

ANNEXURE A



Technical Specification
Discipline Electrical Engineering
Specification No: TPD-009-STANDBYPLANTSPEC

**SPECIFICATION FOR THE SUPPLY, DELIVERY, OFFLOADING AND INSTALLATION
AND COMMISSIONING OF DIESEL DRIVEN STANDBY GENERATOR SETS**

REVISIONS		
REV	DATE	APPROVED
01	30/05/2017	S.Sewdayal
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SECTION A

STANDARD SPECIFICATION

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GENERAL STANDBY PLANT SPECIFICATION – TECHNICAL

A1 GENERAL:

This section of the specification covers the standards for the design, manufacture, delivery to site, off-loading on site, commissioning, testing and handling over in full working order the standby plant and ancillary equipment necessary to comply with the specified requirements.

A2 PLANT:

- 2.1. General: The diesel generator plant and ancillary equipment offered shall be capable, at any time and under any ambient conditions likely to occur at site, of meeting the load requirements stated in Section B7.
- 2.2. Operation: The diesel generator plant and ancillary equipment normally operate as an automatic mains failure installation and shall be capable of delivery rated output to the essential loads detailed in Section B7. The diesel generator plant and ancillary equipment will not be required to be synchronised with the mains.

A3 SITE RATING:

All plants offered shall be capable of providing the required and specified outputs at site conditions but, for comparative purposes, tenders shall also state the sea level ratings of their plants.

The general plant and ancillary equipment shall normally operate as an automatic mains failure installation and shall be capable of delivering rated output in accordance with A DIN 8270/6271 (continuous rating with 10% overload capability for one hour continuous in eighteen hours) to the essential loads.

A4 DELIVERY REQUIREMENTS:

Nil

A5 TENDERING INFORMATION REQUIRED:

- 5.1 General: Tenderers shall submit with their tenders full technical details of all engines, generators, machines, equipment and ancillary equipment offered, together with any relevant descriptive leaflets, illustrations, standard drawings and documents. In addition, the schedule of technical information shall be completed in full and submitted with the tender.

Failure to provide any of the above requested information may lead to disqualification of tenders.

- 5.2 Drawings: Tenderers shall submit with their tender dimensioned drawings showing the general layout of the offered plant and all buildings and structural details required for its installation and operation.

Within one month of the receipt of order the successful tenderer shall submit three prints of drawings for approval. The drawings shall include the layout and schematic of all electrical panels and boards; schematic of the complete electrical systems, battery and automatic battery chargers; schematic of the fuel system; dimensioned layout of the complete plant including all piping, cabling, etc., and any other drawings the Engineer may require for the approval of the proposed installation.

At the time of hand-over of the plant the successful tenderer shall provide and mount suitable wall frames, with clear Perspex front, with "as installed" prints of the above specified schematic and general layout drawings.

- 5.3 All items to be included: Tenderers will be deemed to have included all items for the proper operation of the standby plant, notwithstanding that such items may not be referred to in the specification unless he qualifies his tender accordingly. In such instances he shall submit a quotation at the time of tendering for the items omitted onto the inner canopy door.

A6 CIVIL WORK:

The contractor shall notify the Engineer and the main contractor of the position and sizes of any holes, sleeves, recesses, chases, etc., that will be required in good time to enable these to be provided during the course of construction in order that no unnecessary expense may be incurred.

The cost of the above and of all such cutting away and making good will form part of this contract.

The contractor will be held responsible for the sizes and positions of holes, sleeves, recesses, chases, etc., required.

A7 REGULATIONS AND BY-LAWS:

The whole of the work shall be carried out in strict accordance with the Power Supply Authority's regulations and current edition and addenda of the SANS 10142-1 "Code of Practice for Wiring of Premises". The requirements of the Mines Works and Machinery Regulations and the "Machinery and Occupational Safety Act" and of any Local Municipal Regulations and By-laws or such other relevant Regulations or By-laws which have the force of law shall be compiled with. The onus will be on the contractor to ensure that all such regulations or requirements are compiled with. Should any compliance entail a modification of the Specification the matter shall be referred to the Engineer before or at the time of tendering. No claims for extras arising out of the need to comply with Regulations or By-laws will be considered.

A8 TESTING AND COMMISSIONING:

- 8.1 General: Any instruments or equipment required for testing shall be provided by the successful Tenderer.

Notwithstanding the carrying out of any tests at the manufacture's works or the submission of any test certificates, the supplier will in no way be relieved of his responsibility for the successful and efficient operation of the Standby plant and ancillary equipment on site or of his liability for its conforming to any relevant laws.

- 8.2 Inspection and Test by the Engineer: The Engineer shall be entitled at all reasonable times during the currency of the contract to inspect, examine and test any of the work, material, equipment and workmanship of the Sub-contractor works, at the Contractor's premises or at the premises of any outside suppliers of equipment for the Sub-contract works.

The contractor shall provide such attendance and assistance as may be required for such inspections or tests.

8.3 Commissioning: The final commissioning of the standby plant shall be carried out in the presence of the Engineer. All lubricating oils used during the commissioning shall be drained after commissioning of the plant in the presence of the Engineer and replaced with the new lubricating oils on handover. Commissioning shall be carried out by the manufacturer upon successful installation of the generator by the competent electrical contractor approved by the engineer on site. The standby plant shall be load tested with SABS calibrated resistor banks that are rated to the load capacity of the standby plant. The test will be carried out in the presence of the engineer.

8.4 Fuel Oil: The contractor shall supply all fuel oil used during commissioning and testing and shall hand-over the standby plants with full fuel and oil tanks – (Bulk and Day tanks).

8.5 Handbook and Maintenance Instructions:

At the time of handover, the contractor shall provide 4 copies of:

- (i) All the drawings referred to in Clause 5.2.
- (ii) A fully comprehensive operations handbook with maintenance instructions.
- (iii) A list of spare parts complete with names and addresses of the supplier.

