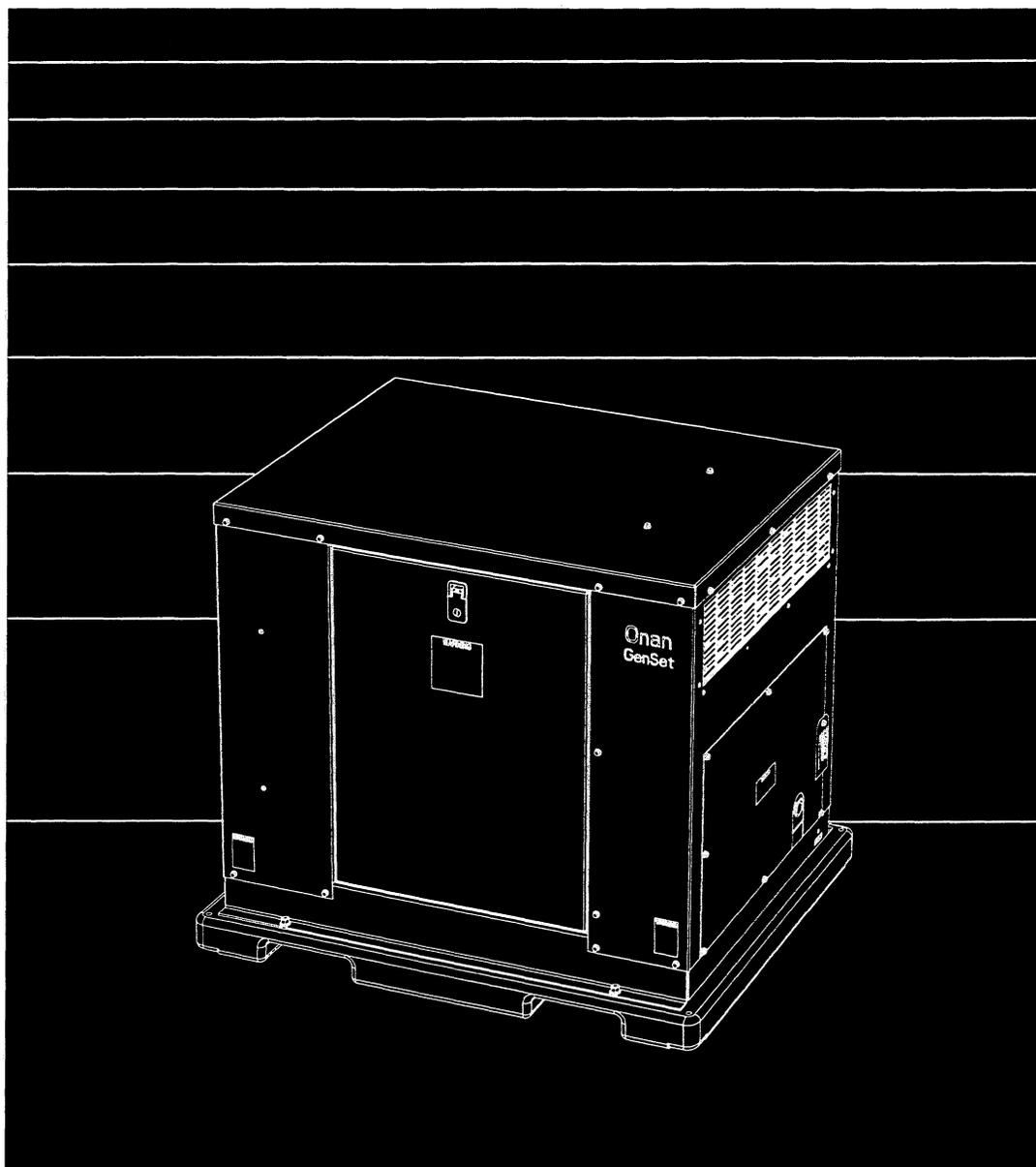


Onan Operator's Manual

GRCA



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184-0168
May, 2004



WARNING:



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

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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS - This manual contains important instructions that should be followed during installation and maintenance of the generator and battery.

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 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 PRECAUTIONS

Battery Gas Is Explosive!

- When replacing batteries use the same number and the following type batteries: **Group 26**
- **▲ CAUTION** Do not dispose of battery or batteries in a fire. The battery is capable of exploding.
- **▲ CAUTION** Do not open or mutilate the battery or batteries. Released electrolyte has been known to be harmful to the skin and eyes and to be toxic.
- **▲ CAUTION** A battery presents a risk of electrical shock and high short circuit current. The following precautions are to be observed when working on batteries.
 - (1) Remove watches, rings, or other metal objects.
 - (2) Use tools with insulated handles.
- **▲ CAUTION** The electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive. The following procedures are to be observed:
 - (1) Wear full eye protection and protective clothing,
 - (2) Where electrolyte contacts the skin,

wash it off immediately with water and seek medical attention, and

- (3) Where electrolyte contacts the eyes, flush thoroughly and immediately with water and seek medical attention, and
 - (4) Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda to one gallon (4 liters) of water. The bicarbonate of soda solution is to be added until the evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water and the area dried.
- **▲ CAUTION** Lead acid batteries present a risk of fire because they generate hydrogen gas. The following procedures are to be followed:
 - (1) DO NOT SMOKE when near batteries.
 - (2) DO NOT cause flame or spark in battery area, and
 - (3) Discharge static electricity from body before touching batteries by first touching a grounded metal surface.
 - When disconnecting the battery cables, always check for a battery charger and disconnect it first then disconnect the negative (-) battery cable.
 - When reconnecting battery cables, always reconnect the negative (-) battery cable after the positive (+) cable, then reconnect the battery charger to reduce arcing.
- ### MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH
- Do not wear loose clothing or jewelry near moving parts such as fans.
 - Keep hands away from moving parts.
 - Keep guards in place over fans.

