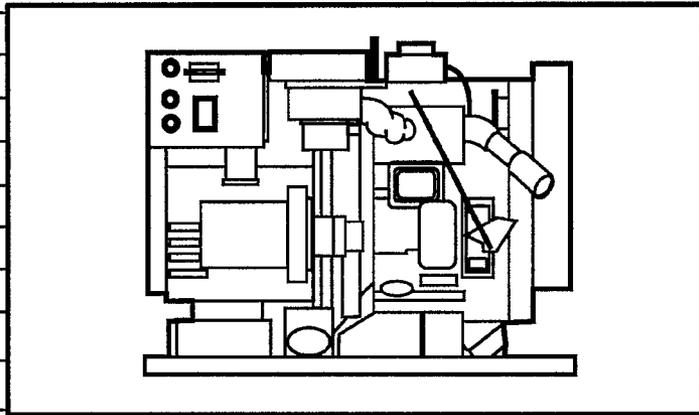
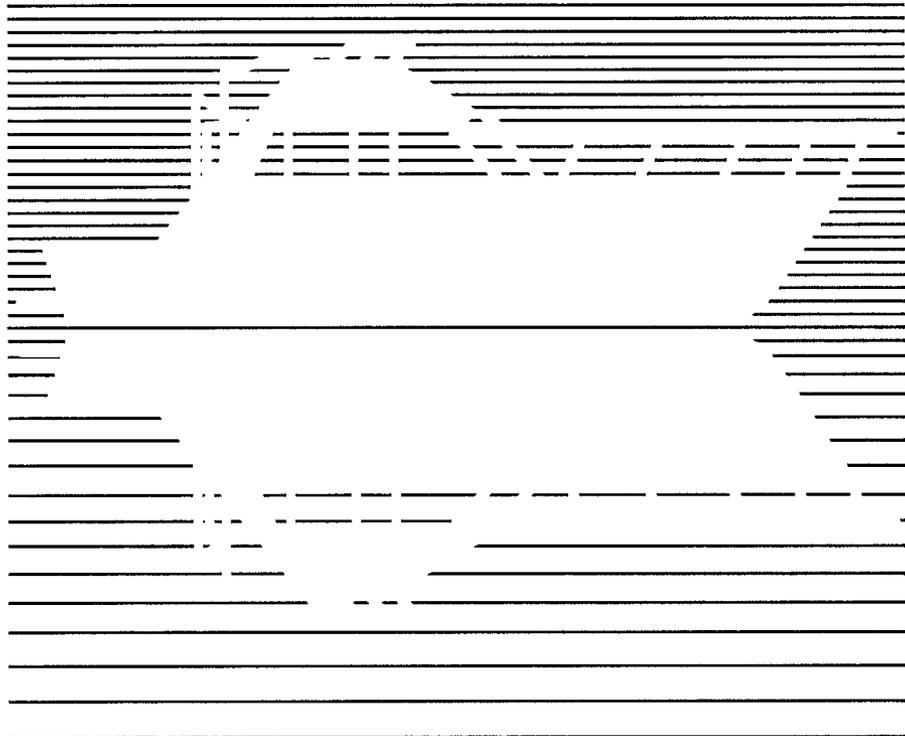


Onan

MARINE

Operator's Manual

MAJB



Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and your unit. **Safe and efficient operation can be achieved only if the unit is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

Throughout this manual you will notice symbols which alert you to potentially dangerous conditions to the operator, service personnel, or the equipment itself.

▲ DANGER *This symbol warns of immediate hazards which will result in severe personal injury or death.*

▲ WARNING *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

▲ CAUTION *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC. Fire, explosion, and personal injury can result from improper practices.

- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Do not fill fuel tanks with the engine running. Do not smoke around the generator set area. Wipe up any oil or gas spills. Do not leave oily rags in engine compartment or on the generator set. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip the engine fuel supply with a positive fuel shutoff.
- Always disconnect the battery ground (–) lead first and reconnect it last. Make sure you connect the battery correctly. A direct short across the battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is very explosive.
- Keep a fire extinguisher available in or near the engine compartment and in other areas throughout the vessel. Use the correct extinguisher for the area. For most types of fires, an extinguisher rated ABC by the NFPA is available and suitable for use on all types of fires except alcohol.

EXHAUST GASES ARE DEADLY

- Provide adequate ventilation. Equip the bilge with a power exhauster.
- Be sure propulsion and generator set engine exhaust systems are free of leaks. Perform thorough, periodic inspections of the exhaust system and repair leaks immediately. Exhaust gases are deadly.
- Never sleep in the vessel with the generator set running unless the vessel is equipped with an operating carbon monoxide detector.

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

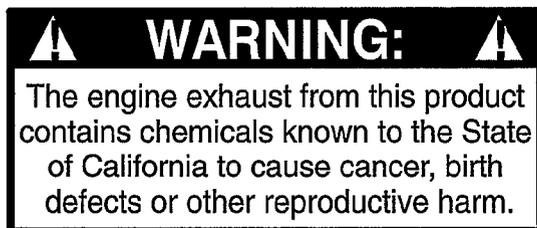
- Do not remove any belt guards or covers with the generator set running.
- Keep hands and loose clothing away from moving parts. Do not wear jewelry while servicing any part of the generator set.
- Never step on the generator set (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions... from leaking fuel, leaking exhaust fumes, etc.
- Before performing any maintenance on the generator set, disconnect its batteries to prevent accidental starting. Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the generator set compartment or bilge thoroughly with the power exhauster.

ELECTRICAL SHOCK WILL CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not make adjustments in the control panel or on engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel standing on dry surfaces to reduce shock hazard.
- **DO NOT CONNECT THE GENERATOR SET TO THE PUBLIC UTILITY OR TO ANY OTHER ELECTRICAL POWER SYSTEM.** Electrocution or damage to property can occur at a site remote from the boat where line or equipment repairs are being made if the set is connected to the power system. An approved transfer switch must be used if more than one power source is to be made available to service the boat.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

Table of Contents

SECTION	TITLE	PAGE
	SAFETY PRECAUTIONS	Inside Front Cover
1	INTRODUCTION	1-1
	About this Manual	1-1
	How to Obtain Service	1-1
2	SPECIFICATIONS	2-1
	Generator Details	2-1
	Engine Details	2-1
3	OPERATION	3-1
	General	3-1
	Pre-Start Checks	3-1
	Control Panel	3-2
	Starting	3-3
	Stopping	3-3
	Operating Recommendations	3-3
	Troubleshooting	3-4
4	MAINTENANCE	4-1
	General	4-1
	Periodic Maintenance Schedule	4-1
	Generator Set Inspection	4-2
	Lubrication System	4-2
	Cooling System	4-3
	Fuel System	4-6
	Spark Plugs	4-7
	Governor Linkage	4-7
	Battery	4-7
	AC Generator	4-8
	Out-Of-Service Protection	4-9



Section 1. Introduction

ABOUT THIS MANUAL

This manual provides information for operating and maintaining the genset. Study this manual carefully and observe all warnings and cautions. Using the genset properly and following a regular maintenance schedule will contribute to longer unit life, better performance, and safer operation.

