



**TECHNICAL SPECIFICATION**

**FOR THE**

**SUPPLY, DELIVERY AND INSTALLATION OF**

**A DIESEL ENGINE, ALTERNATOR AND CONTROL PANEL TO BE**

**USED AS A STANDBY POWER PLANT**

**Specification no. SOW-WR-186**

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**TRANSNET NATIONAL PORTS AUTHORITY OF SOUTH AFRICA  
A DIVISION OF TRANSNET SOC LTD.**

**SPECIFICATION FOR THE SUPPLY, DELIVERY AND INSTALLATION OF A DIESEL ENGINE AND ALTERNATOR (D/A) SET TO BE USED AS A STANDBY POWER PLANT**

**1. GENERAL**

**1.1 Scope**

- 1.1.1 This specification describes a diesel engine, 15 kVA alternator, an automatic mains failure control panel and mounting frame (D/A set). The D/A set will be used as the secondary source of supply upon failure of the primary power supply to the Aid to Navigation (AtoN).
- 1.1.2 The equipment for which tenders are invited is listed in the attached Schedule of Requirements.
- 1.1.3 The installation and commissioning of the D/A set will be undertaken by the Tenderer at sites stated in the Schedule of Requirements.
- 1.1.4 The installation works include the provision of a base mounted service fuel tank and all associated fittings required to provide a fuel line to the D/A set.
- 1.1.5 It is essential that the plant complies with the following requirements:
- (i) Minimum fuel consumption.
  - (ii) Maximum reliability.
  - (iii) Minimum maintenance attention.
  - (iv) Easy access to all parts for adjustment and/or replacement.
- 1.1.6 Tenderers must furnish a definite statement confirming that they have staff in South Africa competent to deal with any technical problems that may arise with regard to the installation, operation and maintenance of the D/A set offered.
- 1.1.7 Transnet National Ports Authority may decide to accept all, or only part of the quantity indicated on the Schedule of Requirements.

**1.2 Service Conditions**

- 1.2.1 The D/A set must be suitable for operation under conditions of high humidity, corrosive atmosphere, high temperature and dust laden air, and all engine accessories, electrical wiring, solenoid coils, etc., must be fully protected against failure and damage by these conditions.
- 1.2.2 The alternator windings must be double dipped to compensate for the high humidity.

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### 1.3 Standards

- 1.3.1 Except where otherwise provided for in this specification, all the equipment offered must comply with the standard specifications of the South African National Standards SANS in force at the time of tendering.
- 1.3.2 Where the equipment offered complies with the recognised standards of the country of manufacture and not specifically with the standards required by this specification, such plant will be considered at the discretion of Transnet National Ports Authority, in which case tenderers may be required to supply copies of such standards translated into English.
- 1.3.3 Tenderers must state the standard specification to which the equipment on offer, as well as, where relevant, the individual items of equipment on offer complies with.

### 1.4 Submission of Tenders

- 1.4.1 Tenderers must include the supply of all the equipment listed in the Schedule of Requirements and which must be checked and tested on the successful tenderer's premises prior to delivery.
- 1.4.2 Tenderers must state in detail (using the same numbered paragraph headings of this specification) in what respects their offers comply with or depart from the requirements of this specification. It is preferred that wherever possible, tenderers offer their standard equipment most closely complying with this specification provided that their standard equipment provides better but not worse facilities than required by this specification.

The submission of manufacturer's data sheets and advertising pamphlets without the necessary amplification to indicate compliance or otherwise with this specification will not be acceptable. Cross-section drawings of the engines offered against this tender must be submitted with the tender documents.

- 1.4.3 All tenders and associated literature must be submitted in duplicate and must be in English.
- 1.4.4 Tenderers must complete the technical data sheet and annexure attached to this specification. Failure to submit this sheet fully completed with the tender, will preclude a tender from consideration.

