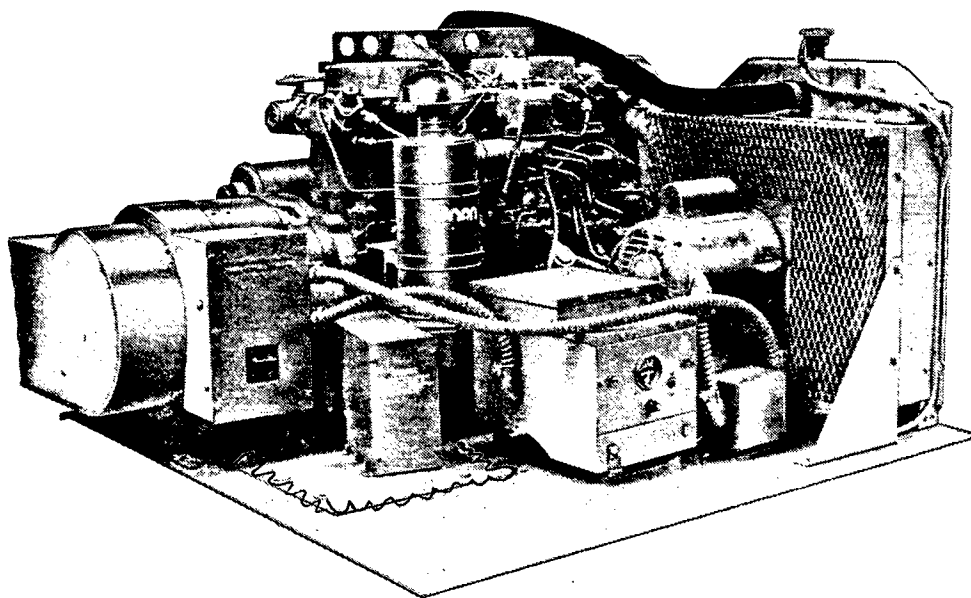


Operators Manual

SERIES
RDJC
GenSet

**Diesel Driven
Liquid-Cooled
Recreational Vehicle
Electric Generating Set**



SAFETY PRECAUTIONS

The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

WARNING Onan uses this symbol throughout this manual to warn of possible serious personal injury.

CAUTION This symbol refers to possible equipment damage.

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in serious, personal injury. Take care in following these recommended procedures.

- **Use Extreme Caution Near Fuel.**

Do not fill fuel tank near unit with engine running. Do not smoke or use open flame near the unit or the fuel tank.

Be sure all fuel supplies have a positive shutoff valve.

Use steel fuel lines, adequately secured and free of leaks. Use a flexible section of fuel line between generator set and stationary fuel line in the vehicle. This flexible section must be 100% NON-METALLIC to prevent electrical currents from using it as a conductor.

Have a fire extinguisher nearby. Be sure extinguisher is properly maintained and be familiar with its proper use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.

- **Guard Against Electric Shock**

Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms 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.

Jewelry is a good conductor of electricity and should be removed when working on electrical equipment.

Always use an appropriately sized, approved double-throw transfer switch with any standby generator set. DO NOT PLUG PORTABLE OR STANDBY SETS DIRECTLY INTO A HOUSE RECEPTACLE TO PROVIDE EMERGENCY POWER. It is possible for current to flow from generator into the utility line. This creates extreme hazards to anyone working on lines to restore power.

Use extreme caution when working on electrical components. High voltages cause injury or death.

Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician.

- **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.

- **Exhaust Gases Are Toxic**

Provide an adequate exhaust system to properly expel discharged gases. Check exhaust system regularly for leaks. Ensure that exhaust manifolds are secure and not warped.

Be sure the unit is well ventilated.

- **Keep The Unit And Surrounding Area Clean**

Remove all oil deposits. Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and subsequent engine damage and may present a potential fire hazard.

Do NOT store anything in the generator compartment such as oil cans, oily rags, chains, wooden blocks etc. A fire could result or the generator set operation may be adversely affected. Keep the floor clean and dry.

- **Protect Against Moving Parts**

Avoid moving parts of the unit. Loose jackets, shirts or sleeves should not be permitted because of the danger of becoming caught in moving parts.

Make sure all nuts and bolts are secure. Keep power shields and guards in position.

If adjustments *must* be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

Do not work on this equipment when mentally or physically fatigued.

INTRODUCTION

TO THE OWNER

Welcome to the growing family of *Onan Power users*.
... We are proud to have you as a customer.

Read this manual carefully and observe all safety rules within. Operating instructions, adjustments and periodic maintenance procedures are given so that you... the owner, can keep your unit running like new and expect many years of dependable service from it. Remember... any machine, regardless of design or

type, will perform only in relation to the services it received.

If your generator set needs special attention, ask your Onan dealer for assistance; the Onan Parts and Service Organization has been factory-trained to provide up-to-date know-how for keeping your RV electric generating set "on the road." A complete Parts Catalog is available at nominal cost and may be ordered under #974-0224.

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WARNING

TO PREVENT FIRE OR ACCIDENT HAZARD...
THIS UNIT MUST BE INSTALLED ACCORDING
TO THE MANUFACTURER'S DETAILED IN-
STALLATION PROCEDURES OBSERVING ALL
MINIMUM CLEARANCES.

TO AVOID POSSIBLE PERSONAL INJURY OR
EQUIPMENT DAMAGE, ANY INSTALLATION
AND ALL SERVICE MUST BE PERFORMED BY
QUALIFIED PERSONNEL.

KEEP FUEL CLEAN!

•
DIRTY FUEL IS ONE OF THE MAJOR CAUSES
OF ENGINE FAILURE

•
REMEMBER—EVEN A TINY PARTICLE OF DIRT IN THE INJEC-
TION SYSTEM MAY STOP YOUR ENGINE!
•

GENERAL INFORMATION

YOUR MANUAL

This manual contains operation and other information to properly maintain, service, and make adjustments on your RDJC generator set. Study and follow the instructions carefully. A well-planned service and maintenance program will result in longer unit life and better performance. Because the most important part of repair is diagnosis, a troubleshooting chart is included.

Throughout the manual, engine end of the generator set is the front. Left and right sides are determined when facing the engine (front) end.

When contacting your Onan dealer, distributor, or the factory about the generator set, always supply the complete model number and serial number as shown on the nameplate (see *Model Designation* following). This information is necessary to identify your generator set among the many types manufactured by Onan.

Where applicable, metric equivalents appear in parentheses following the U.S. customary units.

MODEL DESIGNATION

The following typical model number is broken down into code segments used by Onan.

12.0	RDJC	-	3	R	21680	AC
1	2		3	4	5	6

1. Indicates kilowatt rating.
2. Series identification.
3. Number 3 is the voltage code for 120/240 volts single phase.
4. Method of starting: R-remote electric starting.
5. Factory code for designating optional equipment, if any.
6. Specification letter which advances when the factory makes production modification.

Onan electric sets are given a complete running test under various load conditions and are thoroughly checked before leaving the factory. Upon receiving your unit, check it thoroughly for any damage that may have occurred during shipping. Tighten loose parts, replace missing parts and repair any damage before operating the unit.

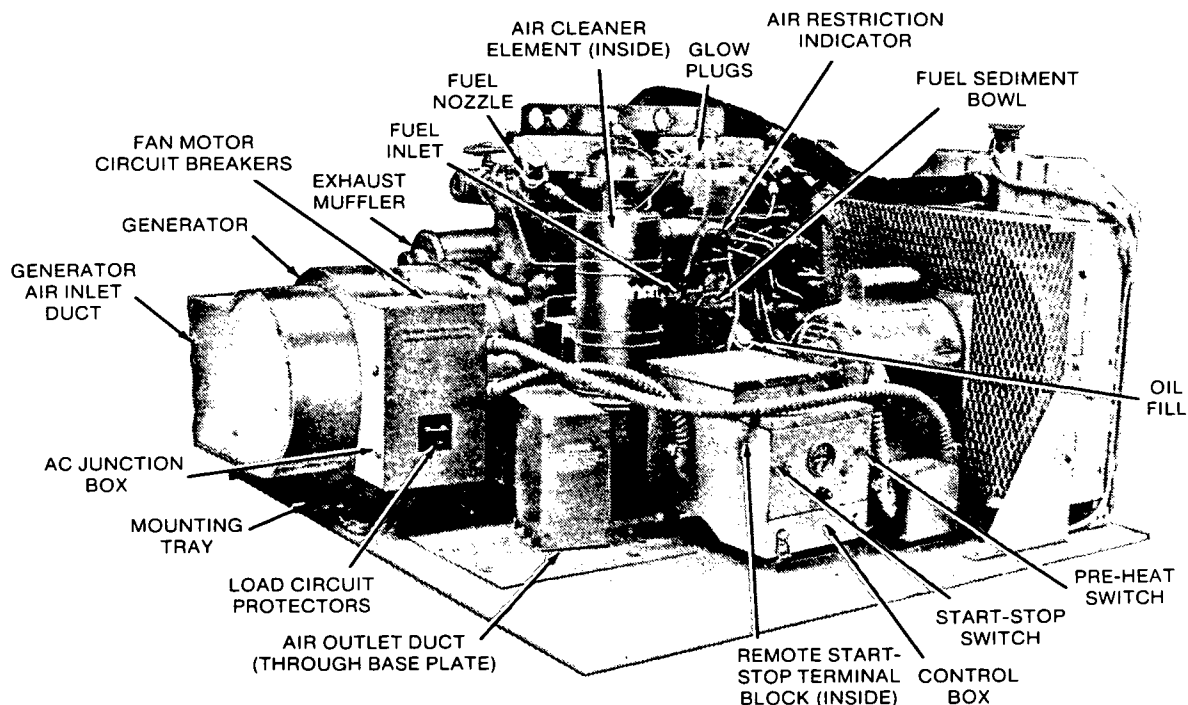


FIGURE 1. TYPICAL RDJC FOR RECREATIONAL VEHICLES

SPECIFICATIONS

GENERAL

Nominal Dimensions of Set

Height	28.50 in. (724 mm)
Width	44.00 in. (1118 mm)
Length	47.00 in. (1194 mm)
Weight (Approx)	1100 lb (499 kg)

