Operator Manual

Our energy working for you.™

Power Generation

Generator Set

MGKBC

MGKBD

English 07–2009 981–0168 (Issue 2)

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Safety Precautions

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

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

The following symbols in this manual alert you to potential hazards to operators, service personnel 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.***

GENERAL PRECAUTIONS

- Keep children away from the genset.
- Do not step on the genset when entering or leaving the generator room. Parts can bend or break leading to electrical shorts or to fuel, coolant or exhaust leaks.
- To prevent accidental or remote starting while working on the genset, disconnect the negative (–) battery cable at the battery.
- Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray and cause severe burns.
- Do not use evaporative starting fluids such as ether. They are highly explosive.
- Keep the genset, drip pan and compartment clean. Oily rags can catch fire. Gear stowed in the compartment can cause the genset to overheat.
- Make sure all fasteners are secure and properly torqued.
- Do not work on the genset when mentally or physically fatigued or after having consumed alcohol or drugs.
- You must be trained and experienced to make adjustments while the genset is running—hot, moving or electrically live parts can cause severe personal injury or death.
- Used engine oil has been identified by some U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.
- Benzene and lead in some gasolines have been identified by some U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not to ingest, inhale or contact gasoline or its vapors.
- Ethylene glycol, used as engine antifreeze, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
- Keep USCG Approved multi-class ABC fire extinguishers on the boat. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10)
- Genset installation and operation must comply with all applicable local, state and national codes and regulations.

POST THESE SUGGESTIONS IN POTENTIAL HAZARD AREAS OF THE BOAT

GENERATOR VOLTAGE IS DEADLY

- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.
- When the boat has provisions for connection to shore power, the genset must be connected to the boat electrical system through an approved transfer switch to prevent backfeed. Backfeed can lead to electric shock resulting in severe personal injury or death.
- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

ENGINE EXHAUST IS DEADLY

- Never sleep in a boat while the genset is running unless the cabin is equipped with a properly working carbon monoxide detector-alarm.
- Inspect for exhaust leaks at every startup and after every eight hours of operation.
- The exhaust system must be installed in accordance with the genset Installation Manual.
- When modifying or repairing the boat, care must be taken to maintain sealing of the living quarters from spaces where exhaust gas can accumulate.
- The ventilation exhaust blowers must be kept in good working order to prevent the accumulations of engine exhaust.
- For more information about the hazards of carbon monoxide see American Boat and Yacht Council (ABYC) publication TH-22—*Educational Information About Carbon Monoxide.*

GASOLINE IS FLAMMABLE AND EXPLOSIVE

- Do not smoke where fuel vapors are present or in areas sharing ventilation with fuel tanks, engines and other such equipment. Keep flames, sparks, pilot lights, electrical switches, arc-producing equipment and all other sources of ignition well away.
- All electrical devices, such as switches, circuit breakers, meters and control panels used in areas where gasoline vapors can accumulate must be *Ignition Protected.*
- No substitutes are permitted for the parts listed in the *Critical Parts Index* of the genset Parts Catalog. They must be purchased from Onan and be installed in accordance with the genset Service Manual by those who are trained and experienced in marine gasoline genset service.
- Fuel lines must be secure, free of leaks and separated or shielded from electrical wiring.
- When modifying or repairing the boat, care must be taken to maintain sealing of the living quarters from spaces where gasoline vapors can accumulate.
- The ventilation exhaust blowers must be kept in good working order to prevent the accumulations of gasoline vapors.

BATTERY GAS IS EXPLOSIVE

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

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

POST THESE SUGGESTIONS IN POTENTIAL HAZARD AREAS OF THE BOAT

The Hazards of Carbon Monoxide

Most people know not to run a car in the garage. Many people know about the threat of carbon monoxide poisoning in the house. But few people are aware that this invisible killer is even more insidious aboard a boat.

Engine-driven generators can produce harmful levels of carbon monoxide that can injure or kill you. The nature of boating is such that you can be harmed by this poisonous gas despite good generator set maintenance and proper ventilation.

WHAT IS CARBON MONOXIDE POISONING?

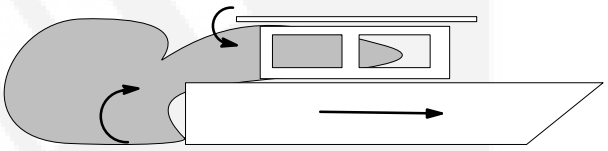
Carbon Monoxide (CO) is an odorless and colorless gas. You cannot see it or smell it. Red blood cells, however, have a greater affinity for CO than for Oxygen. Therefore, exposure even to low levels of CO for a prolonged period can lead to asphyxiation (lack of oxygen) resulting in death. Mild effects of CO poisoning include eye irritation, dizziness, headaches, fatigue and the inability to think clearly. More extreme symptoms include vomiting, seizures and collapse.

WHAT ARE THE SPECIAL RISKS OF CO ON BOATS?

Depending on air temperature and wind, CO can accumulate between hulls, under an overhanging deck or rear swimming platform and in and around the boat. A swimmer can be exposed to lethal levels of CO when the genset is running. Passengers on deck and in the living quarters can also be exposed, especially when the boat is docked, beached or tied to a neighboring boat.

The risk of exposure to CO can be multiplied greatly by the “station wagon” effect, obstructions that block exhaust dissipation, and infiltration from neighboring boats. To protect against all three situations, Onan recommends that reliable CO detector-alarms be installed on your boat.

- ***The Station Wagon Effect*** – A boat pushes aside the air through which it is moving, causing a zone of low pressure in the back of the boat and cabins into which exhaust gases can be drawn (see figure). A breeze across an anchored boat can have the same effect. Opening doors and windows so that air can flow through the boat can reduce the effect.



- ***Obstructions*** – Anchoring near a large object such as a boat house or sea wall or in a confined space such as a canyon can cause exhaust gases to accumulate in and around the boat despite good generator set maintenance and proper ventilation. Don’t run the generator set when anchored in such places.

- ***Exhaust from Neighboring Boats*** – When boats are anchored in close quarters exhaust from neighboring boats can accumulate in and around yours.

ONLY YOU CAN PROTECT YOURSELF FROM CO POISONING!

- Watch constantly for swimmers when the generator set is running.
- Make sure exhaust cannot get under the deck, between hulls or enter the living quarters through a window, vent or door.
- Make sure all CO detectors are working.
- Pay attention to the signs of CO poisoning.
- Check the exhaust system for corrosion, obstruction and leaks each time you start the generator set and every eight hours if you run it continuously.

POST THESE SUGGESTIONS IN POTENTIAL HAZARD AREAS OF THE BOAT

Introduction

ABOUT THIS MANUAL

This manual covers the operation and maintenance of the MGKBC and MGKBD Series of generator sets (gensets). Each operator should study this manual carefully and observe all of its instructions and safety precautions. Keep this manual readily available for reference.

Operation, Periodic Maintenance and *Troubleshooting* provide the instructions necessary for operating the genset and maintaining good performance. The owner is responsible for performing maintenance in accordance with the PERIODIC MAINTENANCE SCHEDULE (Page 14). *Emissions* (Page 41) includes information regarding compliance with emissions regulations.

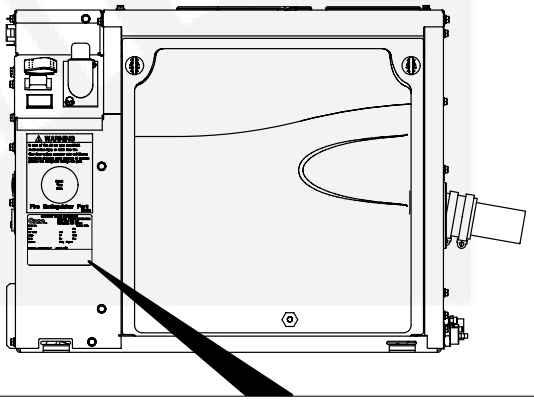
⚠WARNING ***This genset is not a life support system. It can stop without warning. Children, persons with physical or mental limitations, and pets could suffer severe personal injury or death. A personal attendant, redundant power or an alarm system must be used if genset operation is critical.***

NAMEPLATE

Model and Serial Numbers: The gray areas in Figure 1 illustrate where the model and serial numbers are printed on the nameplate. Record these numbers in the boxes provided in Figure 1 so that they are readily available when contacting an Onan dealer for parts, service or product information. Each character is significant. The last character of the model number is the specification letter, which is important for obtaining the right parts. Genuine Onan replacement parts are recommended for best performance and safety.

⚠WARNING ***No substitutes are permitted for the parts listed in the Critical Parts Index of the genset Parts Catalog. They must be purchased from Onan and be installed in accordance with the genset Service Manual by those who are trained and experienced in marine gasoline genset service.***

Federal Emissions Compliance Period: The Federal Emissions Compliance Period referred to on the nameplate indicates the number of operating hours for which the engine has been shown to meet Federal emissions requirements. Category C = 250 hrs, B = 500 hrs, A = 1000 hrs.



IMPORTANT ENGINE INFORMATION

Onan®

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

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

Insulation - NEMA Class Ambient

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

RECORD NUMBERS HERE

MODEL NUMBER:

SERIAL NUMBER:

FIGURE 1. TYPICAL NAMEPLATE

FUEL RECOMMENDATIONS

⚠WARNING ***Gasoline is highly flammable and explosive and can cause severe personal injury or death. Do not smoke where fuel vapors are present or in areas sharing ventilation with fuel tanks, engines and other such equipment. Keep flames, sparks, pilot lights, electrical switches, arc-producing equipment and all other sources of ignition well away.***

***All electrical devices, such as switches, circuit breakers, meters and control panels used in areas where gasoline vapors can accumulate must be Ignition Protected*.**

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

⚠ CAUTION ***Do not use gasoline or gasoline additives containing Methanol or gasoline containing more than 10 percent Ethanol. These additives can lead to fuel system corrosion.***

Do not use leaded gasoline because of the extra engine maintenance that will be required.

ENGINE OIL RECOMMENDATIONS

Use API (American Petroleum Institute) performance Class **SL** or **SJ** engine oil. Also look for the SAE (Society of Automotive Engineers) viscosity grade. Referring to Figure 2, choose the viscosity grade appropriate for the ambient temperatures expected until the next scheduled oil change. Multigrade oils such as SAE 15W-40 are recommended for year-round use.

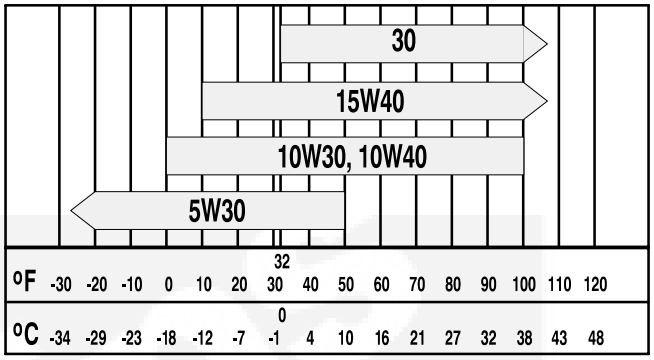


FIGURE 2. SAE VISCOSITY GRADE vs. AMBIENT TEMPERATURE

STARTING BATTERIES

The genset requires a 12 volt battery to power its control and starting circuits. Reliable genset starting and starter service life depend upon adequate battery system capacity and maintenance. See *Specifications* (Page 40) for battery requirements and *Periodic Maintenance* (Page 18) for battery care.

FIRE EXTINGUISHER PORT

Fire Extinguisher Port

The genset enclosure has a fire extinguisher port accessible by breaking through the circle on the warning label located as illustrated in Figure 3.

Fire Extinguisher

The boat must have a fire extinguisher readily available for putting out a fire in the genset. It must be approved for both Class B and Class C fires (for liquid fuel and electrical equipment). Make sure that the nozzle of the fire extinguisher is small enough to fit through the port.

In the Event of Fire

1. DO NOT open genset.
2. Shut down engines, generators and blowers.
3. Push the nozzle through the circle and discharge the full contents of the fire extinguisher.