### 1.5 Guarantee

- 1.5.1 The successful tenderer will be required to guarantee the equipment supplied for a period of not less than one year from the date of placing the plant in service in South Africa. If during the first year that the plant is in service, any inherent faults develop not due to fair wear and tear, of which Transnet National Ports Authority is not aware at the time of acceptance of the tender, Transnet National Ports Authority reserves the right to return to the supplier all or part of the complete plant.

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The supplier must assume full liability for the cost of the plant and such transport charges between the factory and the lighthouse as Transnet National Ports Authority may have incurred. Under these circumstances, Transnet National Ports Authority shall not be liable for any depreciation or wear of the plant whilst it was in service.

1.5.2 Transnet National Ports Authority will not consider tenders which do not include a guarantee for the full 12-month period, commencing from the date the equipment is placed in service.

1.5.3 The terms of the guarantee shall be clearly stated.

## 1.6 Tests

1.6.1 The successful tenderer must supply immediately on completion of the tests on the manufacturer's premises, the following data:

- (i) Test certificate for the engine and alternator.
- (ii) Fuel oil specification for the engine and the recommended brands of fuel oil.
- (iii) Lubrication oil specification for the engine and the recommended brand of oil.

1.6.2 Tests may be performed by Transnet National Ports Authority after installation of the plant and the successful tenderer may, if he so desires, appoint a representative to be present at his own expense during the performance of the tests.

## 1.7 Instruction Books, Maintenance Manuals, Drawings, etc.

1.7.1 Copies of all instruction manuals, maintenance manuals and parts lists including workshop manuals, together with adjusting- instructions necessary for the installation and maintenance of the plant, the quantities of which is stated in the Schedule of Requirements, must be supplied by the successful tenderer to the address/es specified in the Schedule of Requirements. This information must be in English.

1.7.2 Copies of all drawings, wiring diagrams and test results relevant to the plant, the quantity of which is stated in the Schedule of Requirements, must accompany the information mentioned in paragraph 1.7.1. These drawings must be in accordance with British Standards and must be in English. The drawings supplied must include the following, besides any other drawings considered necessary by the manufacturer:

- (i) General arrangement drawing of the engine, alternator and control panel.
- (ii) Both schematic and wiring diagrams of the control panel.
- (iii) All electrical connection drawings for the D/A set.
- (iv) Cross-sectional drawings of engine and alternator.
- (v) Wiring diagram of the alternator.

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(vi) Schematic circuit diagram of the electronic excitation system showing component values, ratings, semi-conductor types, etc.

1.7.3 Provide software for the PLC program including training.

1.7.4 As technical literature is regarded as an integral part of the order, payment for equipment received will be deferred until the delivery of all technical literature, drawings, software and wiring diagrams have been received per the requirements of clauses 1.7.1, 1.7.2 and 1.7.3.

## 1.8 Spares

1.8.1 The availability of spares in the Republic of South Africa shall be an important consideration in the adjudication of the tender.

1.8.2 The tenderer shall state if all spares for the maintenance and urgent repairs of the engine, alternator and control panel offered are available over the counter. The names and addresses of the suppliers from which these spares are available in South Africa, shall be furnished.

1.8.3 The tenderer shall guarantee local availability of all spares for a period of 10 years after the order is placed.

## 1.9 Delivery

1.9.1 Delivery will be an important consideration in the adjudication of this tender as the D/A set is urgently required.

1.9.2 All fabrication designs, component layouts and wiring diagrams are to be approved by Lighthouse and Navigational Systems before the commencement of manufacture and assembly.

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## 2. DIESEL ENGINE AND ACCESSORIES

### 2.1 General

- 2.1.1 The diesel engine is required for driving a 15kVA alternator as stated in clause 1.1.1. The engine must be capable of producing an output as specified in the Schedule of Requirements at 1 500 r.p.m. operating at an altitude of 0 - 50 metres above sea level and a maximum temperature of 40°C.
- 2.1.2 The diesel engine with fittings, lubrication oil tanks and stands, must be finished with a good quality heat resistant enamel paint.

