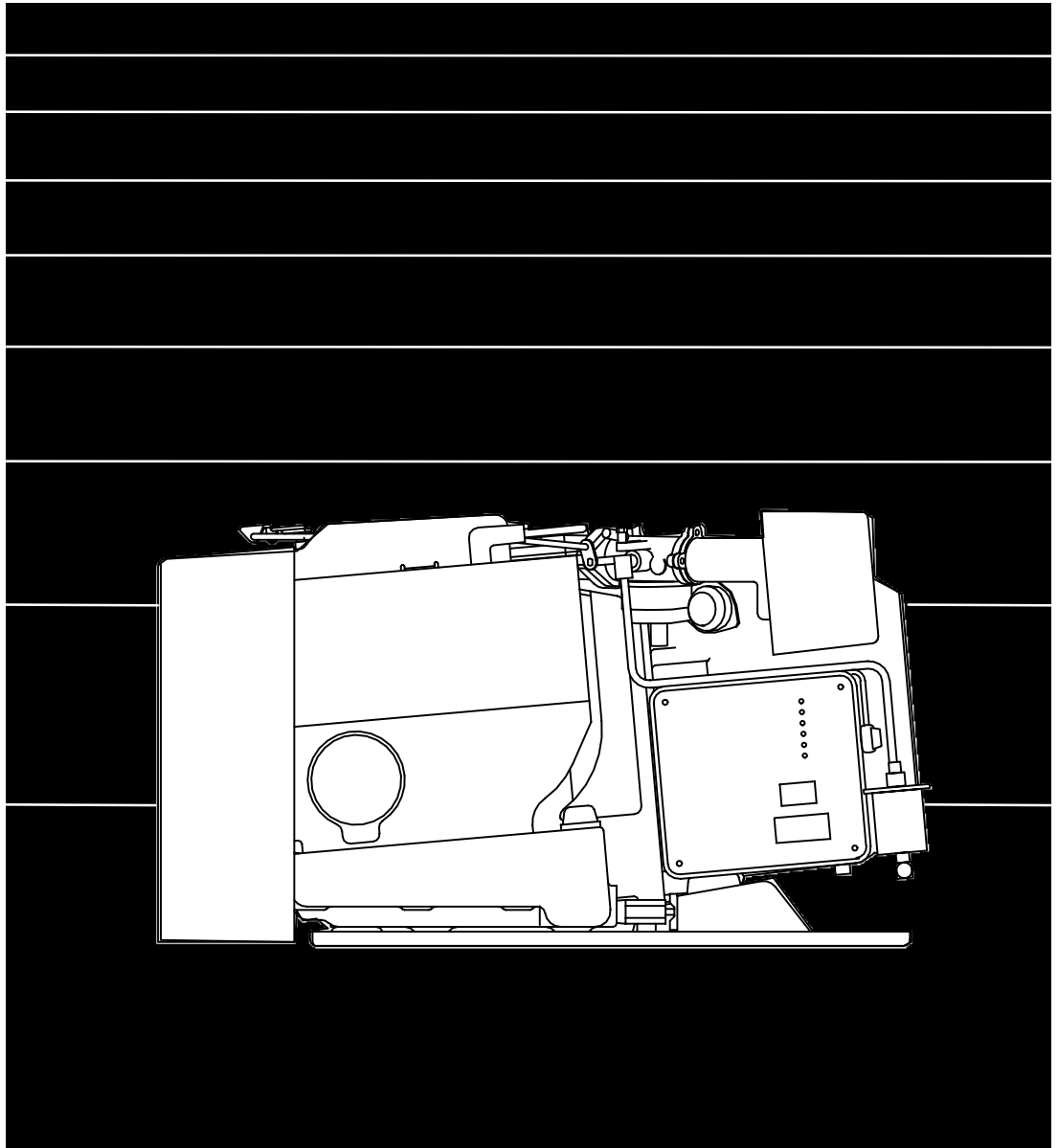




# Operator's Manual

## Model BGD and NHD Generator Sets



# Safety Precautions

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

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

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

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

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

Read and observe each of the following safety precautions.

## FUEL AND FUMES ARE FLAMMABLE

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

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

## EXHAUST GASES ARE DEADLY

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

## ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect the negative (-) cable at the starting battery before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms on the ground or over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death.
- Tag remote or open switches to avoid accidental closure or starting.

- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

## MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

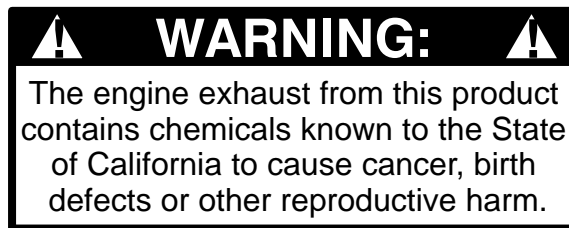
- Before starting work on the generator set, disconnect negative (-) cable at the battery. This will prevent accidental arcing or starting.
- Keep your hands away from moving parts.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans,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

## GENERAL SAFETY PRECAUTIONS

- Wear safety glasses and protective clothing when servicing batteries. DO NOT SMOKE while servicing batteries. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.
- Have a fire extinguisher rated ABC nearby. Maintain extinguisher properly and become familiar with its use.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage, which presents a potential fire hazard.
- Do not store anything in the generator set compartment such as oil or gas cans, oily rags, chains, wooden blocks, portable propane cylinders, etc. A fire could result or the generator set operation (cooling, noise and vibration) may be adversely affected. Keep the compartment floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

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# Introduction

## ABOUT THIS MANUAL

This manual covers the operation and maintenance of the Commercial BGD and NHD series of generator sets (gensets). Study this manual carefully and observe all of its instructions and precautions.

*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 2 on Page 12).

This manual also covers genset break-in, exercise and storage, how to obtain service, genset specifications and important information for California genset users.

Each operator of the genset should become thoroughly familiar with the information in this manual. Keep this manual and the genset Installation Manual with the other vehicle manuals.