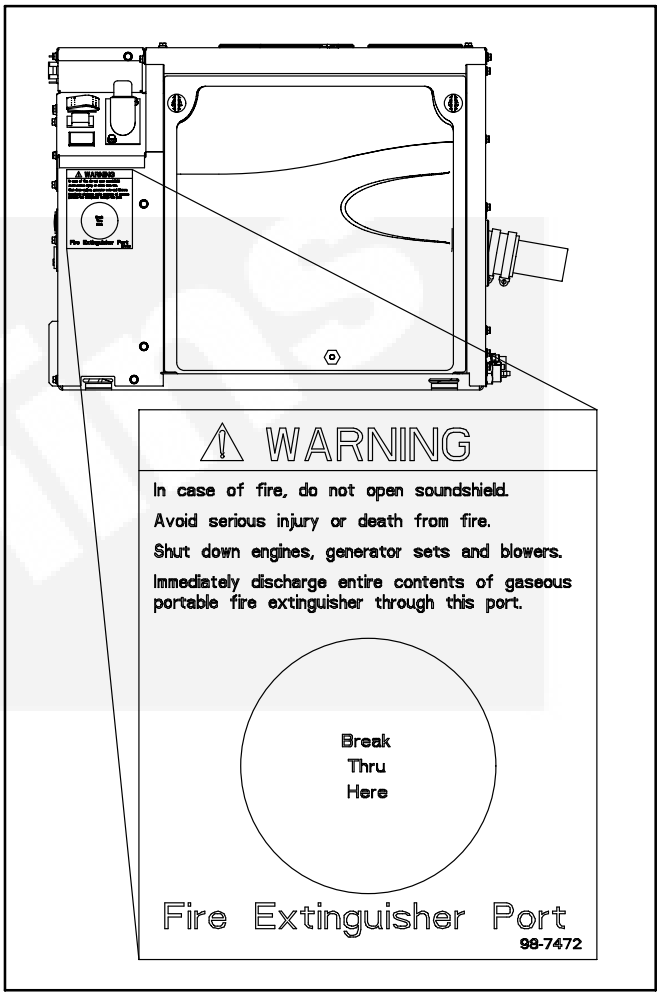


FIGURE 3. FIRE EXTINGUISHER PORT

GENSET CONTROL PANEL

The control panel is located in the front, upper left hand corner of the genset (Figure 4).

Control Switch – This switch is used to prime the fuel system, start and stop the genset and display the fault codes.

- Press and hold **START** to crank and start the genset.
- Momentarily press **STOP (Prime)** to stop the genset.
- Press and hold **STOP (Prime)** to prime the fuel system. The *amber* status light will light in 2 seconds.
- See *Troubleshooting* (Page 28) about displaying the fault codes.

Status Indicator Lights– There are two LED (light emitting diode) lights in the control switch. The *amber* status light lights during priming and blinks rapidly during cranking. If the genset shuts down abnormally it will slowly blink the fault code number. See *Troubleshooting* (Page 28). The *amber* status light goes out and the *green* status light lights when the genset starts producing AC voltage.

Emergency Stop Switch – In an emergency, push this rocker switch **OFF**. Push the switch **ON** after all necessary repairs to the genset and connected equipment have been made.

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

Hour Meter – The hour meter records genset operating time in hours. It cannot be reset.

Oil Fill – The oil fill neck is located on the control panel. The fill plug has a flexible dipstick attached for checking engine oil level.

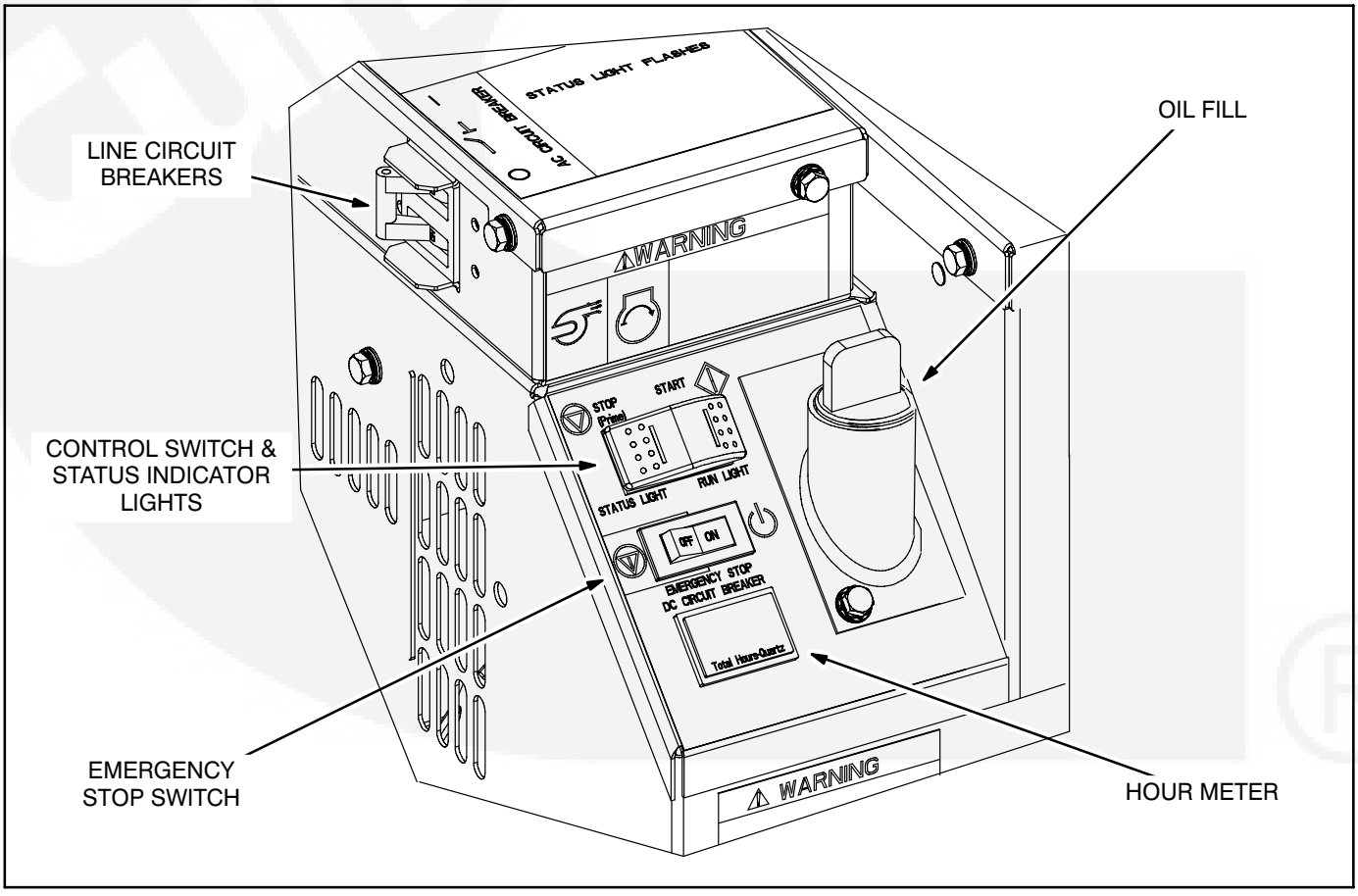


FIGURE 4. GENSET CONTROL PANEL

Operation

⚠WARNING ***EXHAUST GAS IS DEADLY!***

Engine exhaust contains carbon monoxide, a poisonous, odorless and colorless gas that can cause unconsciousness and death. Symptoms of carbon monoxide poisoning include:

- ***Dizziness***
- ***Throbbing in Temples***
- ***Nausea***
- ***Muscular Twitching***
- ***Headache***
- ***Vomiting***
- ***Weakness***
- ***Trouble Thinking Clearly***
- ***Sleepiness***

GET EVERYONE OUT INTO FRESH AIR IMMEDIATELY IF ANYONE EXPERIENCES ANY OF THESE SYMPTOMS. Seek medical attention if symptoms persist. Never sleep in a boat while the genset is running unless the cabin is equipped with a properly working carbon monoxide detector-alarm.

Look over the entire exhaust system and listen for leaks every time you start up the genset and after every eight hours of operation. Shut down the genset immediately if there is a leak. Do not run the genset until the leak has been repaired. The exhaust system must be installed in accordance with the genset Installation Manual.

PRE-START CHECKS AND GENSET COMPARTMENT VENTILATION

Conduct general inspections (Page 15) before the first start of the day and after every eight hours of operation. Keep a log of maintenance and the hours run (Page 43) and perform any maintenance that may be due. Perform maintenance required to return the genset to service if the boat has been in storage (Page 13). Before each start:

1. Make sure all CO detectors on board are working properly.
2. Check for swimmers who might be exposed to engine exhaust.
3. Turn off air conditioners and other large appliances.
4. Operate the ventilation exhaust blower for 4 minutes and check the genset compartment and bilge for gasoline vapors.

⚠WARNING ***Gasoline vapors can explode. Before starting the genset, operate the exhaust blower for 4 minutes and check the genset compartment and bilge for gasoline vapors.***

STARTING THE GENSET

1. Press and hold **STOP (Prime)** for 30 seconds to prime the fuel system if the genset ran out of fuel. The *amber* status light will light in 2 seconds.

   See Page 36 to prime the fuel system using the *e-Series Digital Display.*
2. Press and hold **START** until the genset starts. The *amber* status light will blink rapidly. The *amber* light will go out and the *green* status light will light when the genset starts producing AC voltage.

   See Page 36 to start the genset using the *e-Series Digital Display.*
3. For longer engine life, let the engine warm up for 2 minutes before turning on air conditioners and other large appliances.
4. Check for water, coolant, fuel and exhaust leaks. Stop the genset immediately if there is any leak. *Stop fuel leaks immediately.*
5. If the boat is equipped with an *e-Series Digital Display*, observe engine coolant temperature, oil pressure and battery voltage. Perform maintenance or service as necessary if an abnormal engine condition is indicated. See *Periodic Maintenance* (Page 14).

6. ***If the genset fails to start***, cranking will discontinue in 20 to 60 seconds, depending on temperature, and the *amber* status light will blink Fault Code No. 4 (Page 30). See *Troubleshooting* (Page 28) if the genset does not start after two or three tries.

   ⚠ CAUTION ***Do not continue cranking and risk burning out the starter or flooding the engine (exhaust flow during cranking is too low to expel water from the exhaust system). Find out why the genset does not start and make necessary repairs.***

7. ***If the genset shuts down abnormally***, the *amber* status light will slowly blink the fault code number. See *Troubleshooting* (Page 28) for step-by-step procedures to correct the fault that caused shutdown.

STOPPING THE GENSET

Turn off air conditioners and other large appliances and let the genset run for two minutes to cool down. Then momentarily press **STOP (Prime)**.

See Page 36 to stop the genset using the *e-Series Digital Display.*

EMERGENCY STOP

In an emergency, push the EMERGENCY STOP switch **OFF** (Page 9). Make all necessary repairs to the genset and connected equipment and then push it **ON** to allow genset operation.

LOADING THE GENSET

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

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

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

The genset has been rated for maximum power at standard barometric pressure, humidity and temperature (ref. ISO 3046). Either low barometric pressure (high altitude) or high ambient temperature will decrease engine power. ***It may be necessary to run fewer appliances under such conditions.***

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

RESETTING CIRCUIT BREAKERS

If a circuit breaker in the main power distribution panel of the boat or on the genset (Page 9) trips, either a circuit shorted or too many appliances were running. Note that the genset may continue to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off all connected loads and reset the circuit breaker. (It may be necessary to push the circuit breaker **OFF** to reset it and then **ON** to reconnect the circuit.) If the circuit breaker trips right away, either the electrical distribution system has a short circuit or the circuit breaker is faulty. Call a trained and experienced electrician.

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

Electric appliances and tools must be used and maintained in accordance their manufacturer's instructions and safety precautions. They must be properly grounded to reduce the risk of electric shock and fire.

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

SHORE POWER

When the boat has provisions for connection to shore power, the genset must be connected to the boat electrical system through an approved transfer switch to prevent backfeed.

