Generating Set
Installation Manual

Please make a note of the below information from the rating plate of your new Generating set for future reference (rating plate located on the side plate of the alternator terminal box)

Generating Set Serial No.	
Generating Set Model	
Phases	
Rated Frequency (Hz)	
Rated Voltage (V)	
Rated Power (kVA)	
Rated (kW)	
Rated Power Factor (pu)	
Rated Current (A)	
Rated Speed (A)	
Rated Speed (rpm)	
Ambient Temp (deg C)	
Mass (Kg)	
Year of Manufacture	

1. Introduction

This Generating Set is one of a family of Generating Sets designed to be ready to run when it arrives on site.

This manual has been prepared to assist with the Installation and maintenance of the Generating Set.
Please use this manual in conjunction with the associated Engine Manual, Alternator Manual and control panel manual.

Always ensure that installation, commissioning, on-site adjustments and servicing is carried out by qualified personnel, authorised to do the work and trained accordingly
Each Generating set is uniquely defined by a serial number indicated on the rating plate generally affixed to the alternator terminal box.
This information is very important if contacting the factory for technical support or ordering spare parts.

A typical rating plate is shown below:

Generating Set Serial No.	H0123A/001
Generating Set Model	DA3-AJ17S-5D2
Phases	3
Rated Frequency (Hz)	50
Rated Voltage (V)	400/230
Rated Power (kVA)	16.5
Rated Power (kW)	13.2
Rated Power Factor (pu)	0.8
Rated Current (A)	23.8
Rated Speed (rpm)	1500
Altitude (metres)	152.4
Ambient Temp (deg C)	25
Mass (kg)	575
Year of manufacture	2009

2. Safety

Correct installation of the generation set will ensure year's of safe operation

- ! Read and understand all safety advice and warnings before operating or performing maintenance on the Generating set
- ! Never start the generating set unless it is safe to do so
- ! Do not attempt to operate the Generating set with a known unsafe condition
- ! Disconnect the battery negative (-) lead prior to attempting any repairs or maintenance
- ! Install and operate this generating set in full compliance with relevant National, Local, or Federal codes, Standards or other requirements

Mechanical Moving Parts

The generating set contains many moving mechanical parts. Remove guards and belt covers with caution and only if completely necessary to do so. Do not run the generating set without the guards in the correct position.

Hot to Touch

Many areas of the engine, particularly the exhaust manifold, turbo charger and the radiator assembly can get extremely hot during operation. Do not touch these areas while the set is running and ensure that it has sufficiently cooled down before attempting any maintenance. Do not add cold coolant to a hot machine, this can cause cracking of the engine block and machine damage.

First Aid for Electrical Shock

WARNING

Electricity and electrical machinery are EXTREMELY dangerous Never touch any cable, or bus bar that you suspect to be live. ALWAYS check that all sources have been switched off / isolated before working on the installation. Be aware that diesel generators can be remotely controlled and may start without warning, disable/isolate this ability before carrying out work. ALWAYS remember that a generator contains mechanical rotating parts, and should not be used by untrained personnel.

Electrocution / Electrical Hazard

The passage of electrical current through the body can cause cardiac arrest, burning, and shock. Many injuries result from faulty switches, frayed cables or defects in electrical appliances. Whatever the cause of an electrical accident,

never touch the casualty with bare hands unless you are sure there is no danger to yourself. If you come across someone that has been electrocuted, follow the treatment guide below.

Treatment:

- Switch off the electrical supply if possible or remove fuse.
- Remove the casualty from contact with electrical source, using non-conductive articles such as a dry brush handle, dry rope or piece of clothing.
- Call for help and contact the emergency services.
- If breathing and heartbeat have stopped, begin C.P.R. immediately (see guidelines below)
- If the casualty is breathing, but unconscious, place him/her in the recovery position.
- Treat any burns.
- Treat for shock.

C.P.R. Guidelines

1. Call Check the victim for any response. If there is none, call for medical help and return to the victim. Ideally send someone else to make the call so no time is wasted.

2. Listen Tilt the head back and listen for ten seconds.

3. Pump If after a further 10 seconds the victim is still not breathing normally, coughing or moving, begin chest compressions. Push down on the chest 1.5 to 2 inches 15 times right between the nipples. Pump at the rate of 100-120/minute, faster than once per second. Only if Casualty has inadequate breathing, less than 10 breaths per minute, Artificially Ventilate. When breathing restarts place the victim into the recovery position described below.

