Onan

RV GenSet

Operator's Manual

BGM, NHM

Printed in U.S.A.

965-0138
5-97

WARNING:

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Emissions Supplement: 900-1021
Date: 07-2000
Insert with-
Manual Number & Date: See Table 1
Models: See Table 1

Purpose: This supplement for the Operator's Manuals specified in Table 1 clarifies how compliance with engine emissions regulations, including U. S. EPA Phase 2 and California Air Resources Board regulations for Model Year 2000 onwards, is presented on genset and engine nameplates (Figures 1 and 2). This sheet is to be bound in the genset or engine manual behind the front cover and in front of earlier Supplements, if any.

TABLE 1. MANUALS AFFECTED BY SUPPLEMENT

Manual No.	Date	Genset Models
965-0138	5/97	BGM / NHM
965-0175	7/97	BGD / NHD
965-0176	7/97	BGE / NHE
981-0153	7/97	KV
981-0158	6/99	KVC
981-0159	5/00	KY
981-0160	7/99	MKY
983-0101	5/00	HGJAA / HGJAB / HGJAC
Manual No.	**Date**	**Engine Models**
965-0163	10/95	Miller P216 / P218 / P220 / P224
965-0174	10/97	E124V Floorcare
965-0178	7/97	E125V / E140V
965-0179	7/97	E125H / E140H
965-0180	7/97	P218V / P220V
965-0182B	-	P216 / P218 / P220 / P224
965-0183	-	P248V Floorcare

Nameplate Information: See the Operator's Manual for the location of the actual nameplate on the genset or engine. Figures 1 and 2 illustrate where the information regarding compliance with U. S. EPA and California Air Resources Board regulations on the nameplate. The appropriate figure in this supplement supercedes the nameplate illustration in Figure 1 in the genset or engine manual in which the supplement is bound.

Federal Emissions Compliance Period: The Federal Emissions Compliance Period referred to on the nameplate indicates the number of operating hours for which the engine has been shown to meet Federal emissions requirements.

For engines of less than 225 cc displacement, Category C = 125 hrs, B = 250 hrs, A = 500 hrs. For engines of 225 cc and greater displacement, Category C = 250 hrs, B = 500 hrs, A = 1000 hrs.

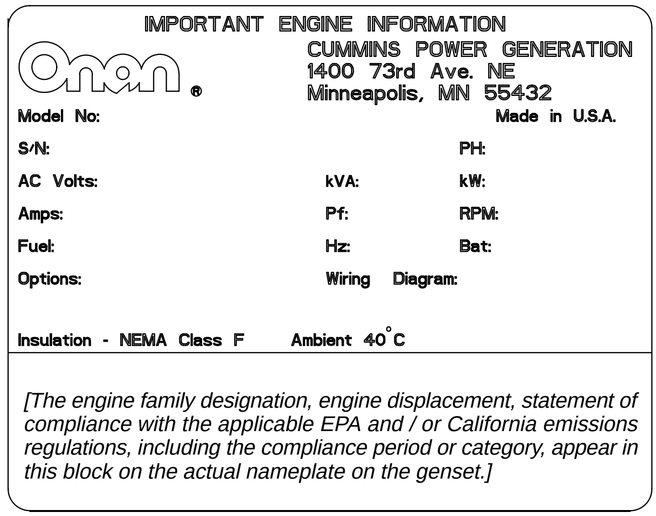

FIGURE 1. TYPICAL GENSET NAMEPLATE

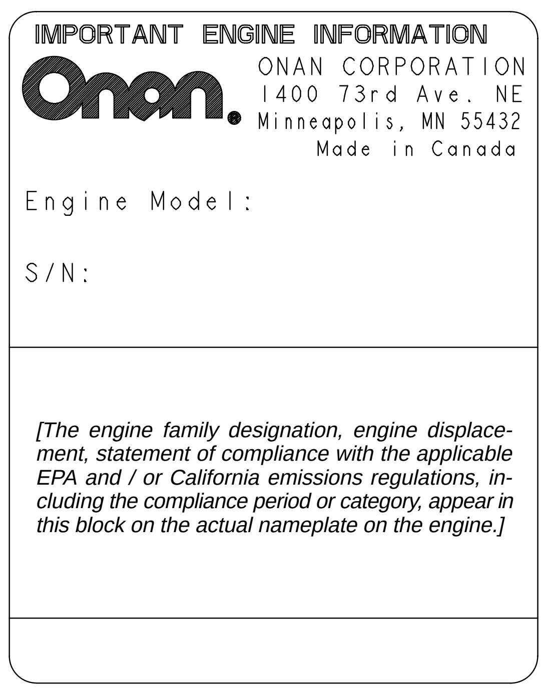

FIGURE 2. TYPICAL ENGINE NAMEPLATE

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Safety Precautions

Thoroughly read the OPERATOR'S MANUAL before operating the genset. Safe operation and top performance can be obtained only when equipment is operated and maintained properly.

The following symbols in this manual alert you to potential hazards to the operator, service person and equipment.

⚠ DANGER ***alerts you to an immediate hazard which will result in severe personal injury or death.***

⚠WARNING ***alerts you to a hazard or unsafe practice which can result in severe personal injury or death.***

⚠ CAUTION ***alerts you to a hazard or unsafe practice which can result in personal injury or equipment damage.***

Electricity, fuel, exhaust, moving parts and batteries present hazards which can result in severe personal injury or death.

GENERAL PRECAUTIONS

- Keep ABC fire extinguishers handy.
- Make sure all fasteners are secure and torqued properly.
- Keep the genset and its compartment clean. Excess oil and oily rags can catch fire. Dirt and gear stowed in the compartment can restrict cooling air.
- Before working on the genset, disconnect the negative (**-**) battery cable at the battery to prevent starting.
- Use caution when making adjustments while the genset is running—hot, moving or electrically live parts can cause severe personal injury or death.
- Used engine oil has been identified by some state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.
- Benzene and lead in some gasolines have been identified by some state and federal agencies as causing cancer or reproductive toxicity. Do not to ingest, inhale or contact gasoline or its vapors.
- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.

GENERATOR VOLTAGE IS DEADLY!

- Generator output connections must be made by a qualified electrician in accordance with applicable codes.
- The genset must not be connected to the public utility or any other source of electrical power. Connection could lead to electrocution of utility workers and damage to equipment. An approved switching device must be used to prevent interconnections.
- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry and stand on a dry wooden platform.

FUEL IS FLAMMABLE AND EXPLOSIVE

- Do not smoke or turn electrical switches ON or OFF where fuel fumes, tanks or equipment are present or in areas sharing ventilation. Keep flame, sparks, pilot lights, arc-producing equipment and switches and all other sources of ignition well away.
- Fuel lines must be secured, free of leaks and separated or shielded from electrical wiring.
- Use approved non-conductive flexible fuel hose for fuel connections at the genset.
- Leaks can lead to explosive accumulations of gas. LPG sinks when released and can accumulate inside housings and basements and other below-grade spaces. Prevent leaks and the accumulation of gas.

ENGINE EXHAUST IS DEADLY!

- Learn the symptoms of carbon monoxide poisoning in this Manual.
- The exhaust system must be installed in accordance with the genset Installation Manual.
- Do not use engine cooling air to heat a room or compartment.
- Make sure there is ample fresh air when operating the genset in a confined area.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- When disconnecting or reconnecting battery cables, always disconnect the negative (**-**) battery cable first and reconnect it last to reduce arcing.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not wear loose clothing or jewelry near moving parts such as PTO shafts, fans, belts and pulleys.
- Keep hands away from moving parts.
- Keep guards in place over fans, belts, pulleys, etc.

Introduction

ABOUT THIS MANUAL

This manual covers the operation and maintenance of the BGM and NHM series of generator sets (gensets). Each operator should study this manual carefully and observe all of its instructions and precautions. Keep this manual and the Installation Manual with the other vehicle manuals.

Component Locations, Starting and Stopping, Powering Equipment and *Varying Operating Conditions* cover basic operation of the genset. *Periodic Maintenance* and *Troubleshooting* cover the maintenance and care necessary for top performance. The owner is responsible for maintaining the genset according to the maintenance schedule (Table 4 on page 14). This manual also covers genset break-in, exercise and storage, how to obtain service, genset specifications and important information for California genset users.

⚠WARNING ***This genset is not a life support system. It can stop without warning. Children, persons with physical or mental limitations, and pets could suffer personal injury or death. A personal attendant, redundant power or an alarm system must be used if genset operation is critical.***

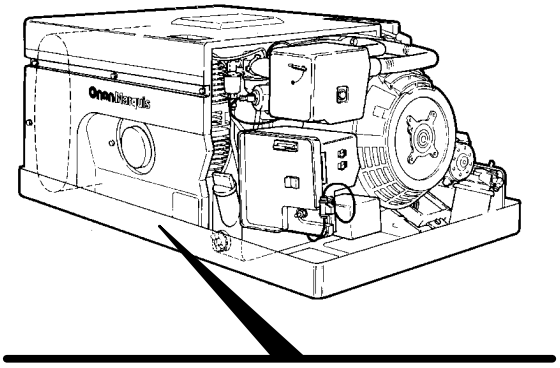
⚠WARNING ***This genset is not for marine use. On a vessel, can cause asphyxiation, explosion or electrocution.***

MODEL IDENTIFICATION

When contacting an Onan® dealer or distributor for parts, service or product information, be ready to provide the model and serial numbers on the genset nameplate (Figure 3). Every character in these numbers is significant. (The last character of the model number is the specification letter, which is important for obtaining the right parts.) To make the model and serial numbers easy to find when you need them, record them in the boxes provided in Figure 3.