⚠WARNING ***Backfeed to shore power can lead to electric shock resulting in severe personal injury or death. Prevent backfeed by connecting the genset to the boat electrical system through an approved transfer switch.***

NEW OR RE-BUILT ENGINE CARE

Change the oil and oil filter after the first 50 hours of operation with a new or re-built engine (Page 17).

EXERCISING THE GENSET

Exercise the genset at least 1 hour every month if use is infrequent. Run the genset at 1/4 to 3/4 load (Page 11). A single exercise period is better than several shorter periods. Exercising a genset drives off moisture, re-lubricates the engine, uses up fuel before it becomes stale and removes oxides from electrical contacts and generator slip rings. The result is better starting, more reliable operation and longer engine life.

COLD TEMPERATURE OPERATION

Do not let raw water freeze in the heat exchanger (Page 24) or muffler during cold weather when the genset is not operating. Freezing water can damage the heat exchanger and muffler. Engine coolant, but not raw water, is protected from freezing. Drain the heat exchanger and muffler if there is a danger of freezing.

STORING THE GENSET

Proper storage is essential for preserving top genset performance and reliability when the genset will be idle for more than 120 days.

Storing the Genset

1. Fill the fuel tank with fresh fuel and add a fuel preservative such as OnaFresh™. Follow the instructions on the container label. Unless a preservative (stabilizer) is added, the gasoline in the fuel system will deteriorate causing fuel system corrosion, gum formation and varnish-like deposits that can lead to hard starting and rough operation.

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

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

2. Change the engine oil (Page 17) and attach a tag indicating viscosity grade (Page 7).
3. Disconnect the battery cables (negative [–] first) from the battery (Page 18). Follow the manufacturer's recommendations when storing the battery.

   ⚠WARNING ***Hot coolant is under pressure and can cause severe burns when loosening the pressure cap. Let the engine cool before loosening the pressure cap.***

4. Check coolant level and add as necessary (Page 19). Test the coolant mixture if freezing temperatures are possible and change it if necessary.
5. If freezing temperatures are expected, drain the heat exchanger (Page 24), hoses and muffler to prevent damage from freezing water.
6. Clean and lightly oil parts that can rust.

Returning the Genset to Service

1. Check the oil tag on the genset and change the oil (Page 17) if the viscosity is not appropriate for the temperatures expected (Page 7).
2. Reconnect the battery cables (negative [–] last) (Page 18).
3. Replace the raw water pump impeller if it was installed more than a year ago (Page 22).
4. Perform the maintenance required (Page 14), conduct the pre-start checks and prime the fuel system (Page 10).
5. Start and run the genset (Page 10).

Periodic Maintenance

Periodic maintenance is essential for good performance and long genset life. Use Table 1 as a guide for normal periodic maintenance. Use Page 43 to keep a record of all maintenance that has been performed.

Maintenance, replacement and repair of emission control devices and systems may be performed by anyone trained and experienced in marine gasoline genset service. Warranty work, however, must be performed by an authorized Onan dealer.

TABLE 1. PERIODIC MAINTENANCE SCHEDULE

PROCEDURE	FREQUENCY									
	After first 50 Hrs	Every Day/ 8 Hrs	Every Month	Every Year	Every 150 Hrs	Every 450 Hrs	Every 2 Yrs	Every 900 Hrs	Every 3 Yrs	Page
General Inspection[1]		x								15
Check Battery			x[2]							18
Check V-Belt Tension			x[3]							22
Check Siphon Break			x							21
Change Oil & Oil Filter	x			x	x					17
Replace Raw Water Impeller				x						22
Check Brushes & Slip Rings[7]				x[5]						–
Check & Clean/Replace Flame Arrestor[7]				x						26
Replace Spark Plugs						x				27
Replace External Fuel Filter						x				–
Adjust Valve Lash						x[5]				–
Replace Coolant, Pressure Cap & Thermostat							x			20
Clean Heat Exchanger							x[4]			24
Replace Fuel Filter at Carburetor								x[5]		–
Clean Cylinder Head & Recondition Valves & Valve Seats								x[5, 6]		–
Inspect Ignition Cables, Distributor Cap and Rotor[7]								x[5, 8]		–
Check Generator Bearings, Drive Belt, Belt Tensioner & Drive Coupling								x[5]	x[5]	–

1 – Includes Oil and Coolant Level checks and checks for leaks and damage in fuel, exhaust, coolant and raw water systems.
2 – See battery manufacturer's maintenance recommendations.
3 – Check for slippage, cracking and wear and adjust or replace as necessary (pump drive belt only).
4 – There is no zinc anode to replace.
5 – Must be performed by someone trained and experienced in marine gasoline genset service (Onan Dealer).
6 – EPA emissions requirement.
7 – *Ignition Protected* component. No substitutes for Onan supplied parts are permitted. See genset Parts Catalog.
8 – Inspect cables for hardening, cracks and chaffing. Inspect cap and rotor for cracks, pitting and corrosion. **REPLACE EVERY 1800 HRS.**

GENERAL INSPECTION

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent starting while working on the genset.***

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

Oil Level

Check engine oil level (Page 16).

Coolant Level

Keep the level of coolant in the recovery tank between COLD and HOT. The recovery tank is designed to maintain coolant level; not to fill the system. If the tank is empty, check for and repair any coolant leaks and refill the system through the fill neck on the engine (Filling the System, Page 20). Then refill the recovery tank up to the COLD mark. Use the recommended mixture of antifreeze (Page 20).

Exhaust System

Inspect the exhaust system for leaks and loose hose clamps at the exhaust manifold, exhaust elbow, muffler, water separator and hull fittings. Replace damaged sections of exhaust hose.

⚠WARNING ***EXHAUST GAS IS DEADLY! Do not operate the genset until all exhaust leaks have been repaired.***

Check that all CO monitors are working properly.

Fuel System

Check for leaks at hose, tube and pipe fittings in the fuel supply system while the genset is running and while it is stopped. Check flexible fuel hose for cuts, cracks, abrasions and loose hose clamps. Make sure fuel lines do not rub against other parts. Replace worn or damaged fuel line parts before leaks occur. Replace hose with with USCG TYPE A1 fuel hose.

⚠WARNING ***Fuel leaks can lead to fire or explosion. Stop leaks immediately. Do not run the genset if it causes fuel to leak.***

Raw Water System

Clean out the sea water strainer if necessary and make sure the sea cock is open for genset operation. Also, when a water/exhaust separator is provided (see Installation Manual), open the sea cock for the water drain hose.

Battery Connections

Check the battery terminals and keep them clean and tight (Page 18). Loose or corroded terminals have high electrical resistance, which can cause hard starting and short starter life.

Mechanical

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

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

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

If the boat is equipped with an *e-Series Digital Display* (Page 36), monitor engine coolant temperature, oil pressure and battery voltage whenever the genset is running.

Ventilation Exhaust Blowers

The ventilation exhaust blowers must be kept in good working order to prevent accumulations of engine exhaust and gasoline vapors. Check for proper operation.

⚠WARNING ***Starting the genset without being able to ventilate the genset compartment could cause an explosion of gasoline vapors. Have the exhaust blowers repaired before starting the genset.***

CHECKING ENGINE OIL LEVEL

Shut off the genset before checking engine oil level.

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

1. Pull the plug and dipstick out of the oil fill neck (Figure 5). The plug may be difficult to pull straight out. It is easier if you tilt the plug in its socket while pulling out. Wipe off the dipstick and thread it back into the fill neck and seat the plug, which snaps into its socket. Remove the plug and dipstick again and check the oil level on the dip stick.

2. Add or drain oil as necessary. See ENGINE OIL RECOMMENDATIONS (Page 7). Keep the oil level between the high and low beads on the end of the dipstick, as shown. It is not necessary to add oil between oil changes if the oil has not dropped more than 1/3 of the way between the high and low beads. A full quart (0.9 liter) can be added if the oil level is at the lower bead.

   ⚠CAUTION ***Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the high and low beads on the dipstick.***

3. Secure the oil fill plug, which snaps into its socket.

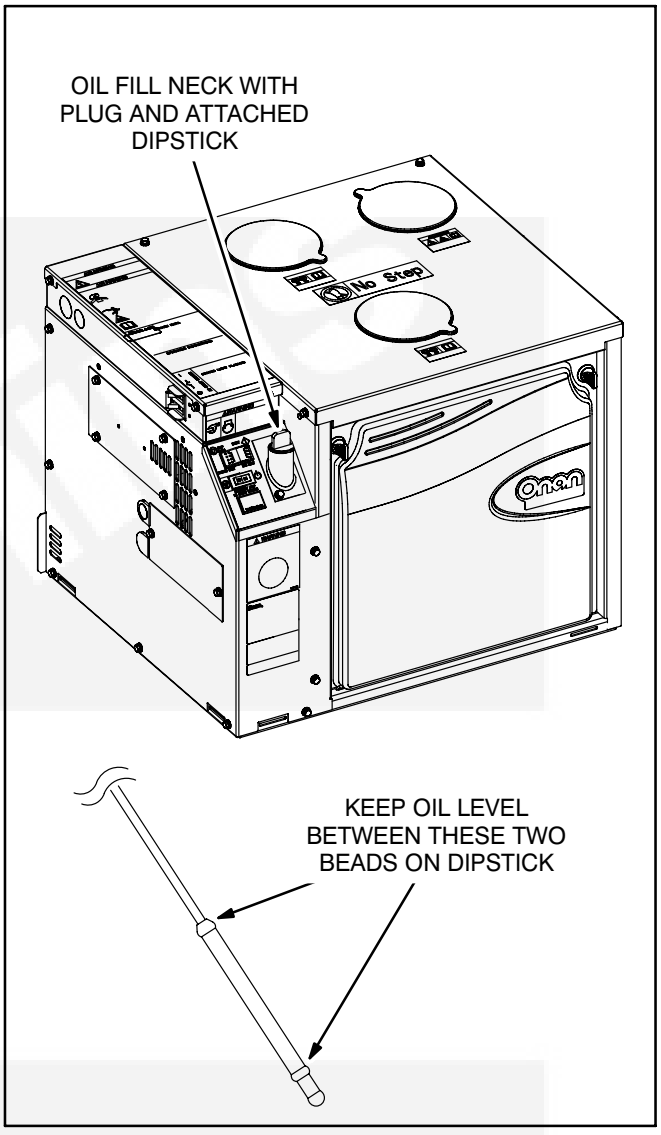


FIGURE 5. OIL FILL NECK AND DIPSTICK

CHANGING ENGINE OIL AND FILTER

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

See Table 1 for scheduled oil change.

1. Run the genset until it is up to operating temperature, stop it and disconnect the negative (–) battery cable at the battery.

   ⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

2. Remove the oil fill plug (Figure 5), open the front access door and drain the engine oil into a container by opening the drain valve (Figure 6). (The drain valve has a 3/8 NPT outlet for connecting a hose fitting to facilitate oil draining.) If an oil pump-out system is installed, follow the instructions provided.
3. Close the oil drain valve.
4. Spin off the old oil filter (Figure 6) and wipe off the filter mounting surface. (A filter wrench is available from Onan.) Remove the old gasket if it does not come off with the filter.
5. Apply a film of oil to the filter gasket, spin the new filter on by hand until the gasket just touches the mounting pad and tighten 3/4 turn.
6. Refill with 2 quarts (1.9 liters) of oil. See ENGINE OIL RECOMMENDATIONS (Page 7). Check the level (Page 16) and add or drain oil as necessary.

   ⚠CAUTION ***Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the high and low beads on the dipstick.***

7. Close the front access door and reconnect the battery cables (negative [–] last).
8. Dispose of the used oil and oil filter in accordance with local environmental regulations.