Recovery Position

In unconscious patients with a pulse and intact breathing, the recovery position, prevents the tongue falling back and blocking the airway.

What to do:

Place the patient on their back.

1. Lift the chin to ensure the airway is open.
2. Patient's arm on your side should be positioned so as to make a right angle with his body, with elbow bent and palm facing out.
3. Patient's other arm on opposite side should be placed across the chest, with back of their hand against the cheek on your side of the patient.

4. Pull up the patient's knee joint (side away from you) as it bends with the foot flat on the ground.
5. Roll over the patient in this position towards your side.
6. By tilting the patient's head back ensure that the airway is open.

7. The uppermost leg should be adjusted in such a way that the hip and knee are at right angles.
8. Seek immediate medical help / ambulance.

Do not:

1. Move the patient if a spinal injury is suspected.

3. Site Installation

The Generating Set is dispatched in a protective wrapping. Take care whilst removing this packaging with a knife/scissors not to damage the underlying paint work or wiring looms of the machine. Remove any wooden plinths that have been fitted to the base of the unit. Non canopied machines must be stored under a roof as the protective wrapping is not weatherproof.

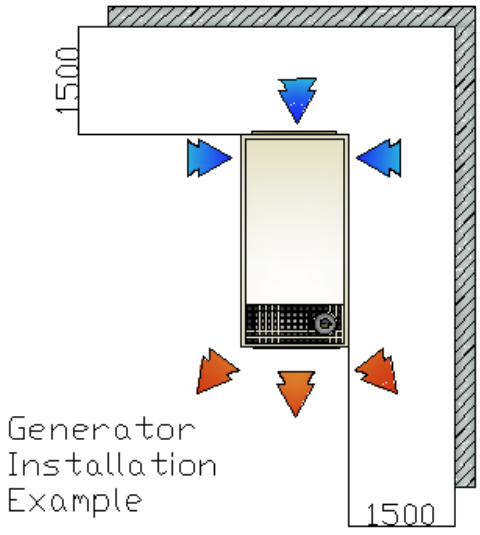
Location

Selecting a location for the Generating set is an important part of any installation procedure. The following factors determine the location.

- Adequate ventilation.
- Protection from precipitation and extreme temperatures.
- Protection from exposure to airborne contaminants such as abrasive or conductive particles, oil mist, vapours, engine exhaust fumes or other contaminants.
- Clearance around the Generating set for service.
- Limiting access to unauthorised personnel.

If it is nescessary to locate the Generating set externally, a canopied or containerised Generating set must be selected.

Adequate airflow is critical to the correct operation of the generating set. Outdoor installation should allow for suitable clearance between air inlets and outlets to maintain the correct ventilation. As a guideline when installing an enclosed set outdoors maintain a clearance of at least 1.5m around the unit. **This is for guidance only. For more detailed information contact the manufacturer**. It is also important to note that placing the unit close to solid surfaces e.g. concrete walls can cause sound reverberation. This can impede on the noise rating of the unit.



(Plan - View)

Where noise considerations are of particular importance, contact the technical support team for more advice. Indoor installation should also take note of airflow requirements; adequate ventilation should be available to inlet and outlet air. Both exhausted gas and cooling air must be ventilated to the outside of the building, and not allowed to return. Precautions must be taken to minimise fire risk in any installation. Bulk fuel tanks should be placed externally where possible. .

Noise

Generating sets that are not equiped with sound attenuating enclosures can produce noise levels in excess of 105 dBA. Prolonged exposure to noise levels above 85 dBA is hazardous to hearing.

⚠ **Warning:**	Ear protection must be worn at all times around an operating generating set.

4. Exhaust System Installation Guidelines

⚠ **Warning:**	All exposed hot exhaust parts should be fitted with guards or lagged to minimise the direct chance of injury to personnel.

The purpose of the exhaust system is to extract exhaust gases from the engine and discharge them at an appropriate location which ensures satisfactory gas dispersal and noise reduction.

Exhaust System General.

When planning the exhaust system installation the following points should be considered:

1. Flexible Connections

A flexible section (expansion bellows) must be installed in the exhaust system to isolate the engine. This prevents damage resulting from vibration and thermal expansion. This expansion unit is installed as close to the engine outlet as possible.