## 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 1). 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 1.

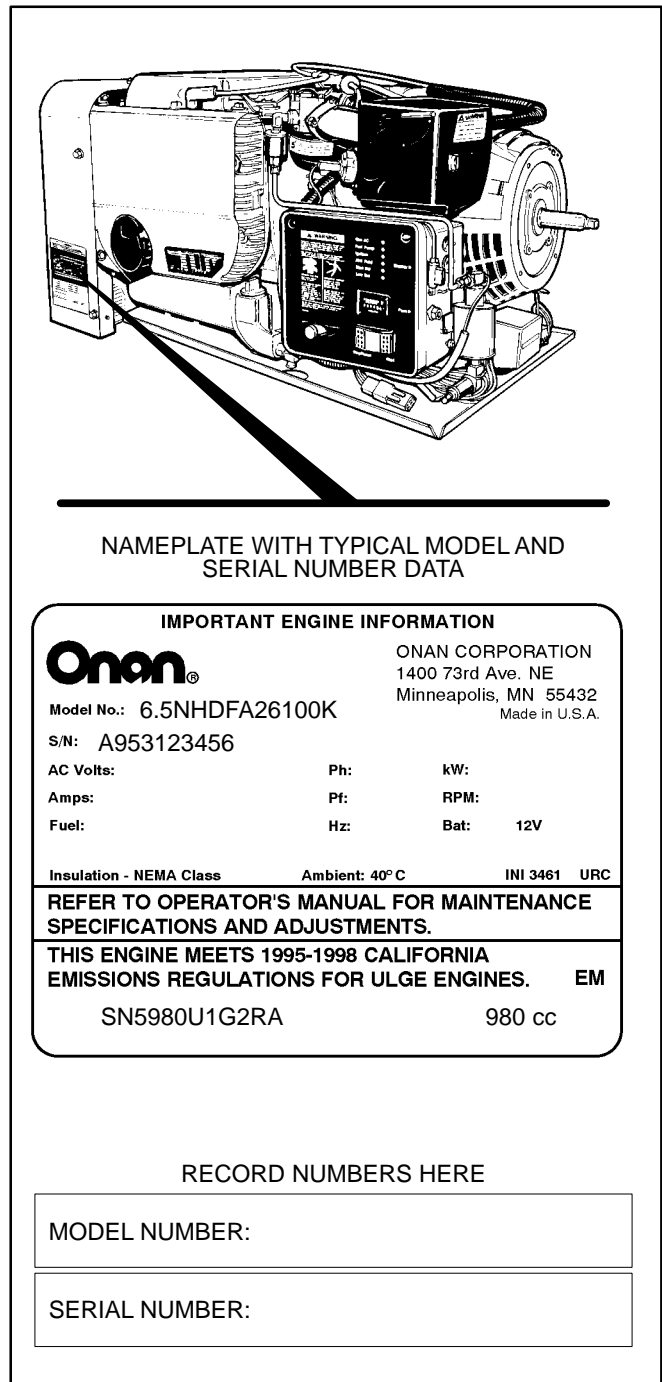


FIGURE 1. TYPICAL NAMEPLATE

## FUEL RECOMMENDATIONS

**⚠️WARNING** Gasoline, LPG (liquefied petroleum gas), and CNG (compressed natural gas) are highly flammable fuels and can cause severe personal injury or death. Do not smoke if you smell gas or gasoline or are near fuel tanks or fuel-burning equipment or are in an area sharing ventilation with such equipment. Keep flames, sparks, pilot lights, electrical arcs and arc-producing equipment 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 (Liquefied Petroleum Gas) Models

Use clean, fresh HD-5 grade LPG or equivalent product consisting of at least 90 percent propane. Commercial LPG 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 as specified in the *Specifications Section* by qualified personnel.

### CNG (Compressed Natural Gas) Models

Use commercially available natural gas for CNG models. The methane content of the natural gas used should be at least 90 percent.

Satisfactory performance requires that the CNG be supplied at a pressure within the range indicated in the *Specifications Section*.

**⚠️WARNING** High CNG supply pressure can cause gas leaks which can lead to fire and severe personal injury or death. CNG supply pressure must be adjusted as specified in the *Specifications Section* by qualified personnel.

## 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 (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

These gensets have a 12 volt, direct current (DC) starting and control system. See *Specifications* for minimum battery requirements for genset cranking.

Regular, monthly maintenance of batteries may be required. See *Periodic Maintenance* and any in-

structions available from the vehicle manufacturer or battery manufacturer. These gensets are equipped with an automatic battery recharging system. See *Specifications*.

Reliable genset starting and starter service life depend upon an 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 (see *Periodic*

*Maintenance*) are located as shown in Figure 2. The genset itself is usually located behind a door in a compartment somewhere around the perimeter of the vehicle.

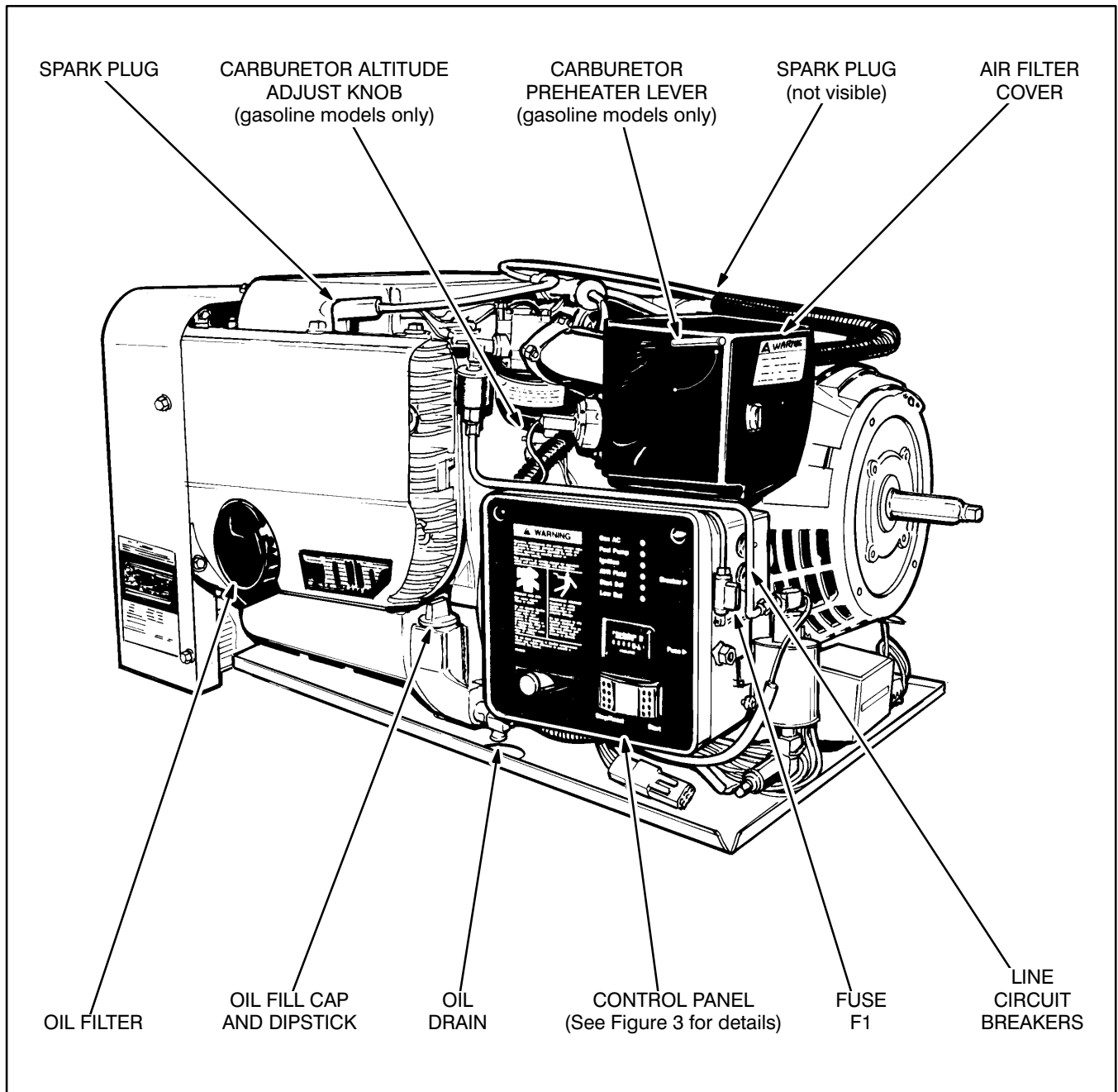


FIGURE 2. COMPONENT LOCATIONS

## GENSET CONTROL PANEL

The genset control panel (Figure 3) and box include the following features:

**START-STOP/RESET 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/RESET position to stop the genset or reset the control after a safety shutdown (low oil pressure).

**Hour Meter** - This meter records genset operating time in hours. Use it for periodic maintenance as a record of operating time.