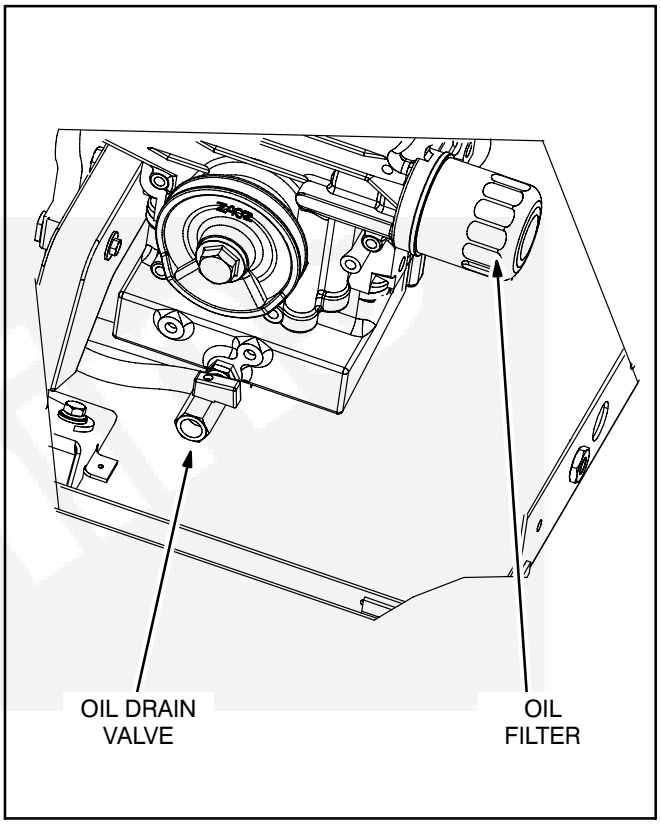


FIGURE 6. OIL FILTER AND DRAIN VALVE

BATTERY AND BATTERY CONNECTIONS

⚠WARNING ***Flames, sparks or arcing at battery terminals, light switches or other equipment can ignite battery gas causing severe personal injury — Ventilate the battery area before working on or near the battery — Wear safety glasses — Do not smoke — Switch a work lamp ON and OFF away from the battery — Do not disconnect the battery cables while the genset is running or a battery charger is on — Always disconnect the negative (–) cable first and reconnect it last.***

See Table 1 for scheduled maintenance. Follow the battery manufacturer's instructions. Have the battery charging system serviced if DC system voltage is consistently low or high. Always:

1. Keep the battery case, terminals and cables clean and dry and the terminals tight at the battery and at the genset (Figure 7). Torque the battery cable terminals on the genset to 6.5 lb-ft (8.8 N-m).
2. Remove battery cables with a battery terminal puller.
3. Make sure which terminal is positive (+) and which is negative (–) before making battery connections. Always remove the negative (–) cable first and reconnect it last to reduce arcing.
4. Follow the manufacturer's recommendations when storing the battery. Disconnect the battery so that it does not discharge through the genset control during storage.
5. Replace the insulting boots over the positive (+) terminals at the battery and at the genset.

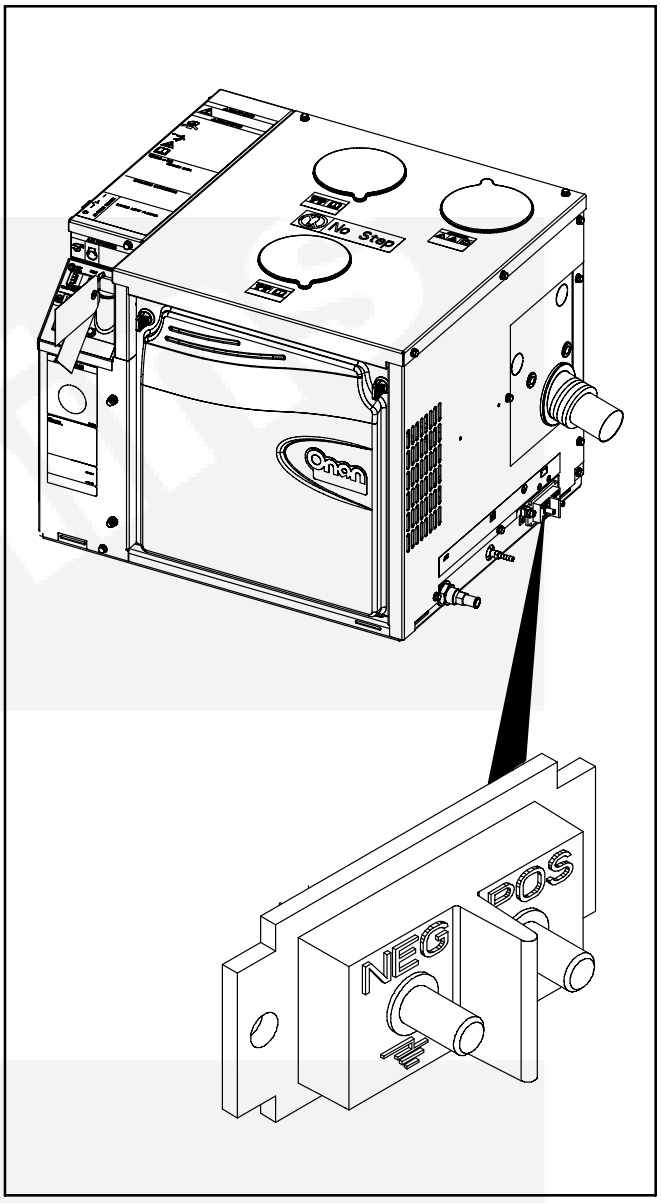


FIGURE 7. GENSET BATTERY CABLE TERMINALS

ENGINE COOLING SYSTEM

Cooling System Overview

Refer to Figure 8. The engine is cooled by a pressurized, closed-loop liquid cooling system. Coolant is pumped through passages in the engine block, head and exhaust manifold. The exhaust manifold also serves as the engine coolant reservoir.

The heat exchanger is mounted inside the exhaust manifold. Raw water (the flotation water) is pumped through tubes in the heat exchanger to cool the engine coolant. The raw water then passes through a hose into the exhaust-water mixer where it cools the exhaust gases and is then expelled. The V-belt drives the coolant and the raw water pumps.

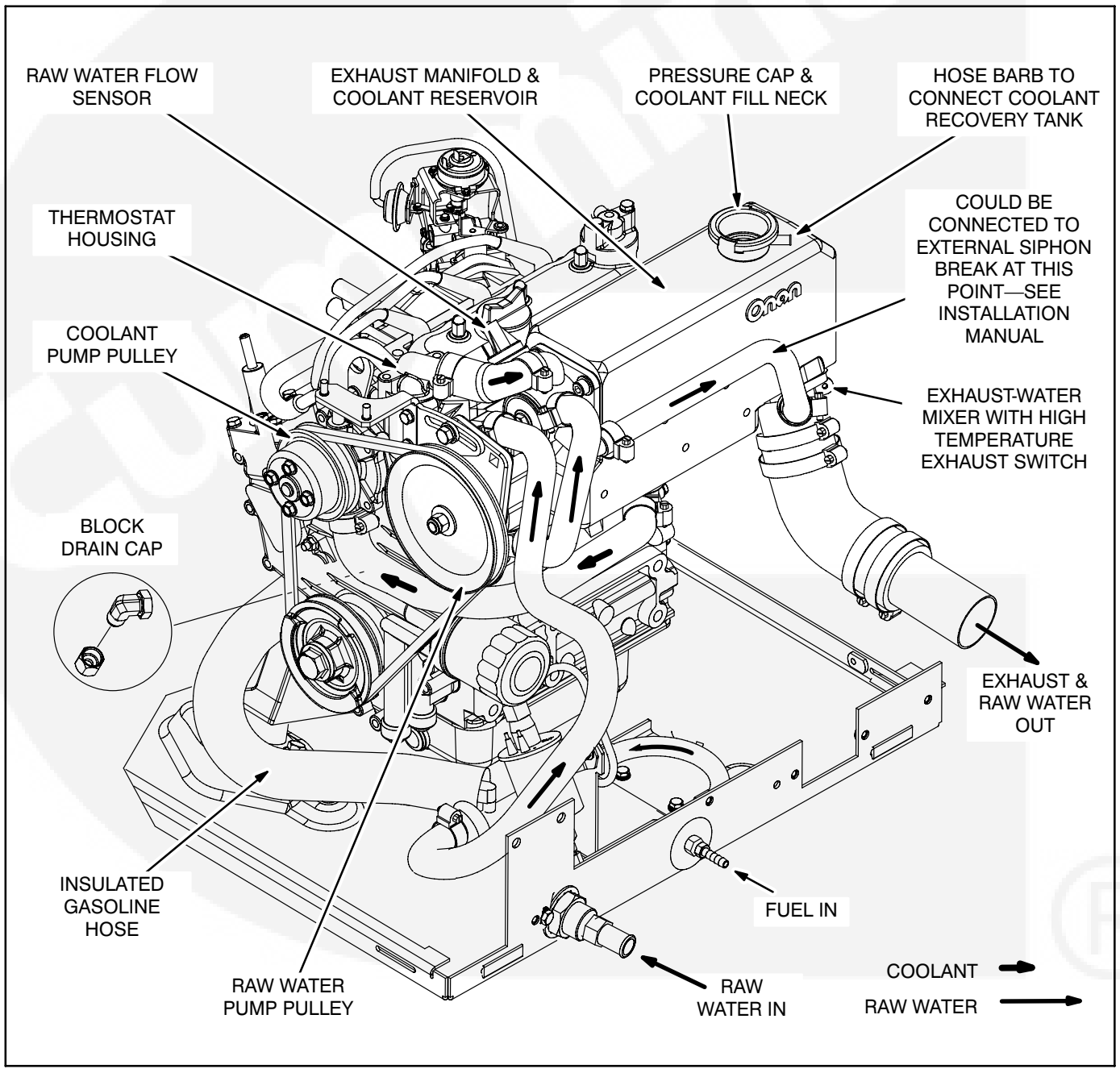


FIGURE 8. ENGINE COOLING SYSTEM

Pressure Cap

See Table 1 for scheduled replacement. The pressure cap is necessary for optimal engine cooling and reduced coolant loss.

Replenishing Normal Coolant Loss

Keep the level of coolant in the recovery tank between COLD and HOT. The recovery tank is designed to maintain coolant level; not to fill the system. If the tank is empty, check for and repair any coolant leaks and refill the system through the fill neck on the engine. Then refill the recovery tank up to the COLD mark. Use the recommended coolant mixture.

Make sure the two hoses from the recovery tank are routed through the two holes in the right end of the genset enclosure, that the coolant recovery hose is connected to the fill neck on the engine and that the overflow hose terminates in the drip pan where it will not splash coolant on electrical components.

Recommended Coolant Mixture

Use the best quality ethylene glycol antifreeze solution available. It should be fully formulated with rust inhibitors and coolant stabilizers. Use fresh water that is low in minerals and corrosive chemicals. Distilled water is best. Unless prohibited by shipping regulations, the genset is shipped with the recommended 50 / 50 mixture of water / ethylene glycol, which is good for -34°F (-37°C). In warmer climates and sea water environments a 60 / 40 mixture of water / ethylene glycol is recommended. Coolant capacity is 3.3 quarts (3.1 liters).

⚠WARNING ***Ethylene glycol antifreeze is considered toxic. Dispose of it according to local regulations for hazardous substances.***

Changing Coolant

See Table 1 for scheduled change of coolant.

Draining the System: Have towels and containers ready to wipe up, collect and properly dispose of the coolant.

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable from the battery to prevent the engine from starting.***

⚠WARNING ***Hot coolant is under pressure and can cause severe burns when loosening the pressure cap. Let the engine cool before loosening the pressure cap.***

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting, let the engine cool, remove the front access door, top of the enclosure (Figure 11) and coolant pressure cap.
2. Drain the exhaust manifold/coolant reservoir by disconnecting the hose at the coolant pump inlet (Figure 8) and twisting it down into a container.
3. Drain the block by removing the cap on the drain fitting on the left side of the block (Figure 8). Use an 11/16 inch socket on a swivel and 12 to 18 inch extension. To catch the coolant and direct it into a container, insert the socket and extension through a piece of hose large enough to fit over the socket but shorter than the extension. The hose will catch the coolant as the cap is being unscrewed.

Coolant Hoses: Inspect and replace hoses that leak or are damaged.

Cleaning and Flushing the System: Use radiator cleaning chemicals to clean and flush the cooling system before refilling with fresh coolant. Follow the cleaner manufacturer's instructions.

