 hours test runs with available load up to full satisfaction of the Engineer-in-charge. The cost of fuel and other consumables required for the test run shall be borne by the supplier.
- Suitable battery charger from 230 Volt AC power supply shall be provided for charging of the batteries when the DG is not under running condition.
- The bidder is requested to visit the site and verify the site conditions to determine the requirement of fuel piping, exhaust piping etc. The bidder shall furnish the layout drawing of the DG room indicating the location of the fuel tanks and exhaust arrangements etc.
- The supplier shall obtain statutory clearance from the Electrical Inspector for the installation. Statutory fees for obtaining the clearance shall be borne by the WBUT
- Statutory Clearance from Pollution Control department must also be coordinated by the contractor while the statutory fees will be borne by the university
- The rates quoted shall be firm and inclusive of all taxes, duties as applicable, freight/transportation, insurance, erection, testing, commissioning charges etc., complete till handling over of the installation including works contract tax as currently applicable. The bidders shall mention current rate of taxes and duties in a separate sheet. In case of statutory variation in taxes and duties., the same shall be considered on production of documentary evidence to WBUT.

## GUARANTEED TECHNICAL PARTICULARS

(To be furnished by the bidders)

(A)	Alternator		
1	Name of manufacturer	:	
2	Brand Name	:	
3	Factory Address	:	
4	Reference Standard	:	
5	Frequency	:	
6	Rated Voltage	:	
7	No. of phases	:	
8	Rated speed	:	
a)	No load	:	
b)	Rated load	:	
9	Power Factor	:	
10	Rated output (KW/KVA)	:	
11	Rated Current	:	
12	Excitation system	:	
13	Class of insulation	:	
14	Temperature rise	:	
15	Efficiency at rated voltage and frequency and 0.8 pf	:	
a)	In full load	:	
b)	1/3 <sup>rd</sup> of full load	:	
c)	3/4 <sup>th</sup> of full load	:	
16	Short circuit rating (Peak)	:	
17	Type of enclosure	:	
18	Cooling system	:	
19	Variation in	:	
a)	Voltage	:	
b)	Frequency	:	
20	Overload withstand capacity	:	
a)	Momentary	:	
b)	Intermittent	:	
c)	Sustained	:	
21	Motor starting ability (Current/duration)	:	

	<b>PRIME MOVER</b>		
1	Name of the engine manufacturer	:	
2	Type of engine	:	
3	Model and number of cylinders	:	
4	IS rating	:	
a)	Rating A (with overload)	:	
b)	Rating B (without overload)	:	
5	Rating at site condition	:	
6	Direction of rotation	:	
7	No & arrangement of cylinders	:	
8	Whether two stroke or four stroke	:	
9	Bore (mm)	:	
10	Stroke (mm)	:	
11	Cubic capacity (Litres)	:	
12	Nominal Compression Ratio	:	
13	BMEP Developed	:	
14	Mean piston speed	:	
15	Muffler (silencer) type	:	
16	Filter type and make		
a)	Air	:	
b)	Fuel	:	
c)	Lubricating Oil	:	
17	Recommended fuel oil specification	:	
18	Fuel oil tank capacity	:	
19	Lubricating oil specification	:	
20	Mode of starting, apparatus required	:	
21	Specific fuel consumption in Litres per hour under standard reference conditions as per I.S. 10000 part-II		
a)	At rated output	:	
b)	At 110% of rated load	:	
c)	At 75% of rated load	:	
d)	At 50% of rated load	:	
e)	At 25% of rated load		
22	Lubricating of consumption at 100% load in litre/engine operating hour	:	
23	Weight of engine	:	

24	Overall dimension of engine	:	
25	DC voltage of electrical system	:	
26	Schedule of recommended maintenance and overhead periods	:	
27	Aspiration	:	
	<b>ACOUSTIC ENCLOSURE</b>		
1	Name of Acoustic Enclosure manufacturer	:	
2	Enclosure material	:	
3	Insulation material	:	
4	Type of shutters	:	
5	Overall dimension L x B x H	:	
6	Noise level to be achieved	:	
7	Maximum rise in inside temperature above ambient at full load	:	
8	Provision of Illumination inside the enclosure	:	
9	Handling / Lifting facilities	:	

**Name of Work : Supply, Erection, Testing & Commissioning of Outdoor, Silent Type 500 KVA Diesel Generating Set for West Bengal University Of Technology campus Kolkata.**