Safety Informational Data

1. Where can I find field wiring data on this unit? It is covered by Section 7 of the Installation Manual.
2. Where can I find explanations of all symbols used in this manual? Refer to Page iii.
3. Where can I find the circuit breaker used with this unit? A 2-Pole 50 Amp circuit breaker is an integral part of the Genset located in the main control panel.
4. At what temperature range can the unit run at? The Genset is designed to run from 0° to 110° F.
5. What are the electrical ratings for this unit? Refer to Installation Section 6-1.
6. What is the electrical Phase Configuration of the unit? Single Phase - 3 Wire 120/240v, refer to Installation Section 6-1.
7. What is the fuel connection type, pressure and flow of the unit? See Installation Sections 6-1, and 3-2 to 3-5.
8. Where can I find exhaust connection and muffler part numbers for the unit? Refer to Installation Section 3-2.
9. Where are the ground connection instructions? See Installation Section 4-3.
10. Where can I find instructions on the fuses the unit uses? See Installation Section 4-1.
11. What voltage is the battery rated at? See Installation Section 4-6 and 6-1.
12. What is the minimum cold cranking amperage rating of the batteries? See Installation Section 6-1.
13. How do I remove and replace the battery? See Installation Section 4-8 and Operator's Section 3-7.

1. Introduction

ABOUT THIS MANUAL

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

This manual covers the convertible fuel GRCA genset:

- (Natural Gas or LP Vapor)

Operation (Section 2) 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 (Section 3) covers the maintenance and care necessary for peak performance. The owner is responsible for maintaining the genset according to the Maintenance Schedule (See Table 3–1).

Troubleshooting (Section 4) provides basic troubleshooting guidance for a genset that fails to start or that shuts down.

This manual also contains useful genset specifications and important information for California genset users.

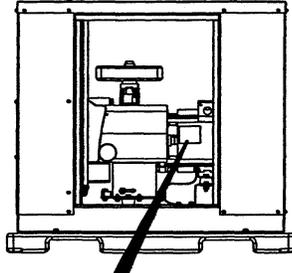
Each operator of the genset should become thoroughly familiar with the information in this manual. Keep this and the Installation Manual at the site.

⚠ 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 a Cummins/Onan dealer or distributor for parts, service, or product information, be ready to provide the model and serial numbers on the genset nameplate (See Figure 1-1). (The serial number is in the row marked S/N, just below the model number. The last character of the model number is the specification letter, which is important for obtaining the right parts.) Space is provided in Figure 1-1 for you to record the model and serial numbers of your genset so that you have them at hand when you need them.



The diagram shows a genset housed in a metal cabinet with its doors open. A line points from the nameplate area to the actual genset unit inside.

IMPORTANT ENGINE INFORMATION
Onan. CUMMINS POWER GENERATION
1400 73rd Ave. NE
Minneapolis, MN 55432
Made in U.S.A.

Model No:
S/N: 0000 000000 PH:1

AC Volts: 120/ 240 KVA:11.0 Kw:11.0
Amps: 45.8 Pf:1.0 RPM:3600
Fuel: Hz:60 Bat: 12V

Options: B241 B274 C053 Wire Diagram: 0611-1255
F172 L888 R104

Insulation: NEMA Class H Ambient 40 C

THIS ENGINE MEETS U. S. EPA PH1 AND 1995-1999
CALIFORNIA EMISSION REGULATIONS FOR ULGE ENGINES
XN5XS. 9002EL 900 CC

REFER TO OPERATOR'S MANUAL FOR MAINTENANCE
SPECIFICATIONS AND ADJUSTMENTS 30-0000 URC

record numbers here

model number:

serial number:

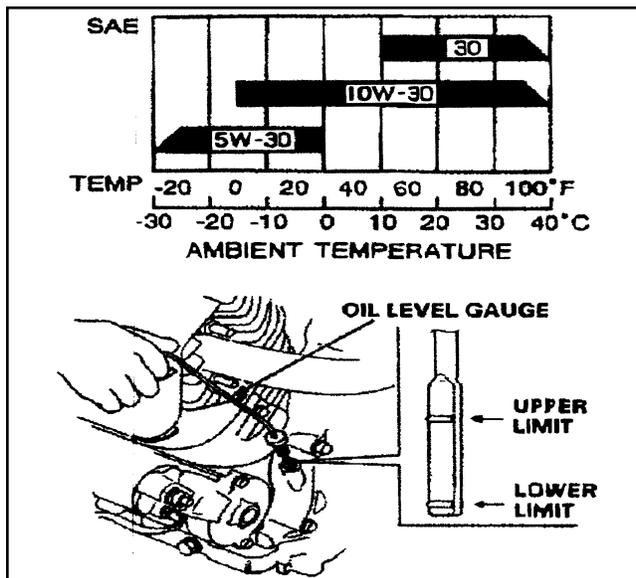
FIGURE 1-1. TYPICAL NAMEPLATE

2. Operation

Engine Oil Recommendations

Oil is a major factor affecting performance and service life. Use 4-stroke automotive detergent oil that is designed for engines operating on LPG or NATURAL GAS.

(The table below are examples of oils that meet Honda's requirements for LPG/NATURAL GAS-fueled engines.) SAE 30 (API service classification SJ) is recommended for general use. For operation in temperatures below 32°F (0°C), 5W-30 sythetic oil may be used for easier starting. Do not use 5W-30 sythetic oil when the air temperature is above 32°F (0°C). Units are shipped with 10W-30 Oil.



STARTING BATTERY

This genset has a 12 VDC starting battery and control system. See *Specifications* in Section 6 of installation manual for minimum battery requirements for genset cranking.

FUEL RECOMMENDATIONS

⚠ WARNING *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, arc-producing equipment, switches, 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 LP to be trained in proper handling and operating procedures.*

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

When LP (liquified petroleum) is the required fuel, use grade HD-5 or equivalent consisting of at least 90 percent propane. Commercial LP 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 fuel 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 in Section 5 by qualified personnel.*

FUEL SELECTION

The natural gas/LP vapor genset leaves the factory set up for natural gas. If the genset is to be run on LP vapor it must be converted for use with LP vapor. See the Installation Manual for the conversion procedure.