**Green LEDs** - The five green LEDs (light emitting diodes) monitor the genset control and the AC output. The **Fuel Pump**, **Ignition**, **AVR Field** and **Start Sol** LEDs should come on during engine

cranking. As soon as the engine starts, the **Gen AC** LED should come on and the **AVR Field** and **Start Sol** LEDs should go out. See *Troubleshooting*.

**Red LED** - The red LED indicates low voltage across the 12 VDC control system and battery. It should stay off during normal operation. It will probably come on during cranking because of the high demand for current on the battery. If it stays on during operation, see BATTERY CARE under *Periodic Maintenance*.

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

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

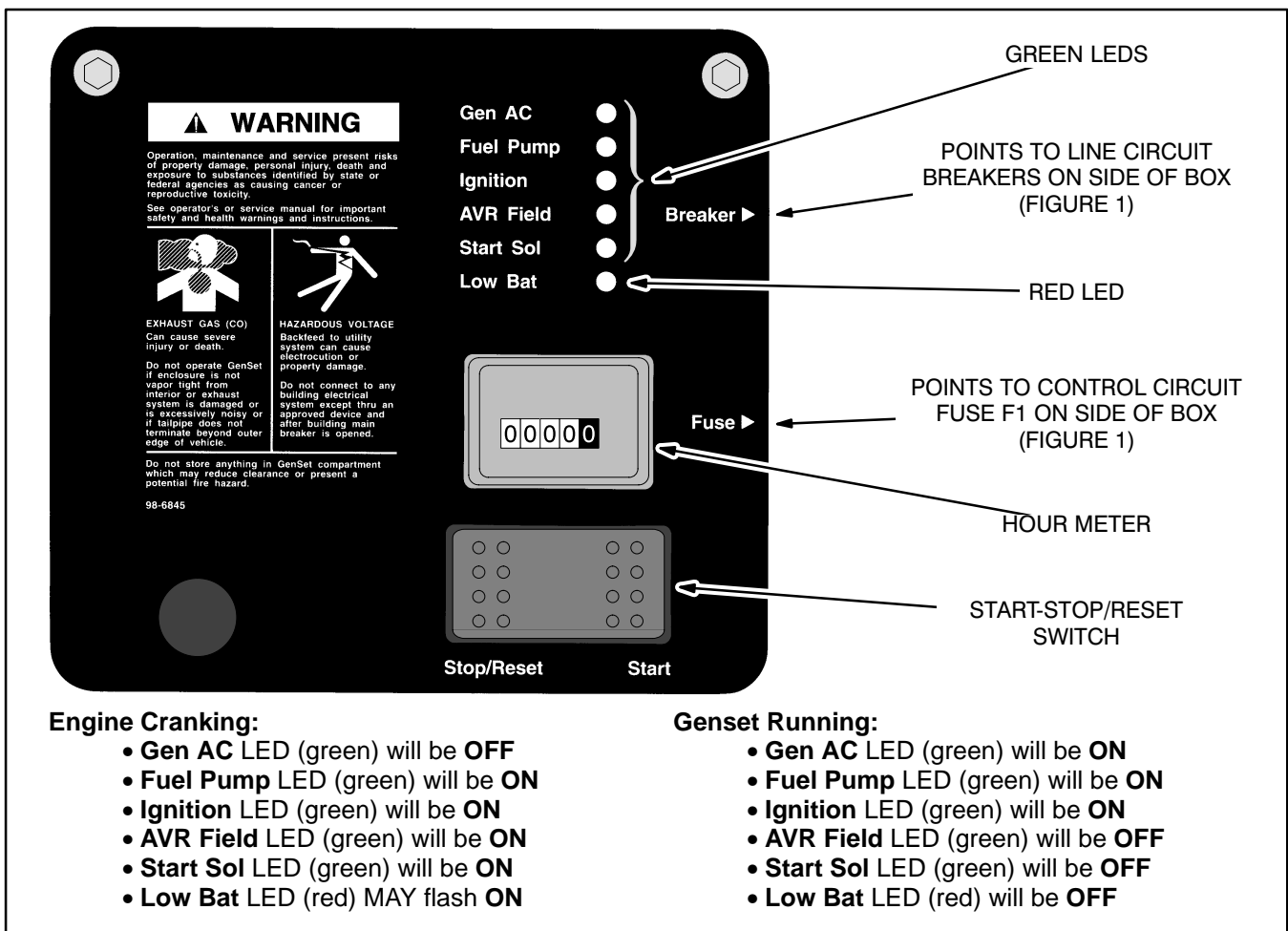


FIGURE 3. GENSET CONTROL PANEL



## 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 panel with start/stop switch and indicator lamp only (see Figure 4).
- Remote panel with start/stop switch, indicator lamp, and running (elapsed) time meter (see Figure 5).
- Remote panel with start/stop switch, indicator lamp, and battery DC voltmeter (see Figure 6).

The hour meter records genset operating time in hours. Use it for periodic maintenance as a record of operating time.

The battery 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 under *Periodic Maintenance*.