ENGINE DETAILS

Manufacturer	Onan
Number of Cylinders (Vertical-in-line)	4
Displacement (Cubic inches)	120 Cu in. (1966 cm ³)
Cylinder Bore	3-1/4 in. (82.6 mm)
Piston Stroke	3-5/8 in. (92.1 mm)
RPM	1800
Compression Ratio	19.0:-1
Injection pump (American Bosch)	PSU
Recommended Fuel	#1 or #2 Diesel
Starting System (Automotive type)	Solenoid Shift Starter
Exhaust Connection (Pipe tapped)	1-1/2 in. (38.1 mm)
Diesel Fuel Lift (Maximum)	6-feet (1.8 mm)
Oil Filter	Full Flow Type
Lubrication System (Oil pump)	Full Pressure

GENERATOR DETAILS

Manufacturer	Onan
Design	Revolving Field, 4-pole, Brushless Exciter and Solid State Voltage Regulator
Rating (In Watts) 60 Hertz	12000 (12 kW)
Voltage	120 or 120/240
Current Rating	
120 Volt	100 Amperes
120/240 Volt (each leg)	50 Amperes
Phase	Single
Wire	4
Output Rating	Unity Power Factor
Cranking Current	475 Amps

CAPACITIES AND REQUIREMENTS

Battery Voltage	12 Volt Negative Ground
Battery Size	
Two 6-Volt (In Series)	
Above 32°F (0°C)	BCI Group 2, 560 Cold Crank Amps
Above 0°F (-18°C)	BCI Group 5D, 800 Cold Crank Amps
Battery Charge Rate (Adjustable)	2 to 5 Amps
Oil Capacity	
With Filter	6-1/2 U.S. Qts (6.15 L)
Without Filter	6 U.S. Qts (5.7 L)
Water Capacity (Radiator)	3 U.S. Gallons (11.36 L)
Engine Fan Size and RPM	15 in. (1725 rpm) Sucking type, C.C.W. Rotation
Ventilation Required	2250 CFM (637 m ³ /min)
Cooling Water Flow	24-gpm (90.84 L/min)

TUNE-UP SPECIFICATIONS

Start-Disconnect Centrifugal Switch	0.020 in (0.51 mm)
Cylinder Head Bolt Torque	44 to 46 lb. Ft (60 to 62 N•m)
Glow Plug Torque	10 to 15 lb. Ft (14 to 20 N•m)
Valve Clearance	
Intake	0.011 in. (0.28 mm)
Exhaust	0.016 in. (0.41 mm)

INSTALLATION CHECKS

Nearly all Onan electric generating sets are installed by the motor home manufacturer. Although the manufacturer must follow safety codes when installing, certain installation problems could arise after the unit is installed and subjected to vibration. There are a few areas that you as the operator should be concerned with. If in doubt about any aspect of your generator set's operation or safety, contact your nearest authorized Onan Service Center. Periodic inspection of your installation should include the following:

EXHAUST

Check for leaks around manifolds, gaskets, and welds. Make sure exhaust lines are not heating surrounding areas excessively. If so, have corrected immediately. Remember EXHAUST GASES CONTAIN DEADLY CARBON MONOXIDE. Be sure all holes to the inside of RV from set compartment are sealed to prevent poisonous exhaust gases from entering vehicles.

The exhaust outlet is 1-1/2 inch pipe size. Shield the exhaust line with fire retardant material if it passes through a combustible wall or partition. If turns or bends are necessary, use long sweeping type elbows. Use one pipe size larger for each ten feet (3.1 m) in length. Position the exhaust outlet away from the engine air intake. The generator set muffler is mounted near the set itself but the exhaust spark arrester is remotely located in the motor home exhaust line.

Certain states (particularly California) have state ordinances pertaining to the type and usage of exhaust muffler/spark arresters on internal combustion engines or engine driven equipment when used in a recreational vehicle such as electric generating sets. Be sure your installation meets all Federal, State and local codes pertaining to your unit. Failure to provide and maintain a spark arrester may be in violation of the law.

WARNING

Plan the exhaust system carefully. Exhaust gases are deadly!

CAUTION

Do not connect the electric generating set exhaust to the vehicle exhaust system. Water vapor from one engine can damage the other engine.

WARNING

Do not terminate poisonous carbon monoxide exhaust gas under vehicle. Direct exhaust gases away from window and door openings. Keep all openings above or to the rear of exhaust pipes closed when generator set is operating.

VENTILATION

The generator set requires fresh air for combustion and generator cooling. Onan recommends that the

ventilation system be able to deliver 1-1/2 to 2 times the air required by the set. RV installations need properly sized and positioned vents for the required air flow.

Generator cooling air travels from the rear inlet duct towards the front of the set and is discharged through the engine-to-generator adapter ductwork which exits through the mounting plate. Engine heat is removed by a sucking type fan (counterclockwise rotation) which pulls fresh outside air through the radiator and out the rear of the compartment. The radiator inlet air opening should be as large as the radiator area and provided with a protective metal grill. Make sure all air inlets and outlets are not plugged with dust, dirt, bugs, leaves or anything that could restrict cooling air.

WARNING

Don't use discharged cooling air for compartment heating since it could contain poisonous exhaust gases.

FUEL TANK AND LINES

For servicing, install a shut-off valve at the tank. When sharing the fuel tank with another engine, use a separate fuel line for each engine to avoid starving either one of the engines. Keep generator set fuel tank pick-up higher in the tank than the vehicle pick-up to prevent using up the fuel supply preventing the vehicle engine from starting.

WARNING

The fuel system should meet applicable codes. Always use flexible tubing between engine and the fuel supply to avoid line failure and leaks due to vibration. Fuel leaks create fire hazards.

Use approved flexible fuel line next to the engine. Diesel engines require a fuel supply line and a separate fuel return line.

FUEL LINE CONNECTIONS

Connect the fuel supply line to the fuel pump inlet. Pump is threaded 7/16-24 NPTF (American Standard Internal Tapered Pipe Thread). The pump inlet is an inverted flare male elbow. See Figure 2. Install the fuel return line from the 7/16-24 opening in the overflow fitting (bleeder valve) located on injection pump to the top of the fuel supply tank. Any dirt or contamination may cause major damage to the fuel injection system.

Do not use galvanized lines, fittings or fuel tanks in the fuel system. Carefully clean all fuel system components before putting the unit into operation.

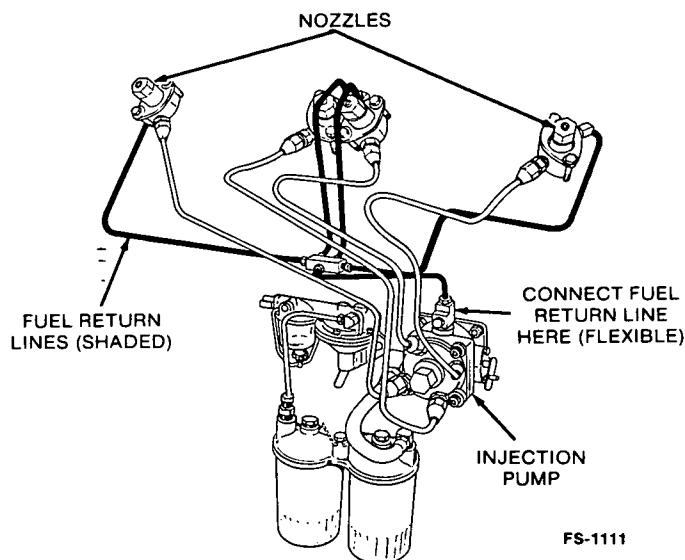


FIGURE 2. FUEL SYSTEM

FUEL SYSTEM

With set running, check for leaks. Check around fuel transfer pump, injectors and fuel supply and return lines for leaks. Make sure fuel lines are not rubbing against anything which could cause breakage. Entire fuel system must be air tight.

BATTERY CONNECTIONS

The battery is connected for negative ground. Be sure all battery connections are tight. If battery polarity must be changed, reverse the rectifier connection in the control box. Refer to *Specifications* for minimum battery size requirements. Connect battery positive (+) to starter engaging solenoid terminal post (Figure 3). Connect battery negative (-) to ground lug on starter (Figure 3) or on engine block.

