Onan RV GenSet

Operator's Manual

HDKAG

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California

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and the equipment. **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.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ 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.***

Read and observe each of the following safety precautions.

FUEL AND FUMES ARE FLAMMABLE

Fire, explosion, and personal injury can result from improper practices.

- Do not smoke or allow an open flame or spark producing equipment near the generator set or fuel tank.
- Inspect the fuel lines and connections daily for leaks per the maintenance schedule.

EXHAUST GASES ARE DEADLY

- Never sleep in the vehicle with the generator set running unless vehicle is equipped with an operating carbon monoxide detector.
- Inspect exhaust system daily for leaks per the maintenance schedule. Do not use engine cooling air to heat a compartment.
- Never operate the generator set inside a building or in an area where exhaust gases could accumulate such as near a wall or snow bank, or in high grass. When parking, make sure the exhaust outlet is not obstructed. Make sure the generator set is well ventilated.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect the negative (-) cable at the starting battery before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms on the ground or over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death.
- Tag remote or open switches to avoid accidental closure or starting.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Before starting work on the generator set, disconnect negative (-) cable at the battery. This will prevent accidental arcing or starting.
- Keep your hands away from moving parts.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, etc.
- Do not wear loose clothing or jewelry while working on generator sets. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

GENERAL SAFETY PRECAUTIONS

- Wear safety glasses and protective clothing when servicing batteries. DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.
- Have a fire extinguisher rated ABC nearby. Maintain extinguisher properly and become familiar with its use.
- (Gasoline sets) 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.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage, which presents a potential fire hazard.
- Do not store anything in the generator compartment such as oil or gas cans, oily rags, chains, wooden blocks, portable propane cylinders, etc. A fire could result or the generator set operation (cooling, noise and vibration) may be adversely affected. Keep the compartment floor clean and dry.
- 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.

RGA-OP1

Introduction

ABOUT THIS MANUAL

This manual shows how to operate and maintain the Onan® HDKAG generator set. Study the manual and heed all warnings and cautions. Using the genset properly and maintaining it regularly will promote longer set life, better performance, and safer operation.

The *Operating Recommendations* section covers the break-in procedure and the effects of high altitude and variations in climate. The *Wattage Requirements* section describes the wattage capacity of the set and lists the wattage use of common appliances and tools. Familiarize yourself and others who will operate this set with this information.

MODEL IDENTIFICATION

Have the following information ready when you call a distributor:

- Model number
- Serial number

These are found on the nameplate (Figure 1).

Record these numbers from your generator set in the area provided in Figure 1. Make sure that all numbers are recorded correctly.

FEATURE AND COMPONENT LOCATIONS

The standard control panel and the routine maintenance items are shown in Figure 2.

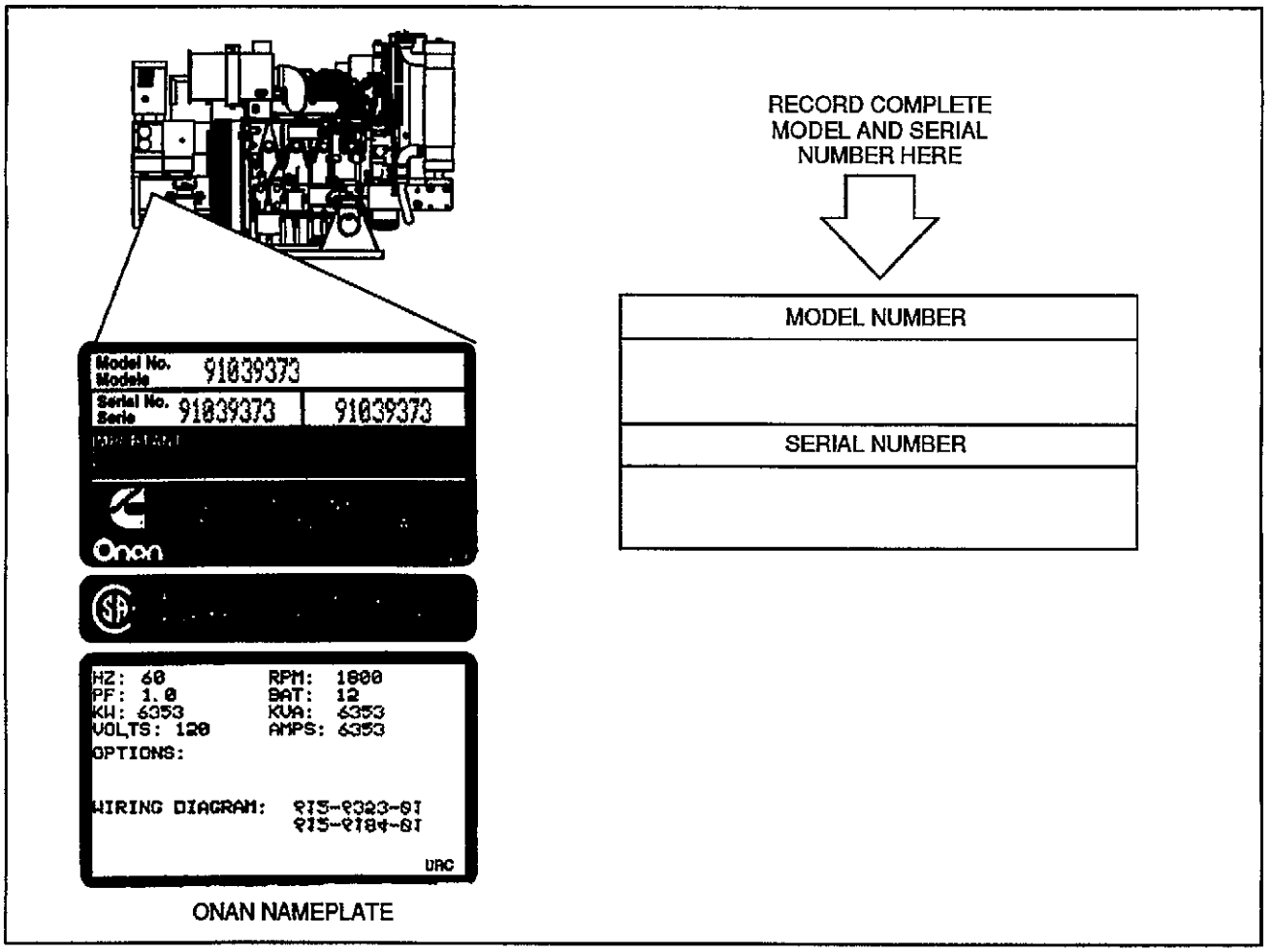


FIGURE 1. MODEL IDENTIFICATION

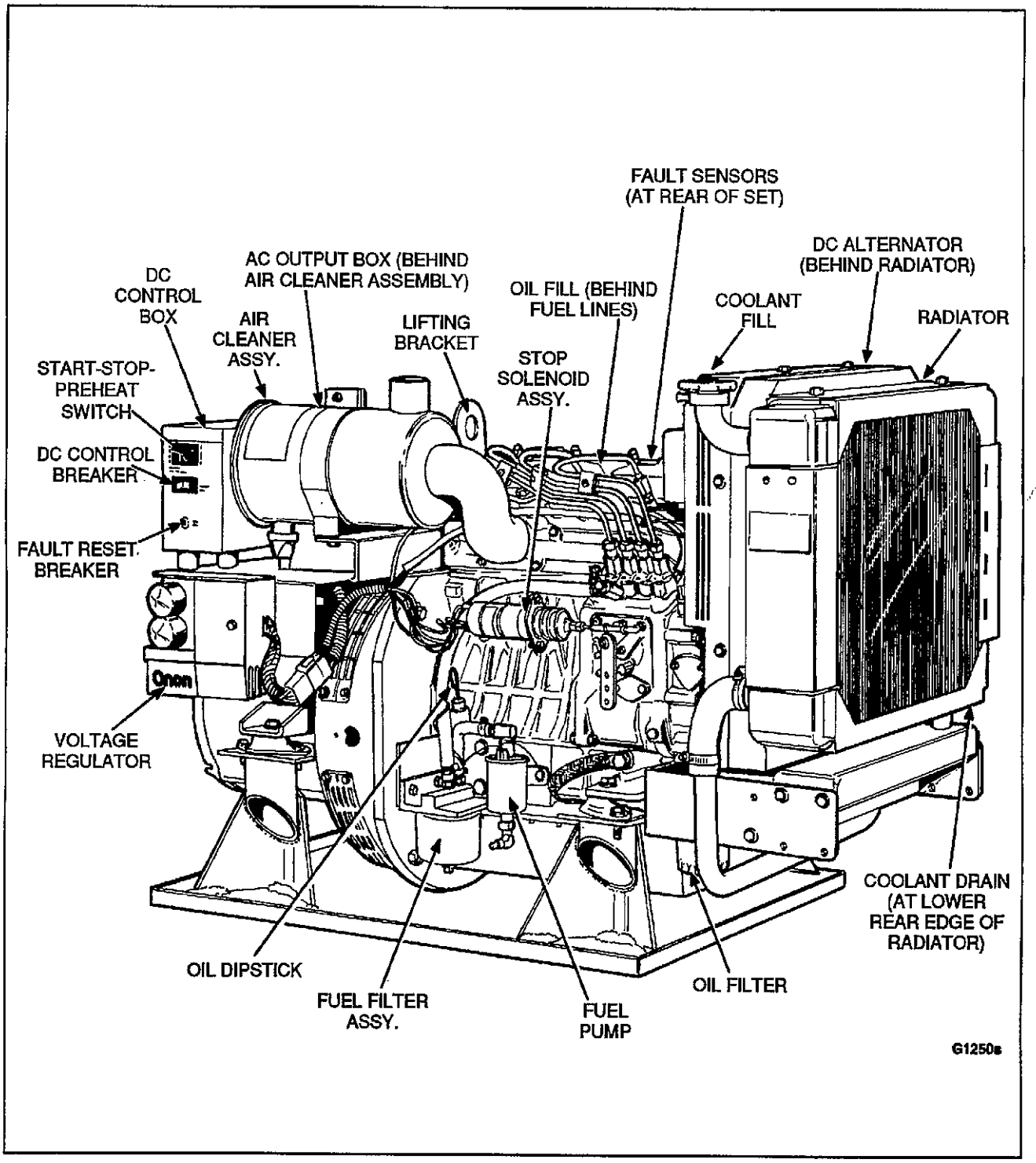


FIGURE 2. HDKAG GENERATOR SET

Control Panel

This section describes the features of the standard control panel. The set controls and breakers are located on the front of the DC control box. The line circuit breaker is located on the side of the AC control box. See Figure 3.

