

**PROVINCE OF KWAZULU-NATAL
DEPARTMENT OF HEALTH**

BID No. ZNB 5168/2024-H

Wentworth EMS Base - Generator Replacement

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PROVINCE OF KWAZULU-NATAL
DEPARTMENT OF HEALTH

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Wentworth EMS Base - Generator Replacement

PART ONE

PROJECT SPECIFICATIONS

1 NOTES TO BIDDERS

- 1.1 The institutions will remain open and operational at all times therefore the Contractor shall make the necessary arrangements with the Institutional Management and maintenance staff for any power outages that are required. This may necessitate weekend work
- 1.1.2 All items to be priced fully inclusive of all charges e.g. labour, transport, scaffolding, materials, profit, etc., but excluding Value Added Tax.
- 1.1.3 The Administration reserves the right to negotiate prices in the Schedule of Prices.
- 1.1.4 **All redundant material and rubble shall to be removed from the institution's property immediately. Material removed from site must have approval for site removal together with appropriate disposal certificate.**
- 1.1.5 All equipment and materials used in this contract shall be that which is specified or **approved prior to submission and closure of the bid.**
- 1.1.6 The Contractor is advised to examine all the drawings (if any) and to visit the site prior to tendering to acquaint him/herself with the nature of the work to be done and access to the siting of the existing buildings etc., as no claim will be allowed on the grounds of ignorance of the conditions under which the work will be executed.
- 1.1.7 All items in the Schedule of Prices are **PROVISIONAL** and subject to re-measure after installation.
- 1.1.8 The Schedule of Prices shall be read in conjunction with the Scope of Work. Any discrepancies or omissions shall be brought to the attention of the Project Leader immediately.
- 1.1.9 **Preference will be given to Bidders who have registered offices / workshops within the borders of the Province of KwaZulu-Natal. This is in an effort to reduce response times to call outs for breakdowns in the more remote areas of the Province.**
- 1.1.10 **Only Contractors who are registered with a CIDB Grading of 5 EB OR 5 EP or higher shall be considered.**

1.2 SCOPE OF CONTRACT

- 1.2.1 The Scope of the Contract is contained in Part Three (Particular Specification) contained hereunder.

1.3 PERIOD OF CONTRACT

Nine (9) Months as the completion period for the Contract from the **date of site handover.**

1.4 SITE AND MODE OF PROCEDURE

The work contained in this contract will be carried out on the site of WENTWORTH EMS BASE in eThekweni in the Province of KwaZulu-Natal.

Damage to the existing buildings - Bidders to note that any damages done or occurring to any of the buildings will be repaired at the expense of the contractor/ Bidder.

The work undertaken shall be to the satisfaction of the KwaZulu-Natal Department of Health.

1.5 SATISFACTORY INSTALLATION

All work shall be carried out according to the Department of Health's Standard Preambles to all Trades, the OHS Act, National Building Code of Practices and Regulations, the KZN DOH Policy Document for the Design of Electrical Installations and the SANS 10142-1 Wiring Code.

Copies of these documents are available from the office of the Manager, Infrastructure Development KwaZulu-Natal Department of Health, Townhill Office Park, 35 Hyslop Road, Pietermaritzburg and may be obtained on request.

PROVINCE OF KWAZULU-NATAL

BID No. ZNB ___5168___/2023-H

WENTWORTH EMS BASE
INSTALLATION OF NEW 250kVA STANDBY GENERATOR AND BULK DIESEL TANK

PART TWO

TECHNICAL SPECIFICATION

1. GENERAL: OUTDOOR CANOPY TYPE STANDBY GENERATOR

FAILURE TO COMPLETE THE SCHEDULE OF INFORMATION IN ITS ENTIRITY SHALL LEAD TO THE DISQUALIFICATION OF THE BID.

The standby generator set herein specified is to be installed at **WENTWORTH EMS BASE located in eThekweni Health District**. The ambient temperatures are 40°C maximum and 10°C minimum and +- 500m above mean sea level.

In order to best meet South Africa's employment targets, locally assembled generator sets will receive preference.

Due to the critical nature of this installation, ONLY genuine and accredited DIESEL GENERATOR SET MANUFACTURERS / ASSEMBLERS with Local 24 hour support and IN HOUSE maintenance facilities will be considered.

When pricing this document, allowance must be made for the installation to be carried out after hours and / or over a weekend at a time suitable to the KZN Department of Health's institution. This will also include provision for a portable loan unit and LV panel during installation.

Prior to any shutdown it should be agreed with the Health Institution whether any temporary standby plant is required. Apart from this, downtime must be kept to a minimum and once an installation starts, it must be completed and commissioned without any interruptions.

The Tenderer must provide documented proof that they have the staff and capacity to carry out this type of installation. Including additional rotational staff on standby in the event of increased staff infection due to Covid19.

The whole of the installation shall be carried out in accordance with:

- The Department of Health Policy Document on the Design of Electrical Installations Revision 7 of 2013.
- All low voltage switchgear and control gear assemblies are to comply to SABS 1473 Part 1 - 1989 /IEC 439 - 1 1985.
- An Electrical Certificate of Compliance, in accordance with the SANS 10142-1 Wiring Code will be required for all Electrical Works.
- The Occupational Health and Safety Act and Regulations 85 of 1993.
- The Municipal By-laws and any special requirements of the Supply Authorities of the area or district concerned.
- Local Fire Regulations.
- National Building Regulations – SANS 10400 Part T
- The contractor should fully familiarise himself with these documents prior to quoting.

The **Outdoor Sound Attenuated Canopy Type** stand-alone standby generator set herein specified is to be installed at **WENTWORTH EMS BASE**. The ambient temperatures are 40°C maximum and 10°C minimum and is approximately 20m above sea level. ****Canopy to be tropical and not weatherproof.***

2. SCOPE OF CONTRACT

The contract comprises the design, manufacture, assembly, delivery to site, off-loading at site, installation, testing, commissioning and handing over in first class working order of a complete standby diesel generating set and all ancillary equipment necessary to comply with the requirements of this specification.

The plant generally shall comprise a diesel engine coupled to an alternator mounted on a common base, a set of starting batteries, automatic charging unit, interconnecting cables, a control panel housing the generator M.C.C.B. and all necessary switchgear, including the changeover equipment and on-load bypass switch, together with a fuel system, capable of running the set for a minimum **72 hours at full load**.