HOW TO OBTAIN SERVICE

When the genset requires service, contact an Onan distributor or service center for assistance. Onan factory trained parts and service representatives are ready to handle your service needs.

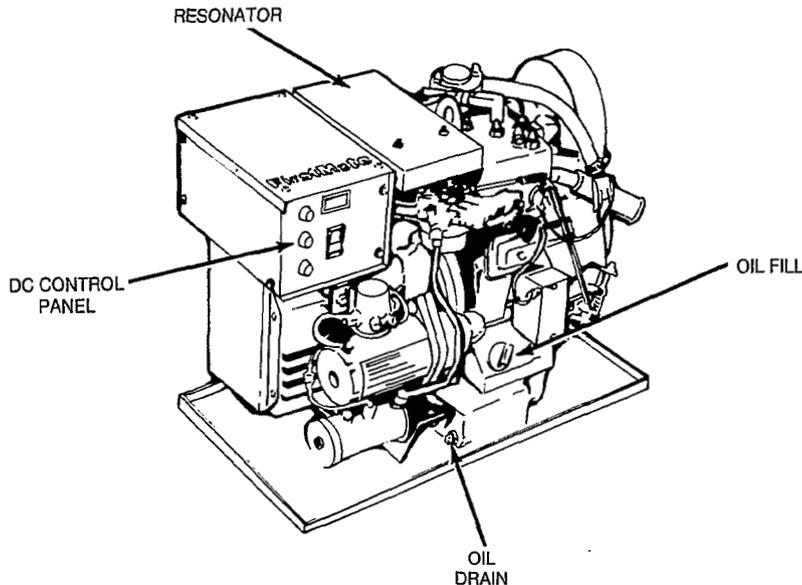
When calling for service or parts, always supply the complete Model and Serial number shown on the Onan nameplate, Figure 1-1. The nameplate is on the side of the control box, Figure 1-2.

Onan		
Model and Spec No.		
Serial No.		
Important Always give above no.'s when ordering parts		
AC Volts	Ph	
KVA	kW	
PF	Amps	Hz
DCV	Amps	Watts
RPM	Bat.	
Time Rating		
For Elec Eqpt Only		
Insulation - NEMA Class F Amb 40°C		
Onan Corp Minneapolis Mn 55432 USA Made in USA 99 0873		

FIGURE 1-1. ONAN NAMEPLATE

▲WARNING

INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.



LS-1144-2

FIGURE 1-2. ONAN MAJB MARINE GENSET

Section 2. Specifications

GENERATOR DETAILS

Type	Onan, Revolving Field, 2-Pole
Standby Rating:	
60 Hertz, 3.0 MAJB	3.0 kW, (3.0 kVA @ 1.0 PF)
50 Hertz, 2.5 MAJB	2.5 kW, (2.5 kVA @ 1.0 PF)
Frequency Regulation:	
60 Hertz, 3.0 MAJB	3 Hertz (5%)
50 Hertz, 2.5 MAJB	2.5 Hertz (5%)
Voltage Regulation:	
60 Hertz, 3.0 MAJB	8% Max. Over 5% Frequency Range
50 Hertz, 2.5 MAJB	8% Max. Over 5% Frequency Range
Battery Charge Output	0.1 to 1.0 Amps

ENGINE DETAILS

Engine Type	Onan, 4 Cycle, Single Cylinder
Engine Speed (r/min)	3600/3000
Fuel	Unleaded Gasoline, 88 Octane
Fuel Consumption, Average @ Full Load:	
60 Hertz, 3.0 MAJB	0.81 gph (3.17 Lph)
50 Hertz, 2.5 MAJB	0.76 gph (2.98 Lph)
Battery Requirements:	
Voltage	12
Minimum Cold Cranking Amps @ 0°F (-18°C)	360
Oil Capacity	2 quarts (1.9 L)
Spark Plug Gap	0.025 in. (0.64 mm)
Spark Plug Torque Spec	11 Ft/Lbs (15 N•m)

Section 2. Specifications

GENERATOR DETAILS

Type	Onan, Revolving Field, 2-Pole
Standby Rating:	
60 Hertz, 3.0 MAJB	3.0 kW, (3.0 kVA @ 1.0 PF)
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60 Hertz, 3.0 MAJB	3 Hertz (5%)
50 Hertz, 2.5 MAJB	2.5 Hertz (5%)
Voltage Regulation:	
60 Hertz, 3.0 MAJB	8% Max. Over 5% Frequency Range
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Spark Plug Gap	0.025 in. (0.64 mm)
Spark Plug Torque Spec	11 Ft/Lbs (15 N•m)

Section 3. Operation

⚠ WARNING

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- **Dizziness**
- **Nausea**
- **Headache**
- **Weakness and Sleepiness**
- **Throbbing in Temples**
- **Muscular Twitching**
- **Vomiting**
- **Inability to Think Coherently**

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Never sleep in the vessel with the generator set running unless the vessel interior is equipped with an operating carbon monoxide detector. Protection against carbon monoxide inhalation also includes proper exhaust system installation and visual and audible inspection of the complete exhaust system at the start of each generator set operation.

1-M

GENERAL

This section covers starting, stopping, and operation of the genset. It is essential that the operator be completely familiar with the genset for safe operation. Read through this entire section before attempting operation.

PRE-START CHECKS

Before starting the genset, be sure the following checks have been made and the unit is ready for operation. Refer to the *Maintenance* section for the proper service procedures when needed.

Lubrication

Check the engine oil level. Keep the oil level as close to 1/4 inch (6 mm) of the oil fill opening as possible. Do not overfill.

Fuel

Make sure the fuel tanks are full and the service shut-off valve is open.

Exhaust

Make sure exhaust system components are tightly connected and not corroded.

Sea Water Pump Priming

Before beginning operation (initial start-up) the sea water pump should be primed. Operation with a dry pump causes excessive wear of the impeller blades. Priming water prevents dry operation of the neoprene impeller until sea water (flotation water) is pulled into the pump.

To prime the pump, close the sea cock and remove the hose from the water strainer outlet. Fill the hose and pump with clean water. Replace the hose, then open the sea cock. Check for pump operation on start-up by observing water discharge from the hull exhaust outlet.

If water is not available for cooling the exhaust gases, the exhaust system components become exposed to high temperatures. The high exhaust temperature shut-down switch will cause genset shutdown; however, some exhaust system components can be damaged by high temperature. Onan recommends that if sea water is lost, even for a short time, that the flexible exhaust hose near the genset be replaced. Also replace any other components showing evidence of damage. The entire exhaust system must be examined and tested to avoid potential leaks.

▲WARNING *Inhalation of exhaust gas can cause severe personal injury or death. In the event of sea water loss to the genset, the flexible exhaust hose near the generator set must be replaced, and any other components showing damage must also be replaced. The entire exhaust system must be examined and tested to avoid any potential exhaust leaks.*

CONTROL PANEL

The following describes function and operation of components found on the control panel, Figure 3-1.

Start-Stop Switch

This switch starts and stops the genset.

Running Time Meter

Registers total number of hours that the unit has run. Useful for determining need for periodic maintenance procedures. Time is cumulative and cannot be reset.

