
**Section H Detailed Specifications for Refurbishment of Electrical and Control &
Instrumentation Works**

CONTENTS

Part 5 – Pump Station 34 (Existing) H36

PS-E-001 – Electrical Installation H36

PS-E-002 – Standby Generator H38

Part 5 – Pump Station 34 (Existing)

PS-E-001 – Electrical Installation

SCOPE OF WORKS

The scope of works includes the following:

New Motor Control Centre (MCC-PS34-XR)

The Contractor shall design a new motor control centre (MCC) to control the following motors:

- Two submersible foul water pump motors at Pump Station 34
- One self-priming pump at the Balancing Dam
- All motors as required for the rock catcher

For the purpose of tendering the bidder shall quote on amounts in the bill of quantities and for an MCC as shown on Drawing No J39079-E001 and these shall be remeasurable.

Drawings issued

Only one tender drawing is issued for the electrical installation. This is

Drawing No J39079-E001 PS 35 refurbishment: Schematic diagram for MCC

Main Supply

The Contractor shall install one new circuit breaker in the existing MCC or Distribution Board at the existing Inlet Works and shall install an underground steel wire armoured cable to bring power from there to the new MCC-PS24-XR. The Contractor shall determine the correct size of circuit breaker and cable and these shall be reviewed and accepted by the Engineer. For the purposes of tendering the bidder shall use the sizes and quantities as stated in the Bill of Quantities.

Standby Generator

A 200 kVA diesel standby generator is proposed to give 100% back-up in the event of Mains failure. During the design phase the Contractor shall advise as to whether or not this will be adequate.

For the purposes of tendering the bidder shall price based on a 200 kVA diesel generator in a sound attenuating weatherproof as described in the detailed specification below.

The Contractor shall include for and shall install automatic mains failure (AMF) controls with the change-over isolators being installed in the MCC.

The Contractor shall supply and install an underground steel wire armoured cable to bring power from the standby generator to the MCC. The Contractor shall determine the correct size of cable and this shall be reviewed and accepted by the Engineer. For the purposes of tendering the bidder shall use the sizes and quantities as stated in the Bill of Quantities.

Power Distribution to Motors

Power distribution to motors shall be designed and installed by the Contractor and shall comprise the following for each motor:

- Local weatherproof isolator mounted on a galvanised iron stanchion next to the motor
- Underground steel wire armoured cable from the MCC to the isolator (4 core cables are proposed with one core per each phase and the fourth as protective earth.)
- Steel wire armoured cable or un-armoured flexible cable from the isolator to the motor

- Weatherproof field control station mounted on a galvanised iron stanchion next to the motor
- Underground multi-core cable connecting the field control station to the MCC
- The field control stations shall each incorporate an emergency stop pushbutton and either a “START” and “STOP” button or else, where required a “FORWARD”, “REVERSE” and “STOP” button. Pressing of these buttons shall cause the relevant motor to perform as stated.

For the purposes of tendering the bidder shall use the sizes, lengths and quantities as stated in the Bill of Quantities

Earthing and Bonding

The installation shall comply with SANS 10142 Part 1 for The Wiring of Premises.

The earthing shall be a TN-S system.

Bare copper earth wires shall be run together with the supply cables from the existing MCC or DB and from the generator and these shall be bonded to the main earth mat for the site or else to the incoming municipal earth wire.

The motor casings, isolators and stanchions are to be bonded via the fourth core of the cables supplying power to the motors.

A provisional sum has been allowed for any lightning protection and earthing of extraneous conductive parts, such as handrails to be done by a specialist.

Control

Submersible Pumps

There is an existing automatic control system in place. This system shall be adapted to automatically control the pumps by opening and closing circuits in the MCC.

The system shall operate as follows:

- Level sensors shall detect three states, namely Low Level, High Level and Very High Level
- Pumps shall start and stop as follows:
 - High Level: One pump to run
 - Very High Level: Both pumps to run
 - Low Level: Both pumps to stop

The Contractor shall check whether the necessary level detection devices are in place and shall design a system incorporating these devices and existing cabling to effect the control system as described above. This shall be reviewed and accepted by the Engineer and then installed. A provisional sum has been allowed in the Bill of Quantities.

Balancing Dam Pump

The balancing dam pump shall be manually controlled either via the pushbuttons in the field control station or else the ones in the MCC.

Rock Catcher

The automatic control for the rock catcher is expected to be quite complex and a provisional sum has been allowed in the bill of quantities.

The Contractor shall obtain the Control Philosophy Document and the Piping and Instrumentation Diagram (P&ID) for the rock catcher.

