

Onan

RV GenSet

Operator's Manual

KVD



Printed in U.S.A.

981-0164B
05-04

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

⚠ WARNING ⚠
Do not use this genset on a boat
Such use may violate U. S. Coast Guard regulations and can result in severe personal injury or death from fire, electrocution, or carbon monoxide poisoning

Table of Contents

SAFETY PRECAUTIONS	ii
SPECIFICATIONS	iv
INTRODUCTION	1
About this Manual	1
Nameplate	1
Typical Genset	2
Fuel Recommendations	3
Engine Oil Recommendations	3
Starting Batteries	3
Genset Control Panel	4
Remote Control Panel	4
OPERATION	5
Conducting the Pre-Start Checks	5
Starting the Genset	5
Stopping the Genset	5
Restarting the Genset	6
Automatic Starting and Stopping	6
Loading the Genset	6
Connecting Shore Power	7
Resetting Circuit Breakers	7
Operating in Cold Weather	8
Operating in Hot Weather	8
Operating at High Altitude (Gasoline Models Only)	8
Operating in Dusty Environments	8
Breaking in a New Engine	9
Exercising the Genset	9
Storing the Genset	9
PERIODIC MAINTENANCE	11
Conducting General Inspections	12
Checking Engine Oil Level	13
Changing Engine Oil	13
Replacing the Air Filter Element	14
Maintaining the Battery and Battery Connections	14
Replacing the Spark Plug	15
Cleaning the Spark Arrestor	15
Replacing the Fuel Filter (Gasoline Models Only)	16
TROUBLESHOOTING	17
HOW TO OBTAIN SERVICE	18
Calling for Service	18
Information to Have Ready	18
MAINTENANCE RECORD	19
INFORMATION FOR CALIFORNIA USERS	20

Safety Precautions

Thoroughly read the **OPERATOR'S MANUAL** before operating the genset. Safe operation and top performance can only be attained 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 that will result in severe personal injury or death.

▲ WARNING alerts you to a hazard or unsafe practice that can result in severe personal injury or death.

▲ CAUTION alerts you to a hazard or unsafe practice that 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 children away from the genset.
- Do not use evaporative starting fluids. They are highly explosive.
- To prevent accidental or remote starting while working on the genset, disconnect the negative (-) battery cable at the battery.
- 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.
- Make sure all fasteners are secure and torqued properly.
- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- You must be trained and experienced to make 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.
- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10)
- Genset installation and operation must comply with all applicable local, state and federal codes and regulations.

GENERATOR VOLTAGE IS DEADLY!

- Disable the automatic genset starting feature of an inverter-charger or other automatic starting device before servicing the genset.
- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.
- The genset must not be connected to shore power or to any other source of electrical power. Back-feed to shore power can cause electric shock resulting in severe personal injury or death 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, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

ENGINE EXHAUST IS DEADLY!

- Inspect for exhaust leaks at every startup and after every eight hours of running.
- Learn the symptoms of carbon monoxide poisoning in this manual.
- Never sleep in the vehicle while the genset is running unless the vehicle is equipped with a working carbon monoxide detector.
- Make sure there is ample fresh air when operating the genset in a confined area.
- Disable the automatic genset starting feature of an inverter-charger or other automatic starting device before storing the vehicle or parking it in a garage or other confined space.
- The exhaust system must be installed in accordance with the genset Installation Manual.
- Engine cooling air must not be used for heating the working or living space or compartment.

FUEL IS FLAMMABLE AND EXPLOSIVE

- Do not smoke or turn electrical switches ON or OFF where fuel fumes are present or in areas sharing ventilation with fuel tanks or equipment. 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.

- Leaks can lead to explosive accumulations of gas. Natural gas rises when released and can accumulate under hoods and inside housings and buildings. LPG sinks when released and can accumulate inside housings and basements and other below-grade spaces. Prevent leaks and the accumulation of gas.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses.
- Do not smoke.
- To reduce arcing when disconnecting or reconnecting battery cables, always disconnect the negative (-) battery cable first and reconnect it last.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disable the automatic genset starting feature of an inverter-charger or other automatic starting device before servicing the genset.
- 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, and other moving parts.

Specifications

	Gasoline Models		LPG Models	
GENERATOR: 2-Pole Revolving Field, Self-Excited, 1-Phase, Electronically Regulated				
Frequency	60 Hertz	50 Hertz	60 Hertz	50 Hertz
Power	2800 watts	2500 watts	2500 watts	2000 watts
Voltage	120 volts	220 volts	120 volts	220 volts
Current	23.3 amps	11.4 amps	20.8 amps	9.1 amps
Speed	3600 rpm	3000 rpm	3600 rpm	3000 rpm
FUEL CONSUMPTION:				
No load	0.20 gph (0.7 l/h)	0.16 gph (0.6 l/h)	1.0 lbs/h (0.44 kg/h)	0.9 lbs/h (0.40 kg/h)
Half load	0.30 gph (1.1 l/h)	0.23 gph (0.9 l/h)	1.5 lbs/h (0.68 kg/h)	1.3 lbs/h (0.59 kg/h)
Full load	0.43 gph (1.6 l/h)	0.32 gph (1.2 l/h)	2.5 lbs/h (1.1 kg/h)	2.1 lbs/h (0.92 kg/h)
ENGINE: 1-Cylinder, 4-Stroke Cycle, Spark-Ignited, OHV, Air Cooled, Mechanically Governed				
Bore	2.64 in (67 mm)		2.64 in (67 mm)	
Stroke	2.2 in (56 mm)		2.2 in (56 mm)	
Displacement	12 in ³ (197 cc)		12 in ³ (197 cc)	
Compression Ratio	8.5 : 1		8.5 : 1	
Oil Capacity	1 quart (0.95 liter)		1 quart (0.95 liter)	
Intake Valve Lash (Cold)	0.002 in (0.05 mm)		0.002 in (0.05 mm)	
Exhaust Valve Lash (Cold)	0.002 in (0.05 mm)		0.002 in (0.05 mm)	
Spark Plug Gap	0.025 in (0.64 mm)		0.020 in (0.64 mm)	
Spark Plug Tightening Torque	13 lbs-ft (17 N-m)		13 lbs-ft (17 N-m)	
Ignition Timing (magneto type ignition)	25° BTDC, non-adjustable		25° BTDC, non-adjustable	
DC SYSTEM:				
Nominal Battery Voltage	12 volts		12 volts	
Min CCA Rating – SAE @ 32° F (0° C)	360/450 above/below 32° F (0° C)		360/450 above/below 32° F (0° C)	
Control Fuse	5 amp		5 amp	
INSTALLATION:				
Noise	71 dB(A)*	64 dB(A)*	71 dB(A)*	64 dB(A)*
Weight of Genset (with muffler)	111.6 lbs (50.6 kg)		111.6 lbs (50.6 kg)	
Weight of Genset (without muffler)	107.2 lbs (48.6 kg)		107.2 lbs (48.6 kg)	
Minimum Compartment Size (H x D x W)**	12.52 in x 18.20 in x 20.46 in (317.9 mm x 462.2 mm x 519.8 mm)		12.52 in x 18.20 in x 20.46 in (317.9 mm x 462.2 mm x 519.8 mm)	
Minimum Free Air Inlet Area	24 in ² (155 cm ²)		24 in ² (155 cm ²)	
Gasoline Fuel Connection	1/4 in Hose Barb		-	
Maximum Gasoline Fuel Pump Lift	3 ft (1 m)		-	
LPG Vapor Fuel Connection	-		1/4 in NPTF	
LPG Vapor Connection Pressure	-		9-13 in (228-330 mm) WC	
* In a typical RV installation at half load and distance of 10 ft (3 m).				
** See the Installation Manual for additional considerations when sizing the genset compartment.				