Controls and Breakers

Start-Stop-Preheat Switch: Starts and stops the generator set. Operates the engine cylinder preheaters.

DC Control Breaker: A 15 ampere DC breaker that protects the control box and remote wiring from short circuits or overload. Also serves as an emergency stop switch.

Fault Reset Breaker: A manual reset breaker that shuts down the engine for:

- Low oil pressure
- High coolant temperature
- Overspeed

Line Circuit Breaker: A circuit breaker that protects the set from a short circuit or other overload. It is mounted on the side of the AC control box. The single phase genset uses a dual 45-amp breaker. The three-phase set uses a three-pole 35-amp breaker.

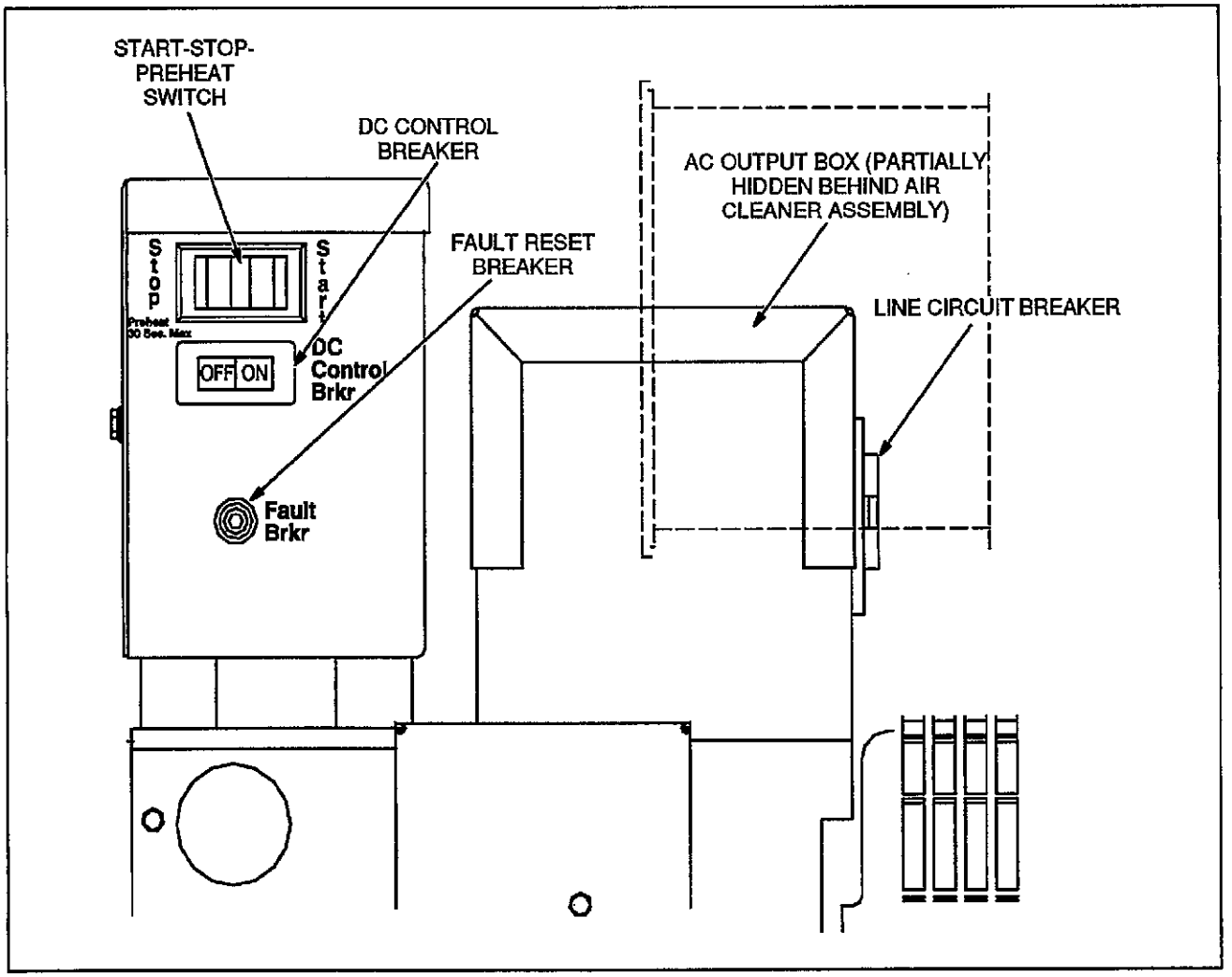


FIGURE 3. GENERATOR SET CONTROLS AND BREAKERS

Pre-Start Checks

ENGINE OIL

Check the engine oil level before each start. When the generator set is new, the engine must be filled with oil before the initial start. The engine oil capacity is 4.7 liters (5 quarts).

If adding oil between changes, use the same brand because different brands might not be compatible when mixed. Be careful not to overfill the crankcase because the oil will foam, resulting in engine shutdown.

Oil Recommendations

Use oils with the American Petroleum Institute (API) classification SF/CD in viscosities shown below in Table 1.

Select the oil viscosity that is right for the lowest temperature expected. Oil that is too thick may not lubricate when the engine is started. Use a lower viscosity oil as the ambient temperature gets colder.

Do not use synthetic oil or non-detergent oil. Do not mix different brands of oil.

Checking Engine Oil Level

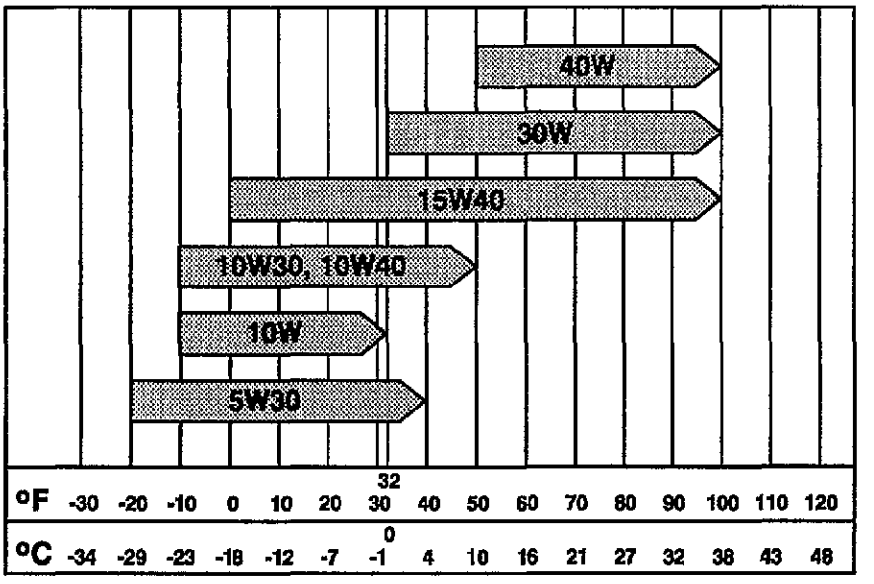
⚠CAUTION ***Do not operate the engine with the oil below the ADD mark or above the FULL mark. Overfilling can cause foaming or aeration of the oil, while operation below the ADD mark might cause loss of oil pressure.***

Check the engine oil level at the intervals shown in Table 4. The oil dipstick and fill are located on the side of the engine (see Figure 4). The dipstick is stamped with FULL and ADD to indicate the oil level in the crankcase. For an accurate reading, shut off the engine and wait 10 minutes before checking the level. This lets oil in the upper part of the engine drain into the crankcase.

Keep the oil level near as possible to the FULL mark on the dipstick. Remove the oil fill cap and add the same type of oil when necessary.

⚠CAUTION ***Do not operate the engine with the oil level below the ADD mark or above the FULL mark. Overfilling can cause foaming or aeration of the oil, while operation below the ADD mark can cause loss of oil pressure.***

