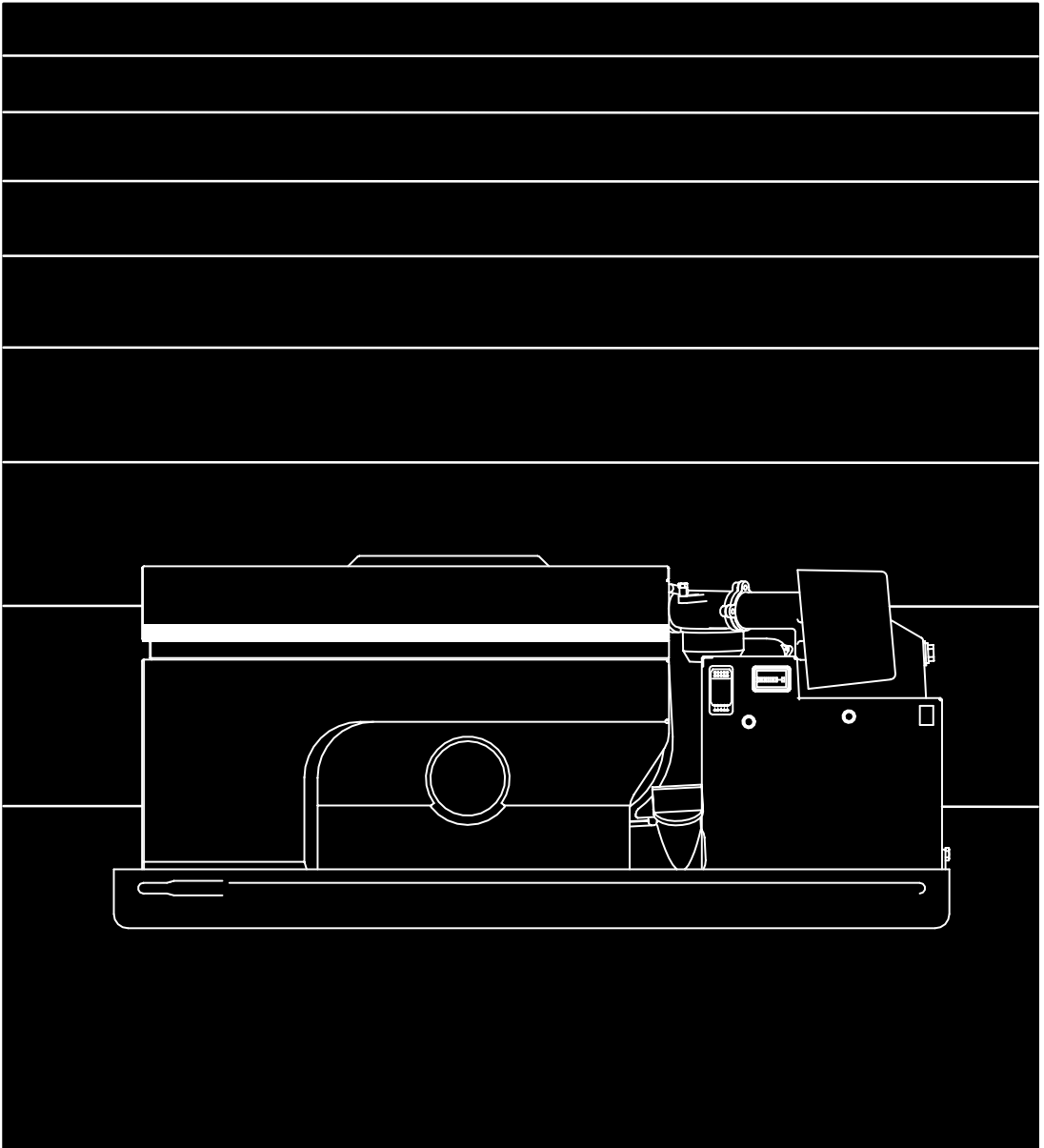
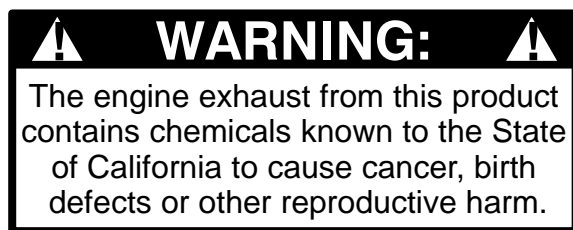




Operator's Manual

TGHAA





This generator set is for stationary applications only. Non-stationary applications may be in violation of Federal regulations

Table of Contents

| | |
|--|----|
| SAFETY PRECAUTIONS | 2 |
| INTRODUCTION | 4 |
| About this Manual | 4 |
| Model Identification | 4 |
| OPERATION | 5 |
| Engine Oil Recommendations | 5 |
| Starting Batteries | 5 |
| Fuel Recommendations | 5 |
| Fuel Selection | 6 |
| Genset Configuration and Control | 7 |
| Starting and Stopping the Genset | 9 |
| Powering Equipment | 10 |
| Varying Operating Conditions | 10 |
| Genset Break-In | 11 |
| Genset Exercise | 11 |
| Genset Storage | 11 |
| PERIODIC MAINTENANCE | 12 |
| General Inspection | 13 |
| Checking Engine Oil Level | 13 |
| Changing Engine Oil and Oil Filter | 14 |
| Air Filter | 15 |
| Spark Plugs | 15 |
| Battery Care | 16 |
| TROUBLESHOOTING | 17 |
| SPECIFICATIONS | 24 |
| INFORMATION FOR CALIFORNIA GENSET USERS | 25 |

Safety Precautions

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

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

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

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

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

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

GENERAL PRECAUTIONS

- Keep ABC fire extinguishers handy.
- Make sure all fasteners are secure and torqued properly.
- Keep the genset and its compartment clean. Excess oil and oily rags can catch fire. Dirt and gear stowed in the compartment can restrict cooling air.
- Before working on the genset, disconnect the negative (–) battery cable at the battery to prevent starting.
- Use caution when making adjustments while the genset is running—hot, moving or electrically live parts can cause severe personal injury or death.
- Used engine oil has been identified by some state and federal agencies as causing cancer

or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.

- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.

GENERATOR VOLTAGE IS DEADLY!

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

FUEL IS FLAMMABLE AND EXPLOSIVE

- Keep flames, cigarettes, sparks, pilot lights, electrical arc-producing equipment and switches and all other sources of ignition well away from areas where fuel fumes are present and areas sharing ventilation.
- 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.