WARNING Do not smoke while servicing batteries. Lead acid batteries give off explosive gases while being charged.

CAUTION If battery polarity is reversed, damage will occur within 3 minutes while stopped or 5 seconds while running. Alternator windings will be damaged almost instantly if battery charging circuit is shorted between resistor R21 and the B1 end of the charging winding.

WARNING DO NOT DISCONNECT BATTERY CABLES FROM BATTERY WHILE GENERATOR SET IS CRANKING OR RUNNING; SPARKS MAY CAUSE AN EXPLOSION.

Onan recommends using a separate battery for operation of the generator set in addition to the regular vehicle starting battery. Refer to individual installation guide for additional information on battery sharing.

Grounding: Generator must be effectively bonded to recreational vehicle chassis.

For additional information on installation, contact your Onan Service Representative or request Installation Guide #974-0610.

Vehicle chassis (frame) ground and the battery and generator set ground should all be electrically connected to be at 0 ground potential. All Onan units are designed for negative ground application.

WARNING Mount the battery in a separate compartment from the set or any spark-producing device to prevent fire or explosion.

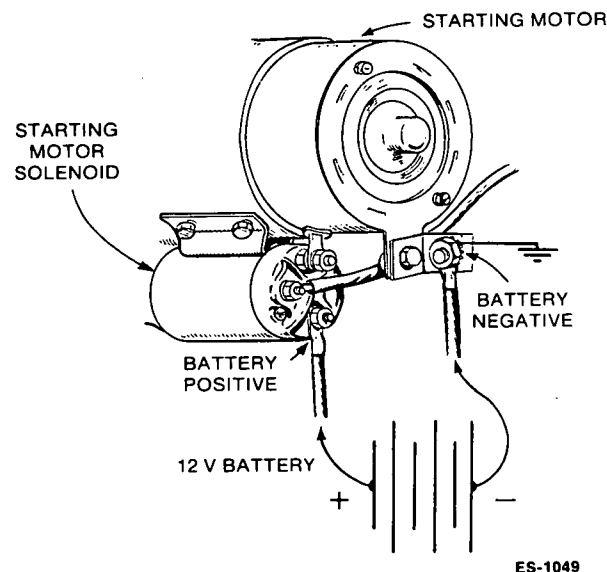


FIGURE 3. BATTERY CONNECTIONS AND CABLE DIMENSIONS

ELECTRICAL

All generator AC output leads (T¹, T², T³ and T⁴) terminate at the main circuit breaker in the generator set junction box. Connection of generator output leads between circuit protector and "RV" distribution box should be made with multistrand wire enclosed in a flexible conduit. Check all wires (to and from the generator set) for fraying and loose connections.

REMOTE START-STOP SWITCH (Optional)

For remote control starting and stopping, use 3 wires to connect the remote switch (single pole, double throw, momentary contact, center-off type) to the terminals 1, 2, 3 on terminal block, in the set control box. Preheat circuit requires an extra wire to terminal H and momentary contact switch (SPST) connection. Remove jumper between terminals 3 and H before

installing remote wiring. Wire size must be a minimum of #18 gauge.

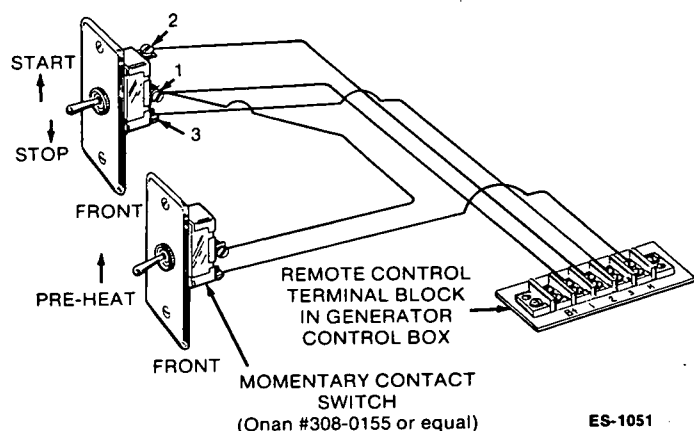


FIGURE 4. REMOTE CONTROL

Load Wires

The junction box has knockout sections to accommodate load wires. Use flexible metallic conduit and stranded load wires near the set to absorb vibration. Use sufficiently large insulated wires. Strip insulation from wire ends as necessary for clean connections.

Connect each load wire to the proper generator circuit protector inside the junction box. Insulate bare ends of ungrounded wires.

Ground fault circuit interrupter protection shall be installed in the recreational vehicle by the installer to protect branch circuits as required by ANSI/NFPA 501C-1977 Chapter 4, paragraph 7.3.3 (Standard for Recreational Vehicles).

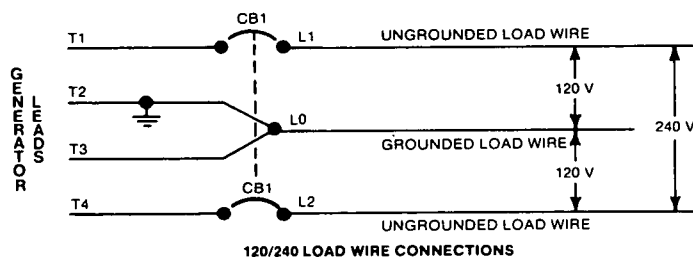


FIGURE 5. SINGLE PHASE "3" WIRE GENERATOR CONNECTIONS

Balance All Loads: Divide the loads equally between output leads. Load current for any one output lead must not exceed nameplate value.

CAUTION Overloading can damage the generator windings. Divide the loads equally between output leads to prevent unbalanced loading and burned windings.

WARNING

ENGINE EXHAUST GAS (CARBON MONOXIDE) IS DEADLY!

Carbon monoxide is an odorless, colorless gas formed by incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal. Some of the symptoms or signs of carbon monoxide inhalation are:

- Dizziness
- Intense Headache
- Weakness and Sleepiness
- Vomiting
- Muscular Twitching
- Throbbing in Temples

If you experience any of the above symptoms, get out into fresh air immediately.

The best protection against carbon monoxide inhalation is a regular inspection of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

OPERATION

BEFORE STARTING

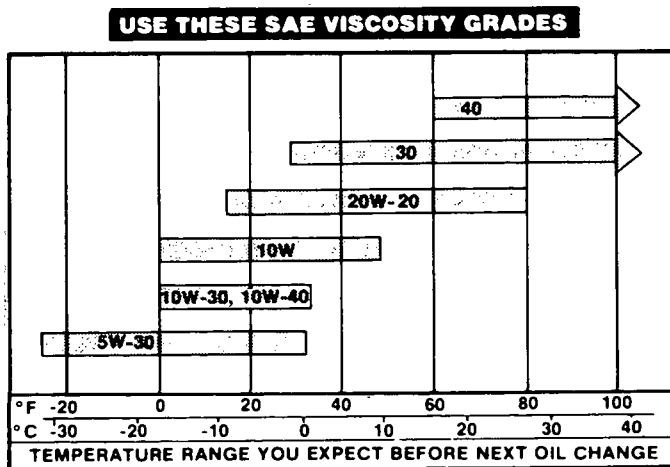
Inspect the set visually before starting. Look for loose or missing parts. Check the oil, fuel, cooling and electrical systems. If any defective part or operating difficulty is detected, service or replace as required. Keep the set free of dust, dirt and spilled oil or fuel.

COOLING SYSTEM

Use 1-1/2 gallons of permanent type anti-freeze along with 1-1/2 gallons of water for initial fill of radiator.

CRANKCASE OIL

Use an oil with the American Petroleum Institute (API) designation CD/SD or CD/SE. However, to reduce oil consumption to a normal level in the shortest time possible on a new or rebuilt engine, use CC oil for the first fill only (50 hours). CD is the API classification for severe duty diesel lube oil. Refer to oil chart for recommended viscosity and temperature.



The set oil capacity is 6 U.S. quarts plus 1/2 quart for oil filter change. Fill the crankcase until the oil reaches the "FULL" mark on the oil level indicator. See Figure 6.

If operating in extremely dusty or dirty conditions, the oil might have to be changed more frequently. When adding oil between changes, use the same brand as in the crankcase. Various brands of oil might

not be compatible when mixed. Refer to *MAINTENANCE* section for oil change interval and procedures. Always change the oil filter when the oil is changed.

