TOM GENERATORS

A PERFECT GENERATOR

OPERATING & MAINTENANCE MANUAL

Diesel generator sets, alternators and light towers. Read this manual in full before installing, operating or servicing the equipment.

Built, tested and shipped from Belfast, United Kingdom

Edition 2026

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1. FOREWORD

WARNING

Important safety notice

Most accidents involving the operation, maintenance and repair of the product are caused by failure to observe basic safety rules or precautions. Accidents can often be avoided if a potentially hazardous situation is recognised before the accident occurs. A person must be alert to potential hazards. That person must also have the necessary training, skills and tools to carry out these functions.

Improper operation, maintenance or repair of this product can be dangerous and may result in injury or death.

Do not operate this product, and do not carry out any operation or maintenance on it, until you have read and understood the operating and maintenance information.

Safety precautions and warnings are given in this manual and on the product. If these hazard warnings are not observed, injury or death to yourself or to others may result.

Tom Generators cannot anticipate every possible circumstance that may give rise to a potential hazard. The warnings in this publication and on the product are therefore not exhaustive.

The information, specifications and illustrations in this publication are based on the information that was available at the time of writing. The information presented may be changed at any time without notice. Obtain complete and fully up-to-date information before starting work.

NOTE

If replacement parts are required, it is recommended that original spare parts are used.

This handbook is intended for customers of Tom Generators. It contains safety precautions, product information, installation and operating instructions, and preventive maintenance recommendations for Tom Generators generator sets.

This handbook also contains instructions covering the various control modules — their features and technical characteristics. It describes in detail the operating stages of the generator set in manual and in automatic mode. Tables and diagrams describing the generator set are also provided.

Every generator set carries a model and serial number, shown on a label. This label is located on the control panel. This data is required in order to identify the rating of the generator set, to assist in ordering spare parts, and to support warranty claims (see the Warranty Conditions chapter).

WARNING

Never operate, service or repair your generator set without observing the general safety precautions.

It is essential that the contents of this book are read and understood before proceeding with the installation or use of the generator set.

If you are in doubt, do not proceed: stop and consult your supplier before continuing.

2. SAFETY PRECAUTIONS

The general precautions set out below must be observed during the operation, handling and servicing of the generator set.

WARNING

Exhaust gases are dangerous to personnel. The exhaust of every indoor generator set must be discharged to the outside through sealed pipework.

WARNING

Make certain that flammable liquids are never stored close to the generator set.

WARNING

The day fuel tank contains fuel. Naked flames and smoking in the vicinity must be strictly avoided.

Hot surface hazard.

WARNING

There are hot areas around the exhaust pipe and the radiator cap. Do not touch these surfaces until the generator set has cooled down.

Rotating parts — entanglement hazard.

WARNING

Keep hands, long hair and jewellery away from pulleys, belts and other moving parts.

WARNING

Do not attempt to operate the generator set with the protective guarding removed.

Danger of electric shock.

WARNING

Danger of electric shock. Only trained and qualified electricians may connect the generator set to the load.

WARNING

Stop the engine before carrying out preventive maintenance. Do not carry out any modification or repair work while the engine is running.

The generator set must be effectively earthed.

WARNING

Make certain that the generator set — including a mobile generator set — is effectively earthed.

Do not lift by the top hooks.

WARNING

Do not lift: do not lift the canopy or the generator set by the top hooks, where these are fitted.

Protective gloves must be worn.

WARNING

Wear protective gloves when:

1. handling inhibitors;
2. handling antifreeze;
3. removing the pressure cap from the cooling system;
4. changing oil or filters.

WARNING

Prolonged exposure to generator sets that are not fitted with acoustic canopies is dangerous to hearing. Wear hearing protection when working near the generator set.

3. PRODUCT INFORMATION

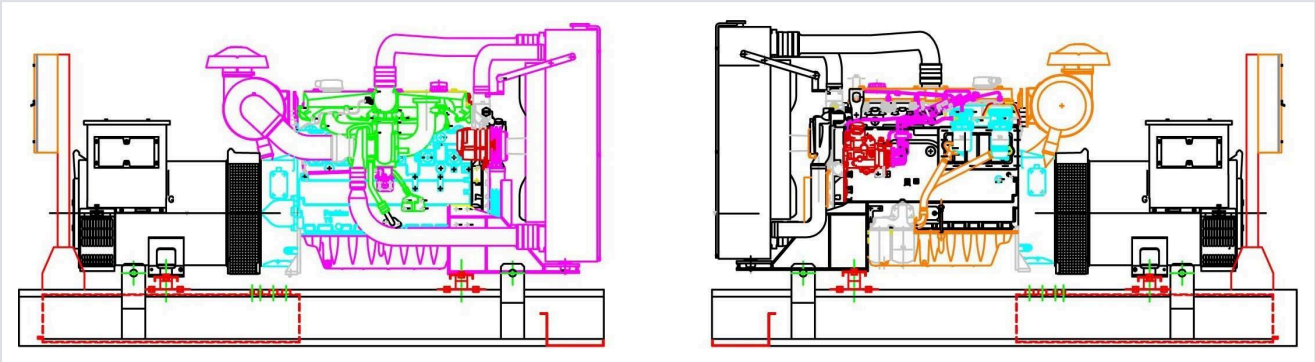


FIG. 2 — Generator set: right side and left side views.

1. Steel base frame
2. Anti-vibration mounts
3. Radiator with fan and protective guarding
4. Starter motor
5. Charging alternator
6. Battery mounted on a rack and connected by cable
7. Oil drain valve with extended flexible drain pipe
8. Fuel filters
9. Control panel
10. Mechanical governor, electronic governor or ECM (where fitted)
11. Spin-on type oil filters
12. Standard type air filter
13. Integral fuel tank

Generating set

The generator set is designed to deliver full performance and reliability. FIG. 2 shows the generator set from the left and from the right. This chapter briefly describes the features of the generator sets. Each generator set does, however, differ somewhat in size and configuration.

Diesel engine

A powerful industrial-type engine, known for its high reliability and quality. The engine is a 4-stroke, compression-ignition diesel. It may be either direct injection (DI) or indirect injection (IDI).

Cooling system

The engine cooling system is water-based. The water cooling system consists of a tropical radiator, a pusher fan with protective guarding, and a thermostat.

Engine electrical system

The engine electrical system comprises the starter motor, the battery and battery rack, the AC charging alternator and the starter solenoid. A later chapter of this manual gives a detailed explanation of the engine electrical system and the control system.

Vibration isolation

Vibration isolators are fitted between the generator set and the base frame in order to reduce vibration and improve performance.

Engine management system

The electronic engine control functions differ according to the engine range. The functions include speed governing, air/fuel ratio control, starting sequence control, and engine protection and diagnostics.

AC alternator

A drip-proof, self-excited, self-regulating AC alternator. The alternator output depends on the range of the generator set.

Control panel

The electrical control panel is mounted on the base frame of the generator set. It allows the generator set to be operated and protected. The panel design incorporates various types of controller with different operating modes and different warning and shutdown signals. Tom Generators uses Deep Sea Electronics and Smart-type controllers.

Fuel tank and base frame

Small and medium range generator sets are mounted on a steel base frame with an integral day fuel tank providing storage for eight continuous hours of running. Large range sets (from 750 kVA upwards) are not supplied with integral fuel tanks.

Battery and starter motor

Generator sets are equipped either with sealed maintenance-free batteries or with wet lead-acid batteries, mounted on a rack and connected by cable.