ENGINE EXHAUST IS DEADLY!

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

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.

- When disconnecting or reconnecting battery cables, always disconnect the negative (–) battery cable first and reconnect it last to reduce arcing.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

Introduction

ABOUT THIS MANUAL

This manual covers the operation and maintenance of the Series TGHAA generator sets (gensets). Study this manual carefully and observe all of its instructions and precautions.

Operation covers basic operation of the genset under various conditions and includes recommendations regarding fuel and engine oil and procedures for break-in, exercise and storage.

Periodic Maintenance covers the maintenance and care necessary for top performance. The owner is responsible for maintaining the genset according to the Maintenance Schedule (Table 1 on Page 12).

Troubleshooting provides basic troubleshooting guidance for a genset that fails to start or that shuts down.

This manual also tabulates useful 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 and the Installation Manual at the site.

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

Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.

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).

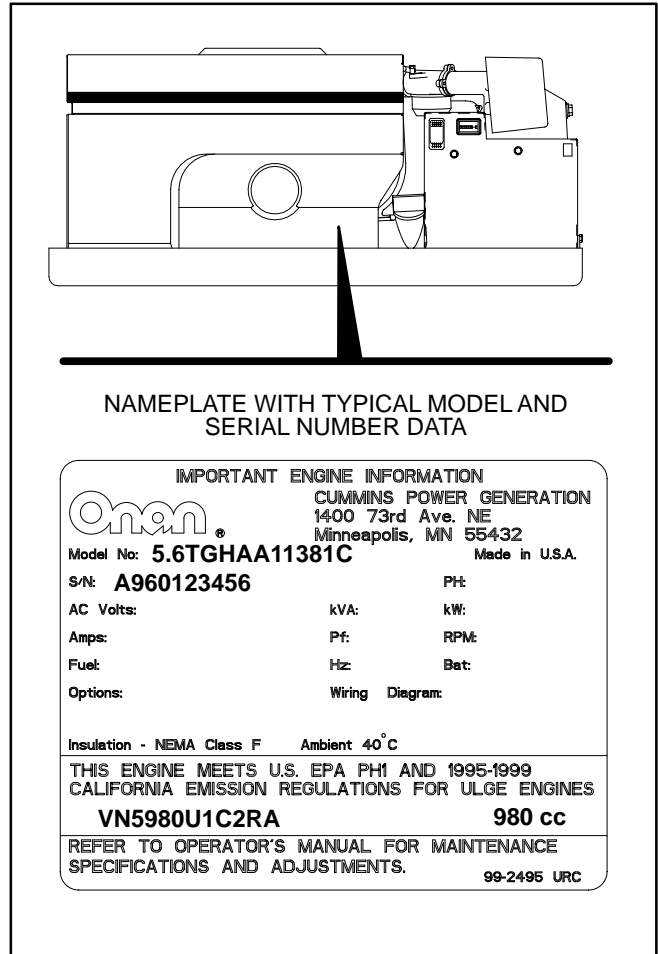


FIGURE 1. TYPICAL NAMEPLATE

Operation

ENGINE OIL RECOMMENDATIONS

Use Mobil 1 Formula 15W-50 synthetic motor oil or equivalent.

STARTING BATTERIES

These gensets have a 12 VDC starting and control system. See *Specifications* for minimum battery requirements for genset cranking.

FUEL RECOMMENDATIONS

⚠WARNING *Gaseous fuels are flammable and explosive and can cause severe personal injury or death. Do not smoke if you smell gas 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 switches and arc-producing equipment and all other sources of ignition well away. Keep a type ABC fire extinguisher handy.*

NFPA Standard No. 58 requires all persons handling and operating LPG to be trained in proper handling and operating procedures.

When natural gas is the fuel being used, use commercially available natural gas fuel having a methane content of at least 90 percent (by volume).

When LPG (liquified petroleum gas) is the fuel being used, use grade HD-5 or equivalent consisting of at least 90 percent propane. Commercial LPG may contain more than 2.5 percent butane, which can result in poor fuel vaporization and poor engine starting in ambient temperatures below 32° F (0° C).

Satisfactory performance requires that the gas (natural gas or LPG) be supplied at a pressure within the range indicated in *Specifications*.

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

FUEL SELECTION

LP Gensets

If the nameplate specifies “LP” as the fuel, the genset is *not* convertible for use with natural gas.

Natural Gas Gensets

If the nameplate specifies “Natural Gas” as the fuel, the genset is convertible for use with LPG (vapor withdrawal) in accordance with the instruction label on the genset (Figure 2). See Figure 3 for a layout of the fueling parts of the genset.

For LPG – Turn the fuel type selector on the carburetor *clockwise* as far as it will go, remove the cap over the hose fitting on the air cleaner adapter and *clamp* the balance hose onto the fitting.

For Natural Gas – Turn the fuel type selector on the carburetor *counterclockwise* as far as it will go, *disconnect* the balance hose from the hose fitting on the air cleaner adapter and *clamp* a hose fitting cap over the hose fitting. Secure the balance hose out of the way of vibrating parts so that it will not get pinched.

CAUTION *Wrong fuel selection can result in hard starting, poor genset performance and fault shutdown.*

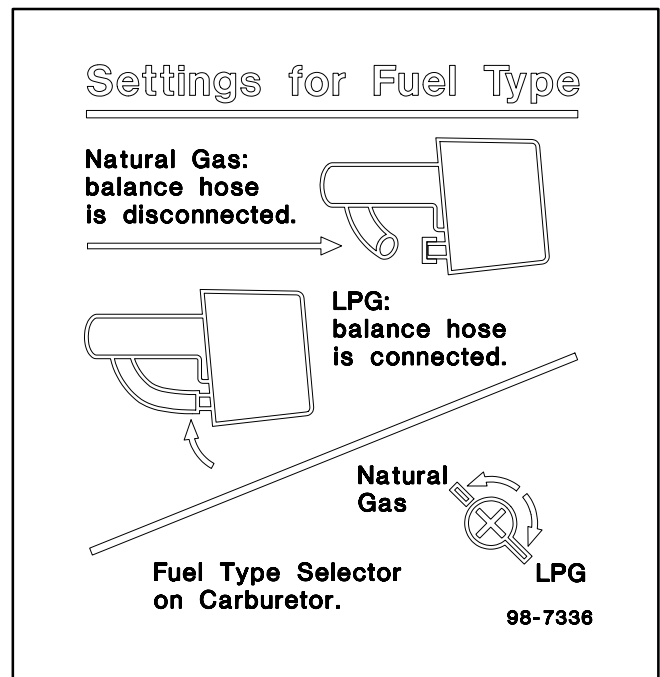


FIGURE 2. FUEL SELECTION INSTRUCTIONS

GENSET CONFIGURATION AND CONTROL

Figure 3 is a layout of a typical genset. The control features are as follows:

Controller – The controller uses two microcontrollers with embedded software. One microcontroller supports the traditional functions of genset control and the other serial communications with external systems.