Introduction

ABOUT THIS MANUAL

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

Operation, Periodic Maintenance and Troubleshooting provide the instructions necessary for operating the genset and maintaining it at top performance. The owner is responsible for performing maintenance in accordance with the PERIODIC MAINTENANCE SCHEDULE (Page 11). This manual also includes genset specifications, information on how to obtain service, and information for California 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.*

NAMEPLATE

Model and Serial Numbers: Have the model and serial numbers handy when contacting an Onan dealer for parts, service or product information. The gray boxes in Figure 1 show where the numbers are found on the nameplate. Each character is significant. (The last character of the model number is the specification letter, which is important for obtaining the right parts.) Record these numbers in the boxes in Figure 1 so that they are handy when you need them.

Genuine Onan replacement parts are recommended for best performance and safety.

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. Category C = 250 hrs, B = 500 hrs, A = 1000 hrs.

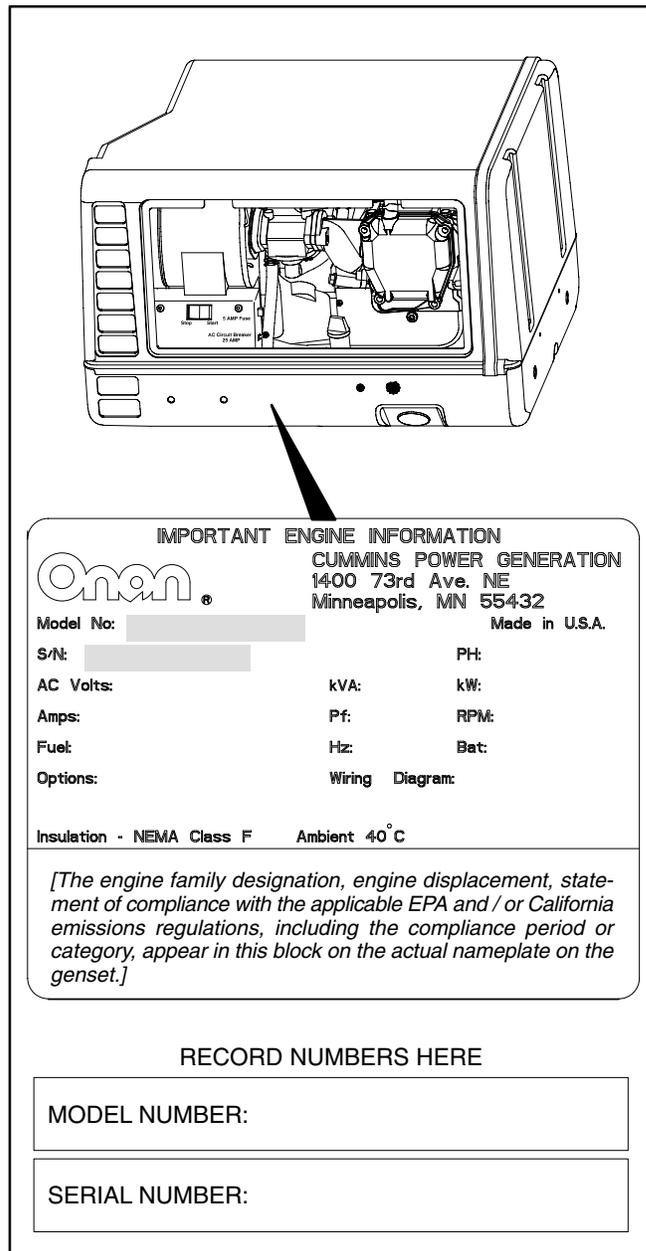


FIGURE 1. TYPICAL NAMEPLATE

TYPICAL GENSET

Figure 2 illustrates a typical genset showing features such as the maintenance access door and control panel. Keep the maintenance access door closed except to perform maintenance or to start the genset at the genset.

⚠WARNING *Operating the genset with the maintenance access door off can lead to severe burns and engine damage due to overheating. Always secure the door after starting the genset.*