Silencer and exhaust system

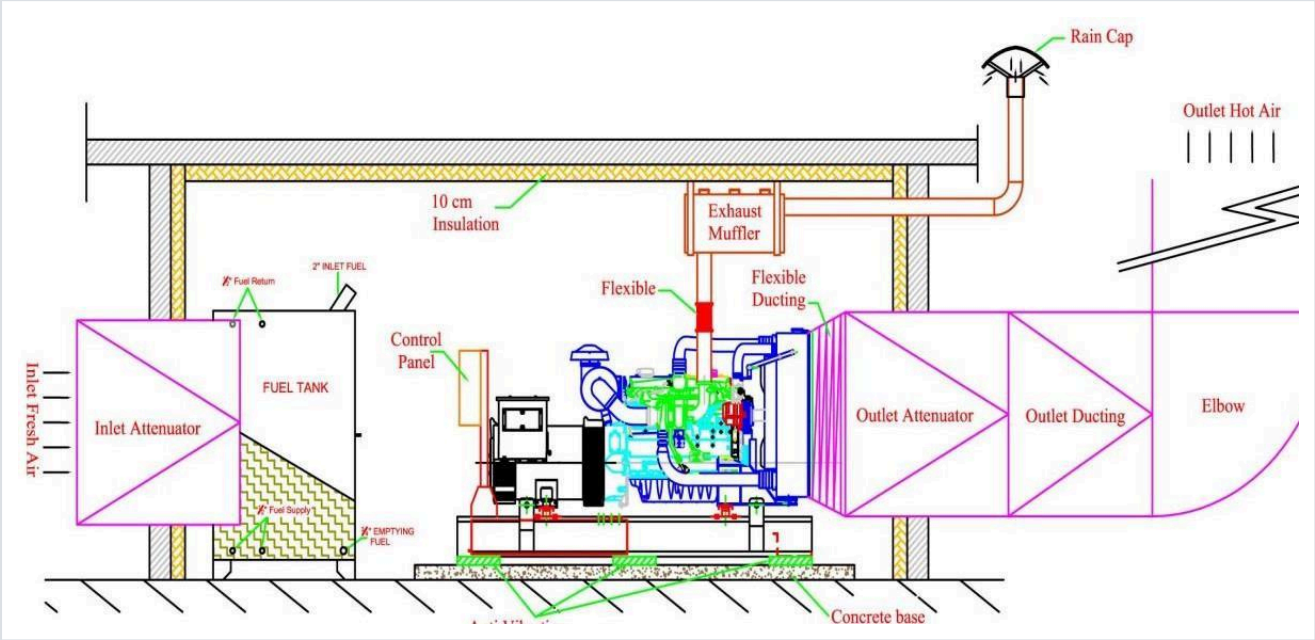
Generator sets are supplied with loose silencers for installation. The function of the exhaust system is to reduce noise and to direct the gases produced to a safe point of discharge.

Output circuit breaker

An output circuit breaker box is supplied with every generator set. The output circuit breaker provides short-circuit and overload protection.

4. INSTALLATION, TRANSPORT AND STORAGE

The ideal installation of a generator set is shown in the following diagram.



Ideal generator set installation.

4.1 Site preparation

- The location of the generator set is of decisive importance. The site must be able to carry the weight of the generator set plus that of the concrete block on which the generator set is supported. If the load-bearing strength of the site is in any doubt, advice must be obtained from a structural engineer.

4.2 Foundation and vibration isolation

- In some applications, where the level of vibration transmitted to the building is highly critical, it may be necessary to install the generator set on a vibration-isolating base. In this case additional considerations apply: the foundations must be of reinforced concrete with a high compressive strength.
- The best base for a generator set is a reinforced concrete base. It provides rigid support to prevent deflection and vibration.
- The foundation must carry the weight of the generator set and withstand any loads and vibration arising during operation of the generator set.
- The foundation must be rigid and stable, so that no distortion occurs that would affect the alignment between the engine and the alternator.

- The depth of the foundation must be between 150 and 250 mm. The depth is calculated using the following rule:

$$F = \frac{W}{D * B * L}$$

Foundation depth calculation.

- F — depth of the foundation, in m
- W — dry weight of the generator set, in kg
- D — density of the concrete base, in kg/m^3. Use D = 2403.8 kg/m^3 if not known
- B — width of the foundation, in m
- L — length of the foundation, in m

- The outer dimensions of the foundation must exceed the dimensions of the generator set by a minimum of 300 mm on all sides.
- In addition, various types of vibration isolator may be placed between the base frame and the concrete base. These include:
  - **Pad isolators:** consisting of layers of flexible materials, intended to attenuate the level of vibration in non-critical applications.
  - **Spring isolators:** consisting of a rubber pad mounted on a support spring, located inside the isolator housing and fixed to the base frame. These can damp up to 98% of the vibration energy produced by the generator set.

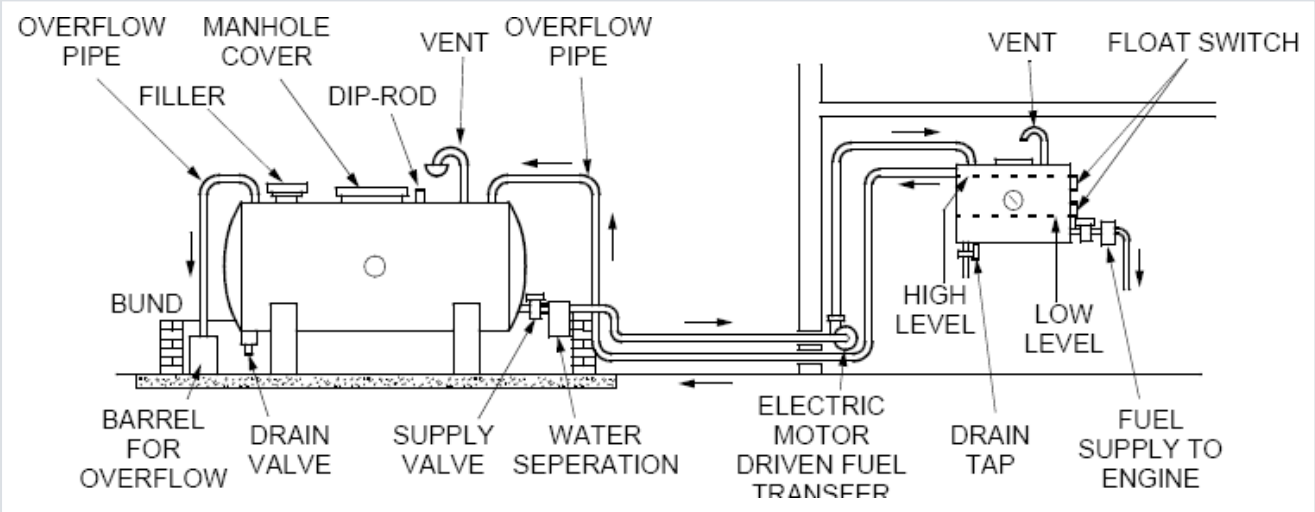
4.3 Induction and exhaust systems

- The design of the exhaust system is of primary importance to the installation of the generator set. The purpose of the exhaust system is to discharge the exhaust gases safely outside the building and to disperse the exhaust gases and noise away from the building.
- Operation of the generator set without air filters is prohibited.
- Flexible connections are required in order to isolate engine vibration and noise from the ducting system.
- The exhaust pipes must be fixed to the roof in order to minimise the weight loading acting on the generator set. Bends and ducting must be correctly selected in order to minimise restriction of the inlet air.
- To prevent rain entering the exhaust system, a rain cap or a drain trap may be required in the case of a vertical exhaust system.

- The positions of the exhaust pipe and of the air supply ducts must be studied carefully in order to prevent recirculation of hot air.
- The discharged gases must be directed in such a way as to prevent them entering the radiator.
- To minimise exhaust system back pressure, bends and ducts must be correctly sized. To minimise back pressure, the radius of a bend must be 1.5 times the radius of the pipe.
- Exhaust back pressure must not exceed the permissible back pressure specified by the engine manufacturer.

4.4 Fuel system

- The fuel system consists of the engine fuel system, the generator set fuel tank and the connecting fuel lines. To optimise the performance of the system, a number of recommendations for the fuel lines and for the bulk storage fuel tank must be observed.
- The fuel tank and the fuel lines must be ready before the generator set is installed.
- The system must be designed so as to ensure a continuous and clean supply of fuel.
- The fuel inlet temperature must not exceed 55°C during operation; for this reason the fuel tank must be designed so as to promote the radiation of heat, and its capacity must be large enough to absorb the heat of the returning fuel without raising the fuel temperature.
- The ideal arrangement of the fuel system would be as follows.



Fuel system arrangement.