### 2.2 Engine

- 2.2.1 A vertical, four-stroke, direct injection, cold starting, normally aspirated, oil-cooled, multi-cylinder engine is required.
- 2.2.2 The rated output of the engine must be the load in kW which it is capable of carrying for a period of twelve hours at rated speed when working under the service conditions stated in clause 2.1.1.
- 2.2.3 The engine must be capable for periods of one hour of developing a load of 10% above its rated output without undue heating of the engine or other mechanical defects.
- 2.2.4 **Starting**
- (i) The engine will be started electrically and an independent, gear controlled, axial starter must be fitted. The operating voltage of the starter shall be the same as that of the battery as stated in the Schedule of Requirements.
  - (ii) A repeat start facility must be provided to give at least 3 starting attempts during a 30-second starting period, should the engine for any reason fail to start at the initial attempt. After the 30-second start period, the D/A set will be placed out of commission should the engine fail to start.
  - (iii) The starter motor circuit will also be disconnected immediately after the engine has started during the start period
  - (iv) A heavy-duty battery of such capacity as to give at least 6 successive starts of 30 seconds duration each must be supplied. The required battery voltage is stated in the Schedule of Requirements.
  - (v) To ensure that the battery is kept charged an external battery charging circuit should be provided.

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#### 2.2.5 **Speed**

The speed of the engine must be 1 500 r.p.m.

#### 2.2.6 **Governing**

Precise governing is to be accomplished by the use of an electric/electronic governing system.

This system shall have the same operating voltage as that of the battery.

#### 2.2.7 **Lubrication**

The lubrication system must be of the pressure feed type. A reliable type of oil filter must be fitted between the lubricating oil pump and the engine circuit.

A by-pass valve must be included in the lubrication oil circuit in order that a full flow of oil will be available to the working parts of the engine in the event of a filter becoming blocked. The sump drain outlet must be positioned beyond the extremity of the engine frame clear of any obstruction so it can accessible.

#### 2.2.8 **Air Intake**

A cartridge type air filter element housed in a suitable air filter housing is required.

#### 2.2.9 **Ventilation**

Create sufficient ventilation in the engine room for the cooling of the DA set.

#### 2.2.10 **Exhaust System**

An overhead stainless steel exhaust system is required for the engine which must have the following,

- (i) A robust and effective exhaust silencer for inside the engine room.
- (ii) Flexible exhaust piping is required for the vertical section,
- (iii) Output of exhaust to be through the wall with sufficient length as not to discolor outside wall.

#### 2.2.11 **Enclosures**

- (i) All the working parts must be enclosed but must be readily accessible for adjustment.
- (ii) There must be safety guards for all moving parts.
- (iii) The fuel pumps and governor equipment must be completely enclosed to prevent the ingress of dust, etc. to any moving parts.



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#### 2.2.12 Fuel Tanks

- (i) The fuel base tank and all associated equipment and components shall be manufactured in accordance with the applicable South African standards.
- (ii) Double skinned fuel tank made out of Grade 304 stainless steel and to be coated.
- (iii) Tank must be mounted on a stand separately from the frame and secured.
- (iv) Pick up pipe must be installed in tank.
- (v) Fuel return pipe must be installed in tank.
- (vi) Inspection lid to be fitted on top of tank.
- (vii) Filler cap to be installed on top of tank.
- (viii) Fuel level probe must be installed to measure fuel level in tank.
- (ix) Drain cock to be installed in tank to drain fuel when necessary.
- (x) Pressure tests must be performed by the manufacturer on each tank prior to installation.
- (xi) Leakage tests are required to be performed and to be done prior to the painting of the fuel tank.
- (xii) The leakage test is to be carried out until there are zero leaks apparent for two consecutive test periods.
- (xiii) Proof of the tests carried out on the fuel tanks are to be submitted to Transnet National Ports Authority.
- (xiv) The fuel tank is to hold a capacity of 300 liters of diesel.
- (xv) An adequately sized drip tray shall be placed under the tank to accommodate any spill or drip.
- (xvi) A fuel gauge should be fitted on the fuel tank.