All the above information shall be collected and bound in loose leaf hard-covered binders suitably numbered and indexed. The front covers shall clearly state the job name, contractor's name, address and telephone numbers (normal business, after hours and emergency).

- (iv) Logbook: At the time of commissioning the successful tenderer shall provide a logbook, duly approved by the Engineer. The logbook shall be placed on a suitably sized shelf unit or in a suitable metal box mounted in the prominent position on the inside of the canopy door.

A9 GUARANTEE AND MAINTENANCE:

9.1 General: The Sub-Contractor shall guarantee and maintain the contract works for a period of twelve months after hand over. During this period the contract works shall be maintained as set out in Clause 9.3 by the contractor and any defective material, equipment or workmanship (excepting only proven wilful or accidental damage, or fair wear and tear) shall be made

good without inconvenience to the client at the contractor's expense and to the satisfaction of the Engineer. The guarantee period will only commence upon successful commissioning and handover of the equipment in proper working order to the client.

- 9.2 Making Good: When called upon by the Engineer the contractor shall make good on site and shall bear all expenses incidental thereto including making good work by others which may arise out of removal or reinstallation of equipment.

The contractor may delegate such making good to an approved party. All work arising from the implementation of the guarantee or maintenance of equipment shall be carried out at a time which will be indicated by the Engineer.

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

- 9.3 Maintenance: At quarterly intervals during the maintenance period of twelve months, the contractor shall adjust and maintain the Standby Plant and its ancillary equipment in proper working order. As a minimum requirement the contractor shall:

- (i) Check and top-up if necessary the fluid levels in the cooling systems, engine sumps, and batteries.
- (ii) Test run the standby plant and ancillary equipment for a period of 30 minutes.
- (iii) Wipe down the standby plant and ancillary equipment and report any evidence of any fluid leaks or other defects
- (iv) Check batteries.

The cost of such inspections, maintenance, adjustments, repairs, etc. shall be included in the tenderer price but the cost of renewing any parts 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 plants are 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 plants 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 engineer and at his own expense, replace the whole or such parts thereof as the Engineer may deem necessary with equipment to be specified by the Engineer.

Approval of the equipment installed shall be considered as provisional only and shall not invalidate the client's rights as indicated above.

A10 DIESEL ENGINES:

10.1 General: The engines shall be of reciprocating, compression ignition four stroke, liquid fuel type with a running speed not exceeding 1500 rpm. The engine shall be capable of delivering the specified output continuously at the stated site conditions and shall do this without overheating. The engine and radiator shall comply with BS 5513 or A DIN 6271 as amended, and where applicable shall be built together with the brushless alternator and shall be close coupled via a flexible coupling mounted on a steel base frame (duplex or simplex) with resilient anti-vibration mountings.

The skid base shall be suitable for installation direct onto the reinforced concrete floor. A torsional vibration analysis test certificate must be supplied after installation. The engines shall be fully derated for site conditions in accordance with BS 5514 or DIN 6270/6271 as amended.

10.2 Starting: The engine shall be easily started from cold, under summer as well as winter conditions, and shall be capable of supplying the specified loads immediately change-over occurs. The total time taken for the diesel generator plant to achieve stabilised running from the start shall not exceed 10 seconds. Thermostatically controlled water jacket heaters shall be fitted and full details of such equipment shall be submitted with the tender.

10.3 Starter Method: The engine shall be fitted with a direct current electric starting motor rated for operation from a battery of not less than 12 volts.

- 10.4 Starters and Control Batteries: The starter and control battery shall be a gel type maintenance free, automotive battery. It shall be adequately rated to provide three automatic starts immediately followed by three manual starts without any appreciable permanent voltage drop but the voltage drop during cranking shall not exceed 25% of the nominal battery voltage. Only reputable approved "maintenance free" gel type batteries shall be supplied.

The battery shall be placed on suitable plastic lined or coated battery stand which shall stand in a suitable acid resistant tray resting on the standby plant room floor. The battery shall be connected to the starter motor with suitably rated and insulated flexible cables and the battery terminals shall be greased to minimise chemical attack. Note that neither the positive nor the negative terminals of the battery or starter shall be earthed.

- 10.5 Battery Charging Equipment: 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 generator plant via an inhibitor relay to prevent dual charging. The charging equipment shall include a suitable ammeter and protection equipment.

The trickle charging equipment shall be incorporated in the standby plant switchboard and shall be of the two stage type (ie. booster and trickle charging).

- 10.6 Cooling System: The engine shall be either water cooled or air cooled and full details of the cooling system shall be included with tenderers. Although the plant is used for standby purposes it must be appreciated that the engines shall be continuously rated (refer to Clause 3) and cooling system shall be designed accordingly.

Where specified elsewhere suitable ducting shall be provided and fitted between the radiator and the ventilation air outlet louver. In the case of air cooled engines suitable ducting shall be provided between the room air intake louver and the cooling air intake of the engine.

The ducting shall incorporate a suitable flexible section to minimise vibration transmission.

Whether water cooled or air cooled engines are offered, a suitable engine

driven or independently driven fan shall be provided for adequate engine and standby plant room ventilation when the plant is operating. A protective device shall be fitted to the engine to prevent operation at excessive engine temperatures.

- 10.7 Lubrication: Lubrication of the main bearings and other moving parts shall be by force feed system. A pressure sensitive device shall be fitted to prevent operation of the engine at low engine oil pressure.

The engine shall be handed over with the first fill of new oil.