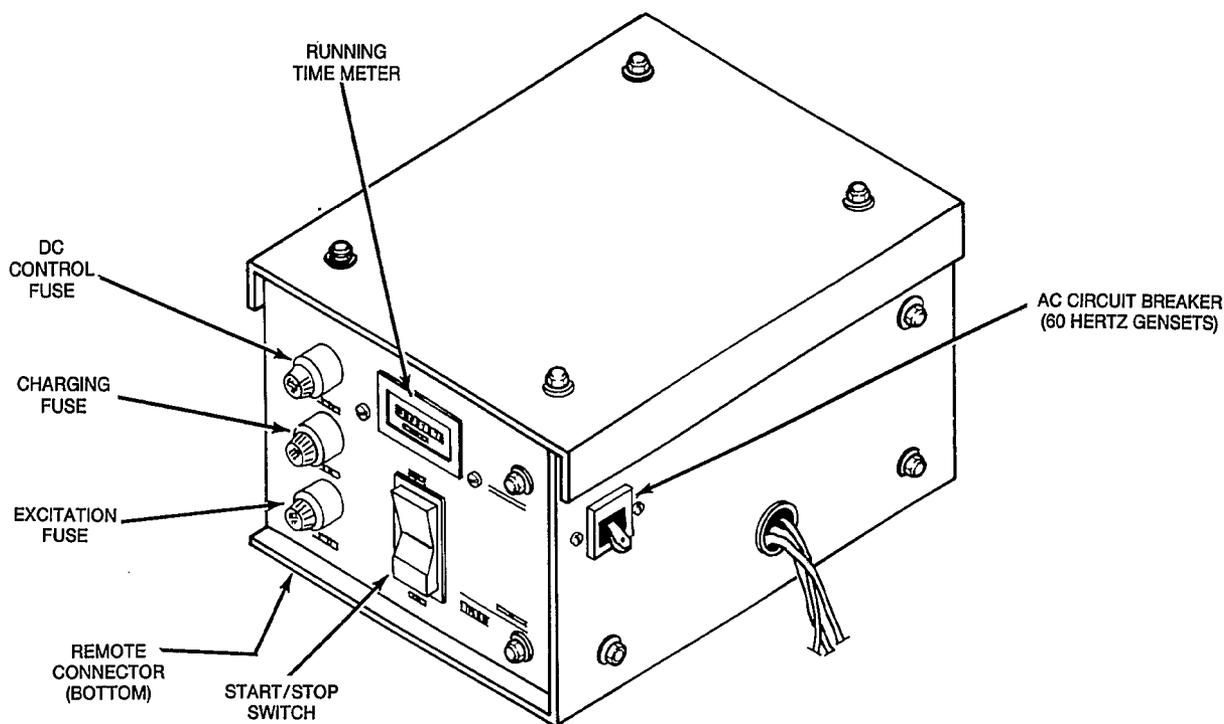
Fuses and Circuit Breaker

DC Control Fuse: A 10 ampere fuse providing protection to the control box wiring and remote wiring from short circuits or overload.

Excitation Fuse: A 10 ampere fuse providing generator exciter protection.

Charging Fuse: A 10 ampere fuse providing charging circuit protection.

Line Circuit Breaker: Protects the generator from a line short circuit or overload. It is mounted on the side of the control box. Replacements must meet ABYC specifications for proper protection.



M-1786-1

FIGURE 3-1. CONTROL BOX AND PANEL

STARTING

This section covers starting of the genset at the control panel or the remote panel (when used). The same procedure applies for both locations.

▲WARNING *Gasoline vapors can cause an explosion and fire resulting in severe personal injury or death. Before starting the generator set, operate the bilge blower for a minimum of 4 minutes. If fuel fumes are present, locate the source and correct prior to generator set operation.*

Use the following steps for starting the genset.

1. Operate the bilge blowers for a minimum of four minutes prior to starting.
2. Holding the Start/Stop switch in the Start position activates the engine control and starting system. The starter will crank and after a few seconds the engine should start. The starter automatically disconnects when generator AC voltage builds up.

Premature release of the Start switch at low engine speed can result in no start. If this occurs, hold the switch closed longer to allow speed increase and the start/disconnect circuit to function.

▲CAUTION *Excessive cranking can overheat and damage the starter. Do not engage starter for periods longer than 30 seconds without allowing two minutes for the starter to cool.*

▲CAUTION *Water in the engine combustion area can cause engine damage. When a marine hydrodynamic muffler is used, excessive engine cranking without starting can fill the muffler with water and back this water into the engine. If cranking is longer than two to three minutes, check the exhaust system for excess water and drain prior to repeated starting attempts.*

3. If the engine does not start after cranking 30 seconds, release the start switch. Wait two minutes before trying to start again.
4. If the engine does not start on the second try, check the fuel supply. Be sure the fuel valves are open.

STOPPING

Before Stopping

Run the genset at no load for three to five minutes before stopping. This allows the engine lubricating oil and cooling system to carry heat away from the combustion chamber and bearings.

▲CAUTION *Failure to allow running time for engine to cool without load can result in engine damage. Make sure generator set runs unloaded for at least three minutes.*

Stopping

Press the Stop position of the Start/Stop switch at either the remote station or genset control panel.

OPERATING RECOMMENDATIONS

Break-In

For new or reconditioned gensets, operate at 1/2 load for the first half hour and at 3/4 load for the second half hour. Then run the genset as close to full load as possible for normal applications.

This method of load application speeds piston ring seating. Continuous running at light load during the first few hundred hours usually results in poor ring seating and higher oil consumption.

Drain and replace the crankcase oil after the first 35 hours of operation on new or reconditioned gensets. Refer to the Maintenance section of this manual for the recommended procedures.

No-Load Operation

Before shutdown, run the generator set 3 to 5 minutes without load. However, avoid longer periods of no-load operation if possible. No-load operation allows combustion chamber temperatures to drop so low that the fuel does not burn completely. This results in carbon deposits which can cause piston rings and valves to stick.

Exercise Period

Infrequent generator set use can result in hard starting. Exercise the generator set at least once a month for a minimum of 30 minutes. Run the set with load applied to allow the engine to reach normal operating temperature. Exercising will keep the engine parts lubricated and maintain fuel prime. Top off the fuel tank after each exercise period. Use a gasoline stabilizer if fuel in the tank will not be used entirely within two months. Your Onan dealer or distributor has a product available for this purpose.

TROUBLESHOOTING

DC Control

The engine has a number of sensors that continuously monitor it for abnormal conditions such as low oil pressure, high engine temperature and high exhaust temperature. If any one of these conditions occur, the genset shuts down. See Figure 3-2.

The following sections describe operation of the fault systems and suggested items the operator can check. If a major problem is indicated, contact an Onan dealer or distributor for help or service.

Low Oil Pressure: Check the oil level. If low, add oil to bring level up to 1/4 inch (6 mm) from the fill opening. Do not overfill. Inspect engine exterior for leaks and repair as necessary. The oil pressure switch grounds the ignition circuit if pressure drops below 8 to 10 psi (55 to 69 kPa), and causes genset shutdown.

High Engine Temperature: The thermostat switch closes at engine temperatures over 200° F (93° C) and grounds the ignition circuit to cause genset shutdown.