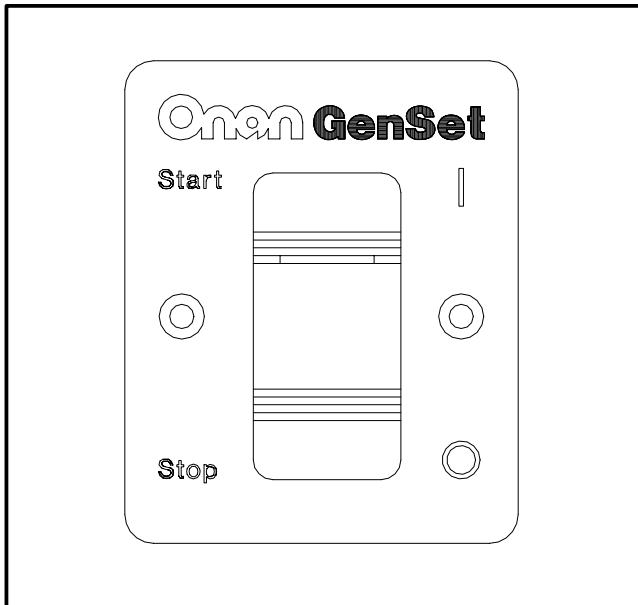


FIGURE 4. START/STOP SWITCH ONLY PANEL

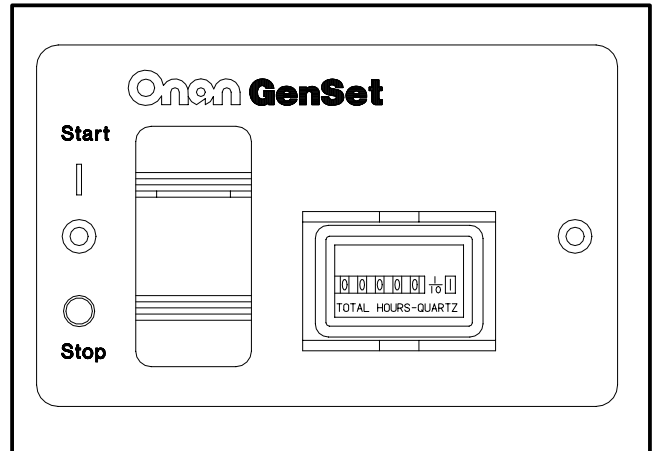


FIGURE 5. START/STOP SWITCH WITH TIME METER

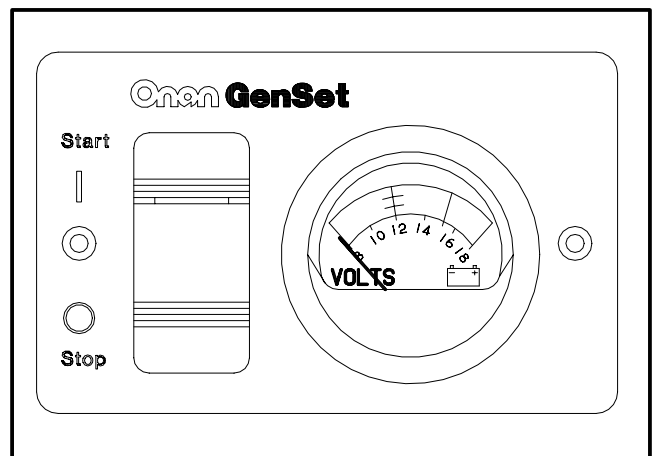


FIGURE 6. START/STOP SWITCH WITH BATTERY DC VOLTMETER

# Starting and Stopping

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## **⚠ 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 the maintenance instructed in OIL LEVEL CHECK AND GENERAL INSPECTION (Page 13) under *Periodic Maintenance*. 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 or from a remote control panel inside the vehicle (if so equipped).

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 or CNG container if this is an LPG or CNG genset.
2. Move the enable switch (if the vehicle is so equipped) to the position that allows genset operation.
3. Push and hold the genset or remote START switch (Figures 3 and NO TAG) until the genset starts.

**⚠ CAUTION** *Cranking the starter 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.*

4. 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 or mechanical loads. See *Powering Equipment*.
5. 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.
6. See *Troubleshooting* if the engine does not crank or start after several tries or stops running.

## STOPPING

1. Turn off large electrical loads and disengage mechanical 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 AC motors and air conditioners and the power tools that may be plugged into the electrical outlets of the vehicle. The genset may also have provision for driving mechanical equipment or a hydraulic pump. How much equipment (whether electrical, mechanical or hydraulic) 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 watt and Hp (horsepower) ratings of the individual tools and pieces of equipment that are likely to be used at the same time and compare the sum to the kW (kilowatt) rating of the genset. Note that 1 kW = 1000 watts and that 1 Hp = 746 watts. If power consumption, as totaled up, exceeds genset power output, you may have to consider operating some tools and pieces of equipment in sequence, one after another, rather than all at the same time.

Note that when the genset is loaded nearly to full power it is possible that it may stall when an air conditioner or other large motor load “cycles on”. The reason for this is that for a brief moment at startup a motor draws up to three times the power stated on its nameplate. You may, therefore, have to consider operating some tools and pieces of equipment at times when the large motor loads are not “On”.

Note also that as altitude increases air density decreases, causing genset engine power to decrease (even when the altitude adjust knob is set correctly—see *Variations In Weather and Altitude*). Power decreases approximately 3.5 percent of rated power each 1000 feet (305 m) of increase in elevation above sea level. Therefore, at higher altitudes consider operating fewer tools and pieces of equipment at the same time.

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.*

## RESTARTING A STALLED GENSET

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

## RESETTING CIRCUIT BREAKERS

If a circuit breaker in the main power distribution panel of the vehicle or on the genset trips, there is either a short circuit or too much electrical equipment being operated at the same time. Note that the genset will continue to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as much equipment as possible and reset the circuit breaker (typically, 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 vehicle electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician.

If the circuit breaker does not trip, reconnect pieces of equipment, 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 a piece of equipment is connected, the equipment probably has a short.

## 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 personnel working on the utility lines, damage to equipment and fire. An approved switching device must be used to prevent interconnections.*

# 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 on Page 3. 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 7). 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 8) for your altitude (gasoline models only).

## HOT WEATHER

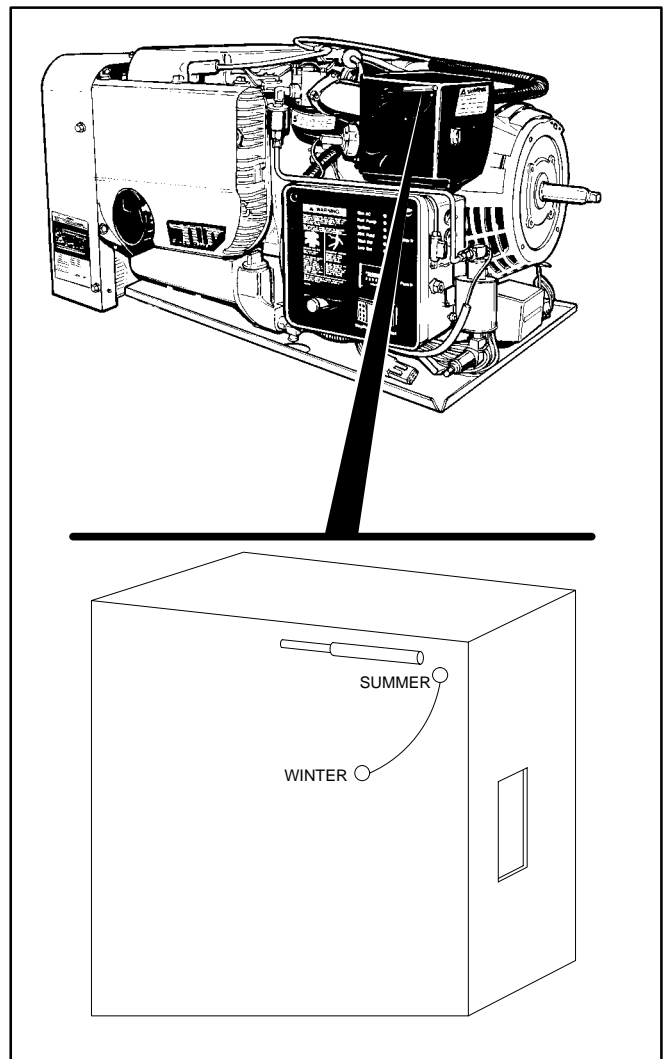
Pay particular attention to the following items when operating the genset in hot weather:

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 on Page 3.
3. Keep the genset clean.
4. Perform maintenance due. See *Periodic Maintenance*.
5. At temperatures above 70° F (21° C) push the carburetor preheater lever up to the SUMMER position (gasoline models only).

position (gasoline models only). The lever is located on the front of the air cleaner (Figure 7).