The exhaust pipe work should be supported to ensure no load is applied to the engine manifold, turbocharger or exhaust bellows. All supports should allow pipe work to move due to thermal expansion and contraction.

2. Exhaust System Sizing and Mounting Location

The diameter of the exhaust system must be greater than or equal to that of the engine outlet pipe. Attention should be paid to exhaust back pressure when determining exhaust system size.

Where possible, the silencer should be mounted close to the engine as this will result in the best overall noise reduction.

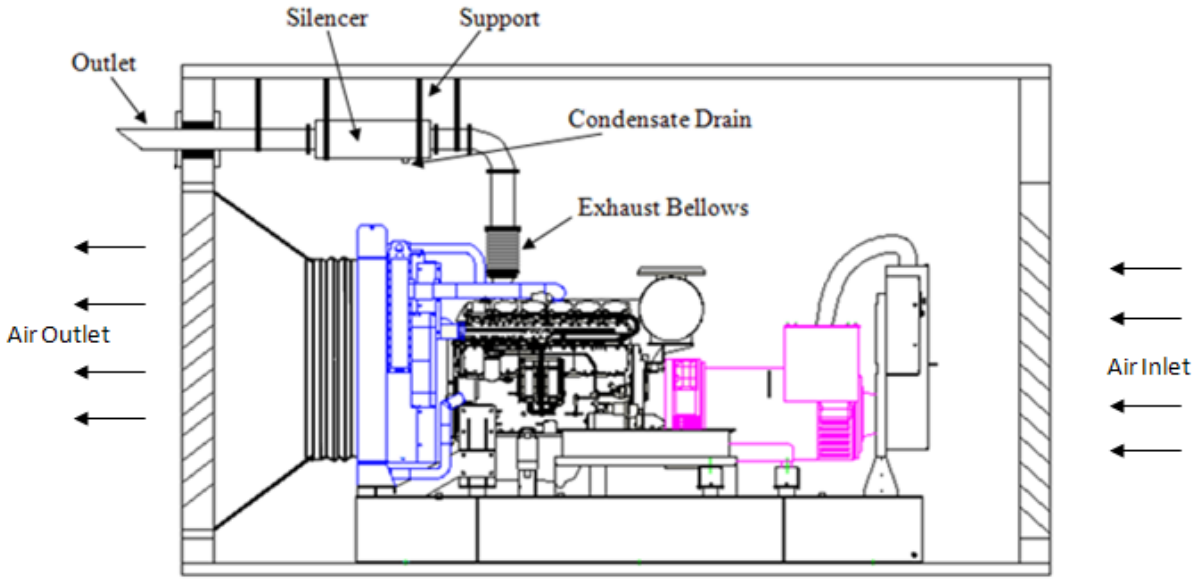
Where exhaust pipe work passes through combustible walls/ceilings, approved thimbles should be used.

The exhaust outlet must be positioned in a location which eliminates the possibility of hot exhaust gases re-circulating and entering the air inlet duct or passing over the radiator. Ideally the outlet should be adjacent to the hot air outlet from the radiator.

Preferably the exhaust to atmosphere should be in a horizontal position to eliminate the chance of water entering the exhaust system. In the instance where the outlet pipe has to be fitted in a vertical position a rain shield or flap should be added to the system to prevent water from getting inside the engine.

Exhaust pipe work may also accumulate condensed water which can be drained off using a water trap fitted at the lowest point of the exhaust system to avoid internal corrosion.

A typical Installation is shown in Figure 1.



Typical Exhaust System Installation.

The table below may be used as a reference when planning an exhaust system using an industrial silencer with compact genset.

	RECOMMENDED			
Generating Set (kVA)	**Flexible Bellows**	**Pipe Diameter**	**Maximum Pipe Length**	**Maximum No. of Bends**
17 – 33	2“	2“	15m	3
40 – 138	3“	3“	15m	3
144 – 275	4“	4“	15m	3
330 – 500	5“	5“	15m	3
550 – 600	5“	6“	15m	3

3. Back Pressure

When designing the exhaust system the resistance to gas flow (Back Pressure) must be minimised. Failure to comply with the recommended back pressures may result in poor engine performance, high exhaust temperature and increased fuel consumption.