This genset is designed to use natural gas or LP vapor & can not be converted to use LP liquid.

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

GENSET CONTROL

Figure 2-1 shows the GRCA genset control panel. The control features are as follows:

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. The **Off** position is also used for resetting the controller following a fault shutdown. The **Auto** position is for remote start or transfer switch control.

Status/Diagnostics Light – This is an LED (light emitting diode) in the control switch. It blinks rapidly during cranking. It blinks in a coded fashion to indicate the nature of a genset shut down or of maintenance required to keep the genset running. See *Troubleshooting* in Section 4.

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

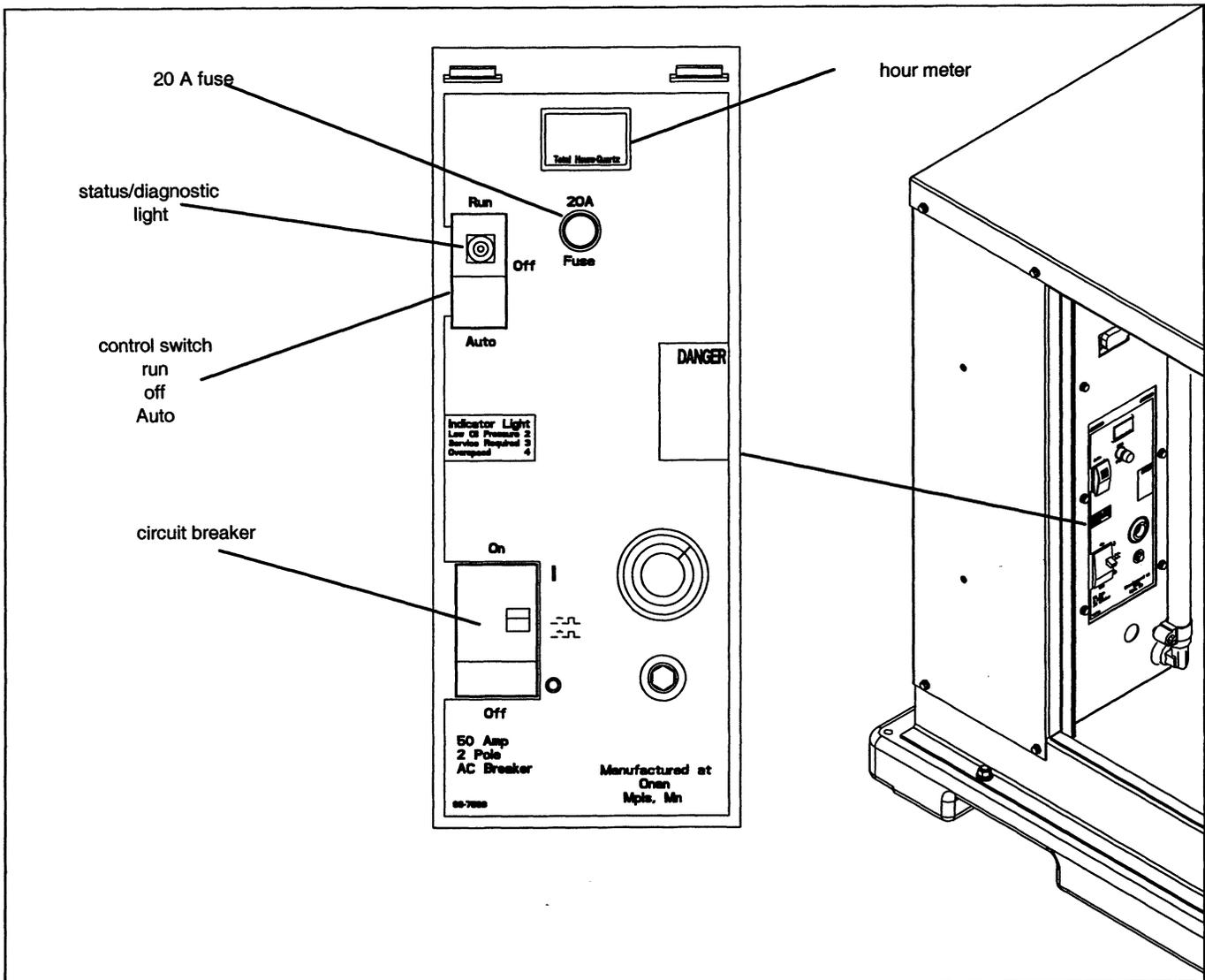


FIGURE 2-1. GENSET CONTROL

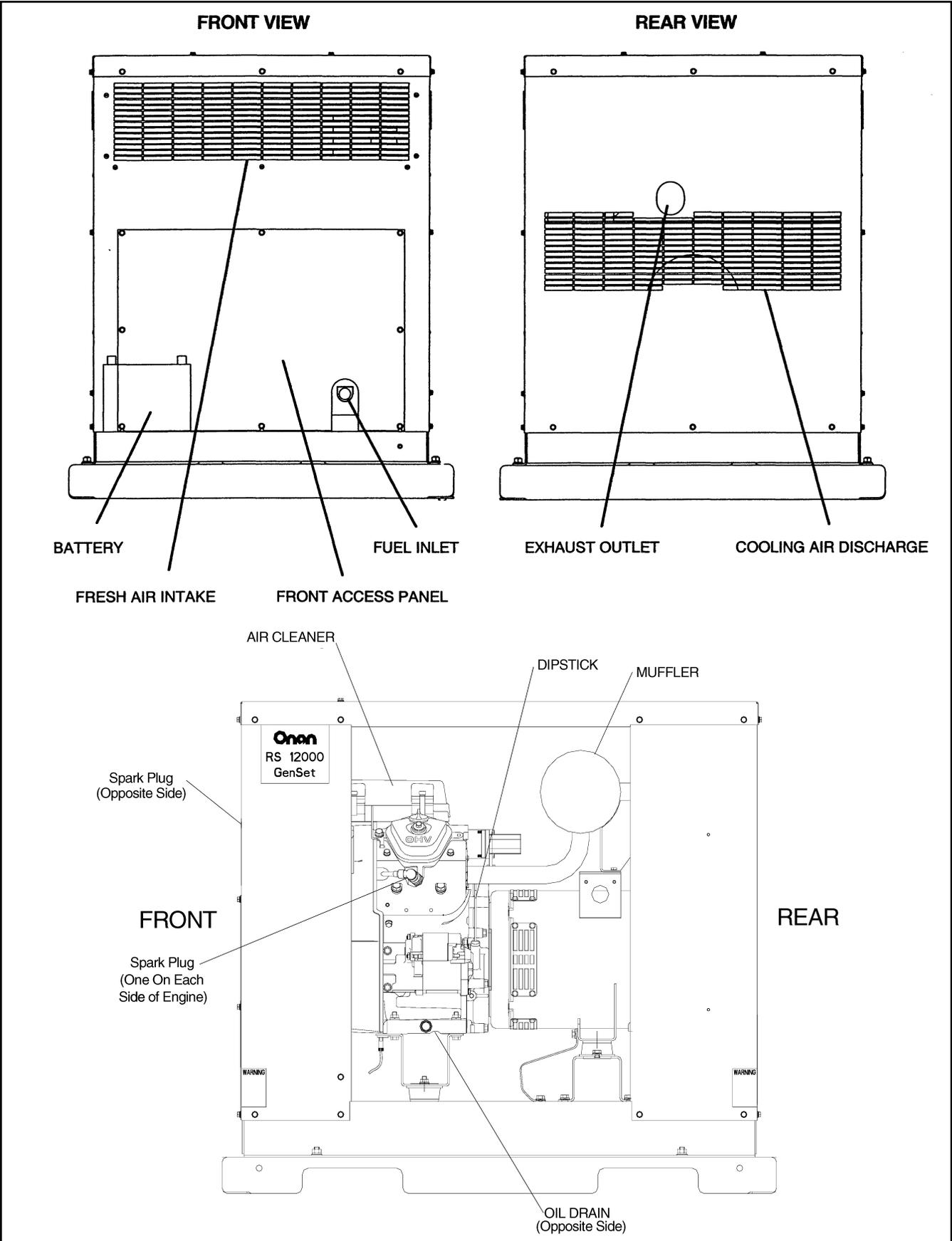


FIGURE 2-2. GRCA GENSET

⚠ 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 is an integral part of the genset. Do not modify the exhaust system. Make sure there is ample fresh air when operating the genset in a confined area.

STARTING AND STOPPING THE GENSET

Pre-start Checks

Perform the maintenance checks instructed in *General Inspection* (See page 3–2). Service the genset and make repairs as required if a fault shutdown code displays (see *Troubleshooting* in Section 4). 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 within 15 seconds. The starter disconnects automatically as the status light stops blinking.

If the engine does not start (after 20 seconds of cranking), the starter disengages. See *Troubleshooting* in Section 4 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.

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.

⚠ CAUTION *Failure to push the control switch to **AUTO** before leaving the genset renders 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).

⚠ 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 cranking and starting 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 (See Specifications, Section 5) and the type of load being supplied. If the genset is “overloaded,” its circuit breaker trips or its controller shuts it down or both.

Determine how much equipment can be operated at one time by adding the power consumption ratings of the individual system loads that are likely to be used at the same time. Compare the sum of the loads to the kW (kilowatt) rating of the genset data plate. Note that 1 kW = 1000 watts. See Table 2-2 for power consumption of typical residential appliances.