GENERATOR OUTPUT RANGE (KVA)	MINIMUM FUEL TANK CAPACITY (L)	FUEL INLET PIPE DIAMETER	RETURN PIPE DIAMETER*
9 to 150	1000 l	1/2 inch*	1/2 inch*
135 to 250	2000 l		
300	4000 l		
350 to 650	4000 l	3/4 inch*	3/4 inch*
725 & 800	5000 l	1 inch*	1 inch*
1000	8000 l		
1250 & 1500	14000 l		
2000	18000 l		

* Valid if the effective length of the pipework does not exceed 15 metres.

> **NOTE**
>
> Where no pipe diameter is shown, no value is stated for that output range in the source table. Confirm the required pipe size with your supplier before installation.

- It is recommended that the fuel tank is manufactured from steel (with a suitable coating) or from aluminium.
- Galvanised steel and zinc-bearing alloys must NOT be used.
- A fuel level indicator and a low fuel level switch are recommended, for connection to the generator set protection panel. The indicator and the switch must be enclosed and secured.
- The tank must have a vent at the top and a drain at the bottom.
- A fuel cooler in the return line is recommended at 300 kVA and above.
- A fuel heater is recommended if the ambient temperature is close to the cloud point of the fuel. This value should be determined by the fuel supplier, but it may be taken as approximately 5°C.
- The fuel tank must be as close as possible to the generator set. Less than 15 m is recommended.
- The fuel inlet line to the engine must be taken from 5 cm above the bottom of the tank, through a shut-off valve.
- The fuel return line must enter the top of the tank, with no shut-off valves.
- Black cast iron pipe, seamless steel pipe or copper pipe is recommended. Galvanised steel and zinc-bearing alloys must NOT be used.
- The highest fuel level must not exceed 1.5 m above the level of the injectors. This applies to all engines. Some engines may, however, permit higher values; refer to the relevant installation

manual, or consult your supplier.

- The lowest fuel level in the tank must not be more than 80 cm below the level of the injectors. This applies to all engines. Some engines may, however, permit higher values; refer to the relevant installation manual, or consult your supplier.
- For applications where the engine starting time must comply with particular standards, or where the generator set must be available very quickly, as in parallel-operation applications, it is preferable for the lowest fuel tank level to be above the level of the engine pump/injectors.
- If the tank is more than 15 m away, larger diameter pipework must be used, or a separate small day tank may be installed.
- The return line must always be routed to the main tank: the tank integrated in the base frame may only be used to run the engine for a limited time, for example for engine testing. From 300 kVA upwards, no return line should be routed to this tank.

4.5 Cooling and ventilation system

- When a generator set with an integral radiator is installed in a plant room, the basic principle is to extract hot air from the room and to draw in air at ambient temperature from outside the plant room, with minimum recirculation.
- The aim is to admit cool air at the lowest possible point, force it through the radiator matrix, and then discharge it from the building.
- The discharge opening in the wall must have a FREE FLOW AREA approximately 25% greater than the frontal area of the radiator matrix, and must be of the same rectangular shape.
- Sheet metal or plastic ducting is fixed to the frame of the opening by means of a flexible connection to the flange of the radiator duct. The flexible section is particularly necessary where the set is mounted on a floating concrete block or on anti-vibration mounts, so that vibration is not transmitted from the generator set to the wall.
- The air inlet opening must likewise have a FREE FLOW AREA at least 25% greater than the radiator matrix.
- Inlet and outlet openings are normally fitted with mesh grilles, louvres, acoustic panels or internal and external ducting. Anything fitted will add resistance to the airflow, and it may be necessary to increase the area of the opening still further.
- As shown in FIG. 5, cool inlet air is drawn in across the AC alternator, which takes its own cooling air from this flow, and then through the engine air intake filter and the engine. The radiator fan then forces the air out through the radiator matrix to the outside. There must be no obstruction to the airflow — baffles and similar — immediately in front of the radiator discharge opening.

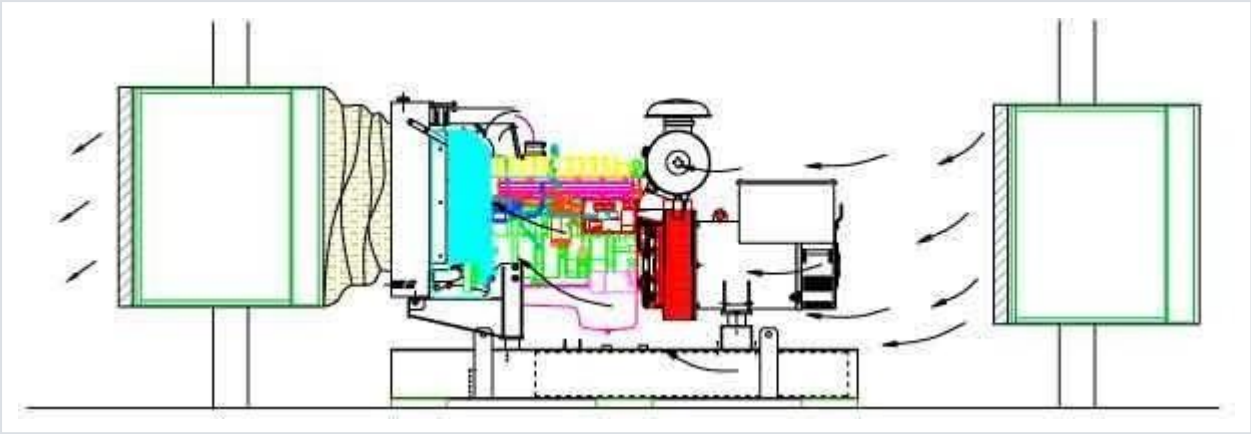


FIG. 5 — Airflow through the plant room.

- This is one possible ventilation system, but in practice the best is not always achievable. FIG. 7 shows an air intake positioned high in the wall. This is acceptable if ducting directs the air to the alternator end, and it has the advantage of preventing heated air collecting at ceiling level.
- FIG. 6 shows an air inlet opening positioned high in the wall and at right angles to the fan airflow. This is incorrect and should not be considered. With this arrangement, the cooling air will bypass the AC alternator and the engine air intake filter, resulting in increased operating temperatures unless the load is reduced.

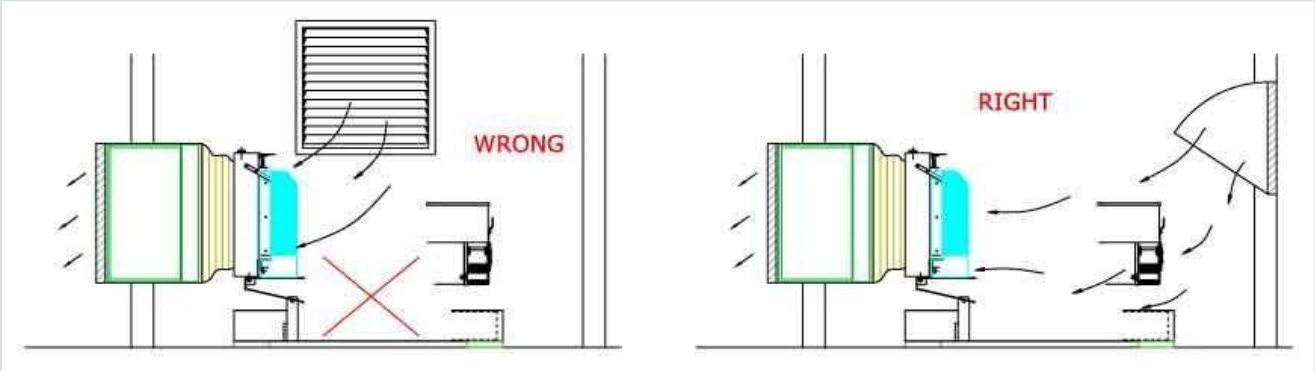


FIG. 6 (wrong) and FIG. 7 (right) — air inlet arrangements.

4.6 Transport

- Generator sets and canopies must be lifted using suitable lifting equipment and the correct lifting procedure (FIG. 8 and FIG. 9). Generator sets and canopies must be lifted from below upwards, taking account of the even distribution of weight across the four lifting points.