Based on this and in consultation with the Engineer the Contractor shall design an appropriate control scheme for the rock catcher and this shall be installed subject to review and acceptance by the Engineer.

PS-E-002 – Standby Generator

Section 1: General

The extent of work described herein shall be read in conjunction with the other parts of the specification, technical schedules and accompanying drawings.

Section 2: Project Description

The project is for the supply, delivery, offloading, testing and commissioning of a 200 kVA standby diesel generator set complete with weatherproof sound attenuating canopy and integral fuel tank.

The set shall be installed at the existing Pump Station No 34 at the Leeuwkuil WWTW, Sedibeng.

Section 3: Installer's Responsibility

The Installer shall be responsible for the supply, installation, testing, commissioning and free maintenance during the guarantee period (three years) of the Standby Generating Set.

The Installer shall provide all materials, equipment, labour and services necessary for the complete, safe and efficient operation of the electrical installation in accordance with the intent of this Specification and Drawings.

The works shall be carried out strictly in accordance with the following:

The Occupational Health and Safety Act No. 85 of 1993 and the relevant Regulations as amended.

National Building Regulations

The relevant local bye-laws and regulations of the Supply Authority.

SANS 8528-1:2008 Reciprocating internal combustion engine driven alternating current Generating Sets: Part 1: Application, ratings and performance.

SANS 8528-2:2008 Reciprocating internal combustion engine driven alternating current Generating Sets: Part 2: Engines.

SANS 8528-3:2008 Reciprocating internal combustion engine driven alternating current Generating Sets: Part 3: Alternating current generators for generating sets.

SANS 8528-4:2008 Reciprocating internal combustion engine driven alternating Current Generating Sets: Part 4: Control gear and switchgear.

SANS 8528-5:2008 Reciprocating internal combustion engine driven alternating current Generating Sets: Part 5: Generating sets.

SANS 8528-6:2008 Reciprocating internal combustion engine driven alternating

Current Generating Sets: Part 6: Test methods.

SANS 8528-7:2008 Reciprocating internal combustion engine driven alternating current Generating Sets: Part 7: Technical declarations for specification and design.

SANS 8528-9:2008 Reciprocating internal combustion engine driven alternating current Generating Sets: Part 9: Measurement and evaluation of mechanical vibrations.

NRS 010-2	Stationary lead acid batteries
NRS 024-Part 1	Diesel alternator sets for fixed installations
NRS 026	Battery chargers, industrial type
SANS 013	The determination of performance (at net power) of internal combustion engine
SANS 529	Heat-resisting wiring cables
SANS 556-1	Low-voltage switchgear
SANS 1411-1	Materials of insulated electric cables and flexible cords – Part 1: Conductors
SANS 1433	Electrical terminals and connectors
SANS 1473-1	Low-voltage, switchgear and controlgear assemblies – Part 1: Type-tested, partially type-tested and specially tested assemblies with a rated short-circuit withstand strength above 10 kA
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
SANS 1765	Low-voltage switchgear and controlgear assemblies (distribution boards) with a rated short-circuit withstand strength up to and including 10 kA
SANS 10103	The measurement and rating of environmental noise with respect to annoyance and speech communications
SANS 10131	The storage and handling of liquid fuel
SANS 10140	Identification for colour parking (Part 2)
SANS 10142 - Part 1	The wiring of premises; low voltage installations
SANS 10400	National building regulations
SANS/IEC 6034	Rotating electrical machines
SANS 60529/IEC 60529	Degrees of protection provided by enclosures (IP Code)
SANS 60947/IEC 60947	Low-voltage switchgear and controlgear
BS 500	Machines for miscellaneous application
BS 2757	Classification of insulating material for electrical machinery
BS 4999	

BS 5000

BS 5514 Specification for reciprocating internal combustion engines performance

IEC 61643 Surge protective devices connected to low voltage distribution systems

In terms of Government Notice No 17548, it is the Installer's responsibility to ensure that all electrical fittings installed comply with the relevant SANS safety standards, applicable to the particular class of fitting.

The Installer shall not install any fitting under any circumstance which does not comply with the SANS safety standards unless specifically instructed in writing by the Engineer on an item for item basis.

Where a product is claimed to comply with the SANS safety standard by compliance to an alternative foreign safety standard recognised and accepted by the SANS, the Installer shall obtain and submit proof of such acceptance. Where the SANS grants a permit for the use of equipment which does not carry the SANS/SABS mark, the Installer shall submit copies of the permits and test reports to the Engineer at the time of tender.