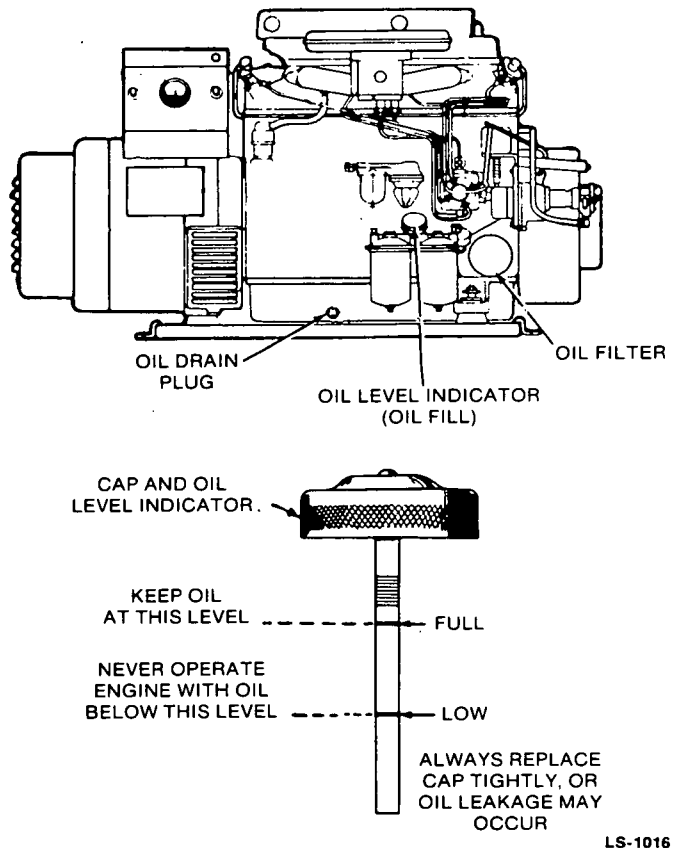


FIGURE 6. LOCATION OF OIL FILL, OIL DRAIN, AND OIL FILTER

WARNING

Do NOT check oil while the generator set is operating. Hot oil could cause burns by blowing out of oil fill tube.

Recommended Fuel

Use ASTM 2-D or 1-D fuel with a minimum Cetane number of 45*. Number 2 diesel fuel gives the best economy for most operating conditions; however, use ASTM 1-D fuel during the following conditions:

1. When ambient temperatures are below 32°F (0°C);
2. During long periods of light engine load; or no load.

*NOTE: Fuels with Cetane numbers higher than 45 may be needed in higher altitudes or when extremely low ambient temperatures are encountered to prevent misfires.

Use low sulfur content fuel having a pour point (ability to filter) of at least 10° F (6° C) below the lowest expected temperature. Keep the fuel clean and protected from adverse weather. Leave some room for expansion when filling the fuel tank.

CAUTION Due to the precise tolerances of diesel injection systems, it is extremely important the fuel be kept clean. Dirt in the system can cause severe damage to both the injection pump and the injection nozzles.

Bleeding Fuel System

Bleed air from fuel system as follows: Disconnect fuel return line, Figure 7. Operate hand priming lever on fuel transfer pump until fuel flowing from fuel return line is free of air bubbles. Then reconnect the fuel return line. Cranking the engine should expel trapped air from the injection pump.

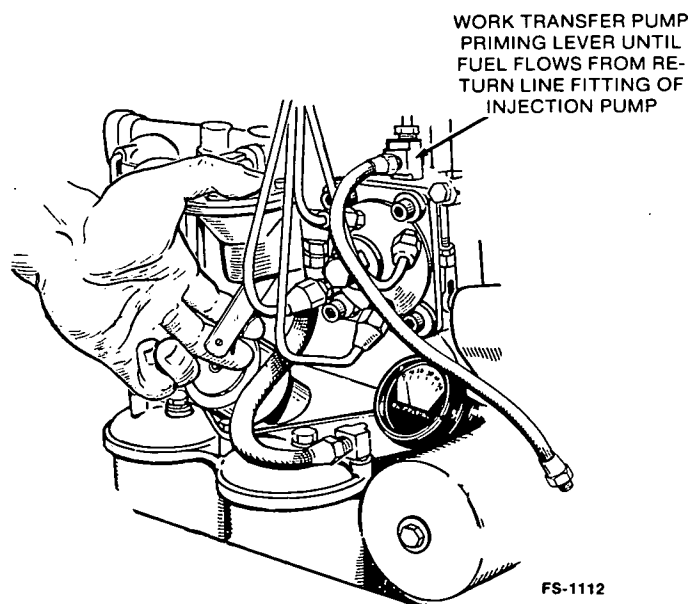


FIGURE 7. BLEEDING THE FUEL SYSTEM

If the camshaft's pump lobe is up, crank engine one revolution to permit hand priming. When finished, return priming lever inward (disengaged position) to permit normal pump operation.

Controls

Before operation, become familiar with the various generator set controls and instruments. The standard control box has a battery charge rate ammeter, pre-heat switch, a start-stop switch, and field circuit breaker on the control panel, Figure 8.

Start-Stop Switch: Starts and stops the unit locally.

Battery Charge Rate DC Ammeter: Indicates charging current.

Emergency Relay: Automatically shuts unit down in the event of low oil pressure or high water temperature conditions.

Field Circuit Breaker: Provides generator exciter and regulator protection from overheating in the event of certain failure modes of the generator, exciter, and voltage regulator.

Pre-Heater Switch: Provides pre-heat control for manifold heater and glow plugs for cold diesel engine starting. Extremes in starting temperatures may require additional preheating. If engine fails to start quickly, rest starter several seconds and repeat starting sequence applying preheat for a longer interval.

Line Circuit Breakers: Protect generator from line overloads (not shown).

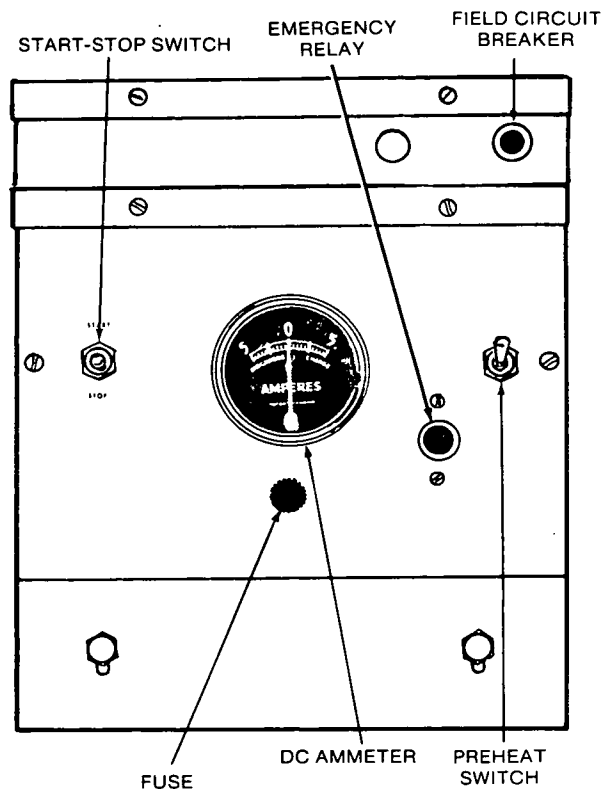


FIGURE 8. STANDARD CONTROL PANEL

STARTING

Preheating for 60 seconds is recommended when ambient temperature is 55° F (13° C) or lower, and 30 seconds for temperatures above 55° F (13° C).

1. Engage Preheat switch for one minute.
2. Engage Start switch and hold in Start position until engine comes up to speed. (This will maintain heater operation until Start switch is released.)

CAUTION Do not exceed the one minute preheat periods to prevent heater burn out and conserve the battery. Longer preheating time prior to cranking the engine can ruin the manifold heater and glow plugs because there is no incoming air flow to cool them. Additional operation of the preheaters for a few seconds during cranking in cold weather may help to preheat the incoming combustion air and prevent misfires as the engine starts running.

3. If engine fails to start after 20 seconds of cranking, wait one minute to conserve battery and repeat steps 1 and 2. Absence of blue exhaust smoke during cranking indicates no fuel is being delivered.
4. In extreme cold (below 32° F) it may be necessary to maintain preheating for 2 minutes after engine starts to obtain firing or smooth out cylinders, especially at no load or light loads.

Refer to Onan Diesel Starting Guide, page 11.

When starting set from a remote station, the switch on the set control must be in its **REMOTE** position.

When engine comes up to speed, cranking will automatically stop by action of the centrifugal switch and start-disconnect relay.

To prevent false starts, hold start switch to **ON** until the centrifugal switch automatically disengages starter motor.

CAUTION Depress preheat switch for one minute and then push start switch. Both switches must be engaged for starting.

If the control has an emergency relay reset button, push it to reset only after a shutdown resulting from low oil pressure or high water temperature condition occurs. Find the cause before restarting the engine.

CAUTION Do not apply overvoltage to the starting circuit at any time. Overvoltage will destroy the glow plugs and air heater in 2 to 3 seconds. If it becomes necessary to use an additional source of power to start the set, use a 12 volt battery connected in parallel.

STOPPING

1. Push fuel solenoid switch to **STOP** position.
2. Release switch when set stops. If stop circuit fails, close fuel valve.

INITIAL BREAK-IN

For a new unit, run the unit with as much load as is available (without exceeding nameplate rating) for approximately 2 hours. This procedure promotes better ring seating and lower oil consumption which leads to longer over-all service life.

CAUTION Continuous running with less than one-half load during the first few hundred hours usually results in poor piston ring seating, causing higher than normal oil consumption and blowby.

Drain and replace the crankcase oil and oil filter after initial 50 hours of operation; drain while the engine is still hot.

