**MORMUGAO PORT AUTHORITY**
**ENGINEERING MECHANICAL DEPARTMENT**
**ELECTRICAL HEADLAND SECTION**

## NOTICE INVITING BUDGETORY OFFER

| | |
|---|---|
| Name of Work | **NAME OF WORK "Replacement of 500KVA DG set at Admin Building"** |
| Date of submission of budgetary quotation | On or Before **28/02/2024 at 11.00 Hrs.** |
| Address for communication: | Executive Engineer (E-HL),<br>Mechanical Engineering Department,<br>Mormugao Port Authority,<br>Electrical Section, 1st Floor,<br>Admin. Building,<br>Headland sada<br>Vasco-de-Gama<br>Goa - 403804 |
| Contact Details | Phone : (0832) 2594241, 2594244<br>Email : xene.mgpt@gmail.com |
| Website | www.mptgoa.gov.in |

**EXECUTIVE ENGINEER (E-HL)**
**MORMUGAO PORT AUTHORITY**

CME/XEN(EHL)/W-8/2024/ .02.2024

**Sub: Replacement of 500KVA DG set at Admin Building**

Mormugao Port Authority intends to carry out replacement of 500KVA DG set at Admin Building. As such, kindly furnish the budgetary quotation for the same (Scope of work enclosed as Schedule - 'A' and Price Schedule enclosed as Schedule - 'A1'.

Your budgetary quotation should reach to this office on 28.02.2024.

Thanking you,

Yours sincerely,

**EXECUTIVE ENGINEER (E-HL)**

# SCHEDULE - 'A'
# TECHNICAL SPECIFICATION

## 1.0 GENERAL

Mormugao Port Authority proposes to procure 1 No. outdoor type, 500 KVA, 415 Volts, Diesel Generator Set along with AMF panel to replace the existing 500KVA DG set, inclusive of CAMC for 5 years after completion of two years guarantee period at Admin Building, Headland, sada including providing Exhaust piping with all required accessories from the Hospital grade silencer of DG set up to the existing Chimney, providing earthing for the DG set as per the IE Rules i.e. 02 Nos. for body and 02 Nos. for neutral. This also includes Supplying & laying of LT Aluminium Armoured 31/2C Cable for connection of the DG set to the AMF panel and termination of both ends. Providing Suitable foundation for the DG set as per the OEM recommendations. The statutory approvals of CPCB/electrical inspectorate etc. as required shall be the responsibility of the Contractor.

## 2.0 SCOPE OF WORK

Supply of factory assembled, factory tested Engine-Alternator set with CPCB approved acoustic enclosure capable of delivering not less than 500 KVA at 0.8 pf at site conditions including all accessories like base frame, Hospital grade silencer, exhaust piping, fuel piping (C class) with bends, stop cock and other fittings/accessories as felt necessary for supply and return lines, suitable capacity of battery for starting on MS frame, battery charging dynamo/alternator as necessary, Anti vibration mounting arrangements, Engine instrument panel, new AMF panel, armoured copper conductor control cable with suitable glands from Genet to new AMF panel, 3½C X 300 sq.mm. LT Aluminium XLPE cable as per IS: 7098 Part-2 of, etc., complete conforming to the attached specifications as required.

2.1 Dismantling of existing 500 KVA DG set along with acoustic enclosure and complete accessories which is presently installed and is in working condition at Admin Building and shifting the same to MM division, Baina for Disposal.

2.2 Supply, erection, testing & commissioning of one number of silent type Generator Set of 500 KVA Capacity along with accessories and other items required for proper completion of the work as mentioned in the BOQ.

2.3 Dismantling and removing the existing AMF panel. Supply, Installation, connection, testing and commissioning of new AMF panel as per technical specifications.

2.4 Providing Exhaust piping with all required accessories from the Hospital grade silencer of DG set up to the existing chimney as per statutory requirements under pollution control.

2.5 Supply and laying 2 runs of LT 1.1 KV, 3.5c x 300 sq.mm armored Aluminum cable from DG Set to AMF panel and making end terminations for LT cables. Necessary control wiring to be carried out.

2.6 Supply, laying and termination of armored copper control wiring cable as per OEM standard and required quantity cable to connect DG set to AMF panel.

2.7 GI plate Earthing is to be provided as per latest IS: 3043 and IER amended upto date, for the Generator Set.

2.8 Providing standby generator of Min. 500 KVA rating, to maintain the power supply to the affected areas during the period of execution of work i.e from dismantling of exiting generator till commissioning of new generator.

2.9 All labours, materials, tools plants, machinery, equipments and any other things required for execution for work shall be arranged by the contractor at his own cost.

2.10 After successful commissioning of DG Set, the bidder shall carry out Comprehensive AMC for five years after expiry of two years of guarantee period.

**Note:** The bidder shall carry out the above complete work as per IER and other relevant standard. The scope of work is not restricted, If, any additional material or accessories are felt necessary, the contractor shall execute the same as per IER and relevant standard on the offered rate.