TABLE 1. OIL VISCOSITY VS. TEMPERATURE



Anticipated Ambient Temperature

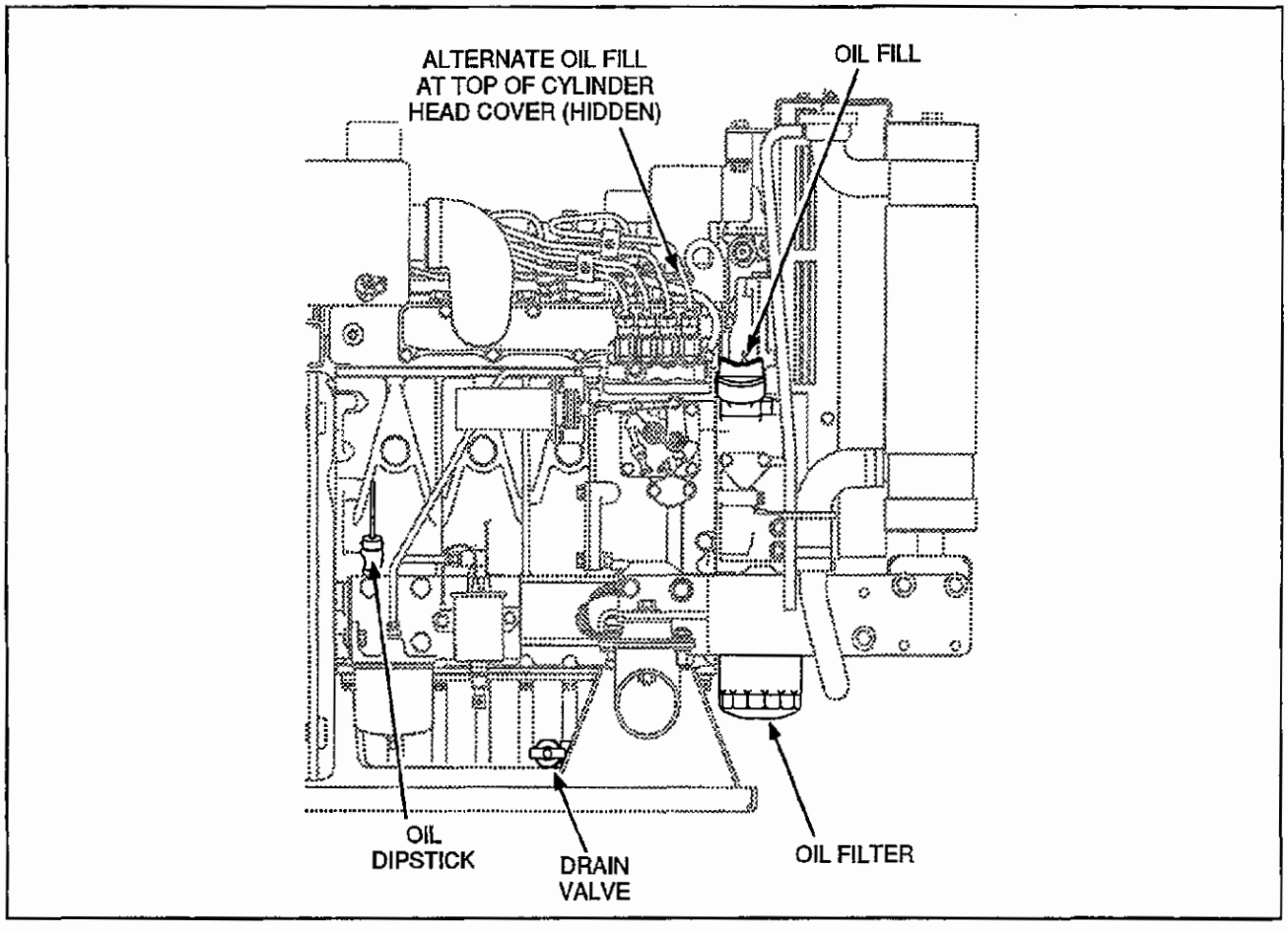


FIGURE 4. ENGINE OIL

EXHAUST CHECK

Thoroughly inspect the exhaust system for leaks or corrosion. Have any problems repaired before operating the generator set.

⚠WARNING ***Exhaust gas presents the hazard of severe personal injury or death. Make certain that all exhaust components are operational and that there are no exhaust leaks.***

Do not start the set if exhaust gases will not effectively expel away from the vehicle. Be aware that any vent, window or opening that is not permanently sealed from the vehicle living space can be an avenue for carbon monoxide.

⚠WARNING ***Exhaust gases can cause severe personal injury or death. Never operate the generator set unless the exhaust outlet is clear of walls, snow banks, or any obstructions that can prevent exhaust gases from dissipating. Never operate any exhaust fan in the vehicle when the generator set is running: an exhaust fan can draw exhaust gas into the vehicle.***

FUEL CHECK

Carefully inspect the fuel system for leaks or corrosion. Have any problems repaired immediately.

⚠WARNING ***Fuel presents the hazard of fire or explosion which can cause severe personal injury or death. Do not permit any flame, spark, pilot light, cigarette, or other ignition source near the fuel system.***

Use the best fuel available. Fuel quality is important for dependable performance and satisfactory engine life.

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

Fuel Recommendation

Use ASTM 2-D (No. 2 Diesel) or ASTM 1-D (No. 1 Diesel) fuel with a minimum Cetane number of 45. Number 2 diesel fuel gives the best economy and performance under most conditions. Use number 1 diesel fuel when ambient temperatures are below 32° F (0° C), and during long periods of light engine load.

Use low sulfur content fuel which has a cloud point at least 10 degrees below the lowest expected fuel temperature. (Cloud point is the temperature at which wax crystals begin to form in diesel fuel.)

GENERAL INSPECTION

Check the generator set for damaged or loose parts. Make sure the air inlet and outlet areas are not blocked. Investigate any abnormal operating noises. Make sure that the generator set is securely mounted in its compartment or under-floor housing.

Check to see that the vehicle is not parked in high grass or brush.

⚠WARNING ***Do not operate the generator set when the vehicle is parked in high grass or brush. Engine exhaust could ignite the grass, and the resulting fire could cause severe personal injury or death, and/or property damage.***

Starting and Stopping

⚠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 vehicle with the generator set running unless the vehicle 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.

STARTING

Starting at Set

1. Press the Start/Stop/Preheat switch to **Stop/ Preheat.** Hold for 10 to 30 seconds, depending on the temperature (see Table 2).

   ⚠CAUTION ***Preheat time longer than 30 seconds may damage glow plugs.***

TABLE 2. PREHEAT TIME vs. TEMPERATURE

Ambient Temperature	Preheat Time
Above 86° F (30° C)	10 seconds
Between 50° to 86° F (10° to 30° C)	15 seconds
Between 32° to 50° F (0° to 10° C)	20 seconds
Below 32° F (0° C)	30 seconds

2. Press the Start/Stop/Preheat switch to **Start.** Release the switch when the engine starts.
3. If the engine does not start after cranking 30 seconds, release the switch. Wait two minutes, then repeat Step 1 (preheat).

   ⚠CAUTION ***Excessive cranking can overheat the starter, damaging it. Do not engage the starter longer than 30 seconds without allowing two minutes for cooling.***

4. If the engine does not start on the second try:

   - Check the fuel supply.
   - Make sure the fuel system has been primed.

   With an empty tank, the fuel system may need priming before the set can start. See *Fuel System* in the *Maintenance* Section.

Starting at Remote Panel

The same procedures and cautions for normal starting apply to remote starting.

Start-up Checks (Remote Panel)

Check the gauges on the control box after the engine starts. Check the oil pressure gauge immediately.

Oil Pressure Gauge: Oil pressure should be 40 to 60 psi (276 to 414 kPa) when the engine is at operating temperature.

DC Voltmeter: Battery voltage during operation should be 14 to 15 volts, depending on the state of battery charge.

Water Temperature Gauge: Water temperature should be 165° to 195° F (74° to 91° C) depending on load and ambient temperature.

STOPPING

Before Stopping

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

⚠CAUTION ***Failure to allow running time for engine cooling without load can cause engine damage. Make sure the generator set runs unloaded at least three minutes.***

To Stop: Press the Start/Stop/Preheat switch to **Stop.** Failure to hold the stop button down long enough may allow the genset to slow, but begin running again, if AC voltage to the control does not fall below the minimum operating level.

Wattage Requirements

AC WATTAGE CAPACITY

The AC power output from the generator will power appliances and other equipment. (The wattage requirement of appliances and electrical equipment may be referred to as "electrical load".)

On the single-phase set, a 45-amp dual circuit breaker (two 45-amp circuits) mounted on the set protects the generator from an overloaded output, which occurs when too much load is applied at once. On the three-phase set, a three-pole 35-amp breaker is used.

Connecting a Load

To determine the maximum amount of electrical load that can be applied, follow these steps:

1. Determine the maximum load (wattage) supplied by the genset/vehicle circuit, by multiplying the circuit breaker size by the AC output voltage:

   2 x 45 (amps) x 120 (volts) = 10800 watts
   or
   2 x 22.5 (amps) x 240 (volts) = 10800 watts

2. Check the wattage requirement of each device to be connected (see Table 3). The appliance nameplate should list the wattage of each item.

3. Add the wattages of all the items to be powered at the same time. Make sure that the total wattage does not exceed the limit of the circuit breaker.

   Example:

Air Conditioner	1800 watts
Converter	500 watts
Coffee Percolator	600 watts
Television	300 watts
Total	3200 watts

4. Start the generator set and let it warm up a few minutes before applying electrical load.

Make sure that each appliance and tool is properly grounded and in good working condition before using it.

⚠WARNING ***Electrical shock can cause severe personal injury or death. Appliances should be in good working condition and be properly grounded to provide additional protection from electrical shock.***

TABLE 3. APPROXIMATE POWER DRAW OF COMMON APPLIANCES

Appliance or Tool	Approximate Running Wattage
Air Conditioner	1400-2000
Battery Charger	Up to 800
Coffee Percolator	550-750
Converter	300-500
Electric Blanket	50-200
Electric Broom	200-500
Electric Drill	250-750
Electric Frying Pan or Wok	1000-1500
Electric Iron	500-1200
Electric Stove (Per Element)	350-1000
Electric Water Heater	1000-1500
Hair Dryer	800-1500
Microwave Oven	1000-1500
Radio	50-200
Refrigerator	600-1000
Space Heater	1000-1500
Television	200-600

Motorized Devices

Motorized devices consume more power during startup than they do when running at normal speed. (Some motors draw as much as three times their operating power during startup.) If you plan to use a motorized device, turn it on **before** starting other appliances. When the motor is running at normal speed, more devices may be added.

Circuit Breakers

Circuit breakers on the electrical distribution panel or on the genset will open if their current ratings are exceeded. This may be caused either by running too many appliances at once, or by a short circuit.

The genset will continue to run after a breaker trips. Turn off all loads, then reset the breaker. If it trips again, a short circuit is indicated. Turn off the set and contact a qualified technician for assistance.

If the breaker does not trip, turn on only as many devices as the breaker size allows (see *Connecting A Load* in this section). If the breaker trips again, a defective load or circuit breaker is indicated.

Connection to Utility Power

Connect the RV or commercial vehicle to utility power (power from an outside source such as a plug-in outlet) **only** through an approved device, to protect against the possibility of generator power and utility power being connected. Consult the Installation Manual (publication 981-0605) for information on isolating the genset from utility-supplied power.

⚠WARNING ***Connecting the generator set directly to the public utility or any other power system can cause electrocution, damage to equipment, or fire. Hazardous voltages can flow from the generator set into the utility line. An approved switching device must be used to prevent interconnections.***

DC POWER

A 30-amp belt-driven alternator on the engine supplies DC power to recharge the starting battery for the set.

Operating Recommendations

BREAK-IN PROCEDURE

Drain the crankcase oil after the first 35 hours of operation. See the *Maintenance* section of this manual for the procedure.

NO-LOAD OPERATION

Hold no-load operation to a minimum. With no load, combustion chamber temperatures drop so low that fuel does not burn completely. This creates carbon deposits which clog injectors, glaze cylinders and cause piston rings and valves to stick. If it is necessary to run the engine for long periods, **connect an electrical load to the generator output.**

EXERCISE PERIOD

Infrequent use can result in difficult starting and moisture condensation problems. This moisture is a result of the engine not being run long enough to reach normal operating temperature. In extreme cases, water may be deposited in the oil. If this happens, severe engine damage can result. To prevent this possibility, run the generator set under load at least one hour per week.