Note that when a genset is loaded nearly to full power and one of the large motor loads (such as

an air conditioner) “cycles on,” an undervoltage or under frequency fault shutdown (Code Nos. 13 and 15) could occur. The reason is that for a brief moment, at startup, motors can draw up to three or more times their rated power consumption. You may, therefore, have to consider shutting off some loads at times when large motor loads are “On.” When powering large motor loads (such as an air conditioner) it is recommended that the total load should not exceed 80% of the genset kW rating.

Operating at High Altitude or High Temperature

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 meters) of increase in elevation above sea level. Power also decreases approximately 1.5 percent each 10°F (5.5°C) increase in ambient temperature above 77°F (25°C).

TABLE 2-2. TYPICAL APPLIANCE POWER CONSUMPTION

Appliance	Typical Watts	Basic Loads	Loads Chosen
<i>Basic Needs</i>			
Electric Lighting - N=Number of 100 W Bulbs	N 100 W Bulbs	N x 100 =	
Furnace - Gas	750		
Electric Heat (See Heater Nameplate)	2000-5000		
Well Pump - 1/2 HP	1000		
Well Pump - 1 HP	2000		
Refrigerator - 20 Cu. Ft.	800		
Heat Pump	5000		
Electric Water Heater	5000		
Security System	20		
Freezer - 20 Cu. Ft.	550		
Sump Pump 1/3 HP	500		
Garage Door Opener - 1/3 HP	500		
Garage Door Opener - 1/2 HP	720		
<i>Typical Discretionary Loads</i>			
Microwave Oven - 800 Watt	1200		
Microwave Oven - 1000 Watt	1500		
Coffee Maker	900		
Dishwasher	1400		
Toaster	900		
Computer	250		
Electric Range - Two Burners	2900		
Electric Range - Oven	7500		
TV - 13" Color	70		
TV - 32" Color	170		
VCR	60		
Stereo System	140		
Electric Iron	1100		
Electric Clothes Dryer	6000		
Gas Clothes Dryer	720		
Washing Machine	1000		
Electric Hair Dryer	1600		
Air Conditioner - 1 Ton	2000		
Air Conditioner - 2Ton	3000		
Air Conditioner - 3 Ton	4500		
Window A/C - 17,800 BTU	2000		
Ceiling Fan	100		
Vacuum Cleaner	780		
Central Vacuum	1750		
Total Basic Loads:			
Total Chosen Loads:			
Total Power Requirement:			

How To Use the Table

Table 2-2 lists the typical power consumption of some common household appliances. The value in the table is a typical value, check the value on the nameplate of your appliance for the most accurate value. Also, you may want to use appliances that are not listed in the table. In that case, use the value on the nameplate of the appliance for its power consumption. For the most accurate genset loading, substitute the values from the nameplates on the appliances for all calculations.