Refer to factory for recomended Back Pressures.

The back pressure should be measured in a straight section of pipe as close to the engine as possible.

The following factors should be considered to help minimise backpressure:

a) Sufficiently sized exhaust pipe diameter.
b) Minimise the length of exhaust pipe between the turbocharger and the silencer.
c) Avoid the use of right angle bends, use swept elbows.
d) Minimise silencer resistance.

WARNING

Exhausted gas is dangerous; ensure that all gas is vented properly as breathing exhausted fumes can kill.

5. Electrical Connection

WARNING

Make electrical connections in compliance with relevant Electrical Codes and Standards or other requirements. This includes requirements about grounding and ground / earth faults

Onsite electrical installation will generally consist only of connecting up the site load to the generating set output terminals. Only fully qualified and experienced electrical technicians should carry out electrical installation, service and repair work.

Cabling

Due to movement of generating sets on their vibration mounts, the electrical connection to the set should be made with flexible cable. This will prevent transmission of vibrations and possible damage to the alternator or circuit breaker terminals

The cable must be suitable for the output voltage and the rated current of the Generating set, In determining cable size, allowances should be made for ambient temperature, method of installation, cable run distance and bunching.
When single core cables are used the gland plates must be of non-ferrous material such as aluminium, brass or a non-metallic material such as tufnol,
Alternatively slots can be cut between gland holes of cables to prevent circulating (eddy) currents in magnetic gland plates.

Phase rotation should be checked for compatibility with the installation site.

Loading

When planning the electrical distribution system it is important to enure that a balanced load is presented to the generating set.
If loading on one phase is significantly higher than the other phases it could possibly cause overheating in the alternator windings or imbalance in the phase to phase output voltage.
Ensure that no individual phase current exceeds the current rating of the generating set. For connection to an exisitng distribution system, it may be nescessary to reorganise the distribution system to ensure these loading factors are met.

Power Factor

The power factor (cos Φ) of the connected load should be determined. Power factors of 0.8 lagging (inductive) can overload the generator. The set will provide its kW rating and operate satisfactorily from 0.8 lagging to unity power factor (1.0)

Grounding / Earthing Requirements

Regulations vary for different locations. The frame of the Generating set must be positively connected to an earth ground.
Ground connection cables or straps should have at least full load current carrying capacity and meet applicable regulations.

6. Battery Commissioning

WARNING

Installation and commissioning should ONLY be carried out by a suitably qualified personnel. Failure to do so can result in damage to equipment and persons.

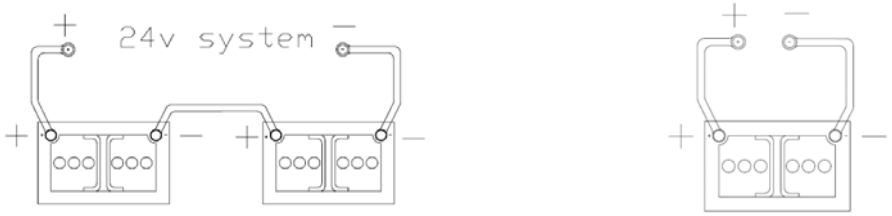
When working with batteries, do not smoke or use an open flame in the vicinity. Hydrogen gas from batteries is explosive.

Battery Information

When working with batteries please observe the battery precautions.

Battery Precautions

Connection and Disconnection (battery arrangement)



24V System **12V System**

When connecting the battery to the machine, always connect the **positive terminal first** followed by the negative terminal. When disconnecting, remove the negative first then the positive. These steps will ensure accidental shorting of the battery terminals cannot take place.
Depending on the size of the generating set, the electrical system will either be 12V or 24V in the manner illustrated above.

Activating Dry Batteries

Due to shipping and safety regulations many Generating Sets may be provided to the customer with ‘dry batteries’. These batteries require activation before they can be used. To activate the batteries use the following procedure:

- Remove the vent plugs on the top of the battery Fill the cells with sulphuric acid for batteries (using appropriate personal protective equipment and if suitably trained) with a specific gravity of 1.27 - 1.28 kg/l at the temperature of 25°C for use in cold climates, and 1.25 - 1.26 kg/l at 25°C for use in hot or tropical climates. Fill each cell to the level of 8 - 15 mm above the battery plates, or to the specific upper level indicated on the battery box. (N.B.

contaminated acid with impurities can seriously damage the life of the battery. Do not use acid from old batteries.

