Engine Operation Manual

For Engine Models

3IRL2N
4IRQ2N
4IRS2N
4IRS2T

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Engine Information

Engine Safety Instructions

If you do not understand or have any doubts about any point in this instruction manual, please contact your agent who can explain or give you a demonstration.

- Please also refer to the local and national regulations applicable to your region or country.
- Read the manuals supplied with the generating set carefully.
- Do not modify the engine.
- Do not smoke when refuelling the tank.
- Always wipe off spillage and store impregnated cloths in a safe place.
- Avoid refuelling when the engine is running.
- Never clean, lubricate or adjust a running engine (unless you are qualified to do so, in which case great care should be taken to avoid injury).
- Do not attempt to make any adjustments unfamiliar to you.
- Ensure that the engine is placed in such a way so as to avoid toxic gas accumulation.
- Warn the people around to keep their distance during the operation.
- Do not wear loose-fitting clothing and do not go near operating machines. Note that fan blades are not clearly visible when the engine is running.
- Do not run the engine without reinstalling the protective covers.
- Do not remove the radiator cap when the engine is hot or when the coolant is under pressure.
- Do not touch hot parts such as the exhaust pipe and do not put combustible materials on them.
- Never use sea water or any other electrolytic or corrosive product in the cooling system.
- Never allow sparks or naked flames near the batteries because the electrolyte gases are flammable. Battery acid can cause serious injury.
- Always operate the generating set from the control panel.
- If your skin is exposed to high pressure fuel (injector), consult a doctor immediately.
- Diesel fuel can, in some people, cause a skin reaction. Use protective gloves or a hand cream.
- Disconnect the battery before undertaking any repair works to prevent accidental start-up of the engine. Place a notice forbidding any starting attempts on the controls.
- ONLY use the correct engine barring techniques for manually rotating the crankshaft. Do not attempt to rotate the crankshaft by pulling or levering the fan. This method can cause serious personal injury, property damage or damage to the fan blade(s) leading to a premature fan failure.
- Relieve all pressure in the air, oil and cooling systems before removing or disconnecting any lines, fittings, hoses or connected items. Beware of possible pressure when disconnecting a

device from a system under pressure. Do not check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.

- The corrosion inhibitor contains alkali. Avoid any prolonged or repeated contact with the skin, or eyes. Do not Swallow, In case of contact with the skin, thoroughly wash with water and soap. In case of contact with the eyes, immediately and thoroughly rinse with water for at least 15 minutes. IMMEDIATELY CALL A DOCTOR. KEEP THE PRODUCT OUT OF REACH OF CHILDREN.
- Always use tools that are in good condition. Make sure that you understand instructions before taking any action.
- Never use petrol or other inflammable substances to clean the parts.
- Only install original parts.
- Any action on the equipment should be performed with the installation or equipment switched off.
- Electrical connections must be carried out according to the standards and regulations in force in your country.
- Do not use frayed or faulty cables.
- Engines with a turbocharger: Never start the engine without fitting the air filter. The rotating compressor blades in the turbo charger can lead to serious personal injury. Foreign bodies in the inlet pipe can lead to mechanical damage.
- Engines with an air heater (starting element) : Never use starting aerosol or other similar product as a starting aid. Contact with the starting element can cause an explosion in the intake manifold and lead to personal injury.
- Lubricating oil is toxic and dangerous if swallowed. Avoid prolonged or repeated contact with the skin. Avoid inhaling these oil vapors. Read the instructions on the packaging.
- Anti-corrosion agents are toxic and dangerous if swallowed. Avoid contact with the skin and eyes. Read the instructions on the packaging.
- Glycol is toxic and dangerous if swallowed. Avoid contact with the skin and eyes. Read the instructions on the package.
- Some inhibiting oils are inflammable. Also, some are dangerous if inhaled. Ensure good ventilation. Use a protective mask for the injection.
- Avoid contact of hot oil with the skin. Before any action, ensure that the system is no longer under pressure. Never start or run the engine with the oil filler cap removed to avoid oil splashing.
- Do not reverse the positive and negative battery terminals when fitting them. Reversing can lead to serious damage to the electrical system. Refer to the electrical diagram.
- Use correct lifting points to lift the generating set. Always check that the lifting equipment is in good condition and has a sufficient lifting capacity.
- If other equipment fitted on to the generating set changes its center of gravity, special lifting devices may be necessary to maintain correct balance and safe working conditions.