#### 2.2.13 Failure detection

The engine will be shut down automatically under electrical control conditions should any of the following sensors supplied and fitted to the engine register a faulty condition:

- (i) Excessive engine temperature sensor,
- (ii) Low oil pressure,
- (iii) In the case of belt driven cooling blowers, a belt destruction switch must be fitted.

2.2.12 All electrical alarm and control cabling associated with the diesel engine should be completed and terminated on a local terminal box which can be mounted on the bedplate.

2.2.13 The engine shall be oil-cooled.

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### 3. ALTERNATOR

- 3.1 The alternator shall be a single bearing capable of producing an output of 15kVA at 0,8 p.f., 50Hz when driven at a speed of 1 500 r.p.m
- 3.2 The insulation of the alternator windings must be double coated.
- 3.3 The temperature rise of the windings for continuous full load operation of each alternator under rated conditions must not exceed the limits laid down in the latest edition of BS 500 series.
- 3.4 The alternator must be self-excited.
- 3.5 The alternator must be inherently self-regulating and the inherent voltage regulation, defined as a percentage rise in terminal voltage when full rated load at 0,8 p.f. irrespective of engine speed fluctuations and shall not exceed 2,5%.
- 3.6 Precautions will be taken to prevent power being delivered to the output circuits unless the voltage generated is within:  $\pm 10\%$  of 220 volts.
- 3.7 Screen protected drip-proof enclosures will be the minimum degree of enclosure acceptable.
- 3.8 The alternator shall be fitted with either ball or roller bearings.
- 3.9 The alternators shall be of the brushless type.
- 3.10 The excitation system shall incorporate a solid-state voltage control unit. The excitation power source shall be constant and independent of the main stator terminals but reference signals from the latter terminals to the voltage control unit shall maintain output voltage regulation within fine limits as well as provide for decreasing excitation when faults such as prolonged short circuits, sustained overloads or rotating diode failures occur.
- 3.11 The wiring on the alternator shall be protected against damage by vibration and impregnation by lubricating and diesel fuel oil. The wiring shall be terminated on numbered terminal strips in suitable boxes with provision for marking off the external cabling.
- 3.12 The alternator shall be finished in good quality heat-resistant enamel paint
- 3.13 Alternators shall be fitted with a means of removing moisture from alternator space.

### 4. DIESEL ALTERNATOR STANDBY CONTROL SYSTEM

#### 4.1 Functional requirements

##### 4.1.1 General description

- 4.1.1.1 In order to ensure continuous functionality of a lighthouse, the standby D/A set is required to automatically take over the load in the event of the primary supply failure. A primary supply failure could mean either a total or partial failure, or if the set parameters are deviated from.

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Should the situation arise as described above, the following is required.

- (a) The load should be connected to the busbar during this period to ensure a minimal period of disruption. The load should be disconnected once the primary supply is restored.
- 4.1.1.2 Once the primary supply has been restored, the D/A set is to shut down after the load had been taken over by the primary supply.
- 4.1.1.3 The primary supply voltage and current supplied shall be effectively and reliably monitored. If there is any deviation from the set parameters (under or over) for the mains supply, the Control System shall automatically control the starting and running of the D/A set to effectively take over the load.
- 4.1.1.4 All the set parameters and those indicated below should all be able to be easily adjustable on site.
- 4.1.1.5 Local manual control functions are required.
- 4.1.1.6 The functionality of being able to remotely monitor of the primary supply and D/A set alarm conditions is required. Control functions shall be able to be done remotely, such as, inter alia, the resetting of alarms, the starting of the D/A set and the simulation of the primary supply failure.
- 4.1.1.7 Any malfunction of the remote controls and monitoring should not have any effect on the operation of the Control System.
- 4.1.1.8 The D/A set should only take over the load once it has reached full operational speed and voltage.
- 4.1.1.9 The Control System shall monitor the under and over voltage, abnormal current and frequency of the alternator supply.
- 4.1.1.10 The engine's hours of running shall be monitored and recorded.
- 4.1.1.11 The Control System shall monitor the temperature, oil pressure and under/over speed of the engine. Cognisance should be taken of the fact that the monitoring of the set D/A parameters should only take place after the D/A set has reached full speed and voltage.
- 4.1.1.12 When the mains supply is fully restored to within the set parameters, the Control System should automatically switch the load back to the primary supply and shut the D/A set down.
- 4.1.1.13 The Control System shall have a repeat starting facility which will allow 3 starting attempts during a 30-second starting period, should the engine fail to start during the first attempt. After the 30-second start period, the D/A set will be placed out of commission should the engine have failed to start.
- 4.1.1.14 The starter motor circuit shall be disconnected immediately after the engine has fired during the starting period.