Control Switch – This is a three-position **Run-Off-Auto** switch with a status/diagnostics light. The **Run** and **Off** positions are for manual starting and stopping of the genset at the site. The **Stop** position is also used for resetting the controller following a fault shutdown. The **Auto** position is for automatic network or transfer switch control.

Status/Diagnostics Light – This is an LED (light emitting diode) in the control switch. It blinks rapidly during cranking. It will blink in a coded fashion to indicate the nature of a genset shut down or of maintenance required to keep the genset running. See *Troubleshooting*.

Blinking stops in five minutes but can be restored by pushing the control switch to **OFF** and then returning it to **AUTO**. **This also resets the controller.**

Code No. 6 will blink if the control switch is left in the **OFF** position more than 5 seconds.

RJ45 Service Jack – This connector provides for direct communications with a PC (laptop). Special software is required for the PC. See your authorized Onan dealer for details.

Network Connector – This 12-pin connector provides for serial communications with a network. A modem is required. See your authorized Onan dealer for details.

Transfer Switch Connector – This 8-pin connector provides for the Start/Stop and Emergency/Utility status signals from and Remote Test signals to the transfer switch.

Cabinet Interface Connector – This 3-pin connector provides for cabinet fault (**Code No. 8**) and low supply gas pressure fault (**Code No. 9**) signals.

Major/Minor Alarm Connector – This 8-pin connector provides for remote alarm signals.

Fuses F1, F2 and F3 – These fuses protect the control circuits of the genset.

Hour Meter – The hour meter records the total running time of the genset. It cannot be reset.

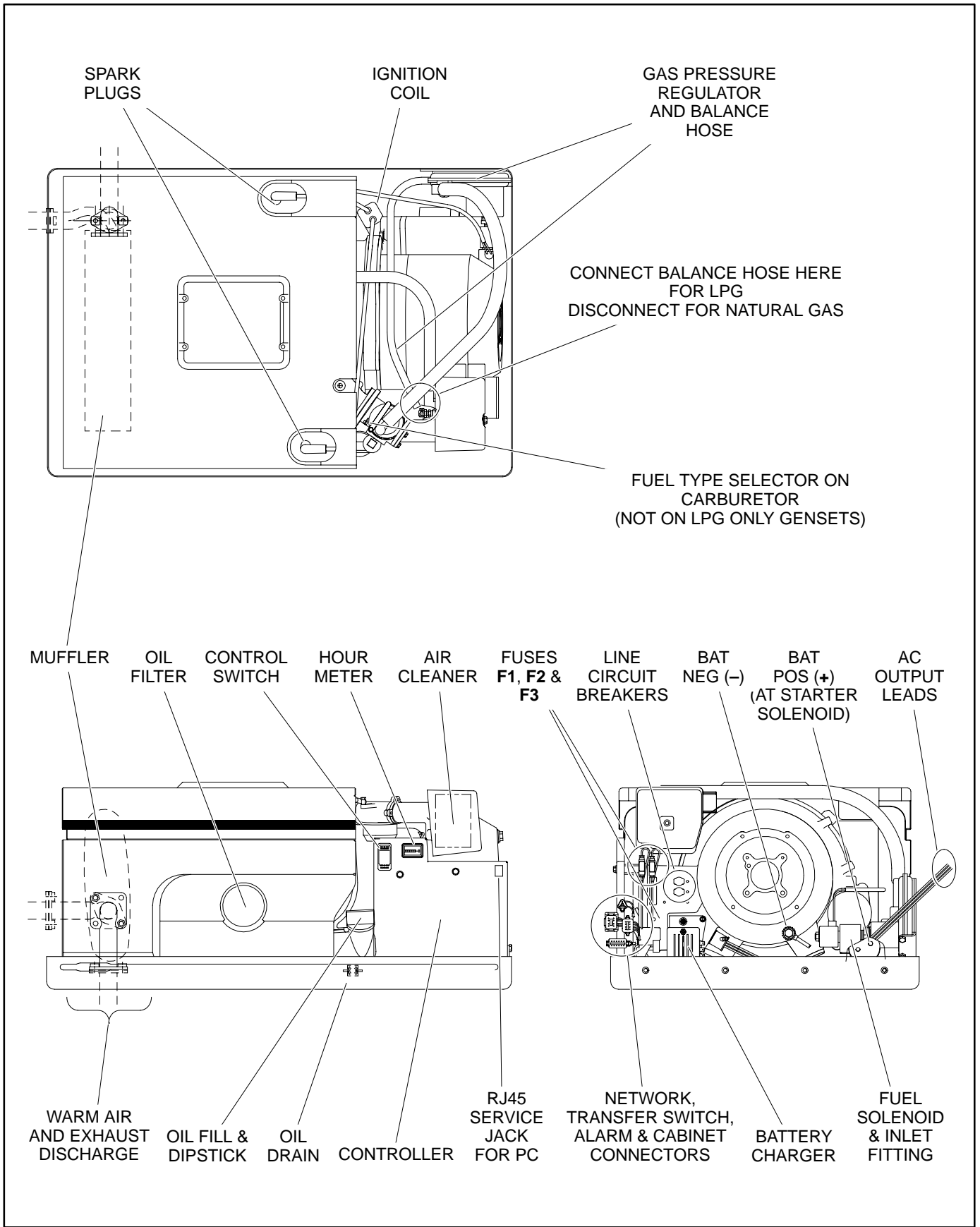


FIGURE 3. TYPICAL AC GENSET

⚠ WARNING EXHAUST GAS IS DEADLY!

All engine exhaust contains carbon monoxide, an odorless, colorless, poisonous gas that can cause unconsciousness and death. Symptoms of carbon monoxide poisoning include

- *Dizziness*
- *Headache*
- *Weakness and Sleepiness*
- *Nausea*
- *Vomiting*
- *Inability to Think Coherently*

IF YOU EXPERIENCE ANY OF THESE SYMPTOMS, GET INTO 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.

