Specification

Technical Specification – Permanent Diesel Engine Driven Generator

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Revision details

Version No.	Clause	Description of revision
2	General	Overall review and update. Numerous editorial changes.
		Specification aligned with industry best practice and recent installations at SP1220, SP1173 & SP0138.
	1.3	Allowed 400 V AC 3-phase jacket water heaters as an alternative to 230 V AC.
	1.3, 3.5.1, 3.5.2 & 3.5.3	Allowed 12 V DC electric starting system for smaller diesel generators up to 200 kVA in addition to 24 V DC for larger units.
	3.2	Added requirement for hazard signage on enclosure for electrical voltage, hot surfaces, low headroom etc.).
		Removed option to allow installation of load banks in the same acoustic enclosure.
		Allowed alternative for maintenance access (generator installed on rails instead of having removable enclosure).
	3.3.4	Full authority electronic governor included as an option.
	3.3.5	Drip tray or sump requirements elaborated.
	3.3.6	400 V AC 3-phase water heater allowed as an alternative to 230 V AC.
	3.4.1	Single step load pick up and drop off replaced with requirement to comply with Class G3 of ISO 8528-5.
	3.4.2	Purpose of removable MEN link explained.
	3.5.3 & 3.7.8	Automatic boost charge function for main and control battery chargers allowed as an alternative to automatic restoring full charge.
	3.6	New clause – Baseplate.
	3.7.4	Detailed requirements for I/O to datalink converter.
		High fuel pressure sensor requirement removed for engines with individual injection pumps.
	4	Witness testing of alternator exempted if test report can be supplied prior to factory test of the complete unit.
		Deleted the requirement for diesel generator synchronisation test.
	Appendix 2	Aligned with the changes in the document.
1	All	Complete revision, reformatting and publication.
0	All	Specification created. Not officially published.

Introduction

This Specification is for the design, fabrication and supply of a permanent emergency diesel engine driven generator for Sydney Water facilities.

Appendix 2 - Diesel Generator Data Sheet of this Specification provides site specific information. The Data Sheet must be reviewed by the Designer and filled out by the Supplier.

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Acronyms

Acronym	Definition
A	Ampere
AC	Alternating Current
AS	Australian Standard
ASTM	American Society for Testing and Materials
ATS	Automatic Transfer Switch
AVR	Automatic Voltage Regulator
BMEP	Brake Mean Effective Pressure
BS	British Standard
CT	Current Transformer
DC	Direct Current
DIN	Deutsches Institut für Normung (German Institute for Standardisation)
ELCB	Electric Leakage Circuit Breaker
EPA	Environment Protection Authority
FAT	Factory Acceptance Test
GPO	General Power Outlet
Hz	Hertz
I&C	Instrumentation and Control
IICATS	Integrated Instrumentation, Control and Telemetry System
IP	Ingress Protection
ISO	International Organisation for Standardisation
ITP	Inspection and Test Plan
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt Hour
LED	Light-emitting Diode
MCCB	Moulded Case Circuit Breaker
MEN	Multiple Earthed Neutral
NATA	National Association of Testing Authorities of Australia
NZS	New Zealand Standard

Acronym	Definition
O&M	Operation and Maintenance
PFR	Phase Failure Relay
PLC	Programmable Logic Controller
PMG	Permanent Magnet Generator
Pre-FAT	Preliminary Factory Acceptance Testing
PVC	Polyvinyl Chloride
p.u.	Per unit
RCD	Residual Current Device
rpm	Revolutions per Minute
SAE	Society of Automotive Engineers
SCA	Switchgear and Controlgear Assembly
SCADA	Supervisory Control and Data Acquisition
SPS	Sewage Pumping Station
TGH	Total Ground Harmonics
THC	Total Harmonic Current
THD	Total Harmonic Distortion
TIF	Telephone Influence Factor
USB	Universal Serial Bus
V	Volt
WAC	Work as Constructed
WSAA	Water Services Association of Australia

General Terms & Definitions

Term	Definition
Design life	The period adopted in design for which a product, equipment or component is required to perform its function within the specified parameters with periodic maintenance but without replacement or major overhaul.
Service life	The forecast life expectancy of a product based on operational experience and actual installed conditions during which it remains in use, which may include replacement of critical parts and major overhauls.
Supplier	The person or organisation responsible for the fabrication or manufacture and supply of products, materials, equipment and components described herein.
Sydney Water	The nominated person or organisation that has written authority to act on Sydney Water's behalf.
WSAA Codes	Codes of Practice issued by Water Services Association of Australia

1. General

1.1 Scope

The scope of the Specification is for the supply of a packaged emergency diesel engine driven generator (in further text “diesel generator” or just “generator”) for permanent installation on a concrete plinth within Sydney Water’s facilities. The Specification covers the technical requirements of the diesel generator and associated items, including an acoustic enclosure, load bank and control equipment. The specific details are given in Appendix 2 - Diesel Generator Data Sheet.

1.2 Drawings

The Supplier must provide a full set of certified construction drawings for the diesel generator for Sydney Water’s review prior to fabrication. Detailed equipment list / bill of materials must be supplied prior to performing any work on the project. Additionally, WAC drawings must be supplied for Sydney Water’s review prior to delivery of the diesel generator to site.

The construction drawings submitted for review must include plan, elevations and section views with item numbers, showing:

- major equipment such as the diesel engine, alternator, acoustic enclosure and inlet and exhaust louvres,
- location of all electrical panels and batteries,
- field interface cable entries and access locations,
- acoustic louvre details,
- access doors (in open and closed positions) and min. clearance required where the complete diesel generator can be rolled out of the enclosure,
- removal arrangement for the alternator,
- air filters and lubrication points,
- fuel tank and fuel tank instruments,
- fuel filling point,
- material list, and
- loads and installation details, including anti-vibration mounting pads.

1.3 Scope of Work

The extent of work covered by this Specification includes the design, manufacture, factory testing and delivery to site of a complete diesel generator. The generator must be suitable for outdoor installation.

As a minimum, the work must include:

1. Supply of:
    - complete packaged diesel generator,
    - steel skid baseplate,
    - weatherproof acoustic enclosure,
    - anti-vibration mounting pads,

- lifting lugs or eyebolts,
- load bank.

2. Integral closed-circuit radiator.
3. Engine exhaust system including silencer and flashings.
4. Fuel tank, tank contents gauge and lockable filling point.
5. 230 V AC single phase load centre with separate circuit breakers for:
   - jacket water heater *
   - battery chargers
   - LED lights mounted within the acoustic enclosure with an on/off switch
   - two GPOs (RCD Protected)
   - 20A of spare capacity for future use.

   * 400 V AC 3-phase heaters for larger units also acceptable
6. Local control panel with diesel generator controller, remote wiring interface terminal panel (if required), protection devices, alarms, indicators and control switches.
7. 24 V DC electric starting system including batteries and battery charger (alternatively, 12 V DC electric starting system may be supplied for diesel generators up to 200 kVA power rating).
8. Batteries and battery charger for diesel generator control circuits (separate to starting system batteries and battery charger).
9. Termination panel for termination of outgoing cables from the alternator.
10. Circuit breaker for alternator output.
11. All power and control wiring internal to the package.
12. All programming and configuration of the diesel generator and load bank controllers.
13. Detailed template drawings of skid baseplate and loading information.
14. Detailed drawings of control panel with full equipment list for approval prior to manufacturing.
15. All protective and final finishing painting.
16. Pre-FAT and FAT in accordance with Sydney Water Specification: Commissioning – transitioning assets into operation.
17. Delivery to site.
18. Supply of installation, operating and maintenance manuals and other documentation in accordance with Sydney Water Specification: Commissioning – transitioning assets into operation.
19. Supply of all WAC drawings.
20. 12 months servicing and breakdown cover from the date of final commissioning on site.
21. Minimum 12 months warranty from the date of final commissioning on site.
22. List of recommended critical spare parts and special tools with costs.

1.4 Rating

The diesel generator must be rated as per the requirements detailed in Appendix 2 - Diesel Generator Data Sheet.

The diesel generator must achieve this rating when operating in the ambient temperature range and at an elevation specified in the Diesel Generator Data Sheet.

The output power rating classification for the diesel generator must be based on standby duty and continuous service at rated capacity full load during interruption of the normal power supply.

1.5 Alternator Electricity Supply

The alternator normal output must be 400 V / 230 V, 50 Hz, 3 phase, 4 wire power supply system. The star point of the alternator must be connected to the neutral bar of the diesel generator located in the terminal box. The generator assembly must be connected to an earth bar and the earth bar must be connected to the removable MEN link in the terminal box. The neutral and earth cables must be rated to comply with the relevant Australian Standards.

1.6 Operation

Unless otherwise specified the following operation is intended:

- The diesel generator must be designed to operate as an alternative supply (standby) system in the case of failure of the normal supply. Both, the normal supply and diesel generator supply will be fed to SCA equipped with ATS function (supplied by others).
- A phase failure relay (PFR) in the SCA will continuously monitor the normal supply.
- When the normal supply voltage deviates from nominal for more than a pre-set time (0.1 - 60 seconds adjustable, initially set to 30 seconds), a voltage free contact of the PFR will close and will initiate automatic start-up of the diesel generator (AUTO mode).
- When the ATS controller detects correct voltage on the diesel generator side of the ATS, the ATS controller will open the normal supply circuit breaker. After opening the normal supply circuit breaker and at the expiry of a pre-set time delay (0.1 - 60 seconds adjustable, initially set to 5 seconds) the ATS controller will close the diesel generator supply circuit breaker/load switch.
- When the normal power supply returns the PFR voltage free contact will open. After a time delay, (0.1 - 240 seconds adjustable, initially set to 240 seconds), provided that the PFR contact has remained open, the ATS controller will initiate the opening of the diesel generator supply circuit breaker.
- After a further time delay (0.1 - 30 seconds adjustable, initially set to 5 seconds) the ATS controller will close the normal supply circuit breaker(s)/load switch to transfer power supply from generator to normal supply.
- Finally, after a further time delay (60 - 600 seconds adjustable, initially set to 480 seconds), the ATS controller will stop the diesel generator.

Following transfer back to normal supply the diesel generator must continue to run unloaded for the pre-set time after which it must automatically shut down and reset for a future automatic start up.