**ADDITIONAL ITEM OF WORK**

<b>Sl.No.</b>	<b>Description of work</b>	<b>Unit</b>	<b>Qty</b>	<b>Rate</b>	<b>Amount (Rs.)</b>
1	Supply, Erection, Testing & Commissioning of Auto main failur (AMF) panel for 500 KVA DG set with provision of 2 nos.. 800 Amp. Microprocessor base, 50KA, draw out motorized ACB (Air circuit breaker), Auto/manual/test mode selection switch, metering (v.a.f.pf.kwh meter),Control relay, fault annunciation, battery charging equipment etc. The AMF panel shall be capable to deliver the transfer power at full load within switch over time 5 to 12 seconds complying the enclosed technical specification and providing mounting arrangement, minor civil works etc.	<b>No.</b>	<b>1</b>		
2.	Supply and laying of G.I strip of size 25 mm x 6mm for Earth connection from Earth Electrode to DG, AMF panel and other equipment etc. as required.	<b>Mtrs</b>	<b>60</b>		
3	Supply and making Cable end termination (crimping method) by using Brass compression gland, Aluminium lugs, PVC tape etc. as required for 3.5 core x 300 sq.mm. XLPE insulated Al. Armoured Cable.	<b>Nos.</b>	<b>8</b>		
<b>(Rupees in words)</b>					

## **Technical specification of Auto main failure (AMF) Panel for 500 KVA DG Set**

### **Scope :**

The scope of this section comprises Design, fabrication, supply, installation, testing & commissioning of AMF panel.

### **General :**

Electrical panel shall be provided and installed as specified, switch gear, rating and quantities are as specified in SOQ/BOQ.

The electrical panel shall be fully compartmentalized, totally enclosed, metal clad, flush front and back, cubicle pattern suitable for front access. The AMF panel shall generally conform to IS: 8623.

Drawing indicating the general arrangement of components and control wiring of AMF panel shall be got approved from Engineer in charge before commencement of fabrication.

### **Construction :**

In general the AMF panel shall have separate compartments for the switch gear and the control units. Separate gland plates shall be provided for mains, alternator units and the outgoings.

AMF panel shall be dust and vermin proof construction with minimum classification of IP: 42 suitable for indoor installation.

All doors and covers shall have neoprene gaskets. Adequate protection shall be provided so that ingress of dust and moisture encountered in indoor installation shall not in any amount be sufficient to interfere with the satisfactory operation of enclosed equipment.

AMF panel shall be free standing type as specified with basic structure being fabricated made out of minimum 2.0 mm thick CRCA sheet with reinforcing frame welded in place. All the doors shall also be 2.0 thick CRCA sheet steel.

All partitions shall be not less than 1.6 mm thick CRCA sheet. Door knob should be provided. The panel should be provided with drawing packet and lifting hooks etc.

The switch gear shall comprise a continuous line up of single/multitier cubicles. The design shall be of fully compartmentalized execution with metal partitions. Each switch gear or breaker shall be housed in an individual front access door.

Main incoming indication lamps, control switches and metering instruments shall be flush mounted on a separate cubicle/compartment.

Cont-----P/2



## **Functional requirement :**

The main function of AMF panel is to be enable automatic starting of the DG set in the event of commercial supply failure and transfer the load to the DG set, after the DG set had built up steady voltage and frequency, within the specified switchover time.

The AMF panel shall perform supervisory and monitoring functions for satisfactory operation of the DG set.

The AMF panel shall automatically shutdown the DG set after transfer of load to commercial supply on healthy restoration of commercial supply.

The AMF panel shall work in three modes.

2. **Auto mode** – While AMF panel works in ‘Auto mode’ no human intervention required to switch on/off DG or power contractors. When power fail the DG set is automatically started, load is changed over to DG etc. similarly when mains power is restored load is automatically changed over to mains and DG set is shut down.

3. **Manual mode** – In ‘Manual mode’ the operator has to perform all the required tasks. One has to switch ON the DG set, change over the load, shut down the DG set when commercial power supply is restored etc. Operating the DG set in manual mode may be required in following conditions :- When commercial power supply is hunting i.e. on & off one does not want DG set to get on automatically. In manual mode one can keep the load on DG set till commercial power stabilizes. There can be a situation where the connected load is more than the capacity of the DG set. It is required to switch off non essential loads and then switch-on the DG set. Due to some problem the DG set is not working in “Auto mode”.

4. **Test mode** – As name suggest DG set can be tested when commercial power is not failed. When AMF panel is put ON ‘Test mode’ the DG set starts automatically even if mains power is available. Load remains on the main power in test mode. If power fails while panel is in test mode the load will be automatically transferred to the DG set.

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## **Components for AMF section (Contactors, Relays, Auxiliary relays, Timer etc.) :**

Microprocessor based AMF relay with LCD display, auxiliary relays and timer etc. to fully accomplish the functions described below. All relays shall be numeric type in dust tight enclosures. Auxiliary relays and timers shall be plug in type with dust tight enclosures. Main contactor and alternator contactor shall be effectively interlocked so that one is opened before the other can be closed. In event of malfunctioning of AMF panel, provision shall be made for providing Bypass arrangement to feed power supply directly.

Cont---P/3

## Circuitry Logic :

The following is the circuitry logic and all the following function/operations shall take place automatically without the help of any operator.