## 3.0 DETAILED TECHNICAL DESCRIPTION

### 3.1 DIESEL ENGINE

Diesel Engine shall be radiator cooled of any of the approved make capable of developing required BHP at 1500 rpm confirming to BS 5514/ISO 3046. To deliver specified continuous alternator output at 0.8 lagging power factor at NTP condition. Cooling system shall be designed and tested for 50°C ambient conditions

The exhaust pipe line shall be of suitable dia. for fixing the Hospital grade silencer with suitable supports at suitable intervals with all its accessories such as bends, flanges, couplings etc providing sleeves at the wall crossing complete as required.

The exhaust pipe line shall be with thermal insulation with glass wool, covered with wire mesh and gladded with 24 gauge aluminium sheet.

Engine shall be four stroke, reciprocating compression ignition (Diesel) type and Multi cylinder with electronic injection suitable for the above generating set. It shall have Integrated control module for engine and Exhaust After-Treatment System (EATS)

#### I) ENGINE INSTRUMENT PANEL AND SAFETY CONTROLS

i) INSTRUMENT PANEL

It shall comprise of the following:

a) Starting switch with key

b) Lube oil pressure gauge

c) Lube oil temperature gauge

d) Battery charging ammeter and battery voltage

e) Stop push button or lever.

f) Water temperature indicator

g) Radiator water level indicator.

ii) Safety control auto cut off for low lube oil pressure, High water temperature and over speed with audio and visual lamp indication on control panel.

## II) ENGINE ASSOCIATED ITEMS

i) Hospital grade silencer

ii) Starter Batteries

## III) SPEED & GOVERNING

The engine speed shall be regulated through Electronic Governing system which shall also provide the over speed protection.

## IV) ENGINE START

Engine shall be cold and self-starting type. The engine shall have electrical starter motor with soft start engagement feature. The starter battery shall conform to IS 7372 amended up to date and of sufficient capacity to meet the Engine starting and control gear requirements.

## V) QUIETNESS OF OPERATION

The set shall have Vibration Limits as per IS 8528-9. Anti-Vibration Mounts (AVMs) are to be provided to reduce generator set vibration and noise transmission to the surrounding structure. The set shall be properly dynamically balanced.

## VI) SILENCER

Efficient heavy duty Hospital grade silencer for the exhaust shall be supplied. The Hospital grade silencer shall be capable to provide about 20-30 db suppression in noise. A test certificate to this effect shall be furnished. The silencer shall be specifically tuned to EATS.

## 3.2. ALTERNATOR

Alternator shall be capable of generating 500 KVA at 0.8 pf, 415V, 3 Ph, 50 Hz, AC system while operating at 1500 RPM and suitable for direct coupling with the above diesel engine.

The alternator shall be copper wound of totally enclosed type screen protected type with class H insulation, designed and constructed to withstand tropical conditions, self-regulating type conforming to BS 5000/IS 4722 amended up to date as applicable. Alternator shall be brushless type, screen protected, revolving field and self-regulated through and AVR. It shall have class H insulation with IP 23 protection enclosure and space heater.

## 3.3. ACOUSTIC ENCLOSURE

The acoustic enclosure shall be made of 1.6 mm thick CRCA sheets in suitable approved shade and a structural/sheet metal base frame painted in black. The walls of the enclosure shall be insulated with noise absorbent and fire-retardant grade acoustic Insulation material (Rockwool) complying to IS 8183. It shall be specially designed to meet stringent MOEF/CPCB norms of 75 dBA@ 1 mtr at 75% load or latest under free field conditions. Shall be provided with top lifting facility for easy handling at site. It shall be designed to have optimum serviceability, Air inlet louvers specially designed to operate at rated load made on special purpose CNC machines for consistency in quality and workmanship. It shall be 11 tank pre-treatment processes and UV resistant powder coated for long lasting service life, superior finish to withstand extreme environment. Use of special hardware for longer life, insulation material meets exacting IS 8183 specifications for better sound attenuation, Flush styling – no projections, Fluid drains for lube oil and fuel.

## 3.4. BACK UP GENERATOR

The contractor shall arrange to maintain the Power supply to the affected areas during the period of execution of work and up to completion of work by providing standby generator of minimum 500KVA rating with temporary cable of adequate size, changeover switch of adequate rating, etc. The standby generator's temporary connection/disconnection to the existing distribution system to be carried out by the contractor.

The Contractor shall supply oil, lubricants and any other consumable, spares etc. for the day to day operation and maintenance of DG Set. However, diesel for operation of DG set will be provided by Port.

Transportation of temporary backup DG Set along with accessories to Mormugao Port Admin building and back; transit insurance, and payment of all other taxes and

duties; loading and unloading of the DG Set and accessories; and installation etc. shall be under the scope of the Contractor at their cost.

## 3.5. DISMANTLING OF EXISTING DG SET AND AMF PANEL

The existing 500KVA DG set and AMF panel is to be disconnected, dismantled and removed. Same are to be shifted to MM division, Baina by the contractor. All transport, labour crane tools tackles required for lifting and shifting of the DGset and AMF panel to Baina is in the scope of the contractor.