The exhaust system must be installed in accordance with the genset Installation Manual. Make sure there is ample fresh air when operating the genset in a confined area.

STARTING AND STOPPING THE GENSET

Pre-start Checks

If at the site, perform the maintenance instructed in GENERAL INSPECTION (Page 13). Service the genset and make repairs as required if a fault shutdown code displays (see *Troubleshooting*). Perform the required maintenance when a maintenance or service code displays: No. 3 (100 hours), No. 4 (low oil level), No. 39 (weak battery) or No. 43 (1000 hours)¹. Also, see GENSET BREAK-IN and GENSET STORAGE in this section before placing in service a new or rebuilt genset or one that has been in storage.

Manual Starting

Push the control switch to **Run**. The engine should crank, start and run up to governed speed in a few seconds. The starter will disconnect automatically as the status light stops blinking.

If the engine does not start (after five 10 second cranks with 30 second rests), the starter will disengage and the status light will display **Code No. 5**. See *Troubleshooting* if the engine does not start.

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.

Whenever possible, allow the engine to warm up for a few minutes before connecting the electrical loads.

1. Code No. 3 and Code No. 43 can be turned off only by means of network commands or commands from a PC with appropriate software. See your authorized Onan dealer.

Manual Stopping

Push the control switch to **Off**. Whenever possible, allow the engine to cool down with the electrical loads disconnected for a few minutes before stopping the genset.

The status light blinks **Code No. 6** when the switch is in the **Off** position to remind you to push the switch to the **Auto** position before leaving the site.

⚠ CAUTION *Failure to push the control switch to **AUTO** before leaving the site will render the genset unavailable for automatic standby service.*

Automatic Starting and Stopping

Push the control switch to **Auto** for remote, automatic starting and stopping (transfer switch or network).

Code No. 7 (Loss of Utility Power Alert) will blink if there is a loss of utility power and the genset is called upon by the automatic transfer switch to make up for the loss of utility power.

⚠ WARNING *Automatic startup of the genset while performing maintenance or service can cause severe personal injury or death. Push the control switch to **Off** and disconnect the negative (-) battery cable from the battery to keep the genset from starting up while working on it.*

POWERING EQUIPMENT

Genset Loading

How much electrical equipment (system load) can be connected at one time depends upon how much power is available from the genset. If the genset is “overloaded”, either its circuit breaker(s) will trip or its controller will shut it down.

To get an idea of how much equipment can be operated at one time add up the watt ratings of the individual system loads 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. If power consumption, as totaled up, exceeds genset power output, you may have to consider operating some system loads in sequence, one after another, rather than all at the same time.

Note that when a genset is loaded nearly to full power and one of the large motor load “cycles on”, an undervoltage or under frequency fault shutdown (Code Nos. 13 and 15) could occur. The reason for this is that for a brief moment at startup a motor draws up to three times its rated power. You may, therefore, have to consider shutting off some loads at times when large motor loads are “On”.

Note that air density is less at higher altitudes, resulting in less available engine power. Power decreases approximately 3.5 percent of rated power each 1000 feet (305 m) of increase in elevation above sea level. Power also decreases approximately 1 percent each 10° F (5.5° C) increase in ambient temperature above 85° F (24° C).

Restarting The Genset

If the genset shuts down, disconnect or turn off as many system loads as possible and try restarting the genset as instructed under *Starting and Stopping*. Reconnect the loads 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 or on the genset (Figure 3) trips, there is either a short circuit or too many loads 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 many loads as possible and reset the circuit breaker. If the circuit breaker trips right away, either the main distribution system has a short or the circuit breaker is faulty.

If the circuit breaker does not trip, reconnect the loads, 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 load is connected, the load probably has a short.

Connecting The System To Utility Power

An approved device must be provided to keep the genset and utility from being interconnected.

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

VARYING OPERATING CONDITIONS

Cold Weather

Perform maintenance due according to *Periodic Maintenance*. Use Mobil 1 Formula 15W-50 synthetic motor oil or equivalent.

Thermostatically controlled heaters for the engine oil sump and battery are recommended for more reliable starting in ambient temperatures down to -30° F (-22° C).

Hot Weather

Perform maintenance due according to *Periodic Maintenance*. Make sure nothing blocks airflow to and from the genset. Keep the cooling fins clean.

High Altitude

See *Powering Equipment* for information on how altitude affects the maximum power output of the genset.

Dusty Conditions

Keep the cooling fins clean. Perform air cleaner maintenance and change engine oil and oil filter more often than usual. See *Periodic Maintenance*.

GENSET 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 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. Use Mobil 1 Formula 15W-50 synthetic motor oil or equivalent. 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.

GENSET EXERCISE

If use is infrequent the genset should be exercised at least 1 hour each week at 1/2 rated power. See *Powering Equipment*. Exercising the genset drives off moisture, re-lubricates the engine and removes oxide from electrical contacts and generator slip rings, thereby promoting better starting, more reliable operation and longer engine life.

See the transfer switch operator's manual for instructions on how to adjust and activate the genset exerciser clock.

GENSET STORAGE

If the genset is to be stored for 120 days or more, proper storage is essential for preserving top genset performance and reliability.

Storing the Genset

1. Push the genset line circuit breakers **OFF** (Figure 3).
2. Remove the air filter and start the genset. While the genset is running, spray an engine fogger (OnaGard™)² 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.)

2. OnaGard is a trademark of the Onan Corporation.

3. Change the engine oil and oil filter, and the air filter if it is dirty.
4. Disconnect the battery cables (negative [-] cable first) from the starting battery and store the battery according to the battery manufacturer's recommendations.
5. Close the fuel supply valve. If the genset is being removed from the premises, cap or plug any unused fuel line to prevent gas leakage if a fuel shutoff valve is opened inadvertently.

⚠ WARNING *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.*

Returning The Genset To Service

1. Reconnect the starting battery (negative [-] cable last). See BATTERY CARE under *Periodic Maintenance*.
2. Open the fuel supply valve.
3. Inspect the genset. See GENERAL INSPECTION under *Periodic Maintenance*.
4. 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.
5. Push the genset line circuit breaker to **ON** (Figure 3) and the control switch to **Auto** for remote, automatic starting and stopping (transfer switch or network).