APPLYING LOAD

Allow set to warm up before connecting a heavy load. Continuous generator overloading may cause high operating temperatures that can damage the windings. The generator can safely handle an overload

temporarily, but for normal operation, keep the load within nameplate rating value. The exhaust system may form carbon deposits during operation at light loads; apply full load occasionally before shutdown to prevent excessive carbon accumulations. When possible, connect the load in steps instead of full load at one time.

POWER REQUIREMENTS FOR APPLIANCES

Appliance or Tool	Approximate Running Wattage
Refrigerator	600-1000
Electric broom	200-500
Coffee percolator	550-700
Electric frying pan	1000-1350
Hair dryer	350-500
Electric stove (per element)	350-1000
Electric iron	500-1200
Radio	50-200
Electric water heater	1000-1500
Space heater	1000-1500
Electric blanket	50-200
Television	200-600
Electric drill	250-750
Battery charger	Up to 800
Electric water pump	500-600
Air Conditioner	1400-2200
Converter	300-350
Microwave oven	700-1500

SAFETY DEVICES

In case of dangerously high coolant (water) temperature or low oil pressure, the cut-off switch stops the unit. After an emergency stop, investigate and correct the cause. Press emergency reset button on control panel before restarting.

HIGH TEMPERATURES

1. See that nothing obstructs air flow to and from set.
2. Be sure set location is properly ventilated.
3. Check level of battery electrolyte frequently and add approved water when necessary to maintain proper level.
4. Keep cooling system clean, radiator filled and see that fan belt tension is properly adjusted.

HIGH ALTITUDE

Maximum power will be reduced approximately 4 percent for each 1000 feet (305 m) above sea level, after the first 1000 feet (305 m).

LOW TEMPERATURES

1. Use correct viscosity oil for temperature conditions. Change oil only when engine is warm.

2. Use fresh fuel and protect against moisture condensation.
3. Keep fuel system clean, and batteries in a well-charged condition.
4. Use additional preheating during cold starts.

DUST AND DIRT

1. Keep the generator set clean. Keep cooling system clean.
2. Service air cleaner as frequently as necessary.
3. Change crankcase oil every 100 operating hours. Keep governor linkage clean.

OUT-OF-SERVICE PROTECTION

The natural lubricating qualities of diesel fuel should protect a diesel engine for at least 30 days when unit is not in service. To protect a set that will be out of service for more than 30 days, proceed as follows:

1. Run set until thoroughly warm; generator under at least 50 percent load.
2. Shut down the engine.
3. Disconnect the starting batteries and follow standard battery storage procedures.

CAUTION When batteries are in storage, maintain liquid level and use a trickle charger to maintain specific gravity. Otherwise, severe damage can occur to the batteries if exposed to freezing temperatures.

4. Drain the oil from the oil base while the engine is still warm. Refill the oil base with clean oil and attach a caution tag stating the oil used.
5. If the unit will be exposed to freezing temperatures, drain coolant from the engine, water pump, and cooling system components which are not protected by antifreeze. See *Draining Cooling System*.
6. Remove the flexible section of the exhaust line (where water cooled) and plug the engine exhaust outlet to prevent entrance of moisture and dirt. Attach a warning tag to exhaust line noting exhaust line is plugged.
7. Service air cleaner.
8. Remove glow plugs. Pour 1-ounce of rust inhibitor (or SAE #10 oil) into each cylinder. Crank engine over several times. Reinstall glow plugs.
9. Check the fuel filters for presence of water as shown in the *PERIODIC MAINTENANCE* section.
10. Clean the throttle and governor linkage. Protect by wrapping with a clean cloth.
11. Clean and wipe the entire unit. Coat parts susceptible to rust with a light coat of oil or grease.
12. Provide a suitable cover for the entire unit.

DRAINING COOLING SYSTEM

Drain the entire cooling system including the water-cooled exhaust manifold and exhaust line.

CAUTION Drain only those components not protected from freezing (exhaust lines, water pump, intake and outlet lines, etc.).

1. Open vent valve or vent plugs.
2. To drain the water pump, loosen the cover and hose connections so the water runs out.
3. Drain the engine block by removing the 1/4-inch drain plug on the left, front side of the engine.
4. Drain the water manifold by removing the drain plug on the bottom.
5. Disconnect hose clamps and hoses to aid draining.

Flush out cooling system until water runs clearly.

When all water drains out, reconnect hoses, reinstall drain plugs, and close vent valve or plugs.

Returning Unit to Operation

1. Remove protective cover from unit (if used). Wipe off dust and dirt.
2. Check that fuel lines and injectors are secure and properly torqued without any air or fuel leaks.
3. Check the tag stating oil type and weight. If not correct, drain and refill with correct oil. Be sure oil is up to "FULL" mark on dipstick.
4. Check coolant level and adjust if necessary. Service the cooling system (without antifreeze) with clean and fresh water. Prime the water pump and bleed air from the system.
5. Remove the material used to plug the exhaust outlet and reconnect the exhaust line. Check the complete exhaust system for tight connections and condition of muffler, exhaust line, etc.

WARNING Be sure to connect the exhaust line, making sure the exhaust system is fit for operation and will not leak. Exhaust gases are deadly.

6. Check the entire generator set for water, fuel, or oil leaks. Correct as required.
7. Check wiring system for worn wires, loose connections, etc. Remedy as required.
8. Install the fully-charged batteries and connect to the generator set. Observe correct polarity. Verify that no loads are connected to generator. Start engine and observe oil pressure gauge and charge rate ammeter.

After engine has started, excessive blue smoke will be exhausted until the rust inhibitor or oil has burned away.

After start, apply load to at least 50 percent of rated capacity.

Unit is ready for service and load may be applied.

ONAN DIESEL STARTING GUIDE

IMPORTANT!

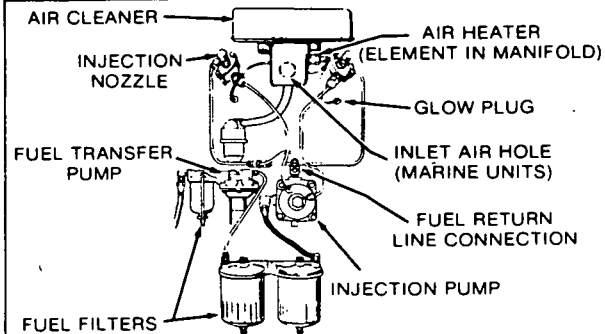
KEEP ENTIRE FUEL SYSTEM CLEAN AND FREE FROM WATER

- DIESEL INJECTION PUMPS WILL FAIL IF SYSTEM CLEANLINESS IS NEGLECTED

INJECTION PUMPS AND NOZZLES ARE NOT FIELD REPAIRABLE

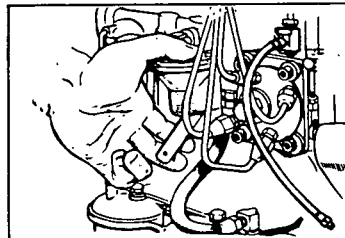
- WHEN TROUBLESHOOTING, CHECK ALL OTHER COMPONENTS FIRST

WARNING DO NOT USE ETHER STARTING AIDS! ETHER IS EXTREMELY EXPLOSIVE AND MAY CAUSE SERIOUS PERSONAL INJURY. ENGINE DAMAGE IS ALSO LIKELY.



BEFORE STARTING:

CHECK FUEL SUPPLY. BE SURE SHUTOFF VALVES ARE OPEN.



PRIME FUEL SYSTEM IF: FUEL FILTERS WERE DRAINED OR CHANGED, SYSTEM WAS JUST INSTALLED, FUEL TANK RAN DRY.

TO PRIME PUMP, MOVE PRIMING LEVER UP AND DOWN UNTIL FUEL FLOWS STEADILY FROM RETURN LINE (DISCONNECTED).

PREHEAT



PREHEAT COLD ENGINE: PUSH PREHEAT SWITCH AND HOLD —

- 30 SECONDS IF ABOVE 55°F (13°C);
- 60 SECONDS IF BELOW 55°F (13°C).

TO START:

PREHEAT



RELEASE PREHEAT

START



ENGAGE START SWITCH

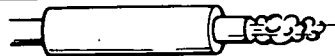
LIMIT CRANKING TO 15 TO 20 SECONDS TO CONSERVE BATTERY. ALLOW 1 MINUTE BEFORE RE-CRANKING.

IF ENGINE DOES NOT START:

IF ENGINE FIRED, REPEAT ABOVE PROCEDURES, INCLUDING PRE-HEAT. IF IT STILL DOES NOT START, PROCEED AS FOLLOWS:

TEMPERATURES BELOW 32°F (0°C):

USE NUMBER 1 DIESEL FUEL. USE CORRECT VISCOSITY OIL. KEEP BATTERIES FULLY CHARGED. DO NOT USE ETHER STARTING AID.