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#### 4.1.2 Alarms

- 4.1.2.1 All alarms shall be able to be tested via individual manual test / reset buttons.
- 4.1.2.2 Alarms and indicators shall be able to be monitored remotely via voltage free contacts.
- 4.1.2.3 Alarms as stated in clause 2.2.12 shall immediately upon being activated, and the prescribed starting up time periods have lapsed, shut down the engine, preventing the engine from restarting unless the alarm is manually or remotely reset.
- 4.1.2.4 Switching between the primary and alternator supply shall be interlocked in order to prevent both supplies being live on the bus bar at the same time.

Both the live and neutral of the mains and alternator supplies shall be disconnected from the bus bar when not feeding it.

- 4.1.2.5 Manual starting of the standby set shall be able to be done via the Control System.
- 4.1.2.6 The Control System shall make provision for a charging facility for the control battery capable of boost or trickle charging the batteries.
- 4.1.2.7 An automatic functional test of the D/A set is required. The Control System shall be capable of automatically starting the engine on a weekly basis at a prescribed time and run the engine on the station load, supplemented with the test load, to ensure a full load condition for a stipulated time and then restore the system to its normal operating conditions.

The frequency [day(s) of the week], the starting time and duration of the functional test should all be able to be easily adjustable on site.

- 4.1.2.8 The Control System shall be able to provide for the following functionalities.
- (a) Parameters to be able to be individually set on site and monitored such as, inter alia:
- (i) Mains supply
- Over voltage
  - Under voltage
  - Over load
  - Bus bar failure
- (ii) D/A set
- Over voltage
  - Under voltage
  - Over speed
  - Under speed

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- High frequency of the alternator supply
- Low frequency of the alternator supply
- Over load condition
- Busbar failure
- High temperature
- Fail to start
- Low oil pressure

(b) Visual displays are required, indicating, inter alia:

(i) Mains supply

- A/C voltage
- Current drawn
- Mains busbar failure

(ii) D/A set

- A/C voltage
- Current drawn
- Alternator Frequency
- Time (in hours, up to 1 decimal point) that the engine has operated for. The time shall not be able to be reset at all.
- Control circuitry D/C voltage supply
- Both control & starting battery Voltmeters
- Both control & starting battery charging currents
- Wrong switch position
- Fan belt failure
- PLC battery OK

(c) Manual switching are required for, inter alia:

- (i) Mains isolator (isolating both live and neutral)
- (ii) Mains ON/OFF (isolating both live and neutral)
- (iii) Alternator supply ON/OFF (isolating both live and neutral)
- (iv) Engine start ON / STOP
- (v) Test load ON / OFF
- (vi) Control battery boost / trickle charge
- (vii) Starting battery boost / trickle charge
- (viii) Emergency D/A stop, lockable push button

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**Note:**

(1). It is a pre-requisite that the following switches shall be mounted in such a way that, in case of an emergency, access thereto shall be unhindered, i.e. not behind any doors.