Select the appliances that satisfy your basic needs and write the power consumption in the

Basic Loads column. Add the power consumption of all Basic Loads and place it in the Total Basic Loads box at the bottom of the table.

Compare the Basic Loads Total with the rated output of the genset. If the genset still has additional capacity (that is the Basic Loads Total is less than 80% of the genset capacity), you can select additional loads from the list. Write the power consumption of these additional loads in the Loads Chosen column. Add the power consumption of all Chosen Loads and place it in the Total Chosen Loads box at the bottom of the table. You can add loads to the Basic Loads until you reach 80% of the genset capacity.

Example

Using the chart on the previous page for a genset rated at 10 kW. Select a total load less than 8kW (8000 watts) in order to operate within the 80% limit.

Well Pump (1/2 HP)	1000
Refrigerator	800
Air Conditioner (2 ton)	2000
10 100 watt Bulbs	1000
Sump Pump (1/3 HP)	500
Microwave Oven (1000 W)	1500
Coffee Maker	900
Total	7700

This example uses 7700 watts. You could still safely use a TV, a small appliance, or even your computer before you exceed the 80% limit.

Remember that some loads are intermittent. For example your refrigerator does not run constantly. However, as it starts it requires considerably more current than when it is running. For the sake of the calculation from the table assume that all loads are constant. If total power consumption exceeds genset power output, the genset may shut down. In this case, you may have to operate some loads in sequence, one after another, rather than all at the same time.

If the load on the genset exceeds the rated capacity of the genset, the genset shuts down. If the genset shuts down under load, remove loads by turning off appliances, press the switch on the control to OFF and back to AUTO to allow automatic remote restarting.

Restarting The Genset

If the genset shuts down because it is overloaded, disconnect or turn off as many loads (appliances) as possible and try to restart the genset as instructed in *Starting and Stopping* in this section. Reconnect the loads one by one up to 80% of the genset rating.

Resetting Circuit Breakers

If a circuit breaker in the main power distribution panel or on the genset (See Figure 2-1) trips, there is either a short circuit or too many loads operating at the same time. Note that the genset continues to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as many loads (appliances) 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 80% of the genset rating. 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 such as a manual or automatic transfer switch must be provided to keep the genset and utility from being interconnected. The automatic transfer switch automatically reconnects the utility when service is restored and also must provide a constant trickle charge to maintain battery voltage.

⚠ 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* in Section 3. See *Engine Oil Recommendations* 2.1.

An optional thermostatically controlled heater for the battery is recommended for more reliable starting in ambient temperatures down to 0°F. The genset may require longer cranking time than warmer conditions; this is normal.

Hot Weather

Perform maintenance according to Table 3-1 of *Periodic Maintenance*. See engine oil section 2.1. Make sure nothing blocks airflow to and from the genset. Keep the cooling fins clean.

High Altitude

See *Powering Equipment* in this section 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* in Section 3.

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. Avoid light load or no load operation during break in. See *Powering Equipment* in this section.

Proper engine oil and oil level are especially critical during break-in because of the higher engine temperatures that can be expected. See *Engine Oil Recommendations* in this section. 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 25 hours of operation.

GENSET EXERCISE

If genset use is infrequent, it is recommended that the genset be exercised at least 1/2 hour, once a month, without load. 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.

An operator can exercise the genset by placing the control switch in the ON position. The genset would start and run at no load for a time determined by the operator. When the exercise period is finished, return the control switch to the AUTO position.

▲CAUTION *Failure to push the control switch to AUTO before leaving the genset renders the genset unavailable for automatic standby service.*

When a transfer switch with an exerciser clock is available, set the clock to exercise the genset once a month for 1/2 hour at no load.

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 longer, proper storage is essential for preserving top genset performance and reliability.

Storing the Genset

1. Push the genset line circuit breaker OFF (Figure 2-1).

2. Remove the air filter and start the genset. While the genset is running, spray an engine fogger (OnaGard™)¹ 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.)
3. Change the engine oil and oil filter. Also, change 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. LP vapor 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. Inspect the genset. See General Inspection.
2. Reconnect the starting battery (negative [-] cable last). See Battery Care in Section 3.
3. Open the fuel supply valve.
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 **Run** (Figure 2-1) and the control switch to **Auto** for remote, automatic starting and stopping (transfer switch).

▲CAUTION *Failure to push the control switch to AUTO before leaving the genset renders the genset unavailable for automatic standby service.*

¹ OnaGard is a trademark of the Onan Corporation.

3. 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 while working on it.*

Periodic maintenance is essential for top performance and long genset life. Use Table 3-1 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. Recording maintenance helps 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 Cummins/Onan dealer or distributor.

SERVICING YOUR ENGINE

MAINTENANCE SCHEDULE

REGULAR SERVICE PERIOD (3)		Each use	First month or 20 Hrs.	Every 3 months or 50 Hrs.	Every 6 months or 100 Hrs.	Every year or 300 Hrs.	Refer to page	
ITEM	Perform at every indicated month or operating hour interval, whichever comes first.							
•	General Inspection		○					
•	Engine oil	○					3-3	
	Check level							
	Change		○	○			3-4	
•	Oil filter					Every 200 hrs.	3-4	
•	Air cleaner	○					3-5	
	Check							
	Clean			○ (1)			3-5	
	Replace					○ (*)		
•	Spark plug				○		3-6	
	Check-adjust							
	Replace					○		
•	Idle speed					○ (2)		
•	Valve clearance					○ (2)		
•	Combustion chamber		After every 300 hrs. (2)					
•	Fuel Lines		Every 2 years (Replace if necessary) (2)					3-2
•	Starting battery		○					

* Emission-related items.

(*) Replace the paper element type only.

(1) Service more frequently when used in dusty areas.

(2) These items should be serviced by your service dealer, unless you have the proper tools and are mechanically proficient. Refer to Honda shop manual for service procedures.