An auto / test switch will be provided in the ATS controls to override the automatic transfer functions and enable local control for testing purposes so that the operator may choose the timing of the transfer back to normal supply. In test position, the ATS will simulate normal supply failure and proceed to complete the

power supply changeover to the diesel generator supply. The facility will remain on diesel generator supply until the selector switch is returned to the auto position, at which time the ATS will complete the transfer of supply to the normal supply. The transfer must not occur unless the normal supply is available. During the complete sequence the timing will be identical to automatic operation.

The diesel generator must also be capable of being manually started and stopped from the generator local control panel (MANUAL mode) to cater for special circumstances. Transfer between the diesel generator operating modes must be smooth and must not affect the operation of the generator.

The normal and standby supply circuit breakers / load switches forming the ATS will be mechanically interlocked to prevent the paralleling of the diesel generator supply with the normal supply. The interlock arrangement must also be agreed by the Distribution Network Service Provider as part of the connection agreement.

The diesel generator will be regularly operated for maintenance purposes. During such operation the diesel generator may be loaded via the integrated load bank or the plant equipment or both.

The load bank must be controlled automatically by the load bank controller, based on the load of the diesel generator, without any interface with the run status of the plant.

1.7 Testing and Commissioning

The Supplier must undertake factory testing of the diesel generator in accordance with Sydney Water's Specification: Commissioning – transitioning assets into operation. The Supplier must provide site testing and commissioning support.

The Supplier must prepare and submit Inspection and Test Plans (ITPs) and Check Lists as part of the Supplier's Project Quality Plan detailing all testing required to satisfactorily complete the factory acceptance testing (Pre-FAT and FAT).

1.8 O&M Manuals and WAC Drawings

The Supplier must provide operation and maintenance (O&M) manuals and WAC drawings in accordance with this Specification and Sydney Water's Specification: Commissioning – transitioning assets into operation.

2. Standards, Codes and Regulations

2.1 General

All equipment, materials and accessories used for the completion of the scope of work must be new. Their design and construction must be in accordance with all legal regulations and latest editions of relevant standards, codes and Sydney Water's specifications including, but not limited to those stated below.

Where no Australian Standard or Code exists, relevant International Standards, subject to Sydney Water acceptance, must apply.

Proof of compliance with a Standard or specified test may be required. Where requested, such proof must comprise a test certificate from an independent testing authority.

Where a standard or specification requires reference to another standard or specification and that document has been amended, replaced or superseded or withdrawn, the reference must be taken to apply to the replacement of that standard or specification or, if withdrawn, to its latest revision. If necessary, the author of such document must be consulted for a determination of the appropriate replacement standard or specification.

2.2 Regulations

- Work Health and Safety Act 2011
- Work Health and Safety Regulation 2017
- Dangerous Goods Act 1985 and Regulations
- NSW Electricity Supply Act 1995
- National Construction Code of Australia
- NSW Environmental Noise Control Manual
- EPA NSW Noise Policy for Industry (NPfI) 2017
- Service and Installation Rules of New South Wales
- Relevant Power Supply Authority Requirements
- Australian Communications and Media Authority Requirements
- Environmental Planning and Assessment Act 1979
- Protection of the Environment Operations Act 1997
- Protection of the Environment Operations (Clean Air) Regulation 2022

2.3 Standards

- AS 1019: Internal combustion engines – Spark emission control devices
- AS 1055: Acoustics - Description and measurement of environmental noise
- AS 1081.1: Acoustics - Measurement of airborne noise emitted by rotating electrical machinery - Engineering method for free-field conditions over a reflective plane
- AS 1081.2: Acoustics - Measurement of airborne noise emitted by rotating electrical machinery - Survey
- AS/NZS 1269: Occupational noise management
- AS 1359: Rotating electrical machines - General requirements

- AS 1627: Metal finishing – Preparation and pre-treatment of surfaces
- AS 1692: Steel tanks for flammable and combustible liquids
- AS 1940: The storage and handling of flammable and combustible liquids
- AS 2317.1: Lifting points – Part 1: Collared eyebolts and collared eyenuts – Grade 4
- AS/NZS 2373: Electric cables - Twisted pair for control and protection circuits
- AS/NZS 3000: Electrical installations
- AS/NZS 3008.1.1: Electrical installation - Selection of cables
- AS/NZS 3010: Electrical installations - Generating sets
- AS/NZS 3111: Approval and test specification - Miniature overcurrent circuit-breakers
- AS 4024: Safety of machinery
- AS 4041: Pressure piping
- AS 4044: Battery chargers for stationary batteries
- ISO 3046: Reciprocating Internal combustion engines – Performance
- AS 60034.1: Rotating electrical machines – Rating and performance
- AS 60034.9: Rotating electrical machines – Noise limits.
- AS 60044.1: Instrument transformers - Inductive voltage transformers
- AS 60269.1: Low-voltage fuses - General requirements
- AS 60529: Degrees of protection provided by enclosures (IP Code)
- AS/NZS 60947.2: Low-voltage switchgear and control gear - Circuit-breakers
- AS/NZS 60947.6.1: Low-voltage switchgear and control gear - Multiple function equipment - Transfer switching equipment
- AS/NZS 60947.8: Low-voltage switchgear and control gear - Control units for built-in thermal protection (PTC) for rotating electrical machines
- AS/NZS 61000.6.1: Electromagnetic compatibility (EMC) - Generic standards - Immunity standard for residential, commercial and light-industrial environments
- AS/NZS CISPR 11: Industrial, scientific and medical equipment - Radio frequency disturbance characteristics - Limits and methods of measurement
- AS/NZS CISPR12: Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of off-board receivers
- ISO 8528: Reciprocating internal combustion engine driven alternating current generating sets
- SAE J1349: Engine power test code - Spark ignition and compression ignition - As installed net power rating
- ISO 10816-6: Mechanical vibration – Evaluation of machine vibration by measurement on non-rotating parts – Reciprocating machines with power rating above 100 kW

2.4 Sydney Water Specifications

- Technical Specification - Instrumentation and Control (General) (HSS0009)
- SPS Specific Instrumentation and Control Standards (HSS0007)
- Treatment Plant SCADA Standards (D0000724)

- Commissioning – transitioning assets into operation (D0001440)
- Technical Specification – Mechanical (BMIS0209)
- Technical Specification – Electrical (CPDMS0022)

2.5 Codes

- Water Services Association of Australia (WSAA) WSA 201 Manual for Selection and Application of Protective Coatings

3. Technical Requirements

3.1 General

All the supplied equipment, including the details of which have not been covered by any specific rating or performance requirements in this Specification, must be of a proven construction and suitable for the duty it must perform.

For any type of equipment or accessory, the same manufacturer and range must be used throughout the construction to maintain standardisation. The diesel generator set and all equipment in the control panel must be of a type commonly used within Sydney Water for standardisation purposes.

Any of the works, which would reasonably and obviously be inferred as necessary, for the complete, safe and satisfactory operation of the supplied equipment, whether or not expressly described or specified, must be provided and such work executed as part of the supply scope.

The whole of the work must be carried out by skilled qualified tradesmen under qualified supervision.

When designing the enclosure and skid careful consideration must be given to providing suitable access to equipment for operation and maintenance. Access doors must be large enough and positioned in such a way that additional ladders or platforms are not required. The enclosure must be wide enough to accommodate any auxiliary equipment associated with the diesel generator.

Auxiliary equipment and accessories must be mounted so as to be free of vibration from the diesel generator. Adequate provisions must be made for the attachment of lifting slings and/or jacks for ease of handling.

The general design must provide easy access to all points requiring servicing, maintenance or regular inspection, including batteries, sensors, fuel filling point and isolators. The crankcase oil drain and cooling water system drain must be brought to the side of the unit so that a 200mm high receptacle may be used to drain the oil or water. Alternatively, if the oil and cooling water drain into a common collection sump, a suitable portable pump to empty the sump into a container must be provided. The oil and cooling water drain hoses must be connected to the oil sump / cooling system lowest point and run to the drain point at a constant grade.

The diesel generator must be supplied with a suitably sized fuel/oil/coolant spill kit located within the acoustic enclosure.

Exposed moving parts must be protected by adequate guards complying with relevant parts of AS 4024. The guards must not interfere with any controls or prevent normal operation or maintenance of the unit.

3.2 Acoustic Enclosure

The diesel generator must be installed inside an acoustic enclosure. The enclosure must not adversely affect the safety or function of the equipment. The acoustic enclosure must not impede the flow of cooling air when fully installed.

The generator must be installed in such a manner that the transmission of noise and vibration is kept to a minimum. Anti-vibration mounting pads under the skid baseplate must be provided to achieve the specified acoustic performance and minimise vibration transfer to the ancillaries. The sound pressure level at 1m from the enclosure must not exceed the noise level stated in the Diesel Generator Data Sheet.

The enclosure must be fabricated from structural steel and be of a vermin proof design. The enclosure must carry the necessary labels to indicate the presence of electrical voltage, hot surfaces, noise, fumes, low headroom, trip hazard and any other hazardous conditions. The enclosure must be weatherproof with ingress protection rated to a minimum of IP22 as per AS 60529. Each access door must be fitted with Sydney Water locking system to suit CB-Y yellow keying.

The enclosure must be painted as per WSA 201 Manual for Selection and Application of Protective Coatings, coating system POW or PUR-A for high exposure class or PUR-B for moderate exposure class. The enclosure colour must be Ocean Mist Satin (Oxytech Oxyplast PR12/61077/CS9) or European Colour Standard No. RAL9018, unless specified otherwise by Sydney Water (e.g. Environmental Green G66 may be more suitable if installed in parks or bush areas). Surfaces of metal parts must be primed and painted to an approved paint system unless they are made from corrosion resistant materials.

Painting of stainless steel and non-metallic service parts such as hoses, clamps, wiring harness and others is not acceptable. Fasteners must be Grade 316 stainless steel, designed to minimise marring of the painted surfaces when removed for normal installation or service work.

The acoustic enclosure must house the diesel generator, control panel, remote wiring interface terminal panel, fuel tank, ancillary components, and harmonic filters. Access to the control panel must be possible without increasing the noise level as per the requirements in the Diesel Generator Data Sheet.