Federal Emissions Compliance Period: The Federal Emissions Compliance Period referred to on the nameplate indicates the number of operating hours for which the engine has been shown to meet Federal emissions requirements.

For engines of less than 225 cc displacement, Category C = 125 hrs, B = 250 hrs, A = 500 hrs. For engines of 225 cc and greater displacement, Category C = 250 hrs, B = 500 hrs, A = 1000 hrs.



NAMEPLATE WITH TYPICAL MODEL AND SERIAL NUMBER DATA

IMPORTANT ENGINE INFORMATION

Onan®

CUMMINS POWER GENERATION
1400 73rd Ave. NE
Minneapolis, MN 55432

Model No:		Made in U.S.A.
S/N:		PH:
AC Volts:	kVA:	kW:
Amps:	Pf:	RPM:
Fuel:	Hz:	Bat:
Options:	Wiring Diagram:	

Insulation - NEMA Class F Ambient 40°C

[The engine family designation, engine displacement, statement of compliance with the applicable EPA and / or California emissions regulations, including the compliance period or category, appear in this block on the actual nameplate on the genset.]

RECORD NUMBERS HERE

MODEL NUMBER:

SERIAL NUMBER:

FIGURE 3. TYPICAL NAMEPLATE

FUEL RECOMMENDATIONS

⚠WARNING ***Gasoline and LPG are highly flammable and explosive and can cause severe personal injury or death. Do not smoke or turn electrical switches ON or OFF where fuel fumes, tanks or equipment are present or in areas sharing ventilation. Keep flame, sparks, pilot lights, arc-producing equipment and switches and all other sources of ignition well away. Keep a type ABC fire extinguisher in the vehicle.***

Gasoline Models

Use clean, fresh unleaded gasoline having a minimum octane rating (Anti-Knock Index) of 87.

During some times of the year only mandated "oxygenated" gasolines may be available. These are acceptable for use, but not preferable. Leaded gasoline may be used but will result in the extra maintenance required for removing combustion chamber and spark plug deposits. Do not use gasoline or gasoline additives (de-icers) containing methanol because methanol can be corrosive to fuel system components.

⚠CAUTION ***Do not use gasoline or gasoline additives containing methanol because methanol can be corrosive to fuel system components.***

Avoid using highly leaded gasolines and lead additives because of the extra engine maintenance that will be required.

LPG Models

Use clean, fresh HD-5 grade liquified petroleum gas or equivalent product consisting of at least 90 percent propane. Commercial liquified petroleum gas fuels may contain more than 2.5 percent butane which can result in poor fuel vaporization and poor engine starting in low ambient temperatures (below 32° F (0° C).

Satisfactory performance requires that the LPG *vapor* (vapor-withdrawal models only) be supplied at a pressure within the range indicated in *Specifications*.

⚠WARNING ***High LPG supply pressure (vapor withdrawal models only) can cause gas leaks which can lead to fire and severe personal injury or death. LPG supply pressure must be adjusted to Specifications by qualified personnel.***

"OnaMax" is a trademark of the Onan Corporation.

ENGINE OIL RECOMMENDATIONS

Use premium quality motor oil. Look for the API (American Petroleum Institute) classification and use Class SG or SH oil (also SG/CD, SG/CE, SH/CD or SH/CE). Also look for the SAE (Society of Automotive Engineers) viscosity grade. Referring to Table 1, choose the viscosity grade appropriate for the ambient temperatures expected during the period of time until the next scheduled oil change.

Single-grade SAE 30 oil is preferable when temperatures are consistently above freezing. Multigrade oils are better when wide temperature variations are expected.

TABLE 1. OIL VISCOSITY VS. TEMPERATURE

EXPECTED AMBIENT TEMPERATURES	SAE VISCOSITY GRADE
32° F (0° C) and higher	30*
10° F to 100° F (-12° C to 38° C)	15W-40*
0° F to 80° F (-18° C to 27° C)	10W-30 10W-40
-20 ° F to 50° F (-28° C to 10° C)	5W-30
* OnaMax™ brand oil is recommended	

STARTING BATTERIES

These gensets have a 12 volt, direct current (DC) starting and control system. Usually, the 12 volt battery used for vehicle lighting and other 12 volt DC vehicle loads is used for genset cranking and start-up. See *Specifications* for minimum battery requirements for genset cranking.

Regular, monthly maintenance of batteries may be required. See *Periodic Maintenance* and any instructions available from the vehicle manufacturer or battery manufacturer. Battery recharging depends upon the vehicle's DC converter/battery charger, which is powered either by the genset AC output or the utility when it is connected.

Reliable genset starting and starter service life depend upon adequate battery system capacity and proper maintenance.

Component Locations

COMPONENTS REQUIRING PERIODIC ATTENTION OR MAINTENANCE

The control panel and the components requiring attention during periodic maintenance are located as shown in Figure 4 (see *Periodic Maintenance*). The genset itself is usually located behind a door in a compartment somewhere around the perimeter of the vehicle.

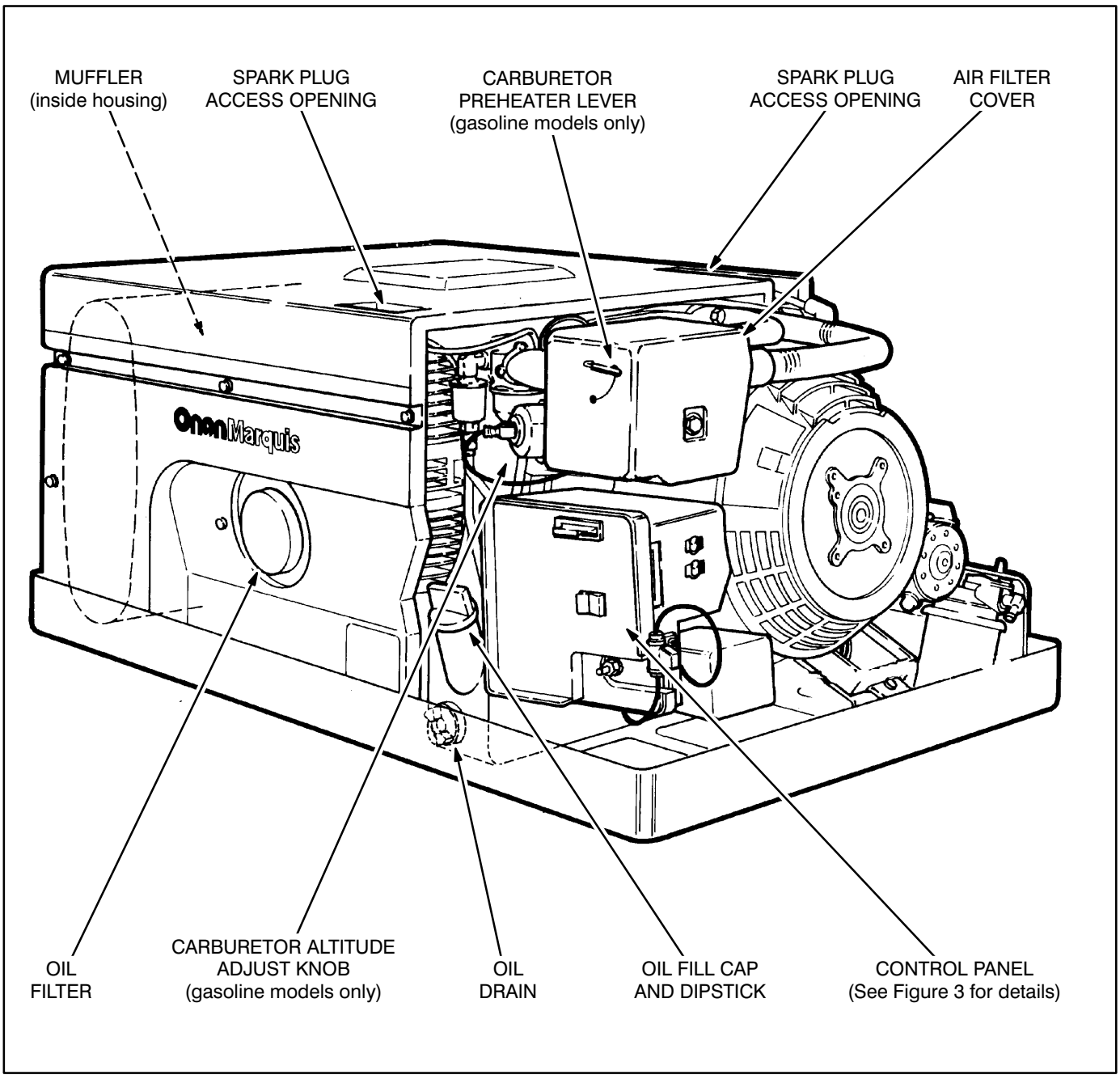


FIGURE 4. COMPONENT LOCATIONS

GENSET CONTROL PANEL

The genset control panel (Figure 5) and box include the following features:

START-STOP Switch - This is a rocker switch which returns to its neutral position when you let go. Hold it in the START position to crank and start the genset and push it momentarily to the STOP position to stop the genset.