- Never carry out any work on the generating set when only supported by a lifting device.
- **WARNING!** The engine must not be operated in areas containing explosive products.
- The fuel filter must be replaced on a cold engine to avoid any risk of fire due to spillage of the fuel onto the exhaust manifold. Always cover the alternator if it is placed under the fuel filters. Fuel spillage can damage the alternator.
- Always protect your hands when checking for leaks. High pressure liquids can penetrate body tissues and cause severe injury. They can contaminate blood.
- Always use recommended fuels. Using poor quality fuels can damage the engine. On a diesel engine, incorrect fuel can lead to seizure of the control rod and engine over-speed with risks of personal injuries and mechanical damage. Poor quality fuels can also lead to higher maintenance costs.
- Engine exhaust gases are toxic. Do not operate the generating set in rooms which are not ventilated.
- The electrical equipment (including connecting wires and plugs) must be defect free.

Fuel, Oil and Coolant Specifications

When set to factory standards, these engines operate properly with a diesel fuel complying with one of the following specifications :

.BS 2869: 1988, class A2

.BS EN590 : 1995, class 1

.ASTM D-975-77 : quality 2D

Use commercially available diesel fuel with a sulphur content lower than 0.5 %.

Gaseous emissions, measured during standard checks, always refer to a standard diesel fuel recommended by the authorities in charge of these standards.

The fuel must be a distillate, and not a residual oil or a blend. The user is warned that, although engines can operate with fuels not complying with the specifications mentioned above, this could lead to excessive wear and damage.

⚠ CAUTION

Fuel injection equipment is manufactured in accordance within very precise limits and the smallest foreign body will affect its efficiency.

It is essential to use fuel free from water and other impurities.

Note: To operate the genset at temperatures below 0°C (32°F), use an anti-parafining additive or use a fuel preheater.

Example: ACCEL additive for cold weather. Recommended mixture ration: 1 litre for 1000 liters of diesel fuel. Average operation of diesel engines guaranteed down to -18°C.

Features:

- Appearance: clear, dark red
- Flash point: above 55°C
- Viscosity at 20°C : around 10 cSt
- Non corrosive
- Does not color fuels
- Specific gravity at 15°C : 0.9
- Flow point: -20°C
- Ash content: nil
- Non toxic

Recommended Oil Specifications

Quality

The oil must be suitable for oil changes as specified in the general maintenance schedule. The temperatures mentioned in the Oil Viscosity Table below are ambient temperatures during engine start-up. However, if operating ambient temperatures are much higher than the starting temperatures, a compromise must be found and higher viscosity oil must be used providing the engine starts satisfactorily.

Multi-grade oils can solve this problem provided that they have an appropriate specification. These diesel engines must be used with heavy duty lubricating oil in compliance with the requirements of the standards API CC, DEF2101D, Mil-I-2104C or Mil-L-46152A/B for L.E. + S.L + S.Q engines and API CD for S.S engines. Straight mineral oils are not suitable, neither are oils of less detergency than specified.

In new or reconditioned engines, 3rd series API CD or Mil-I-2104C/D oils can inhibit the running-in process and are not suitable for engines used in light service cycles. These oils can be recommended for engines operating with a high load factor, particularly with high ambient temperatures after the last oil change. Note, they must be used when the fuel sulphur content exceeds 0.5%.

Viscosity

The following chart shows the correct oil viscosities for various ambient temperatures from cold start to maximum operating levels.