Panels for air intake and exhaust must be of adequate size and robust construction such that air induced vibration does not add to the overall noise level. If the enclosure consists of a separate exhaust chamber, access must be provided to clean debris. If no access is provided to this chamber, then the exhaust must be supplied with an appropriate hood to prevent debris or rainwater entering the chamber.

The enclosure must be provided with adequate drain holes to prevent accumulation of rainwater that may enter through the intake, exhaust or any other panels. All other liquids that may leak from the diesel generator must be contained within the generator. The drain holes must be suitable for connection of drain pipes.

The enclosure must be fully removable from the installed diesel generator assembly to enable major overhauls. The enclosure must be constructed such that it can be removed with minimum disassembly and must retain the acoustic capability when reinstalled. The operation and maintenance manual must provide step by step details of its disassembly and re-installation. Adequate lifting points, certified to the relevant Australian Standard, must be provided for that purpose.

Alternatively, the diesel generator may be installed on rails so that the complete unit can be easily rolled out of the enclosure through the discharge end. The discharge end must be fitted with adequate doors sized for that purpose. The rails must include end stops and side guides. Min. clearance for the removal of the complete diesel generator in front of the enclosure must be shown on the Supplier’s drawings.

The enclosure must reduce the sound level of the diesel generator while operating at rated load to the maximum level specified in the Diesel Generator Data Sheet. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustic material used must be oil, water and fire resistant. Foam materials must not be used unless it can be demonstrated that they have the same durability and life span as mineral wool.

The enclosure must include hinged doors for access to both sides of the engine, alternator and the control equipment for routine maintenance and inspection. Doors must be fitted with neoprene type seals installed within retaining channels. Seals fixed with adhesive only are not acceptable. Door hinges and fasteners must be Grade 316 stainless steel. Each door must be provided with a Grade 316 stainless steel latch to

secure the door in the open position. Each door must be provided with a limit or industrial grade metal type reed switch. The switch must be Grade 316 stainless steel, fastened to the door/enclosure with Grade 316 stainless steel fasteners, not glued. The volt free contact must CLOSE when the door is in fully closed position and must OPEN in any other position. Door limit switches must be terminated at the terminal block in the control panel.

The control panel door must include an inside pocket of suitable size to store one copy of A3-sized WAC drawings, data sheets and O&M manual.

The enclosure must be provided with an exhaust silencer, mounted inside the enclosure that allows the diesel generator to meet specified sound level requirements. Alternatively, the silencer may be installed on top of the enclosure, externally insulated and cladded. The silencer and exhaust must include a rain cap and rain shield, all manufactured from Grade 304 or 316 stainless steel. An exhaust guard is to be provided for protection against vandalism. All exhaust pipework must be lagged.

The Supplier must provide all anticipated noise level information required in the Diesel Generator Data Sheet.

The complete diesel generator assembly with enclosure must be factory tested for noise compliance. Equipment operating under normal conditions that does not meet the defined requirements for noise must be rectified and retested.

3.3 Engine

3.3.1 General

The engine must be a turbo-charged, after-cooled or normally aspirated 4 stroke, 1500 rpm and diesel type of a proven design.

Replaceable cartridge type filters must be provided for fuel, lubricating oil and combustion air. The cartridge filters must be positioned in an easily accessible location to allow for periodic maintenance with no need to disassemble other engine parts within the enclosure.

The engine must be equipped with a radiator and cooling fan system for closed loop cooling.

Crankcase ventilation pipes must be routed to a point adjacent to the air intake filter to minimise contamination of the enclosure with oil and diesel fumes.

Only engines with a proven track record in Australia of reliability, provisions of local service facilities and local availability of spare parts will be considered. The engine and accessories must comply with ISO 3046.

3.3.2 Rating

The power rating of the engine at its minimum tolerance level must be sufficient to drive the alternator and all connected accessories. The engine must be capable of maintaining 100% full load continuously and 110% full load for 1 hour in 12 hours including transients.

The engine rating must be based on the maximum ambient temperature stated in the Diesel Generator Data Sheet. SAE J1349 engine power test code must be used as the baseline for rating the engine. If engine is rated by any other standard, that rating must be converted to SAE J1349 standards by using the correcting formula adopted and published by the SAE Power Test Code Committee under the Engine Group.

3.3.3 Fuel Tank

The on-board fuel tank must be double skinned and manually filled. Unless approved otherwise by Sydney Water, the fuel tank must have a capacity to maintain the diesel generator running for a minimum of 24 hours at rated load.

The fuel tank outer skin must have a capacity to contain a min. 110% of the tank volume, as per AS1940. The fuel filling point must be positioned in an easily accessible location and fitted with a fuel cap designed with a provision for a Sydney Water standard padlock with 10mm shackle. The fuel filling point must be provided with a small bund to capture and remove accidental fuel drips and spills during filling.

A fusible link must be installed above the diesel generator between the engine and alternator to operate in the case of fire and shut off fuel to the engine.

A low fuel level alarm (initiated at 50% full) must be provided for remote monitoring. This is a warning signal only and the configuration of the alarm circuit must be fail-safe with volt free relay contact wired to a termination block in the diesel generator control panel.

A fuel tank leak detector must be provided in the cavity between the inner and outer skin of the fuel tank for remote monitoring. This is a warning signal only and the configuration of the alarm circuit must be fail-safe with volt free relay contact wired to a termination block in the diesel generator control panel.

A local, mechanically operated level gauge close to the filling point must be provided on the fuel tank.

All piping to and from the fuel tank to the engine must be supplied and installed.

All necessary wiring, mechanical equipment, valves and controls covered under all local authority regulations and standards must be provided.

Fuel tank must be pressure tested to AS 1692.

3.3.4 Governor

The engine must be provided with an electronic governor of accuracy Class A1 to ISO 3046, to maintain an output voltage frequency of 50Hz (nominal) and capable of isochronous operation. Governor regulation class must comply with ISO 8528.

The governor system must be of Woodward or Heinzman manufacture or equivalent and must incorporate an electronic speed and load controller in conjunction with a mechanical governor actuator on the engine or be full authority electronic governing.

The electronic governor must include adjustments for speed droop, gain and stability and facilities for rapid stopping under emergency conditions.

3.3.5 Drip Tray

An easily removable drip tray must be provided under the engine. The drip tray must have sufficient capacity to capture oil or coolant leakage or accidental fuel spill and be sloped towards a discharge point. Alternatively, a small accessible sump able to collect any leakages and spillages may be provided instead of the drip tray.

3.3.6 Jacket Water Heaters

Jacket water heaters must be installed to facilitate rapid starting and loading of the engine. The heaters must accept 230 V AC single-phase or 400 V AC 3-phase power and include thermostatic controls. Hoses to and from the heaters must be of industrial quality with long design life.

3.3.7 Radiator

The radiator and fan must be included in the package. The jacket water/radiator cooling circuit must be a closed coolant circuit. Air intakes and outlets must be weather, insect and vermin proof.

3.3.8 Pipework

Pipework and associated components must comply with AS 4041and AS 1940, as well as with the requirements of local authority regulations.

Pipework must be carried out using seamless mild steel to ASTM A106 Grade B or BS 3601 Grade 27 or equivalent. The pipes must be pickled, descaled and externally painted or otherwise protected throughout. Grade 316 stainless steel seamless tubes to ASTM A269 must be used where installed in aggressive environment. All ends must be capped or plugged where not terminated at a piece of equipment.

Joints must be butt-welded and all workmanship must be consistent with the requirements of AS 4041. Joints must be tested to AS 4041 before completion. Press fit (‘crimped’) pipe joints are not acceptable.

Bolted joints must be electrically bonded to protect against the effects of static electricity.

The pipework must be complete with isolation valves, check valves and other fittings necessary for functional operation. Pipe fittings must be malleable iron, steel or bronze.

Valves must be similar to Fire Safe socket weld ball valves.

All pipes must be fixed and supported to prevent rattling or vibration during operation. Where necessary, Grade 316 stainless steel thrust type anti-vibration bellows must be used.

3.4 Alternator

3.4.1 General

The engine alternator set must be mounted on a separate, fabricated steel sub frame. Auxiliary equipment and accessories must be mounted to be free of vibration from the alternator unit.

The alternator must be excited by a self-regulated exciter, which must be drip proof, screen protected and direct coupled to the alternator. The alternator, which must comply with all relevant requirements of AS 60034, must be designed to give an output voltage of 400 V on a 3-phase power supply system when delivering rated load (at 0.8 lag) at 50Hz.

The alternator must deliver continuously the rated output plus a minimum of 10% overload with a voltage regulation of not more than ± 0.5% at any power factor between 0.8 and 1.0.

The alternator must be oversized for any harmonic, voltage distortions and building loads, i.e. pumps, ventilation, variable speed drives etc., if required. See Diesel Generator Data Sheet for details.

The transient response performance of the diesel generator must comply with Class G3 as per ISO 8528-5.

A permanent magnet generator (PMG) must be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls must be capable of sustaining and regulating current supplied to a single phase or 3-phase fault at approximately 300% of rated current for not more than 10 seconds. The sub transient reactance of the alternator must not exceed 12%, based on the standby rating of the alternator set.

An electronic governor system must provide automatic isochronous frequency regulation from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to rated load must not exceed +/- 0.25%.

The alternator must produce a clean AC voltage waveform, with no more than 5% total harmonic distortion at full linear load, when measured from line to neutral and with not more than 3% in any single harmonic. The total harmonic distortion open circuit voltage waveform must be in the order of 1.8%. Telephone influence factor (TIF) must be less than 40.

Diesel generator set control interfaces to other system components must be made on a common permanently labelled terminal block assembly mounted within an IP56 enclosure.

The alternator must be brushless rotating field type directly coupled to the engine.

The cooling system must be IC01 to AS 1359.106 and the degree of protection must be not less than IP22 to AS 60529.

The temperature rise of the insulation systems must not exceed the limits set out in AS 60034.1 thermal Class H. In addition, the output voltage THD must not exceed 5% for any load up to rated.

The alternator/exciter/voltage regulator system must be designed for current forcing, i.e. for a 3-phase short circuit applied at the alternator terminals a current of not less than 3 p.u. must be sustained for at least 10 seconds.