**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 8) for your altitude (gasoline models only).



**FIGURE 7. CARBURETOR PREHEATER LEVER (GASOLINE MODELS ONLY)**

## HIGH ALTITUDE

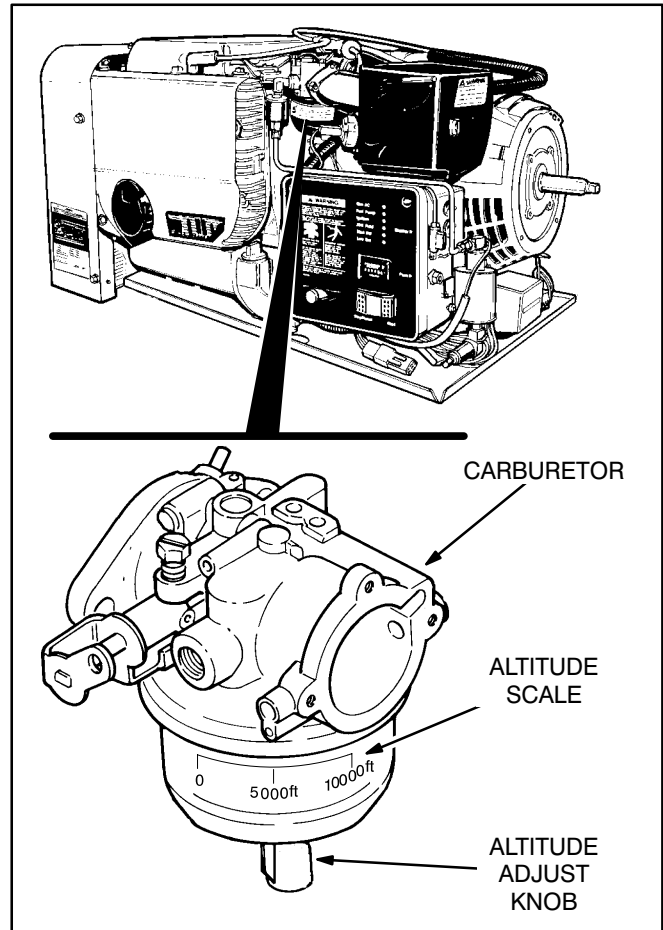
For best fuel economy and genset operation set the carburetor altitude adjust knob (Figure 8) for your altitude (gasoline models only). Look at road maps, travel atlases and road signs for altitude. (See *Powering Equipment* for information on how altitude affects the maximum power output of the genset.)

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

# Periodic Maintenance

Periodic maintenance is essential for top performance and long genset life. Use Table 2 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. Keep a log of maintenance performed and the hours run. See *Maintenance Record*. Recording maintenance will help you keep it regular and provide a basis for supporting warranty claims.

**TABLE 2. PERIODIC MAINTENANCE SCHEDULE**

MAINTENANCE OPERATION	MAINTENANCE FREQUENCY							Page
	Every Day or Every 8 Hours	Every Month	Every 50 Hours	Every 150 Hours	Every 300 Hours	Every 500 Hours		
General Inspection	X							13
Check Engine Oil Level	X							14
Clean and Check Starting Battery		X <sup>3</sup>						16
Clean the Spark Arrestor			X					18
Change Engine Oil and Oil Filter				X <sup>1, 2, 3, 4</sup>				15
Replace Engine Air Filter				X <sup>2, 4</sup>				17
Clean Carburetor and Combustion Chambers with Onan "4C"				X				18
Replace Spark Plugs				X <sup>4</sup>				17
Replace Choke Vacuum Sustain Valve					X <sup>5, 6</sup>			-
Clean Engine Cooling Fins					X <sup>2, 6</sup>			-
Replace Fuel Filter(s) and Clean Fuel Pump Screen						X <sup>5, 6</sup>		-
Adjust Engine Valve Clearance						X <sup>6</sup>		-
Remove Cylinder Heads and Clean Combustion Chambers						X <sup>6</sup>		-
Inspect and Clean Governor Linkage						X <sup>6</sup>		-

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).

---

## OIL LEVEL CHECK AND 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 as explained under CHECKING ENGINE OIL LEVEL in this section.

### 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 and 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 or CNG leaks.* Check flexible fuel hose sec-

tions 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 or CNG container shutoff valve and have the genset serviced before using it again.

**⚠WARNING** ***Gasoline, LPG, and CNG are highly flammable fuels and can cause severe personal injury or death. Repair leaks right away.***

**⚠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.***

**⚠WARNING** ***CNG leaks inside a garage or other inadequately ventilated space also presents an explosion hazard. CNG “rises” when it is released into the air. Check for and comply with all local ordinances regarding the garaging of vehicles with CNG engine fuel systems.***

### Battery Connections

Check the battery terminals for clean, tight connections. Loose or corroded connections have high electrical resistance which makes starting harder. Shut the genset off and disconnect corroded or loose battery cables (negative [-] cable first) and clean and reconnect them as instructed under BATTERY CARE in this section.

**⚠WARNING** ***Batteries give off explosive gases that can cause severe personal injury. Do not smoke near batteries. Keep flames, sparks, pilot lights, electrical arcs and arc-producing equipment and all other ignition sources well away.***

***Do not disconnect the battery cables while the genset is cranking or running: the arcing can ignite the explosive battery gases.***

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

**⚠WARNING** *Always wear safety glasses when using compressed air, a pressure washer or a steam cleaner to avoid severe eye damage.*

### CHECKING ENGINE OIL LEVEL

Park the vehicle on level ground and shut off the genset before checking the engine oil level.

1. Remove the oil fill cap/dipstick (Figure 9) and wipe it clean.

**⚠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. Screw the oil fill cap back on and remove it to check the oil level on the dipstick.
3. Add oil as necessary until the full mark is reached. Use API Class SG or SH oil (also SG/CD, SG/CE, SH/CD or SH/CE) having an SAE viscosity grade appropriate for the expected temperatures, as indicated in Table 1.

DO NOT FILL TO A LEVEL ABOVE THE FULL MARK ON THE DIPSTICK. Drain the excess oil if too much has been added.

**⚠CAUTION** *Too much oil can cause high oil consumption, high operating temperatures and oil foaming. Too little oil can cause severe engine damage. Keep the oil level between the Full and Add marks on the dipstick.*

4. Screw the oil fill cap on securely to prevent oil leakage.

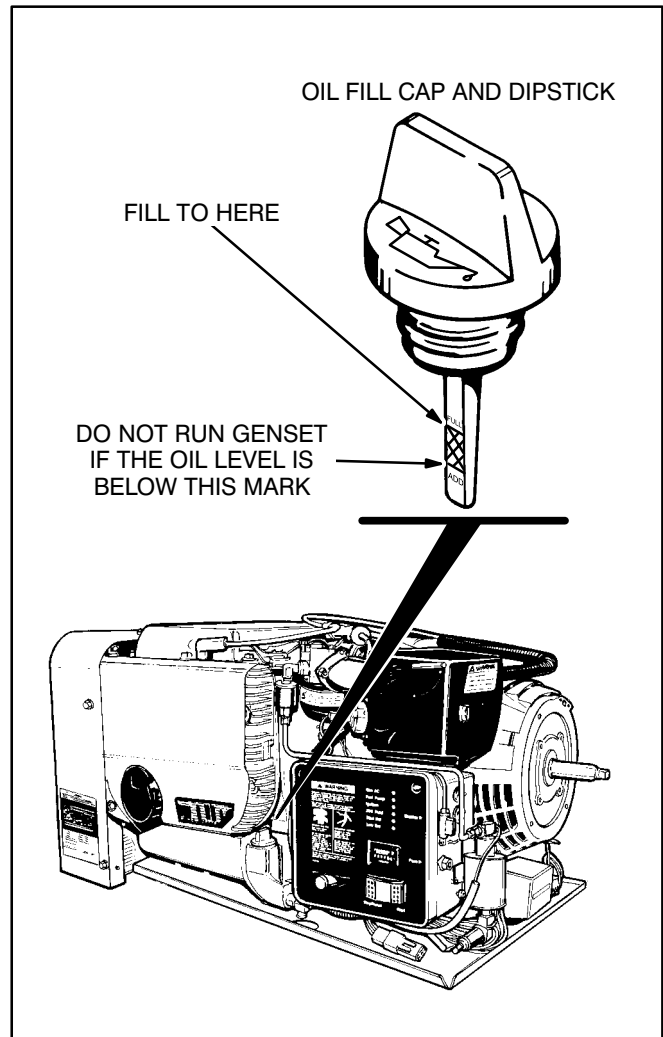


FIGURE 9. OIL LEVEL CHECK



## CHANGING ENGINE OIL AND OIL FILTER

Refer to Table 2 for scheduled engine oil change. In hot weather and dusty conditions the oil should be changed more often.