⚠ CAUTION *Failure to push the control switch to AUTO before leaving the site will render the genset unavailable for automatic standby service.*

Periodic Maintenance

⚠WARNING *Automatic startup of the genset while performing maintenance or service can cause severe personal injury or death. Push the control switch to Off and disconnect the negative (-) battery cable from the battery to keep the genset from starting up while working on it.*

Periodic maintenance is essential for top performance and long genset life. Use Table 1 as a guide for normal periodic maintenance. Under hot or dusty operating conditions some maintenance op-

erations should be performed more frequently, as indicated by the footnotes in the table. Keep a log of maintenance performed and the hours run. Recording maintenance will help you keep it regular and provide a basis for supporting warranty claims.

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

TABLE 1. PERIODIC MAINTENANCE SCHEDULE

| MAINTENANCE OPERATION | MAINTENANCE FREQUENCY | | | |
|---|------------------------------|---|-------------------------------|------|
| | Each Site Visit ¹ | Yearly, or Every 100 Hours ² | Every 1000 Hours ³ | Page |
| General Inspection | X | | | 13 |
| Check Engine Oil Level | X | | | 13 |
| Clean and Check Starting Battery | X | | | 16 |
| Change Engine Oil and Oil Filter | | X ^{4, 5} | | 14 |
| Replace Engine Air Filter | | X ⁴ | | 15 |
| Clean Gas Supply Screen and Sediment Trap | | X | | – |
| Replace Spark Plugs and Cables | | | X ⁶ | 15 |
| Clean Engine Cooling Fins | | | X ^{6, 7} | – |
| Adjust Engine Valve Clearance (Lash) | | | X ^{6, 7} | – |
| Clean Combustion Chambers | | | X ^{6, 7} | – |

1. Maintenance Alert Codes 4 (low oil level) and 39 (weak battery) can be network monitored.
2. Maintenance Alert Code 3 occurs every 100 hours of operation and can be network monitored.
3. Service Alert Code 43 occurs every 1000 hours of operation and can be network monitored.
4. Perform more often when operating in dusty conditions.
5. Perform more often when operating in hot weather.
6. Perform sooner if engine performance deteriorates.
7. Must be performed by a qualified mechanic (authorized Onan dealer).

GENERAL INSPECTION

Inspect the genset during each site visit.

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.

Fuel System

Check the fuel supply line and fittings for leaks while the genset is running. 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.

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

Battery Connections

Check the battery terminals for clean, tight connections. Loose or corroded connections have high electrical resistance which makes starting harder. 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 blocked or clogged with debris.

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 injury.*

CHECKING ENGINE OIL LEVEL

Shut off the genset before checking the engine oil level.

1. Remove the oil fill cap/dipstick (Figure 4), wipe it clean, screw the cap back on and then remove it again to check the oil level on the dipstick.

⚠ 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. Add oil as necessary until the full mark is reached. Use Mobil 1 Formula 15W-50 synthetic motor oil or equivalent. 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.*

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

CHANGING ENGINE OIL AND OIL FILTER

Refer to Table 1 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 and shut it off.
2. Remove the oil fill cap (Figure 4), open the oil drain valve and allow all of the oil to drain from the engine.
3. Close the oil drain valve.
4. Spin off the oil filter canister and discard it according to local regulations.
5. Thoroughly wipe off the filter mounting surface.
6. Make sure the gasket is in place on the new filter canister and apply a thin film of oil to the gasket.
7. 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.
8. Refill with Mobil 1 Formula 15W-50 synthetic motor oil or equivalent. See *Specifications* for oil capacity. Check oil level.
9. Screw the oil fill cap on securely to prevent oil leakage.
10. 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.

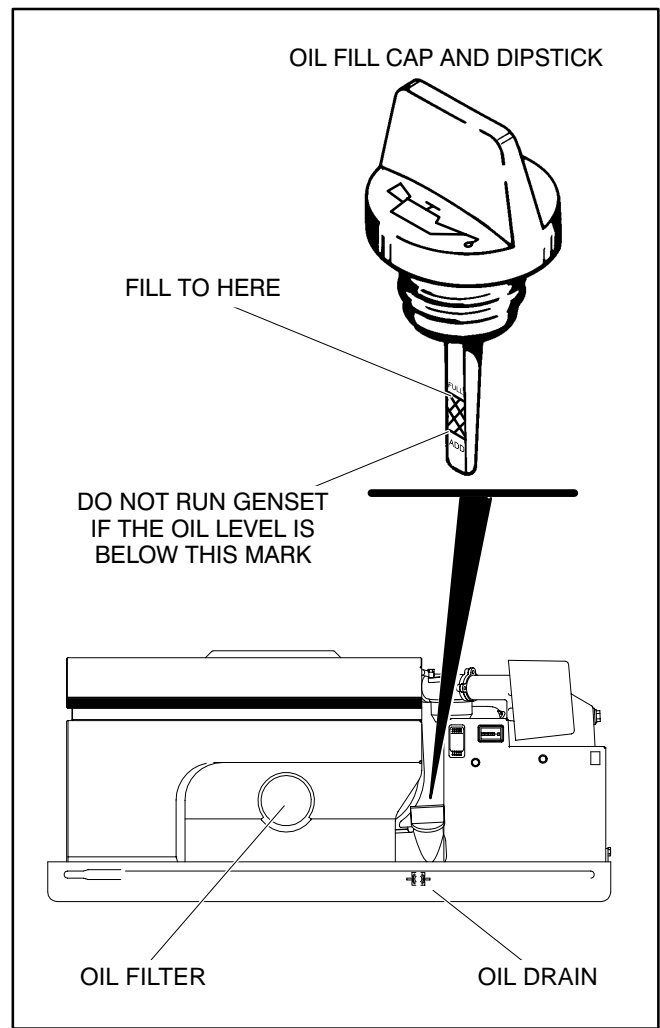


FIGURE 4. OIL LEVEL CHECK

AIR FILTER

Refer to Table 1 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 5). Reassemble the air filter with a new air filter element and wrapper. *Do not oil the filter or wrapper.* Do not over-tighten the through bolt as that can distort the filter element or cover and lead to air leaks around the air filter element.

SPARK PLUGS

Refer to Table 1 for scheduled spark plug replacement. (The genset has two spark plugs, Figure 6.) 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 cross-threading a spark plug, always thread it in by hand until it seats and then torque to 8 lb-ft (10 N-m).