- Let the battery rest for no less than 30 minutes, then check the acid level as indicated above. Tighten the vent plugs and then clean the battery thoroughly. Leave the battery for 20 - 30 minutes and then measure the open-circuit voltage. If it is below 12.50V, charge the battery (see charging the battery below). If it is above 12.50V, adjust the acid levels to the correct operating levels with dilute sulphuric acid.

Charging the Battery

If the battery voltage is below 12.4V (or 24.5V in 24V machine) either after activating (above) or for any other reason, then charging is required.

If the generating set has an on board battery charger this will take care of charging when connected to the auxiliary mains supply. If a charger is not fitted, the recommended charging within 1/10 of the normal capacity for 5-6 hours must be carried out by connecting an external charger.
If using the onboard battery charger the charge current will be controlled by the unit, and reduced accordingly when the battery is fully charged. At this point the battery charger will switch to trickle charge, maintaining the battery in a fully charged condition.

Battery Maintenance

Under normal conditions no topping up is required. However in case of high number of starts, or high operating temperatures topping up may be required**: use only demineralised water; never add sulphuric acid.**

Battery Life

The control panel, remote communications (if installed) and other standby functions, cause some drain on the battery. Its recommended that wherever possible an onboard battery charger is fitted. This charger will provide a maintenance charge to the system batteries allowing for optimum system performance whenever startup signal is received. The onboard battery charger requires an Auxilliary AC supply, therefore installation of this unit is not possible in all applications.

7. Checking and Adding Coolant

WARNING

NEVER remove coolant cap from radiator when the radiator is hot, and NEVER add cold coolant to a hot radiator.

In most cases the generating set is supplied pre-filled with radiator coolant. Standard coolant is a mixture of water and antifreeze (Harmful) at a ratio of 3:1. Before starting and also as part of a regular maintenance schedule it is important to check the level of coolant in the radiator, and replenish as necessary.

Coolant cap - on top of radiator

To check the coolant, remove the cap from the top of the radiator (*) **ONLY when the set is completely cold**, and visually inspect that the coolant in the radiator is visible above the radiator elements. If coolant is required add until the level reaches the base of the filler neck**.** Replace and tighten coolant cap on top of radiator.

(*) **NOTE.** Some generating set models are fitted with a remote expansion tank. This unit is normally formed from a translucent material allowing the coolant level to be observed. Check that the coolant level lies between the Max/Min indeicating marks on this tank. Top-up if necessary **through the filler cap on the expansion tank**. **Do not remove the cap on top of the radiator**.

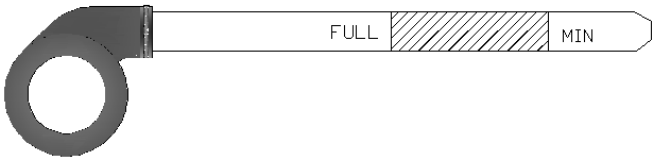
8. Checking and Adding Engine Oil

WARNING

Use only engine manufacturer's recommended lubricant when topping up or replacing engine oil, NEVER check engine oil level or attempt to top up oil with engine running.

The generating set engine is filled before despatch. However it is important to check the level of oil in the engine before any starting can take place, and also as part of a regular maintenance schedule. The engine oil should be replenished as necessary. Diesel engine oil of type 15W40 is recommended for use in all generating sets. For more engine specific lubrication information consult the supplied engine manual.

To check the level of engine oil, remove the dipstick usually located at the side of the engine (refer to engine manufacturers handbook for specific location information), and wipe off excess oil with a clean non-abrasive cloth. Return the dipstick fully to its normal position, remove again and visually inspect oil level against markings on the dipstick itself (example below). If oil level is low, remove the oil cap from the top/side of the engine and add oil. Allow to settle and then check oil level on dipstick again. Repeat exercise until oil level on dipstick has reached the recommended level. Replace oil cap when complete. IMPORTANT: Do not exceed max. Level on dipstick.



9. Control Panel

Please refer to the relevant operating manual for information.

Typically 1000, 3000, 3200/3250, 4000,6000 or ATSc.