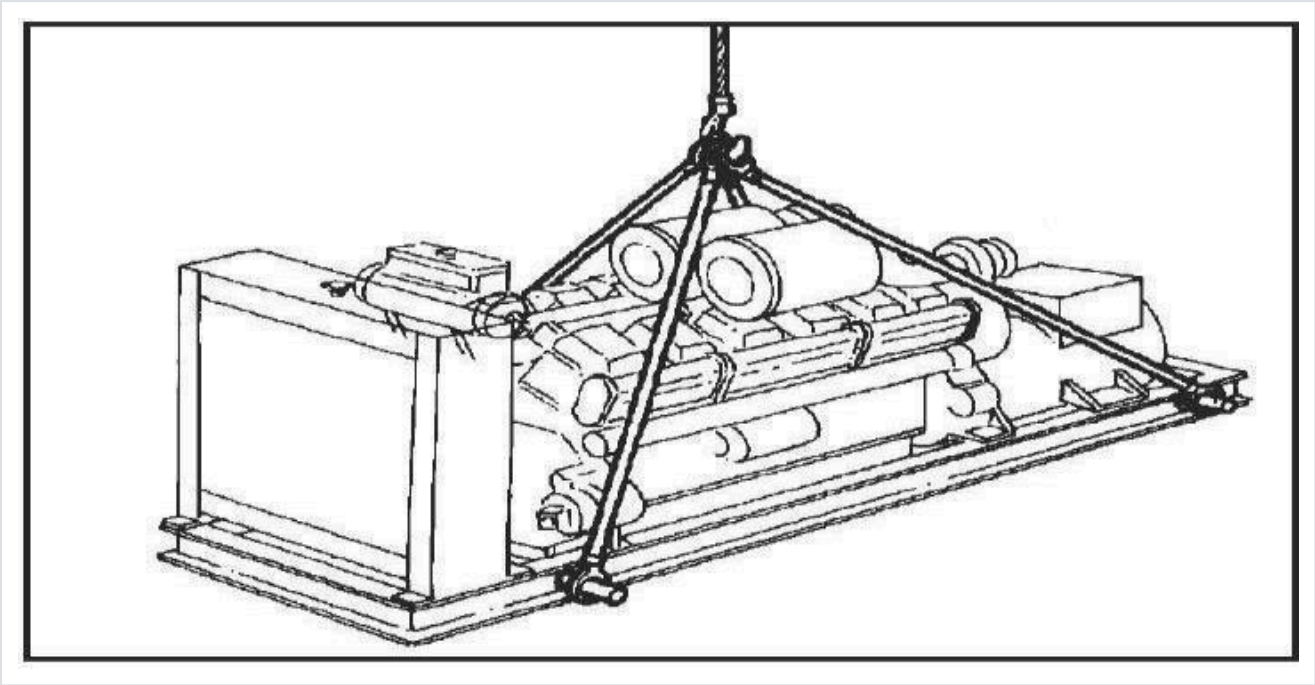


FIG. 8 — Lifting an open generator set.

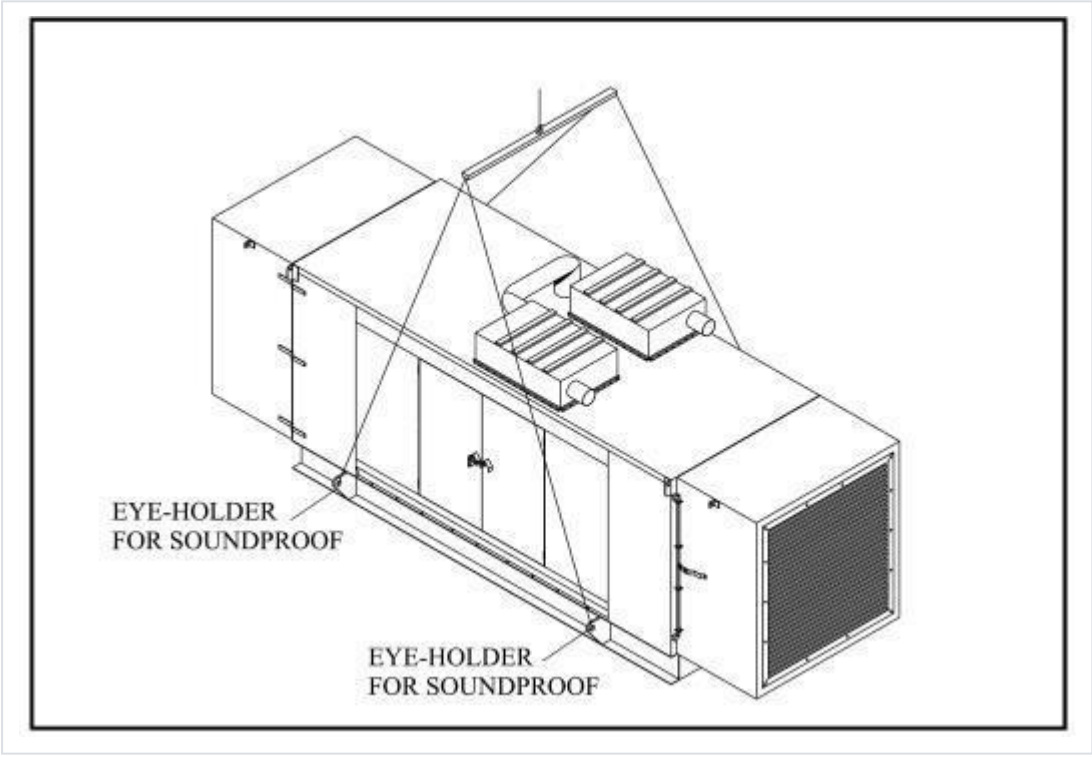


FIG. 9 — Lifting a canopied generator set by the eye-holders provided.

4.7 Storage

- In general, the generator set must be kept clean and must not be exposed to extreme variations of temperature and humidity (failure to observe this may invalidate the warranty). After each six-month period of storage, the following precautions must be taken:
  - The battery cables are disconnected. The battery must be charged before it is refitted.

    - The water and the oil are drained from the engine.
    - The fuel inlet is closed.
    - Check all drive belts carefully, paying particular attention to the point at which the straight run of the belt begins to bend around the pulley. Check the vee groove of the pulley for corrosion.

- Remove the rocker cover and check the valve covers, rocker shaft and similar components for signs of corrosion. Spray with preservative oil (see below) before refitting the cover.
- Turn the crankshaft by hand in order to circulate the deposit over the cylinder bore surfaces. If a belt-driven water pump is fitted, turn it by hand to make certain that the seal is free.
- Check that the preservation of all external surfaces is sound and complete, paying particular attention to the crankshaft lip seal surfaces; re-apply preservative where necessary.
- Make certain that all protective covers over open apertures (air intakes, exhaust manifolds and similar) are securely fitted.

5. OPERATION

5.1 Starting the generator set: general precautions

General precautions must be taken before the generator set is started. The steps described below must be carried out with regard to the safety precautions described earlier in this manual. Specifications for lubricating oil, fuel and coolant are given in the preventive maintenance chapter later in this manual.

Before starting the generator set it is necessary to:

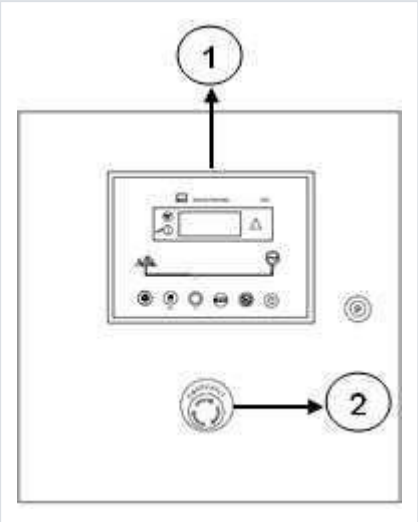
- Inspect the generator set visually for damage, leaks, loose components and cracks.
- Check the fuel level in the day tank and top up as required.
- Check the oil level on the dipstick and top up as required.
- Check the coolant in the radiator.
- Connect the battery cables: connect the battery cables observing correct polarity.
- Circuit breaker OFF: check that the circuit breaker outlet is in the OFF position.
- Emergency stop button: make certain that the emergency stop button (where fitted) is not pressed in.