## 3.6. FOUNDATION FOR 500 KVA DG SET

After removal of the existing DG set and AMF panel, new foundation has to be made for the new DG set and AMF panel by the contractor. Design of the foundation and proportion of PCC shall be as per the recommendation of the OEM of the DG set and the AMF panel and has to be approved by the EIC.

## 3.7. AUTO MAINS FAILURE PANEL

The work involves Design, Supply, Installation, Testing and Commissioning of Indoor type AMF Panel with 1000 Amps ACB EDO type. After installation, the AMF panel is to be connected to the existing cables feeding the load.

The AMF panel shall be indoor type, double door, floor mounted, dust and vermin proof in CRCA sheet steel construction with a thickness of not less than 2.5mm should be used for load bearing members and not less than 2.0 mm for non-load bearing members as per the relevant standards. The panel shall have doors at the front and back for proper maintenance. The panel shall have steel channel fabricated kick-plate and bolted type cable gland plate fitted at the bottom. All the joints shall have provided with neoprene gaskets. The panel should have powder coating with a thickness of not less than 50 microns. The panel should be with c-channel mounting frame of required size.

The Panel is to be manufactured at the supplier's works as per relevant IS codes and shall be CPRI approved. Panel to be installed at MPA site in the minimum down time. It should incorporate LED type phase indicators, two nos Multi-Function Meters (MFM), one for DG supply and other for MAINS supply. Four separate sets of CT's to be provided for DG & MAINS, two sets for metering and two sets for protection relays. Panel should be designed for Automatic and Manual mode functioning with suitable 'On Panel' controls. The Panel should incorporate a battery charging system for the DG set battery and should have provision for internal illumination.

### General Features

When mains are healthy, the Mains ACB should be ON.

When Mains supply is unhealthy i.e. phase failures, under voltage, overvoltage, unbalance voltage and no voltage, the mains ACB Should trip. The DG should start automatically, develop the voltage and connect the DG Breaker to load. Above sequence of operation should be completed in a time period not more than 10 seconds.

Similarly, on resumption of power supply, the generator breaker is to be opened after 3 minutes, mains breaker is to be closed and then generator is to be switched off after 2-3 minutes (cool time) go on standby mode again. The system must have **fail proof** electrical interlocking and mechanical interlocking as well, to ensure that only one breaker is closed at any given time.

The system should be able to detect any single phasing or change in phase sequence in the main supply and in such a case, should switch over to generator supply. The system should also have provision for visual audio alarm indication and annunciation facility.

The complete schematic drawing should be submitted for approval of the Port, within 2 weeks of placement of order.

The entire unit should be pre-wired, pre-assembled and mock tested at Bidder's works. Installation at MPA site will have to be done in minimum time. All components/switchgear to be supplied should be sourced from reputed manufacturers. Control relays/components should be DIN rail mounting type. All wiring should be properly ferruled and should terminate in duly numbered DIN rail mounted connector blocks.

All internal components shall be provided with suitable identification labels suitably engraved. Labels shall be fixed on buttons, indication lamps etc.

## BUSBAR

- Busbars shall be of high conductivity Aluminium with current density for 1 sq.mm = 0.8 A. All busbars shall be fully screened by means of PVC sleeves in their own compartment running throughout the length of the panel and also suitable allowance shall be made for bus expansion. Suitable segregation shall be provided in between busbar chamber and adjoining compartments. Busbars shall run throughout the length of the chamber and shall be of extendable type on either side
- The busbar shall be PVC sleeved with colour strips of red, yellow, blue and black and the same shall be arranged in accordance with IS-375.
- The busbar shall be properly segregated, suitably braced with insulated supports (DMC/FRP/SMC) placed at appropriate intervals to withstand the electro-magnetic stresses during short circuit. Minimum electrical clearances shall be maintained between phase, neutral and body as per standards.
- Earth Busbar shall be provided all around the cubicle at the bottom & it shall be of the same size as neutral busbar.

### 3.7.1 System Operation

**1. Auto Mode**

a. A line voltage monitor shall monitor supply voltage on each phase. When the mains supply voltage fails completely or falls below set value (variable between 80 to 95% of the normal value) or over-voltage (variable between 100-120% of the normal value) on any phase, the monitor module shall open the mains circuit breaker and initiate startup of diesel engine. To avoid initiation due to momentary disturbance, a time delay adjustment between 0 to 5 second shall incorporated in startup initiation.

b. A three attempt starting facility shall be provided 6 seconds ON, 5 seconds OFF, 6 seconds ON, 5 seconds OFF, 6 seconds ON. If at the end of the third attempt, the engine does not start, it shall be locked out of start and a master timer shall be provided for this function. Suitable adjustment timers are to be incorporated which will make it feasible to vary independently ON-OFF setting periods from 1-10 seconds. If alternator does not build up voltage after the first or second start as may be further starting attempt will not be made until the starting facility is reset.

c. Once the alternator has built up voltage, the alternator circuit breaker shall close connecting the load to the alternator. The load is now supplied by the alternator.

d. When the main supply is restored and is healthy as sensed by the line voltage monitor setting, for under voltage, over voltage and unbalance, phase sequence reversal (the system shall be monitored by a suitable timer which can be set between 1 minute to 10 minute.) the Alternator circuit breaker should be open and mains circuit breaker should be closed

e. The diesel generator set reverts to standby for next operation as (a), (b) and (c) above, after cool time running which can be set from 1 minute to 10minute.