3.4.2 Terminal Box

The alternator must be designed for star connection and each end of each winding and neutral must be brought out to a terminal box. The box (with suitable rating circuit breaker to protect diesel generator output) gland plate and terminals must be adequately sized and incorporate cable glands to allow easy termination of cables. The terminal box must be air insulated with copper terminals and brass gland plate for bottom entry cables. The terminal box must have an IP56 rating and be an integral part of the diesel generator enclosure.

Provision must be made for the installation of protection and measurement CTs in the terminal box or if necessary, in a custom made extension box to be supplied by the Supplier. Refer to the Diesel Generator Data Sheet to confirm if CTs or space for CTs is required in terminal box.

The terminal box must be designed and manufactured in accordance with AS/NZS 61439 Part 1 & 2. Alternatively, it may be provided with evidence that the terminal box is verified in accordance with Annex D of AS/NZS 61439.1 for relevant characteristics using the valid verification methods.

A removable MEN link must be provided inside the terminal box. In the final installed state the electrical distribution system must have only one MEN connection which is made at the main switchboard. In these instances, the removeable MEN link in the generator must be removed before it is terminated to the main switchboard.

3.4.3 Voltage Regulator

The alternator must be provided with a solid-state voltage regulating system. Lockable controls must be provided to allow trim of output voltage and output voltage drop.

The voltage regulation must comply with AS 60034.1.

3.5 Starting System

3.5.1 General

An electric starting system must be used. It must be:

- 24 V DC,
- closely regulated over current protected battery charger and batteries, and
- have an engagement mechanism incorporating a chamfered ring-gear and self-lubricated pinion.

Alternatively, diesel generators up to 200 kVA may be supplied with a 12 V DC electric starting system.

The engagement mechanism must be activated through electromechanical engagement. The starter motor must operate on the same DC voltage and must be rated for min. 30 seconds of continuous cranking.

3.5.2 Battery

The battery must be heavy duty and comply with AS 4044. The selection of battery must consider the risk of explosion and suitability for the standby diesel engine starting application. The battery must have sufficient capacity to allow a minimum of 5 successive, 15 second starting attempts at 0°C. The number of charge-discharge cycles must not be less than 2400. The batteries must be mounted within the acoustic enclosure.

All necessary wiring, switches and purpose-made connections must be provided for a complete installation.

A lockable battery isolator must be provided and mounted on the engine adjacent to the starter motor. The terminals must be numbered and DIN rail mounted. All wires must be numbered and pin connected. 230 V AC terminals must be segregated by a physical barrier from the DC terminals and have an appropriate warning label.

The battery must be located so that voltage drop to the starter motor is minimised and that it is unaffected by heat from the engine.

The cells must be mounted in a rigid structure with an electrolyte resistant finish which:

- allows easy access to the terminals and vents for maintenance, and
- protects against falling tools touching the connectors or terminals.

3.5.3 Battery Charger

A constant voltage automatic battery charger, complete with all necessary controls, fuses and alarms must be supplied for charging the battery. The battery charger must be suitable for the type of battery selected and suitable for standby diesel engine starting application.

An engine driven automatic type alternator as the sole means for battery charging is not acceptable.

The battery charger must be a Type 3 with the battery connected in parallel in accordance with AS 4044.

The battery charger must supply the same DC voltage to the battery system for engine starting and the alternator control system. Under normal circumstances when 230 V AC auxiliary power is available the battery charger must charge the batteries ensuring that they are always fully charged. Under emergency conditions where normal site power is not available during power failure, the alternator of the diesel engine must charge the battery.

The battery charger must be capable of automatically restoring the battery to full charge within 12 hours, following a total of five successive start cycles of cranking. Alternatively, the charger may be supplied with an automatic boost charge function if it can provide the same starting capacity.

The charger must include a digital DC voltmeter and ammeter, 12 hour equalise charge timer and AC and DC fuses.

3.5.4 Battery Charger Alarms

The system must include LED type lights to provide local indication for:

1. Supply mains on.
2. Charge fail.
3. Low battery volts.

Provision for remote indication at the control panel of a common fault alarm and a separate "low battery volts" alarm must be made by means of voltage free changeover relay contacts. The "low battery volts" alarm must be initiated if the battery voltage falls below a value required to ensure reliable starting and operation of the diesel generator.

Alarms for DC output / charger failed and low battery voltage must be hardwired to the control panel. Alarms must be configured as fail-safe and must have volts free contacts. The alarms must reflect the true battery voltage and not the rectified voltage from the AC supply.

The alarms must be wired in series with the alarms for the diesel generator control circuit battery charger alarms so that either will trigger the remote alarm input.

3.6 Baseplate

The engine, alternator and all other ancillary equipment must be mounted on a rigid baseplate, fabricated from mild steel and hot dipped galvanised or painted in accordance with WSA 201. The baseplate must be substantial, suitable for installation on a concrete plinth and must ensure the engine and alternator are correctly aligned.

Spring/pad type anti-vibration mounting pads must be provided under the engine and alternator support feet and under the skid baseplate.

The baseplate must be fitted with a minimum of three levelling screws to allow for a minimum 20 mm height adjustment and levelling.

The mounting surfaces for the engine and alternator must be machined so that the alternator mounting locations are in a common plane and the engine mounting locations are in a parallel plane to the alternator mounting locations. The relative dimension of the two planes must provide adequate shimming allowance to achieve final alignment of the engine and alternator after allowing for manufacturers' tolerances of centreline heights.

All holding down bolts must be of Grade 316 stainless steel. Holes drilled for holding down bolts must not be obstructed by the equipment installed on the baseplate.

3.7 Control Panel

3.7.1 General

The diesel generator local control panel must be located inside the generator package, i.e. integrated with the generator and not a stand-alone panel. A separate lockable door to access the controls, indicating instruments and equipment within the control panel must be provided. The diesel generator must be capable of operating at maximum capacity with the opened internal and external access doors of the control panel and must comply with the specified noise rating.

The external door of the control panel must be provided with lockable handle to accept Sydney Water key or Sydney Water standard padlock with 10mm shackle. The internal panel door must be provided with 7mm square pin latches. Control panel doors must be fitted with latches capable to retain the doors in 120^{O} open position. The latches must be mechanical, heavy duty. Gas struts are not acceptable.

In the case of back access to the panels, rear doors or covers must be of the lift off type. Lift off doors or covers must be fitted with lifting handles and must be retained in their position when retaining nuts or bolts are removed. Covers must be held in place with stainless steel captive knurled fixing nuts or screws.

Panels having access from the front only must be provided with lift off covers over cabling compartments.

Doors and covers must be fitted with neoprene type seals installed within retaining channels. Seals fixed with adhesive only are not acceptable.

Panel components and controls must be identified by engraved traffolyte labels with black lettering on white background fixed by self-tapping stainless steel screws or an equivalent approved system.

Incoming or outgoing cabling to the control panel must be bottom entry only. Each incoming or outgoing cable must be fitted with suitable glands such that the cables are adequately spaced and allow for required bending radius.

The panel must be a dead front folded sheet metal type and the general arrangement of equipment on the front panel must be such that an ordered and balanced appearance is provided.

The control panel, doors and covers must be manufactured from minimum 2mm thick cold rolled zinc seal steel sheet, free of scale, rust or indentations. Special attention must be given to doors, which must be rigid and free from buckling. The sheet metal including gear plates must be internally painted white and externally ocean mist in accordance with WSA 201.

Bolts, nuts and screws used must be stainless steel.

The degree of protection must be IP56 with the enclosure door closed.

3.7.2 Control Panel Layout

The control panel layout must comply with the following:

- 230 V AC wiring and control wiring must be suitably segregated within the control panel.
- Control relays and timers must be DIN rail mountable grouped and located on the same DIN Rail.
- Control fuses must be DIN rail mountable grouped and located on the same DIN rail.
- Control input terminals to the diesel generator controller must be grouped and located on the same DIN rail.
- Control output terminals from the controller must be grouped and located on the same DIN Rail. All remote control signal terminals and remote monitored signals must be grouped and located on the same DIN rail.
- Components that are required to be accessible for maintenance must not be mounted higher than 2000 mm and all panel indicators, operating panels and switches must not be mounted higher than 1600 mm from the mounting floor of the diesel generator.
- Equipment, other than the diesel generator controller, unless prior Sydney Water's approval is obtained must be the type currently used in Sydney Water to ensure standardisation. Information will be made available on request. A full equipment list with layout drawings must be supplied and approved prior to any manufacturing taking place.

3.7.3 Diesel Generator Controller

A diesel generator control panel must be provided in the package. The control panel must be suitable for bottom entry of control cables via the cast-in conduit provided in the foundation. The controller must be fascia mounted on the internal door of the control panel.

The diesel generator controller must include but not be limited to the following, however some features such as alarms and indicators may be provided in proprietary integral solid state devices:

1. Ammeter 3-phase with phase selection.
2. Voltmeter 3-phase with phase selection.
3. Frequency meter.
4. Diesel Generator Operation Mode Selection with the following modes:

a. Manual Mode – diesel generator able to start and run from the local control point
b. Auto Mode – started from remote start signal
c. Off Mode – diesel generator set shutdown and cannot be started.

5. Emergency stop pushbutton (red pushbutton with mushroom head, twist release).
6. Diesel Generator Running indication.
7. Not in auto mode indication.
8. Common warning indication.
9. Low oil pressure warning (latched).
10. Low oil pressure shutdown (latched).
11. High engine temperature warning (latched).
12. High engine temperature shutdown (latched).
13. Over-speed shutdown (latched).
14. Under-speed shutdown (latched).
15. Fail to start (latched).
16. Low battery voltage (latched).
17. High battery voltage (latched).
18. Fuel tank leakage.

3.7.4 Telemetry Remote Monitored Status and Alarms

The diesel generator unit must be capable of supplying but not limited to the following alarms and status:

1. Common alarm for all fault/alarm conditions identified by the diesel generator controller / engine management system.
2. Diesel generator unavailable including but not limited to: alternator overload protection shutdown (MCCB tripped), emergency stop pressed, not in AUTO, circuit breaker off, load bank failed.
3. Diesel generator running.
4. Engine fails to start.
5. Diesel generator engine over-crank.
6. Engine cooling system fault including but not limited to:
   - low jacket water temperature shutdown.
   - high jacket water temperature shutdown.
   - low jacket water level shutdown.
7. Engine low lubricating oil pressure shutdown.
8. Engine over speed shutdown.
9. Low fuel tank level (50% level).
10. Fuel tank leakage

11. Diesel engine high fuel pressure (not applicable to diesel engines with individual fuel injection pumps).
12. Combined cranking battery charger fault or control circuit battery charger fault including loss of 230 V AC supply.
13. Combined cranking battery voltage fault or control circuit battery voltage fault.
14. Diesel generator enclosure doors security alarm.