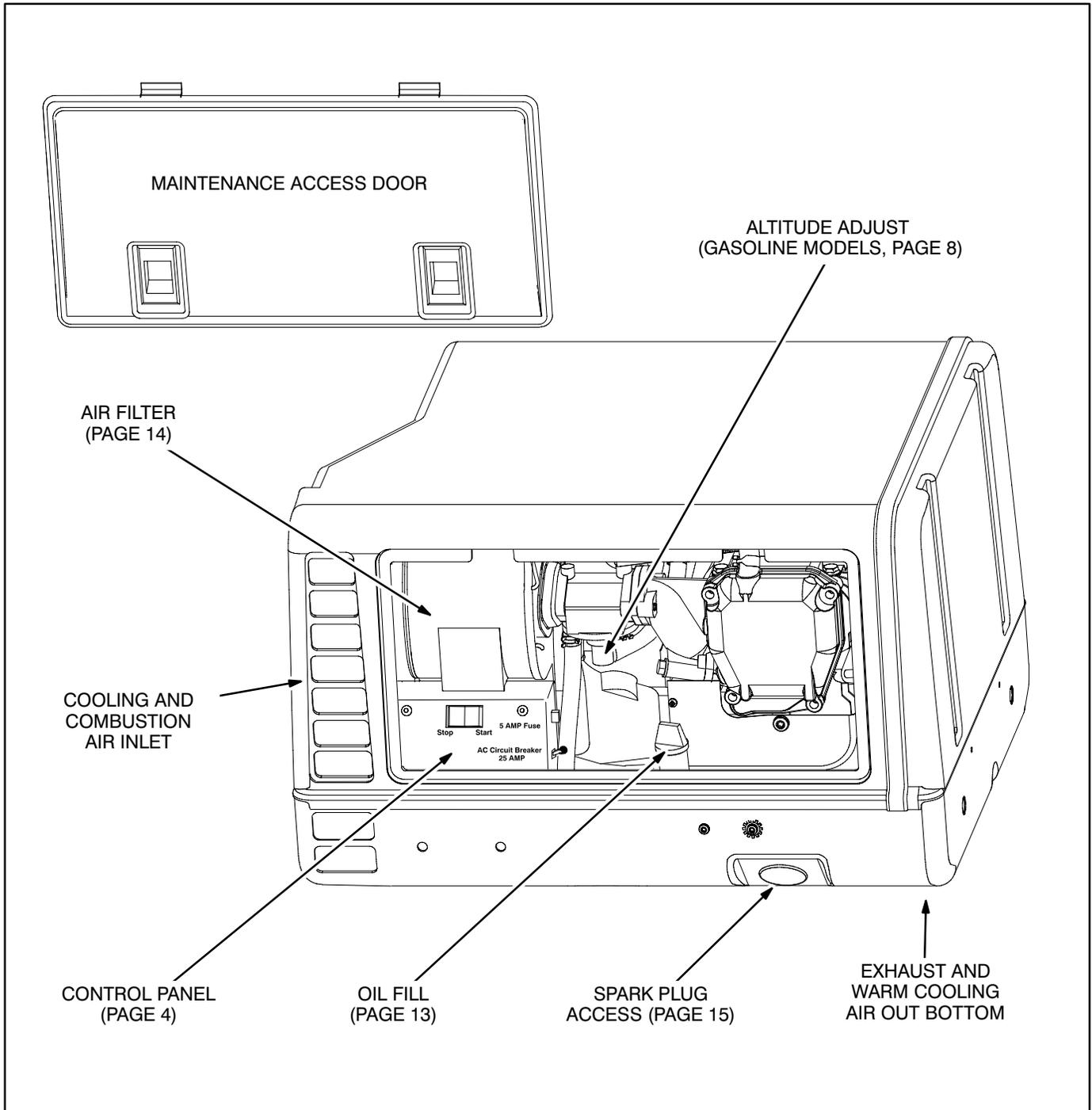


FIGURE 2. LPG GENSET—REPRESENTATIVE ALSO OF GASOLINE MODELS

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 flames, 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.

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

Avoid using leaded gasoline because of the extra engine maintenance that will be required.

LPG Models

Use clean, fresh HD-5 grade liquified petroleum gas (LPG) 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 on low-pressure LPG models requires that the LPG vapor be supplied at a pressure within the range indicated in *Specifications* (Page iv).

⚠️WARNING High LPG supply pressure can cause gas leaks which can lead to fire and severe personal injury or death. LPG supply pressure must be adjusted to Specifications by trained and experienced personnel.

ENGINE OIL RECOMMENDATIONS

Use API (American Petroleum Institute) performance Class **SL**, **SJ** or **SH** engine oil or better. 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 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 (OnaMax™)
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

STARTING BATTERIES

The genset has a 12 volt, direct current (DC) engine cranking and control system. See *Specifications* (Page iv) regarding minimum battery ratings for reliable genset cranking, especially in cold weather. Also see PERIODIC MAINTENANCE SCHEDULE (Page 11) and the battery manufacturer's instructions regarding battery maintenance.

GENSET CONTROL PANEL

The genset control panel (Figure 3) includes the following features:

Control Switch – This is a rocker switch which returns to its neutral position when you let go. Hold the switch in its **START** position to crank and start the genset. Press the switch to its **STOP** position to stop the genset.

Control Fuse – This fuse (5 amp) provides short circuit protection for the control and remote control circuits.

Line Circuit Breaker – The line circuit breaker protects the AC power leads connected to the genset from overloads and equipment short circuits.

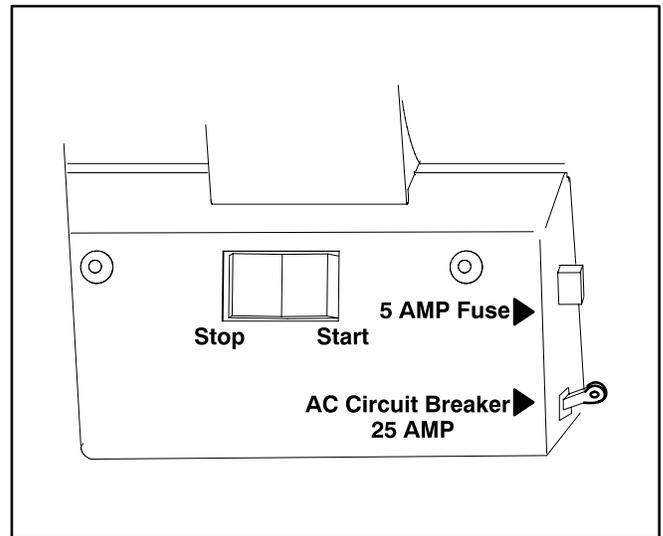


FIGURE 3. GENSET CONTROL PANEL

REMOTE CONTROL PANEL

The vehicle probably has a control panel inside the vehicle for remote control of the genset. Onan offers three remote control kits as follows:

- Remote switch with indicator lamp only (Figure 4).
- Remote switch with indicator lamp and hour meter (Figure 5).
- Remote switch with indicator lamp and DC voltmeter (Figure 6).

The hour meter (time totalizing meter) records genset operating time in hours. It cannot be reset. See the PERIODIC MAINTENANCE SCHEDULE (Page 11).

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 MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 14).

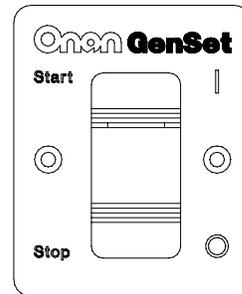


FIGURE 4. REMOTE SWITCH

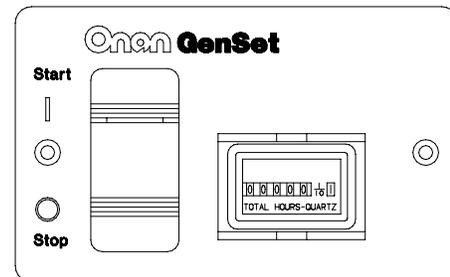


FIGURE 5. REMOTE SWITCH / HOUR METER

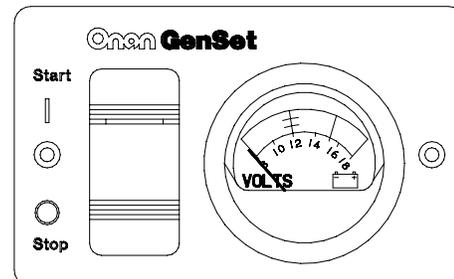


FIGURE 6. REMOTE SWITCH / DC VOLTMETER

Operation

⚠WARNING EXHAUST GAS IS DEADLY!

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

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

IF YOU OR ANYONE ELSE EXPERIENCES 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 proper installation of the exhaust system, daily (every eight hour) inspection for visible and audible exhaust system leaks.

CONDUCTING THE PRE-START CHECKS

Before the first start of the day and after every eight hours of operation, inspect the genset as instructed under CONDUCTING GENERAL INSPECTIONS (Page 12). Keep a log of maintenance and the hours run and perform any maintenance that may be due. See Returning the Genset to Service (Page 10) if the vehicle has been in storage.

Before each start:

1. Make sure all vehicle CO detectors are working.
2. Check for signs of fuel and exhaust leaks and for damage to the exhaust system.
3. To prevent overheating and to reduce fouling with dust and debris, make sure the genset's normal ground clearance is not being reduced by sloping ground, curbs, logs or other objects. Repark the vehicle if necessary and/or remove any objects blocking the air inlet or air outlet.
4. Turn off the air conditioner and other large appliances.