- a). Continuously monitor commercial supply on all the 3 phase for voltage and frequency, total/partial failure etc.
- b). If any deficiency is detected in the commercial supply system incoming voltage such as low voltage less than 350 V, High voltage higher than 450 V, single phasing, low/high frequency, total failure of supply etc., immediately the commercial supply incomer switch gear (mains contactor) shall be tripped and electrically locked.
- c). Immediately upon tripping the commercial supply incomer, Initiate cranking of the Diesel Engine through the 24 V DC starting motor fitted in the DG set within pre-set time so as to quickly start the Diesel Engine.
- d). As soon as the DG set has developed frequency and voltage, transfer the load to the DG set by switching 'on' DG set supply (DG Contactor) switchgear and maintaining this status till the healthy mains supply is restored.
- e). Function (b), (c) and (d) have to be accomplished that on failure of the commercial supply, loads are provided with emergency power supply from DG set within a total time period not exceeding 15 seconds.
- f). When the DG set is running, continuously monitor operating parameters such as Alternator frequency, Alternator voltage, load current on all the three phases. Lubricating oil pressure of Engine, speed of the engine etc. In the event of any abnormality in the operating parameters, beyond acceptable limits, shut down the DG set with an audible signal and appropriate visual display indicating the nature of malfunction. In this situation, if healthy commercial supply gets restored, the load will be transferred back to mains within a pre-set time delay.
- g). On restoration of commercial supply, monitor the status of supply for a predetermined and preset interval of time (up to two or three minutes). If the commercial supply, remains healthy for this preset period, transfer the load to commercial supply by switching off the DG set contactor and switching on mains contactor (maintaining an effective interlock between the two feeder). The DG set will continue to run for a pre-set time period (adjustable from 30 secs. to 10 minutes). At the end of this time period the DG set shuts off. Automatically resetting all auxiliary relays for a restart should it be necessary.
- h). In the event of DG set not responding to the first signal/impulse to start then AMF panel shall make two more cranking efforts ( each for a preset cranking time and interval between each cranking effort). In case the DG set does not start even after three attempts then lock out the start circuitry and sound audible signal and visual display indicating "Sets fail to start". All the three attempts shall be completed within 25 seconds.

- i). Engine lube oil temperature high trip
- j). Manual operation of the DG set :

### **Manual operation of the DG Set :**

The AMF panel, though catering to the auto-start and other functions described above, shall facilitate, when over necessary, manual start, stop and test run of the DG set.

### **Tripping circuit :-**

The DG set and associated switchgear shall be tripped under the following conditions.

1. Incomplete start after a pre-set time /attempts.
2. Engine over speed
3. Engine coolant water high temperature
4. Engine low lubricating oil pressure
5. Engine lubricating oil temperature high
6. Alternator voltage low/high or single phasing etc.
7. Over current/short circuit trip to protect Alternator
8. Failure of DC control supply

### **Visual Indicators on the AMF panel :**

Indications shall be provided to give the following visual indications either in window annunciation / LED indications or in microprocessor based AMF relay, LCD display or in combination.

1. Main supply ON
2. Load on Mains
3. DG set ON
4. DG set Tripped
5. Alternator earth fault trip
6. Alternator under voltage trip
7. Alternator over voltage trip
8. Alternator over current trip
9. DG set over speed
10. Low Engine lube oil pressure trip

11. Coolant water temperature high trip
12. Failure to start the Engine after pre-set time
13. Master trip relay operated
14. 24V DC supply failure

### **Contactors, Relays, Auxiliary Relays, Timer :**

The suitable range and required numbers of control contactors, relays, Auxiliary relays and Timers three impulse units etc. shall be provided in the AMF panel so as to achieve the AMF panel function as described in circuitry logic, tripping and indication functions mentioned above and safe operation of DG set as per the requirement.

### **Metering & Others :**

Following indicating meters shall be provided in the AMF panel –

1. Digital AC Ammeter of suitable range with built in selector switch, CTs & HRC fuse – 01 set
2. Digital AC Voltmeter of suitable range with built in selector switch, CTs & HRC fuse – 01 set
3. Digital frequency meter - 01 No.
4. Digital power factor meter - 01 No.
5. Digital DC Ammeter - 01 No.
6. Digital DC Voltmeter - 01 No.
7. Hooter - 01 No
8. Selector switch (Auto/manual/Test ) - 01 No.

### **Battery Charger :**

One number of Battery Charger unit including transformer service rectifiers etc. suitable for charging batteries shall be provided in the AMF panel. The battery charger unit shall be float-cum-boost type. Under normal condition the battery shall be on float charge. The boost charger shall be capable to charge the fully discharged battery within 10 hours at 2.65V to 2.75V. The maximum output capacity shall not be less than 15A. The ripple content shall be limit to 5%. The battery charger shall protect the battery from over charging.

### **Earthing Arrangement :**

G.I. Strip / Al. strip of size 50 mm x 6 mm shall be run at the rear of the panel. Two number Earth terminals shall be provided at the end of the strip for connection to Earth system.