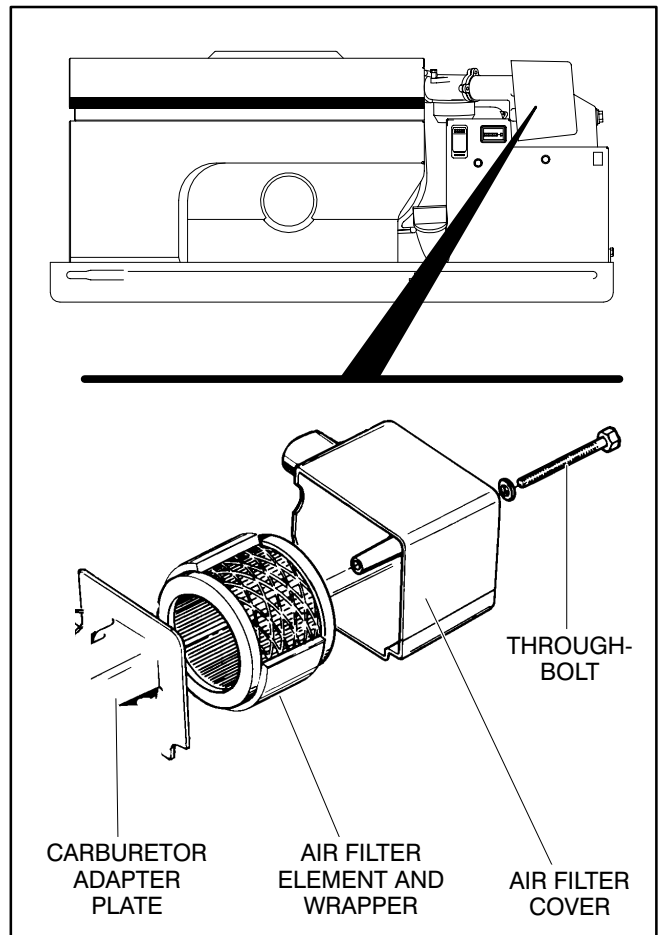


FIGURE 5. AIR FILTER ELEMENT AND WRAPPER

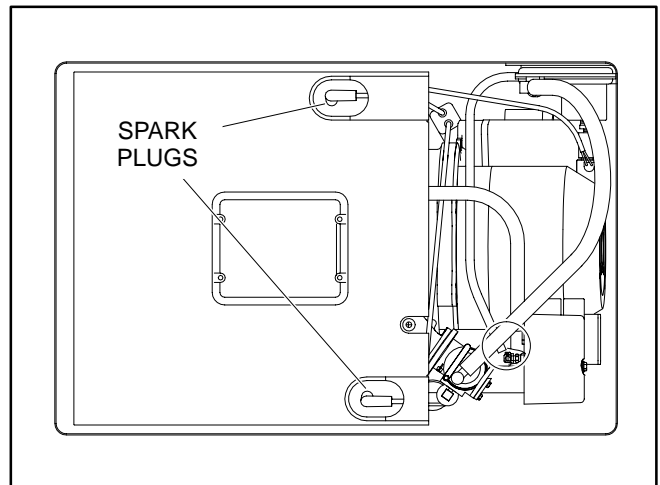


FIGURE 6. SPARK PLUGS

BATTERY CARE

Refer to Table 1 for scheduled battery maintenance and to the battery manufacturer's recommendations and instructions for battery care.

⚠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.

Troubleshooting

Proper maintenance and use of the genset—maintaining oil level, keeping battery connections clean and tight, not overloading the genset—will prevent most shutdowns.

Table 2 provides troubleshooting guidance for a genset that fails to start or that shut downs. The genset controller has an extensive diagnostic capability and its fault codes are covered in numerical sequence in Table 2. *The code numbers that have been skipped over are not active for this series of gensets.*

Service will be required by qualified service personnel in accordance with the Service Manual if you cannot resolve the problem after taking the corrective actions suggested in Table 2.

STATUS / DIAGNOSTICS LIGHT ON THE GENSET CONTROL SWITCH

The genset controller causes the status/diagnostics light (local) and remote alarm (if provided) to repeatedly blink a fault code if there is a fault shutdown or maintenance or service alert. There are distinct pauses between repetitions of the code blink transmissions.

Single-Digit Fault Code – A single-digit fault code is indicated by a corresponding number of blinks. For example:

Code No. 5 – blink–blink–blink–blink–blink

Two-Digit Fault Code – A two-digit fault code is indicated by two sets of blinks separated by a short pause. The first set corresponds to the tens digit and second to the ones digit. For example:

Code No. 23 – blink–blink–*pause*–blink–blink–blink

Last Fault Indication/Controller Reset – Blinking stops in five minutes but can be restored to indicate the last fault by pushing the control switch to OFF and then returning it to AUTO. *This also resets the controller.*

Last Five Faults – The last five faults can be indicated by pushing the control switch between OFF and AUTO rapidly three times:

OFF–AUTO–OFF–AUTO–OFF–AUTO

The light will display the fault codes in succession, starting with the most recent. There will be a two-second pause between fault codes except that there will be a four-second pause before the fifth most recent fault code.

Code No. 6 (Control Switch Off Alert) will blink if the control switch is left in the **OFF** position more than 5 seconds.

Code No. 7 (Loss of Utility Power Alert) will blink if there is a loss of utility power and the genset is called upon by the automatic transfer switch to make up for the loss of utility power.

CONTROL AND DIAGNOSTICS VIA NETWORK OR PC (LAPTOP)

See your authorized Onan dealer regarding software, hardware and network requirements for control and diagnostics via network or PC.

⚠WARNING *Automatic startup of the genset while performing maintenance or service can cause severe personal injury or death. Push the control switch to Off and disconnect the negative (–) battery cable from the battery to keep the genset from starting up while working on it.*

TABLE 2. TROUBLESHOOTING

⚠ WARNING *Some genset service procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

NO RESPONSE WHEN THE CONTROL SWITCH IS IN THE RUN POSITION

(The controller is not being power—12VDC)

Corrective Action:

1. Replace **Fuse F1** (B+) if blown.
2. Clean and tighten the positive (+) and negative (–) battery cable connections at the battery and at the genset (Page 8).
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

NO POWER WHEN THE GENSET IS RUNNING

(A line circuit breaker or transfer switch is OFF, tripped or malfunctioning)

Corrective Action:

1. Reset or turn ON the line circuit breaker on the genset.
2. Reset or turn ON any other circuit breaker in the power supply system.
3. Check for proper transfer switch function.