- Manufacture, supply and deliver a single 250kVA, 400V, 50Hz, diesel standby generator set, with sound proof enclosure made from 3 CR12 material (coastal area).
- Supply and deliver all the needed protection equipment, electrical panels, cables and terminations needed for the complete installation.
- Cast suitable plinths for both generator and bulk diesel tank.
- Install ABS Certified Aluzinc Galvanized fencing for Coastal applications around generator and bulk fuel tank. Fence installation must be all inclusive of a fully installed fencing system including but not limited to posts, foundations, topping, anti-burrow and gate.
- Manufacture, supply, deliver and install the engine exhaust for generators.
- Base tank to be installed beneath the generator and in conjunction with bulk tank, **have sufficient capacity to allow for 72 hour standby power.(i.e. Generator must be able to run for 72 hrs at 100% load.)**
- Self Bunded Bulk tank to feed generator day tank - All pipework and electronic cables to be necessary for the capacity upgrade to be installed.
- Supply and install the standard controller with WebNet reporting module, which allows remote monitoring of the plant and diesel system.
- Refurbish the Substation/Meter Room. This includes paintwork and finish of walls, floor and ceiling:
 - a) Including: doors, windows, vents, cable tunnels, lighting, LV panels and make good wall-mounted drawings.
 - b) Flooring: Cleaning, making good of the surface and painting. Cable tunnels to be cleaned and covers to be replaced if necessary.
 - c) Walls: Cleaning, making good of the surface and painting; this is to allow for any building/civil works that must take place. The doors and frame should be replaced if necessary to accommodate the larger sized generator into the plant room. All brickwork and plaster to be reinstated and must returned to its original state as per the existing building material.
 - d) Ceiling: Cleaning, making good of the surface and painting.
 - e) Paint colour to be discussed during site handover. Paint specification should be Class 4 – “Typical area”.
 - f) Lighting lux levels must adhere to OHS Act (No.85 of 1993) and SANS 10400, SANS 10114-1 lighting requirements. Contractor to install additional lighting if necessary.
 - g) Wall-mounted drawings – refer to Part 17 & 18 within Part 2 of this document.

- h) Renew roof water-proofing and gutters and downpipes.
- i) Remove redundant cable ladders/trays
- j) Replace rusted meter room/transformer room doors with 4 sets of keys (and locks if necessary) as per attached eThekweni Municipality specifications.

- Replace panel to be red to indicate Essential Supply
- Install sound attenuation system whereby the sound level does not exceed 70dB(A) 1m away from the genset.
- Install and commission the fire protection for the generator set. (existing Fire Detection and Alarm Panel may be used)
- An Earth Mat should be installed (if not already in place) of sufficiently low impedance to match the generator rating.
- Electrical Engineers Design:
 - Submission of Engineers Design Report for KZN DOH approval
 - Submission of Single Line Diagram for KZN DOH approval
- Obtain Fire Compliance of the Installation which includes generator and bulk fuel storage unit.
- Obtain Electrical Certification of Compliance for the electrical installation
- Training to be provided to selected staff at the WENTWORTH EMS BASE
- Maintain the installations for 1 year after Practical Completion. (SIX major services to the generator and diesel tank installations which includes fuel remediation and tank cleaning.)
- As built drawings: standby plant arrangement, schematics of plant room, complete electrical system.
- Installation of Breaker panel (Kiosk): Supply, deliver and install suitably rated circuit breakers (2 off) and suitably rated panel (1 off) for cable protection within a weatherproof Kiosk; to be installed within main incomer plant room and installed in accordance with SANS standards (SANS 10142 I&II)
- Supply, delivery and Installation of Chromadeck carport/shadeport to be installed over the concrete plinth area with 400mm overhang. Installation to include all necessary components: gutters, support structure, lighting etc.
- Install ABS Certified Aluzinc Galvanized fencing for Coastal applications around generator and bulk fuel tank. Fence installation must be all inclusive of a fully installed fencing system including but not limited to posts, foundations, topping, anti-burrow and gate with 2 sets of locks and 4 keys.

3. PLANT LOCATION

The standby diesel generating set shall to be installed as indicated under Part Two Particular Specification which forms part of this document.

Tenderers are advised to acquaint themselves with the site conditions including access, as no claim on the grounds of want of knowledge will be entertained.

The set shall consist of an outdoor sound attenuated canopy type unit. The weather proof canopy shall be manufactured from **Grade 3CR12 Stainless Steel for coastal locations**. It shall fit onto the sets base frame, making the entire unit self-contained. Lockable hinged doors (container type system with a robust locking facility required) shall allow access for maintenance purposes and louvres complete with vermin proofing shall be installed at both ends. The louvres shall be sized to suit the sets cooling and combustion air flow requirements. The canopy shall be painted with an etching primer, then finished with two coats of enamel paint or epoxy coated. All fasteners, screws, bolts and nuts used in the manufacturing process MUST be rust proof.

The canopy shall be of folded 1.8 mm thick cold rolled sheet steel construction. Special attention shall be given to vermin proofing and dust sealing.

The concrete plinths for both the generator set and bulk tank (where applicable and if required) forms part of this contract and drawings shall be provided to the engineer for approval, prior to construction taking place.

The standby diesel generating set shall to be located as indicated under Part Two Particular Specification which forms part of this document.

Tenderers are advised to acquaint themselves with the site conditions including access, as no claim on the grounds of want of knowledge will be entertained.

4. PLANT DUTIES

The diesel generating set and its ancillary equipment shall normally operate as an automatic mains failure unit. It shall be capable of delivering its full rated output at any time and any ambient conditions likely to occur at the site. The generating set will not be required to be synchronized with the main supply.

5. SYSTEM

The system to which the plant is to be connected is 3 phase, 4 wire, 400 volt between phases and 230 volt between phase and neutral, with a frequency of 50 Hz.

6. RATING

Note: The units shall be capable of delivering:

- a. **250kVA at 0.8 power factor at PRIME POWER.**

The unit shall deliver 100% of the initial load + - 15 sec after start up.

The rating of the diesel generating set shall be based on operation of the set when equipped with all necessary accessories such as radiator fan, air cleaners, lubricating oil pump, fuel transfer pump, fuel injection pump, water circulating pump, and battery charging alternator.

The generator set shall be capable of delivering the specified output continuously under the site conditions without overheating. The engine shall be capable of delivering an output of 110% of the specified output for one hour in any period of 12 hours consecutive running in accordance with BS5514.

7. DIESEL ENGINE

7.1. Type

The engine shall be of the multi cylinder, four stroke cycle, cold starting, direct injection, compression ignition type, suitable for operation on diesel fuel.

Only genuine engines with full local Original Equipment Manufacturer (O.E.M.) backup will be accepted. Grey products and "copies" will under no circumstances be accepted and will lead to the Tender being rejected.

7.2. Cooling System

The engine shall be of the water cooled type and the cooling system shall be of sufficient capacity to cool the engine when the set is delivering its full rated load in the ambient conditions specified in Clause 1.