Control Fuse F1 - This fuse provides short circuit protection for the control and remote control circuits.

Control Fuse F2 - This fuse provides short circuit protection for the autochoke and fuel pump circuits on gasoline models and the fuel solenoid circuit on LPG models.

Line Circuit Breaker - The line circuit breakers protect the AC power leads connected to the genset from overloads and equipment short circuits.

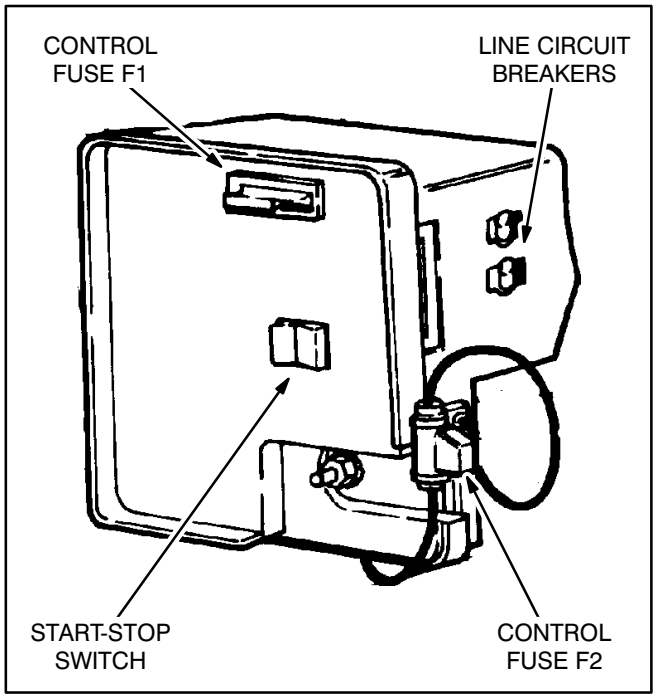


FIGURE 5. GENSET CONTROL PANEL

REMOTE CONTROL

The vehicle probably has a control panel in the cab or at some other location on the vehicle for controlling genset operation. There may also be an enable switch in the cab or other space which can be locked to prevent unauthorized operation of the genset.

Onan offers optional remote control kits that can be connected to the genset. There are three models available:

- Remote start/stop switch with indicator lamp only (Figure 6).
- Remote start/stop switch with indicator lamp and hour meter (Figure 7).
- Remote start/stop switch with indicator lamp and DC voltmeter (Figure 8).

The hour meter records genset operating time in hours. See *Periodic Maintenance*.

The DC voltmeter indicates whether voltage across the 12 VDC control system and battery is normal. If the indicator consistently stays above or below the normal zone, see BATTERY CARE (Page 18).

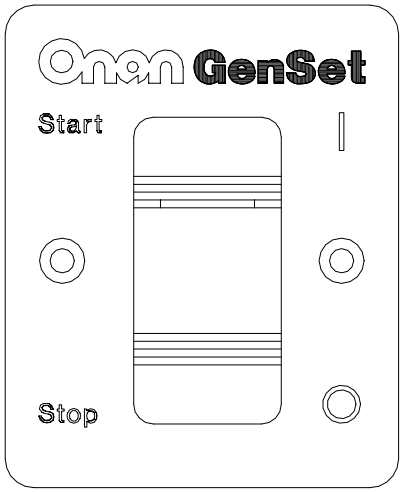


FIGURE 6. REMOTE START/STOP SWITCH ONLY

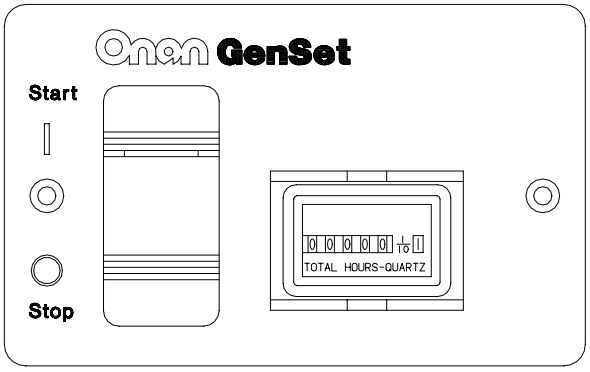


FIGURE 7. REMOTE START/STOP SWITCH AND HOUR METER

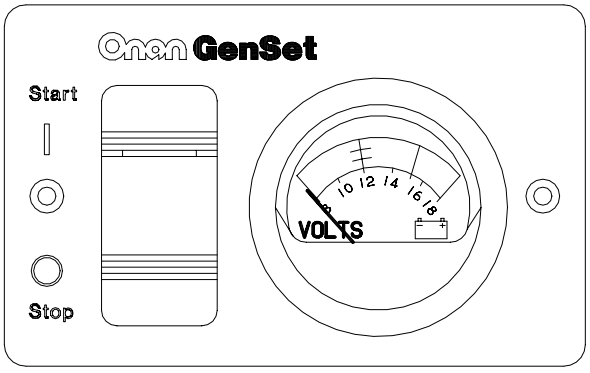


FIGURE 8. REMOTE START/STOP SWITCH AND DC VOLTMETER

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 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 genset and do not operate it until it has been inspected and repaired.

Never sleep in the vehicle with the genset running unless the vehicle is equipped with a working carbon monoxide detector. Primary protection against inhaling carbon monoxide, however, is the proper installation of the exhaust system and the daily (every eight hour) inspection for visible and audible exhaust system leaks.

PRE-START CHECKS

Before the first start of the day and after every eight hours of operation perform GENERAL INSPECTION (Page 15). ***Check for exhaust and fuel system leaks every time you start the genset.*** Keep a log of maintenance and the hours run and perform any maintenance that may be due. Also, see *Genset Break-In, Exercise and Storage* to return the genset to service if the vehicle has been in storage.

STARTING

The genset can be started and stopped from the genset control panel (Figure 5) or from a remote control panel inside the vehicle (Figures 6 through 8).

1. Perform the PRE-START CHECKS and turn off the air conditioner and other large electrical loads. Open the manual shutoff valve at the LPG container if this is an LPG genset.

2. Push and hold the genset or remote START switch until the genset starts. (The remote START switch inside the vehicle should have a lamp which lights to indicate that the genset has started and is running.)

   ⚠CAUTION ***Cranking for longer than 10 seconds at a time can overheat and damage the starter. Do not crank for more than 10 seconds at a time and wait at least 30 seconds before trying again.***

3. For top performance and engine life, especially in colder weather, let the engine warm up for at least two minutes before connecting the genset to the vehicle electrical loads (appliances). See *Powering Equipment*.

4. Check for fuel and exhaust leaks. Stop the genset immediately if there is a fuel or exhaust leak and have it repaired before continuing operation.

5. See *Troubleshooting* if the engine does not crank or start after several tries.

STOPPING

1. Turn off the air conditioner and other large electrical loads and let the genset run two minutes before stopping it. This allows the engine to cool down, reducing the incidence of backfiring and engine run-on.

2. Push the STOP switch momentarily.

Powering Equipment

GENSET LOADING

The AC output of the genset powers the vehicle air conditioners, the DC converter/battery charger and the appliances that may be plugged into the electrical outlets of the vehicle. How much electrical equipment (power consuming appliances) can be operated at one time depends upon how much power is available from the genset. If the genset is "overloaded", either the genset will stall or its circuit breaker(s) will trip.

To get an idea of how much equipment can be operated at one time add up the wattages of the individual appliances that are likely to be used at the same time and compare the sum to the kW (kilowatt) rating of the genset. Use Table 2 or the ratings on the appliances themselves (if so marked) to obtain the appliance wattages. Note that 1 kW = 1000 watts. If power consumption, as totaled up, exceeds genset power output, ***it may be necessary to operate some appliances in sequence, one after the other, rather than all at the same time***.

Note that the genset may stall when it is loaded nearly to full power and an air conditioner (or other large motor load) cycles on. The reason is that for a brief moment at startup a motor draws up to three times rated power. ***It may be necessary to operate some appliances at times when the air conditioner or other large motor load is not "On".***

Note also that air density decreases as altitude increases causing genset engine power to decrease (even though the altitude adjust knob is set correctly, Page 13). Power decreases approximately 3.5 percent of rated power every 1000 feet (305 m) that elevation increases above sea level. See Table 3 for typical calculations. ***It maybe necessary to operate fewer appliances at higher altitudes.***

RESTARTING A STALLED GENSET

If the genset stalls, disconnect or turn off as many appliances as possible and try restarting the genset as instructed under *Starting and Stopping*. Reconnect the loads (appliances) one by one up to a total load that does not overload the genset or cause the circuit breaker to trip.