⚠CAUTION ***Filling a hot engine with cold water can cause cracks in the manifold, head and block. Follow the manufacturer's instructions for cleaning and flushing.***

Filling the System: Secure the block drain cap and reconnect the pump inlet hose and fill the system through the engine fill neck. The system will fill only as fast as the air can escape. Fill to the bottom of the fill neck. Start and run the engine for a couple of minutes to dislodge air pockets and shut it down. Add as much coolant as necessary and secure the pressure cap. Then refill the recovery tank up to the COLD mark.

⚠CAUTION ***Low coolant level can cause severe engine damage. Make sure the system is full.***

Secure the top of the enclosure and front access door and reconnect the battery cables (negative [–] last) when done.

Siphon Break

⚠WARNING ***Bypassing a siphon break or failing to properly maintain it can lead to major engine damage due to flooding, which will not be covered by Warranty.***

A siphon break is installed when the exhaust-water mixer (Figure 8) is below or less than 6 inches above the water line. Replace the siphon break if it is encrusted with deposits, which indicates leakage. If of the bleed-vent type, check that the vent hose is properly connected on both ends. If the vent is connected to a through-hull fitting, check for normal water flow whenever the engine is running. See the Installation Manual for more information regarding siphon breaks.

Replacing the Thermostat

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

⚠WARNING ***Hot coolant is under pressure and can cause severe burns when loosening the pressure cap. Let the engine cool before loosening the pressure cap.***

See Table 1 for scheduled replacement. Referring to Figure 9, replace the thermostat as follows:

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting, let the engine cool and remove the front access door, top of the enclosure (Figure 11) and pressure cap.
2. Remove the two thermostat housing bolts and pull off the housing, thermostat and gasket. The hose does not need to come off.
3. Clean off the gasket area and install the new thermostat and gasket. Apply Three Bond 1215 liquid sealant or equivalent to the top side of the gasket.
4. Replenish any lost coolant, secure the pressure cap, secure the top of the enclosure and front access door and reconnect the battery cables (negative [–] last).

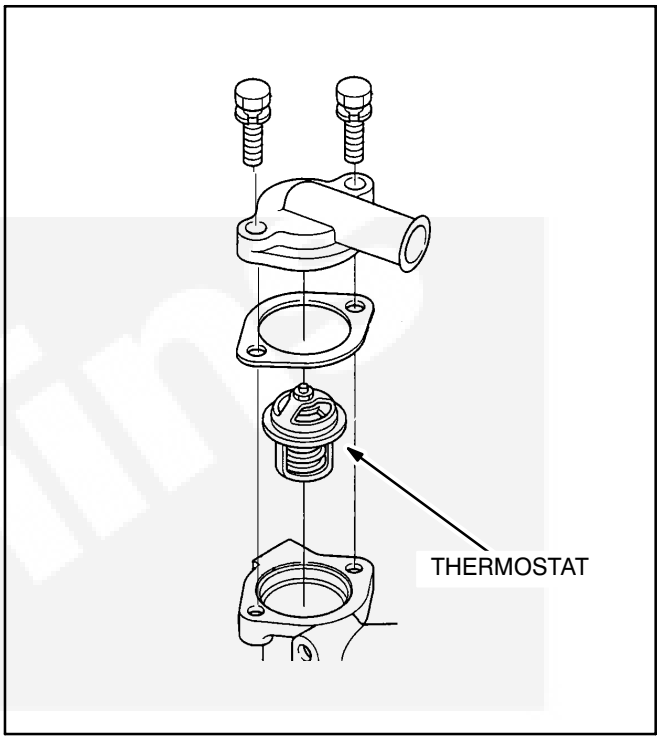


FIGURE 9. THERMOSTAT

Adjusting V-Belt Tension

Referring to Figures 10 and 11, readjust belt tension as follows:

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting.
2. For access, remove the front access door and belt guard, which is secure by 3 wing nuts.
3. Loosen both bolts so that the pump can pivot.
4. Pivot the pump out to tighten belt tension and then tighten the tension adjusting bolt. Check tension by applying 20 pounds (10 kg) to the middle of the pulley span. Belt tension is correct when deflection is 0.4 inch (10 mm).
5. Tighten the bolts, secure the belt guard and front access door and reconnect the battery cables (negative [–] last).

Replacing the Raw Water Pump Impeller

See Table 1 for scheduled replacement. Have towels and containers ready and avoid spilling raw water on the electrical components below the pump. Referring to Figures 11, 12 and 13, replace the impeller as follows:

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting, let the engine cool and *close the sea cock*.
2. For access, remove the front access door, belt guard and top of the enclosure, and if work space is limited, the end panel (Figure 11).

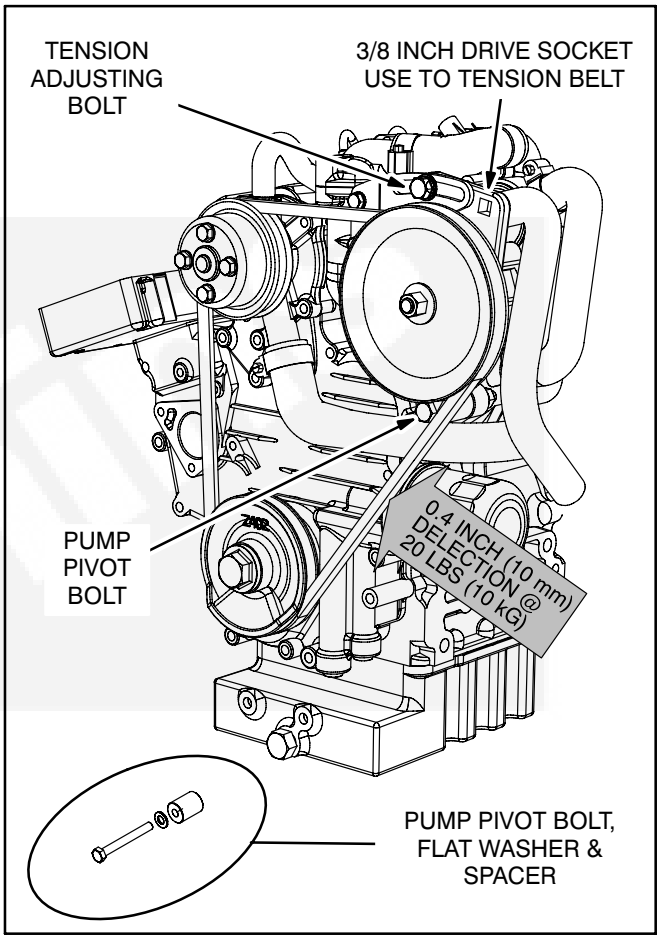


FIGURE 10. ADJUSTING V-BELT TENSION

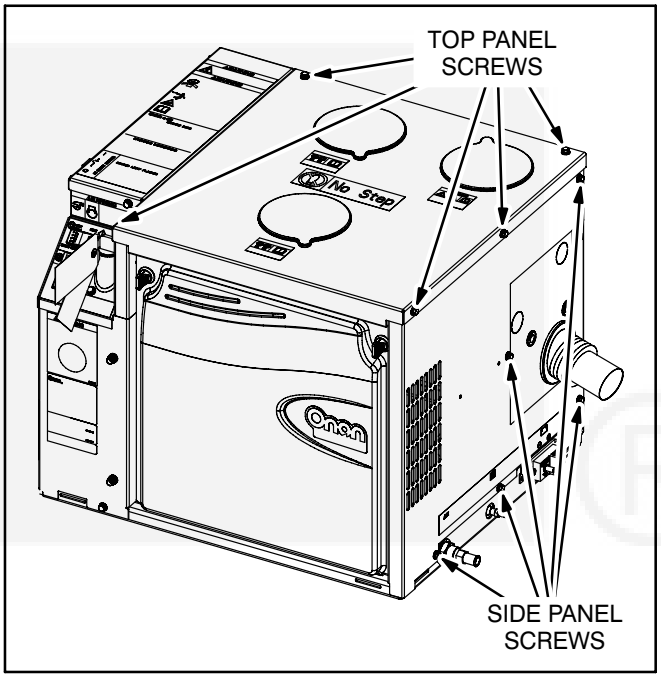


FIGURE 11. ENCLOSURE PANEL SCREWS

3. Loosen the hose clamps shown in Figure 12 and disconnect the hoses.
4. Remove the two pump mounting bolts and belt and pull out the pump.
5. Remove the 4 pump cover screws (Figure 13) and remove the impeller and O-ring. Use two pliers to grip vanes on opposite sides if the impeller is difficult to remove. *It will be necessary to check for and cleanout pieces of the impeller from the heat exchanger and exhaust elbow if vanes have broken off.*
6. Install the new impeller. It helps to twist the impeller counter-clockwise (the way it turns) while squeezing it into the housing.
7. To provide initial lubrication and better pump suction before water reaches the pump, wet the inside of the pump and impeller with water, soap solution or a silicone lubricant and secure the O-ring and cover.

   ⚠ CAUTION ***Do not lubricate with petroleum products like grease and oil which chemically attack impeller materials.***
8. Remount the pump, reconnect the hoses, adjust V-belt tension (Page 22), secure the belt guard, the top of the enclosure and front access door.
9. If the sea water strainer is above the water line, fill it for faster prime and secure its cover.
10. Open the sea cock, reconnect the battery cables (negative [–] last) and start the genset. The genset will shut down within 8 seconds if there is no raw water flow and the *amber* status light will blink fault Code No. 7 (Page 30). If it shuts down, find out why, remove any blockage and restart the genset.

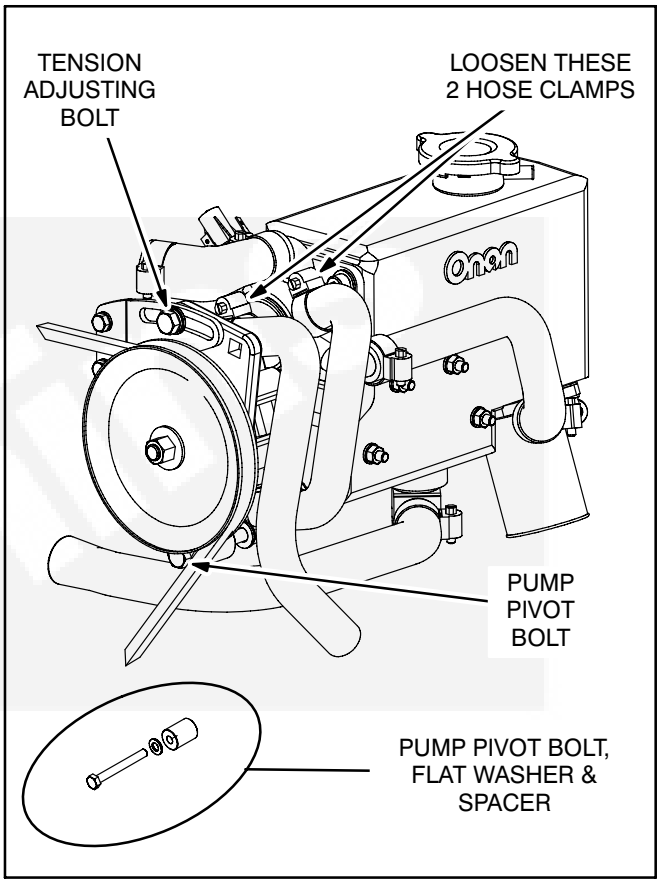


FIGURE 12. REMOVING RAW WATER PUMP

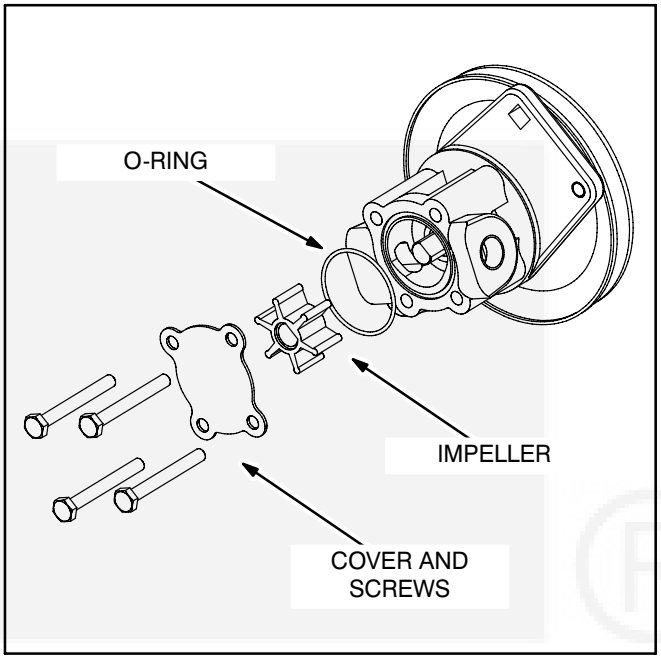


FIGURE 13. REPLACING THE IMPELLER

Heat Exchanger

The heat exchanger has a cleanout cover and drain plug (Figure 14). Clean the raw water tubes if the engine keeps shutting down (Code No. 1) or the *e-Series Digital Display* indicates abnormally high engine temperatures. Drain the heat exchanger if there is a danger of freezing. (Freezing water can damage the heat exchanger raw water tubes. Unlike engine coolant, raw water will freeze in the heat exchanger.)