The engine shall be equipped with a heavy duty type radiator, complete with engine driven fan and centrifugal water circulating pump and a thermostat to maintain the engine at the makers recommended temperature level. **The radiator core MUST be a tropical core.**

A thermostatically controlled immersion heater shall be provided and fitted in the engine cooling circuit to ensure easy starting of the engine at any ambient temperature.

The heater shall be so fitted that it can easily be withdrawn without having to drain the system. The heater shall be suitable for a 220 volt 50 Hz supply.

A low radiator level shutdown sensor switch shall be fitted in the radiator header tank. A separate temperature sensor must be fitted on the block for the normal high engine temperature shutdown and gauge.

The sight gauge shall be easily accessible for reading purposes and it shall be safe and easy to top up the coolant without having to climb inside or over the unit. This includes indoor and outdoor units.

7.3. Speed

The engine speed shall not exceed 1500 R.P.M. at normal full load conditions.

7.4. Fuel

The engine shall be capable of satisfactory performance on a commercial grade of distilled petroleum fuel oil such as Number 2 fuel oil. (Commercial grade diesel fuel: **50ppm**).

7.5. Rating

The engine shall be suitable for continuous running at the specified speed, delivering its rated output at the specified site conditions.

In addition the engine shall be capable of delivering 110 % load for one hour, after the set has been running at full load for a period of six hours and shall, after the overload period of one hour be capable of maintaining the rated output continuously without any undue mechanical strain, overheating, incomplete fuel combustion or other ill effects.

The engine shall have sufficient capacity to start up and shall within 15 seconds from mains failure, supply the full rated load at the specified voltages and frequency.

7.6. Governor

The engine shall be of the latest electronic type, or controlled by a governor to maintain governed speed for 50 Hz operation. Class A1 governing in accordance with B.S. 5514 as amended is required.

7.7. Fuel System

The complete system including bulk tank and base tank shall be sized to allow the set to run for 72 hours at full load.

An engraved label shall be installed in a conspicuous area on the generator control panel that indicates the following:

- **Base tank capacity.**
- **Bulk tank capacity**
- **Full load litres per hour consumption.**

7.7.1 Base tank

The fuel tank shall be an integral part of the base frame of the generator set. The tank shall have sufficient capacity to run the engine on full load for a minimum period of 12 hours.

The base tank shall be a closed channel self-bund walled type that shall be of sufficient capacity to contain any spillage, equivalent to 110% in volume of the base tank. A float level alarm connected to the generator controller shall be incorporated into the bund area located such that the alarm will be activated when 50% of the volume of the bund area has been reached in the event of any diesel fuel leakage.

The **base** tank shall not exceed 1000 litres capacity, be fitted with a suitable filter, **breather pipe, visual gauge**, removable inspection cover, drain, filler cap, low level and extra low shutdown alarm sensors. These shall supply an audible and visible signal on the control panel.

The **base tank** shall be fitted with the following:

- A suitable fuel filter.
- Breather pipe
- Visual dial fuel level indicator
- Removable inspection cover
- Tamper proof drain plug
- Filler pipe & lockable cap
- Low level and extra low shutdown alarm sensors. These shall supply an **audible alarm** and visible indication on the control panel.
- Spillage containment sensor. It shall supply an **audible alarm** and visible indication on the control panel.
- **Fuel level indicator to send signal to DSE controller to indicate Base tank fuel level AND Bulk tank fuel level.**

In addition, pump, solenoid valve start, stop sensors are required to control the automatic filling of the base tank from a remote free standing tank if applicable.

The set shall be supplied with a hand operated “wing pump” with 5m length of oil resistant hose. The hose shall be of the “push lock” type and shall be sufficient for filling from 200 litre drums.

Drain plugs shall be constructed in such a manner that shall prevent the removal of such drain plug by conventional means i.e. shifting spanner, pliers etc.

7.7.2 Bulk Tank

The bulk fuel tank shall consist of an ISO 9001 quality containerised double walled tank mounted on a steel reinforced concrete plinth of suitable MPa strength to carry the weight of a fully fuelled bulk tank and canopy type generator. The size and configuration of the bulk tank shall be matched to the size of generator to enable the generator to run continuously for a minimum period of 72 hours on full load.

The composite bulk tank together with all interconnecting supply and return pipes, low level alarm, **visual fuel level indicators (a. Mechanical and b. Digital gauge on an LCD display)**, lockable shut off valves, breather and an automatic filling system shall be provided and installed to the base tank. This installation shall be carried out by a specialized petrochemical installation contractor in accordance with SABS 0131 Part 2/1979 and SABS 089 Part 3/1991.

In the event of the standard bulk tank size being in between the required volume, the next largest size must be supplied

The automatic filling of the base tank, from the bulk tank, shall be controlled by level switches mounted in the base tank. These switches shall start and stop the electric self-priming pump, or solenoid valve system.

Manually operated filling of the base tank from the bulk tank shall be by way of a spring loaded push button switch that shall switch off the pump if the push button switch is released by the operator.

Drain plugs shall be constructed in such a manner that shall prevent the removal of such drain plug by conventional means i.e. shifting spanner, pliers etc.

The construction of the reinforced concrete plinth and other minor civil work shall form part of this contract.

The **bulk tank** shall be fitted with the following:

- A suitable fuel filter.
- Breather pipe
- Visual dial fuel level indicator
- Removable inspection cover
- Tamper proof drain plug
- Filler pipe & lockable cap
- Low level and extra low shutdown alarm sensors. These shall supply an **audible alarm** and visible indication on the control panel.
- Spillage containment sensor. It shall supply an **audible alarm** and visible indication on the control panel.
- **Fuel level indicator to send signal to DSE controller to indicate Base tank fuel level AND Bulk tank fuel level.**

The bulk tank shall be inspected including:

- pressure testing,
- wall thickness and integrity inspection,
- Diesel cleaning/remediation.

The bulk tank shall be a closed channel self-bund walled type that shall be of sufficient capacity to contain any spillage, equivalent to 110% in volume of the tank. A float level alarm connected to the generator controller shall be incorporated into the bund area located such that the alarm will be activated when 50% of the volume of the bund area has been reached in the event of any diesel fuel leakage.

7.8. Lubricating

The engine shall be provided with a forced feed lubricating system with a gear type lubricated oil pump for supplying oil under pressure to the main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and all other moving parts.

Full flow replaceable element type oil filters, conveniently located for servicing, shall be provided. Filters shall be provided with a spring loaded by-pass valve to ensure circulation if the filters become clogged.

7.9. Cylinder Liners

The engine shall be provided with removable wet or dry type cylinder liners of close grained alloy iron.

7.10. Air Cleaners

The engine shall be provided with one or more dry type air cleaners which shall provide positive air filtration.