TABLE 2. TYPICAL APPLIANCE WATTAGES

Appliance	Power Consumption (W)
Air Conditioner	1400-2000
Battery Charger	Up to 800
DC Converter	300-1500
Refrigerator	600-1000
Microwave Oven	1000-1500
Electric Frying Pan/Wok	1000-1500
Electric Stove Element	350-1000
Electric Water Heater	1000-1500
Electric Iron	500-1200
Electric Hair Dryer	800-1500
Coffee Percolator	550-750
Television	200-600
Radio	50-200
Electric Drill	250-750
Electric Broom	200-500
Electric Blanket	50-200

TABLE 3. POWER VS. ALTITUDE

Elevation above Sea Level	Maximum Power
up to 500 feet (152 m)	5500 W (rated)*
at 2500 feet (762 m)	5100 W
at 5500 feet (1676 m)	4500 W
above 5500 feet (1676 m)	4500 W minus 200 W every 1000 feet (305 m)
* Does not take into account the effect circuit breakers may have in limiting maximum power.	

RESETTING CIRCUIT BREAKERS

If a circuit breaker in the main power distribution panel of the vehicle or on the genset (Figure 9) trips, there is either a short circuit or too much load. Note that the genset will continue to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as many loads as possible and reset the circuit breaker. (Push the circuit breaker to **OFF** to reset it and then to **ON** to reconnect the circuit.) If the circuit breaker trips right away, either the electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician.

If the circuit breaker does not trip, reconnect a combination of loads that does not overload the genset or cause the circuit breaker to trip. An appliance or load probably has a short if it causes a circuit breaker to trip right away.

Electrical equipment and tools must be properly grounded and in good working condition.

⚠WARNING ***Electrical shock can cause severe personal injury or death. Read and follow the equipment and tool manufacturer's instructions and warnings.***

CONNECTING THE VEHICLE TO UTILITY POWER

When the vehicle has provisions for connecting to utility power, such as a cord for plugging into a power outlet receptacle, it must also have an approved device to keep the genset and utility from being interconnected. See the genset Installation Manual for more information.

⚠WARNING ***Interconnecting the genset and the public utility (or any other power source) can lead to the electrocution of utility workers and damage to equipment. An approved switching device must be used to prevent interconnections.***

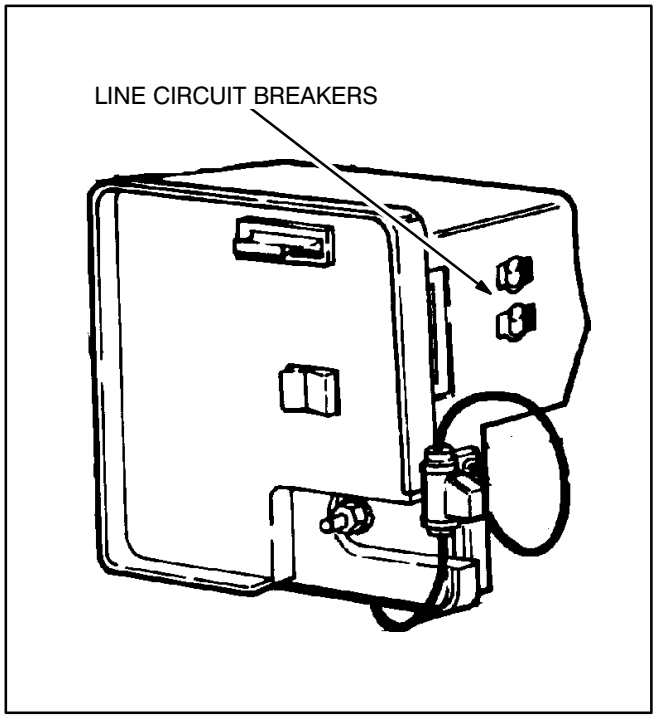


FIGURE 9. SET MOUNTED CIRCUIT BREAKER

Varying Operating Conditions

COLD WEATHER

Pay particular attention to the following items when operating the genset in cold weather:

1. Make sure the engine oil viscosity is appropriate for the cold weather temperatures. See Table 1. Be sure to change the oil if a sudden drop in temperature occurs.
2. At temperatures below 40° F (4° C), push the carburetor air preheater lever down to the WINTER position (gasoline models only). The lever is located on the front of the air cleaner (Figure 10). At temperatures between 40° F (4° C) and 70° F (21° C), the preheater may be left in either position.

   ⚠ CAUTION ***Operating the genset with the preheat lever in the SUMMER position when temperatures are below 40° F (4° C) may cause the genset to run roughly, stop running or overspeed due to carburetor icing.***

3. Set the altitude adjust knob (Figure 11) for your altitude (gasoline models only).

HOT WEATHER

Pay particular attention to the following items when operating the genset in hot weather:

1. Make sure nothing blocks the airflow to and from the set.
2. Make sure the engine oil viscosity is appropriate for the hot weather temperatures. See Table 1.
3. Keep the genset clean.
4. Perform maintenance due. See *Periodic Maintenance*.

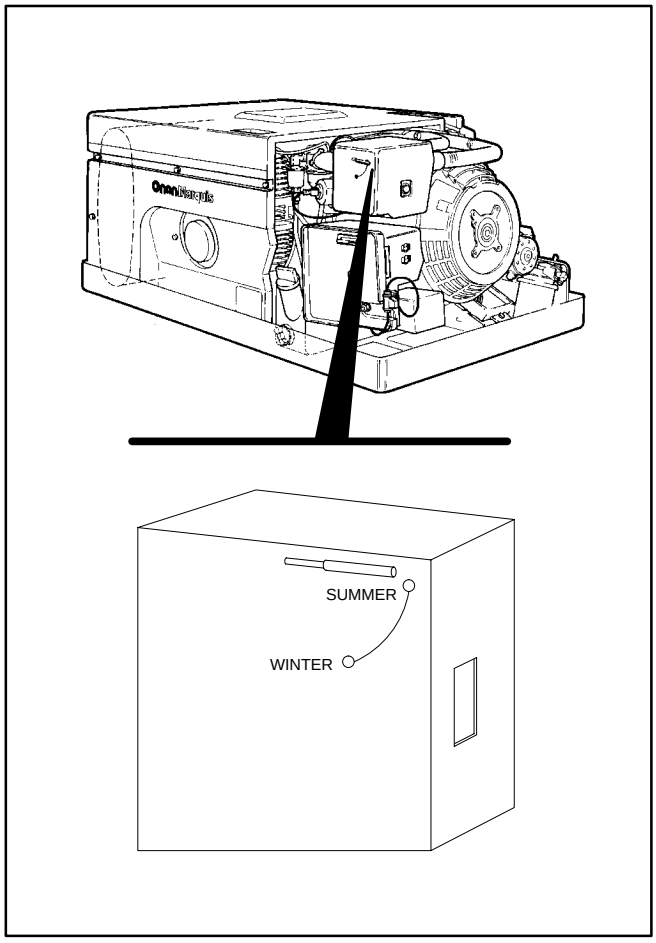


FIGURE 10. CARBURETOR PREHEATER LEVER (GASOLINE MODELS ONLY)

5. At temperatures above 70° F (21° C) push the carburetor preheater lever up to the SUMMER position (gasoline models only). The lever is located on the front of the air cleaner (Figure 10).

   ⚠ CAUTION ***Operating the genset with the preheat lever in the WINTER position when temperatures are above 70° F (21° C) can cause erratic operation, reduced power and reduced engine life.***

6. Set the altitude adjust knob (Figure 11) for your altitude (gasoline models only).

HIGH ALTITUDE

For best fuel economy and genset operation set the carburetor altitude adjust knob (Figure 11) for your altitude (gasoline models only). Look at road maps, travel atlases and road signs for altitude. (See *Powering Equipment* for information on how altitude affects the maximum power output of the genset.)

⚠ CAUTION ***Operating the genset at low altitude with a high altitude setting can cause power loss, overheating and engine damage. Always reset the altitude adjust knob when returning to lower altitudes.***

DUSTY CONDITIONS

Pay particular attention to the following items when operating the genset in dusty conditions:

1. Do not let dirt and debris accumulate inside the genset compartment. Keep the genset clean.
2. Perform air cleaner maintenance more often than usual. See *Periodic Maintenance.*
3. Change engine oil every 50 hours.
4. Keep opened containers of engine oil tightly closed to keep out dust.