Check condition and tightness of the sea water pump belt. Sea water flow at the hull exhaust outlet for a new pump should be about 1.8 gal/min (6.8 L/min) for 60 hertz gensets, and 1.5 gal/min (5.7 L/min) for 50 hertz gensets. Also check cooling system for freedom of contaminants, rust and sludge build-up, etc. The flow of older pumps can be as low as 1.2 gal/min (4.5 L/min) without affecting genset operation, except that the water lifting capacity is reduced.

High Exhaust Temperature: The high exhaust temperature switch is mounted on the exhaust manifold and closes on temperature rise above 190° F (88° C). When the switch closes, it grounds the ignition circuit causing genset shutdown. It will open again when the temperature drops to about 165° F (74° C).

High exhaust manifold temperature is caused by failure of the sea water cooling system. Failure can be caused by a defective sea water pump, drive belt, plugged inlet filter, or a closed water valve. Sea water flow at the exhaust outlet should be as referenced in the High Engine Temperature text. Whenever a shutdown occurs, a thorough inspection of the complete exhaust system must be made by an experienced service person.

⚠ WARNING *Inhalation of exhaust gases can cause severe personal injury or death. Thoroughly inspect the exhaust system after a shutdown. Do not disconnect or bypass the exhaust manifold switch. Excessive heat can damage exhaust hoses and allow exhaust gas to escape.*

AC Control

Circuit Breaker: The AC line circuit breaker, furnished on 60 hertz gensets, is mounted on the side of the AC control box as shown in Figure 3-1. It opens the load circuit if a short or overload occurs.

The 50 hertz gensets must have a separate two-pole breaker sized according to the voltage output connections. The breaker is not furnished with the genset.

Excitation Fuse: This fuse protects the wiring from a shorted exciter.

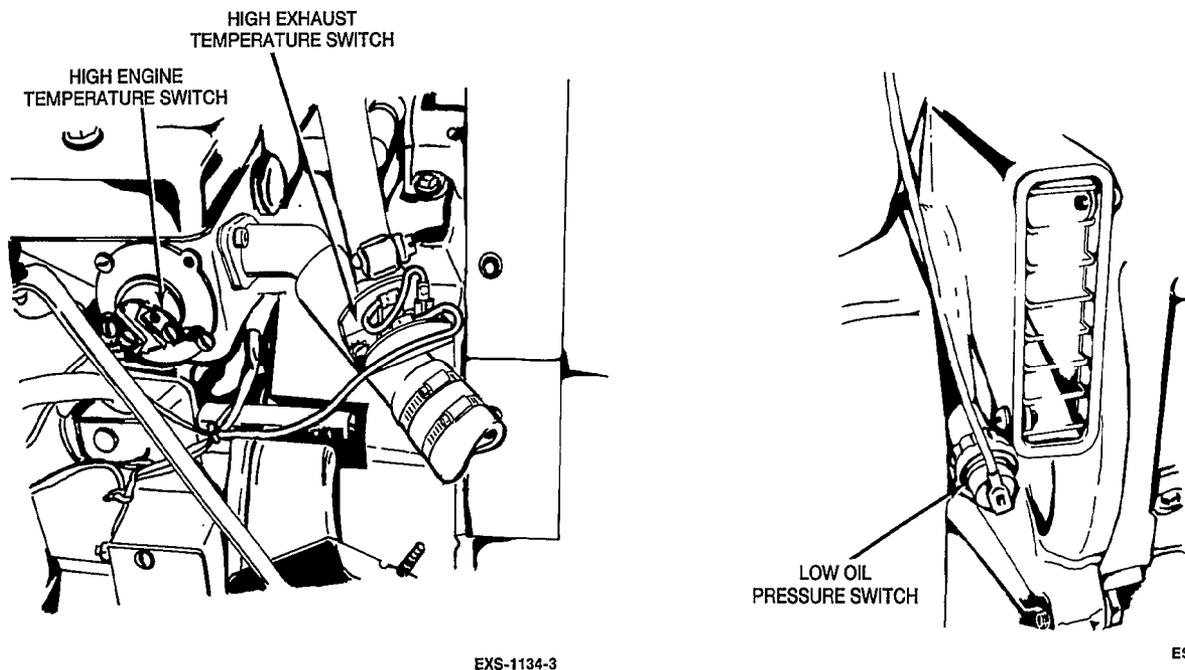


FIGURE 3-2. FAULT SENSOR LOCATION

Section 4. Maintenance

GENERAL

Establish and adhere to a definite schedule for maintenance and service. If the genset will be subjected to extreme operation conditions, the service intervals should be reduced accordingly. The authorized Onan Distributor or Service Facility will help determine a suitable schedule of maintenance if necessary.

Use the running time meter to keep a log of all service performed for warranty support. Perform service at the time period or after the number of operating hours shown, whichever comes first. Use the schedule to determine the maintenance required, then refer to the sections that follow for the correct service procedures.

⚠ WARNING Leakage of fuel in or around the generator set compartment presents a hazard of fire or explosion that can cause severe personal injury or death. Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the compartment thoroughly with the bilge blowers or power exhausters.

⚠ WARNING Accidental starting of the generator set can cause severe personal injury or death. Stop the generator set and disable by disconnecting the starting battery cables (negative [-] cable first) when maintenance or repairs are made to the engine, controls, or generator.

PERIODIC MAINTENANCE SCHEDULE

SERVICE THESE ITEMS	SERVICE TIME				
	DAILY OR AFTER 8 HOURS	MONTHLY OR AFTER 100 HOURS	6 MONTHS OR AFTER 250 HOURS	YEARLY OR AFTER 500 HOURS	P A G E
Inspect Genset, Exhaust System	x ¹				4-2
Check Fuel System	x				4-2
Check Oil Level	x				4-3
Check Cooling System	x				4-3
Check Battery		x			4-7
Clean Governor Linkage		x			4-7
Change Crankcase Oil		x ^{2,3}			4-3
Inspect and Adjust Spark Plug		x ⁴			4-7
Clean Crankcase Breather			x		4-3
Check Drive Belt Tension			x ⁵		4-4
Check Cooling System			x		4-3
Clean/Replace Fuel Pump Filter				x	4-6
Clean Generator, Check Brushes				x	4-8
Check Breaker Points				x ⁶	
Check Valve Lash Clearance				x ⁶	

¹ - Check for oil, fuel, cooling and exhaust system leaks. Check exhaust system audibly and visually with the set running. Shut down set and repair any leaks immediately.

² - Perform after first 35 hours of operation.

³ - Perform more often if operation is in dusty conditions.

⁴ - Replace after 250 hours.

⁵ - Visually check belt for evidence of slippage.

⁶ - Have the Onan service center perform.

GENERATOR SET INSPECTION

During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. The following sections cover several areas that should be frequently inspected for continued safe operation.

Exhaust System

With the generator set operating, inspect the entire exhaust system including the exhaust manifold, flexible hose, muffler and exhaust pipe. Check the sea water pump operation by observing sea water discharge from the exhaust outlet. For a new pump it should be approximately 1.8 gal/min (6.8 litre/min) for 60 hertz gensets; and 1.5 gal/min (5.7 L/min) for 50 hertz gensets. Visually and audibly check for leaks at all connections, welds, gaskets, and joints. If any leaks are detected, shut down the generator set and have them corrected immediately.