All equipment tendered shall comply with the SANS safety standard as required by the above legislation. The Electrical Installer shall provide copies of SANS certificates of compliance for electrical fittings upon request by the Engineer. No claim will be considered on the basis that equipment tendered did not comply with the relevant SANS standard.

Section 4: Scope of Works Included

The Generator Installer's work shall be the complete diesel standby generator installation including commissioning of the following:

Standby Generator Plant: 200 KVA minimum output at 400V/50 Hz at 0.85 Power Factor in a weatherproof sound attenuating enclosure complete with a 999 litre integral fuel tank. This is an emergency standby power rating as defined in Clause 13.3.4 of SANS 8528-1.

- Mains Failure Sensing
- Control Panel
- Exhaust and Silencer Systems
- Batteries and Battery Charger
- Cooling System
- Louvers
- Water jacket heater(s)
- Signs, Notices and Labelling
- Painting of Equipment
- Workshop Drawings and Samples
- Provision of own Hoisting and Lifting
- 3 years Free Maintenance and Services commencing at date of commissioning
- 3 years Guarantee commencing at date of commissioning
- Removal of own Waste

The Automatic Mains/Standby Changeover Switchgear shall form part of the Motor Control Centre (MCC-PS34-XR) and shall be priced as part of the MCC. The Contractor shall make sure that the switchgear supplied is compatible with the generator set.

Section 5: Workshop Drawings, Samples and Inspections

The Installer shall timeously provide workshop drawings and/or catalogues and/or of the following items for the Engineer's review:

- General and Connection Diagrams
- Control Panels
- Standby Generator Plant
- Exhaust System/s
- Proposed Physical Layouts of Plant and Equipment
- Details of Builder's Work Required
- Changeover Panels Where Supplied

Manufacture and delivery of these items shall not proceed without the Engineer's written instruction to proceed.

The Installer shall timeously advise the Engineer that these items may be inspected at the manufacturer's premises to enable the Engineer to inspect the items at the manufacturer's premises prior to delivery.

Section 6: Testing and Commissioning

6.1 Pre-delivery Works Tests

A works test and/or inspection are required by the Engineer of the complete diesel-alternator set and changeover panel before delivery to site. The Engineer shall be given the opportunity to witness the above tests. The Installer shall give the Engineer timeous notice when he is ready to undertake the test. The Installer shall nevertheless undertake his own test as prescribed in the relevant standards.

During the execution of the test the Installer shall record both steady state and transient load, voltage, frequency, oil pressure and engine temperature at regular intervals and shall provide the Engineer with an authenticated test report for his records.

The works test shall include full load tests and step load tests with an adjustable load bank provided by the Installer.

6.2 Acceptance Inspection Test

Acceptance testing of the installation shall take place at a time prior to the contract practical completion date. The Installer shall give the Engineer timeous notice of being ready for such tests.

The Installer shall provide all necessary test equipment, materials and tools and competent staff for the performance of the acceptance tests of the complete installation on site.

The test shall be carried out on site with all details of the plant and its environs complete so that a full rated load test can be performed. A load bank is not required for site acceptance tests.

If any portion of the works fails to pass the tests, tests of the said portion after replacement or rectification of the fault at the Installer's expense shall be repeated within a reasonable time upon the same terms and conditions. All reasonable expenses incurred by the Employer/Engineer by such repetition of the tests shall be paid to the Engineer by the Installer and shall not be added to the contract sum. Final payments in respect of the generator contract works will not be certified before all payments due to the Employer/Engineer in this respect have been made. Should the works fail to pass the test and inspection, the time required to remedy faults shall form part of the contract period. The Installer

is advised to perform the test as timeously as possible to allow time to rectify faults within the contract period. The guarantee period on the contract will commence from the date of issue of the Agent's certificate of practical completion.

6.3 Type Tests

Type test certificates for the current design of the alternator shall be submitted with the tender. Machines for which type test certificates are not available are not acceptable. Routine test certificates shall be submitted to the Engineer prior to the final works test.

6.4 Maintenance Tests

Notwithstanding the successful testing of the equipment and test results the tenderer shall remain responsible for the satisfactory operation of the system as a whole for a period of not less than one year from the date of the Talking-Over Certificate.

6.5 Noise

The Generator Installer shall arrange tests and measurements to prove compliance with SANS 10103 regarding generator plant noise at the boundary of the premises. The location of the generator may be regarded as a rural district in terms of Table 2 of SANS 10103.

Section 7: Spares

The Tenderer shall submit with his tender a detailed itemised list of spares recommended to cover the probable requirements for one year's maintenance of the plant. The list shall include individual catalogued parts numbers and descriptions.