**⚠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 plug. Run the engine until it is warm, then shut it off.
2. Remove the oil fill cap (Figure 9).

**⚠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.*

3. Open the oil drain valve (Figure 10) and allow all of the oil to drain from the engine.
4. Close the oil drain valve.
5. Spin off the oil filter canister (Figure 10), drain it of oil and discard it according to local regulations.
6. Thoroughly wipe off the filter mounting surface.
7. Make sure the gasket is in place on the new filter canister and apply a thin film of oil to the gasket.
8. 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.
9. Refill with API Class SG or SH oil (also SG/CD, SG/CE, SH/CD or SH/CE) having an SAE vis-

cosity grade appropriate for the expected temperatures, as indicated in Table 1. See *Specifications* for oil capacity.

10. Check the oil level and add oil until the full mark is reached.

DO NOT FILL TO A LEVEL ABOVE THE FULL MARK ON THE DIPSTICK. Drain the excess oil if too much has been added.

**⚠CAUTION** *Too much oil can cause high oil consumption, high operating temperatures and oil foaming. Too little oil can cause severe engine damage. Keep the oil level between the Full and Add marks on the dipstick.*

11. Screw the oil fill cap on securely to prevent oil leakage.
12. Used oil is harmful to the environment if it is not disposed of properly. Pour used oil into a sealed container and deliver it to the nearest recycling center or automotive service station.

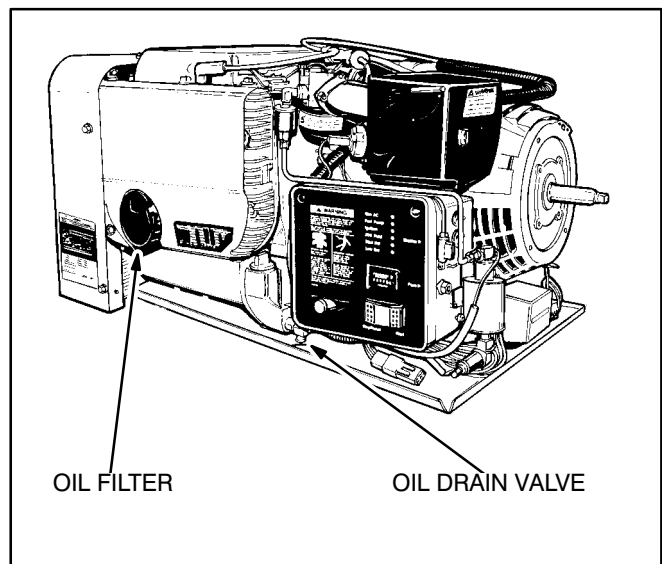


FIGURE 10. OIL DRAIN PLUG AND OIL FILTER

## BATTERY CARE

Refer to Table 2 for scheduled battery maintenance and to the battery manufacturer's recommendations and instructions for battery care. Check the electrolyte level more frequently during hot weather on batteries which are not of the "maintenance-free" type.

**⚠WARNING** *Batteries give off explosive gases that can cause severe personal injury. Do not smoke near batteries. Keep flames, sparks, pilot lights, electrical arcs and arc-producing equipment and all other ignition sources well away.*

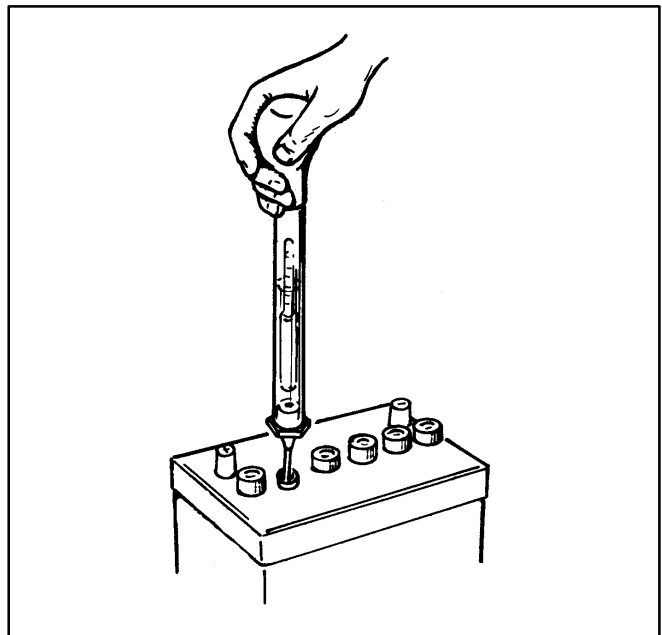
*Do not disconnect the battery cables while the genset is cranking or running: the arcing can ignite the explosive battery gases.*

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

Maintain the battery as follows unless the battery manufacturer has other instructions and recommendations:

1. Keep the battery case clean and dry.
2. Make certain that the battery cable connections are clean and tight. Use a terminal puller tool to remove the battery cables.
3. Identify the cable as positive (+) or negative (-) before making the battery connections. Always remove the negative (-) cable first and connect it last, to reduce the risk of arcing.
4. To remove corrosion from the battery terminals, wash the terminals with an ammonia solution or a solution consisting of 1/4 pound (about 100 grams) of baking soda in 1 quart (about 1 liter) of water. Be sure the vent plugs are tight to prevent cleaning solution from entering the cells. After cleaning, flush the outside of the battery and the surrounding areas with clean water.

5. If the battery is not of the "maintenance-free" type, maintain the electrolyte level by adding distilled water. Fill each cell to the split-level marker in the battery. The water component of the electrolyte evaporates, but the sulfuric acid component remains. For this reason, add water, not electrolyte to the battery.
6. Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell (Figure 11). Charge the battery if the specific gravity measures less than 1.215. Do not overcharge the battery. Stop charging the battery when the electrolyte specific gravity reaches 1.260, at approximately 80° F (27° C).
7. If the remote battery condition meter (Figure NO TAG) continues to indicate that battery voltage is abnormally low or high after battery maintenance has been performed, the vehicle battery charging system may need to be serviced by a qualified mechanic.



**FIGURE 11. BATTERY CHECK WITH HYDROMETER**

## AIR FILTER

Refer to Table 2 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 12). Re-assemble 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.