STARTING THE GENSET

Start the genset from the genset control panel or remote control panel inside the vehicle (Page 4).

1. Push and hold the switch at **START** 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.*

2. For top performance and engine life, especially in colder weather, let the engine warm up for two minutes before connecting appliances.
3. Check for fuel and exhaust leaks. Stop the genset immediately if there is a fuel or exhaust leak and have it repaired.
4. See *Troubleshooting* (Page 17) if the engine does not crank or start after several tries.
5. Always secure the genset compartment door after starting the genset at the genset control panel.

⚠WARNING *Operating the genset with the compartment door off can lead to severe burns and engine damage due to overheating. Always secure the door after starting the genset.*

STOPPING THE GENSET

Turn off the air conditioner and other large appliances and let the genset run for two minutes to cool down. This reduces backfiring and run-on. Then press the switch to **STOP** to stop the genset.

RESTARTING THE GENSET

If the genset shuts down, disconnect or turn off as many appliances as possible and try restarting the genset. Reconnect only as many appliances as will not overload the genset or cause the circuit breaker to trip.

AUTOMATIC STARTING AND STOPPING

The vehicle may be equipped with an inverter-charger or other automatic genset starting device. Always follow the device manufacturer's instructions and safety precautions to enable automatic genset starting.

⚠️WARNING **EXHAUST GAS is deadly. MOVING PARTS and ELECTRICITY can cause severe personal injury or death. To reduce exposure to these hazards, always disable automatic genset starting before:**

- **Sleeping in vehicle, unless vehicle has a working CARBON MONOXIDE detector**
- **Parking vehicle in garage or confined space**
- **Parking vehicle for storage**
- **Servicing genset**
- **Servicing batteries**
- **Servicing electrical appliances**
- **Fueling vehicle**

LOADING THE GENSET

The genset can power AC motors, air conditioners, AC/DC converters and other appliances. How much appliance load* can be serviced depends upon the genset power rating. The genset will shut down or its circuit breakers will trip if the sum of the loads exceeds genset power.

To avoid overloading the genset and causing shut-downs, compare the sum of the loads of the appliances that are likely to be used at the same time to the power rating of the genset. Use Table 2 or the ratings on the appliances themselves to obtain the individual appliance loads. If the appliance is marked in amps and volts only, multiply the amps times the volts to obtain the appliance load (watts). ***It may be necessary to run fewer appliances at the same time—the sum of the loads must not be greater than genset rating.***

* Appliance load and genset power are measured in terms of watts (W) or kilowatts (kW), where 1 kilowatt (kW) = 1000 watts (W).

Note that the genset may shut down due to overload—even though the sum of the loads is less than genset rating—when a large motor or air conditioner is started last or cycles off and then on again. The reason for this is that motor startup load is much larger than running load. ***It may be necessary to run fewer appliances when large motors and air conditioners are cycling on and off.***

TABLE 2. TYPICAL APPLIANCE LOADS

Appliance	Load (watts)
Air Conditioner	1400-2000
Battery Charger	Up to 3000
DC Converter	300-700
Refrigerator	600-1000
Microwave Oven	1000-1500
Electric Frying Pan or 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

Note also that air density decreases as altitude and ambient air temperature increase, causing genset engine power to decrease, even though the altitude adjustment on gasoline carburetors is correct (Page 8). Power decreases approximately 3.5 percent of rated power each 1000 feet (305 m) of increase in elevation and 1 percent each 10° F (5.6° C) rise in temperature above 85° F (29° C). See Table 3 for typical calculations of power versus altitude. ***It may be necessary to run fewer appliances at higher altitudes.***

TABLE 3. POWER VS. ALTITUDE

Elevation above Mean Sea Level	Maximum Genset Power*
up to 500 feet (152 m)	2800 watts (rated)
2500 ft (762 m)	2604 watts
5500 ft (1676 m)	2310 watts
above 5500 ft (1676 m)	2310 watts minus 98 watts each 1000 ft (305 m)

* This table does not take into account the effect circuit breakers may have in limiting maximum power.

CONNECTING SHORE POWER

If the vehicle has provisions for connecting shore power, it must also have an approved device to keep the genset and shore power from being interconnected.

⚠WARNING *Backfeed to shore power can cause electric shock resulting in severe personal injury or death and damage to equipment. The vehicle must have an approved device to prevent the genset from being interconnected with shore power.*

RESETTING CIRCUIT BREAKERS

If a circuit breaker in the main power distribution panel of the vehicle or on the genset (Figure 7) trips, either a circuit shorted or too many appliances were running. Note that the genset may continue to run after a circuit breaker has tripped.

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 the appliances, one by one, up to a total load that does not overload the genset or cause the circuit breaker to trip. If a circuit breaker trips right away when an appliance is connected, the appliance probably has a short.

Electrical appliances and tools must be used and maintained properly and be properly grounded to cause the line circuit breakers to trip when short circuits occur.

⚠WARNING *Short circuits in electrical appliances and tools can cause fire and electrical shock leading to severe personal injury or death. Read and follow the equipment and tool manufacturer's instructions and warnings regarding use, maintenance and proper grounding.*

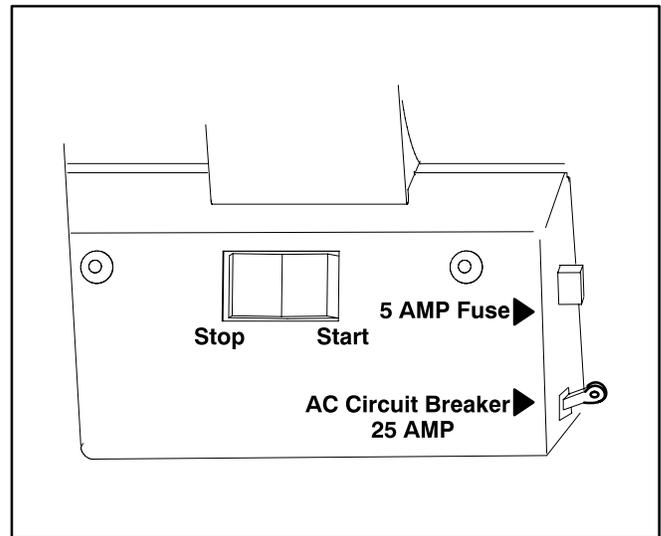


FIGURE 7. AC CIRCUIT BREAKER

OPERATING IN COLD WEATHER

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

1. Make sure engine oil viscosity is appropriate for the ambient temperatures. Change oil if there is a sudden drop in temperature (Page 3).
2. Reset the carburetor for altitude (Figure 8).
3. Perform spark plug maintenance (Page 15).
4. Perform battery maintenance (Page 14).

OPERATING IN 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 engine oil viscosity is appropriate for the ambient temperatures (Page 3).
3. Keep the genset clean.
4. Perform maintenance due (Page 11).
5. Reset the carburetor for altitude (Figure 8).