**2. Manual Mode**

a. In a manual mode, operator should be able to open and close the mains circuit breaker through separate push buttons.

b. It shall be feasible to start-up the generator set by the operator on pressing the start push button.

c. Three attempts starting facility shall be operative for the start-up functions.

d. Alternator circuit breakers closing and trip operations shall also be through operator only by pressing the appropriate button on the panel and closure shall be feasible only after alternator has built up full voltage. If the load is already on 'mains', pressure on 'close' button shall be ineffective.

e. Engine shut down, otherwise due to faults, shall be manual by pressing a 'stop' button.

**3. Test Mode**

a. When under 'test' mode, pressing of 'test' button shall complete the startup sequence simulation and start the engine. The simulation will be that of mains failure.

b. Engine shall build up voltage but the set shall not take load by closing of alternator circuit breaker. When the load is on the mains, monitoring of performance for voltage/frequency etc. shall be feasible without supply to load.

c. If during test mode, the power supply has failed; the load shall automatically get transferred to alternator.

d. Bringing the mode selector to auto position shall shut down the set as main supply is ON. If the main supply is not available at that time, the alternator shall take load.

**3.7.2 Engine shut down and alternator protection equipments:-**

Following shut down and protection system shall be integrated in the control panel:-

**a) Engine:-**

i. Low lubrication oil pressure shut down. This shall be inoperative during start up and acceleration period.
ii. High coolant (water) temperature shut down.
iii. Engine over speed shut down.

**b) Alternator protection:-**

i. Over load
ii. Short circuit
iii. Earth fault
iv. Over voltage

## 3.7.3 Detailed specification of AMF Panel for 320KVA Diesel Generator Set:

| | |
|---|---|
| **A** | **Switch Gears** |
| | • 2 nos. 1000A, 4 pole, Electrical operated Draw-out type ACB with Micrologic 2.0 and breaking capacity of 50KA with electronic microprocessor release for O/C & E/F and shunt trip under voltage facility for Mains and DG Supply with Mechanical Interlock. |
| **B** | **AMF Logic** |
| | • One Main supply voltage monitor<br>• One Alternator supply voltage monitor<br>• Restoration timer<br>• Impulse Automatic Engine Start/Stop Logic & Engine Fails to Start Alarm.<br>• Mains and Generator Voltage, Current & Frequency monitoring.<br>• One Set of control relays for the automatic control system.<br>• Battery voltage sensing & monitoring<br>• Engine protections for: LLOP, HWT, Over Speed, Full load, maximum load warning etc |
| **C** | **Battery Charger** |
| | • SMPS based Automatic float cum boost battery charger<br>• One DC Ammeter<br>• One DC Voltmeter<br>• Selector Switch for Auto/Manual & float/Boost |
| **D** | **CTs: 1000/ 5 A, CL-1, 15VA.** |
| **E** | **Multi Function meter (MFM)** |
| | • Parameters to be measured: True RMS electrical parameters: line & phase voltages, current, maximum demand (Current & KVA) with user Selectable Demand Interval, W, VA, Var, Neutral current, KWh, KVarh, KVAh, THD for voltage & current, Frequency, Power factor, phase angle, Onhours, Runhours & Interrupts, 4 Quadrant energy : bi-directional, absolute & net.<br>• Alpha numeric bright display<br>• Brilliant 3 line, 4 digit per line, (digit height 14 mm)<br>• LED display with auto-scaling capability for kilo, Mega, Giga<br>• View 3 parameters together<br>• Password protection for setup parameters<br>• User selectable default display page through keypad lock |

| | |
|---|---|
| | • Inbuilt Memory to Store CTR, PTR, Password, Previous energies, interrupts & MD period.<br>• Programmable CTR, PTR, Password & MD Period |
| **F** | **Indications** |
| | • DG ON<br>• DG load ON<br>• Mains ON<br>• Mains load ON<br>• **Phase Indications** |
| **G** | **MCBs/Fuses of suitable rating** |
| **H** | Push Buttons (AMF Module Bypass Mode) |
| | • **Engine Start/Stop**<br>• **Generator ACB Close/Trip**<br>• **Mains ACB Close/Trip**<br>• **Fault accept/Reset** |

## 3.8. BATTERY CHARGER:

Supply & Installation of Automatic Battery charger: The Automatic Battery charger shall be of static, multistage, Float cum Boost type capable of charging DG set Batteries and shall be fitted in the existing AMF panel/separate dedicated compartment.