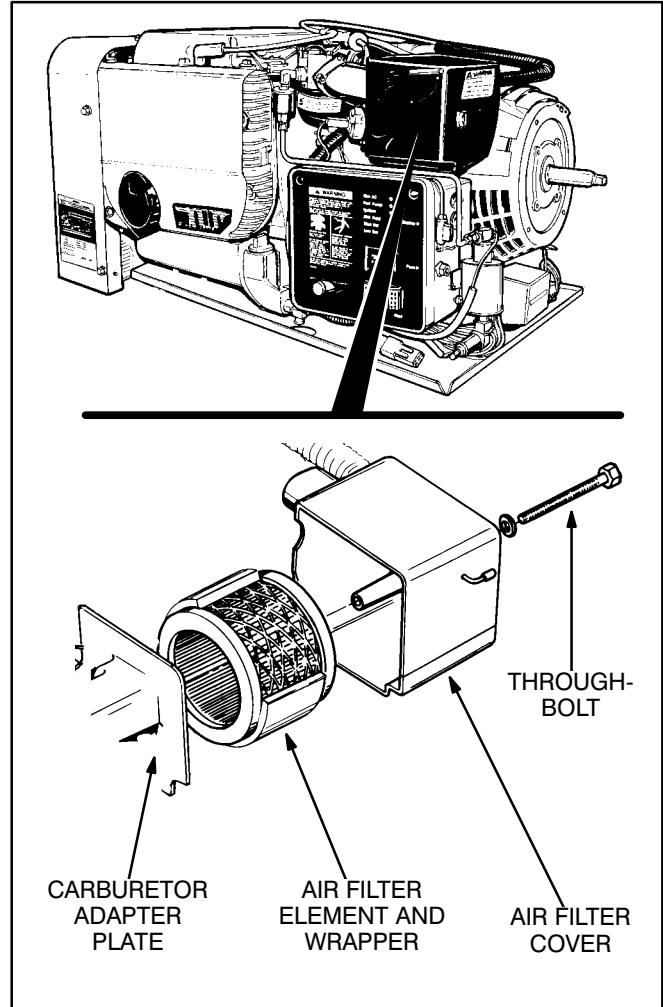


FIGURE 12. AIR FILTER ELEMENT AND WRAPPER

## SPARK PLUGS

Refer to Table 2 for scheduled spark plug replacement. (The genset has two spark plugs, Figure 13.) 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).

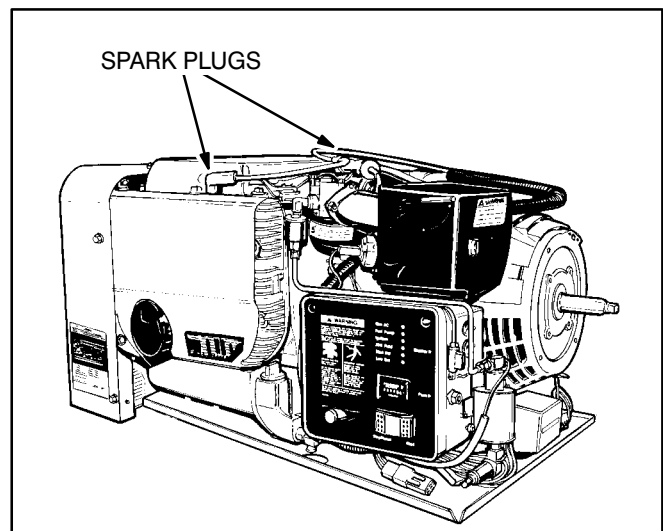


FIGURE 13. SPARK PLUGS

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## CLEANING THE CARBURETOR AND COMBUSTION CHAMBERS WITH ONAN “4C”

Refer to Table 2 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 2 on Page 12.)

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 while performing this operation.**

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 “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.

## SPARK ARRESTOR

Refer to Table 2 on Page 12 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 either below or on the left side of the genset and the cleanout plug is located on the bottom side of the muffler. Clean out the spark arrestor muffler as follows:

1. Remove the cleanout plug from the bottom of the muffler.
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.

# 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 in *Introduction*. 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 (Ona-

Fresh™), 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 (Figure 5) 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).
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).

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9. If the vehicle is to be garaged and is equipped with an LPG or CNG genset, first check for local ordinances regarding the garaging of vehicles with LPG or CNG engine fuel systems. Generally, the ordinances require that the LPG/CNG system be leak-free, that the LPG/CNG 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.*

**⚠WARNING** *CNG leaks inside a garage or other inadequately ventilated space also presents an explosion hazard. CNG “rises” when it is released into the air. Check for and comply with all local ordinances regarding the garaging of vehicles with CNG 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).
2. Reconnect the starting battery (negative [-] cable last). See BATTERY CARE under *Periodic Maintenance*.
3. Remove the plug from the exhaust tailpipe.
4. Open the fuel supply valve (if so equipped).
5. Inspect the genset. See OIL LEVEL CHECK AND GENERAL INSPECTION under *Periodic Maintenance*.
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 when the genset is ready to power appliances.

# Troubleshooting

Table 3 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*.

**sonnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review the safety precautions on the inside cover page.**

**⚠️ WARNING** Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service per-

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

**TABLE 3. TROUBLESHOOTING**

<b>Problem</b>	<b>Corrective Action</b>
1. The engine fails to crank at the remote START switch.	<ul style="list-style-type: none"> <li>a. Turn the enable switch (if so equipped) to the enable position.</li> <li>b. Try starting at the genset rather than at the remote control.</li> <li>c. Push the genset control panel switch to RESET and then to START.</li> </ul>
2. The engine fails to crank at the genset START switch and <b>Start Sol</b> (Fig. 3) does not light.	<ul style="list-style-type: none"> <li>a. Turn the enable switch (if so equipped) to the enable position.</li> <li>b. Push the genset control panel switch to RESET and then to START.</li> <li>c. Replace fuse F1 on the side of the control box if it has blown.</li> <li>d. Clean and tighten the positive (+) and negative (-) battery cable connections at the battery and the genset.</li> <li>e. Recharge the battery. Refer to the battery manufacturer's recommendations.</li> </ul>
3. The engine fails to crank at the genset START switch but <b>Start Sol</b> (Fig. 3) does light.	<ul style="list-style-type: none"> <li>a. Clean and tighten the positive (+) and negative (-) battery cable connections at the battery and the genset.</li> <li>b. Recharge the battery. Refer to the battery manufacturer's recommendations.</li> </ul>
4. The engine cranks slowly.	<ul style="list-style-type: none"> <li>a. Disconnect large electrical and mechanical loads.</li> <li>b. Clean and tighten the positive (+) and negative (-) battery cable connections at the battery and the genset.</li> <li>c. Recharge the battery. Refer to the battery manufacturer's recommendations.</li> <li>d. Change the engine oil to oil having the proper viscosity for the ambient temperature. See Table 1 on Page 3.</li> </ul>
5. The engine cranks but fails to start. <b>Fuel Pump, AVR Field</b> and <b>Ignition</b> (Fig. 3) do light.	<ul style="list-style-type: none"> <li>a. Check the fuel tank and fill if necessary.</li> <li>b. Open any closed fuel shut off valve.</li> <li>c. Check engine oil level and add oil as necessary.</li> <li>d. Service the air cleaner.</li> <li>e. Secure the spark plug leads on the spark plugs.</li> <li>f. Replace the spark plugs.</li> </ul>
6. The engine cranks but fails to start. <b>Fuel Pump, AVR Field</b> or <b>Ignition</b> (Fig. 3) does not light.	Contact an authorized Onan dealer.
7. The engine runs and then stops or surges.	<ul style="list-style-type: none"> <li>a. Check the fuel tank and fill if necessary.</li> <li>b. Check the engine oil level and add oil as necessary. Drain excess oil if the level is above the dipstick Full mark.</li> <li>c. Check and reset the carburetor preheater lever and altitude adjust knob (gasoline models only). See <i>Varying Weather and Altitude</i>.</li> <li>d. Secure the spark plug leads on the spark plugs.</li> <li>e. Replace the spark plugs.</li> </ul>
8. The genset keeps stalling or the circuit breaker keeps tripping.	<ul style="list-style-type: none"> <li>a. Try running with fewer appliances connected. See <i>Powering Equipment</i>.</li> <li>b. Check the fuel tank (LPG, vapor-withdrawal models) 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></li> </ul>
9. There is no electrical power even though the genset runs and <b>Gen AC</b> (Fig. 3) lights.	<ul style="list-style-type: none"> <li>a. Reset tripped circuit breakers. See <i>Powering Equipment</i>.</li> <li>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).</li> </ul>
10. <b>Low Bat</b> (Fig. 3) lights and/or the remote battery meter (Fig. 4) indicates low voltage.	<ul style="list-style-type: none"> <li>a. Clean and tighten the positive (+) and negative (-) battery cable connections at the battery and the genset.</li> <li>b. Recharge the battery. Refer to the battery manufacturer's recommendations.</li> </ul>
11. Black smoke exits the tailpipe.	Service the air cleaner.