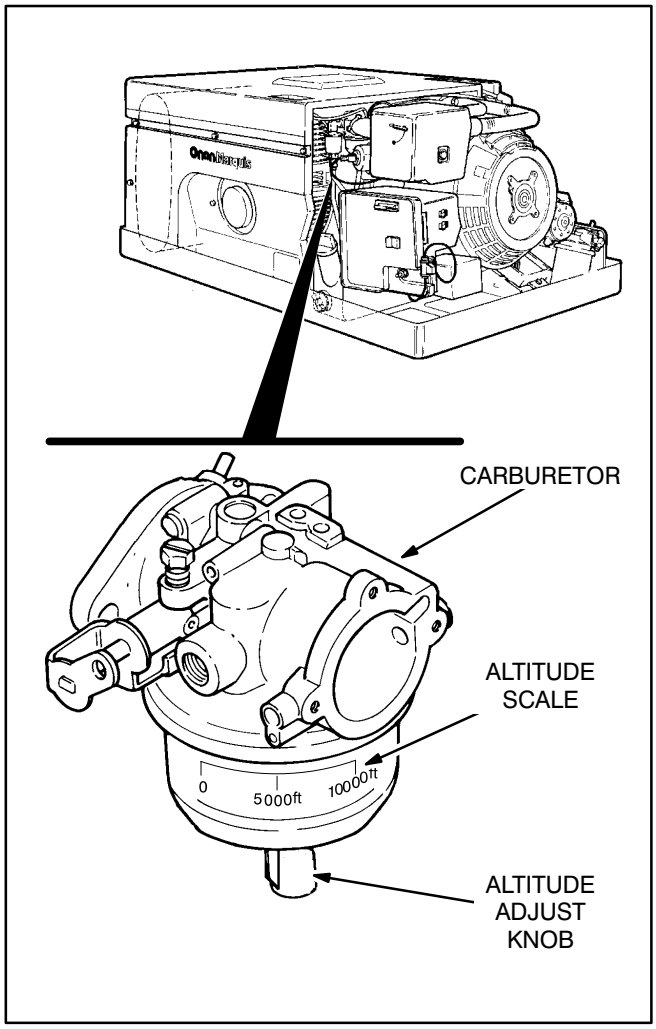


FIGURE 11. ALTITUDE ADJUST KNOB (GASOLINE MODELS ONLY)

Periodic Maintenance

Periodic maintenance is essential for top performance and long genset life. Use Table 4 as a guide for normal periodic maintenance. Under hot or dusty operating conditions some maintenance operations should be performed more frequently, as indicated by the footnotes in the table. Keeping a log of maintenance performed and the hours run (*Maintenance Record*) will help you keep genset maintenance regular and provide a basis for supporting warranty claims.

Maintenance, replacement or repair of emission control devices and systems may be performed by any engine repair establishment or individual. However, warranty work must be completed by an authorized Onan dealer or distributor.

TABLE 4. PERIODIC MAINTENANCE SCHEDULE

MAINTENANCE OPERATION	MAINTENANCE FREQUENCY						
	Every Day or Every 8 Hours	Every Month	Every 50 Hours	Every 150 Hours	Every 300 Hours	Every 500 Hours	Page
General Inspection	X						15
Check Engine Oil Level	X						16
Clean and Check Starting Battery		X[3]					18
Clean the Spark Arrestor			X				21
Change Engine Oil and Oil Filter				X[1, 2, 3, 4]			17
Replace Engine Air Filter				X[2, 4]			19
Clean Carburetor and Combustion Chambers with Onan 4C				X			20
Clean Engine Cooling Fins					X[2, 6]		-
Replace Spark Plugs						X[4]	19
Replace Fuel Filter(s) and Clean Fuel Pump Screen						X[5, 6]	-
Adjust Engine Valve Clearance						X[6]	-
Remove Cylinder Heads and Clean Combustion Chambers						X[6]	-
Inspect and Clean Governor Linkage						X[6]	-

1 - As a part of engine break-in, change the engine oil after the first 50 hours of operation.
2 - Perform more often when operating in dusty conditions.
3 - Perform more often when operating in hot weather.
4 - Perform at least once a year.
5 - Perform sooner if engine performance deteriorates.
6 - Must be performed by a qualified mechanic (authorized Onan dealer).

GENERAL INSPECTION

Inspect the genset before the first start of the day and after every eight hours of operation.

Oil Level

Check the engine oil level (Page 16).

Exhaust System

Look and listen for exhaust system leaks while the genset is running. Shut down the genset if a leak is found and have it repaired before operating the genset.

Look for openings or holes between the genset compartment and vehicle cab or living space if the genset engine sounds louder than usual. Have all such openings or holes closed off or sealed to prevent exhaust gases from entering the vehicle.

Replace dented, bent or severely rusted sections of the tailpipe and make sure the tailpipe extends at least 1 inch (25.4 mm) beyond the perimeter of the vehicle.

Park the vehicle so that the genset exhaust gases can disperse away from the vehicle. Barriers such as walls, snow banks, high grass, brush and other vehicles can cause exhaust gases to accumulate in and around the vehicle.

Do not operate power ventilators or exhaust fans while the vehicle is standing with the genset running. The ventilator or fan can draw exhaust gases into the vehicle.

⚠WARNING ***EXHAUST GAS IS DEADLY! Do not operate the genset if there is an exhaust leak or any danger of exhaust gases entering or being drawn into the vehicle.***

⚠WARNING ***Do not park the vehicle in high grass or brush. Contact with the exhaust system can cause a fire.***

Fuel System

Check for leaks at the hose, tube and pipe fittings in the fuel supply system while the genset is running and while it is stopped. *Do not use a flame to check for LPG leaks.* Check flexible fuel hose sections for cuts, cracks, and abrasions. Make sure the fuel line is not rubbing against other parts. Replace worn or damaged fuel line parts before leaks occur.

If you smell gas close the LPG container shutoff valve immediately to stop further leakage and have the leak fixed. LPG sinks when released and can accumulate in explosive concentrations inside housings and basements and other below-grade spaces. Also see Item 9 under Storing the Genset (Page 23).

⚠WARNING ***Gasoline and LPG are highly flammable and explosive and can cause severe personal injury or death. Repair leaks immediately.***

Battery Connections

Check the battery terminals for clean, tight connections. Loose or corroded connections have high electrical resistance which makes starting harder. See BATTERY CARE (Page 18).

⚠WARNING ***Arcing at battery terminals, light switch or other equipment, flame, and sparks can ignite battery gas causing severe personal injury.***

Ventilate battery area before working on or near battery—Wear safety glasses—Do not smoke—Switch trouble light ON or OFF away from battery—Stop genset and disconnect charger before disconnecting battery cables—Disconnect negative (-) cable first and reconnect last.

Mechanical

Look for mechanical damage. Start the genset and look, listen and feel for any unusual noises and vibrations.

Check the genset mounting bolts to make sure they are secure.

Check to see that the genset air inlet and outlet openings are not clogged with debris or blocked.

Clean accumulated dust and dirt from the genset. Do not clean the genset while it is running or still hot. Protect the generator, air cleaner, control panel, and electrical connections from water, soap and cleaning solvents.

⚠WARNING ***Always wear safety glasses when using compressed air, a pressure washer or a steam cleaner.***

CHECKING ENGINE OIL LEVEL

Park the vehicle on level ground and stop the genset before checking oil level.

⚠WARNING ***Crankcase pressure can blow hot engine oil out the fill opening causing severe burns. Always stop the genset before removing the oil fill cap.***

1. Unscrew the oil fill cap and wipe the oil off the dipstick (Figure 12). Screw the cap back on, remove it again and check the oil level on the dip stick.
2. Add oil as necessary. See ENGINE OIL RECOMMENDATIONS (Page 5). Keep the oil level between the FULL and ADD marks on the dip stick. Drain excess oil if too full.

   ⚠CAUTION ***Too much oil can cause high oil consumption and oil foaming. Too little oil can cause severe engine damage. Keep the oil level between the FULL and ADD marks on the dipstick.***
3. Screw the oil fill cap on securely.

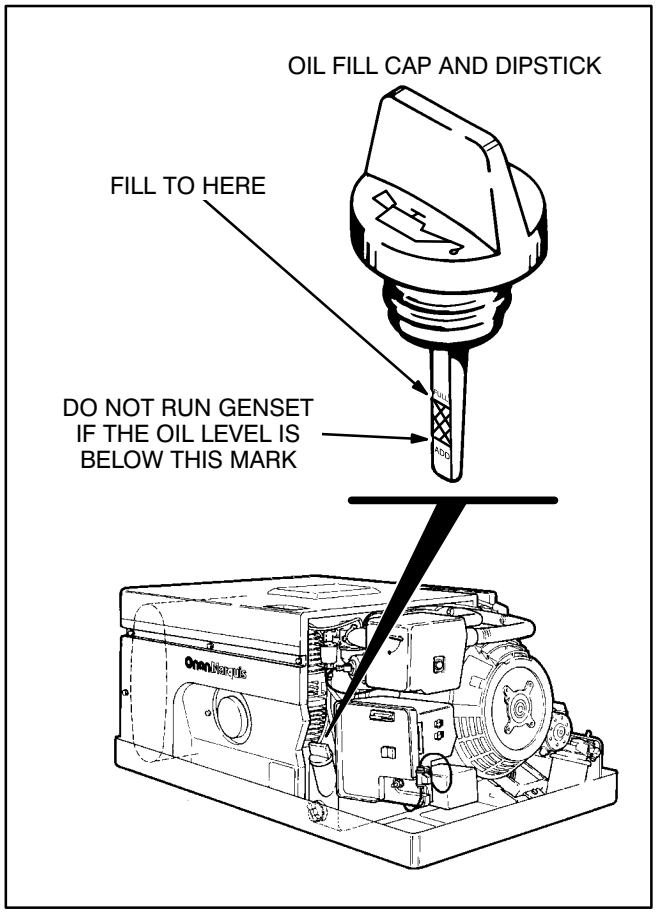


FIGURE 12. OIL LEVEL CHECK

CHANGING ENGINE OIL AND OIL FILTER

See Table 4 for scheduled engine oil changes.