Exercising for one long period each week is better than several shorter periods of operation. Do NOT operate the set for long periods at no load.

LOW TEMPERATURE/HIGH ALTITUDE OPERATION

1. Use the correct SAE oil rating for the current temperature conditions. Change the oil only when it is warm. See Table 1.

2. Use No. 1 diesel fuel for temperatures lower than 14° F (-10° C) or for all temperatures if altitude is above 5000 feet (1500 m). The fuel should have a cetane rating of at least 40. Shorten the oil change interval by half if the sulfur content of the fuel is higher than 0.5%.

EXTREMELY DUSTY OR DIRTY CONDITIONS

If running the genset in extremely dusty or dirty environments, do the following:

- Keep genset and radiator cooling surfaces clean.
- Service the air cleaner more frequently (as necessary).
- Change crankcase oil every 50 operating hours.
- Clean the generator as necessary. See *Maintenance* section.

Maintenance Schedule

Following the maintenance schedule and using the generator set properly will result in longer genset life, better performance, and safer operation. Perform each maintenance procedure at the time period indicated or after the number of operating hours indicated, whichever comes first. Refer to the *Maintenance Procedures* section for instructions.

NOTE: Many of these procedures are best performed by an authorized Onan service center. If you are at all in doubt about your ability to perform genset maintenance, have the Onan service center nearest you perform these tasks.

Consult an Onan service center if the generator set will be subjected to extremely hot or dusty conditions; a more frequent maintenance schedule may be necessary. Log all service and maintenance for warranty support (see the *Maintenance Record* section).

⚠WARNING ***Accidental starting of the generator set during maintenance can cause severe personal injury or death. Disconnect both generator set starting battery cables, before performing maintenance. Remove the negative (-) cable first to reduce the risk of arcing.***

TABLE 4. PERIODIC MAINTENANCE SCHEDULE

	SERVICE TIME				
SERVICE THESE ITEMS	**Daily or after 8 hours**	**Weekly or after 50 hours**	**Monthly or after 100 hours**	**6 Months or after 250 hours**	**Yearly or after 500 hours**
Inspect set	X[1]				
Check oil level	X				
Check coolant level	X				
Check fuel level	X				
Check air cleaner dust cap (clean if required)		X[3]	X		
Check battery charging system			X		
Check drive belt tension			X[4]		
Clean out spark arrester		X			
Check battery specific gravity			X		
Change crankcase oil and filter			X[2]		
Drain water/sediment from fuel filter			X		
Check anti-freeze				X	
Clean generator assembly				X	
Drain sediment from fuel tank				X[5]	
Clean crankcase breather				X[3]	
Check fuel shut-off linkage				X	
Change fuel filter element				X	
Check genset brushes				X[6]	
Change air cleaner element					X[3]
Clean cooling system					X

1 - Check for oil, fuel, cooling and exhaust system leaks. Check exhaust system audibly and visually with genset running and repair any leaks immediately.
2 - Perform after first 35 hours of operation on new genset.
3 - Perform more often in extremely dusty conditions.
4 - Visually check belts for evidence of slippage.
5 - Drain one cup of fuel to remove water and sediment.
6 - To be performed by authorized service technician.

Maintenance Procedures

GENERATOR SET INSPECTION

Inspect the generator set daily or after every eight hours of operation, whichever comes first. Check the exhaust, fuel, and DC electrical systems as described below. Also check the mechanical condition of the set.

Engine Gauges (Remote Installation)

Check these gauges while the set is running.

Oil Pressure Gauge: Oil pressure should be 40 to 60 psi (276 to 414 kPa) when the engine is at operating temperature.

Coolant Temperature Gauge: Coolant temperature should be 165° to 195° F (74° to 91° C), depending on load and ambient temperature.

DC Voltmeter: Battery voltage during operation should be 14 to 15 volts.

Exhaust System

With the set running, inspect the entire exhaust system including the exhaust manifold, exhaust elbow, muffler and exhaust pipe. Visually and audibly check for leaks at all connections, welds, gaskets, and joints. If any leaks are detected, **shut down the genset and do not operate until corrected.** Replace corroded exhaust components before leaks occur.

⚠WARNING ***Inhalation of exhaust gases can result in severe personal injury or death. Inspect exhaust system audibly and visually for leaks daily. Repair all leaks immediately.***

Fuel System

With the set running, inspect the fuel supply lines, return lines, filters, and fittings for leaks. Check flexible sections for cuts, cracks and abrasions. See that the fuel lines do not rub against anything that could break them. Replace worn fuel line components before leaks occur.

⚠WARNING ***Fuel leakage will create a fire hazard which can result in severe personal injury or death if ignited. While checking for leaks, do not smoke or allow any spark, flame, pilot light or other ignition source in the area. If any leaks are detected, have them corrected immediately.***

DC Electrical System

With the genset off, check the battery terminals for clean and tight connections. Loose or corroded connections create resistance which can impede starting. Clean and reconnect loose battery cables. Always disconnect the negative battery cable first and connect it last, to reduce the possibility of arcing.

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

Mechanical

Check for any signs of mechanical damage. Start the set and listen for any unusual noises that may indicate mechanical problems. Have any problems corrected immediately.

Check the mounting fasteners to make sure the set is secure in its compartment. If an under-floor housing is used, make sure that the set is secured to the housing. Check the condition of the housing components and make sure they are secure to the vehicle.

Make sure that the generator set air inlet and outlet areas are not blocked with debris.

Clean the generator set whenever dust and dirt begin to accumulate. Dust and dirt can usually be removed with a damp cloth. Steam cleaning may be needed to remove road contaminants. Do not clean the genset while the engine is running. Protect the generator, air cleaner, control panel, and electrical connections from cleaning solvents. Cleaning solvents can damage electrical connectors.

OIL AND FILTER CHANGE

The engine oil was drained from the crankcase before shipment. **Before the initial start, fill the lubrication system with the recommended oil.** See the *Specifications* section for oil capacity.

Change the oil and filter at the intervals listed in Table 4. Use oil that meets the API classification and SAE viscosity grade indicated in the previous section.

Engine Oil Change

Run the engine until thoroughly warm. Stop the engine, open the drain valve (Figure 5) and drain the oil into a container. When completely drained, close the valve and refill the crankcase with new oil.

⚠WARNING ***Hot crankcase oil can cause burns if it is spilled or splashed on skin. Keep fingers and hands clear when removing the oil drain plug and wear protective clothing.***

⚠WARNING ***State or federal agencies have determined that prolonged contact with used engine oil can cause cancer or reproductive toxicity. When adding, changing or working with used oil, take care not to breathe, ingest or come into excessive contact with these substances. Wash hands after use. Wear protective clothing and equipment. Provide adequate ventilation.***

Oil Filter Change

Spin off the oil filter and discard it. Thoroughly clean the filter mounting surface. Apply a thin film of oil to the filter gasket, and spin the filter on until the gasket just touches the mounting pad. Then turn an additional 3/4 turn. Do not over-tighten the filter.

With oil in the crankcase, start the set and check for leakage around the filter gasket. Tighten the filter only enough to eliminate leaks.

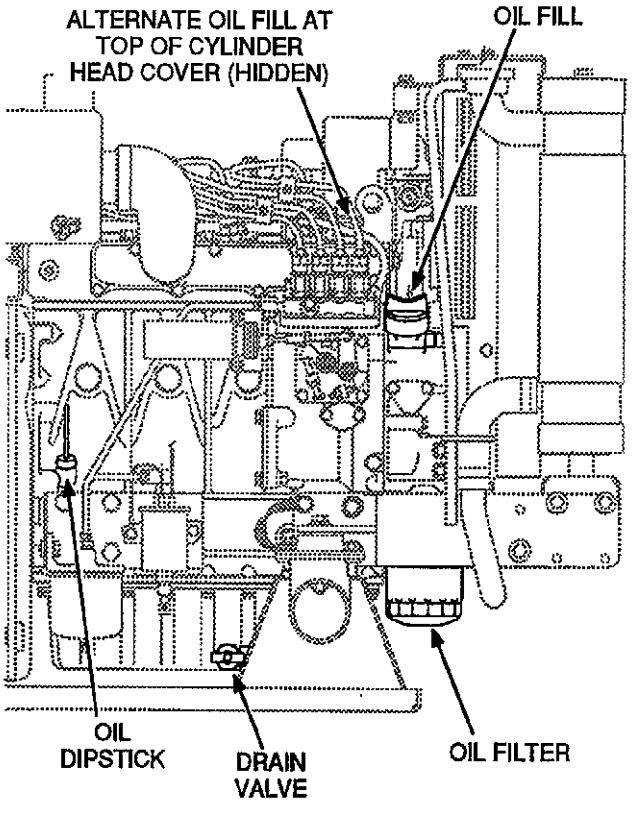


FIGURE 5. ENGINE OIL

COOLING SYSTEM

The cooling system is drained before the set is shipped. **It must be refilled before the genset is operated.** Cooling system capacity is listed in the *Specifications* section.

Coolant Requirements

Engine coolant must inhibit corrosion and protect against freezing. A 50/50 mixture of ethylene glycol anti-freeze and water is recommended for normal operation and storage. Use only a reliable brand of anti-freeze that contains a rust and corrosion inhibitor. **The anti-freeze should not contain a stop-leak additive.**

Do not exceed a 50/50 mixture of ethylene glycol and water. A higher proportion of ethylene glycol will alter the heat transfer properties of the coolant. A 50/50 mixture will provide freeze protection to -34° F (-37° C).

Water used for engine coolant should be clean, low in minerals, and free of corrosive chemicals. Use distilled or soft water if available. Avoid the use of well water, which may contain minerals that can clog the heat exchanger core and reduce cooling efficiency.

Filling the Cooling System

Verify that all drain cocks are closed and all hose clamps are secure. Remove the cooling system pressure cap and slowly fill the cooling system with the coolant mixture.

⚠CAUTION ***Exceeding the recommended fill rate can cause incomplete filling of the engine block, leading to engine damage during warm-up. Always follow the recommended fill procedure.***

Add coolant to the recovery tank (or separate expansion tank if equipped) to the full-cold level.

Start the engine, then remove the pressure cap and monitor the coolant level. As trapped air is expelled from the system, the coolant level will drop. Add coolant to replace it. Replace the pressure cap when the coolant level is stable.