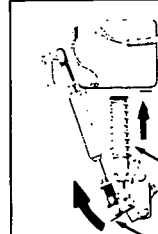
OBSERVE ENGINE EXHAUST "SIGNALS":

BLUE-WHITE EXHAUST SMOKE: ENGINE IS GETTING FUEL

1. OBSERVE AIR HEATER THRU AIR INLET HOLE OR BY REMOVING AIR CLEANER.
2. ENGAGE PREHEAT.
3. IF HEATER ELEMENT DOES NOT GLOW RED WITHIN 30 SECONDS, CHECK AIR HEATER AND GLOW PLUG WIRING:
 - CONNECTIONS TIGHT?
 - FREE FROM CORROSION?

LITTLE OR NO EXHAUST SMOKE: ENGINE IS NOT GETTING FUEL.
PRIME FUEL SYSTEM AS SHOWN ABOVE:
OBSERVE FUEL FLOW FROM RETURN LINE

FUEL FLOWS STEADILY



SOLENOID ROD
THROTTLE ARM

CHECK FUEL SOLENOID:
SOLENOID ROD SHOULD PULL IN AND THROTTLE ARM FOLLOW (AS SHOWN) WHEN START SWITCH IS TURNED ON. IF NOT, CHECK FOR

- BINDING LINKAGE
- LOOSE OR BROKEN WIRES

LITTLE OR NO FUEL FLOW

CHECK FUEL SUPPLY SYSTEM:

- FUEL TANK EMPTY?
- SHUTOFF VALVES CLOSED?
- FUEL LINES KINKED?
- LOOSE CONNECTIONS?
- CLOGGED FUEL FILTERS?

IF ENGINE IS STILL NOT GETTING FUEL, CHECK TRANSFER PUMP:
1. CRANK ENGINE AND OBSERVE FUEL FLOW FROM RETURN LINE.
2. IF FUEL DOES NOT SPURT OUT, PUMP MAY BE DEFECTIVE.

IF ENGINE STILL DOES NOT START, CONTACT AUTHORIZED ONAN SERVICE REPRESENTATIVE

GENERAL MAINTENANCE

Follow a regular schedule of inspection and servicing, based on operating hours. Keep an accurate log-book of maintenance, servicing, and operating time. Use running time meter (optional equipment) to keep a record of operating hours. Follow service schedule in *Periodic Maintenance Schedule* on page 15.

PERIODIC CHECKS

1. Check all fuel and oil lines for possible leakage.
2. Inspect exhaust lines and mufflers for possible leakage and cracks.
3. Periodically drain moisture from condensation traps.
4. Inspect radiator for leaks and security. Be sure cooling fins are clean.
5. Inspect electrical wires and connections for security and fray damage.

If generator requires major repair or servicing, contact an authorized Onan dealer or distributor.

WARNING

Before commencing any maintenance work on the engine, generator, control panel, automatic transfer switch or associated wiring, disconnect batteries. Failure to do so could result in damage to the unit or serious personal injury in the event of inadvertent starting.

OIL FILTER CHANGE

Remove filter by turning counterclockwise. Clean filter mounting area. Oil filter gasket and install new filter. Turn filter on clockwise until gasket touches mounting base, then tighten 1/2 turn.

BATTERIES

Check the condition of the starting batteries at least every two weeks. See that connections are clean and tight. A light coating of non-conductive grease will retard corrosion at terminals. Keep the electrolyte at the proper level above the plates by adding distilled water. Check specific gravity; recharge if below 1.260 at 77°F (25°C).

WARNING

Do not smoke while servicing batteries. Explosive gases are emitted from batteries in operation. Ignition of these gases can cause severe personal injury.

FUEL FILTERS

Every 100 hours, open the drains on the bottom of the fuel filter assembly (Figure 9) and allow any water to escape. The drain plug on the fuel filter can tolerate

only a limited amount of torque. Use two wrenches in combination for breaking the plug loose and for final tightening.

Every 600 hours, change the primary fuel filter by removing the washer and capscrew on top of the fuel filter body. Every 3000 hours, change the secondary fuel filter in the same manner as the primary fuel filter.

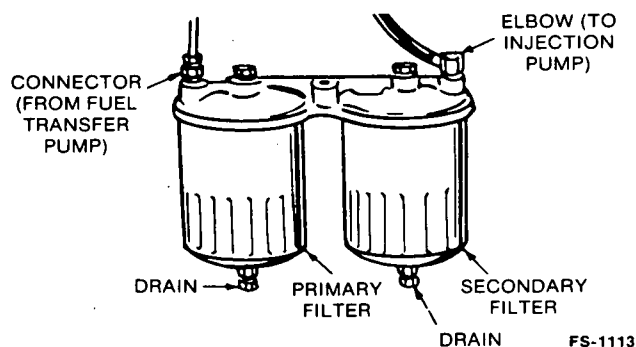


FIGURE 9. DUAL FUEL FILTERS

GOVERNOR LINKAGE

Every 100 hours, carefully pull the neoprene governor ball joints apart and clean. Do not lubricate. See Figure 10.

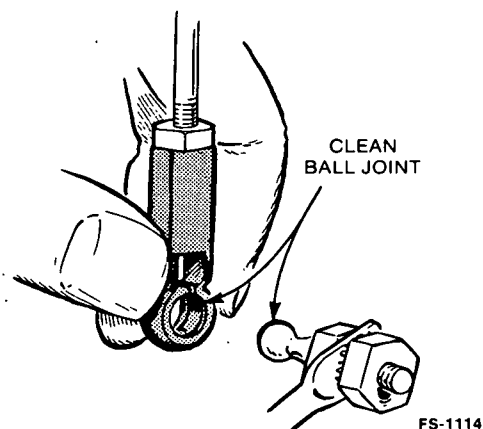


FIGURE 10. GOVERNOR BALL JOINT

WARNING

Use extreme care when cleaning with a petroleum-base solvent due to fire hazard.

CRANKCASE BREATHER

To clean crankcase breather tube it is necessary to remove both rocker covers as shown in Figure 11. The breather tube itself is installed with a sealant on the threads to prevent oil leakage into the intake manifold and should NOT be removed. A small wire,

nail or a drill bit inserted through from top end should be adequate to clean out the breather hole. The breather hole seldom needs cleaning; the 500 hour interval is suggested to coincide with valve lash adjustments, because the rocker box covers must be removed at that time.

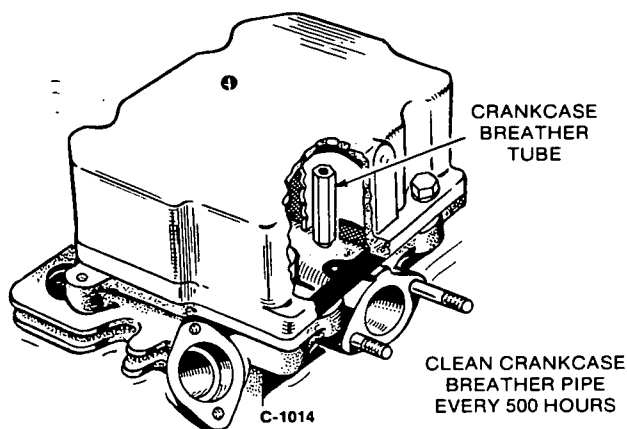


FIGURE 11. CLEANING BREATHER

COOLING SYSTEM MAINTENANCE

The cooling system including the block and radiator should be cleaned and flushed at least once a year. This is especially true in cold weather conditions or when preparing unit for extended storage (over 30 days or more)!

The thermostat is calibrated to open at $150^{\circ}\text{F} \pm 2^{\circ}\text{F}$ (66°C). It should be checked also.

An appropriate anti-freeze mixture should be used in colder climates as necessary.

For identification purposes, left and right sides of the set are viewed from the engine (radiator) end, engine being the front and generator the rear of the set.

The following drain plugs must be removed to allow complete flushing of the cooling system.

Radiator: Hose must be disconnected at the water pump to drain radiator.

Engine Block: One drain plug left front near water pump.

Water Pump: By loosening cover.

Further information concerning the location and part numbers for the various drain plugs throughout the unit is contained in the parts catalog which may be ordered under part #974-0224.

TESTING THERMOSTAT

If a sticking or faulty thermostat is suspected, test as follows:

1. Remove thermostat from cylinder head.

2. Heat a pan of water to approximately 150°F (66°C). Check temperature using a thermometer immersed in water.
3. With thermostat suspended in water at temperature of 150°F (66°C), thermostat should start to open.
4. After thermostat has opened completely, remove it from hot water and allow it to cool in surrounding air. The thermostat should close within a short time.
5. If the thermostat sticks or does not operate properly, replace it with a new one.
6. Always install a new gasket when replacing the thermostat.

FAN BELT

To adjust the fan belt, loosen the nut on the belt tightener pulley shaft. Move the shaft left or right in the elongated slot in pulley mounting bracket until a deflection of $1/2$ inch (13 mm) is obtained when about 15 pounds (67 N) of force is applied at a point midway between the water pump pulley and belt tightener pulley. Be sure to tighten nut securely.

AC GENERATOR

Periodic inspections that coincide with engine oil changes will ensure good performance. When inspecting the rotating rectifier assembly (Figure 12), make sure diodes are free of dust, dirt and grease. Excessive foreign matter on these diodes and heat sinks will cause the diodes to overheat and will result in their failure. Blow out the assembly periodically, with filtered, low pressure air.