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

Cleaning and Draining the Heat Exchanger: To clean the tubes or to drain raw water:

1. Disconnect the negative (–) cable at the battery to prevent the engine from starting, let the engine cool and *close the sea cock*.
2. For access, remove the front access door, belt guard, top of the enclosure and end panel (Figure 11).
3. Have towels and containers ready to prevent spilling raw water on the electrical components below the heat exchanger.
4. Removing the raw water pump will make cleaning the tubes easier. (See Replacing the Raw Water Pump Impeller, Page 22.)
5. Remove the drain plug or cleanout cover. Clean and flush the tubes. The drain plug must be removed to get all the water out of the tubes. Do not use metal rods to clean the tubes. The tubes are made of relatively soft copper alloy and can be damaged.
6. Use thread sealant on the drain plug and a new clean out cover gasket if the old one is torn or otherwise damaged. Reassemble all the parts that were disassembled for access. When reconnecting the battery, connect the negative (–) cable last.

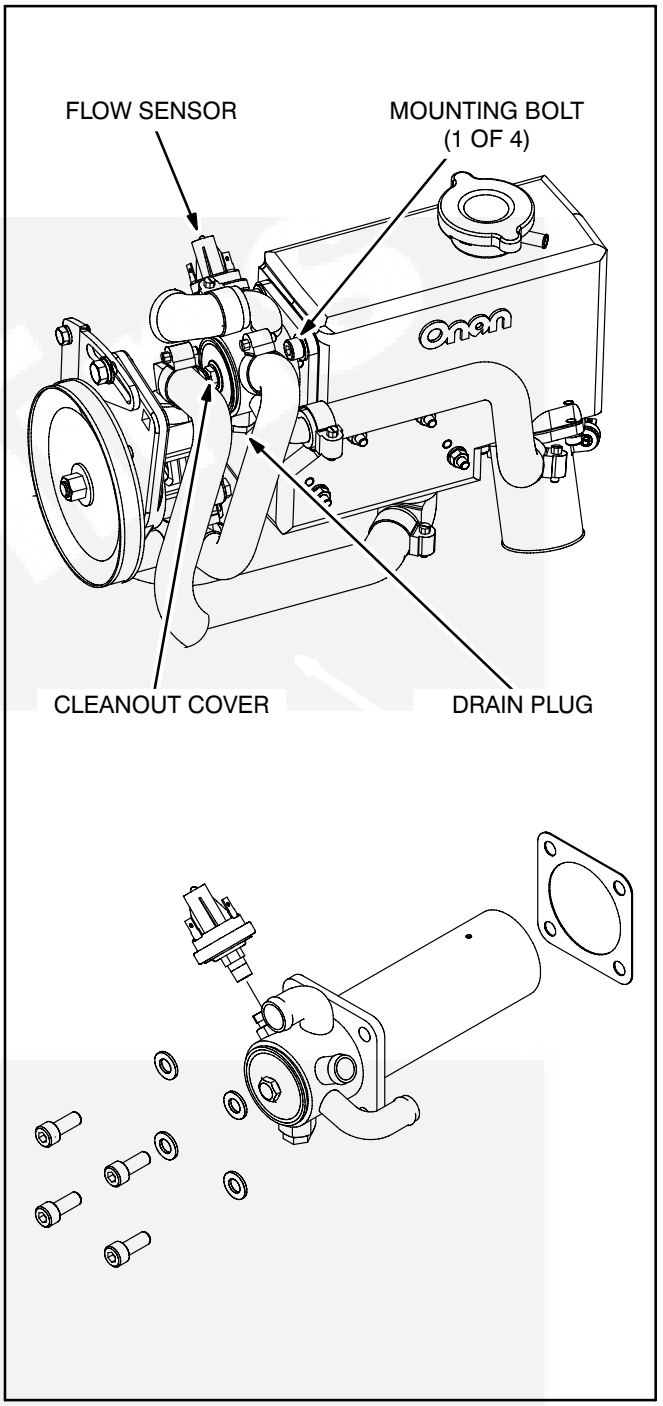


FIGURE 14. ENGINE COOLING HEAT EXCHANGER

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

Removing the Heat Exchanger: Remove the heat exchanger and have it cleaned at a radiator shop if there is hard scale in the tubes. To remove and reinstall the heat exchanger:

1. Perform Steps 1 through 4 under *Cleaning and Draining the Heat Exchanger.*
2. Disconnect the two leads at the flow sensor and remove the sensor.
3. Disconnect the three hoses. (To work the coolant hose elbow off the fitting on the heat exchanger, it will be necessary to loosen the hose clamps on both ends.)
4. Remove the four mounting bolts and withdraw the heat exchanger.

Installing the Heat Exchanger:

1. Clean the mating gasket faces, taking special care not to scratch the face on the aluminum manifold.
2. Use a new gasket and insert the heat exchanger into the manifold. Torque the mounting bolts to 19 lb-ft (26 N-m).
3. Install the flow sensor using pipe thread sealant and reconnect the two leads in the harness.
4. Reconnect the hoses and reassemble all the parts that were disassembled for access. When reconnecting the battery connect the negative (–) cable last.

FLAME ARRESTOR

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

See Table 1 for scheduled maintenance.

1. For access, remove the front access door and top of the enclosure (Figure 11).
2. Remove the 3 screws that secure the intake resonator and lift if off (Figure 15).
3. Remove the 2 screws that secure the flame arrestor to the carburetor inlet elbow and lift it off. Block the intake to prevent objects from falling in while the flame arrestor is off.
4. Carefully clean and examine the flame arrestor. Replace it if it is warped, corroded or has enlarged holes in the steel mesh. Enlarged holes or gaps can let flame through to ignite flammable vapors outside the engine.

   ⚠WARNING ***Always replace a damaged flame arrestor to prevent ignition of gasoline vapors, which can result in severe personal injury or death.***

5. Replace the gaskets if torn and reassemble the parts removed. Torque the 5 assembly screws to 8 lb-ft (11 N-m).
6. Secure the top of the enclosure and front access door and reconnect the battery cables (negative [–] last).

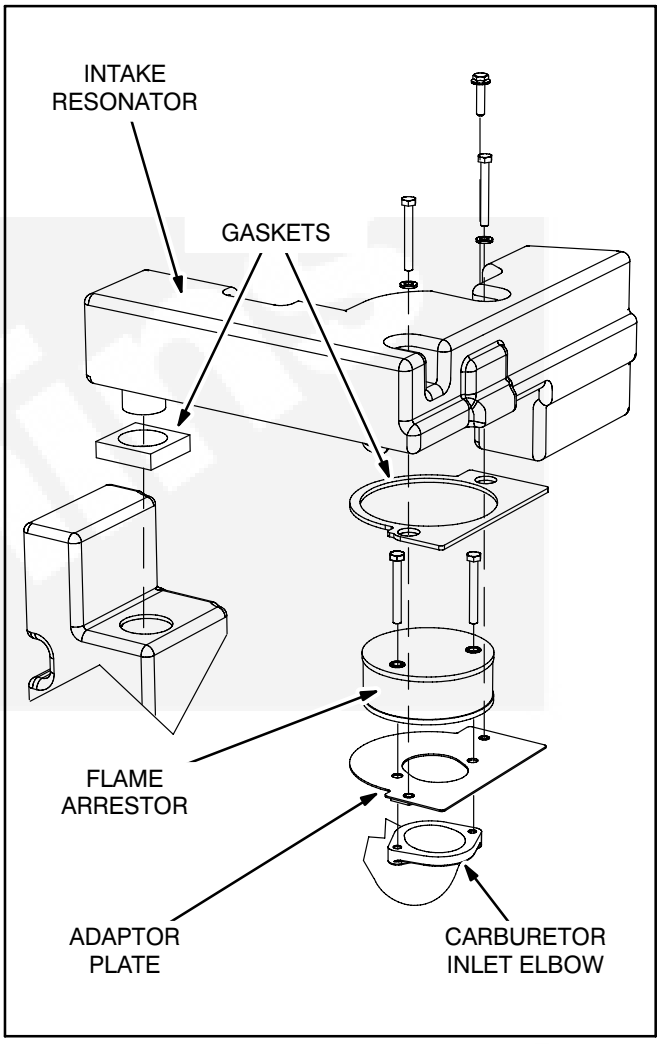


FIGURE 15. FLAME ARRESTOR

SPARK PLUGS

⚠WARNING ***Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting.***

See Table 1 for scheduled replacement. For access, remove the front access door and top of the enclosure (Figure 11).

The 3 spark plugs (Figure 16) must be in good condition for proper engine starting and performance. A spark plug that fouls frequently indicates the need for engine service.

Clear the spark plug wells of dirt and liquid before removing the spark plugs.

Set spark gap at 0.039-0.043 inches (1.0-1.1 mm). To prevent cross threading, always thread a spark plug in by hand until it seats and then torque to 15-18 lbs-ft (20-24 N-m).

Secure the top of the enclosure and front access door and reconnect the battery cables (negative [–] last).

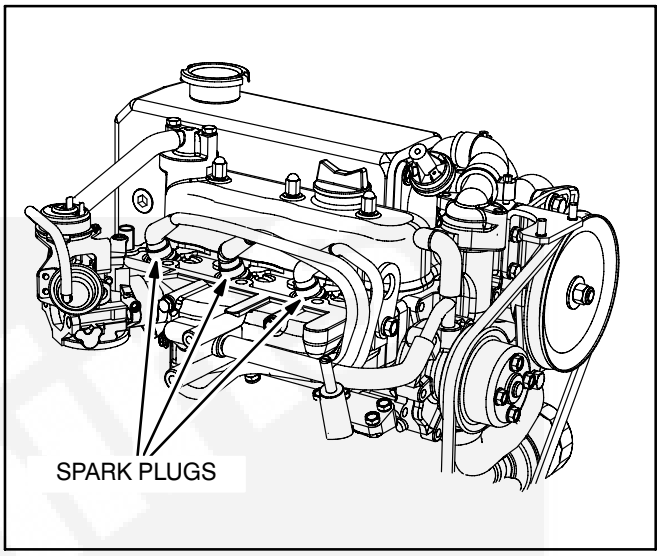


FIGURE 16. SPARK PLUGS

Troubleshooting

TABLE 2 lists the fault shutdown codes in numerical order. Follow the step-by-step procedures to correct the fault. If you are unable to resolve the problem, contact an authorized Onan dealer. See *How to Obtain Service* (Page 42). First note the following:

- Maintaining engine oil and coolant levels, cleaning the sea water strainer, keeping battery connections clean and tight, watching the fuel gauge and not overloading the genset will prevent most shutdowns.
- When the genset and propulsion engines share a common fuel tank, the fuel dip tubes are usually arranged so that the genset will run out of fuel first. Marking the genset empty point on the fuel gauge will make it easier to tell when to stop the genset before running it out of fuel.