7.11. Exhaust System

The engine shall be fitted with an efficient Grade 304 stainless steel exhaust system coastal areas. Flexible bellows shall be fitted between the exhaust outlet and the silencer. The flexible piping must on no account be used to form a bend or compensate for misalignment. The silencer shall be located within, or on top of the canopy. The silencer shall be of the highly efficient type suitable for use in clinical areas and shall be capable of providing **35 to 50 decibels of suppression. Silencer type to be Hospital Plus Grade - Exhaust noise reduction of 35 to 50 dBA**

The silencer and discharge piping shall be suitably supported.

The exhaust pipe inside the canopy shall be suitably lagged then clad in galvanized or polished stainless steel sheet.

The end of the exhaust shall be cut to a 45 degree angle, in order to prevent rain ingress and mesh shall be welded into the end to prevent birds or rodents from entering the pipe. A vertical exhaust end may be used provided an efficient Grade 304 stainless steel design is used to ensure no dust or water ingress is permitted.

7.12. Flywheel

The flywheel shall be designed to limit the cyclic irregularities to within the limits laid down in B.S. 5514 as amended.

7.13. Engine Starting

The engine shall be equipped with a 12/24 volt starting system of sufficient capacity to crank the engine at a speed, which will allow starting of the engine.

The starting equipment shall include a 12/24 volt D.C. starter motor engaging directly on the flywheel ring gear. A heavy duty battery charging alternator and **maintenance free batteries** of the Delco/Deltec type shall be supplied. The batteries shall be mounted in a lockable battery box.

The batteries shall be connected to the engine with suitably rated P.V.C. insulated flexible leads.

The batteries shall have sufficient capacity to provide three automatic attempts to start immediately followed by three manual attempts without any appreciable drop in voltage. The automatic attempts to start shall each be of not less than 10 seconds duration with 10 second intervals between and the manual attempts shall be based on the same cranking period.

A device shall be provided to limit the cranking time of each automatic attempt to start, to the 10 seconds specified above and to provide three automatic attempts after which the automatic starting mechanism will cut out until manually reset and at the same time sound an audible alarm and illuminate the L.E.D. on the generator controller. The engine driven battery charging alternator shall have sufficient capacity to recharge the batteries back to normal starting requirements in not more than six hours.

A battery charging unit of the trickle charge type shall be provided to maintain the batteries at full capacity when the set is at rest. The charging equipment shall be connected so that the battery is normally charged from the mains, but is also charged under mains failure conditions from the diesel generating plant and if required via an inhibitor relay to prevent dual charging. The unit shall be complete with voltmeter, push button test, D.C. and A.C. protective gear. The charging unit shall be incorporated in the diesel generator control cabinet.

7.14. Engine Instruments

As per the Deep Sea DSE 7320 Controller fitted with DSE Webnet DSE890 Gateway complete with separate GPS and GSM antennae.

7.15. Safety Controls

The engine shall be equipped with the safety controls as specified in 11.4.

7.16. Engine/Alternator Coupling and Base

The engine and alternator shall be direct coupled and arranged for operation at 400/230 volt, 50Hz and 1500 RPM.

A steel fabricated base-frame (incorporating the day fuel tank) with anti-vibration mounts between the engine / alternator combination and base shall be provided and must be able to be placed directly on the concrete plinth / slab.

The base frame shall incorporate the canopy mounting arrangement.

8. RADIATOR EXTRACT DUCTING

A galvanized duct shall be provided and installed between the radiator face and outlet louver to positively expel and duct the hot air out of the canopy. A flexible section shall be fitted between the radiator face and duct in order to prevent the recirculation of hot discharged air.

9. A.C. GENERATOR

As per the engine requirements, only genuine and locally supported recognised Original Equipment Manufacturers (O.E.M.) alternators will be acceptable. Grey products and copies from the East are unacceptable and will result in the Tender being rejected.

9.1. Rating

The generator shall be a 400/230 volt, 3 phase, and 4 wire 50 Hz machine. The generator rating shall be applicable for continuous service application.

**Note: The units shall be capable of delivering 250kVA, both at 0.8 power factor.
The unit shall deliver 100% of the initial load + - 15 sec after start up.**

9.2. Construction and Manufacture

The generator shall be a revolving field type, coupled directly to the engine flywheel through a flexible disc for positive alignment. The generator housing shall bolt directly to the engine flywheel housing and shall be equipped with a heavy duty ball bearing support for the rotor. The motor shall be dynamically balanced up to 25 % over speed.

The generator shall be of heavy duty compact design. Insulation shall be Class H as recognised by B.S.5514.

The generator field excitation shall be performed by a rotating exciter mounted on the generator motor shaft through a brushless rotating diode system. The voltage regulator shall be of the static-magnetic type with silicon diode control. It shall be mounted on the top or side of the generator and enclosed in a drip proof enclosure. A built in voltage adjusting rheostat shall provide 10 % voltage adjustment.

9.3. Performance

The generator shall be capable of continuously delivering the full rated load specified in Clause 9.1 and of providing a 10 % overload for the period and in the manner specified for the engine in Clause 7.5.

9.4. Wave Form

The shape for the voltage and current wave shall be within the limits laid down by B.S. 5000.

9.5. Voltage Regulation and Response

The alternator shall be self-regulated and shall incorporate an automatic voltage regulator.

The voltage regulation shall not exceed $\pm 2\frac{1}{2}\%$, from no load to full load, including cold to hot variations at any power factor between 0,8 lagging and unity and inclusive of speed variations within the limits stated in Clause 7.6.

Upon application of full load at a power factor of 0,8 lagging the alternator voltage shall recover to within $2\frac{1}{2}\%$ of the steady state value within approximately 300 milliseconds.

Upon application of any load specified in transient, maximum voltage dip shall not exceed 20% of the nominal voltage when measured at the alternator terminals.

9.6 Windings

The generator stator windings shall be star connected with the star point brought out and connected to the neutral terminal in the terminal box on the generator to provide a 400/230 volt supply.

9.7. Terminal Box

The terminal box shall be fitted to suit the cable route and it shall be large enough to allow for glanding and connecting the cables specified in Clause 13.1.

9.8. Radio and T.V. Interference

The generating set shall be suitably suppressed within the limits of B.S. 800 against radio and television interference.

10. **DIESEL GENERATOR LV & CONTROL PANEL**

10.1. Type and Construction

The panels shall be designed for the **control** of the diesel generating set with instrumentation and **protective devices** to meet both manual and automatic mode requirements.

The panels shall be of robust construction, totally enclosed and dustproof.

It shall be of folded **1.8 mm thick cold rolled sheet steel construction**, suitable for front entry through hinged doors. Internal chassis plates, circuit breaker pans and gland plates shall be provided. Special attention shall be given to vermin proofing and dust sealing.