Section 8: Tools

The Tenderer shall provide a list of the tools and test equipment he recommends for the maintenance of the plant, and shall submit an optional extra price for these, as per the Bill of Quantities.

A tool for opening the control panel (square panel key or similar as applicable) shall in any event be supplied.

Section 9: Operating Instructions, Parts Lists and Maintenance Manuals

The Installer shall supply, after approval by the Engineer, one bound set of comprehensive operating instructions, parts lists, maintenance manuals and as-built drawings including the following details and information:

- Installer's and Supplier's details (name, address, email address, telephone and facsimile numbers)
- Installer's emergency (after hours) contact details
- Cable Layouts, including Feeder and Control Cable Marking Numbers and Details
- Control Panel/s
- Changeover Panel/s
- Spare Parts List
- Tools List
- Standby Generator Operating and Maintenance Manual
- Test Certificates
- Certificates of Compliance
- Guarantees and Warranties

The Contract will not be accepted as complete until these have been supplied, complete and to the satisfaction of the Engineer.

Section 10: Particular Requirements for this Project

10.1 Standby Generator Set

A 200 kVA 400 V 50 Hz standby generator set shall be supplied and installed complete with the necessary control and changeover panels, wiring and interconnecting wiring.

All changeover switchgear shall be electrically and mechanically interlocked, fully automatic and contain all the necessary coils, main contacts, auxiliary contacts, relays and adjustable timers for correct operation. The timers, relays and auxiliary contacts shall be connected to prevent the simultaneous energising of both the main and standby generator supply switchgear.

10.2 Site Conditions

Service Conditions:

Altitude:	1 447 m above sea level
Maximum Daily Temperature:	30°C
Minimum Daily Temperature:	-8°C
Relative Humidity:	80%
Atmosphere	Temperate
Pollution Level:	Light
Mains Voltage:	400/230 Volt (nominal)
Mains Frequency:	50 Hz (nominal)

10.3 Operation

The diesel alternator set shall start up automatically after an adjustable period of 0-10 seconds (as determined by the Engineer) after detection of failure of mains power. The machine shall take load on attaining rated speed and voltage.

The machine and control shall be so designed and set so that the time from mains failure to load acceptance shall not exceed 15 seconds.

The transfer of load shall be by means of motorised isolators. These are to be installed in MCC-PS34-XR and a multicore pilot cable shall be installed linking the generator control panel to the MCC.

On sensing the return of the mains the machine shall continue to run on load for a period adjustable from 0 - 300 seconds after which time the transfer of power from emergency back to mains shall take place.

The machine shall run on at no load to cool the engine for a period determined by the manufacturer whereafter it shall automatically shut down ready for the next mains failure.

A plant selector switch shall be provided with off, manual, automatic and test positions which may be incorporated into a purpose designed controller.

In the automatic mode the machine shall operate as described above.

In the manual mode the machine shall be started by an accompanying start button after which it should take load as for automatic operation but shall be stopped by a stop button. The stop button shall cause the machine to shed its load and run on for its cool down period.

In the off mode the machine shall not operate.

In the test mode the machine shall start and run in response to operation of the start/stop buttons, but shall not take load. In the event of the mains failing during the test procedure the machine shall, however, take load automatically.

An emergency stop button shall be provided to shut the machine down instantly in any operating mode.

10.4 Engines

The engine shall be multi-cylinder vertical or inclined compression ignition two or four stroke naturally aspirated or exhaust gas turbo charged cold starting direct diesel injection water cooled type.

The engine shall be rated for standby power matched to drive the alternator and its imposed load at a speed of 1 500 rpm in accordance with SANS 8528 at site.

The engine shall be rated for 10% overload for a period of 1 hour without deviation from rated speed and without undue heating or mechanical stress.

10.4.1 Engine accessories

The engines shall be complete with the following accessories in addition to those elsewhere specified:

- Oil pressure gauge in kPa
- Water temperature gauge
- Non resettable running (hour meter) in the control panel
- Fuel shut off solenoid valve preferably continuously rated energised for engine to run
- Removable drip tray
- Dynamically and statically balanced fly wheel to limit cyclic irregularity to SANS 8528 requirements independently to the alternator inertia.

10.4.2 Engine protection

The engine shall be provided with the necessary transducers with accompanying relays to indicate separately the following conditions:

- High oil temperature
- Low oil pressure
- Over and under speed exceeding 5% above or below rated speed
- Start failure after 3 attempts

The engine shall shut down under the above conditions an alarm shall be provided in the control panel to indicate the event.