See SPS Specific I&C Standards and Diesel Generator Data Sheet for details.

Volt free alarm contacts must be wired to a set of terminals as shown in Appendix 1. The common for the alarm circuits must be supplied from the diesel generator control voltage to interposing relays in the generator control panel supplied by the Supplier. This is required to ensure that faults within the diesel generator do not jeopardise the Sydney Water's main switchboard control voltage power supply.

Unless agreed otherwise, all alarms must be fail-safe. The fail-safe alarm circuits must be configured to ensure that failure of any component, including primary devices, arising and/or de-energising of the circuit will open the volt-free contact and generate a remote alarm.

In addition, an engine running status signal must also be provided which must not be wired as fail-safe.

Where the diesel generator controller is not capable of supplying volt free fail-safe relay contacts for all of the required remote monitored alarms as described above, they may be provided by alternative programmable devices or solid state devices. Alternative device/s must have capability to communicate directly with the diesel generator controller to extract all alarm and trip status generated by the generator controller. Where alternative programmable devices are proposed the following also applies:

1. Equipment must be approved by Sydney Water
2. Supply of programming software and hardware
3. Supply of manuals for hardware and software
4. Supply of software program
5. Easily accessible within the control panel
6. Powered by the diesel generator control battery supply
7. Must be able to operate reliably within voltage variation caused during diesel generator cranking at starting or use a separate battery supply system and must have:
    - Separate battery charger that has same alarm capability of the diesel generator battery charger.
    - Alarms wired in series with the alarms of diesel generator battery charger.

The control panel must also include a standard Sydney Water I/O to datalink converter Phoenix Contact IB IL 24 DI 8/HD-ECO (2702792) and IB IL 24/48 DOR 2/W-PAC (2863119), or approved equivalent. This includes a 24 V DC power supply and a minimum DIN rail mounting space of 130mm x 110mm x 80mm (H x W x D), cable terminations and grey slotted duct for incoming and outgoing cables from the converter. Incoming cables will be from the alarm terminal rail, described above and shown in Appendix 1. Outgoing cables will go to the RTU panel. The terminals and converter should be located within the generator control panel. Alternatively, where there is insufficient space in the control panel, the terminals and datalink converter may be located in a dedicated remote wiring interface terminal panel. This panel must be an IP56 enclosure.

3.7.5 Local Diesel Generator Alarms

In addition to the remote alarms specified, the engine must be fitted with all protective devices considered necessary by the manufacturer to protect it from damage in event of a malfunction and to provide warning of an impending malfunction. Pre alarms must be capable of being manually cancelled without shutting down the engine once the condition being monitored has returned to the manufacturer's limit.

All alarms must be indicated locally on the diesel generator control panel and be capable of being reset from a remote signal via IICATS or plant SCADA. The remote signal must be a volt free normally open contact.

Alarm wiring must be secured to prevent vibration and must be terminated on the remote control and alarm terminal block mounted in the local control panel.

3.7.6 Control Wiring

Unless otherwise approved control wiring must be carried out in minimum 16/0.2 PVC insulated wire rated at 0.6/1 kV. All ends must be terminated with approved type lugs or ferrules.

Colour coding of wiring must comply with the Sydney Water's Instrumentation and Control Standards.

Wiring within the control panel must be enclosed with grey slotted duct. Terminals must be spaced suitably from the ductwork allowing room for neatly separated wiring, identification, and terminations. The wiring must be identified with wire numbers within plastic sleeves at each end of the wire.

Terminals within the control panel must be an approved type where wiring is terminated on the top and bottom of the terminal, not into the front. All terminals must be numbered sequentially. Each terminal strip within the control panel must also be identified to differentiate between different terminal strips, i.e. X1, X2, etc.

Terminations and terminals exposed on the inside of hinged doors must be appropriately shrouded.

Harness bars or equivalent must be provided for wiring associated with hinged doors to suitably support the weight of the wiring and secured such that it is not affected by any vibration or movement. Wiring across hinged doors must be bound in spiral wrap unless otherwise approved.

3.7.7 Control Circuit Battery

A battery (or batteries) must be supplied, separate to the diesel generator starting system batteries, dedicated to supplying the generator control circuits.

Heavy duty batteries must be supplied which comply with AS 4044. The selection of battery must consider the risk of explosion and suitability for standby diesel engine application. The battery must have sufficient capacity to supply the diesel generator control circuits for a period of 12 hours. The batteries are to be mounted within the acoustic enclosure and be suitable for expected maximum operating temperatures.

All necessary wiring, switches and purpose-made connections must be provided for a complete installation.

A main battery isolator is to be provided. The terminals must be numbered, and DIN rail mounted. All wires are to be numbered and pin connected. 230 V terminals are to be segregated by physical barrier from the 24 V and appropriately warning labelled.

The battery must be located so that voltage drop to the control circuits is minimised and that it is unaffected by heat from the engine.

The cells must be mounted in a rigid structure with an electrolyte resistant finish which:

1. Allows easy access to the terminals and vents for maintenance.

2. Protects against falling tools touching the connectors or terminals.

3.7.8 Control Circuit Battery Charger

A constant voltage automatic battery charger, separate to the diesel generator starting system battery charger, must be supplied, complete with all necessary controls, fuses and alarms for charging the generator control circuit battery. The selection of battery charger must be suitable for the type of batteries selected and for standby diesel engine application.

An engine driven automatic type alternator as the sole means for battery charging is not acceptable.

The battery charger must be a Type 3 with the battery connected in parallel in accordance with AS 4044.

The battery charger must supply 24 V DC battery system for the diesel generator control circuits. Under normal circumstances when 230 V AC auxiliary power supply is available the battery charger will charge the batteries ensuring that they are fully charged. Under emergency conditions where normal site power is not available during power failure, the alternator of the diesel engine must charge the battery.

The battery charger must be capable of restoring full charge to the battery within 12 hours, following supplying the control circuits for 12 hours. Alternatively, the charger may be supplied with an automatic boost charge function if it can provide the same starting capacity. The charger must also be adjustable to compensate for the battery self-discharge rate and must be capable of recharging batteries to full potential within 4 hours.

Alarm for 24 V DC output power supply failed and low battery voltage are to be provided which are to be wired to the control panel. Alarms must be fail-safe and must have volt free contacts. Alarms must reflect the true battery voltage and not the rectified voltage from the AC supply. The alarms must be wired in series with the alarms for the starting system battery charger alarms so that either will trigger the alarm input.

The charger must include a digital DC voltmeter and ammeter, 12 h equalise charge timer and AC and DC fuses.

3.7.9 Control Circuit Battery Charger Alarms

The control circuit battery charger system must include LED type lights to provide indication for:

1. Supply mains on
2. Charge fail
3. Low battery volts

Provision for remote indication at the control panel of a common fault alarm and a separate "low battery volts" alarm must be made by means of voltage free changeover relay contacts. The "low battery volts" alarm must be initiated if the battery voltage falls below a value required to ensure reliable starting and operation of the diesel generator.

3.7.10 Labelling

All components within the control panel must be physically labelled and identified on the diesel generator WAC drawings. Labels must be traffolyte type with black lettering on white background, fixed by self-tapping stainless steel screws or an equivalent approved system and be installed in a clearly viewable position located above the component. Labelling must not be installed directly onto any component nor on any ductwork.

3.7.11 Outgoing Cabling

A number of control and alarm functions on the alternator interface with other systems (e.g. MAIN SWITCHBOARD, ATS control). To facilitate connection to these systems, the wiring associated with these interfaces must be brought to sets of terminals mounted in a single location at the diesel generator. The terminals must be mounted within an IP56 enclosure.

3.7.12 Current Transformers

Current transformers must be encapsulated types complying with AS 60044.1. They must be mounted on easily accessible removable sections of busbar.

Current transformer test and shunt links must be provided and located within the panel for easy front access.

Separate current transformers must be used for instrumentation/metering and protection.

A notice must be located adjacent to the links engraved: "Shunt must be closed before removing instruments".

3.7.13 Instruments, Meters and Accessories

Instruments, meters and accessories must be supplied and connected as indicated on the Single Line Diagram or as specified.

Instruments and meters must be flush mounting types. Voltmeters and voltage operated instruments must be protected by potential fuses. All indicating lights must be LED types.

3.8 Load Bank

3.8.1 General

A fan-cooled resistive load bank must be provided for permanent, on-site installation as a component of the diesel generator. The load bank is to be used for periodic, supervised maintenance exercises, testing and proper loading of the diesel generator to avoid cylinder glazing, wet stacking and improper piston ring seating.

A load bank is to exercise and support the diesel generator operation based on the site specific requirements. The permanently installed load bank must be provided as a tool for maintenance to test the diesel generator.

The load bank must be completely self-contained, free standing unit, incorporating all resistive elements with fusing or circuit breaker to protect each load section and control circuit.

The load bank cooling system must be forced air cooled by fans directly driven by electric motor with overload protection and temperature sensor control circuit. Hot air must be discharged vertically. Any temperature rise of the enclosure must not exceed 20° above ambient temperature.

3.8.2 Load Bank Rating

Capacity:	See Diesel Generator Data Sheet
Power factor:	1.0
Load steps:	10kW resolution (Supplier to advise)

Voltage:	400VAC, 3 phase
Frequency:	50 Hz
Ambient temperature:	See Diesel Generator Data Sheet
Control Voltage:	230 V AC or 24 V DC
Noise level:	See Diesel Generator Data Sheet

3.8.3 Load Bank Enclosure and Load Resistor

The load bank enclosure must be designed and constructed for a long and reliable life in industrial environments. The unit must be constructed from galvanised steel that is primed and painted in accordance with WSA 201. The load bank unit must have fully opening hinged doors to provide full and clear access to all resistor connections, switch and control equipment, ensuring that equipment can be accessed safely at all times. Ideally the load bank controller should be located external to the resistor panel.