Coolant Level

Check the coolant level at the intervals specified in the Periodic Maintenance Schedule. Check by observing the coolant level in the recovery tank (or separate expansion tank if equipped) when the system is cold. See Figure 6 for a typical cooling system. Engine coolant is at the proper level when the recovery tank level is between FULL and LOW marks.

⚠WARNING ***Coolant in a warm engine is under pressure and can flash to steam causing severe burns if the radiator cap or drain cock are opened. Let the engine cool down before opening the radiator cap or drain cock.***

⚠CAUTION ***The high engine temperature cutoff will shut down the engine in an overheat condition only if the coolant level is sufficiently high to physically contact the shutdown switch. Loss of coolant will allow engine to overheat without protection of shutdown device, thereby causing severe damage to the engine. It is therefore imperative that adequate engine coolant levels be maintained for operational integrity of the cooling system and engine coolant overheat shutdown protection.***

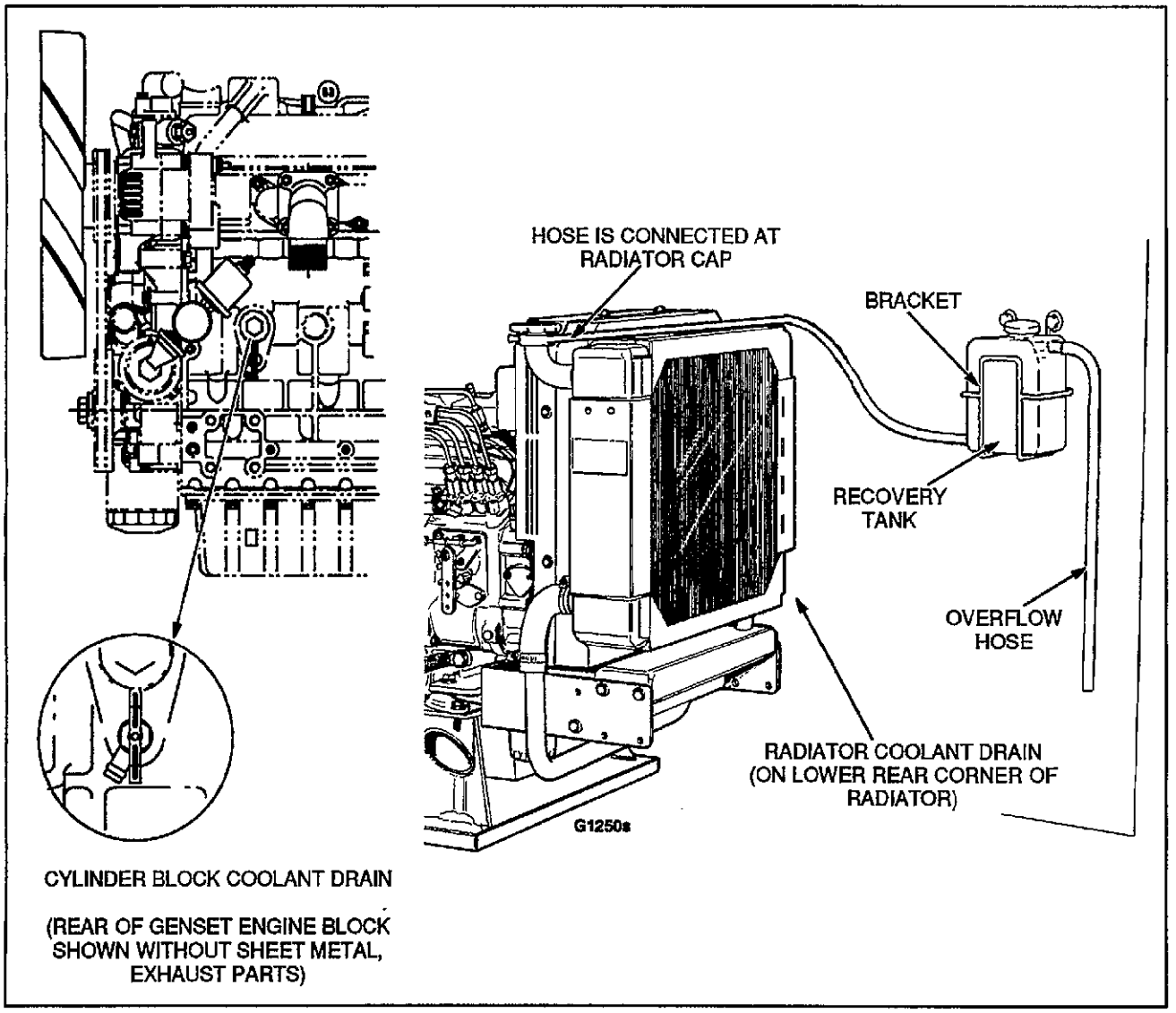


FIGURE 6. COOLING SYSTEM COMPONENTS

Flushing and Cleaning

Once a year, drain, flush and refill the cooling system with new coolant. To drain the system, open the radiator coolant drain and the cylinder block drain on the the rear (non-service access) side of engine. See Figure 6.

⚠WARNING ***Contact with hot coolant can cause severe burns. Do not bleed hot, pressurized coolant from a closed cooling system.***

Chemical Cleaning: Rust and scale slow heat absorption and can block coolant flow. Clean the cooling system if rust and scale have collected on the engine water jacket or in the heat exchanger. Use a good cleaning compound and follow its instructions.

Flushing: After cleaning, or before filling the system with new coolant, drain the system and fill with clean water. Run the genset for 10 minutes, then drain the system completely. Refill with the coolant mixture.

⚠CAUTION ***Never pour hot water into a cold engine or cold water into a hot engine. Doing so can crack the head or the cylinder block. Do not operate the unit without water for even a few minutes.***

Thermostat

If the engine overheats or does not reach and maintain a minimum operating temperature, have the thermostat removed and tested. Replace the thermostat with the gasket if necessary. See the Service Manual for instructions.

Pressure Cap

Closed cooling systems use a pressure cap to increase the boiling point of the coolant and allow higher operating temperatures. Replace the pressure cap every two years, or sooner if it malfunctions.

FAN BELT

A loose fan belt can cause the engine to overheat. The belt tension must be correct for the set to run well.

First, remove the generator set's starting battery cables (negative [-] cable first).

⚠WARNING ***Accidental starting of the set can cause severe personal injury or death. Stop the generator set and disable it by disconnecting the starting battery cables (negative [-] cable first) when maintaining or repairing the engine, controls, or generator.***

To reach the fan belt, remove the belt guard from the front of the set. **Do not operate the genset without the belt guard in place.**

To adjust the belt, loosen the bolt that passes through the long slot in the alternator mounting bracket and slide the alternator until the tension is right. See Figure 7.

Belt tension is correct when a finger pressure of 22 pounds (10 kg) at the middle of the belt deflects it about 0.4 inch (10 mm).

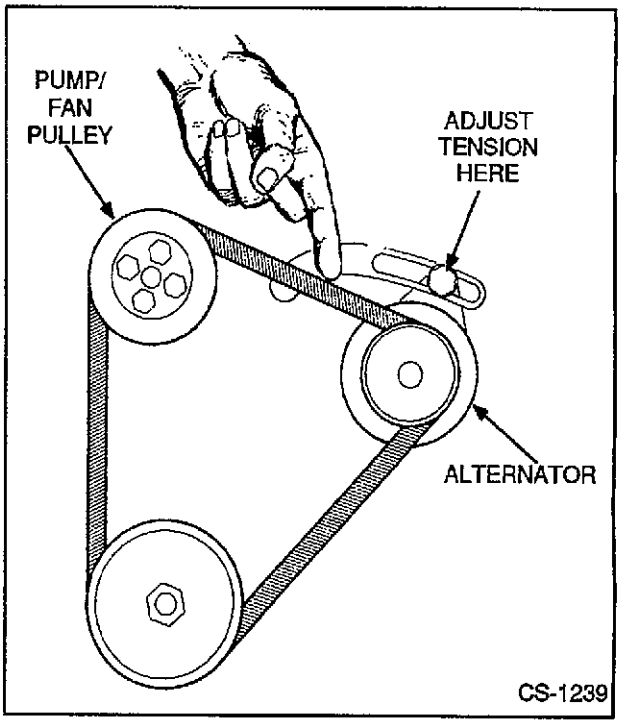


FIGURE 7. FAN BELT ADJUSTMENT

FUEL SYSTEM

Use the best fuel available. Fuel quality is important for dependable performance and satisfactory engine life.

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

Fuel Recommendation

Use ASTM 2-D (no. 2 Diesel) or ASTM 1-D (No. 1 Diesel) fuel with a minimum Cetane number of 45. Number 2 diesel fuel gives the best economy and performance under most conditions. Use number 1 diesel fuel when ambient temperatures are below 32° F (0° C), and during long periods of light engine load.

Use low sulfur content fuel which has a cloud point at least 10 degrees below the lowest expected fuel temperature. (Cloud point is the temperature at which wax crystals begin to form in diesel fuel.)

Fuel Handling Precautions

Prevent dirt, water or other contaminants from entering the fuel system. Filter or strain the fuel as the tank is filled.

⚠CAUTION ***Due to the precise tolerances of diesel injection systems, dirt or water in the system will cause severe damage to both the injection pump and the injection nozzles. It is extremely important the fuel be kept clean and water free.***

Condensation (water) can cause clogging of fuel filters as well as freezing problems. Water mixing with the sulfur in the fuel forms acid which can corrode and damage engine parts.

Low fuel in the tank promotes condensation. In warm weather, the fuel tank cools at night quicker than the fuel. If the fuel level is low, the upper portion of the tank will cool more rapidly, forming condensation. In cold weather, the warm fuel returning from the injectors heats the fuel in the supply tank. If the fuel is low, condensation may form on the upper part of the tank. **To avoid condensation, fill the fuel tank every time the genset is used.**

Low Pressure Fuel System

The electric fuel pump, fuel filter and injection pump inlet comprise the low pressure fuel system. See Figure 8. These components are normally primed (purged of trapped air) at set installation. Be sure to check the fuel level in the tank and that the shutoff valve is open.

NOTE: Priming the fuel system and replacing the fuel filter are procedures that are best performed by an Onan service technician. If you are at all in doubt about these procedures, consult an authorized Onan service center.

Fuel Filter

The wrong fuel or dirty fuel will shorten the life of the fuel filter. See the *Periodic Maintenance Schedule* for the filter change interval.