HIGH ENGINE TEMPERATURE FAULT SHUTDOWN—CODE NO. 1

(The controller sensed that the engine temperature design limit has been exceeded)

Corrective Action:

1. Check for and remove any objects blocking the air inlet or outlet openings.
2. Reduce the electrical load. (Note that high altitude and high ambient temperature decrease engine cooling capacity.)
3. Clean the engine cooling fins and blower blades. See *Periodic Maintenance*.
4. Review the installation and housing design against the specifications and requirements of the Installation Manual.

LOW OIL PRESSURE FAULT SHUTDOWN—CODE NO. 2

(The controller sensed that the low oil pressure cutoff switch did not open within 10 seconds of starting)

Corrective Action:

1. Check engine oil level and add oil as necessary. Repair oil leaks.
2. Drain excess oil. (Excess oil leads to foaming and a consequent loss of oil pressure.)

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING *Some genset service procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

100 HOUR MAINTENANCE ALERT—CODE NO. 3

(The genset has accumulated another 100 hours of operation since the last maintenance alert)

Corrective Action: Perform the required maintenance according to *Periodic Maintenance*. The alert can only be reset by means of a software command via network or PC. See your authorized Onan dealer.

LOW OIL LEVEL ALERT—CODE NO. 4

(The controller sensed that the low oil level switch was open 1 minute after the genset stopped)

Corrective Action: Check the engine oil level and add oil as necessary. Repair oil leaks.

FAILURE TO START FAULT SHUTDOWN—CODE NO. 5

(The engine does not crank, or cranks [five 10 second cranks with 30 second rests] but does not start)

Corrective Action—Engine Does Not Crank:

1. Replace Fuse **F2** if blown.
2. Clean and tighten the positive (+) and negative (–) battery cable connections at the battery and at the genset (Page 8).
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

Corrective Action—Engine Cranks But Does Not Start:

1. Open any closed fuel shutoff valve.
2. Fill the LPG fuel tank if less than half full. *On cold days the LPG container may have to be kept at least half full to provide the rate of vaporization required to keep up with genset fuel demand. LPG with more than 2.5 percent butane will not vaporize below 32° F (0° C). Use HD-5 grade LPG.*
3. Secure the spark plug cables at the spark plugs and at the ignition coil.
4. Make sure the governor rod is not hanging up on the spark plug cable (Page 8).
5. Check for proper fuel selection and change if necessary (Page 6).
6. Check the engine air filter and remove any blockage.
7. Check for a blocked exhaust system and service as necessary.
8. Replace the spark plugs and/or spark plug cables.

CONTROL SWITCH OFF ALERT—CODE NO. 6

(The control switch has been in the OFF position more than 5 seconds, preventing remote control)

Corrective Action: Push the control switch to **AUTO** before leaving the site if the genset is to be placed in service.

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING *Some genset service procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

LOSS OF UTILITY POWER ALERT—CODE NO. 7

(The controller sensed a loss of utility power)

Corrective Action: Verify that the genset is supplying the load.

CABINET FAULT ALERT—CODE NO. 8

(A user-installed cabinet fault sensor switch closed indicating flooding, shear, etc.)

Corrective Action: Service the fault as necessary.

LOW GAS SUPPLY PRESSURE ALERT—CODE NO. 9

(The user-installed pressure switch closed indicating low gas supply pressure)

Corrective Action:

1. Open all shutoff valves in the fuel supply line.
2. Fill the LPG container. *On cold days the LPG container may have to be kept at least half full to provide the rate of vaporization required to keep up with genset fuel demand. LPG with more than 2.5 percent butane will not vaporize below 32° F (0° C). Use HD-5 grade LPG.*

OVERVOLTAGE FAULT SHUTDOWN—CODE NO. 12

(The controller sensed that voltage was greater than 154 VAC for 3 seconds)

Corrective Action: See the Service Manual.

UNDERVOLTAGE FAULT SHUTDOWN—CODE NO. 13

(The controller sensed that voltage was less than 90 VAC for 8 seconds)

Corrective Action: Turn the genset line circuit breaker **OFF**. *If the genset runs without shutting down, run the genset with fewer connected loads.*

OVERFREQUENCY FAULT SHUTDOWN—CODE NO. 14

(The controller sensed that frequency was greater than 80 Hz [2400 rpm] for 0.16 second)

Corrective Action: Make sure the governor rod is not hanging up on the spark plug cable (Page 8).

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING *Some genset service procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

UNDERFREQUENCY FAULT SHUTDOWN—CODE NO. 15

(The controller sensed that frequency was less than 53 Hz [1600 rpm] for 8 seconds)

Corrective Action:

1. Turn the genset line circuit breaker **OFF**. *If the genset runs without shutting down, run the genset with fewer connected loads.*
2. Make sure the governor rod is not hanging up on the spark plug cable (Page 8).
3. Replace Fuse **F3** (carburetor de-icer) if blown.
4. Fill the LPG fuel tank if less than half full. *On cold days the LPG container may have to be kept at least half full to provide the rate of vaporization required to keep up with genset fuel demand. LPG with more than 2.5 percent butane will not vaporize below 32° F (0° C). Use HD-5 grade LPG.*
5. Secure the spark plug cables at the spark plugs and at the ignition coil.
6. Check for proper fuel selection and change if necessary (Page 6).
7. Check the engine air filter and remove any blockage.
8. Check for a blocked exhaust system and service as necessary.
9. Replace the spark plugs and/or spark plug cables.

ENGINE ACCESSORY FAULT SHUTDOWN—CODE NO. 17

(The controller sensed an accessory overload)

Corrective Action: See the Service Manual.

GOVERNOR ACTUATOR FAULT SHUTDOWN—CODE NO. 19

(The controller sensed an overload in the governor actuator circuit)

Corrective Action: See the Service Manual.

LOW OIL PRESSURE CUTOFF SWITCH FAULT ALERT—CODE NO. 23

(The controller sensed that the switch did not close within 1 minute after the genset stopped)

Corrective Action: See the Service Manual.

TEMPERATURE SENDER FAULT ALERT—CODE NO. 24

(The controller did not sense a temperature change during the first 5 minutes of operation)

Corrective Action: See the Service Manual. (Note that under this condition the controller will limit genset output to 3.5 kW.)

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING *Some genset service procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

HIGH ENGINE TEMPERATURE ALERT—CODE NO. 34

(The controller senses that engine temperature is close to the design limit)

Corrective Action:

1. Check for and remove any objects blocking the air inlet or outlet openings.
2. Reduce the electrical load. (Note that high altitude and high ambient temperature decrease engine cooling capacity.)
3. Clean the engine cooling fins and blower blades. See *Periodic Maintenance*.