## 3.9. EXHAUST PIPING:-

3.9.1 All M.S. Pipes for exhaust lines shall be conforming to relevant IS. The runs forming part of factory assembly on the engine flexible connections upto exhaust silencer shall be exclusive of exhaust piping item. The work includes necessary cladding of exhaust pipe work using 50 mm thick loosely bound resin (LBR) mattress/Mineral wool/Rockwool, density not less than 120 kg/meter cube and aluminium cladding (24 gauge) for the complete portion. The exhaust pipe work includes necessary supports, foundation etc. to avoid any load and stress on turbo charger/exhaust piping. The exhaust piping should be connected to the existing chimney.

3.9.2 The following points may be followed for the exhaust system piping work:

a) Exhaust system should create minimum back pressure.
b) Number of bends should be kept minimum and smooth bends should be used to minimize back pressure.

c) Schedule B MS Pipes and long bend/elbows should be used.

3.9.3 Providing and fixing Thermal insulation of exhaust pipeline by LRB (light resin bonded) mattresses of thickness 100 mm x density 150 kg/m3 make Rockwool/Minwool/Lloyds with embedded chicken wire mesh, cladding by 24 SWG aluminium sheets, Including the bends/ flanges therein, by fixing appropriate size steel screws and washers. Workmanship of work should be good to ensure proper finishing having regular diameter all over.

3.10. **GENERAL REQUIREMENTS**

The engine and alternator shall be assembled on a common base frame. Alternator shall be directly coupled to the engine by means of flexible couplings. The alternator shall be provided with its own exciter. When separate units are provided for this purpose, they shall be driven by the alternator shaft itself.

3.11. **BATTERY CHARGER:**

Supply & Installation of Automatic Battery charger: The Automatic Battery charger shall be of static, multistage, Float cum Boost type capable of charging DG set Batteries and shall be fitted in the existing AMF panel/separate dedicated compartment.

3.12. **LUBRICATION**

Lubrication shall be positive pressure type lubricating for all moving parts. No moving parts shall be required lubrication by hand either prior to the starting of the engine or while it is in operation. Lubrication oil shall conform to relevant IS amended up to date. Necessary lubricating oil filter shall be provided for operation at normal conditions for a period of 250 hours, without any necessity of replacement and cleaning. Temperature and pressure gauges shall be fitted to the lubricating system.

3.13. **FUEL SYSTEMS**

Existing fuel tank is to be connected to the proposed generator set using GI/UPVC pipes with bends and stop cock as found necessary.

3.14. **OPERATING CONDITIONS**

The Engine Alternator shall be capable of delivering the specified output under the site conditions. The fuel consumption of DG set at 100% load shall be within 5% of the manufacturers stipulated ratings.

3.15. **OTHER GENERAL REQUIREMENTS**

(i) THE PERIOD OF OPERTATION

The Engine Alternator set offered shall be Prime duty type conforming to BS 5514 or latest.

(ii) OVER LOAD

The set shall be capable of taking 10% overload for a period of one hour during any 12 hours period while operating continuously at full rated load.

(iii) OUTPUT VOLTAGE FREQUENCY AND WAVE FORM

Normal output voltage shall be 415 volts with ± 2.5% manual adjustment at all conditions of load with coarse and fine controls. Frequency shall be 50 cycles per second ±4%. Output wave form shall be sinusoidal at all load conditions. Alternator shall be of brushless type provided with AVR suitable for voltage regulation of ± 2.5% or better at all load conditions and with prime mover speed drop up to 4% of nominal speed. Alternator shall be provided with radio frequency suppressor and in built frequency rollover protection.

(iv) SAFETY PROVISION

All Exposed moving parts like fan blades, belts etc. shall be provided with suitable Guards / covering to avoid the possibility of accidents.

(v) FINISH

All fabricated items should be painted after proper surface finish & treatment. Two coat of zinc metal primer to be applied. Standard colour as specified in IS should only be used wherever applicable. High quality brand of paints should be used to prohibit corrosion under climatic conditions prevailing at site.

(vi) Manufacturer's test certificate for the DG set to be provided to the Port.

## 3.16. SUPPLY AND LAYING OF 3.5 CORE X 300 SQ.MM AND CONTROL CABLES

a) **Supply of LT, 3.5 C x 300 Sq.mm ,XLPE Cable**

The cable measurements are tentative and may vary as per site condition. Supply and laying 2 runs of Aluminium XLPE L.T. underground cable of 1.1KV voltage grade, extruded PVC inner sheathed, single layer of galvanized steel wire / strip armoured, over all PVC sheathed conforming to IS 7098 Part I 1985 with latest amendments with ISI mark of approved make. The cable quantity shown in BOQ is tentative. The Contractor shall measure the actual quantity as per the site requirement and confirm the same from E.I.C before taking for procurement action.

Note: i) Test certificates from the manufacturers for the cable shall be submitted along with the supply of cable.

b) **Laying of LT, 3.5 C x 300 sq.mm, XLPE Cable**

The laying of cable in the existing RCC cable trench / through PCC from New DG set to new AMF panel at Admin building. However, the cable shall be laid as per the relevant IS standard and as detailed under: The cable quantity shown in the price schedule is tentative. The Contractor shall measure the quantity and supply the same.