- 10.8 Fuel System: The fuel system shall comprise the following:
- (i) Fuel Tank (Day Tank): The plant shall be equipped with either a floor mounted tank of sufficient capacity for at least 18 hours running all the engines at full-load. The fuel tank shall be fitted with the following items:
 - (a) Sludge trap (dished bottom) with drain valve and cleaning access and drip pan.
 - (b) Easily removable, dust proof lid.
 - (c) Fuel level indicator other than a sight glass to provide "Full", "Fill" and "Low" indication.
 - (d) Outlet valve positioned 50mm above tank bottom.
 - (e) Injector leak-off return fitting
 - (f) Low fuel alarm float switch to operate an alarm enunciator device specified subsequently.
 - (ii) Fuel Tank (Bulk Tank): This shall be an underground type as specified in Section C.
 - (iii) Fuel Piping: All necessary interconnecting fuel piping shall be provided and installed by the Sub-Contractor. All piping shall be zinc free corrosion protected and colour coded in accordance with the SABS code.
 - (iv) Injection Equipment: The fuel injection equipment shall be suitable for trouble-free operation with commercial brands of diesel fuel normally available in South Africa.
 - (v) Hand Pump: The Sub-Contractor shall supply and install on the day tank, a

hand pump with the delivery pipe permanently connected to the fuel tank and with a flexible suction pipe to fill the fuel tank from drums of diesel fuel.

All fuel used during commissioning etc., shall be supplied by the Sub-Contractor. The engine shall be handed over with the bulk tank full.

10.9 Ventilation Air Louvre's: Ventilation louvers shall be supplied as part of the 3CR12 Stainless steel IP55 enclosure. Detail of the ventilation louvers' must be given with the tender.

10.10 Exhaust Gas System: An exhaust gas system shall be provided. The exhaust pipes shall be flexibly fitted to the engines and shall discharge outside the weather protected enclosure at a point to be approved by the Engineer. The exhaust gas system shall be adequate size and gauge, taking due account of the possible route, and the materials to be used shall be approved by the Engineer.

Within the plant enclosure and in all areas where the exhaust pipe are within reach of any person they shall be lagged with an approved material, and clad with 0,5mm thick sheet material sleeves. The exhaust pipes shall be neatly supported on suitable brackets with expansion joints and spring supports. Silencers shall be provided with the exhaust pipes.

10.11 Governor: The speed of each engine shall be controlled by a governor. Class "A1" governing, in accordance with BS5514, as amended, shall be provided together with an external means of adjustments of the nominal speed setting by +/- 5% at all loads between zero and rated load.

10.12 Flywheel: A flywheel shall be provided to ensure that cyclic irregularity of the engine shall be within the limits specified in BS5514 or DIN 6270/6271 as amended.

10.13 Engine Mounted Instruments: An instrument panel with anti-vibration mountings incorporating the following instruments with suitable limit markings shall be provided on each engine:

- a. A water temperature gauge.
- b. A lubrication oil pressure gauge.

- c. A mechanical driven running hour meter (smallest unit indicated to be one hour).
- d. An engine speed indicator.

10.14 Accessories: The engine shall be complete with all accessories, intake air filter, operation and instruction manual, spare parts list etc.

A11 BRUSHLESS ALTERATIONS:

11.1 General: The alternators shall be of the self excited brushless type with enclosed ventilated drip proof housing, and shall be capable of continuously delivering the output to meet the load requirements stated in Section B7. The alternators shall be generally constructed and rated in accordance with BS 5000, as amended and shall be capable of supplying a 10% overload for the period stated therein.

11.2 Regulations and Response: The alternator shall be self-regulated and shall incorporate a self contained automatic voltage regulator. The voltage regulator shall not exceed +/- 2,5%, 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 B10.11

Upon application of full load at a power factor of 0,8 lagging the alternator voltage shall recover to within 2,5% of the steady state value within approximately 300 milliseconds.

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

11.3 Bearings and Coupling: The brushless alternator shall be of the two bearings type directly coupled to the engine by means of a bell housing or flanged adaptor ring in such a manner as to ensure permanent alignment of the alternator and the engine. The engine vibrations and irregularities in excess of those detailed in BS 5514 or A DIN 6270/6271 as amended, shall not be transmitted to the alternator. Single bearing type shall only must be approved prior to tender and a torsional test must be supplier prior to supply.

A12 STANDBY PLANT SWITCHBOARD:

- 12.1 General: The standby plant switchboard shall be manufactured from 3CR12 stainless steel in either a metal clad cubicle pattern mounted on the wall or floor. The board steelwork shall be degreased, treated with a rust preventative, primed and finished with two coats of electrical orange powder coated paint.

The board, suitably labelled, shall be fitted with all the equipment necessary for control, protection, automatic operation and proper functioning of the complete plant and it shall be fully wired to suitably accessible terminals and terminal strips. However, no terminals shall be provided for the incoming and outgoing mains.

All control wiring shall be done in 1mm coloured PVC conductors throughout. All wiring terminations must be numbered and ferruled with non-deteriorating ferrules. All wiring terminals must be by means of either OBA or 2BA terminals or by means of crimped lugs or directly into a socket where the wire is crimped lugs or directly into a socket where the wire is crimped by a screw which is so fixed that it will not become loose due to vibration or any other cause.

An approved gland plate and earthbar shall also be provided and fitted inside the board.

A mimic diagram of the feeders, breakers and change-over breakers shall be painted onto the front panel of the switchboard.

12.2 Equipment on Standby Plant Switchboard:

Note: The prospective fault level at this board shall be as state in Section B7.

Equipment Installed:

1 x TP Mains isolators with two operating positions labelled "off" and "on" rated as specified in Section B7. The main incoming cables or busbar shall be terminated to this point.

1 x TP Generators ACB, with two operating positions labelled "off" and "on", mounted adjacent to the Mains Isolator. The ACB shall be rated to suit the

generator offered and shall have both adjustable thermal and instantaneous overload elements. Provide a label: "In case of emergency isolate both switches" below these two switches. Auxiliary contacts shall be fitted to meet the operational alarm requirements.