GENERAL INSPECTION

Inspect the genset according to the genset Periodic Maintenance Schedule.

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. Shut down and repair leaks immediately.*

Battery Connections

Check the battery terminals for clean, tight connections. Loose or corroded connections have high electrical resistance which makes starting harder. Shut the genset off and disconnect cor-

roded 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 charger or 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 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.

⚠️ WARNING *Always wear safety glasses when using compressed air to avoid severe eye injury.*

CHECKING ENGINE OIL LEVEL

Set the genset control to the Off position before checking the engine oil level.

1. Remove the oil fill cap/dipstick (See Figure 3-1), 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 upper limit is reached. See *Engine Oil Recommendations*

in Section 2. **Do Not Fill to a Level Above the Upper Limit 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. Secure the oil fill cap by turning clockwise until tight to prevent oil leakage.

Return the genset control to Auto when finished performing maintenance.

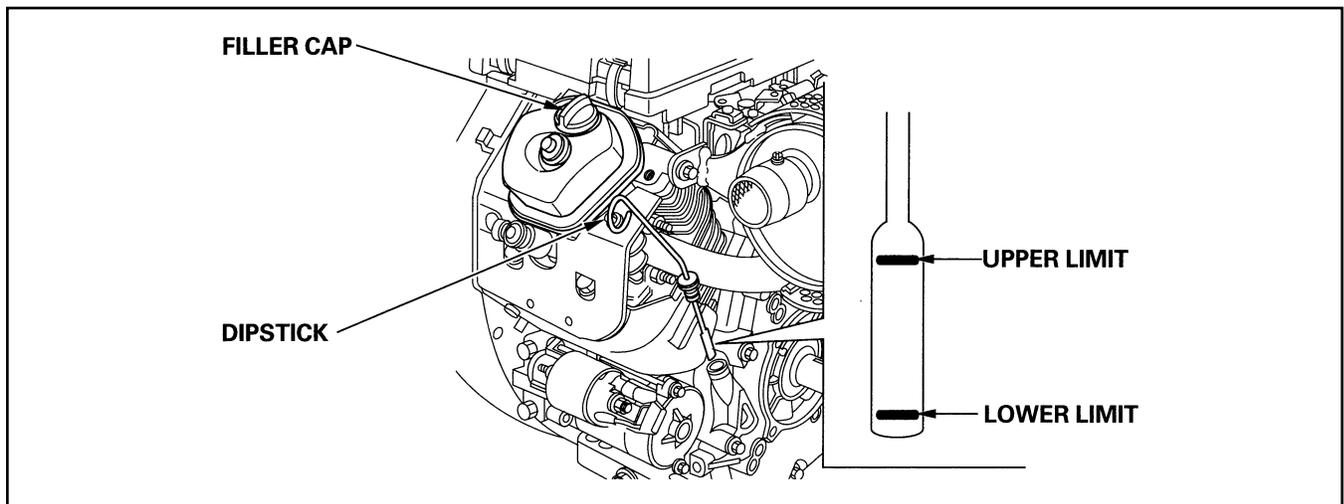


FIGURE 3-1. OIL LEVEL CHECK

CHANGING ENGINE OIL AND OIL FILTER

Refer to Table 3–1 for scheduled engine oil change. In hot weather and dusty conditions the oil should be changed more often.

Set the genset control to the Off position before changing engine oil.

⚠ 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 hose. Run the engine until it is warm and then shut it off.
2. Remove the oil fill cap (See Figure 2–2), remove the hose plug, open the oil drain valve, and allow all of the oil to drain from the engine.
3. Close the oil drain valve (grasp the hose near the engine, push in to stop, turn clockwise to stop, and release) and replace the hose plug.
4. Spin off the oil filter canister (See Figure 2–2) and catch the oil in the canister. Discard the oil filter according to local regulations.
5. Thoroughly wipe off the filter mounting surface. Make sure that the mounting surface is clean and free of filter particles (gasket from old filter is not stuck to 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 oil (See *Engine Oil Recommendations* in Section 2 and *Specifications* in Section 5) for oil capacity. Check oil level.
9. Secure the oil fill cap with a 1/4 turn 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.

Return the genset control to Auto when finished performing maintenance.

AIR FILTER

Refer to Table 3-1 for scheduled air filter replacement. In dusty conditions the air filter element and wrapper should be inspected and changed more frequently for best operation.

Set the genset control to the Off position before checking the air filter.

To change the air filter element (Figure 3-2). Reassemble the air filter with a new air filter element and foam element. Do not oil the filter or foam element.

Return the genset control to Auto when finished performing maintenance.