Prior to painting, all steelwork must be thoroughly degreased and re-rusted and then primed with a zinc chromate primer. All internal steel chassis plates, gland plates and switchgear brackets shall be painted with white powder epoxy paint and all exterior steel surfaces shall be finished with red powder epoxy paint

The **LV Panel** shall house the Generator Circuit Breaker and Mains Circuit Breaker and shall be adequately rated and suitably supported as per "10.2 Bus-Bars, Wiring, Switchgear" below.

The **Control Panel** shall be built into three separate sections, with the controls, change-over and on load bypass switch each having its own section.

10.2 Bus-Bars, Wiring, Switchgear, etc.

All bus-bars and wiring shall be adequately rated and suitably supported, and control wiring shall be neatly laced and numbered with durable plastic ferrules, for easy tracing. Suitable terminals are to be provided for incoming and outgoing cables. Suitably sized holes shall be punched in the gland plates for the required number of cable terminations for both incoming and outgoing cables. The cables shall be secured to the gland plate by means of cable glands as Pratley, C.C.G. or other approved. The gland plate shall be suitably braced to prevent distortion after the cables are glanded thereto.

Circuit breakers are to be of moulded case construction and the 4 pole motorized change-over switch and "On Load" bypass switch shall be a reputable make, with full local representation.

All instrumentation shall be of 1.5% accuracy and their performance shall comply with B.S.89. The instruments shall be flush mounted and the dial dimensions shall be 96mm x 96mm.

Tenderers must give assurance with their tender that replacements for the equipment, switchgear and instruments used in the construction of the panel are readily available from stock held in the Republic of South Africa.

11. CONTROL PANEL

11.1 The change-over control panel is to be situated inside the canopy OR within the substation if there is space.

11.2 The supply and installation of all cables and supports between the generator set and AMF control panel forms part of this contract.

11.3 Changeover Board and Bypass Switch

11.3.1 1 x T.P. Generator MCB. The MCB shall be rated to suit the generator offered and shall have both adjustable thermal and instantaneous overload elements.

11.3.2 ***If over 150kVA***

1 x Set of Four Pole automatic changeover isolators with motor operated mechanisms (Minimum rating of 630amps) and with appropriate auxiliary and control contacts with electrical and mechanical interlocking arrangements to the approval of the Department. The units are to be Socomec, ABB or other approved **prior to the close of the Tender.**

11.3.3 ***If under 150kVA***

1 x Set of Four Pole suitably rated contactors with electrical and mechanical interlocking arrangements to the approval of the Department.

11.3.4 ***If over 150kVA***

1 x On load hand operated by pass switch (Minimum rating of 630amps) of the isolator type with three operating positions labelled "NORMAL", "OFF" and "BYPASS" to enable the changeover equipment and control circuitry to be by passed for maintenance purposes. The units are to be Socomec, ABB or other approved **prior to the close of the Tender.**

11.3.5 ***If under 150kVA***

No by-pass switch required.

11.3.6 3 x Open ring CT's suitably scaled.

11.3.7 1 x Open ring VT

11.3.8 Load, neutral and earth bus-bars.

11.3.9 Control Section

- a) Automatic constant voltage battery charger.
- b) Electronic governor control (if required and not an electronic engine).
- c) Control C/B for instruments.

- d) Control relays for change over contacts.
- e) 12 / 24 Volt fuel relays.
- f) Terminal strips.

11.3.10 Door Mounted Components

NOTE: While the controller incorporates some of this equipment, the specified items as detailed below are STILL REQUIRED and shall be mounted on the door.

- a) As per the Deep Sea DSE 7320 Controller fitted with DSE Webnet DSE890 complete with separate GPS and GSM antennae 1 x Deep Sea DSE 7320 Generator Controller
- b) 3 x Flush mounted M.D.I. 96 x 96mm dial **ammeters** suitably scaled
- c) 1 x Flush mounted 96 x 96 mm dial **voltmeter**, 0 - 500VAC.
- d) 1 x Flush mounted **voltmeter selector switch** with off, phase to phase and phase to neutral positions.
- e) 1 x Flush mounted running hour meter.
- f) 1 x Emergency stop push button - "Latching type".
- g) 1 x Engine alternator charge indication.
- h) 1 x Key operated canopy light switch to operate LED lighting inside the canopy area – set of 2 LED lights required.**

11.4 Control Equipment Requirement

Control systems may not consist of the electromagnetic relay type. Only the Deep Sea DSE 7320 fitted with Deep Sea Webnet DSE890 Gateway complete with separate GPS and GSM antennae or equivalent (Subject to approval by DoH prior to the closure of the Tender) solid state programmable systems will be accepted.

The solid state controller and associated systems wiring shall be to the control system manufacturer's guidelines and shall be adequately protected against transient over voltages arising from lightning effects, switching surges, power system surges or mains and alternator borne noise/interference. Full details of the suppression systems are to be provided at tender. Wiring to and from the solid state programmable controller is to be screened as necessary to prevent electrostatic and magnetic interference from adjacent wiring/systems.

SPECIFICATION FOR CONTROLLER

FRONT PANEL INDICATORS AND DISPLAYED MESSAGES

The controller status including Warning and Shutdown/ Critical alarms shall be indicated by a combination of LCD and messages on the LCD display.

CONDITION	LCD	DISPLAY MESSAGE	WARNING	SHUTDOWN
HIGH ENGINE TEMPERATURE		X		X
LOW OIL PRESSURE		X		X
OVER SPEED		X		X
UNDER SPEED		X		X
BULK TANK FUEL LEVEL (LITRES & PERCENTAGE)	X			
BASE TANK FUEL LEVEL (LITRES & PERCENTAGE)	X			
BULK TANK LOW FUEL AT 30% OF CAPACITY	X	X	X	
BULK NO FUEL AT 10% OF CAPACITY	X	X		X
LOW BULK TANK		X	X	
LOW WATER		X		X
START FAILS AFTER 3 CRANKS AT 10 SECOND INTERVALS.	X	X		X
EMERGENCY STOP	X	X		X
SHUTDOWN / CRITICAL	X	X		X
MAINS PHASE ROTATION FAULT		X		X
HIGH MAINS VOLTS		X		X
LOW MAINS VOLTS		X		X
MAINS ON	X	X		
MAINS ON LOAD	X	X		
ALTERNATOR ON	X	X		
ALTERNATOR ON LOAD	X	X		
ALTERNATOR PHASE ROTATION		X		X
HIGH ALTERNATOR VOLTS		X		X
LOW ALTERNATOR VOLTS		X		X
BATTERY VOLTS FAULT		X	X	
ALTERNATOR CHARGE FAULT		X	X	
AUTO	X			
TEST	X			
MANUAL	X			
MANUAL START	X			
MANUAL STOP	X			
MANUAL OR TEST (NOT IN AUTO)	X			
ALARMS	X			
EVENT LOG	X			
TIME DELAYS IN SECONDS				
MAIN FAILURE DELAY	10			
START-UP TIME	5			
MAINS RETURN DELAY	60			
COOL DOWN DELAY BEFORE SHUT DOWN.	120			

FRONT PANEL SWITCHES

As per the Deep Sea 7320 controller

PLANT OPERATION

The mode selector touch pad functions shall be as follows

OFF/RESET	Control system off and alarm condition reset.
AUTO	Automatic starting and stopping of the set dependent on the mains supply.
MANUAL	Starting and stopping activated manually. In this mode the load will not be transferred in the event of a mains failure.
TEST	The set will start automatically in this position. The load will be taken by the alternator in the event of a mains failure and will run off load.