1 x Sets of TP automatic change over on-load circuit isolators with motor operated mechanisms suitably rated and with appropriate auxiliary and control contacts. The electrical and mechanical interlocking arrangements of these changeover breakers shall be to the approval of the Engineer. A key switch shall be with two positions "Standby" and "Direct" with the key retained in the direct position. It shall be possible, by the operation of this switch, to operate the changeover breakers, and thereby provide a direct bypass function without control of the normal automatic circuitry.

1 x On load main bypass switch on enable the mains to be connected directly to the load.

1 x Flush mounted 100 x 100mm dial voltmeter, sealed 0-400 volts, complete with a set of HRC fuses or MCBs.

1 x Flush mounted 7 position voltmeter selector switch with positions engraved as follows: "Red-White", "White-Blue", "Blue-Red", "Off", "Red-Neutral", "White-Neutral", "Blue-Neutral".

1 x Flush mounted 100 x 100mm dial vibrating reed frequency meter, scaled 47-50-53 Hertz.

1 x Set per incomer of HRC fuses or MCBs for the frequency meter and generator voltage sensing unit.

3 x Flush mounted 100 x 100 dial ammeters (with a set of appropriate ratio CTs) suitably scaled for the generator rating and with suppressed overload scale.

1 x "English Electric" Test terminal block with suitable CTs.

1 x Automatic control panel for the protection, supervision and operation of the diesel generator set. Solid state printed circuitry shall be used wherever possible and the control panel shall incorporate the equipment and features specified hereunder. DC connections and AC connections shall be made of

separate terminal strips.

This control panel shall include the following:

- (a) Automatic starting device to give three automatic start attempts of 10 seconds each, with 10 second intervals between attempts and lockout after the third start failure. Lockout shall initiate an alarm device specified subsequently.
- (b) Mains voltage sensing units on each incomer, initiation on mains failure. This shall be adjustable from 0-10 seconds and connected to the mains via a MCB. This shall start the plant in the event of a voltage drop on any one or combination of phases of more than 20% of the nominal voltage.
- (c) A separate time delay unit shall be provided to ensure that after restoration of the mains supply, the diesel plant will continue to supply load for an adjustable time of thirty seconds in order to ensure that the mains supply has stabilised before the essential loads are reconnected to the mains.
- (d) For water cooled engines only an off load stop delay timer shall be provided to enable the set to run for a further 5 minutes before shutting down.
- (e) Generator voltage sensing unit connected to the generator output to trip the generator change over breakers in the event of a voltage drop on any one or combination of phases of more than 20% of the nominal voltage. Provide an alarm annunciator device as specified subsequently.
- (f) Status selector switch labelled "off", "auto" and "test without load" with contacts to meet the operational requirements.
- (g) A set of alarm annunciator and/or drop trip devices. Each annunciator device shall have a resettable alarm giving visual indication of the specific fault, with a test facility or other approved arrangement. Any alarm condition shall illuminate a common alarm lamp which shall only be cancelled when the fault condition has been rectified and restored to normal and the appropriate alarm has been reset.

The following alarm annunciator and/or trip devices shall be installed.

	Alarm	Trip
High Engine (Temperature)	X	X*
Low Engine (Temperature) (water jacket)	X	
Alternator under voltage	X	X
Start sequence failure	X	
Low Fuel Level	X	
Low Oil Level	X	

*(At higher temperature than the alarm)

- (h) Automatic starters for any ventilation fans, circulating water pumps etc. that may be required. All starters shall operate automatically as soon as the standby generator has started.

A13 PLANT OPERATION:

- 13.1 Normal: For normal operation as an automatic mains failure plant the mains isolator shall be set to the “on” position, the bypass key switch shall be set to set the “standby” position, the generator ACB shall be set to the “on” position, and the status selector switch shall be set to the “auto” position.

Under these condition the plant, after an adjustable delay, shall start automatically to the event of a mains failure, the automatic changeover breakers shall operate and the essential loads shall be applied. When the mains supply has been restored the plant shall continue to operate on load thirty seconds after which the, load will be reconnected to the mains and, in the case of water cooled engines, after a further five minutes delay the plant shall automatically shut down.

- 13.2 Testing, etc: For operation during routine maintenance and testing, etc, the following conditions arise:

- (a) With the status switch set to “test without load” (and the main isolator, bypass key switch and generator ACB are set to “on”, “Direct” and “on” respectively) the plant shall start automatically, the automatic change-over breakers shall not operate and the load will not be

applied. When the status selector switch is returned to the “auto” position the plant shall automatically and immediately shut down without running through the time delay sequence referred to in Clause 13.1. Should the mains supply fail whilst the status selector switch is in the “test” position, the plant shall be loaded by returning the status selector switch to the “auto” position and the bypass key switch to the “standby” position. Thereafter the plant shall continue to operate on load until the mains are restored after which the plant shall automatically shut down in Clause 13.1.

- (b) If the status selector switch is set to the “test without load” position while the bypass switch is in “standby” position and the mains isolator and generator ACB are both in the “on” position, the plant shall start automatically, the automatic change-over breakers shall not operate and the load will not be applied. When the status selector switch is returned to the “auto” position the plant shall automatically and immediately shut down. Should the mains supply fail whilst the status selector switch is in the “test” position the plant shall be loaded by returning the status selector switch to the “auto” position. Thereafter the plant continue to operate on load until the mains are restored after which the plant shall automatically shut down as in Clause 13.1.
- (c) With the status selector switch set to “test without load” and the generator ACB set to the “off” position (while the mains isolator is in the “on” position and the bypass switch is in either the “standby” or the “direct” position) the plant shall start automatically, but the frequency meter will not operate. Under mains failure conditions the generator ACB will have to be set to the “on” position, the status selector switch to the “auto” position and the bypass switch to the “standby” position for the plant to be loaded.
- (d) If the status selector switch is set to the “off” position, whilst the mains isolator, bypass switch and generator ACB are set to “on”, “standby” and “on” respectively, the mains change-over breakers shall be de-energised and the essential loads will not receive any supply. When the status selector switch is returned to the “auto” position the mains change-over breakers shall immediately operate without running through the time delay sequence referred to in Clause 13.1.
- (e) When the status selector switch is set to the “off” position the plant

shall be inoperable, irrespective of the position of the bypass switch. All alarms shall not operate under this condition, but the battery charger shall still remain operational. Under mains failure conditions the essential loads will not receive any supply.