⚠CAUTION ***Dirt or water in the system will cause severe damage to both the injection pump and the injection nozzles. It is extremely important that the fuel be kept clean and free of water.***

Refer to the Periodic Maintenance Schedule for the recommended filter change interval. However, if the engine shows signs of fuel starvation (reduced power or surging), the fuel filter must be changed. This involves bleeding the fuel system of trapped air.

Bleeding the system means loosening the fittings of the low-pressure fuel lines one by one, and cranking the electric fuel pump to drive out trapped air. **This procedure must be done by an Onan service center or a professional diesel technician.**

High Pressure Fuel System: The injection pump, fuel injection lines and fuel injectors are the high pressure fuel system. See Figure 8. The high-pressure system is self-priming; trapped air is forced out through the injection nozzles.

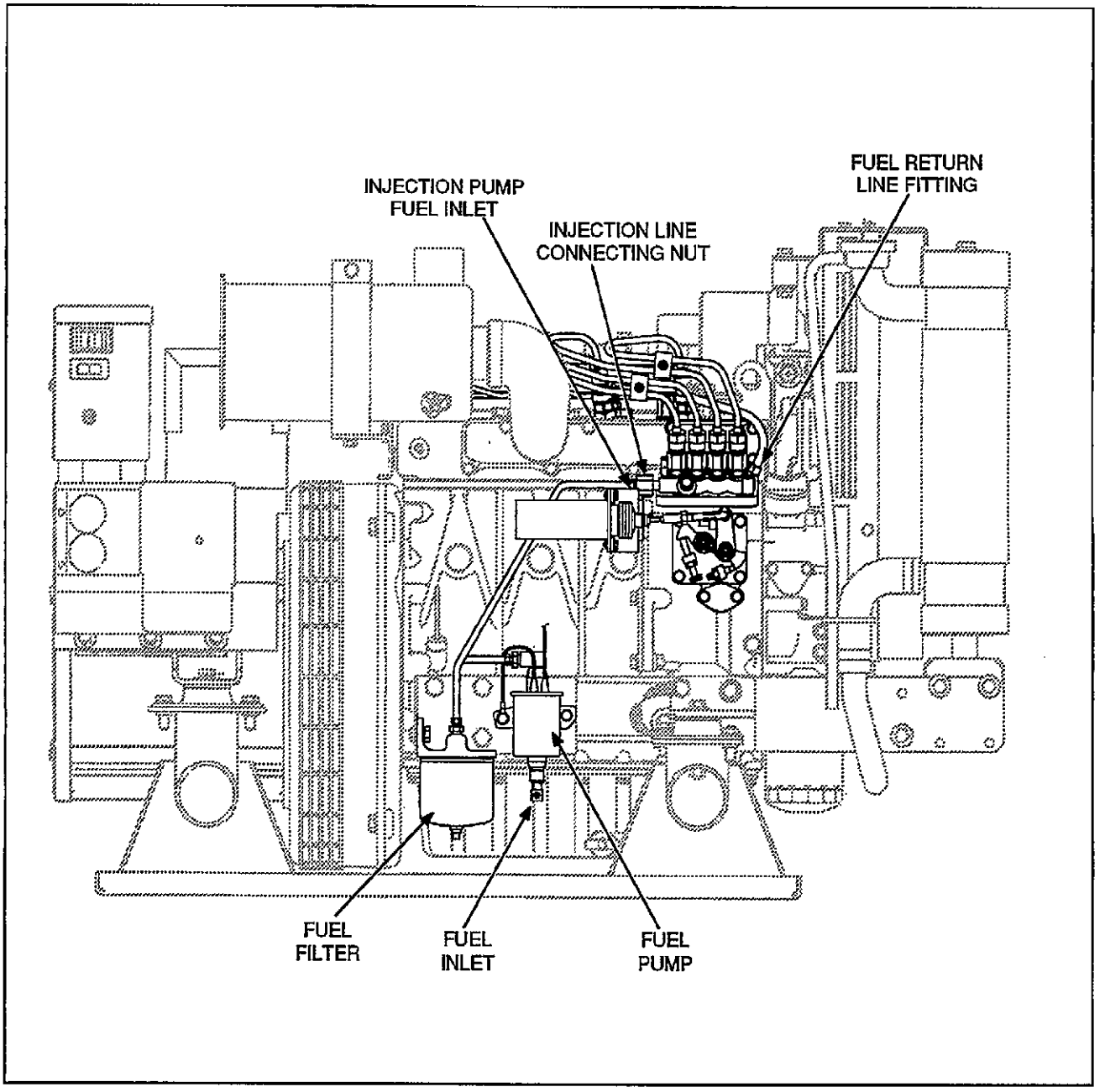


FIGURE 8. FUEL SYSTEM

AIR CLEANER

The air cleaner element is a dry type and should never have oil applied to it. Avoid touching the element except when cleaning it. Instructions for cleaning the element are on a label attached to the element. Change the element yearly, or more often in extremely dusty conditions.

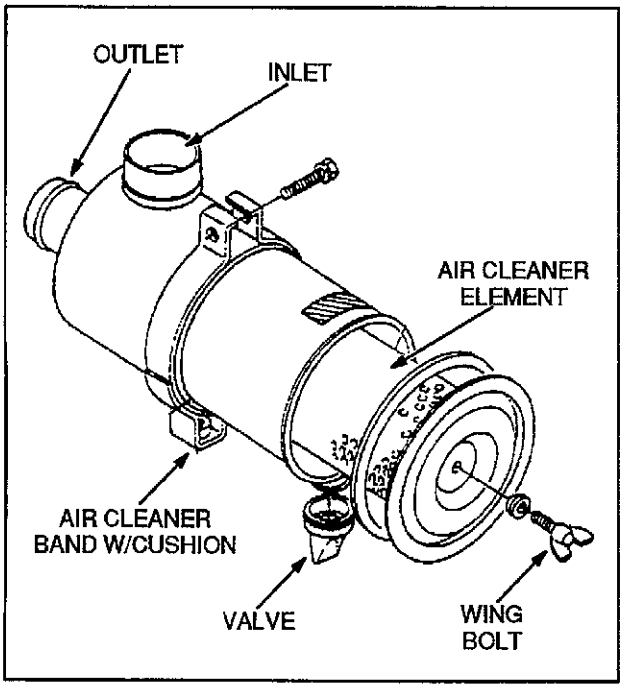


FIGURE 9. AIR CLEANER ASSEMBLY

BATTERY CARE

Service the battery at the intervals shown in the maintenance schedule. Check the electrolyte level more frequently during hot weather.

⚠WARNING ***Batteries present the hazard of explosion that can result in severe personal injury. Do not smoke or allow any fire, flame, spark, pilot light, arc-producing equipment or other ignition sources around the battery area. Do not disconnect battery cables while the generator set is cranking or running because explosive battery gases could be ignited.***

⚠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.***

1. Keep the battery case clean and dry.
2. Make certain that the battery cable connections are clean and tight. Use a terminal puller tool to remove the battery cables.

   Remove corrosion from the battery terminal connections. Wash the terminals with an ammonia solution or a solution consisting of 1/4 pound (about 100 grams) of baking soda in 1 quart (about 1 liter) of water. Be sure the vent plugs are tight to prevent cleaning solution from entering the cells. After cleaning, flush the outside of the battery and the surrounding areas with clean water.
3. Identify the cable as positive (+) or negative (-) before making the battery connections. Always connect the negative (-) cable last, to reduce the risk of arcing.
4. Maintain the electrolyte level by adding distilled water. Fill each cell to the split-level marker in the battery. The water component of the electrolyte evaporates, but the sulfuric acid component remains. For this reason, add water, not electrolyte to the battery.

5. Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell (Figure 10). Charge the battery if the specific gravity measures less than 1.215. Do not overcharge the battery. Stop charging the battery when the electrolyte specific gravity reaches 1.260, at approximately 80° F (27° C).

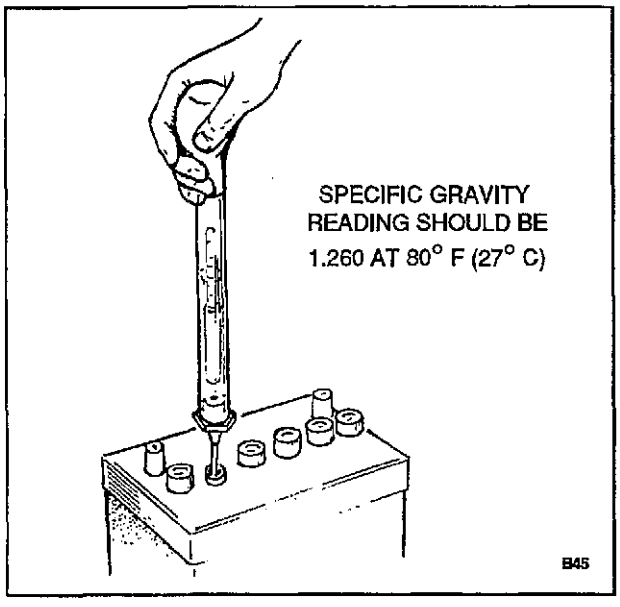


FIGURE 10. BATTERY CHECK

AC GENERATOR

Generator Brushes

The generator should be inspected for brush wear and cleaning as required per the Periodic Maintenance Schedule. This procedure should be performed by an authorized Onan service technician.

⚠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.***

Generator Bearing

Inspect the bearing for evidence of outer case rotation every 1000 hours of use. The bearing should be replaced every five years, because the bearing grease gradually deteriorates due to oxidation. See the Service Manual (publication 981-0516) for the bearing replacement procedure. If the generator requires major repair or service, contact an authorized Onan dealer or distributor.

CRANKCASE BREATHER

Clean the crankcase breather element at the scheduled intervals, using the following procedure (see Figure 11).

1. Remove the cap nuts and gaskets from the top of the cylinder head cover. Carefully remove the cover. Avoid damaging the gasket.
2. From inside the cover, remove two machine screws securing the breather element, plates and shield.
3. Clean the element in a suitable solvent. Dry the element, then saturate with engine oil before replacing.