> **WARNING**
>
> **WARNING.** Opening the radiator cap while the engine is hot can expose you to serious danger.

> **WARNING**
>
> **WARNING.** Engine exhaust gases contain products of combustion that can be harmful to your health. Always start and operate the generator set in a well-ventilated area.

5.2 GMP260 (DSE6010/20 MK II)

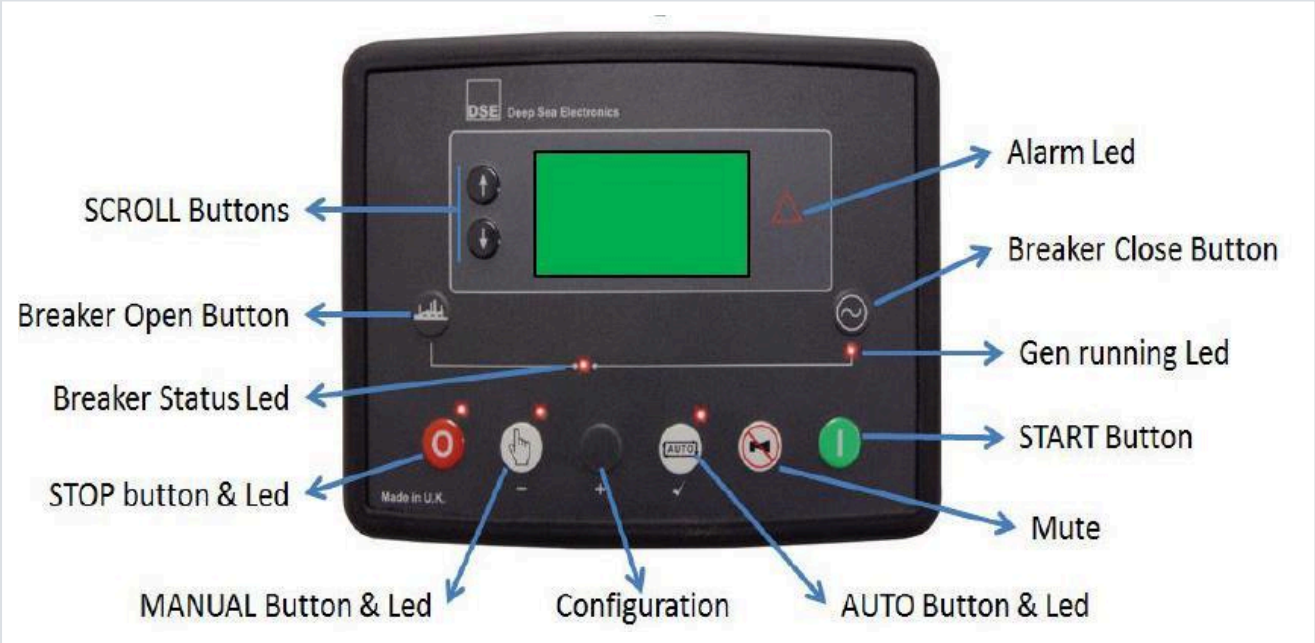
Panel description



GMP260 control panel layout.

1. **DSE 6010 MKII controller:** see the section below for a fuller explanation of the features and functions of the controller.
2. **Emergency stop:** initiates a controlled shutdown of the generator and prevents the generator being restarted until the button has been released.

Controller description



DSE 6010 MKII controller — controls and indicators.

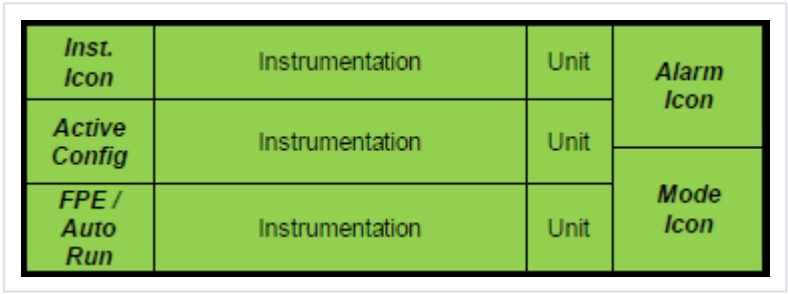
The DSE6010 MKII series module has been designed to allow the operator to start and stop the engine/generator and, where required, to transfer the load. The user also has the facility to view the operating parameters of the system on the LCD display.

The DSE6010 MKII module monitors the engine, indicating the operating state and fault conditions, automatically shutting down the engine and identifying the true first-up engine fault condition. The LCD display indicates the fault.

The powerful microprocessor contained in the module allows a range of advanced features to be included:

1. Icon-based LCD display.
2. True RMS voltage monitoring with 3-phase generator sensing, in addition to power and energy monitoring.
3. Engine parameter monitoring, including engine ECU interface and magnetic pick-up interface where configured.
4. Fully configurable inputs for use as alarms or for a range of different functions.
5. All parameters adjustable from the front panel.

Controller indications and warnings



Display section layout.

Mode icons

NO.	ICON	DESCRIPTION
1	Stop	The engine is not running and the set is in stop mode.
2	Auto	The engine is not running and the set is in automatic mode.
3	Manual	The engine is not running and the set is in manual mode.
4	Timer animation	A timer is active, for example crank time, crank rest and similar.
5	Running animation	The engine is running and all timers, on or off, have expired. During standby operation the animation speed is reduced.
6	Front panel editor	The unit is in the front panel editor.
7	USB	A USB connection to the controller is in place.
8	Corruption	The configuration file or the engine file is corrupted.

Configuration icons

NO.	ICON	DESCRIPTION
1	Main	The main configuration is selected.
2	Alternative	The alternative configuration is selected.

Instrument icons

NO.	ICON	DESCRIPTION
1	Home page	Default home page, showing generator voltage and mains voltage (DSE6620 only).
2	Generator	Used for generator voltage and generator frequency.
3	Mains	Used for mains voltage and frequency.
4	Generator power	Load power instrumentation screen.
5	Engine speed	Engine speed instrumentation screen.
6	Running hours	Running hours instrumentation screen.
7	Battery voltage	Battery voltage instrumentation screen.
8	Engine temperature	Coolant temperature instrumentation screen.
9	Oil pressure	Oil pressure instrumentation screen.
10	Flexible sensor	Flexible sensor screen.
11	Event log	Appears when the event log is displayed.
12	Unit time	Current time held in the unit.
13	Scheduler settings	Current scheduler run time and duration values.
14	CAN DTC	ECU diagnostic trouble codes.
15	Oil filter	Oil filter maintenance timers.
16	Air filter	Air filter maintenance timers.
17	Fuel filter	Fuel filter maintenance timers.

Warnings (W) and shutdowns (S)

NO.	ALARM	DESCRIPTION
1	Fail to stop (W)	The engine is running when it has been instructed to STOP.
2	Fail to start (S)	The engine has failed to start after the set number of start attempts.
3	High coolant temperature (S) / sensor open circuit	The engine coolant temperature has exceeded the engine high temperature shutdown setting / the sensor is open circuit. Active after the Safety On timer has expired.
4	Low oil pressure (S) / sensor open circuit	The engine oil pressure has fallen below the low oil pressure setting after the Safety On timer has expired / the sensor is open circuit.
5	Low/high fuel level (W/S)	The fuel level is below/above the set value.
6	MPU signal lost / open circuit	The speed signal from the magnetic pick-up has been lost / is not connected.
7	Filter change alarm	Maintenance required. Alarm to change the oil filter / fuel filter / air filter.
8	High/low battery voltage (W/S)	The DC supply voltage has risen above or fallen below the set level.
9	CAN ECU alarm / CAN wiring open circuit	The engine ECU has detected a shutdown signal and has communicated this condition to the DSE module. The exact fault is also shown on the module display.
10	Overspeed / underspeed (W/S)	The engine speed has risen above or fallen below the pre-set trip level.
11	Inputs (digital/analogue) (W/S)	Auxiliary digital/analogue inputs can be configured by the user as digital inputs and will show the corresponding icon.
12	Over/under voltage (W/S)	The generator output voltage has risen above or fallen below the set level.
13	High/low frequency (W/S)	The generator output frequency has risen above or fallen below the set level.
14	kW overload (W/S)	The generator power in kW has exceeded the set level.
15	Overcurrent delay (W/S)	The generator output current has exceeded the set level.
16	Flexible sensor (S)	The flexible sensor shutdown alarm has operated.
17	Emergency stop (S)	The emergency stop button has been pressed. This is a fail-safe input which will stop the set immediately if the signal is removed.