- (f) When the mains isolator or the bypass switch or the generator ACB or the status selector switch are moved away from their normal positions an alarm indication shall be given. This alarm shall indicate that the position of one or more of the isolator ACB or switches is incompatible with the operation of the plant as an automatic mains failure installation.

A14 WARNING NOTICES:

Clearly legible and indelible notices made of non-corrodible and non-deteriorating material, preferably plastic, shall be worded and mounted in conspicuous positions on the diesel engine and standby plant switchboard. These two notices shall read as follows:

DANGER

THIS ENGINE WILL START WITHOUT NOTICE. TURN STATUS SELECTOR SWITCH ON CONTROL PANEL TO "OFF" POSITION BEFORE WORKING ON THE PLANT.

GEVAAR

HIERDIE ENJIN SAL SONDER WAARSKUWING BEGIN LOOP. DRAAI STATUS KEUSES KAKELAAR OP BEHEERPANEEL NA "AF" POSISIE VOORDAT AAN DIE MASJEN GEWERK WORD.

A15 ELECTRICAL:

- (1) General: Tenderers shall allow for all cables, wiring, installation and connections in the standby plant enclosure between the diesel generating plant and the standby plant switchboard. General purpose PVC/ECC/SWA/PVC cables to SABS 150/1970 shall be used throughout, and, where necessary, shall be adequately supported on both horizontal and vertical runs of cable by means of galvanised perforated metal cable trays adequately supported by means of substantial angle iron brackets or other

approved means, bearing in mind the number and weight of the cables to be supported.

Where necessary tenderers shall suitably derate cables for proximity of lay, etc. and tenderers shall note that there is not provision for laying cables in cable trenches.

The neutral point of the generator shall be solidly connected, by means of an appropriate size of insulated earth conductor, to the earthbar mounted on busbar insulators in the standby plant switchboard. All plant, ancillary equipment and steelwork in the standby plant room shall be suitably bonded together with an appropriate size of bare copper tape which shall also be connected to the earthbar.

The Sub-Contractor shall ensure that the mains and generator phase rotations are identical.

SECTION B

DETAIL SPECIFICATION

SCOPE OF CONTRACT, SPECIAL CONDITIONS, ELECTRICAL LOADS AND COMMISSIONING

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B1. SCOPE OF CONTRACT:

The Contract shall be for the manufacture, supply, delivery, offload, installation testing, commissioning and handing over in proper working order of Diesel Driven Standby Generating Plants as specified in Clause B7.

B2. SITE LOCATION AND CONDITIONS:

The site location is in a coastal area as stipulated in the tender, it does not exonerate the tender from contacting the engineer before delivery of the equipment:

Port of Ngqura, Port Elizabeth

The plant shall be located on a concrete plinth and craneage for offloading must be allowed for.

The plant shall be rated to suit the local conditions as stipulated above.

The plant shall be located on a concrete plinth and craneage for offloading must be allowed for.

The plant shall be rated to suit the local conditions of the various areas as stipulated above.

B3. APPROVAL AND SUBSTITUTION OF MATERIALS:

Where materials or articles are specified in the Detailed Specification, it is to indicate the quality and type of materials or articles required. Where the term "or equal and approved" and "or other approved" is used in conjunction therewith, it shall mean that no substitution will be permitted unless written authority has been obtained from the Engineer before tenders close.

Approval by the Engineer shall not relieve the Contractor of any of his obligations under the Contract, the guarantee, or compliance with the requirements of the Authorities having jurisdiction.

B4. SPECIALIST FIRMS:

Tenderers are to note that only firms specialising in Standby Generating Plant and with local branches for back-up service will be considered. Tenderers may be required to produce proof of previous contracts completed.

B5. PLANT ROOMS:

Plant rooms are to be constructed by the sub contractor. Tenderers are to ensure that the plants are sized to fit the areas provided with sufficient space around the units for maintenance and inspection purposes. Details of any deviations from the details provided are to be highlighted at time of tender.

B6. PLANT ROOMS VENTILATION:

Tenderers are to ensure that the ventilation requirements for the inlet and exhaust air are suitable for the plant offered. Any additional information is to be clearly stated at time of tender.

All louvers are to be supplied by the Standby Generator Contractor for installation by contractor. The exhaust louvers are to be constructed as to allow the removal of the machine through the clear opening if so required at a future date. All necessary ducting shall be provided between the radiator and the exhaust louvers.

B7. STANDBY PLANT REQUIREMENTS:

This offer shall be for the supply, delivery to the site, offloading and commissioning as follows:

- 7.1.1 1 x Standby Diesel Generator Plant 500 kVA at 0,9 PF continuous 400/230v 3PH 50Hz.
- 7.1.2 The standby diesel generator must have a 200 kVA, 400V alternator, Equal or similar approved to a Marrelli alternator capable of developing over 180 kW continuous power output.
- 7.1.3 The standby diesel generator must have a 200 kVA, 400V alternator, Equal or similar approved to a Marrelli alternator capable of developing turbocharged air-cooled diesel engine, designed for continuous duty and compliant with

applicable emission standards.

7.1.3 The standby diesel generator must have a turbocharged air-cooled diesel engine, designed for continuous duty and compliant with applicable emission standards.