Where it is not included in the diesel generator acoustic enclosure, the load bank must be designed for outdoor installation on a concrete plinth. The load bank enclosure must comply with all relevant requirements specified for the diesel generator acoustic enclosure.

There must be sufficient clearance between the cold air intake and the hot air exhaust as recommended by the manufacturer.

The resistor must be designed specifically for high-density application. The resistor value must be accurate to 2.5% of rated value or must not reduce in value by more than 2.5% at full operating temperature. The resistor supports must be constructed from a ceramic material. Plastic, glass or polyester materials must not be used.

3.8.4 Load Bank Control Operation

The load bank must have the facility to be operated automatically by remote control to provide a complete diesel generator operational support system for loading acquisition support, automatic loading/ regenerative operation for light and variable loading application, automatic exercise with alarm monitoring, and basic manual control function for installation commissioning.

The load bank controller must automatically control the switching of the load bank loading steps in response to the instantaneous kW loading of the diesel generator, to maintain generator kW output at or above 40% of the rated value.

The load bank must be able to provide a common alarm for all fault/alarm conditions identified by the controller. A volt free alarm contact must be wired to a set of terminals as shown in Appendix 1.

Equipment earthing connections must be provided for the load bank to ensure permanent and effective grounds to comply with AS 3000.

3.9 Corrosion Protection

Equipment must be protected from the effects of corrosion using systems detailed in WSA 201 Manual for Selection and Application of Protective Coatings and the guidelines below:

1. Fixings, brackets, nuts, bolts etc. for equipment, pipework, cable trays or similar must be galvanised. All other fixings must be grade 316 stainless steel, unless specified otherwise in this Specification.

2. Where dissimilar materials are used they must be insulated from each other to prevent galvanic corrosion.
3. Anchor bolts for mounting diesel generator unit to concrete slab must be stainless steel.
4. Pipework, tanks and miscellaneous steelwork must be:
    a. cleaned and degreased,
    b. etch primed, and
    c. finished with an undercoat and one coat of gloss enamel of the colour specified.
5. The alternator, pumps, motors and other pre-painted equipment must be:
    a. cleaned, and
    b. finished with two coats of gloss enamel.
6. The engine manufacturer's standard finish is acceptable.
7. Battery charger and control panel must be powder coated.
8. The acoustic / weatherproof canopy must be powder coated in the specified colour.

All of the above systems to be applied are to be approved by Sydney Water.

3.10 Earthing

The engine alternator mounting frame must be bonded to earth by flexible conductors. Any component not in effective electrical contact with these components must be appropriately earthed.

The control panel, battery charger and fuel oil system must be earthed to the mounting frame.

An earth bar must be provided within the terminal box for each required earthing termination as part of the diesel generator.

The diesel generator bonding system must comply with AS 3010.

3.11 Motors

Motors for auxiliary plant must be 3 phase induction types.

Motor starters and other equipment necessary for local or automatic control must be provided together with all interconnecting wiring.

3.12 Installation, Operation and Maintenance Manuals

One hard copy of an installation, operation and maintenance manual must be provided for use with the diesel generator.

A copy of the manual in electronic form must be provided. The media and data must not be password protected so that it can be transposed into the Sydney Water's database for common usage.

The manuals must be specific only to the equipment specified. They must be complete and include all information necessary for engineers, supervisors and tradesman to install, operate and maintain the unit satisfactorily whether they are electrical or mechanical by discipline.

Electronic versions must contain a table of contents with hyperlinks to the reference sub-sections and drawings, and PLC code if applicable.

As part of the manual, a list of recommended spare parts must be included to cover such items as:

- Filters
- Injector components
- Recommended lubricants
- All consumables
- Critical spares

4. Inspection and tests

The complete diesel generator unit must be factory tested in the Supplier's works when manufacturing is complete. Sydney Water may undertake a factory inspection of the completed diesel generator unit and witness factory testing. At least two weeks' notice must be given of a proposed factory testing.

Before commencing tests, the Supplier must provide Sydney Water with details of model, rating, type, manufacturer and serial number for the:

- Engine,
- Alternator,
- voltage regulator,
- Governor,
- control panel,
- battery charger,
- batteries, and
- load bank.

The Supplier must then perform the tests listed. All checks and tests of the unit must be recorded on Sydney Water approved ITP and Check Lists that must be submitted for approval prior to testing. The ITP must include as a minimum the following items:

- Check complete unit and control panel for compliance with the Technical Specification, drawings and Diesel Generator Data Sheet.
- Insulation resistance at 1 kV DC and high voltage test at 1.6 kV AC rms for 1 minute before and immediately after the load test. If the high voltage test is completed as part of the alternator manufacturer works testing, the test report must be available during factory testing.
- Cold winding resistance immediately before and hot winding resistance immediately after the load test.
- A transient frequency test with engine cold for the application of 0.6 p.u. load steps to check that governor performance complies with ISO 3046.
- A transient voltage test with engine cold for the application of a 0.6 p.u. load step to check that voltage regulator performance complies with the requirements of AS 60034.
- A load test at the standby power rating specified for 6 hours. During this test all specified readings must be recorded at 30 minute intervals:

a. The test must be carried out at unity (1) power factor.

b. The test must be recommenced if any failure occurs.

- Battery charging systems functioning.
- Insulation resistance tests on all equipment and wiring.
- Load test on complete battery/charger unit.
- Operational test of the engine.

The complete diesel generator assembly with enclosure must also be factory tested for noise and vibration compliance.

The Supplier must provide all facilities including certified calibrated test equipment and instrumentation for the testing. The instrumentation used for testing must have current certification by NATA, or equivalent.

Readings must be recorded for the following:

1. All temperatures monitored on engine control panel
2. All pressures monitored on engine control panel
3. AVR output voltage and current
4. Load current and power factor
5. Alternator output voltage
6. Ambient air temperature
7. Cooling water temperature
8. Engine and alternator air inlet temperature
9. Frequency
10. Insulation resistances from Test 1
11. Cold and Hot winding resistance from Test 2
12. Derived alternator winding temperature before and after load tests.
13. A transient voltage rise test after rejection of rated load to check that voltage regulator performance complies with the requirements of AS 60034.
14. Harmonic analysis of phase-to-phase and phase-to-neutral voltage waveform at no load and at rated load.
15. Simulated functional tests to prove correct operation of the controls and alarms.
16. Noise ratings
17. Paint thickness
18. Vibration level
19. Fuel consumption during the test.

All temperatures, pressures and voltages must be within the manufacturer’s allowable limits.

Document Control

Ownership

Role	Title
Group	Engineering and Technical Support
Owner	Manager, Engineering
Author	Milan Rubcic, Technical Director – Mechanical Engineering

Change history

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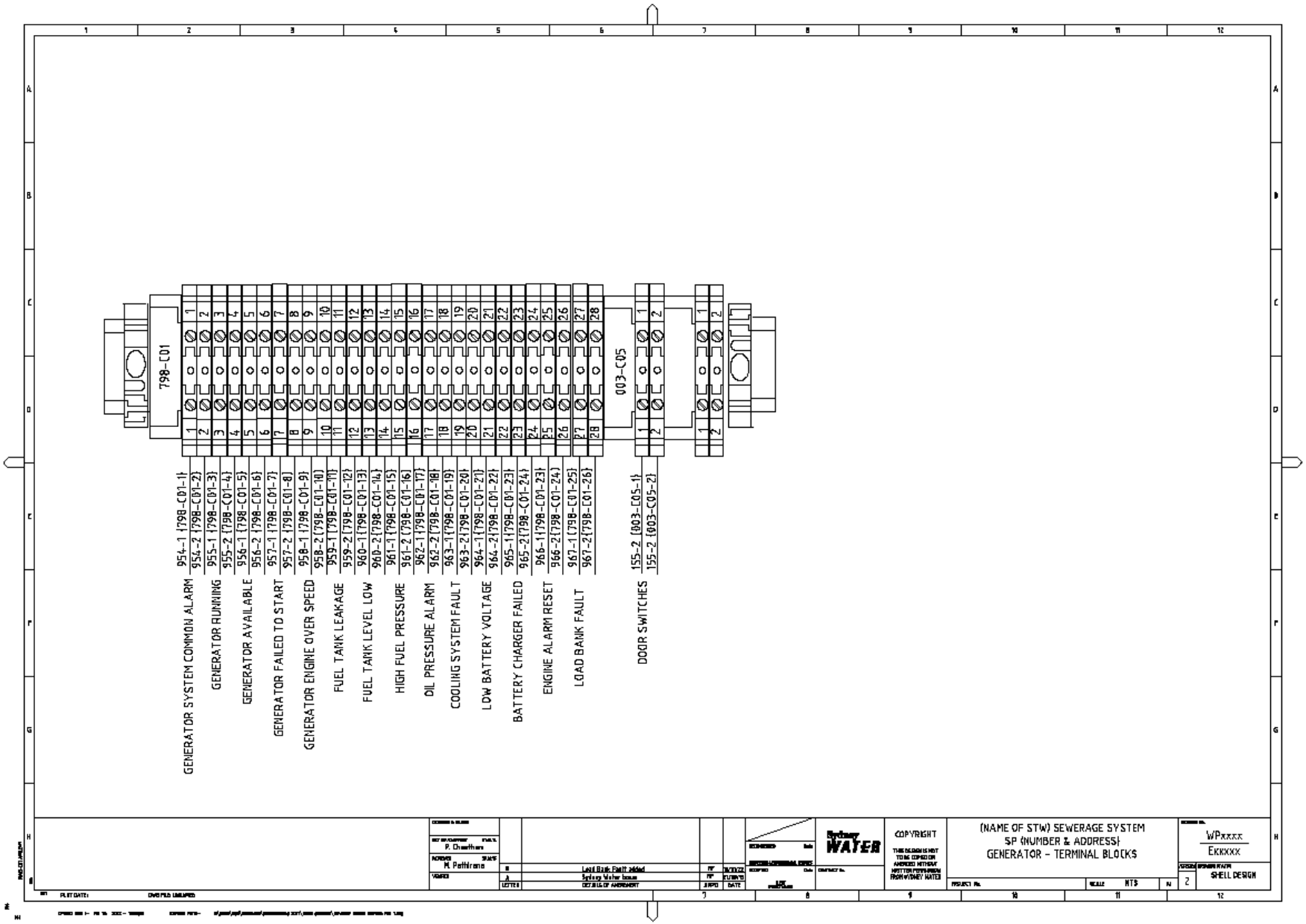
2	Milan Rubcic	22/04/2025	W. Legg, R. Madhok, M. Pathirana, P. Zhou, M. Mordini, S. Mahendra, S. Ross, E. Chee, K. Satani	Norbert Schaeper	22/04/2025
1	Milan Rubcic	25/03/2022	R. Faure, W. Legg, R. Madhok, N. Majlessi, M. Pathirana, P. Zhou, M. Mordini, M. Rush, K. Jones, J. Smith	Norbert Schaeper	22/04/2025
0	Warren Legg	15/02/2017	R. Madhok, B. Maunder	Milton Pathirana	15/02/2017

Appendices

Appendix	Title
1	Diesel Generator – Terminal Block
2	Diesel Generator Data Sheet

Appendix 1 Diesel Generator Terminal Block



Appendix 2 Diesel Generator Data Sheet

Project Number	
Site	
Description	
Tag number(s)	
Quantity required	

SPECIFICATIONS & REFERENCE INFORMATION
• Sydney Water Technical Specification – Permanent Diesel Engine Driven Generator

SCOPE OF SUPPLY
• The design, fabrication, supply, assembly, factory testing and delivery to site of a diesel generator. • The unit must be provided with the necessary electrical control panel, load bank and acoustic enclosure, as per the Technical Specification. • Supply of test documentation, drawings and O&M manuals in accordance with the Technical Specification. **Note:** Civil works, installation, connection of services, site testing and commissioning are excluded from the scope.