▲WARNING *Inhalation of exhaust gases can result in severe personal injury or death. Inspect exhaust system audibly and visually for leaks daily. Shut down the generator set and repair any leaks immediately.*

Fuel System

With the generator set operating, inspect the fuel supply lines, fuel pump, carburetor and fittings for leaks. Check flexible sections for cuts, cracks and abrasions and make sure they are not rubbing against anything that could cause breakage.

▲WARNING *Fuel leakage will create a fire hazard which can result in severe personal injury or death if ignited. Have any leaks corrected immediately.*

▲WARNING *Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, spark, pilot light, or other ignition source near the fuel system.*

DC Electrical System

With the generator set off, check the battery terminals for clean and tight connections. Loose or corroded connections create resistance which can hinder starting. Clean and reconnect the battery cables if corroded or loose. Remove the negative (-) battery cable first and reconnect last. This prevents arcing if a tool accidentally touches the frame or other grounded metal parts while on the positive (+) battery terminal.

▲WARNING *Ignition of explosive battery gases can cause severe personal injury. Do not smoke or allow any flame or spark near the battery while servicing.*

Mechanical

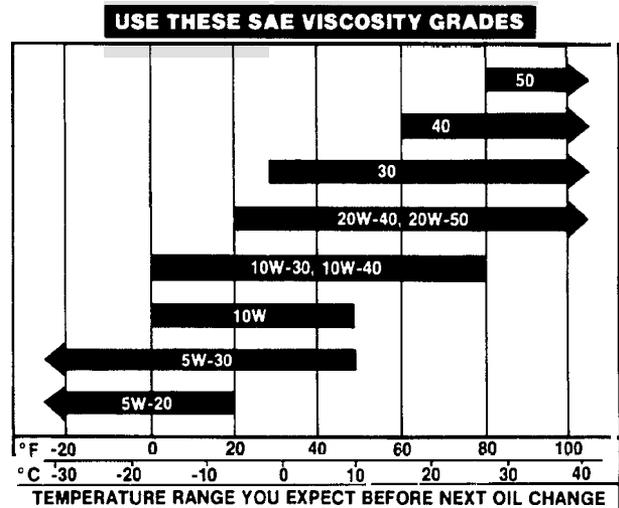
With the generator set stopped, check for a loose belt, fittings, leaking gaskets and hoses, or any signs of mechanical damage. If any problems are found, have them corrected immediately. Check the governor linkage for dust and dirt accumulation and clean if necessary. With the set running, listen for unusual noises that may indicate mechanical problems. Investigate anything that indicates a mechanical malfunction.

LUBRICATION SYSTEM

The engine oil was drained from the crankcase prior to shipment. Before the initial start, the lubrication system must be filled with oil of the recommended classification and viscosity. Fill crankcase to within ¼ inch (6 mm) of the fill opening with a good quality oil (see Oil Recommendations section).

Oil Recommendations

Use oils with the American Petroleum Institute classification SG/CE (minimum SE/CC) in viscosities per temperature as shown in the chart below. Other classification oils can be used, but they should be minimum SE/CC.



C-1116

When selecting oil viscosity, pick the viscosity that is right for the lowest temperature expected. Oil that is thick may result in a lack of lubrication when the engine is started. Use a lower viscosity oil as the temperature reaches the lower end of the scale.

Do not use synthetic oil or non-detergent oil; and do not mix oil brands or grades because they may not be compatible.

Engine Oil Level

Check the engine oil level during engine shut-down periods at intervals specified in the *Periodic Maintenance Schedule*. The oil fill cap is located on the engine base (Figure 4-1). The oil level is correct when 1/4 inch (6 mm) from the fill opening. For an accurate fill, shut off the engine and wait about 10 minutes before checking the level. This allows oil in the upper portion of the engine to drain back into the crankcase.

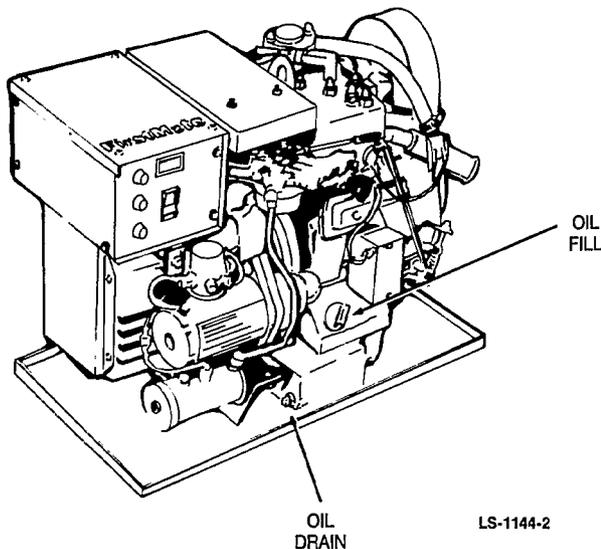


FIGURE 4-1. OIL DRAIN AND FILL LOCATION

Add oil in the fill opening of the same quality and brand when necessary.

CAUTION *Improper oil level can cause engine damage. Overfilling can cause foaming or aeration of the oil, and operation with low oil level can cause loss of oil pressure.*

Oil Change

Change the oil at the intervals recommended in the *Periodic Maintenance Schedule*. Use oil that meets the API classification and viscosity requirements as shown in the *Oil Recommendations* section.

WARNING *Hot crankcase oil can cause burns if splashed or spilled on the skin. Keep hands clear and wear protective clothing when draining the oil.*

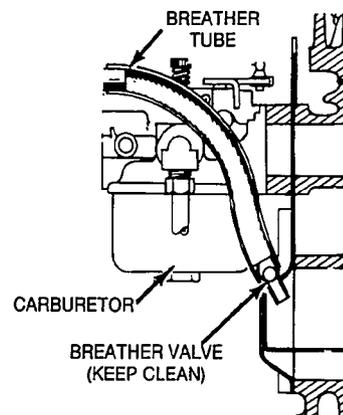
WARNING *Contact with used engine oil can cause cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.*

Run the engine until thoroughly warm before draining the oil. Stop the engine, remove the drain plug (Figure 4-1) and collect the oil in a container. When completely drained, replace the plug and refill crankcase with oil of the correct API classification and appropriate SAE viscosity.

Crankcase Breather Valve

The genset is equipped with a ball check valve for maintaining crankcase vacuum. The only maintenance required is periodic cleaning of the components. Remove the breather hose, breather cap and valve assembly. Wash the cap and valve assembly with a commercial cleaning solvent and reinstall. See Figure 4-2. Most petroleum-based solvents are flammable and must be handled with extreme care. Follow the manufacturer's recommendations.

WARNING *Ignition of flammable cleaning solvent can cause severe personal injury or death. Use only in a well ventilated area, and do not smoke or allow any flame or spark near the solvent.*



FS-1688

FIGURE 4-2. CRANKCASE BREATHER VALVE

COOLING SYSTEM

General

The cooling system works efficiently only when it is clean. Build up of scale and rust will restrict water flow and slow heat absorption. Scale and rust build-up occurs mostly during off season storage when it is necessary to drain the engine cooling system.