The above protection shall be interlocked with control circuits to prevent false indication during run up and run down periods.

10.4.3 Governor

An electronic governor capable of accurate speed regulation within SANS 8528 class G2 suitable for the imposed load shall be provided.

10.4.4 Starting

Battery starting shall be provided by means of an axial type starter. The starting circuits shall ensure that cranking stops as soon as the engine fires and that the starter does not re-engage until the engine is at rest.

The engine shall be provided with water jacket heaters to ensure easy starting and load acceptance as soon as rated speed and voltage are attained. Should the Installer deem it necessary to ensure this condition he shall include for an electric oil circulating pump.

10.5 Step Loading

The plant shall be capable of accepting a step load from 0 – 65% of the nominal rated load with a voltage deviation not exceeding 15% of rated voltage and a frequency variation not exceeding 6% of rated speed. Voltage and frequency recovery shall be within 2 – 4 seconds and frequency in 2 seconds during motor starting while on load frequency and voltage variation shall not exceed the above limit and recovery time.

10.6 Cooling

The engines shall be water cooled by means of a set mounted radiator. The cooling system shall be commissioned with a rust inhibitor in the water.

10.7 Lubrication

The lubrication system shall be pressure fed with a reliable disposable element oil filter fitted between the pump and engine oil circuit. The filter shall have a bypass valve to maintain lubrication when the filter is choked.

10.8 Air Filters

The engine shall be fitted with a suitable air intake filter. Dry types shall be provided with a service indicator.

10.9 Exhaust Systems

The engine shall be supplied complete with an exhaust system and locally mounted exhaust silencer. The maximum noise level from the exhaust shall not exceed the SANS 10103 recommended residual sound levels for a rural area as listed in Table 2.

Flexible couplings and mounting shall be provided between parts of the exhaust system fixed to the structure and the engine.

Where necessary both absorptive and resonator silencers shall be fitted to reduce noise below the above level.

The exhaust system shall be 3CR12 grade stainless steel.

The exhaust cladding shall be galvanised mild steel/stainless steel.

10.10 Fuel Systems

The set shall be fitted with a 999 litre integral fuel tank.

A fuel level indicator shall be fitted with a low fuel level alarm.

10.11 Alternators

The alternator shall comply with SANS 8528 Part 3. Protection shall be IP 22 or better and winding insulation shall be class H or better.

The alternator shall be the self excited, self regulated screen protected, drip-proof brushless type.

The voltage regulation expressed as a percentage rise in terminal voltage on the instant reduction of full rated load at 0.8 power factor to no-load shall not exceed 5%.

The alternator shall be of the two bearing type of the ball and/or roller type.

The electrical characteristics shall be as follows:

Voltage : 400V three phase 230V single phase.

Frequency : 50 Hz at rated speed of 1500 rpm.

Radio and TV interference suppression shall be fitted in accordance with SATRA/Telkom requirements.

The load imposed on the alternator will be as follows:

Motors	154 kVA
--------	---------

The minimum capacity for this plant shall be 200 kVA at 0.8 power factor.

Notwithstanding the specified nominal load capacity of the diesel standby generator, the complete set shall be capable of supplying both the transient and quiescent power, requirements imposed by the equipment above within the voltage and frequency limits specified.

This load excludes engine auxiliaries. The Installer shall add the kVA loading of engine auxiliary equipment to the minimum power required when sizing the alternator.

10.12 Mounting

The engine and alternator shall be mounted on a common base and direct coupled with a flexible coupling. The engine and alternator shall be mounted on the base with anti-vibration mountings.

10.13 Battery and Battery Charger

The batteries shall be of the lead-acid stationary low maintenance type.

The batteries shall be of sufficient capacity to provide six starts in a one hour period.

The battery charger shall be mounted in the alternator control panel and shall automatically boost or trickle charge the batteries as determined by the battery voltage. The boost charge current shall not exceed 20% of the rated battery capacity. A constant trickle charge facility is not acceptable.

The method of charging the battery and charging equipment supplied shall have the prior approval of the battery manufacturer of the batteries the Generator Installer intends installing.

10.14 Control Panel

The alternator set control panel shall be set mounted. The panel shall contain all the engine protection relays, timers, circuit breakers, battery charger, voltage regulator, mains sensing relays, motorised circuit breakers and wiring necessary for the complete safe and reliable operation of the diesel standby generator.

All terminals and equipment shall be labelled clearly with approved markers and legends. Each control wire shall be marked at each end. Markings shall correspond exactly with those on the switchboard circuit diagrams.