Oil Viscosities	Ambient Temperature Range
SAE 30	-5°C to 40°C (23°F to 104°F)
SAE 5W-20	-30°C to -5°C (-22°F to 23°F)
SAE 10W-30	-25°C to 40°C (-13°F to 104°F)
SAE 15W-40	-20°C to 50°C (-4°F to 122°F)

⚠ CAUTION

Avoid mixing oils of different brands. In most cases, the various oil brands are not compatible with each other, and when mixed, can seize parts such as piston rings, cylinders, etc. or abnormally wear moving parts. It is preferable to stick with one and the same brand of oil at successive service intervals.

Limiting requirements for engine oils

If a used oil analysis program is conducted in order to determine the condition of the oil, consult the chart below. Change the oil if any of these requirements is not met.

Note:

- Oil change intervals depend to a great extent on fuel properties. Be sure to use only recommended fuels.
- The limit of total base number is half of that of a new oil in case of a perchloricacid analysis method.

Property		Test Method	Limit
Viscosity	cSt@100°C (212°F)	JIS K 2283	+ 30% maximum of new oil
Total Base Number (Hcl)	mgKOH/g	JIS K 2501	2.0 minimum
Total Acid Number	mgKOH/g		+3,0%, maximum of new oil
Water Content	Vol %	JIS K 2275	0.2, maximum
Flash Point (coc)	°C (°F)	JIS K 2265	180 (356), minimum
Pentane Insolubles	Wt%	ASTM D893	0.5, maximum
Pentane Insolubles Coagulated	Wt%		3.0, maximum

Coolant Specifications

The coolant quality has a significant effect on the efficiency and life of the cooling system. The recommendations below will help users to keep their cooling system in good condition with protection against frost and/or corrosion.

Note: Basically, harmful chemical properties and substances contained in water (as coolant) must not exceed the limits specificed; however they are tolerable up to the limits shown in the table below.

Item	Chemical Symbol	Unit	Limit Recommended	Corrosion & Rust	Scale Formation
pH, 25°C (77°F)	-	-	6.5 a 8.5 (6.5 a 8.0)	0	0
Electrical conductivity, pH, 25°C (77°F)	-	Ω/cm	<400 (<250)	0	0
Total hardness	Ca CO_3	PPM	<100 (<95)	-	0
M alkalinity		PPM	<150 (<70)	-	0
Chlorine ion	Cl”	PPM	<100 (<100)		-
Sulphuric acid ion	SO^{2}_{4}	PPM	<100 (<50)	0	-
Total Iron	Fe	PPM	<1.0 (<1.0)	-	0
Sillica	SiO_2	PPM	<50 (-)	-	0
Residue from evaporation $^{2}_{4}$	-	PPM	<400 (<250)	-	0

Recommended Types of Long Life Coolants (LLC)

All-season, non-amine LLC or equivalent are recommended.

Features of Recommended Brands

- None of amines (methyl amines, ethyl amines, n-propyl amines, etc., all being derivatives of ammonia, NH3) are contained).
- Silicate and borate are not contained.
- Close to neutral on the pH scale, and hence, slightly basic (alkaline).
- Balanced additive ingredients, some being substitutes for amines.
- Long life. The coolant with 30% concentration.

⚠ WARNING

LLC is toxic and can cause personal injury if in contact with the skin or eyes. If LLC enters the eyes, immediately and thoroughly rinse with water and seek medical attention at once.

How to use non-amine Type LLC

(1) Engine coolant containing any of the recommended additives should be changed every two years.

Note: If any other LLC is used, refer to the coolant mixture chart displayed on the container.

(2) Proper concentration of LLC is from 30% to 60% year-round. Aim at a temperature level lower by 5°C (9°F) than the expected lowest temperature. An LLC with a concentration below 30% does not provide sufficient corrosion protection. However, concentrations above 60% affect freeze protection and heat transfer rates. When adding coolant, use LLC of the same concentration.

RECOMMENDED LLC CONCENTRATIONS (Reference)				
Ambient temperature °C (°F)	-10 (14)	-20 (-4)	-30 (-22)	-45 (-49)
LLC concentration %	30	40	50	60

PREVENTIVE MAINTENANCE

Although specific regular maintenance operations have been given in the maintenance schedule, you are reminded that it is the environment in which the engine operates which defines the maintenance schedule.