Back-flushing the cooling system will help remove loose scale and rust. Scale and rust may be observed after removing the thermostat, or if necessary, the cylinder head. If scale build-up is bad and is causing overheating, the cooling system may require cleaning by a specialty shop having the proper tools and chemicals.

Sea Water Pump

Malfunction of the sea water pump is usually caused by failure of the neoprene impeller. Due to continuous flexing, the impeller deteriorates with time and must be replaced. Early failure of the impeller is usually caused by operation in water of high silt concentration. The pump is shown partially disassembled in Figure 4-3. A new pump should discharge a nominal 1.8 gal/min (6.8 L/min) on 60 hertz gensets, and 1.5 gal/min (5.7 L/min) on 50 hertz gensets.

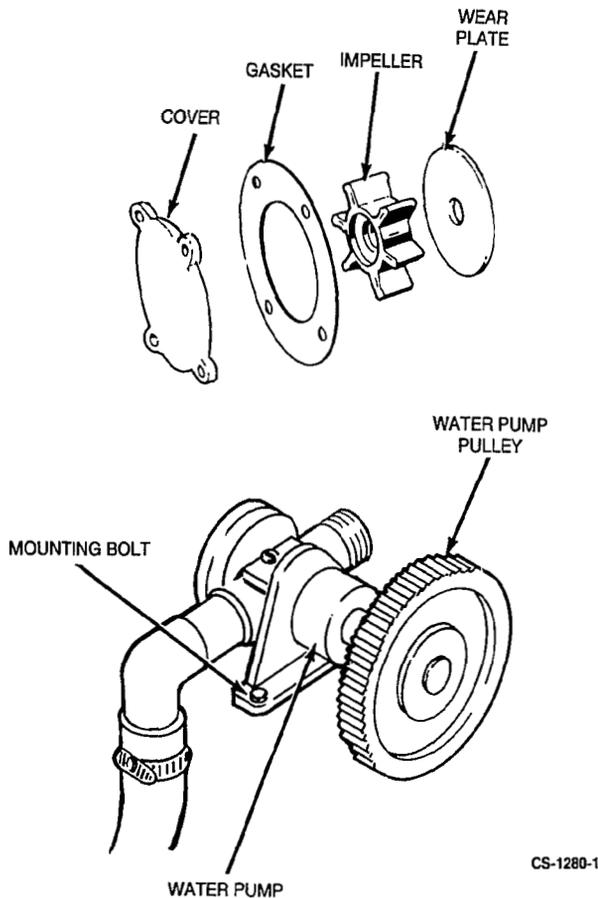


FIGURE 4-3. SEA WATER PUMP

Remove the cover from the water pump and check the end surface of the impeller. Pock marks are a sign of air entering the cooling system, possibly through a leaky connection. Air reduces pump lubrication and causes overheating. Replace the impeller if this condition exists, and check the plumbing for air leaks.

When installing the pump cover, coat the inside with grease for proper pump lubrication during initial operation. Make sure the installed cover is air tight and torque the screws 15 to 17 inch pounds (1.70 to 1.92 N•m).

If the generator set has not operated for an extended period of time, the water pump can lose prime. Operation with a dry pump causes excess wear of the impeller blades. Although a total loss of prime rarely occurs, a good practice after seasonal inactivity is to prime the pump.

Pump Belt

Incorrect belt tension can result in slippage or a broken belt. This will cause engine overheating due to reduced water flow.

Access to the belt is made by removing the belt guard. Before doing so, be sure the generator set is disabled by removing the battery cables. Do not operate the genset without the belt guard in place.

▲WARNING *Accidental starting of the generator set can cause severe personal injury or death. Stop the generator set and disable by disconnecting the starting battery cables (negative [-] cable first) when maintenance or repairs are made to the engine, controls, or generator.*

To adjust belt tension, loosen the sea water pump mounting bolts and slide the pump along bolt slots. A force of 4 ounces (113 gm) applied between the pump pulley and the engine pulley should deflect the belt about 1/8 inch (3 mm). Be sure to tighten the mounting bolts when tension is correct.

Thermostat

The cooling system temperature is controlled by a thermostat. It is housed under a cover on top of the cylinder head as shown in Figure 4-4.

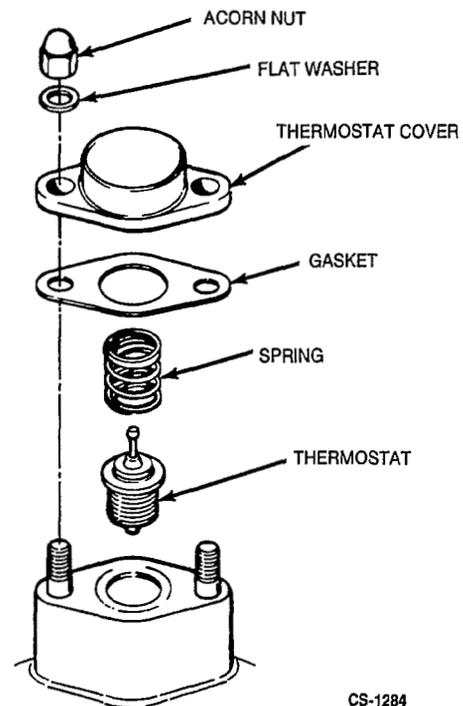
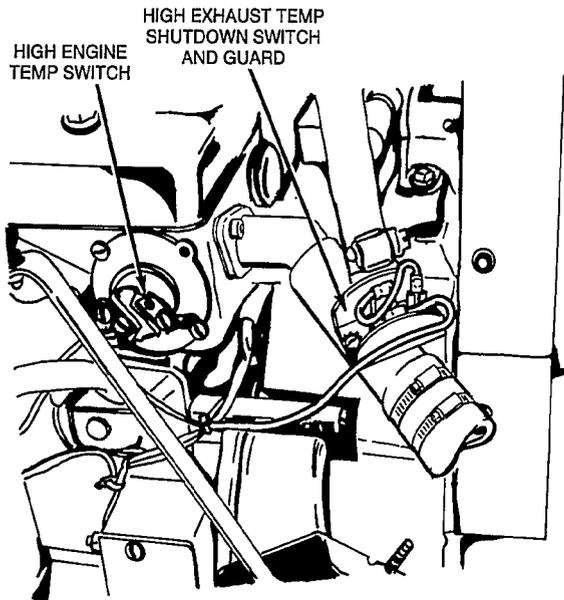


FIGURE 4-4. THERMOSTAT

Replace the thermostat if corroded, damaged, or operates improperly. Opening and closing can be checked by placing the thermostat and a thermometer in a water bath. Heating the water should start opening the thermostat at 145° F (63° C), and be fully open at 165° F (74° C). It should close immediately when removed from the hot water. Clean the mounting surfaces and insert a new gasket when replacing the thermostat.

High Engine Temperature Switch

This switch is mounted on the front of the cylinder head as shown in Figure 4-5. It senses water temperature in the cooling jacket and opens the ignition circuit if temperature reaches about 200° F (93° C). The switch closes again when water temperature drops below about 160° F (71° C).