TROUBLESHOOTING WITH THE BLINKING AMBER STATUS LIGHT

For the purposes of diagnostics, the genset controller causes the *amber* status light (LED) on the control switch to blink the fault code number when the genset shuts down abnormally. The light will blink 1, 2, 3, 4, 5 or 7 times, pause, and then repeat the blinking. ***The number of blinks corresponds to the Fault Number in TABLE 2.***

- **One blink** indicates shutdown due to high engine temperature.
- **Two blinks** indicate shutdown due to low oil pressure.
- **Three blinks** indicate shutdown due to a condition normally requiring service by someone trained and experienced in marine gasoline genset service. Before assistance arrives, you may be asked to help by accessing the second-level, two-digit shutdown code. To do so, press **STOP** once. The two-digit code consists of 1 to 6 blinks, a brief pause, and then 1 to 9 blinks. The first set of blinks represents the tens digit and the second set of blinks the units digit of the shutdown code number. For example, the light blinks **Fault Code No. 24** as follows:

blink-blink—*pause*—blink-blink-blink-blink—*long pause*—repeat

- **Four blinks** indicate shutdown due to a failure to start within the time allowed for cranking.
- **Five blinks** indicate shutdown initiated by a CO monitor in the vessel.
- **Seven blinks** indicate shutdown due to a loss of raw water flow for engine and exhaust cooling.

Blinking continues for five minutes and stops. Pressing **STOP** three times restores blinking. (If you press **STOP** again, blinking stops entirely and you have to start over by pressing **STOP** three times.)

Note: The last shutdown logged will blink, even though the condition that caused shutdown has been serviced.

TROUBLESHOOTING WITH THE E-SERIES DIGITAL DISPLAY

When a fault occurs, the genset controller will cause the *e-Series Digital Display* (Page 36) to flash the red ALARM LED and display the Fault Number and a brief description of the Fault (Figure 17). Find the corresponding Fault Number in *TABLE 2* and follow the step-by-step procedures to correct the fault.

The *e-Series Digital Display* will display the fault indefinitely. Touch any button to clear the fault. The display will turn off in 5 minutes after the fault has been cleared. Press [◂BACK] to go back to the GEN STATUS screen.

See Page 37 to display the last fault.

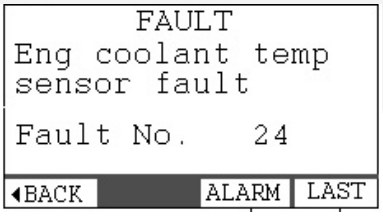


FIGURE 17. TYPICAL FAULT SCREEN

TABLE 2. TROUBLESHOOTING

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only those trained and experienced in marine gasoline genset service may perform service. See Safety Precautions.***

DEAD STATUS INDICATOR LIGHT

(Faulty connections, no battery voltage)

Corrective Action:

1. Try the genset Control Switch if the remote Control Switch does not work, and vice versa.
2. Clean and tighten the positive (+) and negative (–) battery cable connections at the battery and genset (Page 18).
3. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

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 (–) battery cable connections at the battery and genset (Page 18).
2. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.
3. Increase battery cable size or run parallel cables.

STATUS INDICATOR LIGHT STOPS BLINKING OR GOES OUT DURING CRANKING

(Internal short circuit caused automatic-reset circuit protective device to trip)

Corrective Action: Try starting again. See an authorized Onan dealer if the *amber* lamp flashes and then goes out again without the engine starting, or does not light at all with good batteries.

NO POWER—GENSET RUNNING, STATUS LIGHT ON

(Line circuit breaker OFF or tripped)

Corrective Action:

1. Turn on or reset the line circuit breaker on the genset (Page 9).
2. Turn on or reset the line circuit breakers on the main distribution panel in the boat.

HIGH ENGINE TEMPERATURE: NO. 1

(First-level shutdown—Engine coolant temperature exceed design limit)

Corrective Action:

1. Add coolant as necessary and repair leaks (Page 19).
2. Clean the raw water tubes in the heat exchanger, which might be clogged with scale (Page 24).
3. Replace the engine thermostat, which might not be opening fully (Page 21).

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only those trained and experienced in marine gasoline genset service may perform service. See Safety Precautions.***

LOW OIL PRESSURE: NO. 2

(First-level shutdown—Low oil pressure)

Corrective Action:

1. Add engine oil as necessary (Page 16) and repair any leaks.
2. Drain excess oil (above top bead on dipstick).

SERVICE CHECK: NO. 3

(First-level shutdown—Indicates presence of second-level shutdown)

Corrective Action: Check the second-level shutdown code by pressing **STOP** once. The second-level shutdown code will have two-digits. The shutdowns are listed below in numerical order.

Note: Does not apply to the e-Series Digital Display.

OVERCRANK: NO. 4

(First-level shutdown—Cranking exceeded 20 to 60 seconds [temperature dependent] without start)

Corrective Action:

1. Check the fuel tank and fill as necessary. (Note: The arrangement of pickup tubes in the fuel supply tank probably is such that the genset will run out of fuel before the propulsion engines.)
2. Open any closed fuel valves.
3. Prime the engine fuel system by holding the control switch at **Stop**/**Prime** for 30 seconds.
4. Try restarting. The thermal choke may not have reset completely.
5. Reconnect any loose spark plug or ignition coil lead (Page 26).
6. Replace the in-line fuel filter.

WARNING—SHUTDOWN DUE TO VESSEL CO: NO. 5

(First-level shutdown—Genset was shut down by a Carbon Monoxide Detector)

Corrective Action: Get everyone out into fresh air immediately and seek medical attention.

LOSS OF RAW WATER FLOW: NO. 7

(First-level shutdown—Low raw water pressure in heat exchanger)

Corrective Action:

1. Open the sea cock.
2. Close the sea cock and clean the sea water strainer. If the strainer is above the water line, fill it with water to assist priming. Secure the strainer cover and reopen the sea cock.
3. Reconnect or replace any disconnected or leaking raw water hoses (Page 19).
4. Replace the raw water impeller (Page 22).
5. Have the bottom of the hull inspected for blockage of the raw water strainer.

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only those trained and experienced in marine gasoline genset service may perform service. See Safety Precautions.***
HIGH AC VOLTAGE: NO. 12 (Controller unable to maintain rated voltage) **Corrective Action:** See an authorized Onan dealer.
LOW AC VOLTAGE: NO. 13 (Controller unable to maintain rated voltage) **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. Check the fuel tank and fill as necessary. (Note: The arrangement of pickup tubes in the fuel supply tank probably is such that the genset will run out of fuel before the propulsion engines.) 3. Reconnect any loose spark plug or ignition coil lead (Page 26). 4. Replace the in-line fuel filter.
HIGH AC FREQUENCY: NO. 14 (Engine governor unable to maintain rated frequency) **Corrective Action:** See an authorized Onan dealer.
LOW AC FREQUENCY: NO. 15 (Engine governor unable to maintain rated frequency) **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. Check the fuel tank and fill as necessary. (Note: The arrangement of pickup tubes in the fuel supply tank probably is such that the genset will run out of fuel before the propulsion engines.) 3. Reconnect any loose spark plug or ignition coil lead (Page 26). 4. Replace the in-line fuel filter.
GOVERNOR SHORT OR OPEN: NO. 19 (Controller sensed an open or short circuit in actuator circuit) **Corrective Action:** See an authorized Onan dealer.

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only those trained and experienced in marine gasoline genset service may perform service. See Safety Precautions.***

GOVERNOR OVERLOAD: NO. 22

(Maximum allowable time at full-duty cycle was exceeded)

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. Check the fuel tank and fill as necessary. (Note: The arrangement of pickup tubes in the fuel supply tank probably is such that the genset will run out of fuel before the propulsion engines.)
3. Reconnect any loose spark plug or ignition coil lead (Page 26).
4. Replace the in-line fuel filter.

FAULTY OIL PRESSURE SENDER: NO. 23

(Controller sensed shorted or grounded sender)

Corrective Action: Look for a loose oil pressure sender lead and reconnect it if necessary. The sender is directly behind the oil filter (Page 17).

FAULTY ENGINE TEMP SENDER: NO. 24

(Controller sensed open or grounded sender)

Corrective Action: Look for a loose temperature sender lead and reconnect it if necessary. The sender is directly behind the last spark plug (Page 27).

LOSS OF AC VOLTAGE SENSE: NO. 27

(Controller unable to sense output voltage)

Corrective Action: See an authorized Onan dealer.

HIGH BATTERY VOLTAGE: NO. 29

(Battery system at more than 19.2 volts)

Corrective Action:

1. Check battery bank connections and reconnect if necessary to supply 12 volts.
2. Select a lower boost charge rate on the boat battery charger.

STARTING FAULT: NO. 32

(Cranking not detected)

Corrective Action: See an authorized Onan dealer.

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only those trained and experienced in marine gasoline genset service may perform service. See Safety Precautions.***

CONTROL CARD FAILURE—EE: NO. 35

(Microprocessor EEPROM error during self-test)

Corrective Action: See an authorized Onan dealer.

UNKNOWN SHUTDOWN—SEE MANUAL: NO. 36

(Engine stopped without command by controller)

Corrective Action:

1. Open any closed fuel supply valves.
2. Check the fuel tank and fill as necessary. (Note: The arrangement of pickup tubes in the fuel supply tank probably is such that the genset will run out of fuel before the propulsion engines.)
3. Check for mechanical damage and service as necessary.
4. Remove any blockage in the combustion air inlet (left end of genset).
5. Reconnect any loose spark plug or ignition coil lead (Page 26).
6. Replace the in-line fuel filter.

INVALID GENSET CONFIGURATION: NO. 37

(Controller cannot determine genset operating parameters)

Corrective Action: See an authorized Onan dealer.

HIGH FIELD VOLTAGE: NO. 38

(Low power factor loads)

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. Have air conditioners and other appliances checked for proper operation. (A locked compressor rotor can cause very low power factor.)
3. Check the fuel tank and fill as necessary. (Note: The arrangement of pickup tubes in the fuel supply tank probably is such that the genset will run out of fuel before the propulsion engines.)
4. Reconnect any loose spark plug or ignition coil lead (Page 26).
5. Replace the in-line fuel filter.

LOW BATTERY VOLTAGE: NO. 39

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

Corrective Action:

1. Clean and tighten the positive (+) and negative (–) battery cable connections at the battery and genset (Page 18).
2. Recharge or replace the battery. Refer to the battery manufacturer's recommendations.

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only those trained and experienced in marine gasoline genset service may perform service. See Safety Precautions.***
GROUNDED FIELD: NO. 41 (Controller unable to sense field or output voltage) **Corrective Action:** See an authorized Onan dealer.
CONTROL CARD FAILURE–ROM: NO. 42 (Microprocessor ROM error during self-test) **Corrective Action:** See an authorized Onan dealer.
CONTROL CARD FAILURE–RAM: NO. 43 (Microprocessor RAM error during self-test) **Corrective Action:** See an authorized Onan dealer.
SPEED SENSE LOST: NO. 45 (Controller unable to sense field voltage) **Corrective Action:** See an authorized Onan dealer.
CONTROL CARD FIELD SENSE LOST: NO. 48 (Controller unable to sense field voltage) **Corrective Action:** See an authorized Onan dealer.
OVERPRIME: NO. 57 (Prime mode exceeded 5 minutes) **Corrective Action:** Check for and remove any object that may be holding any control switch in the prime position.

TABLE 2. TROUBLESHOOTING (CONT.)

⚠ WARNING ***Some genset service procedures present hazards that can result in severe personal injury or death. Only those trained and experienced in marine gasoline genset service may perform service. See Safety Precautions.***
HIGH EXHAUST TEMPERATURE: NO. 58 (Exhaust temperature exceeded design limits) **Corrective Action:** 1. Check for and reconnect or replace any disconnected or leaking raw water hoses (Page 19). 2. Check for and replace a worn raw water impeller (Page 23).
EMERGENCY SHUTDOWN: NO. 61 (Genset was shut down by a fire suppression system or other external control connected to genset) **Corrective Action:** Make all necessary repairs to the genset and connected equipment and reset the external control which shut down the genset.

e-Series Digital Display

The *e-Series Digital Display* has an LCD panel with 4 navigation buttons, 3 LEDs, a **START** button, and a **STOP** button.