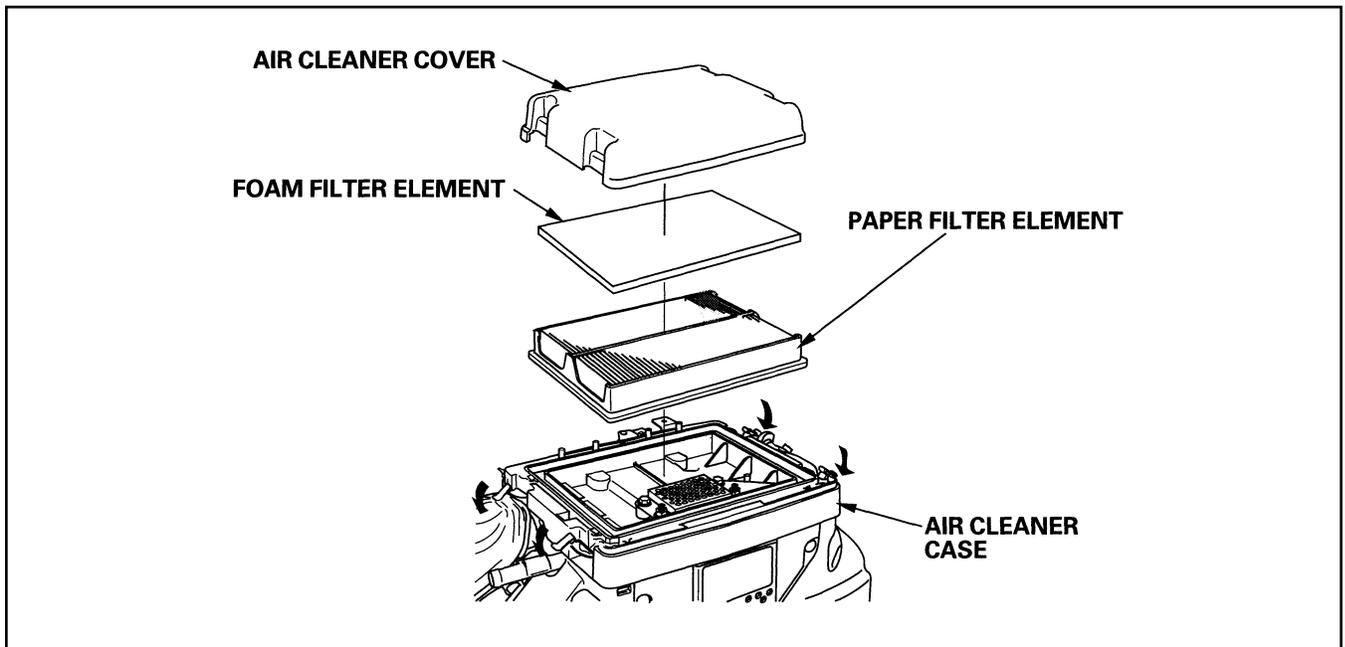


FIGURE 3-2. AIR FILTER ELEMENT AND WRAPPER

SPARK PLUGS

Set the genset control to the Off position before checking the spark plugs.

Refer to Table 3-1 for scheduled spark plug replacement. (The genset has two spark plugs: one on each side of the engine.) 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* in Section 4.

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.

Return the genset control to Auto when finished performing maintenance.

BATTERY CARE

⚠️ WARNING *Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.*

Ventilate battery area before working on or near battery—Wear goggles—Stop genset and disconnect charger before disconnecting battery cables—Disconnect negative (-) cable first and reconnect last.

⚠️ CAUTION *Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the set.*

Check the condition of the starting batteries at the interval specified in the Maintenance Table. To prevent dangerous arcing, always disconnect the negative ground cable from the battery before working on any part of the electrical system or the engine. Disregard the sections On Checking Specific Gravity and Checking Electrolyte Level if using a “maintenance-free” battery.

Cleaning Batteries

⚠️ WARNING *Electrolyte is a dilute sulfuric acid that is harmful to the skin and eyes. Do not get the substance in your eyes or contact with skin. Wear goggles and protective, rubber gloves and apron when servicing batteries.*

In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. IMMEDIATELY CALL A PHYSICIAN.

Keep the batteries clean by wiping them with a damp cloth whenever dirt appears excessive.

If corrosion is present around the terminal connections, remove battery cables and wash the terminals with a solution consisting of 1/4 pound of baking soda added to 1 quart of water. (This solution is also used for washing down spilled electrolyte.)

Be sure the vent plugs are tight to prevent cleaning solution from entering the cells.

After cleaning, flush the outside of the battery and surrounding areas with clean water.

Keep the battery terminals clean and tight. After making connections, coat the terminals with a light application of petroleum jelly or non-conductive grease to retard corrosion.

Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell.

Hold the hydrometer vertical and take the reading. Correct the reading by adding four gravity points (0.004) for every ten degrees the electrolyte temperature is above 80° F (27° C). A fully charged battery will have a corrected specific gravity of 1.260. Charge the battery if the reading is below 1.215.

Checking Electrolyte Level

⚠️ CAUTION *Do not add water in freezing weather unless the engine will run long enough (two to three hours) to assure a thorough mixing of water and electrolyte.*

Check the level of the electrolyte (acid and water solution) in the batteries at least every 200 hours of operation.

Fill the battery cells to the bottom of the filler neck. If cells are low on water, add distilled water and recharge. If one cell is low, check case for leaks. Keep the battery case clean and dry. An accumulation of moisture will lead to a more rapid discharge and battery failure.

Battery Replacement

Always replace the starting battery with the same number and type (vented, lead acid). Properly dispose of battery in accordance with local environmental agency requirements.

⚠️ WARNING *Electrolyte or explosion of battery can cause severe personal injury or death. Do not mutilate or burn the battery in a fire for disposal.*

Damage to case will release electrolyte which is harmful to the skin and eyes and is also toxic. Burning of battery may cause an explosion.

4. Troubleshooting

Table 4–1 provides troubleshooting guidance for a genset that fails to start or that shuts down. The genset controller has an extensive diagnostic capability and its fault codes are covered in numerical sequence in Table 4–1. *Gaps in the code numbers are for codes that do not apply to this genset.*

Most shutdowns can be prevented by proper maintenance and use of the genset—maintaining oil levels, keeping battery connections clean and tight, and not overloading the genset.

If the load on the genset exceeds the rated capacity of the genset, the genset shuts down. In this case, remove loads by turning off appliances, press the switch on the control to OFF and back to AUTO to reenable automatic remote restarting.

If you fail to resolve the problem after taking the corrective actions suggested, contact an authorized Cummins/Onan dealer. See *How to Obtain Service* in Section 7.

STATUS/DIAGNOSTICS LIGHT ON THE GENSET CONTROL SWITCH

The genset controller blinks the status/diagnostics LED to indicate a fault code if there is a fault shutdown that requires maintenance or service. 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. 4: blink-blink-blink-blink

Two–Digit Fault Code - Two–digit faults indicate that a service fault has occurred. These codes are accessed by an authorized Cummins/Onan service Technician.

⚠ 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.

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

FAULT CODES

The genset controller provides extensive diagnostics by causing the status indicator light on the Control Switch to blink in a coded fashion. Following a fault shutdown, the indicator light blinks repeatedly 2, 3, or 4 blinks at a time.

- **Two blinks** indicates that the low oil pressure cutoff switch did not open within 10 seconds of starting.
- **Three blinks** indicates a service fault.
- **Four blinks** indicates that cranking without start exceeded 20 seconds.