LOGGING OF EVENTS

As per the Deep Sea DSE 7320 Controller fitted with DSE Webnet DSE890 Gateway complete with separate GPS and GSM antennae.

USER PROGRAMMABLE

As per the Deep Sea DSE 7320 Controller fitted with DSE Webnet DSE890 Gateway complete with separate GPS and GSM antennae.

12. ELECTRICAL

Cables between the generator set and control panel shall be supplied and installed in accordance with the requirements of the S.A.N.S. Wiring Code (S.A.N.S. 10142 – 1:2017 as amended).

12.2. Terminations

The cables are to be made off with suitable cable glands as C.C.G, Pratley or other approved. The cable glands at the control panel shall be secured to the gland plate in the base section of the panel and at the generator end to the terminal box.

The cable conductors shall be terminated with suitably rated pressure crimped cable lugs.

12.3. Earthing

The neutral point of the generator shall be solidly connected, by means of an appropriate size of insulated earth conductor, to the earth bar in the alternator and in the panel. All plant, ancillary equipment and steel work in the stand-by plant room shall be suitably bonded together with an appropriate size of bare copper tape which shall also be connected to the earthbar.

An Earth Mat should be installed (if not already in place) of sufficiently low impedance to match the generator rating.

12.4. Phase Rotation

The Contractor shall ensure that the mains and generator phase rotations are identical. The existing phase rotation shall be determined prior to the changeover shutdown to ensure that the new set is connected with the same phase rotation.

13. **PAINTING**

The engine and generator shall be painted **uniformly** with best quality enamel paint **in a colour approved by the Department.**

The control panel shall be painted with best quality powder coated signal red paint.

14. **TESTING**

14.1. Testing At Contractor's Premises

An acceptance test shall be carried out at the Contractor's works to establish that the diesel generating plant and its ancillary equipment meets with the requirements of the specification. The Contractor shall give the consultant at least seven days notice prior to testing the plant. In the event of the plant failing the test and having to be re-tested, at some future date, all expenses (including travelling) incurred by the consultant in attending the second test will be to the Contractor's account. All fuel used for the test will be for the tenderers account. All test equipment including load banks must be present and readily available on the day of the FATs and will be for the bidders account

- a) Simulate a mains failure to automatically start the plant from cold to test its ability to attain full rated speed and voltage and assume the full load in the specified time of ten seconds.
- b) Test run the plant at full load for a period of one hour.
- c) Immediately after the above specified run, without stopping the plant, run it for a further hour at 110 % load.
- d) Test the plant with regards to voltage dip, voltage and frequency recovery, with a sudden application of various loads.
- e) Test the plant for its ability to assume full rated load immediately on failure of the normal supply.
- f) Test and demonstrate (by simulation only where actual Conditions could damage the plant and its ancillary equipment) the correct operation of the engine safety controls and alarms together with other alarms as specified.
- g) Any other tests the client may consider necessary to establish that the diesel generator and its ancillary equipment as a whole is functioning correctly and in accordance with the specification.
- h) The aforementioned tests must be completed together with the pre-commissioning checksheets as per the attached Annexure – “DEPARTMENT OF HEALTH - GENERATOR PRE-DELIVERY SHEET REV 3.2 OCT 2020”. – (ANNEXURE 5)
- i) ***The testing at Contractors facilities will include all accommodation, transportation and subsistence for the project leader; in the event of the manufacturer's premises falling outside of the eThekweni District and shall be at the cost of the Contractor.***

NB The Contractor shall provide necessary instruments and equipment for carrying out the tests. The test equipment shall be capable of producing 100 % load for one hour and 110 % load for a further

hour continuously without interruption. The test load shall be adjustable and balanced over three phases.

The instrumentation shall be capable of recording and producing printed data pertaining to transient voltage dips, recovery time, applied load, etc, as specified in Clause 9.5.

14.2. Tests On Site

On completion of the installation of the plant, the following test shall be carried out.

- a) Automatic starting and stopping with load change over. The load in this instance will be provided by the client.
- b) Test by simulation only of the operation of the engine protection and alarm devices.
- c) Any other tests which the Project Leader may require on site.

15. NOTICES & LABELS

15.1. Warning Notice

The Contractor shall provide and install in a conspicuous position in the plant room a clearly legible and indelible notice 450 x 450mm made from non-deteriorating material, preferably plastic with red letters on a white background worded to read as follows:

“DANGER
THIS ENGINE WILL START WITHOUT NOTICE. TURN THE CONTROLLER OFF AND PRESS THE EMERGENCY STOP BUTTON IN BEFORE WORKING ON THE PLANT.”

- 15.2 All labels shall be RED engraved letters on WHITE Ivorene glued with super glue or pop riveted to cover plates where applicable. Letter size shall be a minimum of 3mm.

16. OPERATING AND MAINTENANCE MANUALS, ETC.

The Contractor shall supply three complete comprehensive sets of operating and maintenance manuals, complete with schematic control diagrams and complete spare parts list for both engine and generator.

The above manuals are to be handed to the authorized representative on completion of the installation.

In addition a complete schematic diagram of the power and control circuitry is to be mounted in a glass fronted wooden or non-ferrous metal frame and fixed **to the canopy door adjacent to the generator control panel.**

The Contractor is to provide a schedule containing particulars and part numbers of all major components e.g. relays, timers etc. of the control circuitry to facilitate the ordering of spares.

NOTE: Under no circumstances will **Practical Completion** be taken of the plant and equipment unless these requirements have been completed.

17. DRAWINGS

Within one month of the receipt of order the successful Tenderer shall submit prints of each of the following drawings for approval:-

- a) General arrangement of the stand-by plant switchboard front panel.
- b) Schematic of the complete electrical systems, including starter motor, battery and automatic battery charger.
- c) Dimensioned layout of all plant in **the canopy compartment**.