W: warning; S: shutdown; W/S: warning and shutdown.

Starting the GMP 260 (DSE6010) — manual mode of operation

1. Check the safety precautions before starting the generator set.
2. Check that the main circuit breaker is switched off.
3. To start the generator set manually, press the manual mode button.
4. To begin the starting procedure, press the start button.
5. The button must be held pressed until the engine starts.
7. The generator set must be sufficiently warmed up before the main circuit breaker is closed.
8. The generator set can be stopped by opening the main circuit breaker, waiting a few minutes for the engine to cool, and then pressing the stop button.

> **NOTE**
>
> The step numbering above follows the source document, in which step 6 is not printed.

Automatic mode

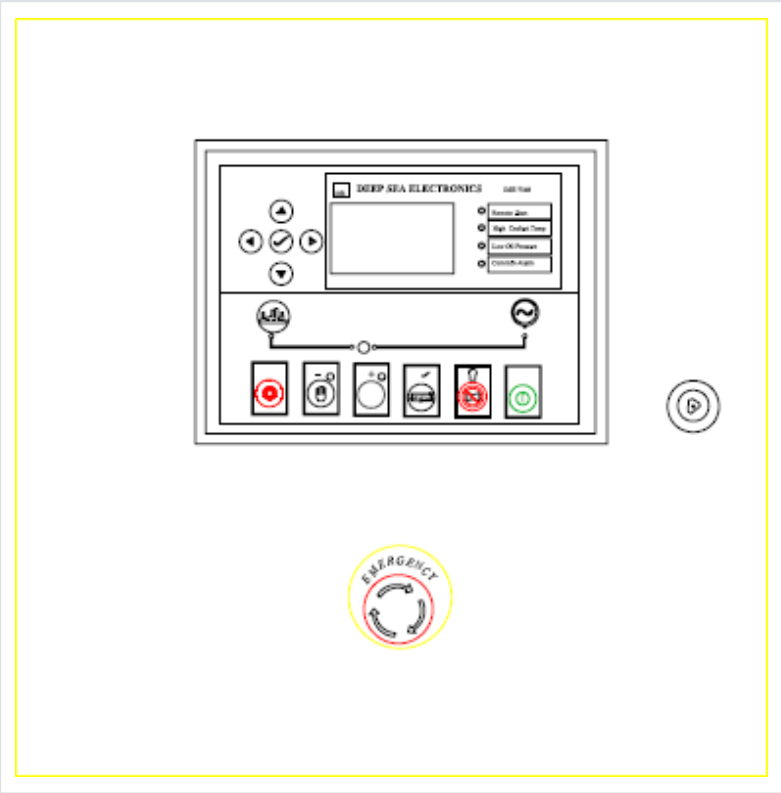
1. Check the safety precautions before starting the generator set.
2. Make certain that the main circuit breaker is switched on.
3. For automatic operation of the generator set, press the AUTO button.
4. This icon is displayed to indicate automatic mode.
5. If there are no alarms, the controller will be ready to start when it receives a start signal.
6. When the remote start signal is received, within seconds the controller initiates the response and pre-heat delays, and then the starting procedure.
7. If the generator set fails to start, this icon is displayed.

Stop / reset

1. If any alarm is initiated, the operator must investigate the case and press "STOP".
2. Selecting "Stop" results in a complete shutdown.

5.3 GMP203 (DSE7310/20)

Panel description



GMP203 control panel layout.

The control panel carries the following instruments:

1. **DSE7310 controller:** see the section below for a fuller explanation of the features and functions of the controller.
2. **Emergency stop:** the emergency stop function is designed to initiate a controlled shutdown of the generator and to prevent any attempt to restart the generator until the emergency stop is reset. It is a protective device that removes the positive DC supply from the fuel solenoid and the starter solenoid.

Controller description

DSE 7310 controller — navigation pane, configurable LEDs and the START, AUTO, MANUAL and STOP controls.

This controller monitors the engine, indicating the operating state and fault conditions. It has:

1. Real-time clock
2. Text LCD display
3. Configurable display language
4. USB connection
5. Voltage/current and power monitoring
6. Engine parameter monitoring
7. Configurable digital inputs (8) and outputs (6)
8. Event log (50) with dates and times
9. SMS messaging
10. Magnetic pick-up
11. Automatic load transfer
12. Unbalanced load protection
13. kW overload protection
14. Fully configurable using PC software
15. Enhanced engine communication with CANbus support

Engine protection

1. **Low oil pressure:** the module detects that the engine oil pressure has fallen below the oil pressure setting level. A shutdown will accordingly occur. The controller LCD screen displays the message: *Alarm — WARNING — Low oil pressure*.
2. **High coolant temperature:** the module detects that the engine coolant temperature has risen above the engine high temperature shutdown setting level. A shutdown will accordingly occur. The following message appears on the controller LCD screen: *Alarm — WARNING — High coolant temperature*.
3. **Over/underspeed:** the engine speed exceeds or falls below the pre-set speed; a shutdown will occur. The controller displays: *Alarm — WARNING — Overspeed*.
4. **DC charging alternator:** if the module does not detect a voltage from the warning lamp terminal on the charging alternator, a warning is displayed.
5. **High/low battery voltage:** if the module detects a high/low battery voltage, a warning is initiated.
6. **Low fuel level:** where a fuel level sensor is fitted, the module can measure the level of fuel present in the day tank. The module displays the measurement between the top of the tank and the fuel level (as a percentage). Example: the fuel level sensor will report that the tank is 50% full. If the fuel level falls below the set level, a warning is initiated. The controller displays: *Alarm — WARNING — Low fuel level*.

Generator protection

1. High current, warning/shutdown.
2. **Frequency:** if the module detects that the generator output frequency exceeds the pre-set pre-alarm, a warning is initiated. The controller displays: *Alarm — WARNING — Over frequency*.
3. **Over/under voltage:** if the module detects that the generator output voltage rises above or falls below the pre-set trip, a shutdown is initiated. Over/under voltage is not delayed; an immediate shutdown is initiated. The controller displays: *Alarm — WARNING — Overvoltage*.

Indications

INDICATION	DISPLAY
Engine speed (rpm)	Displayed in Hz/rpm.
Generator set alternating current (L1, L2 and L3) (A)	Generator Amps — L1 50A, L2 52A, L3 50A
Generator set voltage	Phase to phase or phase to neutral: L1-N, L2-N, L3-N, L1-L2, L1-L3, L2-L3.
Oil pressure (in kPa, bar and psi)	Engine oil pressure is measured in three units of measurement (kPa, bar and psi): 6.2 Bar / 90 Psi / 620 KPa
Engine coolant temperature	Displays the coolant temperature in degrees Fahrenheit and Celsius.
Fuel level (%)	
Running hours	
DC battery voltage	
Energy meters	

The following are available via the CANbus datalink (electronic engines):

- Engine oil temperature
- Inlet manifold temperature
- Coolant pressure
- Fuel pressure
- Fuel consumption
- Total fuel used
- Turbo pressure

Starting the GMP 203 (DSE7310/20) — manual mode of operation

1. Check the general safety precautions before starting the generator set.
2. To begin the starting sequence in manual mode, press the manual button.
3. With the controller in manual mode, press the start button.
4. If the pre-heat output option is selected, this timer starts and the selected auxiliary output is energised.
5. The engine cranks for the set time.
6. If the engine does not start, a fail-to-start alarm is raised.
7. After the starter is disengaged, the safety timer is started, allowing the engine to stabilise.

8. Once the engine is running, the warm-up timer starts, allowing the engine to warm up before it can be loaded.
9. The generator will run off load unless a remote start on load signal is applied.
10. The generator will continue to run on load until automatic mode is selected.
11. If automatic mode is selected and the remote start on load signal is not active, the load is disconnected.