Item	**Units**	**Requirement***	**Suppliers offer**
***To be reviewed and completed by the Designer.**			
VENDOR INFORMATION			
Function	-	Provide standby power during power outages.	
Engine type	-	Diesel	
Supplier	-	Supplier to advise	
Manufacturer	-	Supplier to advise	
Model	-	Supplier to advise	
Engine make and model	-	Supplier to advise	
Diesel generator make and model	-	Supplier to advise	
Control panel make	-	Supplier to advise	
AMBIENT CONDITIONS			
Location	-	Outdoor	
Ambient environment	-	Inland/Coastal	
Ambient temperature range	^{O}C	-6 to +50	
Maximum 24 hours average ambient temperature	^{O}C	+35	
Ambient humidity range	% RH	30 to 90	
Elevation	mAHD		

OPERATING CONDITIONS			
Continuous nominal rating @ 45^{O}C ambient temperature	kVA		
Load requirements	-		
Power factor	-		
Set output voltage	V		
Operating speed	rpm	1500	
Overall dimensions	mm	Supplier to advise	
Fuel tank capacity	Hours	24 Diesel generator must hold sufficient fuel stock for continuous operation at rated load for minimum 24 hours Supplier to advise if this is possible with a single tank or if an additional tank is required	
Current transformers	-	Yes	
Harmonic filter	-	No	
Synchronising function	-	Yes / No May be required where multiple diesel generators required.	
Maximum voltage dip	%	20	
Weatherproof enclosure required	-	Yes	
Acoustic enclosure required	-	Yes	
Control panel installation	-	Separate from the main diesel generator compartment	
Load bank	-	Yes Load bank should be automatically variable to provide minimum of 40% diesel generator load	
ACOUSTIC ENCLOSURE			
Noise level limit – Sound pressure level @ 1m	dB(A)	The noise level limit is required for any position 1m from the perimeter of the enclosure with the diesel generator operating at 100% load	
Manufacturer	-	Supplier to advise	
Height	mm	Supplier to advise	
Width	mm	Supplier to advise	
Length	mm	Supplier to advise	
Materials	-	Supplier to advise	
Thickness	mm	Supplier to advise	
Removable panels	-	Supplier to advise	
Mass of each panel	kg	Supplier to advise	
Method of removal	-	Supplier to advise	
Locks to SWC standards	-	Supplier to advise	
IP rating	IP	Minimum 22	
Design life	Years	Minimum 25 years Supplier to advise	

ALTERNATOR			
Type	-	Supplier to advise	
Number of phases	-	Supplier to advise	
Power factor	-	Supplier to advise	
Insulation class	-	Supplier to advise	
Temperature class	-	Supplier to advise	
Winding pitch	-	Supplier to advise	
Winding type	-	Supplier to advise	
Protection	-	Supplier to advise	
IP rating	IP	Supplier to advise	
Voltage regulation	%	Supplier to advise	
Total harmonics (TGH/THC)	%	Supplier to advise	
Wave form: NEMA = TIF – TGH/THC	%	Supplier to advise	
Wave form: CEI = FHT – TGH/THC	%	Supplier to advise	
Number of bearings	-	Supplier to advise	
Bearing details	-	Supplier to advise	
Bearing lubricant	-	Supplier to advise	
Number of poles	-	Supplier to advise	
Efficiency	%	Supplier to advise	
Short circuit ratio: 50 (kcc)	-	Supplier to advise	
Direct axis synchro reactance unsaturated (Xd)	-	Supplier to advise	
Quadra axis synchro reactance unsaturated (Xq)	-	Supplier to advise	
Open circuit time constant; 50 (T'do)	-	Supplier to advise	
Direct axis transient reactance saturated (X'd)	-	Supplier to advise	
Short circuit transient time constant (T'd)	-	Supplier to advise	
Direct axis sub-transient reactance saturated (X"d)	-	Supplier to advise	
Sub-transient time constant (T"d)	-	Supplier to advise	
Quadra axis sub-transient reactance saturated (X"q)	-	Supplier to advise	
Zero sequence reactance unsaturated (Xo)	-	Supplier to advise	
Negative sequence reactance saturated (X2)	-	Supplier to advise	
Armature time constant (Ta)	-	Supplier to advise	
No load excitation current (io)	-	Supplier to advise	
Full load excitation current (ic)	-	Supplier to advise	
Full load excitation voltage (uc)	-	Supplier to advise	
Recovery time	s	Supplier to advise	
Transient dip	-	Supplier to advise	
No Load losses	-	Supplier to advise	
Heat rejection	-	Supplier to advise	

DIESEL ENGINE - GENERAL			
Rated power	kW	Supplier to advise	
Rated speed	rpm	Supplier to advise	
Rated torque	Nm	Supplier to advise	
Cycles	-	Supplier to advise	
Engine type	-	Supplier to advise	
Rated BMEP	kPa	Supplier to advise	
Minimum speed	rpm	Supplier to advise	
Over speed trip	rpm	Supplier to advise	
Moment of inertia	$kg.m^2$	Supplier to advise	
Turbocharger speed	rpm	Supplier to advise	
No. of cylinders	No.	Supplier to advise	
Bore	-	Supplier to advise	
Stroke	-	Supplier to advise	
Configuration	-	Standard/V Supplier to advise	
Fuel rate at rated load	g/kWh	Supplier to advise	
Fuel rate at 75% load	g/kWh	Supplier to advise	
Fuel rate at 50% load	g/kWh	Supplier to advise	
Cylinder liner type	-	Wet/Dry Supplier to advise	
No. of piston rings	No.	Supplier to advise	
Size of compression	-	Supplier to advise	
Main bearings	-	Size, Type and Material Supplier to advise	
Flywheel bearing	-	Size, Type and Material Supplier to advise	
Thrust bearing	-	Size, Type and Material Supplier to advise	
Connection rod bearing	-	Size, Type and Material Supplier to advise	
Wristpin bearing	-	Size, Type and Material Supplier to advise	
Exhaust valve	-	No., Size, Facing, Seat Supplier to advise	
Inlet valve	-	No., Size, Facing, Seat Supplier to advise	
Exhaust manifold	-	Wet, Dry, Insulated, Shielded, Cooled Supplier to advise	
Exhaust manifold material	-	Supplier to advise	
Vibration dampers	-	Size, Type Supplier to advise	
Torsional calculations	-	Supplier to advise	
Weight (net)	kg	Supplier to advise	
Flywheel weight	kg	Supplier to advise	
Overall dimensions	mm	Supplier to advise	
Exhaust connection	-	No., Size, Rating Supplier to advise	
Air inlet connection	-	No., Size, Rating Supplier to advise	
Starting air connection	-	No., Size, Rating Supplier to advise	
Jacket water inlet	-	No., Size, Rating Supplier to advise	
Jacket water outlet	-	No., Size, Rating Supplier to advise	

Mass of alternator	kg	Supplier to advise	
Oil inlet	-	No., Size, Rating Supplier to advise	
Oil outlet	-	No., Size, Rating Supplier to advise	
Mass of diesel engine	kg	Supplier to advise	
DIESEL ENGINE – COOLING SYSTEMS			
Jacket water pump	-	Yes/No	
Jacket water pump manufacturer	-	Supplier to advise	
Jacket water pump drive	-	Supplier to advise	
Jacket water pump head	m	Supplier to advise	
Jacket water pump speed	rpm	Supplier to advise	
Jacket water pump impeller material	-	Supplier to advise	
Jacket water pump case material	-	Supplier to advise	
Jacket water capacity	L	Supplier to advise	
Jacket water flow	m^3/h	Supplier to advise	
Jacket water pressure	kPa	Supplier to advise	
Jacket water inlet temperature	^OC	Supplier to advise	
Lube oil cooler type	-	Supplier to advise	
Lube oil cooler manufacturer	-	Supplier to advise	
Lube oil cooler duty	kJ/h	Supplier to advise	
Lube oil cooler surface	m^2	Supplier to advise	
Lube oil cooler code		Supplier to advise	
Lube oil cooler shell OD	mm	Supplier to advise	
Lube oil cooler thickness	mm	Supplier to advise	
Lube oil cooler design pressure	kPa	Supplier to advise	
Lube oil cooler tubes O.D.	mm	Supplier to advise	
Lube oil cooler length	mm	Supplier to advise	
Lube oil cooler BWG	-	Supplier to advise	
Lube oil cooler water flow	m^3/h	Supplier to advise	
Lube oil cooler inlet temperature	^OC	Supplier to advise	
Lube oil cooler shell material	-	Supplier to advise	
Lube oil cooler tube material	-	Supplier to advise	
Lube oil cooler channel material	-	Supplier to advise	
Lube oil cooler baffle material	-	Supplier to advise	
Air cooler type	-	Electric Fan/Engine Driven Fan Supplier to advise	
DIESEL ENGINE – LUBRICATION SYSTEM			
Lube oil pump type	-	Integral/Separate Supplier to advise	
Lube oil pump manufacturer	-	Supplier to advise	
Lube oil pump model	-	Supplier to advise	
Lube oil pump drive	-	Supplier to advise	
Lube oil pump capacity	m^3/h	Supplier to advise	
Lube oil pump pressure	kPa	Supplier to advise	