⚠WARNING ***State and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Take care to limit skin contact and breathing of vapors as much as possible. Use rubber gloves and wash exposed skin.***

1. Place a pan under the oil drain outlet, run the engine until it is warm and stop it.

   ⚠WARNING ***Crankcase pressure can blow hot engine oil out the fill opening causing severe burns. Always stop the genset before removing the oil fill cap.***

2. Unscrew the oil fill cap and open the oil drain valve (Figure 13) to drain all oil from the engine. ***Close the drain valve when finished draining oil.***
3. Spin off the oil filter canister and clean the filter mounting surface on the engine block. Remove the old gasket if it remains.
4. Make sure the gasket is in place on the new filter and apply a film of oil to the gasket. Spin on the new filter canister by hand until the gasket just touches the mounting pad and then turn it an additional 1/2 to 3/4 turn. Do not over-tighten.
5. Refill with oil. See ENGINE OIL RECOMMENDATIONS (Page 5) and *Specifications* for oil capacity. Check oil level as instructed under CHECKING ENGINE OIL LEVEL (Page 16).

   Note: The oil level will appear high until the engine has run and filled up the new oil filter.

6. Dispose of the used oil and oil filter according to local environmental regulations.

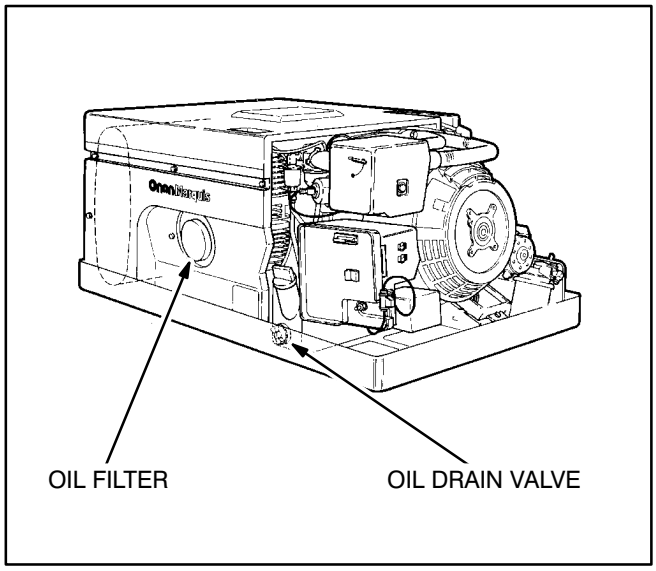


FIGURE 13. OIL DRAIN PLUG AND OIL FILTER

BATTERY CARE

⚠WARNING ***Arcing at battery terminals, light switch or other equipment, flame, and sparks can ignite battery gas causing severe personal injury.***

Ventilate battery area before working on or near battery—Wear safety glasses—Do not smoke—Switch trouble light ON or OFF away from battery—Stop genset and disconnect charger before disconnecting battery cables—Disconnect negative (-) cable first and reconnect last.

See Table 4 for scheduled battery maintenance. Maintain a battery as follows or as the manufacturer recommends:

1. Keep the battery case and terminals clean and dry and the terminals tight. Always remove battery cables with a battery terminal puller.
2. Always make sure which terminal is positive (**+**) and which is negative (**-**) before making battery connections and always remove the negative (**-**) cable first and reconnect it last to reduce arcing.
3. Use a solution of ammonia or baking soda (1/4 pound [100 grams] per quart [liter] of water) to remove corrosion from the battery terminals. Make sure the vent plugs are tight to keep cleaning solution out of the cells. Flush the outside of the battery and the surrounding area with clean water when done.
4. Maintain electrolyte level at the split-level marker in each cell of a *non-maintenance-free* battery by adding distilled water. Check more often in hot weather. (Add water only, not electrolyte. Only the water, not the acid, evaporates from the electrolyte.)
5. Check the specific gravity of each cell with a battery hydrometer (Figure 14). Charge the battery if specific gravity is less than 1.215. Do not overcharge. Normal specific gravity is 1.260 at 80° F (27° C).
6. Have the battery charging system(s) serviced if DC system voltage is consistently low or high.

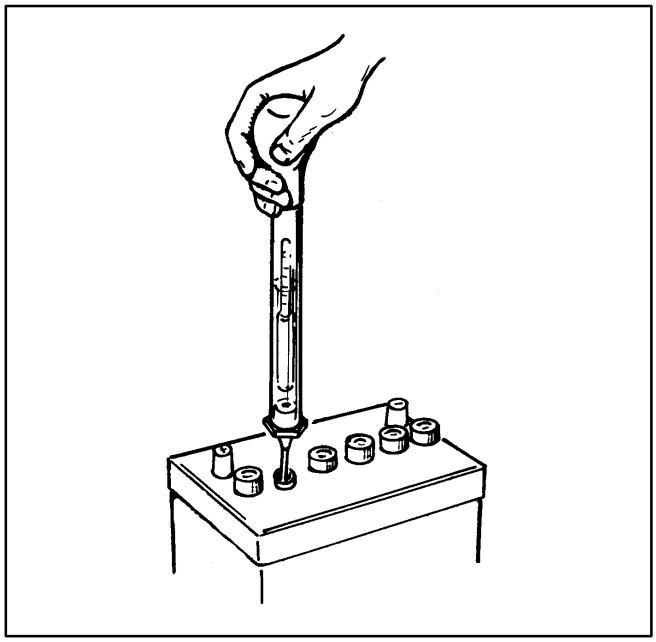


FIGURE 14. BATTERY CHECK WITH HYDROMETER

AIR FILTER

See Table 4 for scheduled air filter replacement. In dusty conditions the air filter element and wrapper should be inspected and changed more frequently for best operation.

To change the air filter element and wrapper, remove the through-bolt and cover (Figure 15). Reassemble the air filter with a new air filter element and wrapper. Do not over-tighten the through bolt as that can distort the filter element or cover and lead to air leaks around the air filter element.

SPARK PLUGS

See Table 4 for scheduled spark plug replacement. (The genset has two spark plugs, Figure 12.) The spark plugs must be in good condition for proper engine starting and performance. A spark plug that fouls frequently or has heavy soot deposits indicates the need for engine service. See *Troubleshooting*.

To prevent crossthreading a spark plug, always thread it in by hand until it seats. If the spark plug is being reused, turn it with a wrench an additional 1/4 turn. If the spark plug is new, turn it an additional 3/8 to 1/2 turn. If you have a torque wrench, tighten the spark plug to 8 lbs-ft (10 N-m).