You must therefore realize that, if the engine operates under extreme conditions, intervals between operations should be shortened. Use the maintenance schedule to establish your own schedule and adapt it to your particular operating conditions.

DAILY MAINTENANCE CHECKS

These checks must be carried out every day or before every start-up (except repeat starts on the same day).

- Check the oil level in the engine oil sump and top up if necessary.
- Check the fuel level and fill up if necessary.**
- Check the coolant level and top up if necessary.
- Check the pipe work** for leaks and deterioration.
- Check for unusual noises or vibration. **
- Check the oil level in the oil bath air cleaner (optional).
- Check for unrestricted air flow on the parts to be ventilated.
- Check that the control panel safety indicators and systems are operational.**

AFTER THE ENGINE HAS BEEN STARTED

- Check the colour of the exhaust gases (the emission of black gas indicates that the engine is malfunctioning).
- Check for oil, fuel or coolant leaks.
- Check for unusual noises corning from the generating set.
- During repeat engine start-ups, checks can still be carried out: see texts followed by (**).

Maintenance Schedule	Every						
Operations to be performed	50 hrs	100 hrs	250 hrs	400/ 500 hrs	800/ 1000 hrs	2 yrs	if req'd
MOTOR							
Check the degree of clogging of air filter	x						
Replace the lube oil and oil filter		x	x				
Lubricate all the couplings			x				
Replace the fuel filter				x			
Adjust the valve clearance				#			
Clean and check the injectors				#			
Check condition/tension of v-belt				x			
Check the Preheating Glow Plugs				#			
Clean or change the air filter				x			
Check the starter and charge alternator					#		
Clean the radiator					x		
Check the injection pump (L.E. engines)					#		
Clean the generator set					#		
Retighten the nuts and bolts					#		
Drain the cooling system						x	
ALTERNATOR							
Check the nameplate before carrying out any maintenance or repair work			or 3 mths	or 12 mths	or 12 mths		
Check for unrestricted air flow	x	x					
Check the insulation of the windings				#			
Check the bearings			x				#
Check the electrical connections				x			
Remove dust from the inside of the machine				x			
CONTROL PANEL							
Operate genset on load for 15 minutes and check the safety indicators every 2 weeks							
Check the tightness of electrical connections			x				
Remove dust if operating in dusty conditions			x				
Remove dust from inside and out and lightly lubricate hinges and locks					x		
# = Operations require specialist knowledge and must be carried out by an engineer with special tools.							

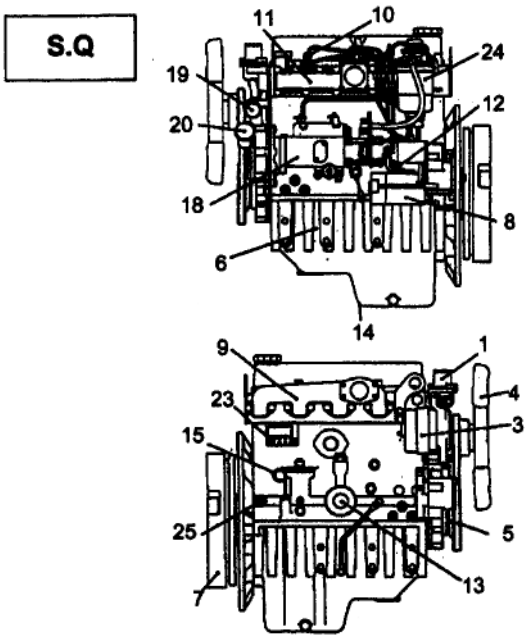
This summary will help you keep a record of the maintenance performed on your generating set. It must be filled in by the engineer undertaking the service work in accordance with the general maintenance schedule