# Specifications

	GASOLINE MODELS			
	BGD		NHD	
<b>GENERATOR:</b> 4-Pole Revolving Field, Self-Excited, Electronically Regulated				
Power (watts)	4500	4000	6500	5000
Frequency (Hertz)	60	50	60	50
120/240 Volt Single-Phase Output Current (amperes @ 1.0 PF)	37.5/18.8	33.3/16.6	54/27	41.7/20.8
120/240 Volt Three-Phase Output Current (amperes @ 1.0 PF)	21.7/10.8	-	31.3/15.6	-
220/380 Volt Three-Phase Output Current (amperes @ 1.0 PF)	-	10.5/6.1	-	13.1/7.6
Speed (RPM)	1800	1500	1800	1500
<b>FUEL CONSUMPTION:</b>				
No load gph (l/h)	0.3 (1.1)	0.3 (1.1)	0.4 (1.5)	0.4 (1.5)
Half load gph (l/h)	0.5 (1.9)	0.5 (1.9)	0.7 (2.6)	0.7 (2.6)
Full load gph (l/h)	0.8 (3.0)	0.8 (3.0)	1.3 (4.9)	1.0 (3.8)
<b>ENGINE:</b> 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 <sup>3</sup> (782 cc)		60 inches <sup>3</sup> (980 cc)	
Compression Ratio	7.0 : 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)			
Electronic Ignition Timing	12° BTDC, non-adjustable			
<b>CONTROL AND CRANKING SYSTEM:</b> 12 VDC				
Nominal Battery Voltage	12 volts			
Minimum Battery Cold Cranking Capacity: Above/Below Freezing	360/450 amperes			
Nominal Regulated-Voltage Battery Charging Output	10 amperes			
Fuse F1 (control circuit)	10 amperes mini-bayonet			
* -See <i>Periodic Maintenance</i> for oil filling instructions.				



	LPG MODELS			
	BGD		NHD	
<b>GENERATOR:</b> 4-Pole Revolving Field, Self-Excited, Electronically Regulated				
Power (watts)	4500	4000	6300	5000
Frequency (Hertz)	60	50	60	50
120/240 Volt Single-Phase Output Current (amperes @ 1.0 PF)	37.5/18.8	33.3/16.6	52.5/26.3	41.7/20.8
120/240 Volt Three-Phase Output Current (amperes @ 1.0 PF)	21.7/10.8	-	30.3/15.2	-
220/380 Volt Three-Phase Output Current (amperes @ 1.0 PF)	-	10.5/6.1	-	13.1/7.6
Speed (RPM)	1800	1500	1800	1500
<b>FUEL CONSUMPTION:</b>				
No load lbs/h (kg/h)	1.8 (0.8)	1.5 (0.7)	2.2 (1.0)	2.0 (0.9)
Half load lbs/h (kg/h)	3.1 (1.4)	2.6 (1.2)	3.8 (1.7)	3.5 (1.6)
Full load lbs/h (kg/h)	4.4 (2.0)	4.0 (1.8)	6.6 (3.0)	5.1 (2.3)
<b>ENGINE:</b> 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 <sup>3</sup> (782 cc)		60 inches <sup>3</sup> (980 cc)	
Compression Ratio	7.0 : 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)			
Electronic Ignition Timing	12° BTDC, non-adjustable			
LPG Vapor Supply Pressure (Range)—Vapor-Withdrawal Models Only	9 to 13 inch (229 to 330 mm) W.C. (water column)			
<b>CONTROL AND CRANKING SYSTEM:</b> 12 VDC				
Nominal Battery Voltage	12 volts			
Minimum Battery Cold Cranking Capacity: Above/Below Freezing	360/450 amperes			
Nominal Regulated-Voltage Battery Charging Output	10 amperes			
Fuse F1 (control circuit)	10 amperes mini-bayonet			
* -See <i>Periodic Maintenance</i> for oil filling instructions.				

	<b>CNG MODELS</b>	
	<b>NHD</b>	
<b>GENERATOR:</b> 4-Pole Revolving Field, Self-Excited, Electronically Regulated		
Power (watts)	5400	4500
Frequency (Hertz)	60	50
120/240 Volt Single-Phase Output Current (amperes @ 1.0 PF)	45/22.5	37.5/18.8
120/240 Volt Three-Phase Output Current (amperes @ 1.0 PF)	-	-
220/380 Volt Three-Phase Output Current (amperes @ 1.0 PF)	-	-
Speed (RPM)	1800	1500
<b>FUEL CONSUMPTION:</b>		
No load lbs/h (kg/h)	2.0 (0.9)	1.8 (0.8)
Half load lbs/h (kg/h)	3.3 (1.5)	2.9 (1.3)
Full load lbs/h (kg/h)	5.3 (2.4)	4.2 (1.9)
<b>ENGINE:</b> 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 <sup>3</sup> (980 cc)	
Compression Ratio	7.0 : 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)	
Electronic Ignition Timing	12° BTDC, non-adjustable	
CNG Supply Pressure (Range)	75 to 150 psi	
<b>CONTROL AND CRANKING SYSTEM:</b> 12 VDC		
Nominal Battery Voltage	12 volts	
Minimum Battery Cold Cranking Capacity: Above/Below Freezing	360/450 amperes	
Nominal Regulated-Voltage Battery Charging Output	10 amperes	
Fuse F1 (control circuit)	10 amperes mini-bayonet	
* -See <i>Periodic Maintenance</i> for oil filling instructions.		

# Information for California Genset Users

These gensets meet the requirements of California's Exhaust Emissions Standards for 1995 and later for Utility and Lawn and Garden Equipment Engines.

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 4 as an aid in locating information related to the California Air Resources Board requirements for emissions control.

**TABLE 4. 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 <i>Specifications</i> .
Engine Ignition Timing	See <i>Specifications</i> .
Engine Fuel Requirements	<b>Gasoline Models:</b> The engine is certified to operate on unleaded gasoline. See Fuel Recommendations in <i>Introduction</i> . <b>LPG Models:</b> The engine is certified to operate on LPG. See Fuel Recommendations in <i>Introduction</i> . <b>CNG Models:</b> The engine is certified to operate on natural gas. See Fuel Recommendations in <i>Introduction</i> .
Engine Lubricating Oil Requirements	See ENGINE OIL RECOMMENDATIONS in <i>Introduction</i> .
Engine Fuel Mixture Settings	These genset engines have precision-manufactured carburetors which are not adjustable.
Engine Adjustments	<b>Gasoline Models:</b> See Figures 7 and 8. <b>LPG and CNG Models:</b> Not applicable.
Engine Emission Control System	The engine emission control system consists of internal engine modifications.



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