7.1.4 The generator set shall be supplied complete with:

- Radiator with louver system for adequate cooling and air flow control.
- Sound attenuation enclosure, in the form of a sound attenuated 3CR12 stainless steel canopy, suitable for coastal and outdoor installation.
- The canopy shall be mounted on a common heavy-duty hot-dip galvanized and powder-coated base plate
- The unit shall be equipped with anti-vibration mountings to minimize transmitted vibration and noise.

7.1.5 Fuel Tank (Day Tank)

The generator set shall be supplied with an integral day fuel tank, preferably located within the base frame:

- The tank shall be manufactured from a **minimum Grade 304 stainless steel**.
- The tank shall be powder-coated black for corrosion protection
- The tank capacity shall be sized for a minimum of 8-12 hours of operation at full load.
- The tank shall include a level indicator, a drain valve and a filling point.

7.1.6 Automatic Mains Failure (AFM) Panel

A suitably rated Automatic Mains Failure panel shall be provided:

- Rated at approximately 250A–280A.
- Equipped with 15 kA fault level circuit breakers.
- Includes main circuit breaker and full protection/control system.
- Fitted with an electronic engine management and control unit, equal or similar approved to a Deep-Sea Electronics (DSE) controller.

7.1.7 Changeover Control

The changeover panel shall include a fully automatic changeover control system

that enables seamless switching between mains and generator supplies.

7.1.8 Battery charger

The control panel shall incorporate an automatic battery charger:

- Suitable for maintaining starting batteries in a fully charged condition.
- Includes protection against overcharging and deep discharge.

7.1.9 Cabling

All power and control cables between the generator set and control panel shall be supplied and installed:

- Sized according to load requirements.
- Installed in a suitable containment (trunking/conduit/cable tray).
- Compliant with applicable electrical standards.

7.1.10 Exhaust System

Exhaust system shall:

- Be manufactured from minimum Grade 304 stainless steel.
- Include industrial silencer(s) to meet noise attenuation requirements.
- Be designed for outdoor installation and high-temperature operation.

7.1.11 Data Monitoring and Downloading

The control system shall:

- Provide data logging and storage capacity.
- Include facilities to download operational data, fault logs, and performance reports via USB, Ethernet, or similar interface.

7.1.12 Control Panel Enclosure

The control panel and AMF unit shall be housed in a robust enclosure:

- Manufactured from Grade 3CR12 stainless steel.
- Finished with orange powder coating.
- Minimum IP56 protection rating
- Equipped with lockable doors
- Designed for floor/surface mounting

B8. BASE FRAME, FUEL STORAGE AND HANDLING:

The Standby Generator shall have a powder-coated hot-dipped galvanised steel bolted base frame. Suitable anti-vibration mountings between the generator set and its base frame or between the generating set's base frame and its support structure shall be provided.

The contractor shall supply and install fuel tanks as detailed below as well as the pumps, sensors of fuel level for automatic operation, pipe work, fittings and valves required for the storage and handling of the fuel for the Standby Diesel Generators. The whole installation shall comply with the Code of Practice for the Storage and handling of liquid fuel issued by the South African Bureau of Standards and with the local Authority requirements.

DAY TANK: This shall consist of a suitably sized tank installed in the position shown on the drawings. The filling shall be by an automatically controlled pump. A return pipe double in size of the feeder pipe is to be installed to avoid overflow in the event of automatic pump malfunction.

B9. CHANGEOVER SYSTEM:

GENERAL: The changeover switching of the essential loads between normal and standby power will be affected in the AMF Panels.

The switching of the standby power may be in sequence with a maximum delay of 10 seconds. The proposed sequence is to be submitted to the Engineer for approval.

CHANGEOVER: Each changeover will consist of 2 suitably rated TP motor operated ACB's with the appropriate auxiliary contacts supplied and wired to a terminal block by the Main LV Board Manufacturer.

The Standby Contractor shall liaise with the Main LV Board Manufacturer to ensure that the changeover installation suits the Standby Plant Operation.

CONTROL CIRCUITRY: The control and operation of the changeover system shall be from the Standby Plant. The Standby Contractor shall supply, install and connect all the wiring for control and sensing purposes between the Standby Plant and the LV Main Distribution Board. Tenderers are advised that three sets of mains

sensing wiring are required.

B10 AUTOMATIC MAINS FAIL CONSOLE:

All equipment necessary for the operation, control, protection, supervision as well as synchronising and automatic load balancing of the Standby Plant shall be included in a self-standing Control Console Unit.

Solid state printed circuitry with plug-in modules for easy maintenance and repair shall be used wherever possible.

The following are the basic items to be incorporated in each generator section of the control console.

Automatic Mains Failure Control Unit: This unit shall contain all components required for the sensing of the normal supply voltage, the automatic and manual starting/stopping operation as well as automatic load changeover operations.

"OFF" -"AUTO" - "MANUAL" "TEST" Mode Selector Switch : This shall provide the following facilities:

- (i) "OFF" position : set will be entirely inoperative and isolated.
- (ii) "AUTO" position : set will automatically start/stop depending on the status of the mains supply.
- (iii) "MANUAL" position : set will start manually (push button) for maintenance allowing mains supply to load but will not transfer the load in the event of power failure.
- (iv) "TEST" position : set will start automatically bypassing the automatic control to test the starting sequence and alarm circuitry without switching onto the standby busbars. However, in the event of power failure the generator has to take the load.