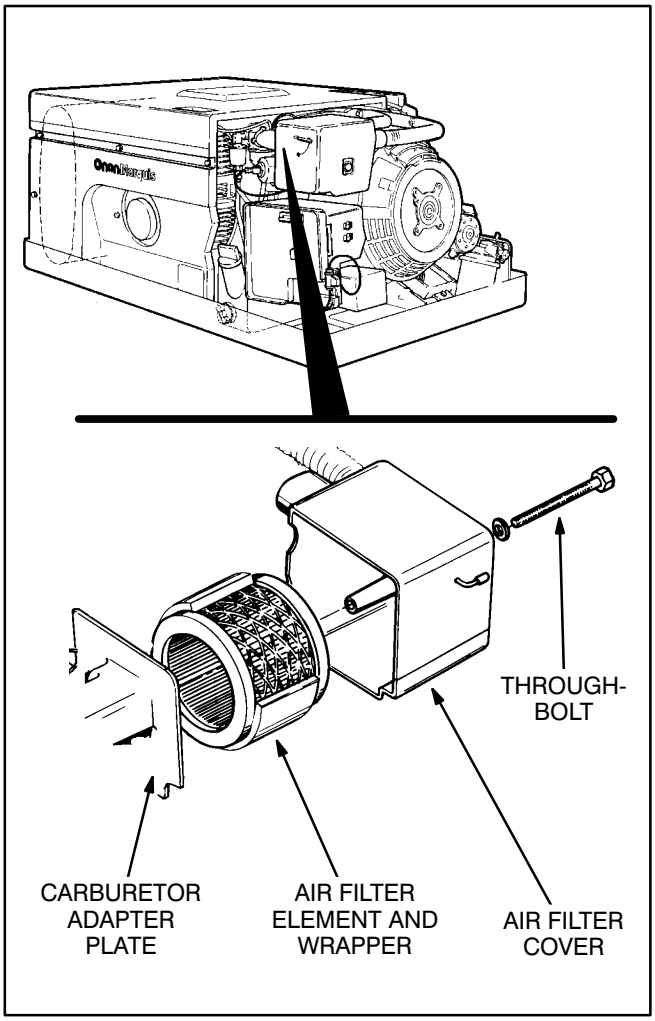


FIGURE 15. AIR FILTER ELEMENT AND WRAPPER

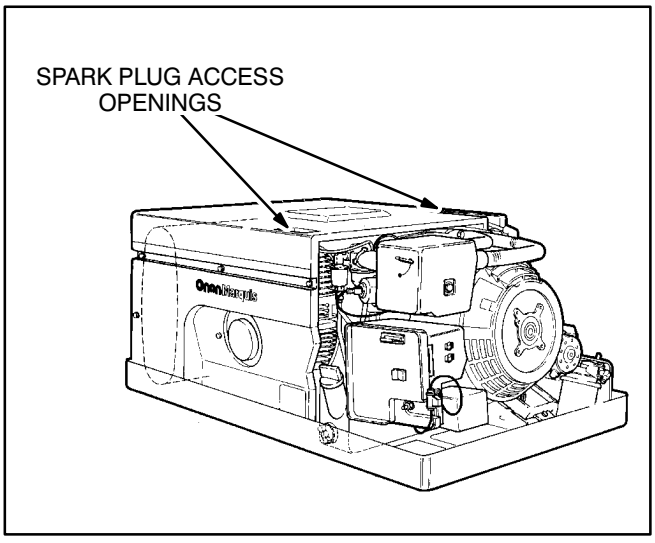


FIGURE 16. SPARK PLUGS

CLEANING CARBURETOR AND COMBUSTION CHAMBERS WITH ONAN 4C™

See Table 4 for scheduled cleaning of the carburetor and combustion chambers. It is important to keep to this periodic cleaning schedule so that carbon deposits do not continue to build. The alternative is to have a qualified mechanic remove the cylinder heads to clean the combustion chambers. (Note the scheduled cleaning of the combustion chambers after 500 hours in Table 4.)

Always park the vehicle outside where the fumes and soot can disperse when performing this operation.

⚠WARNING ***Chemical combustion chamber cleaners are caustic, toxic and flammable and can cause severe personal injury.***

Park the vehicle outside where the fumes can disperse—Wear safety goggles and rubber gloves to prevent eye and skin contact—Keep your face well away and out of line of cleaner fluid that may spit back from the carburetor—If there is skin or eye contact, flush with water for 15 minutes and seek medical attention if necessary—Do not smoke.

Clean the carburetor and combustion chambers as follows:

1. Run the genset until it is up to normal operating temperature.

2. Stop the genset and remove the air filter for access to the carburetor throat and choke plate. See AIR FILTER in this section.

3. Restart the genset and spray Onan 4C into the carburetor throat, washing down the choke plate and carburetor throat. Spray as fast as possible without causing the engine to stall. Just before the can empties, flood the engine so that it does stall.

4. Let the genset sit for 15 minutes to allow time for the cleaner to soften the carbon deposits.

5. Restart the genset and load it nearly to full power (see *Powering Equipment)*. Let the genset run for about five minutes to expel the carbon loosened by the cleaner.

"Onan 4C" is a trademark of the Onan Corporation.

SPARK ARRESTOR

See Table 4 for scheduled cleaning of the spark arrestor muffler (which meets U.S. Forest Service requirements). Cleaning is required for maximum genset performance.

⚠WARNING ***A hot muffler can cause severe burns. Let the muffler cool down before removing or installing the cleanout plug.***

The muffler is mounted inside the genset housing. The cleanout plug is located on the bottom side of the muffler, accessible through the air outlet opening in the bottom of the genset. Clean out the spark arrestor muffler as follows:

1. Remove the cleanout plug from the bottom of the muffler (Figure 17).
2. Restart the genset and load it nearly to full power (see *Powering Equipment)*. Let the genset run for about five minutes to expel the soot in the muffler.
3. Stop the genset, allow the muffler to cool down and then reinstall the plug.

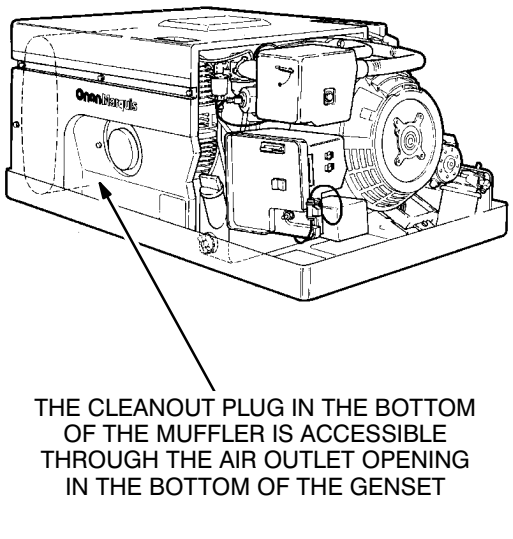


FIGURE 17. SPARK ARRESTOR CLEANOUT PLUG

Genset Break-In, Exercise and Storage

BREAK-IN

Proper engine break-in on a new genset or on one with a rebuilt engine is essential for top engine performance and acceptable oil consumption.

For proper break-in, run the genset at approximately 1/2 rated power for the first 2 hours and then at 3/4 rated power for 2 more hours. See *Powering Equipment*.

Proper engine oil and oil level are especially critical during break-in because of the higher engine temperatures that can be expected. See RECOMMENDED ENGINE OIL Page 5). Change the oil if its viscosity (Table 1) is not appropriate for the ambient temperatures during break-in. Check the oil level twice a day or every 4 hours during the first 24 hours of operation and change the oil after the first 50 hours of operation.

EXERCISE

If use is infrequent the genset should be exercised at least 2 hours each month at approximately 1/2 rated power. See *Powering Equipment*. Exercising the genset drives off moisture, re-lubricates the engine, replaces the stale fuel in the fuel lines and carburetor with fresh fuel and removes oxide from electrical contacts and generator slip rings, thereby promoting better starting, more reliable operation and longer engine life.

A single two hour exercise period is better than several shorter periods. See STORAGE as an alternative if it is impractical to have someone exercise the genset on a regular basis.

STORAGE

Proper storage is essential for preserving top genset performance and reliability when the genset cannot be exercised regularly and will be idle for more than 120 days.

Storing the Genset

1. For gasoline models only, fill the fuel tank with fresh fuel and add a fuel preservative (OnaFresh™), following the instructions on the container label. Unless a preservative (stabilizer) is added, the gasoline will deteriorate causing fuel system corrosion, gum formation and varnish-like deposits which can lead to hard starting and rough operation.

   ⚠WARNING ***Gasoline preservatives (stabilizers) are toxic. Follow the instructions on the container label. Avoid skin contact. Wash your hands with soap and water after dispensing the fluid.***

2. Run the genset (gasoline models only) for about 10 minutes at approximately 1/2 rated power (see *Powering Equipment*) to fill the fuel lines and carburetor with the fresh fuel and preservative and to bring the genset up to operating temperatures. Then turn off the air conditioner and other large loads, push the genset line circuit breaker to OFF (Page 7) and stop the genset.

3. Remove the air filter and restart the genset. While the genset is running, spray an engine fogger (OnaGard™) into the carburetor, following the instructions on the container label, and then stop the genset. (A fogger coats the intake, cylinder and exhaust systems with a protective coat of oil.)

4. Change the air filter element if it is dirty.

5. Change the engine oil and attach a tag indicating its oil viscosity (Table 1, Page 5).

6. Disconnect the battery cables (negative [-] cable first) from the starting battery and store the battery according to the battery manufacturer's recommendations.

7. Plug the exhaust tail pipe to keep out dirt, moisture, bugs, etc.

8. Close the fuel supply valve (if so equipped).

9. If the vehicle is to be garaged and is equipped with an LPG genset, first check for local ordinances regarding the garaging of vehicles with LPG engine fuel systems. Generally, the ordinances require that the LPG system be leak-free, that the LPG container not be filled beyond specified limits, that the container shutoff valve be closed and that the vehicle not be parked near sources of heat or ignition.

   ⚠WARNING ***LPG leaks inside a garage or other inadequately ventilated space or near a pit or basement or other below-grade space can lead to explosive accumulations of gas because LPG "sinks" when it is released into the air. Check for and comply with all local ordinances regarding the garaging of vehicles with LPG engine fuel systems.***

Returning The Genset To Service

1. Check the oil tag on the genset and change the oil if the viscosity indicated is not appropriate for the temperatures expected (Table 1, Page 5).

2. Reconnect the starting battery (negative [-] cable last). See BATTERY CARE (Page 18).

3. Remove the plug from the exhaust tailpipe.

4. Open the fuel supply valve (if so equipped).

5. Inspect the genset. See GENERAL INSPECTION (Page 15).

6. Start the genset at the genset control panel. The initial startup may be slow and there may be smoke and rough operation for a few minutes until the oil in the cylinders from the fogger burns off. If the engine does not start, clean or replace the spark plugs, as they may have been fouled by the fogger.

7. Push the genset line circuit breaker ON (Page 7) when the genset is ready to power appliances.

Troubleshooting

Table 5 provides basic troubleshooting guidance. If you fail to resolve the problem after taking the corrective actions suggested, contact an authorized Onan dealer. See *How to Obtain Service*.

WARNING** **Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review the safety precautions on the inside cover page.