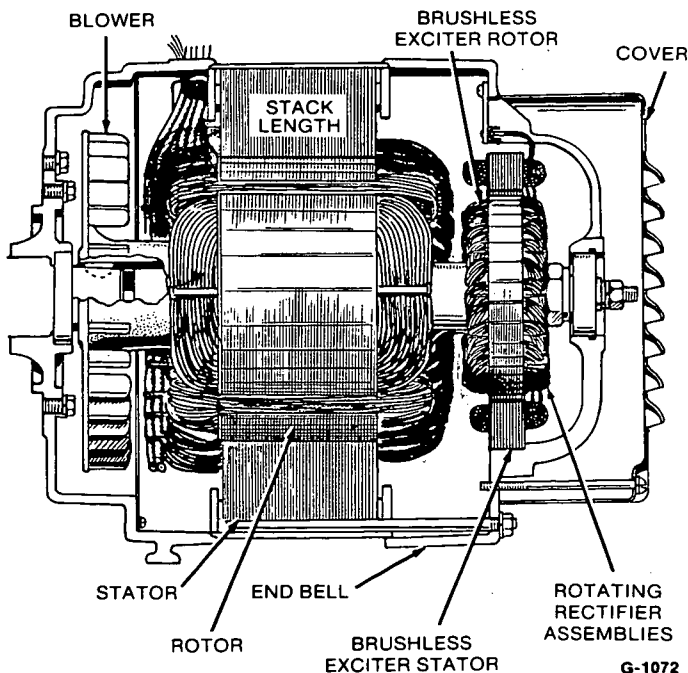


FIGURE 12. GENERATOR (CUTAWAY VIEW)

FUEL PUMP SEDIMENT BOWL

Every 100 hours, remove the sediment bowl from the fuel transfer pump and filter body (Figure 13). Clean out any water or particulate from the bowl and filter. When re-installing the sediment bowl, make sure the filter and gasket are in place.

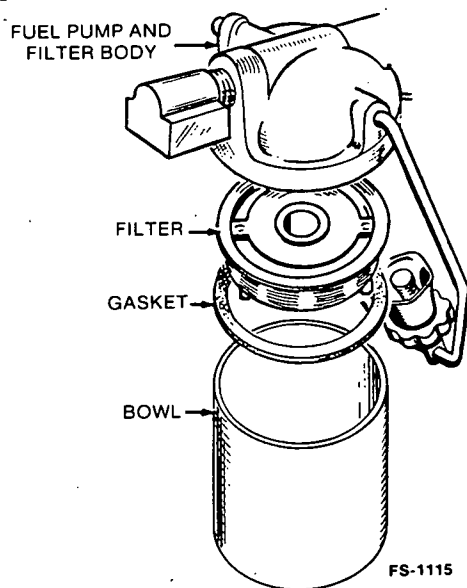


FIGURE 13. FUEL PUMP SEDIMENT BOWL

AIR CLEANER

The dust bowl should be emptied every 100 hours, and the element replaced every 200 hours of operation. See Figure 14. A visual means of signaling that replacement of the air cleaner element is necessary is indicated by the red signal remaining in the service window with set shut off.

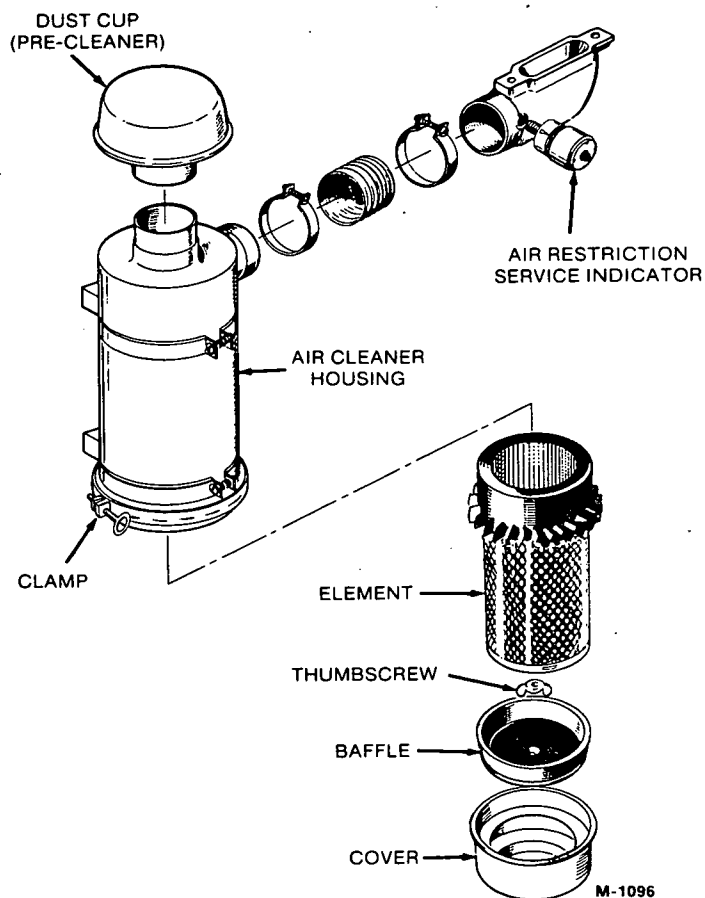


FIGURE 14. AIR CLEANER ASSEMBLY

1. Remove pre-cleaner and wash out dirt. Dry and re-install.
2. Loosen clamp and remove end cover.
3. Remove thumbscrew and take out element. Wash element in detergent and water (use new element after 6 washings or every 200 hours). Dry and re-install.
4. Remove air cleaner baffle from cover, wash out dirt, and re-install in cover.
5. Install cover with "TOP" up and tighten clamp.

PERIODIC MAINTENANCE SCHEDULE

Regularly scheduled maintenance is the key to lower operating costs and longer service life for the unit. The following schedule can be used as a guide. However, actual operating conditions under which a unit is run should be the determining factor in establishing a maintenance schedule. When operating in very dusty or dirty conditions, some of the service periods may have to be reduced. Check the condition of the crankcase oil, the filters, etc., frequently until the proper service time periods can be established.

For any abnormalities in operation, unusual noises from engine or accessories, loss of power, overheating, etc., contact your nearest authorized Onan dealer.

WARNING

Always allow generator set to cool off before performing any maintenance or installation work on the set. Working on a hot set could cause severe burns.

HOURS OF OPERATION	MAINTENANCE TASK
8	<ul style="list-style-type: none"> • Inspect exhaust system • Inspect generator set • Check fuel supply; see Note 1. • Check oil level
50 (more often in dusty conditions)	<ul style="list-style-type: none"> • See Note 3. • Check air cleaner.
100	<ul style="list-style-type: none"> • Clean governor linkage • Change crankcase oil • Clean sediment bowl and filter on fuel transfer pump. See Note 1.
200	<ul style="list-style-type: none"> • Replace air cleaner element • Replace oil filter • Check battery condition
500	<ul style="list-style-type: none"> • Check start-disconnect circuit • Check valve clearances
600	<ul style="list-style-type: none"> • Change primary fuel filter
2000	<ul style="list-style-type: none"> • Grind valves (if required) • Clean holes in rocker box oil line • Check nozzle spray pattern; see Note 2 • Clean generator
3000	<ul style="list-style-type: none"> • Change secondary fuel filter
5000	<ul style="list-style-type: none"> • General overhaul (if required) • See Note 3.

NOTE 1. Water or foreign material in fuel can ruin the injection system. If daily inspection shows water or excessive dirt in sediment bowl, fuel handling and storing facilities should be checked and situation corrected. Primary and secondary fuel filters can be replaced following correction of fuel contamination problem.

2. This service must be conducted by trained diesel injection equipment personnel with suitable test facilities. Omit this service until these conditions can be met.

3. Adjust valve clearance after first 50 hours on new and overhauled engines, and then adjust valve clearance each 500 hours thereafter.

WARNING

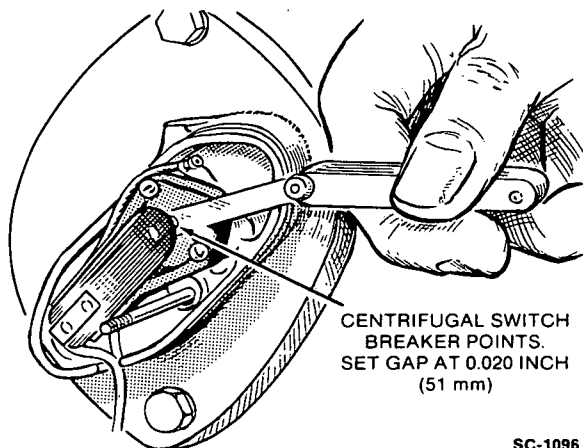
All exhaust system connections MUST be checked regularly for any leaks and tightened as necessary. Do NOT terminate exhaust pipe under vehicle or near any window or door openings. Inspect the vapor tight seals around all openings made in the set's compartment for wiring, conduit, etc., to prevent entrance of any noxious fumes to motor home interior.