OPERATING AT HIGH ALTITUDE (GASOLINE MODELS ONLY)

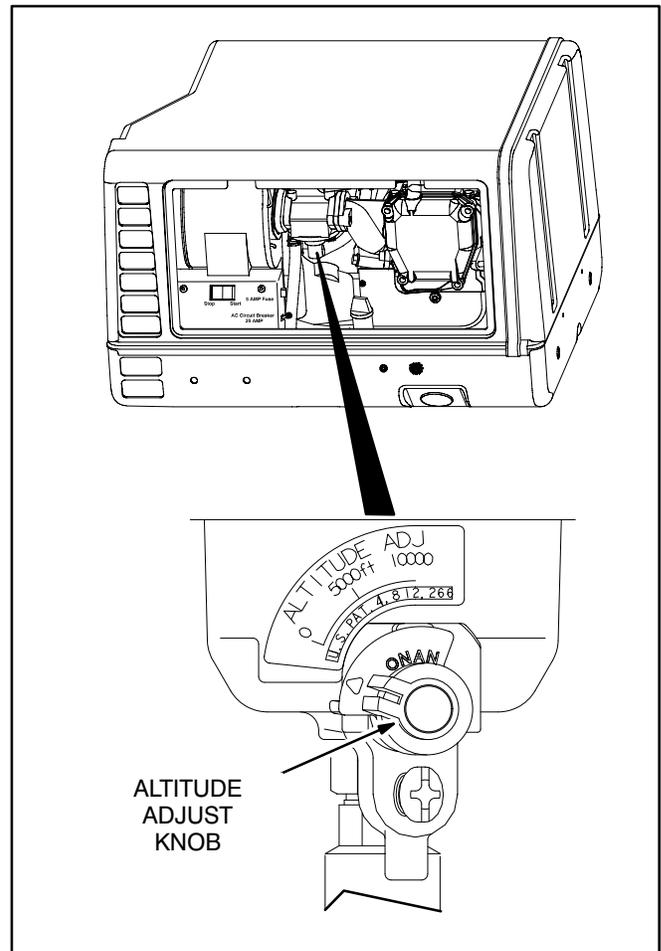
For best fuel economy and genset operation reset the carburetor for the current altitude (Figure 8). Look at road maps and road signs. For the effect of altitude on maximum power, see LOADING THE GENSET (Page 6).

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

OPERATING IN DUSTY ENVIRONMENTS

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

1. Do not let dirt and debris accumulate inside the genset compartment. Keep the genset clean.
2. Perform air cleaner maintenance more often (Page 11).
3. Change engine oil every 50 hours.
4. Keep containers of engine oil that have been opened tightly closed to keep out dust.



**FIGURE 8. ALTITUDE ADJUST KNOB
(GASOLINE MODELS ONLY)**

BREAKING IN A NEW ENGINE

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. 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 LOADING THE GENSET (Page 6).

Proper engine oil and oil level are especially critical during break-in because of the higher engine temperatures that can be expected. Change the oil if not appropriate for the ambient temperatures during break-in (Page 3). Check oil level twice a day or every 4 hours during the first 20 hours of operation and change the oil after the first 20 hours of operation.

EXERCISING THE GENSET

Exercise the genset at least 2 hours each month if use is infrequent. Run the genset at approximately 1/2 rated power. See LOADING THE GENSET (Page 6). A single two hour exercise period is better than several shorter periods.

Exercising a genset drives off moisture, re-lubricates the engine, replaces stale fuel in fuel lines and carburetor and removes oxides from electrical contacts and generator slip rings. The result is better starting, more reliable operation and longer engine life.

STORING THE GENSET

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. **Gasoline Models** – 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 in the fuel system will deteriorate causing fuel system corrosion, gum formation and varnish-like deposits which can lead to hard starting and rough operation.

2. Then run the genset for about 10 minutes at approximately 1/2 rated power to fill the fuel lines with the fresh fuel and preservative.

⚠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.*

3. Change the engine oil (Page 13) and attach a tag indicating its oil viscosity (Page 3).
4. Remove the air filter (Page 14) 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. The fogger leaves a protective coat of oil on the internal surfaces of the engine.
5. Disconnect the battery cables, negative (–) cable first, from the starting battery and store the battery according to the battery manufacturer's recommendations (Page 14).
6. Plug the exhaust tail pipe to keep out dirt, moisture, rodents and such.
7. Close the fuel supply valve (if so equipped).
8. Turn OFF the AC circuit breaker (Page 7).
9. **LPG Models** – Check local ordinances if the vehicle is to be garaged. Generally, 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 can lead to explosive accumulations in pits, sumps or other below-grade locations. Comply with all local ordinances regarding the garaging of vehicles with LPG engine fuel systems.*

OnaFresh and OnaGard are trademarks of Onan Corporation.

⚠WARNING *Do not open the carburetor drain when the engine is hot. Close the drain immediately after draining. Failure to heed this warning can lead to fire resulting in severe personal injury or death.

10. **Gasoline Models** – Draining the carburetor float bowl prevents deposits of gum from clogging the tiny passages in the carburetor as the gasoline in the bowl evaporates during storage. If the carburetor has a drain (Figure 9), drain it as follows:
 - A. Let the engine cool down thoroughly.
 - B. Place paper towels under the drain to absorb all of the drainage (less than 1/2 cup).
 - C. Open the drain valve by turning counter-clockwise with a screwdriver.
 - D. Immediately close the drain valve after draining by turning clockwise with a screwdriver *until just snug*.

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 (Page 3).
2. Reconnect the starting battery, negative (-) cable last (Page 14).
3. Remove the plug from the exhaust tailpipe.
4. Change the air filter element if it is dirty.
5. Open the fuel supply valve (if so equipped).
6. Inspect the genset (Page 12).
7. Start the genset. There may be smoke and rough operation for a few minutes until the oil from the fogger burns off. If the engine does not start, clean or replace the spark plug, which may have been fouled by the fogger.
8. Turn ON the AC circuit breaker (Page 7) when the genset is ready to power appliances.