Automatic mode

1. Check the general safety precautions before starting the generator set.
2. To begin the starting sequence in automatic mode, press the auto button.
3. If a remote start input is applied to the remote start input, the starting sequence is initiated.
4. The pre-heat function is started, and the starting procedure then begins.
5. The fuel solenoid is energised. The starter is then engaged.
6. The engine cranks for the set time.
7. If the engine does not start during this start attempt, the starter is disengaged and the "Fail to start" fault message appears on the display.
8. If an auxiliary output is selected for load transfer, it will be energised.

Stop / reset

1. If any alarm is initiated, the operator must investigate the case and press "STOP".
2. Selecting "Stop" results in a complete shutdown.

5.4 Control system upgrades

A large number of options can be fitted in order to adapt the control system to a particular installation. The following is a comprehensive list of the options that may be found on the controller you are using.

Protection options

1. Emergency stop
2. High exhaust temperature
3. Low coolant temperature
4. Unbalanced load
5. Overload (kW) protection relay
6. Overspeed/underspeed shutdown
7. Fan belt breakage
8. Low fuel level
9. Low coolant level

10. High/low battery voltage
11. Loss of field (excitation)
12. Reverse active power
13. Earth leakage
14. High alternator winding temperature
15. Negative sequence current
16. Overcurrent
17. High alternator bearing temperature
18. Residual current circuit breaker
19. Overload (kW) through circuit breaker trip contacts
20. Earth fault
21. Four-pole circuit breaker

Control options

1. Battery charger
2. Battery isolating switch
3. Centralised visible alarm
4. Volt-free contacts for common alarm
5. Voltage potentiometer
6. Local/remote annunciator panel (alarm)
7. Weekly exerciser
8. AMF mains sensing
9. Computer communication (RS232)
10. MOD Bus communication (RS 485)
11. Volt-free contacts for low/high fuel level
12. Expansion input/output modules (DSE 5220 and above)
13. Electric fuel pump (suitable for installations with remotely located fuel tanks)
14. Speed adjustment potentiometer
15. Glow plugs: heater used for the pre-heat option supplied with every controller
16. Anti-condensation heater
17. Battery heater
18. Lubricating oil heater
19. Fuel tank heater
20. Water jacket heaters
21. High alternator winding temperature
22. High alternator bearing temperature

23. PMG alternator
24. Three-phase AVR sensing
25. Parallel droop kit
26. Motorised circuit breaker
27. Circuit breaker tripping on fault (using a shunt trip)
28. IP-rated socket outlet
29. Dummy load

Meters and gauges

1. Kilowatt meter
2. Oil temperature gauge
3. Battery charging ammeter
4. SAE J1939 gauge
5. Exhaust pyrometer
6. Fuel level gauge
7. Oil level indicator
8. Air filter differential pressure gauge
9. Enhanced power/energy meter
10. kWh meters
11. Three AC ammeters
12. Alternator winding temperature gauge
13. Alternator bearing temperature gauge

6. PREVENTIVE MAINTENANCE

6.1 Preventive maintenance of the generator set

Regular preventive maintenance is the means of ensuring the uninterrupted operation of the engine generator set and of substantially extending its service life. This applies whether the generating set is in full-time use or is held on standby; infrequent use makes regular maintenance of the generator set more important still.

Facilities with qualified in-house technical personnel can often carry out the necessary preventive maintenance of diesel generator sets themselves. Other facility managers prefer to contract with a local service provider or power system distributor for regular maintenance.

Because the stability and performance of diesel engines depend on preventive maintenance, the following operations must be carried out:

- General inspection
- Lubrication services
- Cooling system service
- Fuel system service
- Servicing and testing of starting batteries
- Regular engine exercising

The engine preventive maintenance requirements are described in detail in section 6.2 of this manual, which should be read together with this part. The alternator requires no scheduled maintenance. Periodic inspection of the condition of the alternator windings and periodic cleaning are, however, recommended.

Daily or at every start

In addition to the maintenance instruction that defines the required daily checks, an inspection walk-round should be carried out daily. The pre-start checks contained in this chapter must be completed during that walk-round.

Monthly

Carry out an operational check and a load check on the generator set by starting and running the set at a load of at least 50% for 1 to 2 hours.

Every six months

Check all control system safety devices by electrically simulating faults.

1. Clean all battery cover vents.
2. Tighten all exhaust connections.

3. Tighten all electrical connections.
4. Carry out the other engine maintenance specified in the manual.
5. Start the engine and observe the control panel to confirm that all sensors are operating correctly.

Under a scheduled maintenance agreement you will benefit from:

- Peace of mind
- Fewer emergency call-outs
- Extended service life of your equipment
- A well-documented service history
- Warranty cover

6.2 Preventive maintenance of the engine

A maintenance programme is the key to a long engine service life. Generator sets follow the preventive maintenance instructions set out in the following tables.

> **WARNING**
>
> **Maintenance must be carried out only by qualified specialists.**

INTERVAL	OPERATION
Daily	1. Check the coolant level 2. Drain water from the pre-filter 3. Check the engine oil level 4. Clean the air filter element 5. Check for and rectify any engine leaks or damage 6. Check the intercooler, where fitted 7. Visual inspection
Every 250 hours	1. Check the coolant level 2. Drain water from the pre-filter 3. Change the oil 4. Change the oil filter 5. Change the fuel filter
Every 500 hours	1. Change the air filter 2. Check the coolant concentration 3. Check the tension and condition of the drive belt 4. Inspect/adjust/renew the alternator and fan belts 5. Check/renew the coolant hoses, air hoses and hose clamps 6. Inspect and, if necessary, clean the exterior of the radiator/charge cooler 7. Check the condition of the battery

PREVENTIVE MAINTENANCE	GENERATOR SET RANGE (KVA)				
	9 TO 20	27 TO 150	200 TO 250	300 TO 650	725 TO 800
Clean the turbocharger impeller and compressor housing (1)	Every 1000 hours · Every 5000 hours · Every 3000 hours · Every 7500 hours †				
Replace the alternator drive belt	Every 1000 hours / inspect				
Check / adjust the engine valve clearances	Every 3000 hours · – · Every 1000 hours · Every 5000 hours †				
Check / adjust the fuel injectors	Every 3000 hours · – · Every 1000 hours · Every 5000 hours †				
Check / replace the cooling system thermostats	Annually				
Check / clean / calibrate the engine speed and timing sensors	– · – · Annually †				
Check the governor drive and confirm that it operates correctly	– · Every 2000 hours †				
Check the air intake hoses, connections and system	– · Every 1000 hours · – · Annually †				
Replace the engine breather	– · Every 1000 hours · – †				
Check the charging alternator and the starter motor	–	–	–	Every 2000 hours	Every 5000 hours
Drain and flush the cooling system	– · Every 2000 hours · – †				
Inspect the coolant pump	–	–	–	–	Every 5000 hours

> **NOTE**
>
> † The source table uses merged cells, and the extraction does not preserve which generator set range each interval belongs to. The intervals for these rows are reproduced exactly as printed, in the printed order; verify them against the original document, or consult your supplier, before applying them.

(1) The recommended oil type must meet API CH-4, CI-4 or later for all engines (refer to the engine manufacturer's manual for further specifications).

(2) Use only original spare parts in order to achieve maximum performance and a long product service life.

(3) If you have any questions, stop and consult your supplier before proceeding.

6.3 Preventive maintenance of the alternator

1. Checks after starting up

After approximately 20 hours of operation, check that all the fixing screws on the machine are still tight, and check the general condition of the machine and the various electrical connections in the installation.

2. Cooling circuit

It is recommended that the circulation of the cooling air is checked to confirm that it is not restricted.

3. Bearings

The bearings are sealed for life: maximum grease service life 20,000 hours or 3 years.

Monitor the temperature rise of the ball bearings, which must not exceed the ambient temperature by more than 50°C. If it is higher, the machine must be stopped in order to proceed to a general inspection.

4. Abnormal noise

The generation of abnormal noise and vibration may be the result of wear of the ball bearings. It is better to proceed with their replacement in order to avoid the risk of seizure, which can seriously damage the alternator.