The control panel shall contain inter alia:

-
- Alternator protection circuit breaker
 - Battery charger
 - Voltage regulator
 - Plant selector switch
 - Emergency stop button
 - Start/stop button
 - Demand indication ammeters
 - Voltmeters
 - Battery volt- and ammeter
 - Running hour meter
 - Reset buttons
 - Engine protection relays and indication
 - Frequency meter
 - Fuses
 - Terminals
 - Start delay, potential and stop delay timers
 - Run on timer
 - Three phase adjustable phase failure and rotation sensing relay
 - Low fuel level warning indicator

As much of the above as possible can be combined into a controller (except the emergency stop button).

Four coloured indicator lights shall be mounted in the panel, with clear labelling, to indicate the following:

- Mains live
- Mains on load
- Standby live
- Standby on load

Only circuit breaker toggles, push buttons and indication equipment shall be accessible. The balance of equipment shall be behind hinged doors. Perforated plastic trunking shall be provided wherever necessary to neatly house all control wiring.

10.15 Painting

Painting of equipment shall be in accordance with SANS 0140 Part 2 specification LEE-P4A-1.

10.16 Noise and Attenuation

The completed installation shall generally comply with the requirements of SANS 10103 in relation to noise at the property boundary. Tenderers shall advise the Engineer at tender stage if additional special treatment of the generator plant and enclosure will be necessary to meet this requirement.

The Installer shall arrange testing and measurement to prove compliance.

The engine and alternator shall be mounted on the frame using anti-vibration mounts to prevent transmission of vibration to the structure. Where necessary the exhaust system shall be suspended on spring mounts to prevent transmission of vibration to the structure.

10.17 Remote Indication and Control Facilities

The Generator Installer shall provide potential free contacts for signalling the following conditions to a Building Management System (BMS):

- Low fuel (30% capacity)

-
- Common failure alarm
 - Generator running

10.18 Labels

All labels shall be English. All labels shall be of ivory or plastic and securely fixed by screws or rivets. Lettering shall be block capitals, minimum size 4 mm.

All feeder and control cables shall be identified with approved marked brass or fibre identifying discs at terminations, every 10 m (if practical) horizontally and at every floor level vertically. The Installer shall provide diagrammatic charts showing the identity, type and size of each cable.

10.19 Danger Notices

The Generator Installer shall supply and install all danger and statutory notices in terms of the relevant regulations.

10.20 Corrosion

The Generator shall take adequate measures to protect the installations against corrosion, according to the site conditions.

Section 11: Training

The Installer shall provide training to the Employer/Employers' agent at practical completion.

Training shall be provided in the routine operation and maintenance of the standby generator and related plant included in this subcontract.

Section 12: Guarantee and Maintenance and Servicing

The Installer shall provide a three year guarantee (from date of commissioning) to replace or repair, free of charge, any part of the installation in which defects may develop as a result of manufacturing defects or poor workmanship.

The Installer shall provide maintenance and services during the three year guarantee period, included in the tendered contract sum.

Where products supplied normally carry a guarantee exceeding three years, the full normal guarantee for the product shall apply.

SECTION 13: SCHEDULES OF INFORMATION TO BE COMPLETED BY THE TENDERER

1. TECHNICAL DECLARATIONS FOR SPECIFICATION AND DESIGN

(Extract from SANS 8528 Part 7)

Tenderers shall fill in under Column M for all items unless N/A has been inserted by the Engineer.

No	Term	Item	Reference	C	M
4.1	Basic data	Power demand			
		Power factor		From 0.8 to 0.89	N/A
		Rated frequency		50 Hz	
		Rated voltage		400 V	
		Type of system earthing	SANS 10142	TNS	
		Profile of the connected electrical load	9.1 of SANS 8528-5		N/A
		Required steady-state frequency and voltage behaviour	16 of SANS 8525-5	Class G2	
		Required transient frequency behaviour	16 of SANS 8525-5	Class G2	
		Type of fuel available	12 of SANS 8528-2	Refer South African Suppliers	
		Starting	15.1 of SANS 8528-5 and C.3.11 of SANS 8525-7	Electrical	
		Cooling and room ventilation	15.6 of SANS 8525-5		N/A

No	Term	Item	Reference	C	M
4.2	Engine	Speed	6.2 of SANS 8525-2		
		Fuel specification	12 of SANS 8525-2	Diesel: Refer South African Suppliers	
		Nature and type of speed governor	6.3 of SANS 8525-2		
		Nature of engine cooling		Water cooled	
		Required operating time without refuelling	15.3 of SANS 8525-2		N/A
		Required engine instrumentation	7.4 of SANS 8525-4	a,b,c,d,e,h	
		Required protection system	7.3 of SANS 8525-4	Over current, underspeed, control circuit protection	
		Fuel consumption	14.5 of SANS 8525-1		