The cable shall be laid in the existing trench by opening the covers and reclosing the same without damaging the covers after laying of the cable.

(i) The cable is to be laid by excavating existing PCC till the cable trench. After laying the cable, surface is to be made good by providing PCC.

(ii) The end termination for 1100Vgrade underground cables shall be of crimping type lugs and shall be supplied by the contractor. The crimping type lugs shall be installed by highly skilled personnel with all accessories and other material confirming to relevant IS specification the additional length of cable shall be provided for loop of sufficient length for future requirement before commencing and termination work. The work includes all labour and material as directed by E.I.C.

All the tests shall be carried out as per relevant IS specifications and IER 1956 before charging the Transformer.

(iii) Scope of work shall also include Supply, laying, end termination and connections of armored control wiring cable as per OEM standard and required quantity cable to connect DG set to AMF panel. The cable shall be laid through PCC /underground /existing trench as per site requirement.

## 3.17. EARTHING

The G.I. plate earthing system shall be designed and installed so as to meet the requirement of CEA.

All non-current carrying parts with conducting surface such as frame works of circuit breakers and medium / low voltage switch gears, instrument transformer cases, cable glands, cable supports, any steel works should be efficiently grounded for the protection of equipments and operating personnel by connecting to the earth ring bus with two distinct and separate earth leads. The earth connection shall be made of copper of adequate size and section of the conductor conforming to IS 3043 to safely carry the maximum fault current for a short period without burning the conductor and pass on the fault current in excess of this, additional earth connections under fault condition and at no time the potential shall exceed 10 volts between the equipment and earth. The earthing system shall be mechanically robust and joints shall be capable of retaining low resistance even after many passages of fault current.

All ground connections shall be compounded and braided. The earth electrodes shall be driven to a depth of not less than 2 meters below the ground level and at least 3 meters away from the building and any other earthing electrodes. Treating the soil surrounding the electrodes with the salt, coke and charcoal in accordance with IS 3043. The size of the G.I. plate shall be 600x600x3.18mm. Supply, laying & connection of GI strip of size 50 x 6mm from new earth stations to the DG set neutral and its body. The laying of GI strip to be done above the ground and should be connected at both ends with SS bolts, nuts & washers. GI strips has to be supplied in standard lengths and joints of GI strips has to be made only with SS bolts & nuts (02nos for one joint). Sharp bends required in GI strip should be formed by the use of a bending machine. Earthing Strips which are installed below the ground should be covered adequately with insulating Sleeve to avoid corrosion. For installing GI strip on wall, GI clamps to be used for every one metre.

A suitable brick cemented enclosure for neutral and body earth will be as per IE Rule (i.e) 450mm x 450mm with 125mm wall thickness. The depth of the masonry work will be not less than 600mm below the ground level and with suitable cover provided by the contractor enclosing the earth electrodes and shall be able to take up the load of lorries, etc., operating in that area. The top surface of the earth pit shall be in level with the finished surface level of the surrounding area. After installation, earthing stations has to be tested with earth tester and earthing resistance should be below 5 ohms and records of which are to be submitted as part of installation reports. Also copy of valid calibration certificate of the above earth tester and earth testing certificate has to be provided to the Port. The details of earth station such as neutral/body earthing, date of testing etc has to be marked on the earth pits with yellow paint with black background paint.

The GI strip quantity shown in BOQ is tentative. The Contractor shall measure the actual quantity as per the site requirement and confirm the same from E.I.C before taking for procurement action.

## 3.18. INSTALLATION, TESTING AND COMMISSIONING

Installation, testing and commissioning of the above Genset complete with its acoustic enclosure, AMF panel, Exhaust Chimney, battery Charger and all equipments, accessories/ associated items on the existing cement concrete floor / foundation including supplying consumables like lube oil, fuel and providing artificial resistive load, cabling, switching arrangements, etc., for trial run and final Acceptance Testing of Genset, including topping up of lube oil upto full mark and filling of fuel suitable for working etc., as per specifications as required.

## 4 ACCEPTANCE TEST

The test shall be with artificial resistive load only and nonlinear load will not be arranged for testing purpose.

## 5 INSULATION TEST

Immediately after the over-load test, the insulation resistance between the stationary coil and the frame is tested with 500V Meggar.

## 6 REGULATION TEST

The Automatic and manual regulation of the alternator at no load, half load and full load are noted for the nominal voltage of 230 Volts between phase and neutral at power factor 0.8. All the arrangements for all the test shall be the responsibility of the tenderer.

## 7 FUNCTIONAL TEST

Performance of incoming switch / circuit breaker starting arrangement for the engine safety features, instruments and control panel etc., shall be verified.

## 8 INSPECTION AND TESTING OF GENSET

The engine alternator sets shall be tested at factory, before dispatch to site and at site as per detailed specification of NIT in the presence of department representatives. Pre dispatch reports are to be sent to Port for acceptance before dispatch of the DG set.