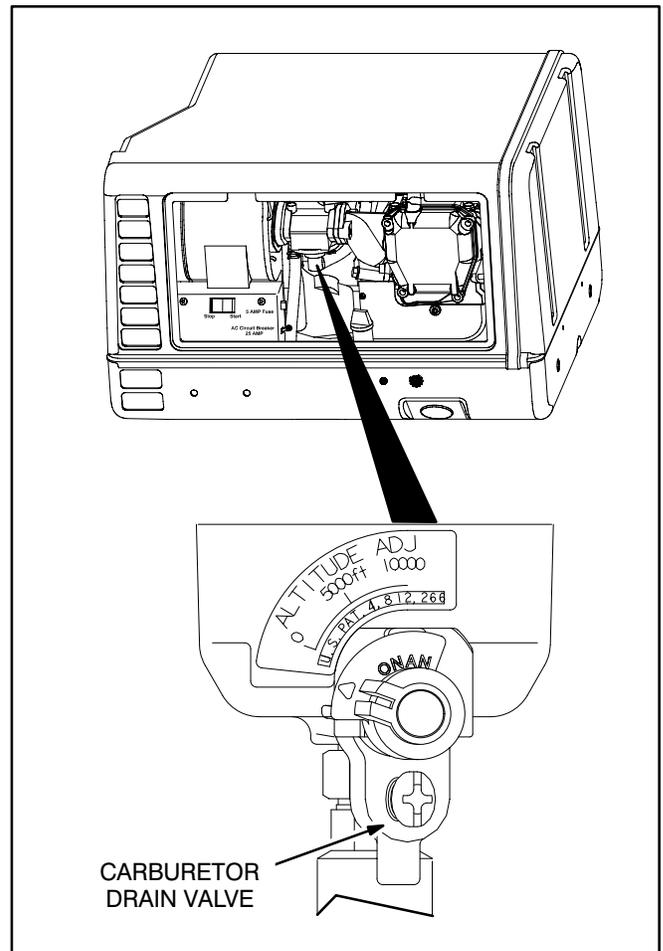


FIGURE 9. CARBURETOR DRAIN VALVE

Periodic Maintenance

Periodic maintenance is essential for top performance and long genset life. Use Table 4 as a guide for normal periodic maintenance. In hot and dusty environments some maintenance procedures should be performed more frequently, as indicated by the footnotes in the table. Keeping a log of maintenance performed and hours run will help you keep

genset maintenance regular and provide a basis for supporting warranty claims (Page 19).

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.

TABLE 4. PERIODIC MAINTENANCE SCHEDULE

MAINTENANCE PROCEDURE	MAINTENANCE FREQUENCY								Page
	Every Day or Every 8 Hours	After First 20 Hours	Every Month	Every 50 Hours	Every 150 Hours	Every 200 Hours	Every 450 Hours		
General Inspection	X								12
Check Engine Oil Level	X								13
Clean and Check Battery			X ³						14
Clean Spark Arrestor				X					15
Change Engine Oil		X ¹			X ^{2, 3, 4}				13
Replace Air Filter Element					X ²				14
Clean Engine Cooling Fins						X ²			-
Replace Spark Plug							X ⁵		15
Replace Fuel Filter (Gasoline)							X ⁵		16
Adjust Valve Lash							X ⁶		-
Clean/Replace Cylinder Head							X ⁶		-

1 – As a part of engine break-in, change the engine oil after the first 20 hours of operation.
 2 – Perform more often when operating in dusty environments.
 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).

CONDUCTING GENERAL INSPECTIONS

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

Oil Level

Check engine oil level (Page 13).

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 again.

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.

Check all CO monitors to assure proper operation.

⚠️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 and return systems 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 and have the genset serviced before using it again.

⚠️WARNING ***Gasoline and LPG are highly flammable and explosive and can cause severe personal injury or death. Shut down the genset and 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 MAINTAINING THE BATTERY AND BATTERY CONNECTIONS (Page 14).

Mechanical

Look for mechanical damage and listen for unusual noises. Check the genset mounting bolts.

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 to avoid severe eye injury.***

CHECKING ENGINE OIL LEVEL

Park the vehicle on level ground and stop the genset before checking engine 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 oil off the dipstick (Figure 10). Reinsert the dipstick, **but do not screw the cap down**. Remove the dipstick again and check the oil level on the dipstick.
2. Add or drain oil as necessary. See ENGINE OIL RECOMMENDATIONS (Page 3). Keep the oil level between the FULL and ADD marks.

⚠CAUTION *Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the FULL and ADD marks.*

3. Screw the oil fill cap back on securely.

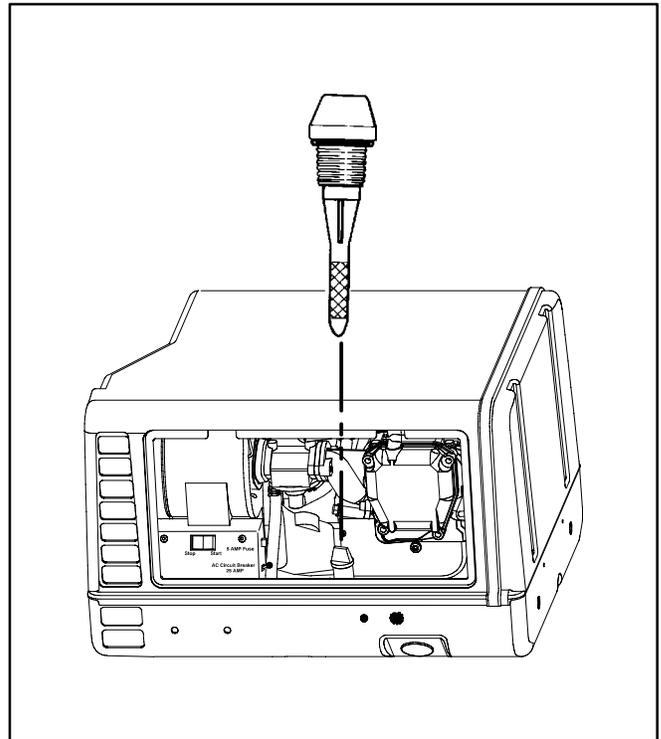


FIGURE 10. OIL LEVEL DIP STICK

CHANGING ENGINE OIL

⚠WARNING *U. S. state and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin.*

Refer to Table 4 for scheduled engine oil change. Change oil more often in hot or dusty environments.

⚠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. Run the engine until warm, stop it and remove the oil fill cap (Figure 10).
2. Place a pan under the oil drain plug and remove the plug (Figure 11) with a 14 mm socket. Let all oil drain from the engine and then **secure the drain plug**.
3. Refill with 1 quart (0.95 liter) of oil. See ENGINE OIL RECOMMENDATIONS (Page 3). Check the oil level and add or drain oil as necessary.
4. Screw the oil fill cap on securely.
5. Dispose of the used oil in accordance with local environmental regulations.

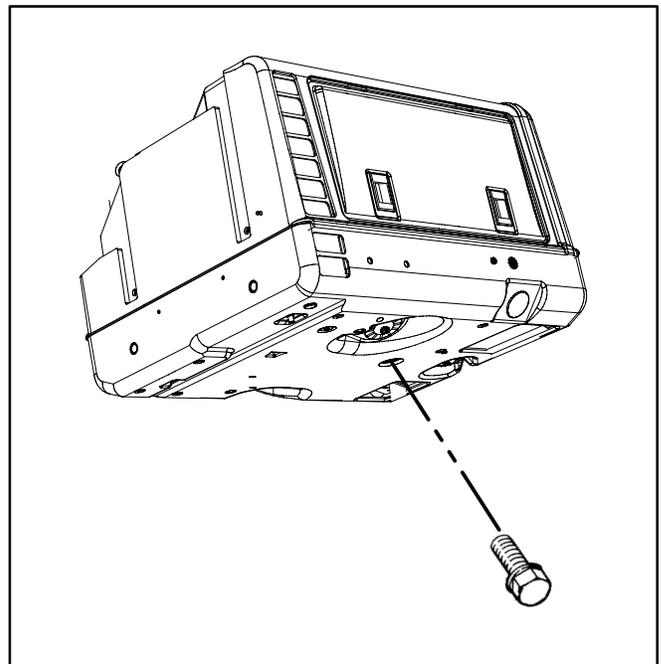


FIGURE 11. OIL DRAIN PLUG

REPLACING THE AIR FILTER ELEMENT

Refer to Table 4 for scheduled air filter replacement. Under dusty operating conditions inspect and change the air filter element more often. To change the air filter element (Figure 12), lift the filter cover out of the scroll housing and pull the filter retainer straight out. Install the new filter with the open end of the filter facing the carburetor, as shown.