Running hours	Date	Maintenance performed	Engineer	Running hours	Date	Maintenance performed	Engineer	Running hours	Date	Maintenance performed	Engineer
100				200				300			
400				500				600			
700				800				900			
1 000				1 100				1 200			
1 300				1 400				1 500			
1 600				1 700				1 800			
1 900				2 000				2 100			
2 200				2 300				2 400			
2 500				2 600				2 700			
2 800				2 900				3 000			
3 100				3 200				3 300			
3 400				3 500				3 600			
3 700				3 800				3 900			
4 000				4 100				4 200			
4 300				4 400				4 500			
4 600				4 700				4 800			
4 900				5 000				5 100			
5 200				5 300				5 400			
5 500				5 600				5 700			
5 800				5 900				6 000			
6 100				6 200				6 300			
6 400				6 500				6 600			
6 700				6 800				6 900			
7 000				7 100				7 200			
7 300				7 400				7 500			
7 600				7 700				7 800			
7 900				8 000				8 100			
8 200				8 300				8 400			
8 500				8 600				8 700			
8 800				8 900				9 000			
9 100				9 200				9 300			
9 400				9 500				9 600			
9 700				9 800				9 900			
10 000								Start a new table from 10 100 running hours			

Spare Parts Changed (except Maintenance Parts)

Running Hours	Parts	Running Hours	Parts	Running Hours	Parts

Description of Engine



1	Water Thermostat	13	Oil Filter
2	Lifting Eye	14	Oil Drain Plug
3	Charging Alternator	15	Dipstick
4	Fan	16	Crankcase Pulley
5	V-Belt	17	Oil Filler Neck
6	Oil Sump	18	Fuel Pump
7	Flywheel	19	Water Pump
8	Starter Motor	20	Oil Filler Neck
9	Exhaust Manifold	21	Governor
10	Injector	22	Fuel Feed Pump
11	Air Inlet Housing	23	Engine Serial No.
12	Water Drain Plug	24	Fuel Filter
		25	Oil Pressure Plug

Replacing the lube oil and oil filter

Only change the oil when the engine Is at operating temperature but stationary (lubricating oil temperature of around 80 °C).

This operation is carried out when the engine is warm and stationary (around 80 °C).

- Remove the oil filler cap.

Two drain methods are available :

1st method: drain tap

- Place the free end of the flexible into a drain pan with a capacity equivalent to the oil sump, and make secure.

- Open the drain tap and let the used oil drain out completely.

2nd method: drain tap

- Place the free end of the flexible pipe into a drain pan with a capacity equivalent to the oil sump, and make secure.

- Open the drain tap if necessary with a spanner, then pump the used oil out with the hand pump until the engine oil sump is completely empty.

⚠ CAUTION

Great care must be taken when draining hot oil. Risk of scalding. Collect the used oil and avoid spillage. Used oil must be disposed in accordance with pollution recommendations.

- Slacken the oil filter cartridge with a commercially available tool and unscrew it.

- Collect any leaking oil.

- Clean the seal surface of the filter holder.

- Lightly coat the rubber seal of the new lubricating oil filter cartridge with oil.

- Retighten the cartridge by hand until the seal is in place.

- Tighten the oil filter cartridge an extra 1 turn.

- Start the engine and wait for a few moments, then check that the oil pressure is correct and that the oil filter does not leak.

- Stop the engine and check the oil level and top off with oil, if necessary.

Lubricate the couplings and grease all the mechanical couplings.

Replacing the fuel filter (Plastic see-through filter which cannot be dismantled)

- Remove the fuel inlet and outlet flexible pipes from the filter.

- Unclip the used filter then replace with a new one.

- Reinstall the flexible pipes and tighten the 2 clamps.

- Start the engine to fill the fuel filter and bleed the air if necessary at the injection pump.

- Check for any fuel leaks. The operation is then complete.

Cartridge fuel filter

- Remove the cartridge with a filter wrench and apply a small amout of fuel to the o-ring of new cartridge.

- Install new cartridge by hand. CAUTION: Do not add fuel to new cartridge.

- After replacing the cartridge, prime the fuel system.