⚠WARNING ***Many cleaning solvents present a hazard of severe personal injury or death. Follow the manufacturer's instructions and proceed with care.***

4. If necessary, clean other breather components in solvent before reassembling.

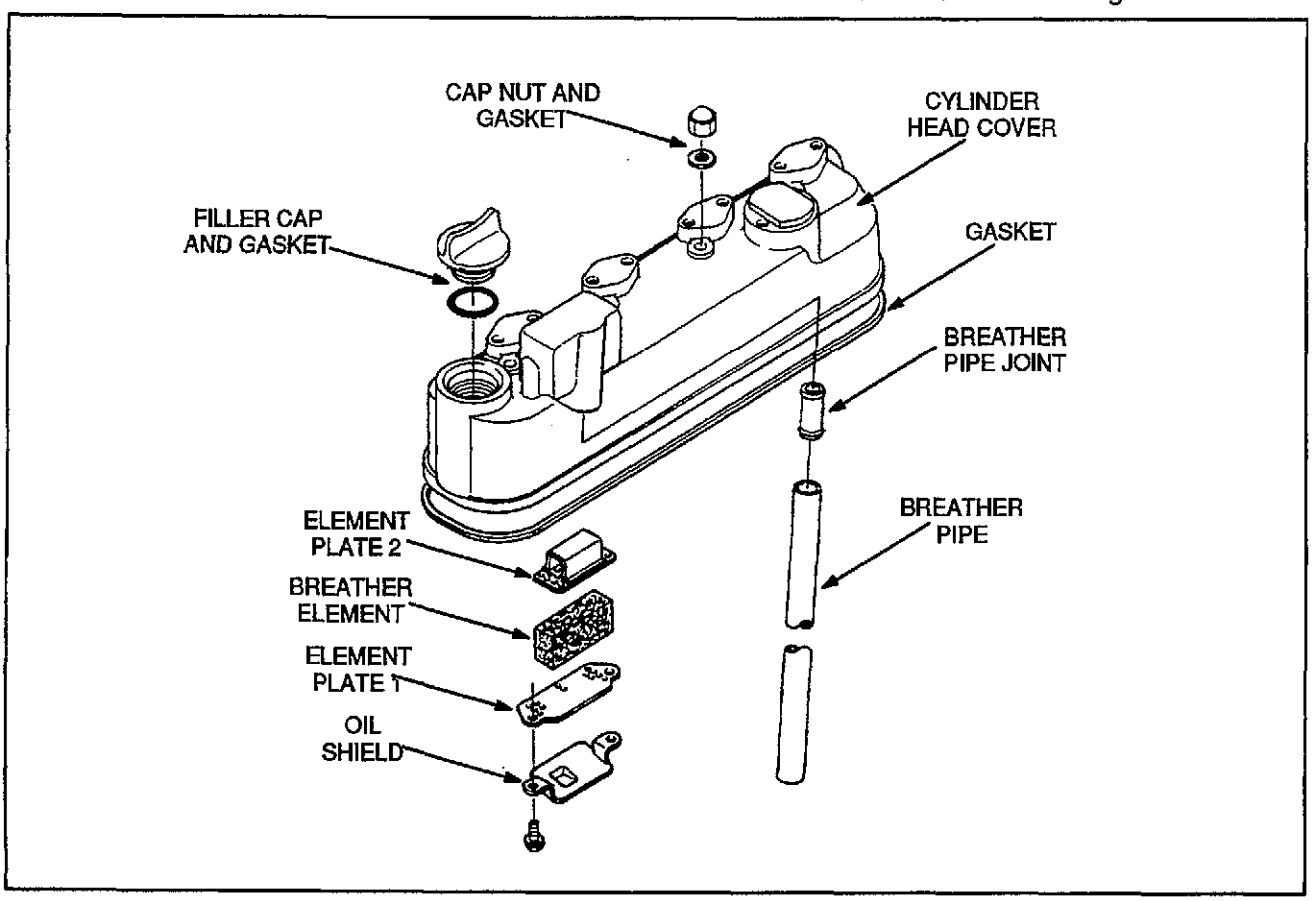


FIGURE 11. CRANKCASE BREATHER

MUFFLER/SPARK ARRESTER

The exhaust spark arrester mounted inside the muffler is necessary for **safe operation.** It must be periodically cleaned out for maximum efficiency, and to meet Forest Service requirements (RV use). See the maintenance schedule for cleaning intervals.

To clean the spark arrester, remove the 1/8 inch pipe plug from the bottom of the muffler. Run the generator set with a full load for five minutes. Stop the generator set and allow the muffler to cool. Replace the pipe plug in the muffler. See Figure 12.

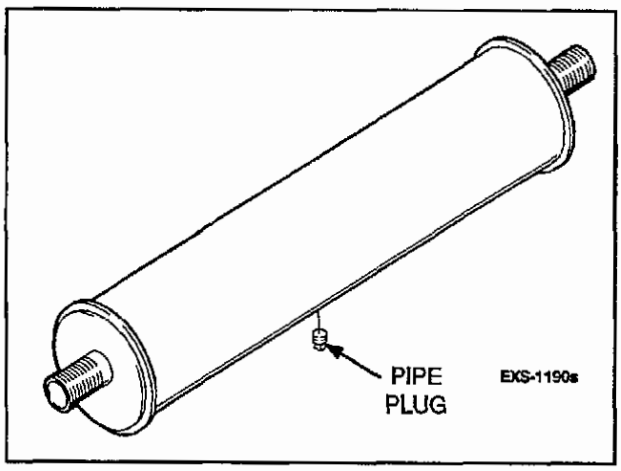


FIGURE 12. EXHAUST MUFFLER

CLEANING THE GENERATOR SET

Clean the generator set at least every six months. Dust usually can be removed with a damp cloth. Some road contaminants may require steam cleaning. Do not steam clean the generator set while the engine is running. When cleaning, protect the area so spray is not directed into the generator, air cleaner, control box, fuel solenoid, or electrical connections. Do not clean with solvents; they can damage electrical connectors.

Generator Set Storage

OUT-OF-SERVICE PROTECTION

The lubricating qualities of No. 2 diesel fuel should protect the cylinders of a diesel engine at least 30 days when the set is not being run. For storage longer than 30 days, proceed as follows:

1. Exercise the genset (see *Operation* section) until the engine is at operating temperature.
2. Shut down the genset and disconnect the battery cables (negative [-] cable first). Store the battery in a cool, dry place and connect to a trickle charger once every 30 days to maintain full charge.

   ⚠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.***

3. Drain the crankcase oil while still warm. Replace oil filter. Refill crankcase and attach a tag indicating oil viscosity.
4. Check the coolant level. Add more coolant if low. If freezing temperatures are possible, test the coolant mixture.
5. Plug exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
6. Clean and wipe the entire genset. Lightly coat parts that may rust with grease or oil.

Returning the Genset to Service

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

1. Remove plug from the exhaust outlet.
2. Check tag on oil base and verify that oil viscosity is still correct for existing ambient temperature.
3. Clean and check the battery. Measure the electrolyte specific gravity with a hydrometer (1.260 @ 80° F [27° C]) and verify the proper level. If the specific gravity is low, charge the battery until the value is correct. If the level is low, add distilled water and charge until the specific gravity reading is correct. 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. Prime the fuel system.
5. Connect the starting battery, negative (-) cable last.
6. Remove all loads before starting the genset.
7. After starting, apply load of at least 50 percent rated capacity.
8. Check all gauges for normal readings. Genset is ready for operation.

Troubleshooting

DC CONTROL

The DC control has a number of sensors that continuously monitor the engine for abnormal conditions such as low oil pressure and high coolant temperature. If any one of these conditions occur, the control stops the engine. See Figure 14.

The following sections describe the 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.

Fault Reset Breaker

The control panel fault reset breaker will trip for any one of the fault conditions described separately below. The white breaker reset button pops out about 1/4 inch (6mm) when a fault occurs. Locate the problem and make the necessary corrections before resetting breaker and starting the generator set. All fault shutdowns except overspeed are delayed 5 seconds to avoid nuisance tripping.

Low Oil Pressure

Remove dipstick and check oil level. If low, add oil to bring level up to the Full mark. Inspect engine exterior for leaks and repair as necessary. The oil pressure switch actuates the fault circuit if pressure drops below 9 psi (62 kPa).

⚠WARNING ***Crankcase pressure can blow out hot oil and cause SEVERE burns. Do NOT check oil while the generator set is operating.***

High Coolant Temperature

If fault occurred during operation, observe Coolant Temperature Gauge (option) for indication of temperature over 230° F (110° C). The coolant thermostat switch closes at this temperature and actuates the fault circuit.

Check coolant level in radiator after allowing engine to cool down. See that the pump belt is OK and has proper tension. Also check cooling system cleanliness (freedom from contaminants, rust, sludge buildup, etc.).