The fault code stops blinking after five minutes.

FUSE REPLACEMENT

- **Control Power Fuse 20A:**
Push in fuse holder cap - turn counter clockwise 1/4 turn. Pull cap and fuse from fuse holder. Replace with Buss MDL20A or equivalent.
- **Battery Charger AC Supply Fuse 10A current limiting:**
Unscrew fuse holder cap counterclockwise. Pull cap and fuse from fuse holder. Replace with ATMR10 or equivalent.
- **Battery Charger DC Outlet Fuse 9A:**
Locate red wire from battery charger to battery. Pull apart yellow fuse holder. Replace with SFE9 or equivalent.

TABLE 4-1. 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.*

STARTING BATTERIES RUN DOWN

(Marginal batteries, connections, or charging system or parasitic loads)

Corrective Action:

1. Clean and tighten the positive (+) and negative (-) genset battery cable connections.
2. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.
3. Have a battery charging system installed or serviced.

STARTER ENGAGES-DISENGAGES

(Cranking voltage dips below 6 volts—low battery charge, poor connections, long cables)

Corrective Action:

1. Clean and tighten the positive (+) and negative (-) genset battery cable connections.
2. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

NO POWER—GENSET RUNNING, RUN LIGHT ON

(Line circuit breaker OFF or tripped or faulty wiring)

Corrective Action:

1. Turn on or reset the line circuit breaker on the genset.
2. Turn on or reset the line circuit breakers on the main distribution panel
3. If the condition still exists, contact Cummins/Onan service.

LOW OIL PRESSURE FAULT—CODE NO. 2

(The controller sensed that the low oil pressure cutoff 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.)
3. If the oil level is OK, contact Cummins/Onan Service.

SERVICE CHECK FAULT—CODE NO. 3

(A service check fault occurred)

Corrective Action:

1. Reduce the number of appliances running at the same time, especially those with high motor starting loads such as air conditioners.
2. Open any closed fuel valves and check for an adequate fuel supply.
3. Check for fouled spark plugs.
4. Check air cleaner.
5. Clean and tighten the positive (+) and negative (-) genset battery cable connections.
6. If the condition still exists, contact Cummins/Onan Service.

OVERCRANK FAULT—CODE NO. 4

(Cranking exceeded 20 seconds without engine starting)

Corrective Action:

1. Check fuel level.
2. Open any closed fuel valves.
3. Secure the spark plug lead on the spark plug.
4. Check the spark plugs.
5. Service the air cleaner.

5. Specifications

ENGINE

GX670-VXC2 Type

Length × Width × Height	16.1 × 18.5 × 18.0 in (408 × 471 × 457 mm)
Dry weight	97.0 lbs (44.0 kg)
Engine type	4-stroke, overhead valve, 2 cylinders (90° V-Twin)
Displacement [Bore × Stroke]	40.9 cu-in (670 cm ³) [3.03 × 2.83 in (77 × 72 mm)]
Max. output	24 bhp (17.9 kW, 24 PS) at 3,600 rpm (*)
Max. torque	37.5 lbf·ft (50.8 N·m, 5.18 kgf·m) at 2,500 rpm (*)
Fuel consumption	0.54 lb/hph (326 g/kWh, 240 g/PSh)
Cooling system	Forced air
Ignition system	Transistorized magneto
PTO shaft rotation	Counterclockwise

GENSET

Fuel	Type	LPG: Propane content of 95% or higher (page 17) in Engine Manual. NATURAL GAS: Methane content of 90% or equivalent (page 17) in Engine Manual.
Engine Oil	Type	See Page 2-1
	Capacity	Without oil filter replacement: approximately 1.16 US qt (1.10 ℓ) With oil filter replacement: approximately 1.48 US qt (1.40 ℓ)
Spark Plug	Type	NGK: ZGR5A-4
	Gap	0.012 – 0.016 in (0.30 – 0.40 mm) (page 25)
Carburetor	Idle speed	3600
Maintenance	Before each use	Check engine oil level. Check air filter.
	First 20 hours	Change engine oil.
	Subsequent	Refer to the maintenance schedule on page 3-1

* Refer to the power equipment manual, because the capacity of engine oil differs by the oil cooler that is attached.

6. Information for California Genset Users

The Honda GX670 (used in Model GRCA Spec 4229 genset) meets 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 6–1 as an aid in locating information related to the California Air Resources Board requirements for emissions control.

TABLE 6–1. 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> , Section 5.
Engine Ignition Timing	See <i>Specifications</i> , Section 5.
Engine Fuel Requirements	LPG Models: The engine is certified to operate on LPG. See <i>Fuel Recommendations</i> in <i>Operation</i> , Section 2.
Engine Lubricating Oil Requirements	See <i>Engine Oil Recommendations</i> in <i>Operation</i> , Section 2.
Engine Fuel Mixture Settings	These genset engines have precision–manufactured carburetors and gas demand regulators and mixers which are not adjustable.
Engine Adjustments	See <i>Fuel Selection in Operation</i> , Section 2 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).

7. How to Obtain Service

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

1. Check the North American Sales and Service Directory (F-118) supplied with your Onan genset. These directories list authorized distributors who will assist you in locating the nearest authorized dealer.
2. Consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS - ELECTRIC,
ENGINES - GASOLINE OR DIESEL, or
RECREATIONAL VEHICLES - EQUIPMENT,
PARTS AND SERVICE.
3. Call 1-800-888-ONAN for the name and telephone number of the nearest Cummins/Onan or Onan-only distributor in the United States or Canada. (This automated service utilizes touch-tone phones only).

To get service, contact the authorized dealer or distributor nearest you, explain the problem and make an appointment. If you have difficulty in arranging for service or resolving a problem, please contact the dealer coordinator or service manager at the nearest Cummins/Onan distributor for assistance.

Before calling for service, have the following information available:

1. *The complete genset model number, spec number, and serial number (see Model Identification on page 1-2)*
2. *The date of purchase*
3. *The nature of the problem (See Troubleshooting, Section 4)*

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

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