All the following tests to check the performance of the set to meet the requirements of specifications shall be carried out at site after installation. The engine shall be run for at least half an hour on no load and then the engine shall be run continuously for eight hours daily for six days at its full rated load. 'The set will be tested with an overload of 10% for one hour. The over load test may be taken at any stage during the full load period and need not be at the end of six hours of full load test. During the full rated load test half hourly readings of the stationary coil temperature are to be taken and the rise in temperature should not be more than the value stipulated as per relevant clauses of insulation given in IS - 4722 - 1958. The fuel consumption should be within 5% of the manufacturers stipulated ratings. The onsite commissioning reports are to be concurred by the E.I.C

## 9 APPROVAL OF INSTALLATION AND COMPLETION CERTIFICATE

Obtaining approval of statutory bodies i.e. GSPCB/CPCB/Electrical Inspectorate etc. as required shall be the responsibility of the contractor. The statutory fees/charges required to be paid to these bodies shall be borne by the Contractor.

The entire work shall be carried out on turnkey basis within the quoted price. No additional charges will be paid by Port later on.

## 10.0 GUARANTEE

The installation shall be guaranteed for a period of two years from the date of commissioning and acceptance by the Port and free maintenance shall be done during the guarantee period of 2 years. During the guarantee period all the manpower, spares/consumables required for preventive/ breakdown maintenance of the DG set and AMF panel shall be in the scope of the contractor. However, fuel i.e High speed diesel shall be provided by the Port.

## 11.0 MAINTENANCE WORK DURING GUARANTEE PERIOD AND CAMC PERIOD

i. After successful installation by the Contractor and accepted by the Port, annual maintenance shall be carried out by the contractor for a period of 05 years after expire of 2 years guarantee period.

ii. The annual maintenance work is comprehensive nature, therefore, all the repairing refurbishing and maintenance costs including spares shall be borne by the Contractor.

iii. The contractor shall submit the maintenance schedule to Port for approval based on OEM recommendation to carry out the maintenance work during guarantee and CAMC period. The Maintenance schedule has to be approved by EIC.

iv. Records of the maintenance works carried out shall be submitted along with bill for payment.

v. During the maintenance, the contractor shall properly clean the D.G. sets, AMF panels etc and check all the parameters as per maintenance schedule and standards and also to the satisfaction of the Port's representatives.

vi. The contractor shall arrange training for 2 days (Theory & hands on experience) for the technical staffs of Port for operation of D.G.sets with AMF panel operation on both the mode i.e Auto/manual start of DG set immediately during failure of power supply & including important check list.

vii. The Bidder shall complete the preventive maintenance activity as per schedule and shall record in register with sign of appropriate authority of Port.

viii. The contractor shall arrange local representative, whenever fault occurs during the CAMC period to attend the same within 3hrs of call logging by the Port's personnel.

ix. Payment shall be made on quarterly basis during CAMC period. However, the contractor shall submit the availability records and also maintenance report with the bills.

x. The contractor shall maintain 99% availability of the DG set for each quarter. During guarantee period of 2 years, if 99% availability is not achieved during any quarter, an amount equivalent to 1% of contract value excluding CAMC part shall be deducted from the security deposit.

xi. During CAMC period, if 99% availability is not achieved, an amount equivalent to 1% of that particular year CAMC amount shall be deducted from the quarterly running bills.

xii. The bidder shall provide the contact details, mobile no., email of deputed person for this Job & escalation matrix to higher supervisor.

## 12.0 OPERATION INSTRUCTIONS AND DRAWINGS

The Contractor shall provide 3 sets of operation and maintenance manual, complete as built layout drawings of Genset, AMF panel with wiring, earthing system and battery charger for DC source compiled in the spiral binding hard copy and soft copy and hand over to the Port's representative.

## 13.0 TRANSPORTATION

The prices also include packing charges, transportations charges and insurance as required. All necessary clearances as per the prevailing rules shall be obtained by the supplier for transportation of the Generator set to the site. The packing shall be in such way as to prevent damages or deterioration in transit and final destination as mentioned in the tender. The packing should be sufficient to withstand rough handling and atmospheric condition.

## 14.0 WORK INSTRUCTIONS:-

- The party shall bring all the necessary tools and instruments required for erection, installation, commissioning and testing. All instruments shall be duly calibrated and shall be verified by the EIC

- For all electrical works such as crimping, terminal connections, tinning… etc right size and proper tools should be used.
- All the piping materials shall meet the requirements of ASTM standards.
- All the pipelines joints should be flange type. Sharp bends should be avoided. High quality gaskets should be used.
- All works shall be carried out strictly as per standard code of practice. All prevailing safety & environment regulations & standards to be followed by the contractor.
- The contractor shall arrange Crane and Logistics at his own cost for the entire work.
- Power and water required for the work shall be provided by Port on free of cost. However, contractor has to make his own arrangements to tap the same from nearest provided source.
- All allied works as per the Bill of Quantities to be carried out by the Contractor in all respects invariably mentioned or not in the specification to complete the work in all respects.
- The materials required / intended for the work should be handled carefully and neatly installed / laid / commissioned and any damages during installation will be Contractors account and same shall be rectified immediately to its original condition.
- The Miscellaneous works and minor works as necessary for the final commissioning of the DG set and AMF panel as a system to be carried out invariably whether clearly mentioned or not in the specifications and BOQ and to be completed in all respects for the said project work.
- Supply & termination of Power cable from DG to AMF Panel is in scope of contractor.
- Supply & termination of control cable / Cat 5 cable (as necessary required) is in scope of contractor.