Alarm/Shut Down System for Faulty Conditions : This system is to be battery operated and shall consist of a set of alarm annunciators and shutdown devices with test facilities. Any faulty condition in the system shall cause a luminous alarm with clear indication of the specific fault. The luminous alarm must persist until the faulty condition is rectified. An acoustic alarm shall also be activated but it will be

possible to cancel it by a "cancel" push button. Certain faulty conditions as listed below shall cause the automatic shutdown of the generator when the fault reaches preset (adjustable) values. The following alarm annunciators and "shutdown" devices are to be supplied

Fault/Conditions	Alarm	Shutdown
High Engine Temperature	X	X
Low Oil Pressure	X	X
Overspeed	X	X
Underspeed	X	X
Low Radiator Water Level	X	X
High A C. Volts	X	X
Low AC. Volts	X	X
Emergency Stop		X
Start Failure	X	X
Fuel Bulk Tank Low Level	X	X
Jacket Heater Faulty		X
Fuel Day Tank Low Level	X	

Warning Indications:

Set not in Auto	Flashing L.E.D.
Manual Start	Flashing L.E.D.
Manual Stop	Flashing L.E.D.
Mains available	L. E. D.
Load on Mains	L. E. D.
Alternator Available	L. E. D.
Load on Alternator	L. E. D.
Battery Charge Failure	L. E. D.

Lamp test facilities are to be included in the system

Programming Controller:

This shall allow the following parameters of the system to be programmable on site:

Mains low volt sense level

Mains high volt sense level

Alternator low volt sense level

Alternator high volt sense level

Start Delay	0.5 - 60 sec
Crank delay	0.5 - 30 sec
Run up delay	0.5 - 30 sec
Run up timer	0.5 - 30 min
Mains return timer	0.5 - 30 min
Load transfer delay	0.5 - 60 sec
Engine under speed	0001 - 4900 RPM
Engine over speed	0001 - 4900 RPM
Number of start attempts	1 - 20
Low battery level	08.0 - 50.0 V
High engine temperature sensor	N/O - N/C
Low oil pressure sensor	N/O - N/C
Low fuel sensor	N/O - N/C
Manual stop sensor	N/O - N/C
Manual start sensor	N/O - N/C
Emergency stop sensor	N/O - N/C
Low water level sensor	N/O - N/C

The controller shall be protected against lightning hazards, power surges, mains borne and other noise interference to prevent malfunctioning of the system. The suppressor shall be as "Powertech Kleen-Line" or other approved.

Logging of Events: All events relating to the status of the generator set shall be

logged with date time in a non volatile memory (which can retain information for a period of 60 days in the absence of power to the controller-).

The user must be able to obtain a hard copy of these events on site which are based on the above system configuration i.e.

Mains available	Date	Time
Mains phase low	Date	Time
Start attempts	1	
Alternator on load	Date	Time
Mains on load	Date	Time
Unit switched off	Date	Time
Unit mode - manual	Date	Time
Emergency stop	Date	Time
All fault conditions etc.	Date	Time

Automatic Frequency Controller: This shall be of the solid state type and it will consist of a device to compare the busbar frequency with the alternator's and control the engine governor actuator accordingly. After paralleling the frequency controller will be over-ridden by the load balancing unit. The frequency controller is to be within Class AO (1 %).

Synchroniser Unit: This unit shall monitor phase angle and voltage of the associated alternator against those of the standby busbars and provide an output signal to switch the alternator's ACB on the busbars when the above parameters are within preset limits.

Load Balancing Unit: This unit shall monitor and compare the load on the standby busbars and the output of the associated alternator. By controlling the governor actuator of the associated engine the unit will automatically equalize. the load of the two generator sets.

Reverse Power Relay : In the event of the reverse power flow this relay will isolate the set from system.

Battery Charger : This shall be of the solid state type with fully automatic voltage and current control.

Metering : The following components are to be mounted in the top panel of the console.

3 X K.I.D.I. 0-1500A Ammeters
1 X C, - 500V Voltmeter
1 X Voltmeter Selector Switch with off, phase to phase and phase to neutral positions. (7 positions)
1 X 47 - 50 - 53Hz frequency meter
1 X 0 - 30V DC Voltmeter (battery)
1 X 0 - 10A DC Ammeter (battery)
1 X Running hour meter
1 X Synchronoscope
1 X Manual start push button
1 X Emergency stop push button "latching type"
1 X Manual speed actuator for manual synchronizing

All above components are to be flush mounted. The meters must be 96mm square equal or similar approved to Elima or Gosen meters.

B11. EXHAUST GAS SYSTEM:

The Standby Generator Contractor shall supply and install the exhaust gas system for the diesel engines. The piping shall be made of Grade 304 stainless steel and shall extend **XXX**m outside the plant room.

All pipes and bends to be thermo-insulated.

B12 ACCEPTANCE OF LOAD:

The time from the initiating of the starting operation of the first engine and the switching of the total essential load to standby supply shall not exceed 15 seconds. The contractor must make use of resistance banks such that the client can verify that the supplied machine can handle the desired load and is as stipulated on the name plate.

This shall be set at time of Commissioning.

B13. FEEDER CABLES:

The cables between the Generators and the Main LV Board shall form part of this contract.

Cognisance must be taken into account of the number of cables and the Generator Main Board shall be constructed with sufficient space to accommodate the termination of these cables.

B14. CABLING WIRING AND PIPING:

General: With the exception of the above, all cabling, wiring, piping, cable trays, etc. required to interconnect the various components of the system including those installed in the Main LV Board shall be supplied and installed under this Contract.

Auxiliary Services - Electrical Installation: The electrical installation related to the auxiliary services (battery chargers, jacket heaters, fuel pumps, etc) is part of this contract. The required db shall be supplied and installed in the Control Console (common section). This board is to be fed by a suitable PVC SWA cable from the essential section of the Main LV Board where a suitable MCB shall be provided.

Earthing: All items of equipment are to be earthed with suitable copper conductors.

B15. MANUAL OPERATION:

It must be possible to manually operate the plant by switching the generator set from automatic to manual control. In the manual control mode the automatic apparatuses for frequency control, synchronizing, load balancing, etc. shall be isolated and it shall be possible to manually carry out their functions.

The changeover switches for this facility are to be installed in the AMF Panel.

B16. SOUND ATTENUATION:

Tenderers shall allow to supply and install both inlet and outlet sound attenuators ensuring a noise level not more than **XXX** dba at **XXX**m.