No	Term	Item	Reference	C	M
		Starting system and ability	11 of SANS 8528-2	Refer Part 4 Clause 18.14 above.	
		Heat balance	9 of SANS 8525-2		
		Air consumption			

No	Term	Item	Reference	C	M
4.3	Generator	Nature and type of excitation and voltage regulation	14.7.2 of SANS 8528-1 a and 12 of SANS 8525-3nd 8	Class G2	
		Required mechanical protection	IEC 34-5	IP 22	
		Required electrical protection	7.3 of SANS 8525-4	Over current, underspeed, control circuit protection	
		Nature of generator cooling	IEC 34-5	Air	
		Heat balance	9 of SANS 8525-3		
		Unsymmetrical load (unbalanced load current)	10.2 of SANS 8525-3	As given in Clause 10.2	
		Construction and mounting arrangement	IEC 34-7	Refer Clause 18.13 of Part 4 above.	
		Grade of telephone and radio interference suppression	10.5 and 10.6 of SANS 8528-3	As given in Clauses 10.5 & 10.6.	
4.4	Mode of operation	Continuous	6.1 of SANS 8525-1	No	N/A
		Limited time operation (emergency generating set, peak load generating set)		As 6.1.5	N/A
		Expected operating hours per year		150	N/A
4.5	Power rating classification	Continuous power	13.3 of SANS 8525-1		
		Prime power			
		Limited-time running power			

No	Term	Item	Reference	C	M
4.6	Site criteria	Land use	6.2.1 of SANS 8525-1	Yes	N/A
		Marine use	6.2.2 and 11.5 of SANS 8525-1	No	N/A
4.7	Performance class		7 of SANS 8525-1	G2	
4.8	Single and parallel operation	Parallel operation with other generating sets	6.3 of SANS 8525-1	No	N/A
		Parallel operation with mains		No	N/A
		Type and execution of		N/A	N/A

No	Term	Item	Reference	C	M
		synchronising			
4.9	Mode of start-up and control	Manual	6.4 of SANS 8525-1 and 6 of SANS 8525-4	No	N/A
		Automatic		Refer Clause 18.4 of Part 4 above.	N/A
		Semi-automatic		No	N/A
		Additional control device proposed by the generating set manufacturer			
4.10	Start-up time	Generator set with no specified start-up time	6.5 of SANS 8525-1	No	
		Long-break set		Yes. Refer Clause 18.4 of Part 4 above.	
		Short-break set		No	
		No-break set		No	
4.11	Installation features	Installation configuration	8.2 of SANS 8525-1	Fixed	
		Set configuration	8.3 of SANS 8525-1	Base frame Type C	
		Type of mounting	8.4 of SANS 8525-1	Rigid	
		Weather effects	8.6 of SANS 8525-1	Outdoor	
4.12	Site conditions	Ambient temperature	11 of SANS 8528-1	31°C	
		Altitude		1260 m above sea level	
		Humidity		55%	
		Sand and dust		No	
		Marine		No	
		Shock and vibration		N/A	
		Chemical pollution		No	
		Type of radiation		No	
		Cooling water/liquid		N/A	

No	Term	Item	Reference	C	M
4.13	Emissions	Noise limitation	9 of SANS 8528-1		
		Exhaust gas limitations			
		Vibrations			
		National legislation		RSA	
4.14	Test methods	Standard	4 of SANS 8528-6	Yes	
		Special requirements		No	
4.15	Maintenance intervals	Routine (e.g. oil changes)		3 monthly	
		Mechanical (e.g. filters)			
		Electrical (e.g. controls)			
		Service life to major overhaul			
4.16	Auxiliaries	Power consumption of the auxiliary devices (e.g. fan, compressor)			
		Pre-heating			
		Pre-lubricating			

No	Term	Item	Reference	C	M
		Auxiliary and starting battery			
4.17	Controlgear and switchgear	Rated current capacity	4.5 of SANS 8528-4	300 A	
		Neutral earth scheme	7.3.7 of SANS 8528-4	N/A	
		Fault-current rating	5.3 of SANS 8528-4	20 kA at changeover	
		Nature of protection device	7.3 of SANS 8528-4	Circuit breaker	
		Nominal operating voltage for control circuit.	4.6 of SANS 8528-4	48 V	

No	Term	Item	Reference	C	M
4.18	Factors affecting generating set's performance	With respect to power	9.2 of SANS 8528-5 and 14.2 of SANS 8528-1	Automatic starting of motors	
		With respect to frequency and voltage	9.2 of SANS 8528-5 and 14.2 of SANS 8528-1	Automatic starting of motors	
4.18	Other regulations and requirements		3 of SANS 8528-7	N/A	

2.