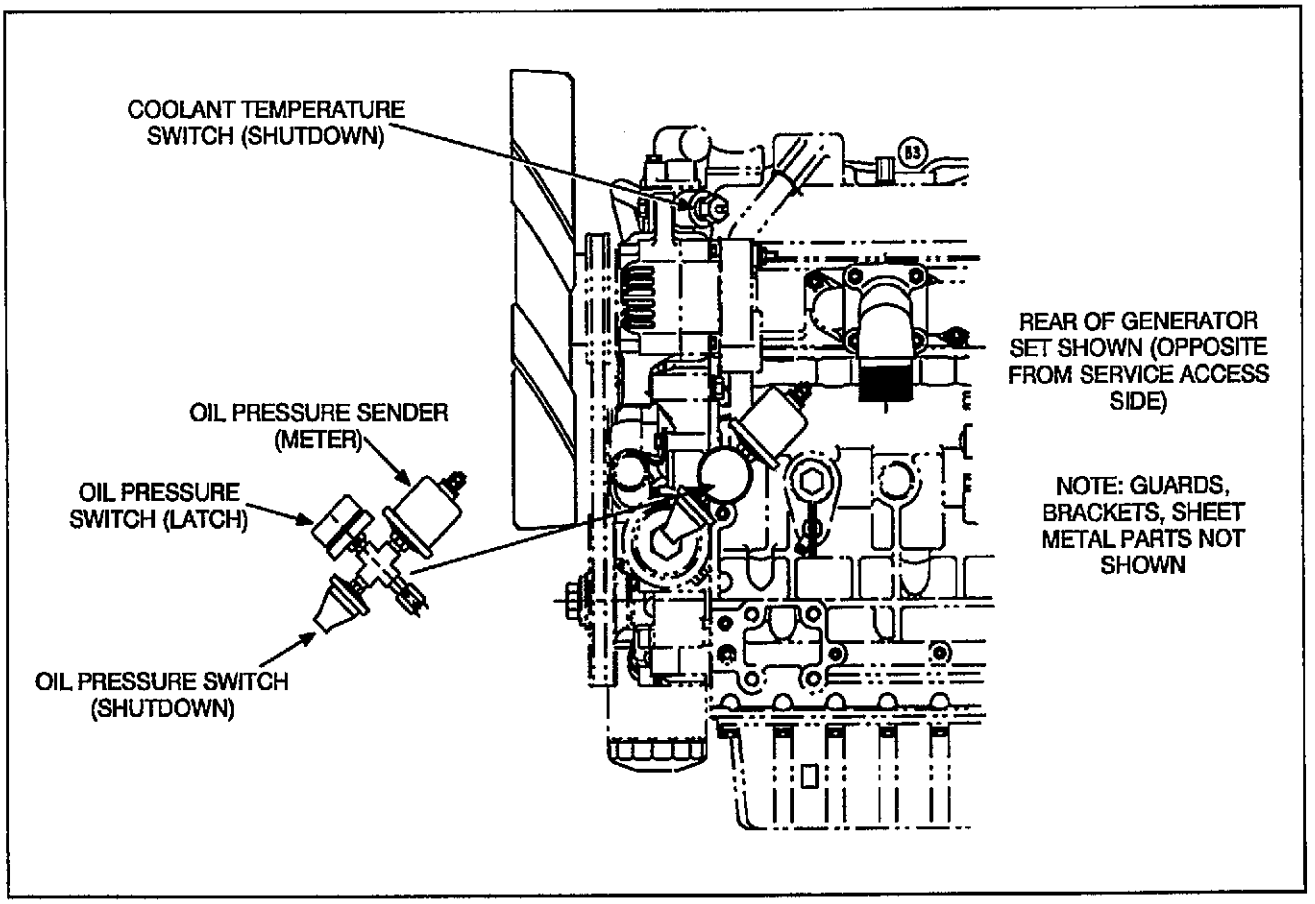


FIGURE 14. OIL AND COOLANT SENSOR LOCATIONS (REAR OF SET)

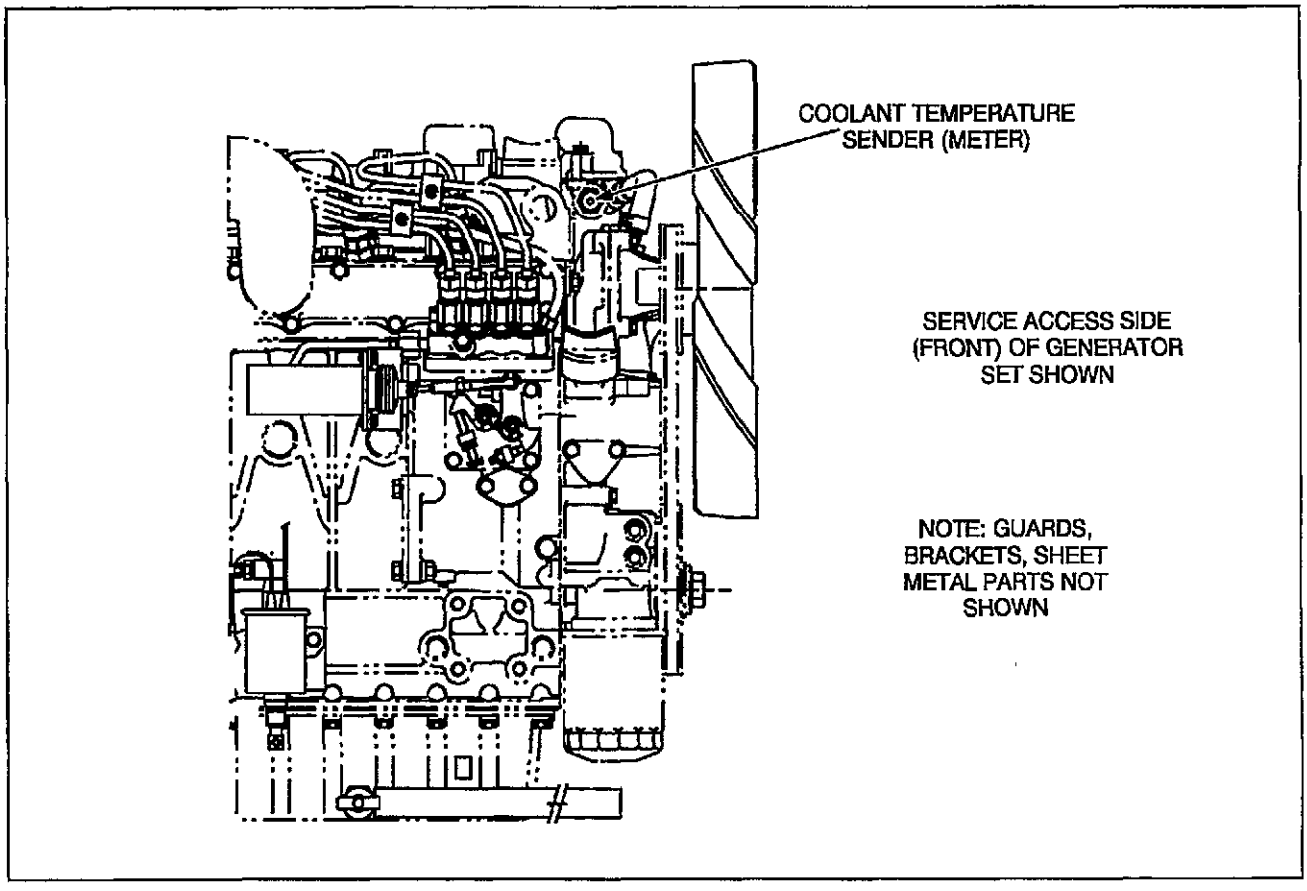


FIGURE 15. COOLANT SENDER LOCATIONS (FRONT OF SET)

⚠WARNING ***Contact with hot coolant can result in SEVERE burns. Allow cooling system to cool before releasing pressure and removing radiator cap or release of hot coolant can result.***

AC CONTROL

The AC control consists of the line circuit breakers connected between the generator output and the load. On the single-phase genset, two 45-amp breakers are mounted on the side of the AC control box on the set. The three-phase genset uses a three-pole 35-amp breaker.

If the breaker trips, the electrical load is too great for the generator set. This may be caused either by running too many appliances at once, or by a short circuit.

Consult the Wattage Requirements section of this manual to determine the wattage needed by typical appliances.

How to Obtain Service

LOCATING SERVICE ASSISTANCE

When your generator set needs parts or service, contact the nearest authorized dealer or distributor. Onan Parts and Service representatives are factory-trained to handle all of your service needs. Locate the nearest authorized distributor as follows:

1. Check the North American Sales and Service Directory (F-118) supplied with your Onan genset. This directory lists authorized distributors who will assist you in locating the nearest authorized dealer.

   -or-

2. Consult the Yellow Pages. Typically, our distributors are listed under:

   GENERATORS-ELECTRIC,
   ENGINES-GASOLINE OR DIESEL, OR
   RECREATIONAL VEHICLES-EQUIPMENT,
   PARTS AND SERVICE.

   -or-

3. For the name of your local Cummins/Onan or Onan-only distributor in the United States or Canada, call 1-800-888-ONAN (this automated service utilizes touch-tone phones only). By entering your area code and the first three digits of your local telephone number, you will receive the name and telephone number of the distributor nearest you.

If you need additional assistance, please call Onan Corporation, 1-612-574-5000, 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday.

You can obtain an individual directory of authorized RV servicing dealers by calling Onan at 1-800-888-ONAN or by writing to Onan ("Attn: Marketing") at the address listed on the rear cover. Please ask for: RV Sales and Service Directory F-919.

SCHEDULING SERVICE

1. Before calling for service, have the following information available:

   The complete Onan product model number and serial number (see Model Identification on page 1)

   Date of purchase

   Nature of the problem

2. Contact the authorized dealer or distributor nearest you to explain the problem and make an appointment.
3. If you have difficulty in arranging for service or resolving a problem, please contact the dealer coordinator or service manager at the nearest Cummins/Onan distributor for assistance.

⚠WARNING

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

Specifications

GENERATOR

Type	4-pole revolving field, brush-type, reconnectible
Standby ratings: 50 Hz	
Standard three-phase:	8.0 kW, three phase, 0.8 power factor
	8.0 kW, single phase, 1.0 power factor
Standby ratings: 60 Hz	
Standard single-phase:	10.0 kW, single phase, 1.0 power factor
Standard three-phase:	10.0 kW, three phase, 0.8 power factor
	6.7 kW, single phase, 1.0 power factor
Extended-stack three-phase:	10.0 kW, three phase, 0.8 power factor
	10.0 kW, single phase, 1.0 power factor
Extended-stack three-phase (heavy-duty):	10.0 kW, three phase, 0.8 power factor
	10.0 kW, single phase, 0.8 power factor
Frequency regulation under varying load:	
50 Hz	±5 percent
60 Hz	±5 percent
Voltage regulation under varying load:	3 Hz maximum
Random voltage variation:	±1 percent

ENGINE (KUBOTA V1305-B)

Engine type	Vertical, water-cooled, 4-cycle diesel
Number of cylinders	4
Bore and stroke	76 x 73.6 mm (2.99 x 2.90 in)
Total displacement	1335 cm^3 (81.46 cu. in.)
Combustion chamber	Spherical type
Engine speed (50 Hz)	1500 rpm
Engine speed (60 Hz)	1800 rpm
Fuel	2-D Diesel (ASTM D975)
Fuel inlet	5/16 in. hose fitting
Fuel return	3/16 in. hose fitting
Maximum fuel pump lift (self-priming)	914.4 mm (36 in.) in 15 sec.
Maximum fuel consumption: Full load	3.78 L/h (1.0 gph)
Half load	2.12 L/h (.56 gph)
Exhaust outlet size, ID	1-1/4 " NPT, male
Battery requirement	
Voltage	12
Cold cranking amps (0° F [-18° C])	425
Coolant capacity:	4.7 liters (5 quarts)
Lubricating oil capacity (with oil filter)	4.7 liters (5 quarts)

Onan

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Cummins Power Generation