18. SPARE PARTS

Tenderers must **provide an assurance** with their Tender that spare parts for the plant offered by them as a whole are readily available within the Republic of South Africa and to state where these **spare parts** are available.

19. GUARANTEE AND MAINTENANCE

19.1. General

The Contractor shall guarantee and maintain the Contract Works for a period of twelve months (12) after **Works Completion** of the plant. During the maintenance period the Contract Works shall be maintained as specified in Clause 21 by the Contractor and any defective material, equipment or workmanship (excepting proven, willful or accidental damage, or fair wear and tear) shall be made good with all possible speed at the Contractor's expense and to the satisfaction of the client.

19.2. Making Good

When called upon by the client the Contractor shall make good on site and shall bear all expense incidental thereto including making good of work by others, arising out of removal or reinstallation of equipment. All work arising from the implementation of the guarantee or maintenance of equipment shall be carried out at times which will not result in any undue inconvenience to users of the equipment or occupants of premises.

If any defects are not remedied within a reasonable time the client may proceed to do the work at the Contractor's risk and expense, but without prejudice to any other rights which the client may have against the Contractor.

19.3. Latent Defects and Failure to Comply with Specification

The client reserves the right to demand the replacement or making good by the Contractor at his own expense of any part of the Contract which is shown to have any latent defects or not to have complied with the Specification, notwithstanding that such work has been taken over or that the guarantee period has expired.

19.4. Qualification by Tenderer

Should any specified materials or equipment in the Tenderer's opinion be of inferior quality, or be unsuitably employed, rated or loaded, the Tenderer shall prior to the submission of his tender advise the consultant accordingly. His failure to do so shall mean that he guarantees the work including all materials or equipment as specified.

20. MAINTENANCE

At six monthly intervals (2) **OR at every 250 hours** during the guarantee period of twelve months, starting from the date of Works Completion, the Contractor shall adjust and maintain the standby plant and its ancillary equipment in proper working order. As a minimum requirement the Contractor shall:

- a) Check and top-up if necessary, the fluid levels in the radiator, engine sump, fuel oil tank and batteries.
- b) Test run the standby plant and ancillary equipment for a period of 15 minutes.
- c) Wipe down the standby plant and its ancillary equipment and report on any evidence of any fluid leaks or other defects.
- d) Fill in the standby plant logbook.

The minor and major services must be done in accordance with “Annexure 6A & 6B - KZN DOH Generator Preventative Maintenance Service Programme - Annual Bi-Annual Service”.

The contractor is to allow for 8 major and 8 minor services during the 52 weeks warranty period including bi-annual fuel remediation and tank cleaning.

The cost of such inspections, maintenance, adjustments, repairs, etc., shall be included in the tender price, but the cost of renewing any part which may become worn through fair wear and tear, or damaged beyond the control of the Contractor (provided this is not due to unsuitable design) shall be excluded.

If during the guarantee and maintenance period the standby plant is not in working order for any reason for which the Contractor can be held responsible, then the Contractor will be notified and immediate steps shall be taken by him to remedy the defects. Should the standby plant defects be so frequent as to become objectionable or should the equipment otherwise prove unsatisfactory during the guarantee period of twelve months, the Contractor shall, if called upon by the client, at his own expense replace the whole or such parts thereof as the client may deem necessary with equipment to be specified by the client. Approval - tacit or otherwise - of the equipment installed shall be considered as provisional only and shall not invalidate the client's right as indicated above.

PROVINCE OF KWAZULU-NATAL
DEPARTMENT OF HEALTH

BID No. ZNB 5168/2024-H

WENTWORTH EMS BASE
INSTALLATION OF NEW 250kVA STANDBY GENERATOR AND BULK DIESEL TANK

PART THREE

PARTICULAR SPECIFICATION

3.1 GENERAL

This particular specification must be read with, and shall form part of, Part Two of this document (Technical Specification).

In so far as the conditions contained herein are at variance with any obtained in the Technical Specifications, the contract shall be interpreted in terms of this Part Three (Particular Specification).

3.2 SCOPE OF WORKS

3.2.1 The contract comprises the design, manufacture, assembly, delivery to site, off-loading at site, installation, testing, commissioning and handing over in first class working order one standby generator sets:

3.2.1.1 250kVA outdoor canopy type standby diesel generating sets and all ancillary equipment necessary to comply with the requirements of this specification.

3.2.2 The generator set shall comprise unless otherwise stated, of a diesel engine coupled to an alternator mounted on a common base, a 72-hour fuel tank, a set of starting batteries, automatic charging unit, interconnecting cables, a control panel housing the generator M.C.C.B. and all necessary switchgear, including the change- over equipment and "on load" bypass switch.

3.2.3 The contractor shall also provide for the following:

- Manufacture, supply and deliver a single 250kVA, 400V, 50Hz, diesel standby generator set, with sound proof enclosure made from 3 CR12 material (coastal area).
- Supply and deliver all the needed protection equipment, electrical panels, cables and terminations needed for the complete installation.
- Cast suitable plinths for both generator and bulk diesel tank.
- Install ABS Certified Aluzinc Galvanized fencing for Coastal applications around generator and bulk fuel tank. Fence installation must be all inclusive of a fully installed fencing system including but not limited to posts, foundations, topping, anti-burrow and gate.
- Manufacture, supply, deliver and install the engine exhaust for generators.
- Base tank to be installed beneath the generator and in conjunction with bulk tank, **have sufficient capacity to allow for 72 hour standby power.(i.e. Generator must be able to run for 72 hrs at 100% load.)**
- Self Bunded Bulk tank to feed generator day tank - All pipework and electronic cables to be necessary for the capacity upgrade to be installed.