Lube oil pump speed	rpm	Supplier to advise	
Lube Oil Pump impeller/ Gear Material	-	Supplier to advise	
Lube oil pump case material	-	Supplier to advise	
Pre-lube pump type	-	Supplier to advise	
Pre-lube pump drive	-	Supplier to advise	
Pre-lube pump capacity	m^3/h	Supplier to advise	
Pre-lube pump minimum pressure	kPa	Supplier to advise	
Lube oil filter type	-	Supplier to advise	
Lube oil filter aperture	µm	Supplier to advise	
Lube oil filter manufacturer	-	Supplier to advise	
Lube oil filter model	-	Supplier to advise	
Lube oil level controller - lubricator	-	Yes/No Supplier to advise	
Lube oil level controller - crankcase	-	Yes/No Supplier to advise	
Lube oil level controller manufacturer	-	Supplier to advise	
Lube oil level controller model	-	Supplier to advise	
Lube oil dipstick	-	Yes/No Supplier to advise	
Lube oil dipstick – magnetic filter	-	Yes/No Supplier to advise	
Slow flow oil meter	-	Yes/No Supplier to advise	
Slow flow oil meter manufacturer	-	Supplier to advise	
Slow flow oil meter model	-	Supplier to advise	
DIESEL ENGINE – STARTING SYSTEM			
Type	-	Electric	
Make	-	Supplier to advise	
Model	-	Supplier to advise	
No. of starts	-	Supplier to advise	
Voltage	V	Supplier to advise	
Battery capacity	Ah	Supplier to advise	
Mains battery charger	Ah	Supplier to advise	
Diesel generator charger	Ah	Supplier to advise	
Glow plug start	-	Yes/No Supplier to advise	
DIESEL ENGINE – FUEL SYSTEM			
Fuel type	-	Diesel	
Tank capacity	L	Supplier to advise	
Outer skin capacity	L	Min. 110% of tank volume Supplier to aadvised	
Fuel pump type	-	Supplier to advise	
Fuel pump manufacturer	-	Supplier to advise	
Fuel pump model	-	Supplier to advise	
Pump driver	-	Pre-chamber/Direct injection/Fuel pressure regulator Supplier to advise	
Water separator	-	Automatic drain/manual drain	

		Supplier to advise	
DIESEL ENGINE – GOVERNOR			
Type	-	Constant speed/variable speed Supplier to advise	
Make	-	Supplier to advise	
Model	-	Supplier to advise	
Reset By	-	Manual/Pneumatic signal/Electric signal/Other Supplier to advise	
Speed range	rpm	Maximum and minimum Supplier to advise	
Regulation	%	Supplier to advise	
Signal range	-	Supplier to advise	
Tachometer	-	Mechanical/Electrical/Other Supplier to advise	
Tachometer make	-	Supplier to advise	
Tachometer model	-	Supplier to advise	
Pyrometer required	-	Supplier to advise	
Pyrometer make	-	Supplier to advise	
Pyrometer model	-	Supplier to advise	
Engine gauge board instruments	-	Pyrometer/Tachometer/Oil pressure gauge/Oil temperature gauge/Jacket water temperature gauge/Fuel pressure gauge/Air pressure gauge/Hours run meter/Other Supplier to advise	
DIESEL ENGINE – AUXILLARY EQUIPMENT			
Jacket water heater voltage	V	Supplier to advise	
Jacket water heater power	W	Supplier to advise	
Jacket water heater phase	-	Supplier to advise	
Lube oil heater voltage	V	Supplier to advise	
Lube oil heater power	W	Supplier to advise	
Lube oil heater phase	-	Supplier to advise	
Exhaust silencer type	-	Spark arrestor/Standard/Hospital Supplier to advise	
Exhaust silencer manufacturer	-	Supplier to advise	
Exhaust silencer model	-	Supplier to advise	
Exhaust silencer mounting	-	Horizontal/Vertical/Saddle/Trunnions/ Other Supplier to advise	
Air filter type	-	Dry/Oil Bath Supplier to advise	
Air filter manufacturer	-	Supplier to advise	
Air filter model	-	Supplier to advise	
Air filter connection	-	Side/Top/Bottom Supplier to advise	
Air filter max. Allowable differential pressure	mbar	Supplier to advise	
Flywheel bearing type	-	Manual/Air Jack Supplier to advise	
Flywheel guard	-	Yes/No Supplier to advise	

DIESEL ENGINE – ALARM AND SAFETY SHUT DOWN			
Over speed	-	Alarm Set, Shut Down Set Supplier to advise	
Low oil pressure	-	Alarm Set, Shut Down Set Supplier to advise	
High oil pressure	-	Alarm Set, Shut Down Set Supplier to advise	
High jacket water temperature	-	Alarm Set, Shut Down Set Supplier to advise	
High fan vibration	-	Alarm Set, Shut Down Set Supplier to advise	
DIESEL ENGINE – ATMOSPHERIC EMISSIONS			
Content O_2 in combustion	%	Supplier to advise	
Guaranteed level NO_x	g/kWh	Supplier to advise	
Guaranteed level NO_x	ppm	Supplier to advise	
Unburnt hydrocarbons (VOC)	ppm	Supplier to advise	
Guaranteed level CO_2	g/kWh	Supplier to advise	
Guaranteed level CO_2	ppm	Supplier to advise	
DIESEL GENERATOR VIBRATION			
Vibration classification no.	-	Supplier to advise	
Max. vibration severity point	-	Supplier to advise	
Max. vibration power/speed	kW/rpm	Supplier to advise	
Vibration severity grade	-	Supplier to advise	
Measured max. acceleration	m/s2	Supplier to advise	
Measured max. velocity	mm/s	Supplier to advise	
Measured max. displacement	µm	Supplier to advise	
ACCESSORIES			
Base plate			
- Type	-	Fabricated for alternator/engine combination	
- Material	-	Steel Gr (AS3678 Gr 300) or Cast Iron (AS1830 Gr T-250)	
- L x W x H	mm	Supplier to advise	
- Mass of base plate	kg	Supplier to advise	
Anti-vibration mounts	-	Supplier to advise	
Foundation bolts	-	Supplier to advise recommended size, grade and torque loads. Material SS316.	
Close coupled	-	Y/N	
Coupling (long coupled only)			
- Manufacturer	-	Supplier to advise	
- Type	-	Flexible	
- Balancing	-	Final Balancing of Coupling/Engine/Pump by the Supplier	
Torque meter provision	-	Provision for spacer to enable torque meter installation for direct measurements of shaft torque and power absorbed	
Guard	-	Required during maintenance	
Gearbox	-		
Required	-	Y/N	
Rating	-	Supplier to advise	

Ratio	-	Supplier to advise	
Electrical control panel enclosure	-	Stainless Steel (ASTM A279 Gr 316)	
Other accessories supplied with skid		Supplier to advise	
INSTALLATION			
Foundation specifications	-	Supplier to advise	
Mounting details	-	Supplier to advise	
Total mass of diesel generator	kg	Supplier to advise	
EQUIPMENT LABELLING			
Label material	-	Traffolyte	
Lettering	-	engraved, black ink filled	
Information required	-	As per Sydney Water Technical Specifications– Mechanical	
Fixing method	-	Oval head stainless steel screws	
PROTECTIVE COATINGS			
Colour	-	Dulux Ocean Mist 96183250 or RAL9018 All enclosures/Canopies	
Requirements	-	As Per WSA 201, System POW, PUR-A or PUR-B, as applicable	
SPARE PARTS			
Years (recommendation list)	Years	5	
Availability	-	Supplier to advise	
Warehouse location	-	Supplier to advise	
Pricing	-	Supplier to advise	
DOCUMENTATION & CERTIFICATION			
Drawings	-	As per Technical Specification	
Test documentation	-	As per Technical Specification	
Operation and maintenance manuals	-	As per Sydney Water Specification Commissioning – transitioning assets into operation	

INSPECTION & TEST REQUIREMENTS			
Inspection and Test Plan	-	Required	
Pre-Factory acceptance tests	-	Required	
Factory Acceptance Test	-	Required (witnessed)	
Pre-Site Acceptance Test	-	NA	
Site Acceptance Test	-	NA	

FACTORY ACCEPTANCE TESTING

1) General construction checks against the Technical Specification
2) Electrical wiring checks against the Specifications
3) Operation of unit under load conditions
4) Diesel generator noise level testing
5) Diesel generator vibration testing
6) All other tests as per the Technical Specification
7)
8)

The diesel generator must not be shipped to site until all defects noted at the FAT have been rectified and accepted by Sydney Water.

SPECIFIC REQUIREMENTS

Tenderers must include the following information with their offers:

- Technical brochures
- Control system details
- Dimensional drawings showing the overall dimensions of the packaged unit including load bank
- Installation details including masses and dynamic loads for design of concrete plinth.
- Diesel engine details
- Diesel generator details
- A statement regarding the availability of spare parts

NOISE DATA SHEET

Measured sound pressure levels	Octave band frequency Hz								8 position average
	65	125	250	500	1000	2000	4000	8000	
With acoustic enclosure fitted									
Air intake into enclosure									
Air exhaust from enclosure									

- Tests performed on rated load with radiator fitted.
- Tests conducted as per AS/NZS 1269 or approved equivalent.
- Reference sound pressure is 20µPa.
- Sound measurement locations is to be 1m from the centre of the diesel generator unit.

Measured sound power levels	Octave band frequency Hz								Sound power level
	65	125	250	500	1000	2000	4000	8000	
With acoustic enclosure fitted									
Air intake into enclosure									
Air exhaust from enclosure									

- Tests performed on rated load with radiator fitted.
- Tests conducted as per AS/NZS 1269 or approved equivalent.
- Reference sound power is 1pW.

Date:					
Revision:					

Prepared by:					
Mechanical verified by:					
Electrical verified by:					
Process verified by:					
Approved by:					