- Mains isolator (isolating both live and neutral)
- Emergency D/A stop

(2). The face plates of all switches shall be marked with the:

- Switch description and
- Position descriptions

(d) (i) Remote monitoring and control functions are required. The functionality of the Control System shall not be affected by the failure of external monitoring and control conditions as such, inter alia, contacts, wiring / cabling, etc.

(ii) The remote monitoring functions will be provided through voltage free normally closed (N/C) and / or normally open (N/O) contacts.

## 4.2 Technical requirements

### 4.2.1 General requirements

4.2.1.1 The design, wiring and equipment of the Control System shall be suitably rated for the connection and operation of the D/A set as indicated in the Schedule of Requirements.

4.2.1.2 The Control System shall be of modular design to enable the easy removal and replacement of faulty components with wiring and equipment suitably rated for a minimum load as indicated on the Schedule of Requirements.

4.2.1.3 All wiring is to be labelled with cable markers and shall be clearly visible without the need to adjust the markers.

### 4.2.2 Control System Operation

4.2.2.1 The mains supply shall be monitored to within +15% (high voltage) and -10% (low voltage) of the normal operating voltage.

4.2.2.2 When the mains supply voltage deviates from these limits, the system shall wait for a period of 5 seconds and if the supply voltage has not recovered during this period, the following sequence of events should occur:

- (a) The mains contactor to de – energise with no delay
- (b) The D/A set starting circuitry to energize with no delay
- (c) If the D/A set starts successfully (monitored by voltage, frequency and engine speed comparators and line monitors), the D/A set will run without load for a defined period of time (approximately 10 seconds) as a warm-up period.

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- (d) If no alarms are received, then the D/A contactor to energise and the supply to be connected to the busbar.

4.2.2.3 When the mains supply normalises, the D/A set shall carry the load for a further 3 minutes. If the mains supply remains within the set parameters during this period, the following should occur:

- (a) The alternator contactor to de-energize with no delay and the engine shuts down.

- (b) The mains contactor to energize with no delay and the mains supply is immediately connected to the busbar.

4.2.2.4 Whilst the D/A set is operational, the alternator supply shall be monitored to within +15% (high voltage) and -10% (low voltage) of the normal operating voltage.

Should the alternator supply voltage exceed these limits, or if any other D/A alarm conditions arise, then the D/A set shall be shut down and the alternator contactor to de-energize with no delay.

#### 4.2.3 Programmable Logic Controller (PLC)

4.2.3.1 A fully operational PLC shall be supplied and installed, being an integral part of the Control System;

4.2.3.2 The PLC software shall be custom designed and fully tested in order to control execute the required functions as described in this Specification;

4.2.3.3 Provision shall be made to ensure that the PLC unit shall fully retain its performance and not lose its stored memory in the event of power interruption, power dip or any other related disturbances;

4.2.3.4 The PLC shall be used to monitor and control the functional requirements, inter alia the:

- (a) The availability of the mains supply between the set parameters;
- (b) Change over procedure between mains and alternator supply and vice versa;
- (c) D/A start run and stop cycle;
- (d) Alternator supply and shut down the D/A set should a fault condition occur together with the necessary alarm annunciation with indications;
- (e) Remote monitoring and control functions;
- (f) Regular functional test run of the D/A set.

#### 4.2.4 Alarms, Indications and Metering equipment

##### 4.2.4.1 Alarms

Individual alarm indications shall be by means of a Liquid Crystal Display (LCD) text

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messages. These alarm indications shall not be interrupted in case of an AC or DC supply failure.

(a) The LCD indications shall be so mounted that viewing thereof can take place through the polycarbonate insert without the need for opening the outer door of the panel.

(b) The following alarms are to be catered for:

(i) *Engine low oil pressure*

If the oil pressure of the engine is low whilst in operation, or for a period of more than 10 seconds during the start-up sequence, then the engine "low oil pressure" alarm shall be activated.

(ii) *Engine over temperature*

If the general temperature of the engine is high whilst in operation then the engine "over temperature" alarm shall be activated.