WARNING** **Hot engine parts can cause severe burns. Always allow the engine time to cool before performing any maintenance or service.

TABLE 5. TROUBLESHOOTING

Problem	Corrective Action
1. Engine fails to crank	a. Try starting at the genset rather than at the remote control. b. Replace fuse F1 on the control panel (Page 7) if it has blown. c. Clean and tighten the positive (**+**) and negative (**-**) battery cable connections at the battery and at the genset. d. Recharge the battery. Refer to the battery manufacturer's recommendations.
2. Engine cranks slowly	a. Disconnect the air conditioner and other large loads. b. Clean and tighten the positive (**+**) and negative (**-**) battery cable connections at the battery and at the genset. c. Recharge the battery. Refer to the battery manufacturer's recommendations. d. Change the engine oil to oil having the proper viscosity for the ambient temperature. See Table 1, Page 5.
3. Engine cranks but fails to start	a. Check the fuel tank and fill if necessary. b. Open any closed fuel shut off valve. c. Check engine oil level and add oil as necessary. d. Replace fuse F2 (Page 7) if it has blown. e. Service the air cleaner. f. Secure the spark plug leads on the spark plugs. g. Replace the spark plugs.
4. Engine runs but stops or surges	a. Check the fuel tank and fill if necessary. b. Check the engine oil level and add oil as necessary. Drain excess oil if the level is above the dipstick Full mark. c. Check and reset the carburetor preheater lever (Page 12) and altitude adjust knob (Page 13). (Gasoline models only.) d. Secure the spark plug leads on the spark plugs. e. Replace the spark plugs.
5. Genset keeps stalling or circuit breaker keeps tripping	a. Try running with fewer appliances connected. See *Powering Equipment*. b. Check the fuel tank (LPG, vapor-withdrawal models) and fill as necessary. *On cold days the LPG container may have to be kept at least half full to provide the rate of vaporization necessary to keep up with the genset fuel demand.*
6. No electrical power when genset running	a. Reset tripped circuit breakers. See *Powering Equipment*. b. Unless there is an automatic power transfer switch, plug the vehicle power cord into the genset power output receptacle (if so equipped) or turn the vehicle power selector switch to its genset position (if so equipped).
7. DC voltmeter (Page 8) indicates low voltage	a. Clean and tighten the positive (**+**) and negative (**-**) battery cable connections at the battery and the genset. b. Recharge the battery. Refer to the battery manufacturer's recommendations.
8. Black smoke out tailpipe	Service the air cleaner.

Specifications

	GASOLINE MODELS	
	BGM	**NHM**
GENERATOR: 4-Pole Revolving Field, Self-Excited, Electronically Regulated, 1-Phase		
Power (watts)	5500	6800
Frequency (Hertz)	60	60
Voltage	120	120
Current (amperes)	45.8	56.7
Speed (RPM)	1800	1800
FUEL CONSUMPTION:		
No load gph (l/h) Half load gph (l/h) Full load gph (l/h)	0.4 (1.5) 0.7 (2.6) 1.0 (3.8)	0.4 (1.5) 0.7 (2.6) 1.3 (4.9)
ENGINE: 2-Cylinder Opposed, 4-Cycle, Spark-Ignited, Side-Valve, Air Cooled		
Bore	3.250 inches (83 mm)	3.563 inches (90 mm)
Stroke	2.875 inches (73 mm)	3.000 inches (76 mm)
Displacement	48 inches^3 (782 cc)	60 inches^3 (980 cc)
Compression Ratio	7:1	7:1
Oil Capacity (with filter)*	3.5 quarts (3.3 l)	
Intake Valve Clearance (Cold)	0.005 inches (0.13 mm)	
Exhaust Valve Clearance (Cold)	0.013 inches (0.33 mm)	
Spark Plug Gap	0.025 inches (0.64 mm)	
Spark Plug Tightening Torque	8 lbs-ft (10 N-m)	
Ignition Timing	12° BTDC (non-adjustable electronic ignition)	
CONTROL AND CRANKING SYSTEM: 12 VDC		
Nominal Battery Voltage	12 volts	
Minimum Battery Cold Cranking Capacity: Above/Below Freezing	360/450 amperes	
Fuse F1 (control circuit)	5 amperes	
Fuse F2 (autochoke/fuel pump)	10 amperes mini-bayonet	
WEIGHT:	258 lb (117 kg)	272 lb (136 kg)

* -See *Periodic Maintenance* for oil filling instructions.

	LPG MODELS
	NHM
GENERATOR: 4-Pole Revolving Field, Self-Excited, Electronically Regulated, 1-Phase	
Power (watts)	6500
Frequency (Hertz)	60
Voltage	120
Current (amperes)	54.2
Speed (RPM)	1,800
FUEL CONSUMPTION:	
No load lbs/h (kg/h) Half load lbs/h (kg/h) Full load lbs/h (kg/h)	2.1 (.96) 4.1 (1.86) 6.6 (3)
ENGINE: 2-Cylinder Opposed, 4-Cycle, Spark-Ignited, Side-Valve, Air Cooled	
Bore	3.563 inches (90 mm)
Stroke	3.000 inches (76 mm)
Displacement	60 inches^3 (980 cc)
Compression Ratio	7:1
Oil Capacity (with filter)*	3.5 quarts (3.3 l)
Intake Valve Clearance (Cold)	0.005 inches (0.13 mm)
Exhaust Valve Clearance (Cold)	0.013 inches (0.33 mm)
Spark Plug Gap	0.025 inches (0.64 mm)
Spark Plug Tightening Torque	8 lbs-ft (10 N-m)
Ignition Timing	12° BTDC (non-adjustable electronic ignition)
LPG Vapor Supply Pressure (Vapor-Withdrawal Models Only)	9 to 13 inch (229 to 330 mm) W. C. (water column)
CONTROL AND CRANKING SYSTEM: 12 VDC	
Nominal Battery Voltage	12 volts
Minimum Battery Cold Cranking Capacity: Above/Below Freezing	360/450 amperes
Fuse F1 (control circuit)	5 amperes
Fuse F2 (fuel solenoid)	10 amperes mini-bayonet
WEIGHT:	272 lb (136 kg)
* -See *Periodic Maintenance* for oil filling instructions.	

Information for California Genset Users

These gensets meet the requirements of California's Exhaust Emissions Standards as stated on the nameplate (Figure 3).

As a California user of these gensets, please be aware that unauthorized modifications or replacement of fuel, exhaust, air intake, or speed control system components that affect engine emissions are prohibited. Unauthorized modification, removal or replacement of the genset label is prohibited.

You should carefully review Operator (Owner), Installation and other manuals and information you receive with your genset. If you are unsure that the installation, use, maintenance or service of your genset is authorized, you should seek assistance from an approved Onan engine or genset dealer.

California genset users may use Table 6 as an aid in locating information related to the California Air Resources Board requirements for emissions control.

TABLE 6. EMISSIONS CONTROL INFORMATION

Genset Warranty Information	The California emissions control warranty statement is located in the same packet of information as this manual when the engine is shipped from the factory.
Engine Valve Clearance	See *Specifications.*
Engine Ignition Timing	See *Specifications.*
Engine Fuel Requirements	***Gasoline Models:*** The engine is certified to operate on unleaded gasoline. See FUEL RECOMMENDATIONS in *Introduction*. ***LPG Models:*** The engine is certified to operate on LPG. See FUEL RECOMMENDATIONS in *Introduction*.
Engine Lubricating Oil Requirements	See ENGINE OIL RECOMMENDATIONS in *Introduction*.
Engine Fuel Mixture Settings	These genset engines have precision-manufactured carburetors which are not adjustable.
Engine Adjustments	***Gasoline Models:*** See Figures 10 and 11. ***LPG Models:*** Not applicable.
Engine Emission Control System	The engine emission control system consists of internal engine modifications.

How to Obtain Service

When you need parts or service for your genset contact the nearest authorized dealer or distributor. Onan has factory-trained representatives to handle your needs for genset parts and service. To locate the nearest authorized distributor:

1. Check the North American Sales and Service Directory (F-118) and the International Sales and Service Directory (IN-1013) supplied with your Onan genset. These directories list authorized distributors who will assist you in locating the nearest authorized dealer.

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

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

3. Call 1-800-888-ONAN for the name and telephone number of the nearest Cummins/Onan or Onan-only distributor in the United States or Canada. (This automated service utilizes touch-tone phones only). By calling this number you can also request a directory of authorized RV servicing dealers: RV Sales and Service Directory F-919.

To get service, contact the authorized dealer or distributor nearest you, explain the problem and make an appointment. 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.

Before calling for service, have the following information available:

1. *The complete genset model number and serial number (see Model Identification on page 4)*

2. *The date of purchase*

3. *The nature of the problem (See Troubleshooting)*

⚠WARNING ***Improper service or replacement of parts can result in severe personal injury, death, and/or equipment damage. Service personnel must be qualified to perform electrical and/or mechanical service.***

Maintenance Record

DATE	HOUR METER READING	MAINTENANCE OR SERVICE PERFORMED

Record the name, address, and phone number of your authorized Onan service center.

Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
763-574-5000
Fax: 763-528-7229