- Supply and install the standard controller with WebNet reporting module, which allows remote monitoring of the plant and diesel system.
- Refurbish the Substation/Meter Room. This includes paintwork and finish of walls, floor and ceiling:
 - k) Including: doors, windows, vents, cable tunnels, lighting, LV panels and make good wall-mounted drawings.
 - l) Flooring: Cleaning, making good of the surface and painting. Cable tunnels to be cleaned and covers to be replaced if necessary.
 - m) Walls: Cleaning, making good of the surface and painting; this is to allow for any building/civil works that must take place. The doors and frame should be replaced if necessary to accommodate the larger sized generator into the plant room. All brickwork and plaster to be reinstated and must returned to its original state as per the existing building material.
 - n) Ceiling: Cleaning, making good of the surface and painting.
 - o) Paint colour to be discussed during site handover. Paint specification should be Class 4 – “Typical area”.
 - p) Lighting lux levels must adhere to OHS Act (No.85 of 1993) and SANS 10400, SANS 10114-1 lighting requirements. Contractor to install additional lighting if necessary.
 - q) Wall-mounted drawings – refer to Part 17 & 18 within Part 2 of this document.
 - r) Renew roof water-proofing and gutters and downpipes.
 - s) Remove redundant cable ladders/trays
 - t) Replace rusted meter room/transformer room doors with 4 sets of keys (and locks if necessary) as per attached eThekweni Municipality specifications.
- Replaced panel to be red to indicate Essential Supply
- Install sound attenuation system whereby the sound level does not exceed 70dB(A) 1m away from the genset.
- Install and commission the fire protection for the generator set. (existing Fire Detection and Alarm Panel may be used)
- An Earth Mat should be installed (if not already in place) of sufficiently low impedance to match the generator rating.
- Electrical Engineers Design:
 - Submission of Engineers Design Report for KZN DOH approval
 - Submission of Single Line Diagram for KZN DOH approval
- Obtain Fire Compliance of the Installation which includes generator and bulk fuel storage unit.
- Obtain Electrical Certification of Compliance for the electrical installation
- Training to be provided to selected staff at the WENTWORTH EMS BASE
- Maintain the installations for 1 year after Practical Completion. (SIX major services to the generator and diesel tank installations which includes fuel remediation and tank cleaning.)
- As built drawings: standby plant arrangement, schematics of plant room, complete electrical system.
- Installation of Breaker panel (Kiosk): Supply, deliver and install suitably rated circuit breakers (2 off) and suitably rated panel (1 off) for cable protection within a weatherproof Kiosk; to be installed within main incomer plant room and installed in accordance with SANS standards (SANS 10142 I&II)

- Supply, delivery and Installation of Chromadeck carport/shadeport to be installed over the concrete plinth area with 400mm overhang. Installation to include all necessary components: gutters, support structure, lighting etc.
- Install ABS Certified Aluzinc Galvanized fencing for Coastal applications around generator and bulk fuel tank. Fence installation must be all inclusive of a fully installed fencing system including but not limited to posts, foundations, topping, anti-burrow and gate with 2 sets of locks and 4 keys.

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INSTALLATION OF NEW 250kVA STANDBY GENERATOR AND BULK DIESEL TANK

PART FOUR

SCHEDULE OF EQUIPMENT

4.1 GENERAL

THE BIDDER MUST COMPLETE THE FOLLOWING SCHEDULE OF INFORMATION AND ARE TO SUBMIT WITH THEIR TENDER COMPREHENSIVE LITERATURE ON THE EQUIPMENT OFFERED.

FAILURE TO COMPLETE THIS SCHEDULE IN ITS ENTIRITY SHALL LEAD TO DISQUALIFICATION OF THE BID.

4.2 DIESEL ENGINE AND ALTERNATOR INFORMATION - DIESEL ENGINE No.1

4.2.1 DIESEL ENGINE 250kVA 400/230-volt

- a) Make and Model
- b) Type (two or four stroke).....
- c) Performance Parameters
 - i) Rated output at sea level: Prime Power:kVA / kW.
Standby Power.....kVA / kW.
 - ii) Rated output atmetres above sea level (Altitude of hospital/Institution)
Prime PowerkVA / kW.
Standby Power.....kVA / kW.
 - iii) Ambient air temperatures atmetres above sea level (Altitude of hospital/Institution)
Minimum °C.....
Maximum °C.....
- d) Governed speedRPM
- e) Number of cylinder
- f) Diameter of cylindersmm
- g) Stroke of pistonmm
- h) Piston speedm/minute
- i) Type of air cleaner

- j) Type of lubricating oil filter
- k) Make and type of injection system
- l) Type and number of fuel filters
- m) Manufacture and type of turbo-charger
- n) Manufacturer and type of governor
- o) Max cyclic variations
- p) Speed variation for sudden release or application of load:
 - i) Temporary
 - ii) Permanent
- q) 100% Rated full load may be applied seconds after initiation of starting sequence
- r) Specific fuel consumption at full load. Litres/ HR (submit curves)
- s) Air quantity required for engine cooling.....,.....cu.m/min.
- t) Cross sectional area of radiator air discharge outlet required

STARTING BATTERY

- a) Manufacturer
- b) Type
- c) Capacity.....
- d) Voltage.....

ALTERNATOR

- a) Make
- b) Type
- c) Type of bearings
- d) Method of lubrication
- e) Rated load at 0.8 power factor at 400/230 volt 50Hz 3 Phase
 - i) Continuous ratingKva.....Amps.....
- f) Efficiency of alternator at full load
- g) Output voltage within governed speed range at:
 - i) No loadVolts
 - ii) 50% loadVolts
 - iii) 100% loadVolts
 - iv) 110% loadVolts
- h) Method of voltage regulation

CONTROL CUBICLE

- a) Manufacturer

- b) Dimensions of control cubicle: Length.....mm
 Width.....mm
 Height.....mm
- c) Type of control equipment
- d) Type, make and rating of 4 pole by pass switch
- e) Type, make and rating of 4 pole motorised change-over switch
- f) Rupturing capacity at rated voltage of main circuitK.A.
- g) Method of tripping employed in main circuit breaker
- h) Range of load setting of main circuit breaker
- i) Electrical and mechanical interlock provided: YES..... NO..... TYPE

VOLTMETER

- a) Make and type
- b) Dial dimensions
- c) B.S.S. accuracy

MAXIMUM DEMAND AMMETERS

- a) Make and type
- b) Dial dimensions
- c) Time lag.....
- d) B.S.S. accuracy

FREQUENCY METER

- a) Make and type
- b) Dial dimensions
- c) B.S.S. accuracy

SELF BUNDED FUEL TANKS

Base tank size (Not to exceed 1000 litres in volume):

Bulk tank size . N/A.

Bulk tank manufacturer and model number: N/A.

EXHAUST

Exhaust material

Exhaust material, silencer and outlet pipe

MASS OF PLANTkg

OVERALL DIMENSIONS OF PLANT

Length

Height

Width

TYPE AND RATING OF EQUIPMENT TO BE USED FOR LOAD TESTS

.....

COMPANY NAME AND ADDRESS OF BULK TANK INSTALLATION

.....

.....

IS THE TENDERER A DIESEL GENERATOR SET MANUFACTURER WITH LOCAL MANUFACTURING AND BACKUP FACILITIESYES / NO.....

IS THE TENDER 100% TO SPECIFICATIONYES / NO.....

If the answer is NO, provide reasons for the deviation from the specification.

.....
.....
.....
.....
.....

DATE..... SIGNATURE OF TENDERER.....

COMPANY STAMP

[Empty rectangular box for company stamp]