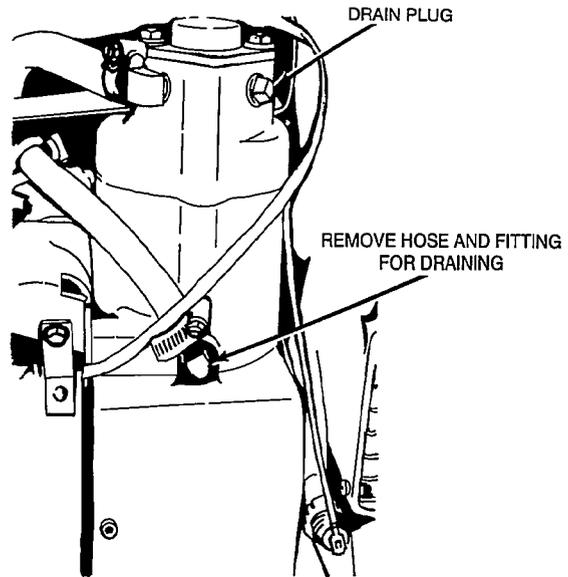
EXS-1134-3

FIGURE 4-5. HIGH EXHAUST TEMPERATURE SWITCH

Water Drain Locations

Figure 4-6 shows the location of drain plug and hose fitting that should be removed for flushing the cooling system. Flushing is recommended at least once a year.

See Out-Of-Service Protection section for storage and freeze protection. The sea water pump can be drained by loosening or removing the end cover on the pump.

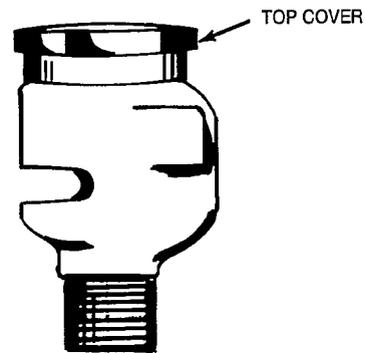


CS-1283

FIGURE 4-6. WATER DRAINS

Siphon Break

A siphon break is installed on generator sets if the engine exhaust/water injection manifold is at or below the load water line. See Figure 4-7. When properly installed, it helps prevent sea water siphoning into the engine and compartment when the generator set is shut down.



EXS-1156

FIGURE 4-7. SIPHON BREAK VALVE

The siphon break valve is normally trouble free. However, when used in contaminated waters or salt water for example, some corrosion may appear. The valve can be checked for free movement after unscrewing the top cover. If the valve sticks or the seat shows wear, the valve must be replaced.

FUEL SYSTEM

Fuel Requirements

Use only good quality fuel obtained from a reputable supplier. The quality of the fuel used is important in obtaining dependable performance and satisfactory engine life. Use clean, fresh, unleaded gasoline. Using unleaded fuel results in reduced valve and carbon clean-out maintenance. Do not use leaded fuels or fuels containing alcohol additives.

If the use of unleaded gasoline is desired, use leaded regular gasoline for the first 25 hours to allow the rings to seat well for best performance. Then use unleaded gasoline thereafter.

▲WARNING *Fuel hose rupture can cause severe personal injury or death by fire or explosion. Alcohol additives in some fuel can permeate fuel hoses and cause swelling and deterioration. Check fuel hoses for deterioration and replace any defective hose immediately.*

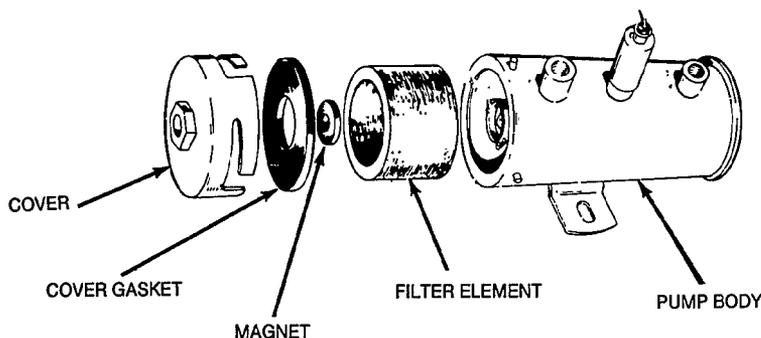
Fuel Handling Precaution

Prevent the entrance of dirt, water, or other contaminants into the fuel system. Filter or strain the fuel as the tank is being filled.

Fuel Filter

An electric fuel pump is used on this genset as shown in Figure 4-8. Service to the pump is limited to cleaning or replacing the filter element and gasket. Drain the fuel pump and check the filter element every 500 hours. Turn the hex nut on the base of the pump to release the cover from the bayonet fittings. If the element is dirty wash it in a suitable solvent. Be sure to replace the gasket when reassembling.

▲WARNING *Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, spark, pilot light, or other ignition source near the fuel system.*



ES-1075

FIGURE 4-8. ELECTRIC FUEL PUMP FILTER

SPARK PLUGS

Remove and inspect/replace the spark plug at the intervals recommended in the *Periodic Maintenance Schedule*. A careful examination of the plug can often pin-point the source of an engine problem. The following covers some common spark plug conditions and the probable cause.

- **Plug Carbon Fouled:** Check for low engine cylinder compression.
- **Black Soot Deposits:** Check for faulty choke operation, overly rich fuel mixture, or restricted air intake.
- **Oil Fouled:** Check for faulty crankcase breather hose, worn rings, or worn valve guides.
- **Burned or Overheated:** Check for a leaking intake manifold gasket, lean fuel mixture, or incorrect ignition timing. Be sure the plug has correct heat range.
- **Chipped Insulator:** Check for advanced timing. Bend the side electrode only when setting plug gap.
- **Splash Fouled:** Check for accumulated combustion chamber deposits.
- **Light Tan or Grey Deposits:** Normal plug color.

The spark plug should be replaced at regular intervals. Replace plug with the same type as listed in the Onan Parts Manual. Check and adjust plug gap to 0.025 inch (0.64 mm). See Figure 4-9.



SPARK PLUG GAP
0.025 IN. (0.64 mm)

ES-1590

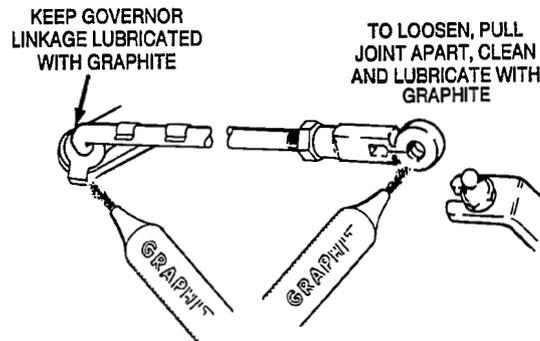
FIGURE 4-9. CHECKING SPARK PLUG GAP

Installation: A 13/16-inch hexagon spark plug socket is required to remove or install the plug. Before removing the plug, blow any dirt from the port area to prevent it from getting into the combustion chamber.

Clean the plug contact surface on the head with a clean cloth before inserting the plug. Torque the spark plug to 11 foot pounds (15 N•m). Correct torque can be had only if the threads are clean.

GOVERNOR LINKAGE

The linkage must be able to move freely through its entire travel. Clean and lubricate the joints with dry graphite every 100 hours of operation as shown in Figure 4-10. Also inspect the linkage for binding, excessive slack and wear.