ADJUSTMENTS

CENTRIFUGAL SWITCH

The start-disconnect centrifugal switch (Figure 15) is located on the side of the engine above the oil filter. The switch opens when the engine stops and closes when engine speed reaches about 900 rpm. If necessary, loosen the stationary contact and adjust point gap at 0.020 inch (51 mm). Replace burned or faulty points.

Using a socket wrench on flywheel retaining screw, rotate engine crankshaft a few degrees counterclockwise before adjusting points.



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FIGURE 15. CENTRIFUGAL SWITCH ADJUSTMENT

GOVERNOR

The governor controls engine speed. Engine speed equals frequency multiplied by 30 on a 4 pole generator, thus 1800 rpm generates 60 hertz; 1500 rpm generates 50 hertz. Preferred speed does not vary more than 3 hertz from no-load to full-load operation. Be sure throttle, linkage, and governor mechanism operate smoothly.

Speed Adjustment

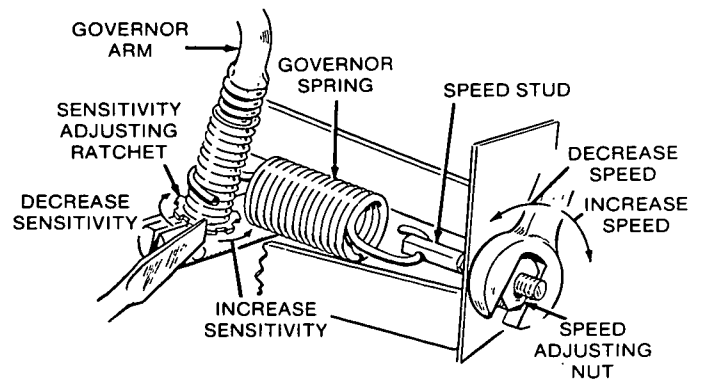
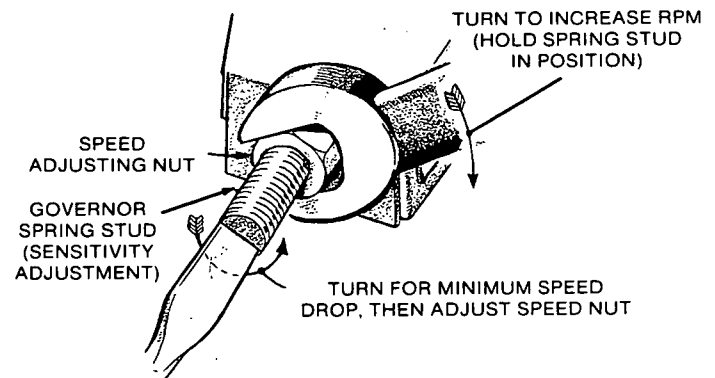
To change the governor speed, change the spring tension by turning the governor spring nut (Figure 16). Turn the nut clockwise (more spring tension) to increase rpm and counterclockwise to reduce governed speed. Hold a tachometer against flywheel-crankshaft cap screw or observe frequency meter.

Sensitivity Adjustment

To adjust governor sensitivity (no load to full load speed droop), turn the sensitivity adjusting ratchet.

Counterclockwise gives more sensitivity (less speed drop when full load is applied); clockwise gives less sensitivity (more speed drop). If the governor is too sensitive, a rapid hunting condition occurs (alternate increasing and decreasing speed). Adjust for maximum sensitivity without hunting. After sensitivity adjustment, the speed will require readjustment. When finished, replace the knockout plug in the blower housing and secure speed stud lock nut.

Excessive droop may be caused by engine misfiring. Correct this condition before adjusting governor.



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FIGURE 16. GOVERNOR ADJUSTMENT

Charge Resistor

The adjustable slide tap resistor (in the charging circuit) is set to give about a two-ampere charging rate. For applications requiring frequent starts, check battery specific gravity periodically and, if necessary, increase the charging rate slightly (move slide tap nearer ungrounded lead) until it keeps the battery

charged. Adjust only when set is stopped. Avoid overcharging. The resistor is located in the generator air outlet. Remove cover on air duct for access to charge resistor.

VALVE CLEARANCE ADJUSTMENTS

Check valve clearance when the engine is at room temperature, about 70°F (21°C).

1. Turn the flywheel until the cylinder which is to have its valve adjusted is on its compression stroke. On engines without a hand crank, use a socket wrench on the flywheel screw hex head.

To determine if the cylinder is in its compression stroke, observe the action of the push rods as the engine is rotated in a clockwise direction. The exhaust valve push rod will be in its lowest position and the intake valve push rod will be moving downward. As the piston reaches top dead center, the flywheel timing mark should be aligned with the timing pointer and the valve push rods stationary.

2. Turn the flywheel clockwise for an additional 10 to 45 degrees. There is no timing mark for this position so it must be estimated. With the piston located in this position, it will be in its power stroke with both valves completely closed.
3. Valve clearance is adjusted with the locknut which secures rocker arm to the cylinder head (see Figure 17). Loosen the locknut to increase clearance and tighten to reduce clearance.

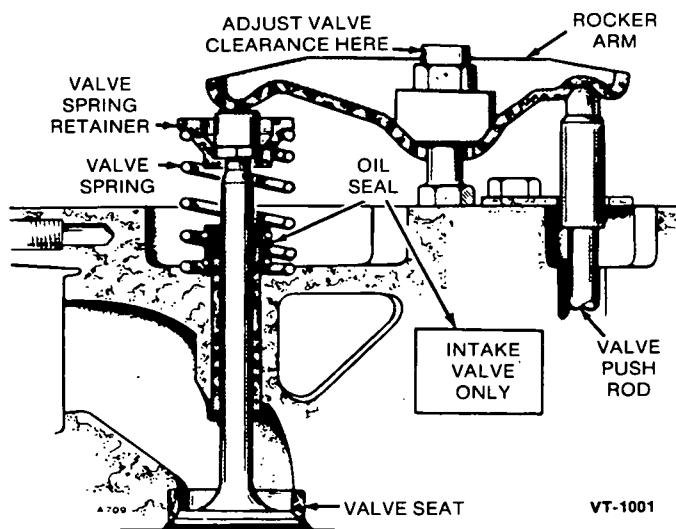


FIGURE 17. VALVE CLEARANCE ADJUSTMENTS

4. Using a feeler gauge, check the clearance between the rocker arm and the valve (see Figure 18). Increase or decrease the clearance until the proper gap is established. Valve clearances are given in the *Specifications* section.

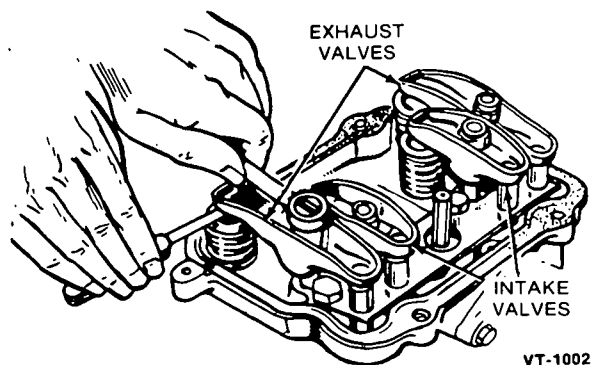
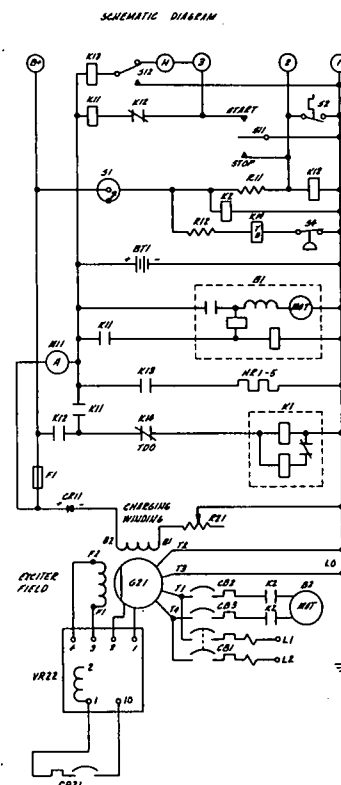


FIGURE 18. CHECK VALVE CLEARANCE

5. Always adjust the valve clearances in the firing order (1-2-4-3) sequence. After positioning #1 cylinder, adjust the valve clearance according to steps 3 and 4.
6. To adjust the valve clearance of #2 cylinder, turn the flywheel in a clockwise direction 180 degrees (one half revolution) from the position used when timing #1 cylinder. The flywheel position should be between 10 and 45 degrees past the BC (bottom center) flywheel mark.
7. After positioning #2 cylinder, adjust the valve clearance according to steps 3 and 4.
8. To adjust the valve clearance for #4 cylinder, turn the flywheel in a clockwise direction 180 degrees (one half revolution). The flywheel should be between 10 and 45 degrees past the TC (top center) flywheel mark.
9. After positioning #4 cylinder, adjust the valve clearance according to steps 3 and 4.
10. To adjust the valve clearance for #3 cylinder, turn the flywheel in a clockwise direction 180 degrees (one half revolution). The flywheel should be between 10 and 45 degrees past the BC (bottom center) flywheel mark.
11. After positioning #3 cylinder, adjust the valve clearance according to steps 3 and 4.



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