GENERATING SET DATA

Tenderers shall complete the table below.

No	Description	
1	DIESEL ENGINE	
1.1	General	
1.1.1	Manufacturer	
1.1.2	Model number	
1.1.3	Type	
1.1.4	Two stroke or four stroke	
1.1.5	Revolutions at 100% load	r/min
1.1.6	Number and arrangement of cylinders	
1.1.7	Total mass of set on base	kg
1.1.10	Starting period to full load	s
1.1.11	Engine run-down time	s
1.1.12	Fuel consumption under site conditions	
	a) Full load	ℓ/kWh
	b) $\frac{3}{4}$ load	ℓ/kWh
	c) $\frac{1}{2}$ load	ℓ/kWh
1.1.13	Guaranteed power output under site conditions	kW
1.2	Mode of Operation (Standby/Continuous)	
1.3	Cooling	
1.3.1	Cooling medium	
1.3.2	Recommended coolant for closed circuit of engine	
1.3.3	Method of cooling, if one method preferred	
1.4	Aspiration and Cooling Air Intake(s)	
1.4.1	Type of air filter	
1.5	Starting System	
1.5.1	Method of starting	
2	INSTRUMENTATION	
2.1	Engine-driven tachometer	r/min Yes/No
2.2	Engine temperature gauge	°C Yes/No
2.3	Fuel oil pressure gauge	kPa Yes/No
2.4	Lubricating oil pressure gauge	kPa Yes/No
2.5	Oil temperature gauge	°C Yes/No
2.6	Starter battery voltage	V Yes/No

2.7	Running hour meter	h	Yes/No
2.8	Dirty filter indicator (if applicable)		Yes/No
2.9	Other instrumentation recommended		
3	ENGINE CONTROLS		
3.1	Manual start key/switch		
3.2	Shutdown in case of fire		
No	Description		
4	ENGINE LABELLING		
4.1	Grade of oil		
4.2	Danger label		
4.3	Information labels		
4.4	Rating plates		
5	ALTERNATOR		
5.1	General		
5.1.1	Manufacturer		
5.1.2	Model number		
5.1.3	Rated output	kVA	
5.1.4	Maximum short-circuit current	kA	
5.1.5	Guaranteed net continuous site rating	kVA	
5.1.6	Power factor at net continuous site rating		
5.1.7	Time intervals for applying loads		
5.1.8	Number of phases		
5.1.9	Phase-to-phase/phase-to-neutral voltage/..... V	
5.1.10	Range of adjustment of terminal voltage	±.....%	
5.1.11	Frequency	Hz	
5.1.12	Nominal speed	r/min	
5.1.13	Efficiency at unity/0.8 lag power factor		
	a) Full load	%	
	b) ¾ load	%	
	c) ½ load	%	
	d) ¼ load	%	
No	Description		
5.1.14	Excitation method		
	a) Excitation voltage range	V	
	b) Maximum field control current	A	
5.1.15	Parallel operation (if required)	No	

5.1.16	Neutral earthing method	
5.2	Alternator Protection	
5.2.1	Overcurrent and earth fault protection	
5.2.2	Other protection	
5.3	Alternator labelling (adjacent to alternator)	
	a) Danger label	
	b) Terminal label and colours	
	c) Information labels	
	d) Rating plates	
5.4	Transient output variations	
5.4.1	Maximum voltage drop during a load step of 120 kVA	%
	Maximum frequency deviation during a load step of 120 kVA	%
5.6	Alternator construction	
5.6.1	Number of bearings	
5.6.2	Are there special bearing and lubrication requirements?	
	a) If Yes, details of requirements	
	b) If No, details of bearings offered	
5.6.3	Alternator cooling	

No	Description	
6	MECHANICAL BUILD	
6.1	Base frames	
	a) Length	mm
	b) Width	mm
6.2	Equipment mounted on the base frame or separately	
6.2.1	Control cubicle	
6.2.2	Day fuel tank	
6.2.3	Battery for starter motor	
6.2.4	Battery for control circuits	
6.2.5	Other accessories	
6.3	Overall mass of set (for lifting purposes)	
6.3.1	Cable entry positions	
6.4	Coupling method	
6.5	Vibration damping mounting details	