Adjusting the valve clearance

-These operations require specialist knowledge and the use of special tools.

Checking and cleaning the injectors

- Checking the operation of an injector

A faulty injector will be indicated by engine misfire.

- To locate the faulty injector, run the engine at fast idle speed.

- Slacken then retighten in turn the high pressure pipe fitting on each injector.

- When the nut connecting the faulty injector is slackened, there will be no or little effect on engine speed.

WARNING: Keep away from fuel sprays.

How to replace an injector

- Remove the fuel leak off pipe.

- Remove the nuts connecting the high pressure pipe from the injector to the injector pump then remove the pipe. If necessary, remove the pipe clamps.

- Remove the injector assembly.

- Install a new injector assembly taking care not to block the injector.

- Reinstall the fuel leak off pipe and clamps if necessary.

- Operate the engine and check for combustion air and fuel leaks.

Checking the condition and the tension of the V-belt. Replacing the V-belt

- To check, retighten or replace V-belts, the engine must be stationary.

- Visually check the V-belt along all its surface and change it if damaged.

- In the case of new belts, check the tension after 15 running minutes and 50 running hours.

-To check the tension, remove the fan and belt guards.

- Measure the distortion obtained by pressing your finger on the longest straight part of the belt when stationary.

Tension of the belt

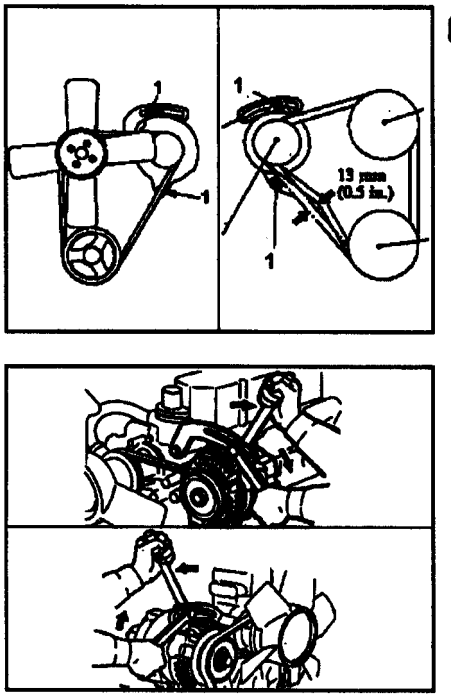
If necessary, readjust the tension of the belt and measure again.

To retighten or tighten the belt :

- Undo the charge alternator screws 1.
- Pull on the alternator until the correct belt tension is achieved.
- Retighten the alternator screws.
- Reinstall the guards.

To replace the belt

- Remove the fan and belt guards.
- Undo the charge alternator screws 1.
- Push on the alternator and remove the worn belt.
- Install a new belt and pull on the alternator until the correct tension is achieved.
- Retighten the alternator screws and check the belt tension.
- Reinstall the guards.



Checking the preheating glow plugs requires specialist knowledge and the use of special tools.

Checking the injectors requires specialist knowledge and the use of special tools.

Exhaust Muffler

- Check the pipe for leaks. Check that there are no gas leaks or deterioration of the pipe work.

- Retighten the Mountings. Check and retighten if necessary, all mountings (engine, exhaust outlet, exhaust mounting, connections, etc.).

- Check for leaks. Visually check that the tank does not leak.

Fault	Cause	Action	Fault	Cause	Action
The engine will not start	Blown fuse	Replace	Not enough Power	Oil of Incorrect viscosity	Change the oil
	Start switch faulty	Repair or replace		Air filter element clogged	Clean or replace
	Starting speed too slow	Recharge battery. Check and replace the starter motor		Fuel filter clogged	Clean or replace
	Oil of incorrect viscosity	Change the oil		Fuel injection pump clogged	Clean or replace
	Mobile parts seized	Repair		Fuel Injectors faulty	Clean or replace
	Air in the delivery system	Prime		Wrong injection timing	Adjust
	Fuel tank empty	Fill the tank		Fuel of Incorrect quality	Change the fuel
	Fuel of incorrect quality	Change the fuel		Overheat	Rinse the cooling system andreplace parts
	Fuel filter clogged	Clean or replace		Valve clearance incorrect	Adjust
	Fuel Injection pump faulty	Repair or replace		Poor compression(cylinders, piston rings, etc, worn)	Repair or replace
	Ignition control unit faulty	Replace			
	Air filter element clogged	Clean or replace			