**SCHEDULE 'A1'**

## SCHEDULE OF PRICES AND QUANTITIES

## PRICE SCHEDULE

**Part - A**

| Sl. No. | Description of work | Unit | *Qty.* | Rate/Unit (Rs.) | | GST % | Amount (Rs.) |
|---|---|---|---|---|---|---|---|
| | | | | In figure | In words | | |
| 1. | Dismantling, removing and shifting of existing DG Set, acoustic enclosure, AMF panel, cables, end connections, accessories, etc. and handing over to MM Division, Baina as per the detailed specification at Schedule-.A | LS | 1 | | | | |
| 2. | Supply, Installation, Testing & Commissioning of AMF panel as per pecification at Schedule-.A | | | | | | |
| a) | Supply | No | 1 | | | | |
| b) | Installation, Testing, Commissioning | No | 1 | | | | |
| 3. | Supply, Installation, Testing & Commissioning of 'Silent Type' Diesel generator set having Prime Power rating of 500 Kva, 415 Volts at 1500 RPM, 0.8 lagging power factor at 415 Volts suitable for 50 Hz, 3 phase system and for 0.85 Load factor and consisting as per the detailed specification at Schedule-.A | | | | | | |
| a) | Supply as indicated at 3 above | No. | 1 | | | | |
| b) | Installation, Testing, Commissioning | No. | 1 | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4. | Supply, Installation, testing and commissioning of 230V/24V Static Battery Charger along with 2Nos of 12V batteries of suitable AH rating including suitable stand for Batteries as per the detailed specification at Schedule-.A | | | | | | |
| a | Supply | Set | 1 | | | | |
| b | Installation, testing and commissioning of battery charger | Set | 1 | | | | |
| 5. | Supply of 3½C X 300 sq.mm. LT Aluminum XLPE armoured cable as per IS : 7098 Part-2 as per the detailed specification at Schedule-.A | Mtr. | 30 | | | | |
| 6. | Laying of two runs of 3.5Cx300 sq. mm. LT Aluminum XLPE armoured cable through existing trench as per the detailed specification at Schedule-.A | Mtr | 15 | | . | | |
| 7. | Termination of 3.5Cx300sq. mm . LT Aluminum XLPE armoured cable with proper gland and lugs in the DG terminal box and the AMF panel as per the detailed specification at Schedule-.A | No. | 4 | | | | |
| 8. | Earthing system for the DG set of size 600 x 600 x 3.15 mm G.I. flat plate buried in ground in a depth of 2Mtr. from ground level with alternate layer of charcoal and salt including supply and fixing of 40mm dia perforated GI pipe funneling for watering purpose including construction of masonry pit with metal cover as per IS: 3043 as per the detailed specification at Schedule-.A | Set | 5 | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9. | Supply of hot dip galvanized earth flat of size 50mm X 6mm as per relevant standard as per the detailed specification at Schedule-.A | Mtr. | 50 | | | | |
| 10 | Laying of hot dip galvanized earth flat of size 50mm X 6mm as per relevant standard as per the detailed specification at Schedule-.A | Mtr. | 50 | | | | |
| 11 | Provide standby generator of minimum 500KVA rating as per the detailed specification at Schedule-A. | Per day | 20 | | | | |
| 12 | Obtaining approval of statutory bodies i.e. GSPCB/CPCB/Electrical Inspectorate etc. as required as per the detailed specification at Schedule-.A | LS | 1 | | | | |
| | | | | | **Total Amount** | | |

(In Words Rupees _____ only exclusive of all taxes and duties)

**Note: The rates quoted shall be inclusive of transportation, lodging and boarding, but exclusive of GST. Applicable GST shall be paid extra as applicable.**

## PART - B

| Sr. No. | Description of work | Unit | Qty. | Rate/Unit | | Amount (Rs.) |
|---|---|---|---|---|---|---|
| | | | | In figure | In words | |
| 1. | Comprehensive Annual Maintenance Contract (CAMC) with full responsibility of carrying out repair and supply of required original spare parts to keep the DG set in fully operational condition for a period of 5 years, after expiry of 2 years Guarantee period | | | | | |
| a. | 1st year CAMC | year | 1 | | | |
| b. | 2nd year CAMC | year | 1 | | | |
| c. | 3rd year CAMC | year | 1 | | | |
| d. | 4th year CAMC | year | 1 | | | |
| e. | 5th year CAMC | year | 1 | | | |
| | **TOTAL AMOUNT 'PART B'** | | | | | |

(In Words Rupees_____

_____only) exclusive of GST

**Note: The rates quoted shall be inclusive of transportation, lodging and boarding, but exclusive of GST. Applicable GST shall be paid extra as applicable.**