B17. GUARANTEE AND MAINTANANCE:

Refer to Clause A9.

B18. DRAWINGS:

The Standby Generating Contractor's attention is drawn to Clause A5.2 and all

drawings are to be submitted timorously for approval prior to manufacture.

B19. SITE LIAISON:

Tenderers shall allow in their Tender for regular Site Visits and liaison with the Main Contractor and Engineer to ensure all builders work is fully in accordance with their requirements.

B20. ADDITIONAL INFORMATION

The tenderer shall supply the following additional information:

- Availability and value of Spares Holding
- Backup Support Provided (Service Centres, Technicians etc)
- Warranty Details (12 Month on-site warranty required)
- Maintenance Contracts Available
- Full brochures/specifications of all the standby generators to be offered.
- All other details to support the offer

SECTION C
 TECHNICAL DATA SHEET
 SCHEDULE OF TECHNICAL INFORMATION
 TO BE COMPLETED BY CONTRACTOR

DIESEL STANDBY PLANT OR DIESEL PRIME MOVERS

Engine and Ancillary Equipment:

- 1 Manufacturer
- 2 Place of Manufacture.....
- 3 Manufacturer's Engine Model No.
- 4 Name of Engine Agencies in RSA
- 5 Continuous sea level rating after reduction for fan and/or ancillaries
kW at.....oC
- 6 Continuous site net rating at specified conditions
kW at.....oC
- 7 Percentage of rated load that may be applied at start up?
- 8 Balance of load to be applied after?
- 9 Nominal speed rpm
- 10 Number and arrangement of the cylinders.....
- 11 State V angle.....
- 12 Recommended fuel.....
- 13 Fuel Tank Capacities:
 - (a) Day Tank.....l

- 14 Fuel Consumption:
 - (a) Full Load.....grams/kW/hr and..... 1/hr
 - (b) 3/4 Full Load..... grams/kW/hr and..... 1/hr
 - (c) 1/2 Full Loadgrams/kW/hr and..... 1/hr
- 15 Air quantity required for adequate cooling of engine and generator at site conditionsm3/h
- 16 Recommended gross cross-section area of ventilation air outlet louvers from standby plant roomm3/h
- 17 Air quantity required for combustion at full load at Site atmospheric conditionsm3/h
- 18 Recommended gross cross-sectional area of ventilation and combustion air inlet louvres into standby plantroom.....m
- 19 Recommended Make and Model No. of outlet air louvres.....
- 20 Velocity of air flow from outlet louvres m/s
- 21 Is a turbocharger fitted?
- 22 Is a jacket water heater fitted?
- 23 If so, make and type of jacket water heater fitted.....
- 24 Rating of jacket water heater
- 25 Method of protection against high engine temperature
- 26 Method of protection against low engine oil pressure.....
- 27 Range of mechanically driven running hours indicator (smallest unit shown on dial to be one hour)
- 28 Make and type of coupling between engine- and generator.....

- 29 Is a torsional analysis carried out?
- 30 Is engine fitted with individual cylinder heads?
- 31 State type and class of engine governor.....
- 32 State material used in cylinder head and crankcase construction.....
- 33 Number of valves per cylinder head?
- 34 Model of fuel injection chamber.....
- 35 Guaranteed unlimited light load.....
- 36 Type of exhaust valve material.....
- 37 Type of bearings.....
- 38 Is it necessary to shut down engine to change lubricating oil and fuel oil filters?
- 39 Recommended interval, in engine running hours, for:
 - (a) Air filter oil change..... hrs
 - (b) Oil filter element change..... hrs
 - (c) Lubricating oil change..... hrs
 - (d) Decarbonising and top overhaul hrs
- B. Generator and Ancillary Equipment:
 - 1 Manufacturer.....
 - 2 Country of Origin.....
 - 3 Manufacturer's Generator Model No.
 - 4 Continuous sea level rating at 0.8 PF lagging.....

- 5 Continuous site rating at 0.9 PF lagging
- C. Standby Plant Switchboard:
 - 1 Manufacturer.....
 - 2 Is board floor, wall mounted or set mounted?
 - 3 Make and rating of Mains Isolator.....
 - 4 Make and rating of Generating ACB
 - 5 Make and rating of Changeover Breakers.....
 - 6 Make of By-pass switch
- D. Control Console:
 - 1 Manufacturer.....
- E. Starter and Control Battery:
 - 1 Manufacturer.....
 - 2 Country of Origin.....
 - 3 Manufacturer's Battery Type No.
 - 4 Ampere hours of battery (10 hours rating)Ah
 - 5 Ampere hours of battery (1 hour rating)Ah
 - 6 Battery voltage (as supplied across starter motor)V
- F. Dimensions and Masses:
 - 1 Engine Generator and Skid Base Unit:

This shall include the radiator but shall exclude radiator ducting, exhaust gas pipework, etc.

- (a) Overall length.....m
- (b) Overall width.....m
- (c) Overall height.....m
- (d) Mass in operating condition with full oil sump and radiator..... kg

2 Day Fuel Tank for Plant

- (a) Widthm
- (b) Depth.....m
- (c) Heightm
- (d) Mass of full fuel tank.....kg
- (e) Volume.....l

3. Delivery Periods:

- (a) Diesel/Alternator Set.....
- (b) Electrical Control Panel.....
- (c) Underground Fuel Tank.....
- (d) Sound Attenuation Equipment.....



APPENDIX 1

**STATEMENT OF COMPLIANCE
(TO BE COMPLETED BY TENDERER)**

This tender complies with specification TPD-009-STANDBYPLANTSPEC in all respects.

SIGNATURE : _____ DATE : _____

This tender complies generally with specification TPD-009-STANDBYPLANTSPEC but differs from it on the following points.

SIGNATURE : _____ DATE : _____

National Ports Authority