- In the case of single-bearing machines, abnormal noise may also be caused by incorrect alignment.
- Both single-phase and three-phase AC alternators supplying an unbalanced load are noisier and vibrate more than three-phase machines with a balanced load.

The same applies to a three-phase alternator connected in "dog-leg", even with a balanced 3-phase load.

5. Electrical maintenance

Winding cleaning agent

> **WARNING**
>
> **DO NOT USE: TRICHLOROETHYLENE, PERCHLOROETHYLENE, TRICHLOROETHANE OR ANY ALKALINE PRODUCTS.**

Certain strictly defined clean, volatile products may be used for degreasing, such as:

- Ordinary petrol (without additives)
- Toluene (slightly toxic); flammable
- Benzene (toxic); flammable
- Cyclohexane (non-toxic); flammable
- Cleaning of the stator, rotor, exciter and diode bridge.

The insulating components and the impregnation system are not at risk of damage from solvents (see the list of permitted products above). Avoid the cleaning agent entering the slots. Apply the agent with a brush, sponging frequently to avoid accumulation in the housing. Dry the winding with a dry cloth. Allow it to evaporate before reassembling the machine. After cleaning the alternator it is important to check the insulation of the windings (for further information, refer to the alternator operating manual).

6.4 Battery description and maintenance

Batteries are selected in accordance with the recommendations of the engine manufacturers, since their size depends mainly on the characteristics of the engine. The viscosity grade of the lubricating oil used and the ambient temperature are also important factors in battery selection.

Two types of battery are used in generator sets:

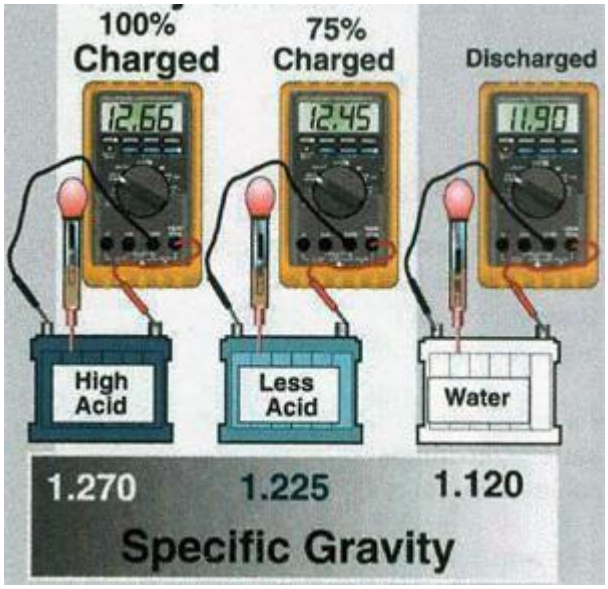
1. Wet lead-acid batteries are the traditional batteries, which can be used for all types of application.
2. Sealed lead-acid batteries are intended mainly for internal combustion engines. These are minimum-maintenance batteries.

Specific gravity check

An instrument called a hydrometer is used to measure the condition of the battery. The hydrometer measures the specific gravity, or SG, of the battery fluid, which is an indication of the state of charge of the battery.

The relationship between the specific gravity of the battery and the state of charge is as follows:

SPECIFIC GRAVITY (AT 27C)	STATE-OF-CHARGE IN %
1.28	100%
1.25	75%
1.22	50%
1.19	25%
1.13 and less	Discharged



State of charge indicated by specific gravity and terminal voltage.

In sealed lead-acid batteries there is no access to the battery fluid for checking. A built-in hydrometer is fitted on the battery. This hydrometer gives an approximate indication of the condition of the battery:

- GREEN: fully charged
- BLACK: fully discharged
- WHITE: requires replacement

This indication is not always reliable, since it determines the condition of one cell out of the six cells of the battery.

Electrolyte level check (wet batteries)

For wet lead-acid batteries, check the electrolyte level in the batteries at least every 200 hours of operation. If the level is low, fill the battery cells with distilled water up to the bottom of the filler neck.

Battery maintenance

Weak or insufficiently charged batteries are the most widespread cause of failures of the main power system. Even if lead-acid starting batteries are kept fully charged and maintained, they deteriorate with time, and they must therefore be replaced periodically once they no longer hold a proper charge. Only a regular schedule of inspection and load testing can prevent problems with starting the generator set.

Battery cleaning

Keep the batteries clean by wiping them with a damp cloth whenever excessive dirt appears. If there is corrosion around the terminals, disconnect the battery cables and wash the terminals with a solution of baking soda and water (1/4 lb of baking soda to one litre of water). Take care that the solution does not enter the battery cells, and when finished, rinse the batteries with clean water. After the connections have been replaced, apply a light coating of petroleum jelly to the terminals.

Battery testing

Simply checking the output voltage of the batteries does not indicate their ability to provide adequate starting power. As batteries age, their internal resistance to current rises, and the only accurate measurement of terminal voltage must be made under load. On generator sets this check is performed automatically each time the generator set is started.

6.5 General recommendations

6.5.1 Fuel specification

Recommended fuel specification:

- The cetane number indicates ignition performance.
- Viscosity is resistance to flow.
- Sulfur is a chemical component.
- Distillation is an indication of the mixture of the different hydrocarbons in the fuel.

PROPERTY	SPECIFICATION
Cetane No.	50 Minimum
Viscosity	2.0/4.5 Centistokes at 40°C
Density	0.835/0.855 Kg/ Liter
Sulfur	0.2 % of mass, maximum
Distillation	85% at 350°C

6.5.2 Lubricating oil specification

Recommended lubricating oil specification:

GENERATOR MODEL	ENGINE MAKE	MINIMUM OIL SPECIFICATION
9 kVA to 20 kVA	Kubota	API CI-4, CH-4 or ACEA E5
30 kVA to 250 kVA	John Deere	API-CI4
300 kVA to 2000 kVA		

> **NOTE**
>
> The engine make in this table is shown in the source as a manufacturer's logo; the third row is not legible in the source. Confirm the oil specification for the 300 kVA to 2000 kVA range with your supplier, and refer in every case to the engine manufacturer's manual.

Recommended engine oil viscosity:

RECOMMENDED OIL GRADE	AMBIENT TEMPERATURE	
	MINIMUM	MAXIMUM
SAE 0W20	-40°C (-40°F)	10°C (50°F)
SAE 0W30	-40°C (-40°F)	30°C (86°F)
SAE 0W40	-40°C (-40°F)	40°C (104°F)
SAE 5W30	-30°C (-22°F)	30°C (86°F)
SAE 5W40	-30°C (-22°F)	40°C (104°F)
SAE 10W30	-20°C (-4°F)	40°C (104°F)
SAE 15W40	-10°C (14°F)	50°C (122°F)

6.5.3 Fuel system requirements

> **NOTE**
>
> The fuel system requirements are set out in section 4.4, Fuel system, of this manual: fuel tank capacity and pipe sizing, fuel inlet temperature, tank materials, tank position relative to the injectors, and the routing of the supply and return lines.

7. WARRANTY CONDITIONS

This warranty is valid under the following conditions:

1. The warranty period is one year or 1000 hours, whichever occurs first, from the date of delivery to the customer.
2. This warranty covers the replacement or repair of any part of this product that proves to be defective in manufacture.
3. This warranty covers labour and transport free of charge, in addition to the defective parts.
4. Filters, lubricating oil and spare parts must be used in accordance with the specifications recommended by Tom Generators (original spare parts).
5. This warranty does not cover cases caused by accidental circumstances or force majeure. It further excludes replacements or repairs resulting from normal wear of the equipment (lubricating oil, filters and similar), as well as damage or accidents arising from negligence, lack of supervision or maintenance, incorrect use of this equipment, or improper operation.
6. This warranty is void if the product has been interfered with by unauthorised technicians or service personnel, or if the factory serial numbers have been altered, removed or changed in any way.
7. This warranty does not cover normal maintenance costs.
8. For any warranty case, provide the following information to your supplier:
    a. Serial number of the generator set
    b. Running hours
    c. Date in service
    d. Date and description of the fault