(iii) *Engine fail to start*

The engine should, after cranking for a period of 5 seconds, and failing to start, wait for 5 seconds before trying to restart. After a total of three attempts without starting, the "fail to start" alarm shall be activated. These time periods shall be able to be adjusted on site.

(iv) *Engine over speed*

If the engine speed rises 5% above 1,500 r.p.m. then the "over speed" alarm should be activated.

(v) *Engine under speed*

If the engine speed falls 5% below 1,500 r.p.m. then the "under speed" alarm should be activated.

(vi) *Alternator over volts*

If the alternator voltage exceeds the maximum stipulated voltage then the "over volt" alarm should be activated.

(vii) *Alternator under volts*

If the alternator voltage drops below the minimum stipulated voltage then the "under volt" alarm should be activated.

(viii) *Alternator under frequency*

If the alternator frequency drops below 47 Hz then the "under frequency"



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alarm should be activated.

(ix) *Alternator over frequency*

If the alternator frequency rises above 53 Hz then the “over frequency” alarm should be activated.

(x) *Alternator busbar failure*

If the alternator voltage to the busbar is interrupted for more than 10 seconds whilst the D/A set is running then the “busbar failure” alarm shall be activated.

(xi) *Alternator overload*

If the alternator current exceeds the stipulated set point for more than 10 seconds then the “overload” alarm should be activated.

(xii) *Mains supply failure*

If the mains electricity supply fails for longer than 10 seconds then the “main supply failure” alarm should be indicated. This should also apply if the mains supply exceeds the set parameters for an over and under voltage setting.

(xiii) *DC Supply failed*

If the Control System’s DC supply voltage drops below the stipulated voltage then the “DC supply fail” alarm should be activated.

(xiv) *D/A starting battery flat*

If the D/A starting battery voltage drops below the stipulated voltage then the “D/A starting battery flat” alarm should be activated.

(xv) *PLC battery low*

If the PLC battery voltage drops below the stipulated voltage then the “PLC battery fail” alarm should be activated.

(xvi) *Engine fan belt failure*

If the engine’s fan belt has broken then the “Engine fan belt failure” alarm should be activated.

(xvii) *Wrong switch position*

If any switch or other relevant device is not in its normal switching position then the “Wrong switch position” alarm should be activated.

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#### 4.2.5 Enclosure

##### 4.2.5.1 Enclosure Construction

- (a) The enclosure protection standard shall be at least IP44 compliant
- (b) The outer door is to be lockable with a large transparent polycarbonate viewing insert that is designed to ensure maximum visibility.
- (c) The materials used in the construction of the enclosure and the workmanship shall be of the highest standard.
- (d) Doors and framework shall be of 1.6 mm stainless steel sheet grade 3CR12. Door shall open to either the left or right.
- (e) Tenderers shall specify what fixing (hinges, catches, locks, etc) for doors etc. will be provided.
- (f) All screws, washers, bolts and nuts shall be cadmium plated, electroplated galvanized or suitably protected against corrosion.
- (g) Enclosure to be etch-primed and epoxy coated electrical orange in colour with a smooth finish. All holes shall be drilled and tapped or cut before the epoxy coating process is commenced. No metalwork or part thereof shall be left unprotected.
- (h) The inner door is to be hinged and mounted on a framework within the panel and shall be able to be locked in position.
- (i) The backing plate is to be mounted using studs and nuts at the rear of the panel.
- (j) The backing plate shall be sprayed white.
- (k) The backing plate shall be manufactured in such a way as to enable it to be removed through the front of the panel.
- (l) A gland plate for allowing bottom entry cabling is to be provided that can be removed from the panel. .

#### 4.2.6 Wiring of Panel

- (a) All power and control wiring shall be terminated in suitable terminals/ connectors from where it can be connected to external equipment.
- (b) All terminals shall be clearly marked in accordance with the circuit diagrams.
- (c) All wiring to the PLC input and output terminals shall terminate in suitable termination blocks (combs) to facilitate easy removal of the PLC.
- (d) A dummy load selector switch shall be installed for testing the standby D/A set.