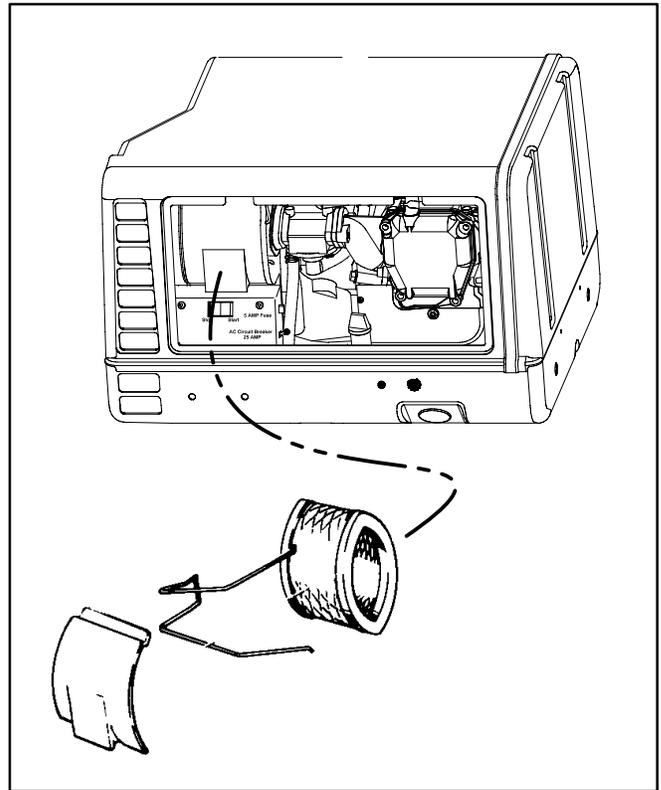


FIGURE 12. AIR FILTER ELEMENT

MAINTAINING THE BATTERY AND BATTERY CONNECTIONS

⚠WARNING *Arcing at battery terminals or light switch or other equipment or flames 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 / OFF away from battery—Do not disconnect battery cables while genset is running or vehicle battery charging system is on—Always disconnect negative (-) cable first and reconnect it last.*

Refer to Table 4 for scheduled battery maintenance, referring to the battery manufacturer's instructions. Have the battery charging system serviced if DC system voltage is consistently low or high. Always:

1. Keep the battery case and terminals clean and dry and the terminals tight.
2. Remove battery cables with a battery terminal puller.
3. Make sure which terminal is positive (+) and which is negative (-) before making battery connections, always removing the negative (-) cable first and reconnecting it last to reduce arcing.

REPLACING THE SPARK PLUG

Refer to Table 4 for scheduled spark plug replacement. (The genset has one spark plug, Figure 13). The spark plug must be in good condition for proper engine starting and performance. A spark plug that fouls frequently or has heavy soot deposits indicates that the engine needs service. See *Troubleshooting* (Page 17).

Always thread the spark plug in by hand until it seats, to prevent crossthreading, and torque to 13 lbs-ft (17 N-m). If you don't have a torque wrench, turn the spark plug an additional 1/4 turn, if being reused, or 3/8 to 1/2 turns if new.

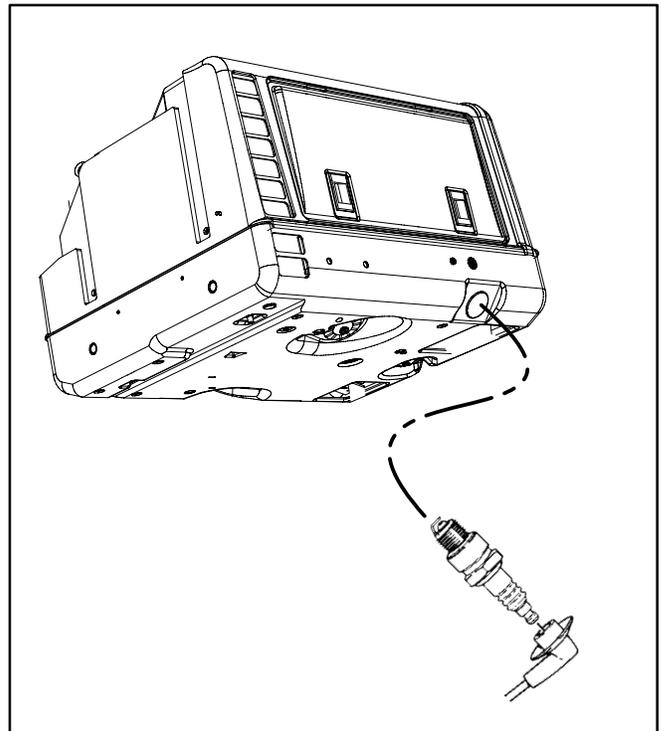


FIGURE 13. SPARK PLUG

CLEANING THE SPARK ARRESTOR

⚠WARNING *A hot muffler can cause severe burns. Let the muffler cool down before removing the spark arrestor screen.*

Refer to Table 4 for scheduled cleaning of the spark arrestor screen in the outlet of the muffler (Figure 14). The screen meets U.S. Forest Service requirements for spark arrestors. Cleaning is required for maximum genset performance.

1. Let the muffler and tailpipe cool down.
2. Unclamp the tailpipe from the muffler outlet.
3. Remove the screw in the muffler outlet collar and withdraw the spark arrestor screen.
4. Brush the soot from the screen, reinstall it and reconnect the tailpipe.

Note: If the spark arrestor screen has been installed in the end of the tail pipe, just remove the screen from the end of the tail pipe.