CONTROL CARD FAULT SHUTDOWN—CODE NO. 35

(There was a memory error in the controller microcontroller during self-test)

Corrective Action: See the Service Manual.

INVALID SET CONFIGURATION ALERT—CODE NO. 37

(Set configuration must be programmed for each replacement controller assembly)

Corrective Action: See your authorized Onan dealer. Special software and a PC are required to re-configure the controller.

WEAK BATTERY ALERT—CODE NO. 39

(The controller sensed that battery voltage was less than 12 volts while the genset was running)

Corrective Action:

1. Clean and tighten the positive (+) and negative (–) battery cable connections at the battery and at the genset.
2. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.
3. Check for and remove any parasitic loads on the battery.

GENERATOR FIELD FAULT SHUTDOWN—CODE NO. 41

(The controller sensed a short in the field circuit while the genset was running)

Corrective Action: See the Service Manual.

1000 HOUR SERVICE ALERT—CODE NO. 43

(The genset has accumulated another 1000 hours of operation since the last service alert)

Corrective Action: Perform the required maintenance according to *Periodic Maintenance*. The alert can only be reset by means of a software command via network or PC. See your authorized Onan dealer.

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING *Some genset service procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform genset service. See Safety Precautions.*

SPEED SENSE FAULT SHUTDOWN—CODE NO. 45

(The controller failed to sense quadrature circuit frequency and voltage)

Corrective Action: See the Service Manual.

LOSS OF BATTERY (B+) ALERT—CODE NO. 46

(The control must be reset after the battery is reconnected—which prevents false genset startup)

Corrective Action: Push the control switch to **OFF** and then to **AUTO** or **RUN**. Clean and tighten the positive (+) and negative (–) battery cable connections at the battery and at the genset to prevent intermittent connections.

REFERENCE VOLTAGE FAULT SHUTDOWN—CODE NO. 47

(The controller sensed an open or short in the reference voltage circuit)

Corrective Action: See the Service Manual.

REMOTE SHUTDOWN—CODE NO. 48

(The remote controller shut down the genset)

Corrective Action: Reset the controller by pushing the control switch to **OFF** and then back to **AUTO**.

Specifications

| | | | |
|--|--|---------------------|---------------------|
| GENERATOR: 4-Pole Revolving Field, Self-Excited, 1-Phase, Microcontroller Regulated | | | |
| Frequency / Speed | 60 Hertz / 1800 RPM | | 50 Hertz / 1500 RPM |
| Fuel | Natural Gas | LPG | LPG |
| Rated Power | 5.6 kW | 6.0 kW | 5.0 kW |
| Voltage | 120/240 or 120 volts | | 230 volts |
| Circuit Breaker Rating | 2-Pole, 25 amps | | |
| FUEL CONSUMPTION: | Natural Gas | LPG | LPG |
| No-load | 55 ft ³ /h (1.6 m ³ /h) | 2.2 lb/h (1.0 Kg/h) | 2.0 lb/h (0.9 Kg/h) |
| Half-load | 73 ft ³ /h (2.1 m ³ /h) | 3.5 lb/h (1.6 Kg/h) | 3.2 lb/h (1.4 Kg/h) |
| Full-load | 120 ft ³ /h (3.4 m ³ /h) | 5.5 lb/h (2.5 Kg/h) | 5.0 lb/h (2.3 Kg/h) |
| ENGINE: Opposed 2-Cylinder, 4-Cycle Spark-Ignited, Side-Valve, Air Cooled, Microcontroller Governed | | | |
| Bore | 3.653 inch (90 mm) | | |
| Stroke | 3.000 inch (76 mm) | | |
| Displacement | 60 inch ³ (980 cc) | | |
| Compression Ratio | 7.0 : 1 | | |
| Min Crankcase Vacuum | 10 inch (254 mm) WC (water column) | | |
| Min Cylinder Compression Test Pressure | 75 psi (517 kPa) | | |
| Oil Capacity (with filter)* | 3.5 quart (3.3 liter) | | |
| Intake Valve Clearance (Cold) | 0.005 inch (0.13 mm) | | |
| Exhaust Valve Clearance (Cold) | 0.013 inch (0.33 mm) | | |
| Spark Plug Gap | 0.025 inch (0.64 mm) | | |
| Spark Plug Tightening Torque | 8 lb-for (10 N-m) | | |
| Ignition Timing (electronic ignition) | 15° BTDC (non-adjustable) | | |
| Natural Gas Supply Pressure | 6-13 inch (152-330 mm) WC (water column) | | |
| LPG Supply Pressure (vapor) | 9-13 inch (229-330 mm) WC (water column) | | |
| Gas Supply Connection | 3/8 inch NPT | | |
| CONTROL AND CRANKING SYSTEM: | | | |
| Nominal Battery Voltage | 12 volts | | |
| Battery Cranking Capacity | 450 amps down to 0° F (-17° C) 650 amps down to -20° F (-29° C) | | |
| Battery Charging Output | 10 amps | | |
| Fuse F1 (control B+ input) | 7.5 amps | | |
| Fuse F2 (starter solenoid) | 7.5 amps | | |
| Fuse F3 (carburetor de-icer) | 25 amps | | |
| * 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 3 as an aid in locating information related to the California Air Resources Board requirements for emissions control.

TABLE 3. 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 genset is shipped from the factory. |
| Engine Valve Clearance | See <i>Specifications</i> . |
| Engine Ignition Timing | See <i>Specifications</i> . |
| Engine Fuel Requirements | Natural Gas Models: The engine is certified to operate on natural gas. See FUEL RECOMMENDATIONS in <i>Operation</i> . LPG Models: The engine is certified to operate on LPG. See FUEL RECOMMENDATIONS in <i>Operation</i> . |
| Engine Lubricating Oil Requirements | See ENGINE OIL RECOMMENDATIONS in <i>Operation</i> . |
| Engine Fuel Mixture Settings | These genset engines have precision-manufactured carburetors and gas demand regulators which are not adjustable. |
| Engine Adjustments | See FUEL SELECTION in <i>Operation</i> for steps necessary to convert from LPG to Natural Gas and vice versa. |
| Engine Emission Control System | The engine emission control system consists of internal engine modifications (EM). |

Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
1-800-888-6626
763-528-7229 International Use
Fax: 763-574-8087

Cummins is a registered trademark of Cummins Inc.