Fault	Cause	Action	Fault	Cause	Action
Overheating	Not enough coolant in the system	Add more coolant		Air filter element clogged	Clean or replace
	Leaks in the cooling system	Retighten or repair		Valve clearance incorrect	Adjust
	Slack fan belt	Adjust		Engine overloaded	Reduce load
	Air flow obstructed in the radiator	Remove obstruction		Poor compression (cylinders, piston rings, etc, worn)	Replace or repair
	Water pump faulty	Replace	Fuel consumption too high	Fuel of incorrect quality	Change the fuel
	Fan faulty	Replace		Fuel injection pump faulty	Replace or repair
	Thermostat faulty	Replace		Fuel injectors faulty	Replace or repair
	High concentration of LLC	Adjust the LLC concentration		Wrong injection timing	Adjust
				Air filter element clogged	Clean or replace
Too much white or blue smoke	Too much oil in the engine	Do not fill above level indicated		Poor compression (cylinders, piston rings, etc, worn)	Replace or repair
	Oil viscosity too low	Change the oil	Oil consumption too high	Too much oil in the engine	Do not fill above level indicated
	Thermostat faulty (coolant temperature too low)	Replace		Oil viscosity too low	Change the oil
	Fuel injector faulty	Repair or replace		Leaks in the lubrication system	Replace or repair
	Wrong injection timing	Adjust		Cylinders and piston rings worn	Repair or replace
	Wrong fuel cetane number	Change the fuel		Valve stem seals worn	Replace
	Poor compression (cylinders, piston rings, etc, worn)	Repair or replace		Not enough oil in the engine	Add more oil
Too much black or gray smoke	Fuel of incorrect quality	Change the fuel		Oil viscosity too low	Change the oil
	Fuel injection pump faulty	Repair or replace		Oil filter clogged	Replace
	Fuel injectors faulty	Repair or replace		Oil pump faulty	Repair or replace
	Wrong injection timing	Adjust		Relief valve faulty	Repair or replace
				Pressure switch faulty	Replace

STORAGE (for prolonged shut-down)

If your generating set cannot or will not be used for more than 1 month, special measures must be taken to avoid damage.

Thoroughly clean the genset (if necessary) and check it is operational.

ENGINE

1. Drain the engine oil and put some inhibiting oil in the engine.

2. Make up a mixture of diesel fuel and inhibiting oil in equal amounts and put the mixture in the fuel tank.

3. Start the engine and let it run for 5 -10 minutes.

4. Stop the engine and spray volatile inhibitor into the air inlet opening.

5. Drain the diesel fuel-inhibiting oil mixture.

6. Apply a thin coat of inhibiting oil to the exposed machined surfaces of the engine.

7. Cover the air inlet and outlet openings and the vent tube with tape.

8.Loosen the fan belt.

9. Apply tape on the alternator lugs. Cover the starter motor and alternator. Cover the starter motor and alternator with a polyethylene sheet and insert a desiccant inside.

10. Cover the engine to protect it against weather.

NOTE

- Store the engine in a well ventilated room.

- The coolant does not need to be drained if it contains LLC.

- Put a label stating the engine is in storage and must not be started.

- New engine oil can be used instead of inhibiting oil.

ALTERNATOR

- Remove the fan guards and put some desiccant bags inside the alternator.

- Seal all openings.

STARTING BATTERY

- Disconnect the battery and store in a clean and airy site, once fully charged.

- Coat the terminals with silicone grease.

- During storage, regularly check the state of charge and recharge if necessary.

- Never store a discharged battery. Never empty the electrolyte from the battery.