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- (e) All electrical loads supplied from this panel shall be protected by suitably rated circuit breakers, which comply with SANS 156.
- (f) Cooling of equipment in the Control System shall be by means of suitable ventilation ducts.

#### 4.2.7 Surge Protection

A complete surge protection system shall be installed on the incoming and outgoing supplies in order to protect the Control System against damaged caused by lightning.

### 5. MOUNTING FRAME

- 5.1 The engine, alternator and control panel is to be mounted on a galvanised frame.
- 5.2 The top of the mounting frame is to be at least 500mm high.
- 5.3 All components are to be mounted within the frame, thereby offering the components some sort of protection.
- 5.4 The Control panel is to be mounted at an accessible height and adequately protected against vibrations caused through the running of the engine.
- 5.5 All cabling and fuel piping is to be routed in such a manner that it is not going to be fouled by the normal running of the engine.
- 5.6 Provision must be made to securely fasten the frame to the ground using appropriate fasteners.
- 5.7 An appropriately sized drip tray made out of galvanized steel is to be placed under the D/A.

### 6. SIGN-OFF

  
.....  
Technical Services Manager

31/08/2023  
.....  
Date

  
.....  
Operational Supervisor

05/09/2023  
.....  
Date

  
.....  
Regional Manager

05/09/2023  
.....  
Date

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**TECHNICAL DATA SHEET**

**ADDENDUM TO SPECIFICATION NO. SLC-49 rev4**

**(To be completed by Tenderer)**

1. Maker's name, type and number of cylinder:

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2. Rated output (twelve-hour rating at rated speed in kW at sea level and 30° C ambient temperature:

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3. Fuel consumption in kg/kW/hour at:

(a) 100 % engine output:

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(b) 50% engine output:

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4. Rated speed in r.p.m.:

---

5. Maximum change of speed on suddenly taking off or throwing on the rated load:

(a) Temporary change as a percentage of rated speed:

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(b) Permanent change as a percentage of rated speed:

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6. Guaranteed cyclic irregularity:

---

7. Bore of cylinder in mm: \_\_\_\_\_

8. Stroke of piston in mm:

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9. Compression ratio:

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10. Mean effective pressure in kg/cm<sup>2</sup>:

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11. Mean piston speed in mm/sec:

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12. Type and size of bearing: (a) Main: \_\_\_\_\_

(b) Big-end: \_\_\_\_\_

13. Dry mass of engine (including fly-wheel) in kg:

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14. Lubrication oil sump capacity (litres):

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15. Is engine still in production?

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16. By what year is it anticipated that this engine will be out of production?

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17. State number of years that spare parts will be freely available after production of engine is discontinued:

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**ALTERNATOR (To be completed by Tenderer)**

1. Maker's name and type number: \_\_\_\_\_  
\_\_\_\_\_
2. Rated output: \_\_\_\_\_
3. Temperature rise of windings at rated output is not more than \_\_\_\_\_ degrees centigrade.
4. Voltage and frequency  
\_\_\_\_\_
5. Guaranteed voltage regulation.  
\_\_\_\_\_
6. Efficiency at:
  - (a) 100% rated output: \_\_\_\_\_
  - (b) 50% rated output: \_\_\_\_\_
7. Speed in r.p.m.: \_\_\_\_\_
8. Mass of alternator in kg: \_\_\_\_\_
9. Maker's name, number and type of bearings: \_\_\_\_\_  
\_\_\_\_\_
10. Is alternator still in production? \_\_\_\_\_
11. By what year is it anticipated that this alternator will be out of production? \_\_\_\_\_
12. Is the windings of the alternator double dipped? \_\_\_\_\_
13. State number of years that spare parts will be freely available after production of alternator is discontinued:  
\_\_\_\_\_