M-1782

FIGURE 4-10. GOVERNOR LINKAGE

BATTERY

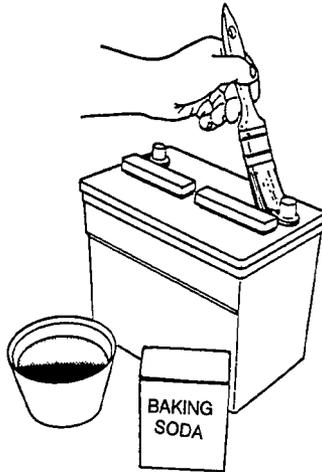
Check condition of the starting battery at the interval specified in the *Periodic Maintenance Schedule*. Always disconnect the battery before working on any part of the electrical system or engine. Disregard the sections *Checking Specific Gravity and Checking Electrolyte Level* when using a maintenance free battery.

⚠ WARNING Leakage of fuel in or around the generator set compartment presents a hazard of fire or explosion that can cause severe personal injury or death. Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the compartment thoroughly with the bilge blowers or power exhausters.

⚠ WARNING Ignition of explosive battery gases can cause severe personal injury. Do not smoke. Wear goggles and protective, rubber gloves and apron when servicing battery.

Cleaning Battery

Keep the battery clean by wiping it with a damp cloth when dirt appears. If corrosion is present around the terminal connections, remove battery cables and wash the terminals with an ammonia solution, or a solution consisting of 1/4 pound (about 100 grams) of baking soda added to 1 quart (about 1 litre) of water. See Figure 4-11.



ES-1675

FIGURE 4-11. CLEANING BATTERY

Remove battery from the vessel for cleaning. Be sure the vent plugs are tight to prevent cleaning solution from entering battery cells. After cleaning, flush the outside of battery and surrounding areas with clean water.

Keep the battery terminals clean and tight. After making connections, coat the terminals with a light application of petroleum jelly or silicon grease to retard corrosion.

Checking Specific Gravity

▲WARNING *Battery electrolyte can cause severe eye damage and burns to the skin. Wear goggles, rubber gloves and a protective apron when working with battery.*

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell. Hold the hydrometer vertical and take the reading.

Correct the reading by adding four gravity points (0.004) for every five degrees below 80° F (27° C). A fully charged battery will have a corrected specific gravity of 1.260. Charge the battery if reading is below 1.215.

Checking Electrolyte Level

Check the electrolyte level at least every 50 hours of operation. Fill the battery cells to the bottom of the filler neck. If one cell is low, check case for leaks or for a bad cell. Keep the battery case clean and dry. An accumulation of moisture will lead to rapid discharge and battery failure.

▲CAUTION *Do not add water in freezing weather unless the engine will run long enough (two to three hours) to charge the battery and assure a thorough mixing of water and electrolyte.*

AC GENERATOR

The generator should be inspected for brush wear and cleaning as required per the *Periodic Maintenance Schedule*. Be sure to disconnect the negative battery terminal to prevent starting of the genset before proceeding.

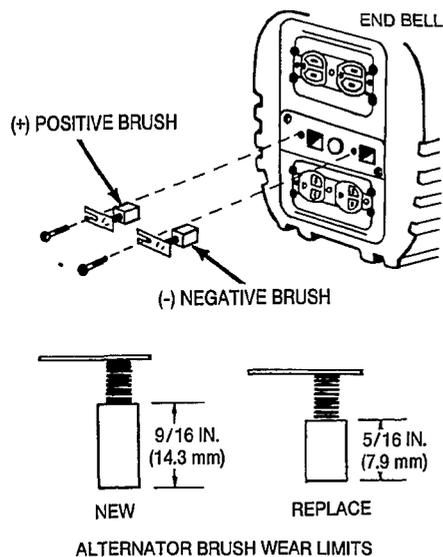
▲WARNING *Accidental starting of the generator set can cause severe personal injury or death. Stop the generator set and disable by disconnecting the starting battery cables (negative [-] cable first) before inspecting the generator.*

Checking Brushes

Remove the end bell cover. Remove the screw securing each brush in place and inspect the brushes. Replace brushes when worn to the dimension shown in Figure 4-12. Clean the holders so the brushes will move freely. New brushes are shaped to fit the collector rings. Always use genuine replacement brushes as listed in the Parts Catalog. Substitutes may appear to be the same, but may have different electrical characteristics.

Cleaning

Collector rings acquire a glossy grey finish in normal operation. Do not attempt to maintain a bright, newly machined surface. Cleaning with a dry, lint-free cloth is usually sufficient. Clean all carbon dust from the generator with filtered, low-pressure air.



ES-1273-1

FIGURE 4-12. CHECKING GENERATOR BRUSHES

OUT-OF-SERVICE PROTECTION

If the genset will be out of service for more than 30 days, protect it by using the following procedures.

1. Start and run the genset with load until it is thoroughly warm. Stop the set.
2. Drain the oil from the crankcase while the engine is still warm. Refill crankcase with new oil. Attach a tag to the genset within clear view indicating crankcase oil viscosity.
3. Turn off the fuel supply valve. Start the engine and let the genset run until it stops from lack of fuel.
4. Remove the spark plug and pour about one ounce (30 ml) of rust inhibitor oil (or SAE 50 engine oil) into the cylinder plug opening. Crank engine over several revolutions, then install spark plug.
5. Protect the cooling system from freezing or corrosion as follows:
 - A. Shut off the sea water cock.
 - B. Remove inlet hose at the sea cock (or strainer if used) and insert hose end into a bucket containing about two gallons (7.6 liters) of 50-50 anti-freeze/water mix.

C. Crank engine until coolant mixture discharges from the outboard exhaust fitting.

D. Re-install inlet hose removed in Step B.

6. Plug the exhaust outlet to prevent entrance of moisture, insects, dirt, etc.

7. Disconnect the starting battery and follow standard battery storage procedure.

CAUTION Freezing temperatures can cause severe damage to the battery when in storage. Maintain electrolyte level and use a trickle charger to maintain specific gravity.

8. Clean and wipe entire unit. Coat parts susceptible to rust with a light coat of rust inhibitor oil or grease.

Returning Unit to Service

Refer to preceding paragraphs in this *Maintenance section* for specific service procedures.

1. Remove plug from the exhaust outlet and open the seacock.
2. Check the oil tag and verify that the oil viscosity is still correct for existing ambient temperature.
3. Clean and check the battery. For batteries not maintenance free, measure the specific gravity. Reading should be 1.260 at 80° F (27° C) for a fully charged battery. Add distilled water to bring level to the split ring on each cell. If the specific gravity reading was low, charge until correct value is obtained. **DO NOT OVERCHARGE.**

WARNING Battery electrolyte can cause severe eye damage and burns to the skin. Wear goggles, rubber gloves and a protective apron when working with batteries.

4. Connect the genset leads to the battery, negative (-) lead last.
5. Remove all load before starting the engine.
6. After starting the genset, apply at least 50 percent of its rated load.
7. Check genset and any optional gauges for normal operation. The genset is now ready for use.



Onan

Onan Corporation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
1-800-888-ONAN
612-574-5000 International Use
Telex: 275477
Fax: 612-574-8087

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