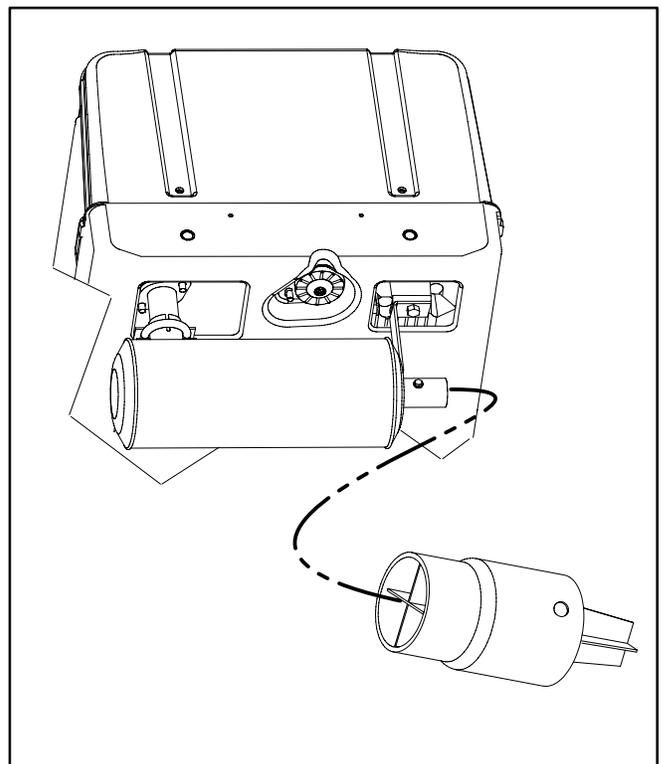


FIGURE 14. SPARK ARRESTOR SCREEN

REPLACING THE FUEL FILTER (GASOLINE MODELS ONLY)

Refer to Table 4 for scheduled replacement of the fuel filter (Figure 15).

Take care to spill as little fuel as possible when disconnecting the filter from the fuel line. Close any shut off valve in the fuel line and let the engine cool down before disconnecting the fuel line so that it cannot ignite any fuel that is spilled. The filter is removable by loosening the hose clamps shown.

⚠WARNING *Gasoline is highly flammable and can cause severe personal injury or death—Let the engine cool and close any fuel line shutoff valve before disconnecting the fuel line from the filter—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.*

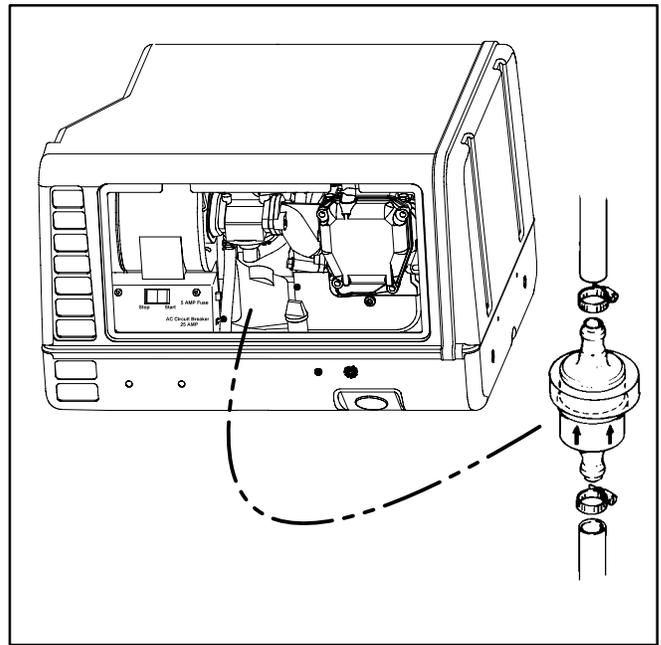


FIGURE 15. FUEL FILTER
(GASOLINE MODELS ONLY)

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* (Page 18).

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

▲WARNING *Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review Safety Precautions.*

TABLE 5. TROUBLESHOOTING

Problem	Corrective Action
1. Engine fails to crank	<ul style="list-style-type: none"> A. Try starting at the genset rather than at the remote control. 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.
2. Engine cranks slowly	<ul style="list-style-type: none"> 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 (Pages 3 and 13).
3. Engine cranks but fails to start	<ul style="list-style-type: none"> A. Gasoline Models – Check the fuel tank and fill if necessary. B. LPG Models – Check and fill the LPG container, as necessary. <i>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 genset fuel demand.</i> C. Open any closed fuel shut off valve. D. Check engine oil level and add or drain oil, as necessary (Page 13). E. Service the air cleaner (Page 14). F. Secure the spark plug lead on the spark plug. G. Replace the spark plug (Page 15). H. Gasoline Models – Replace the fuel filter (Page 16).
4. Engine runs but stops or surges	<ul style="list-style-type: none"> A. Gasoline Models – Check the fuel tank and fill if necessary. B. LPG Models – Check and fill the LPG container, as necessary. <i>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 genset fuel demand.</i> C. Check engine oil level and add or drain oil, as necessary (Page 13). D. Gasoline Models – Reset the carburetor for altitude (Page 8). E. Secure the spark plug lead on the spark plug. F. Replace the spark plug (Page 15).
5. Genset stalls or circuit breakers trip	<ul style="list-style-type: none"> A. Connect fewer appliances (Page 6). B. LPG Models – Check the fuel tank and fill as necessary. <i>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.</i>
6. No electrical power when genset running	<ul style="list-style-type: none"> A. Reset tripped circuit breakers (Page 7). 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 4) indicates low voltage	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> A. Service the air cleaner (Page 14).

How to Obtain Service

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

CALLING FOR SERVICE

When you need service, parts, or product literature (such as the Service Manual) for your genset, contact the nearest authorized distributor. Onan has factory-trained representatives to handle your needs for genset parts and service.

In North America

Call 1-800-888-ONAN to contact the nearest Cummins/Onan or Onan-only distributor in the United States or Canada. (This automated service utilizes touch-tone phones only). Select OPTION 1 (press 1) to be automatically connected to the distributor nearest to you.

If you are unable to contact a distributor using the automated service, consult the Yellow Pages. Typically, our distributors are listed under:

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

If you have difficulty in arranging service or resolving a problem, please contact the Service Manager at the nearest Cummins/Onan distributor for assistance.

Outside North America

If you are outside North America, call Onan Corporation at 1-763-574-5000 from 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday, or fax 1-763-528-7229.

INFORMATION TO HAVE READY

Before calling for service, have the following information available:

1. *The complete genset model number and serial number. See NAMEPLATE (Page 1).*
2. *The date of purchase*
3. *The nature of the problem. See Troubleshooting (Page 17).*

Information for California Users

This genset meets the requirements of California's Exhaust Emissions Standards as stated on the nameplate. Figure 1 (Page 1) illustrates where this information appears on the nameplate.

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 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 Lash	See <i>Specifications</i> (Page iv).
Engine Ignition Timing	See <i>Specifications</i> (Page iv).
Engine Fuel Requirements	Gasoline Models: The engine is certified to operate on unleaded gasoline. See Fuel Recommendations (Page 3). LPG Models: The engine is certified to operate on LPG vapor. See Fuel Recommendations (Page 3).
Engine Lubricating Oil Requirements	See ENGINE OIL RECOMMENDATIONS (Page 3).
Engine Fuel Mixture Settings	Gasoline Models: These genset engines have precision-manufactured carburetors which are not adjustable except for altitude (Page 8). LPG Models: These genset engines have precision-manufactured carburetors which are not adjustable.
Engine Adjustments	None.
Engine Emissions Control System	The engine emissions control system consists of inherent engine design.

Onan

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

Cummins and Onan are registered trademarks of Cummins Inc.



Redistribution or publication of this document by any means, is strictly prohibited.