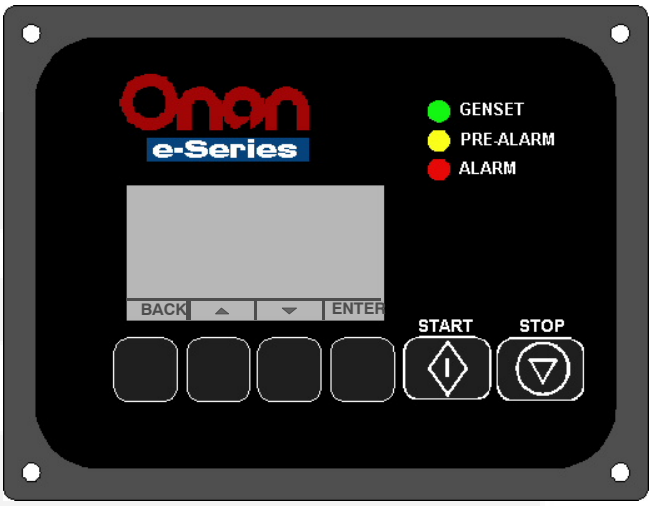


FIGURE 18. E-SERIES DIGITAL DISPLAY

TURNING ON THE DISPLAY

Touch any button to turn on the *e-Series Digital Display*. The LCD back light will turn on. All connected *e-Series Digital Displays* will turn on automatically when the genset is started at any station. They will all turn off 5 minutes after the genset shuts down.

START BUTTON

BEFORE PUSHING START, go to Page 10 and review *Exhaust Gas Warning*, Pre-start Checks, Genset Compartment Ventilation and Starting.

Push and hold the **START** button until the blinking **GENSET** LED (green) stays on, indicating that the genset is producing AC voltage. *Status* on the GEN STATUS screen will change from *Starting* to *Running* (Figure 19).

STOP BUTTON

Stopping Genset: Momentarily press the **STOP** button. See STOPPING THE GENSET (Page 11). *Status* on the GEN STATUS screen will change to *Stopped* (Figure 19).

Priming Fuel System: Press and hold the **STOP** button. *Status* on the GEN STATUS screen will display *Priming* (Figure 19).

GENSET STATUS SCREENS

Genset status is displayed on 3 screens (Figure 19). GEN STATUS PG1 will display when the display is turned on. Press the double arrows [⏬] to go to GEN STATUS PG2, again to go to GEN STATUS PG3 and again to go to GEN STATUS PG1.

The *Status* line will display the word *Priming*, *Starting*, *Running* or *Stopped*. The status screens also display engine coolant temperature and oil pressure, battery voltage and total genset running time.

Note: The total time on the master hour meter on the genset control panel (Page 9) prevails if the total time on the e-Series Digital Display is different.

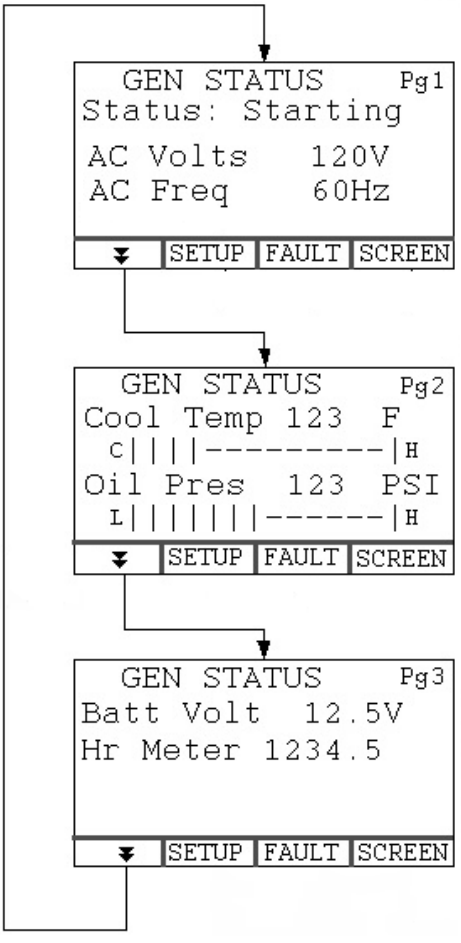


FIGURE 19. TYPICAL GENSET STATUS SCREENS

FAULT SCREENS

Active Fault

When a fault occurs, the genset controller will cause the *e-Series Digital Display* to flash the red ALARM LED and display the Fault Number and a brief description of the Fault (Figure 20). Find the corresponding Fault Number in *TABLE 2. TROUBLESHOOTING* (Page 29) and follow the step-by-step procedures to correct the fault.

The *e-Series Digital Display* will display the fault indefinitely. Touch any button to clear the fault. The display will turn off in 5 minutes after the fault has been cleared. Press [◂BACK] to go back to the GEN STATUS screen.

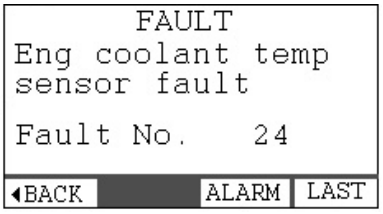


FIGURE 20. TYPICAL FAULT SCREEN

Last Fault

Touch any button again to turn on the *e-Series Digital Display.* Press the FAULT button on the GEN STATUS screen to display the FAULT screen (Figure 21). If there is an active fault, the FAULT screen will display the *Fault Number* and description of the fault. If there is no active fault, the fault screen will display *No Active Fault*.

To display the LAST FAULT screen, press the LAST button on the FAULT screen. The LAST FAULT screen will display the *Fault Number* and description of the last Fault. Press [◂BACK] to go back to GEN STATUS.

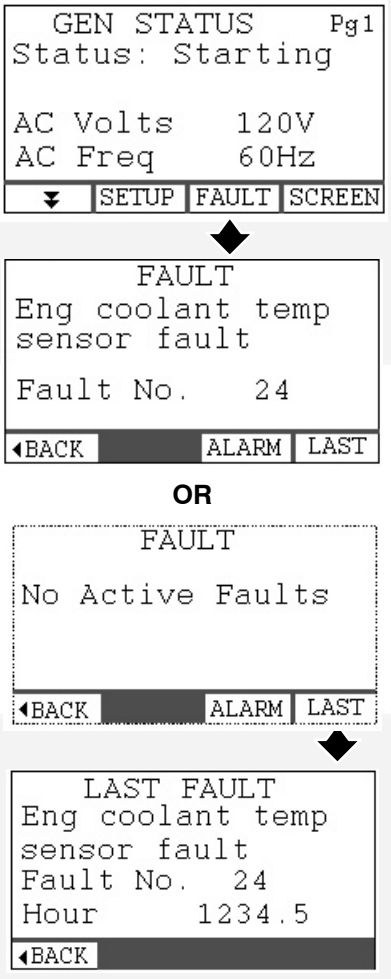


FIGURE 21. LAST FAULT

PRE-ALARM SCREENS

When engine oil pressure or temperature reach set points near the limits where the control shuts down the genset, the *e-Series Digital Display* will flash the amber PRE-ALARM LED and display *Low Oil Pressure* or *High Engine Temperature* on the PRE-ALARM screen (Figure 22). Press [◂BACK] to go back to GEN STATUS to monitor the engine temperature or oil pressure.

Shut down the genset and perform the maintenance or service required to restore normal operation.

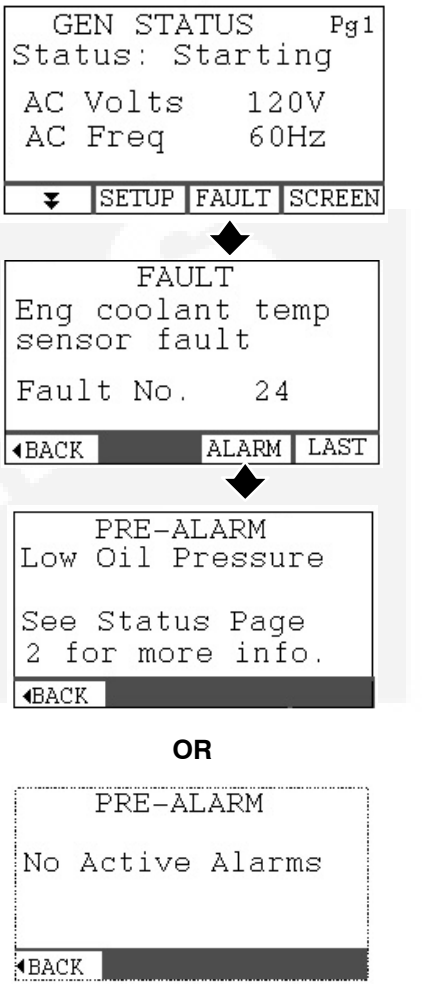


FIGURE 22. PRE-ALARM SCREENS

BRIGHTNESS AND CONTRAST

To adjust the brightness and contrast of the LCD screen and LEDs, go to the SCREEN ADJUST screen by pressing SCREEN on any GEN STATUS screen (Figure 23). Press NEXT to toggle between *Brightness* and *Contrast*. Increase or decrease the selected item by pressing the increase-decrease buttons [◀ ▶]. Press [◀BACK] to save the settings and go back to GEN STATUS.

SETUP

To change the units of measure for engine temperature and pressure (GEN STATUS PG2), press the SETUP button (Figure 24). Press the up-down arrows [▼ ▲] to toggle between SAE and METRIC units. Press [◀BACK] to save the selection and go back to GEN STATUS.

GENSET AND DISPLAY INFORMATION

To display genset information, press the INFO button on the SETUP screen (Figure 24). To display Display information, press the DISP button on the GENSET INFO screen. Keep pressing [◀BACK] to get back to GEN STATUS.

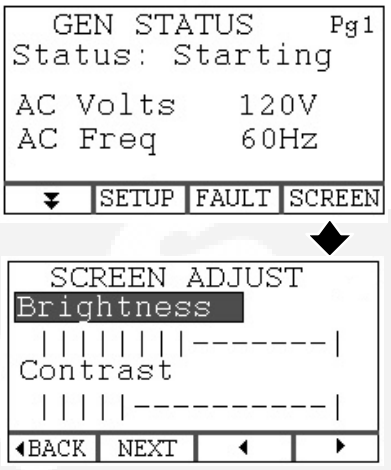


FIGURE 23. SCREEN BRIGHTNESS & CONTRAST

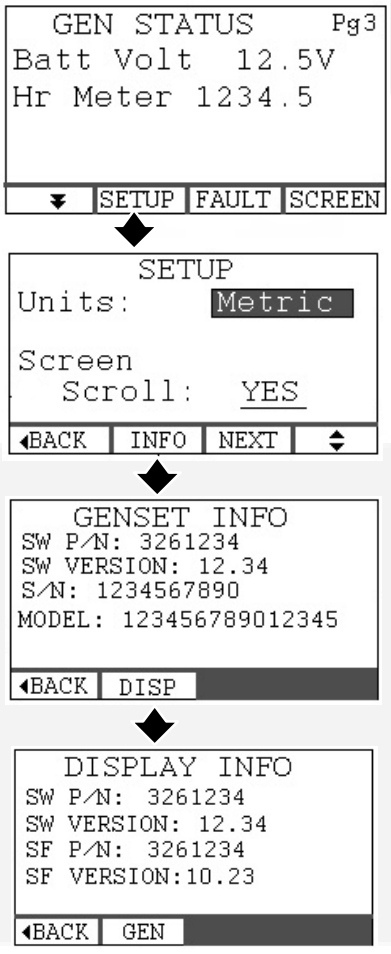


FIGURE 24. SETUP & GENSET & DISPLAY INFO

Specifications

		MGKBC	MGKBD
GENERATOR: Two-Bearing, 2-Pole Rotating Field, Microprocessor Regulated. See Genset Nameplate for Rating			
FUEL CONSUMPTION:			
60 Hz:	Full Load Half Load	1.59 gph (6.0 liter/hr) 0.95 gph (3.6 liter/hr)	1.4 gph (5.3 liter/hr) 0.77 gph (2.9 liter/hr)
50 Hz:	Full Load Half Load	1.4 gph (5.3 liter/hr) 0.77 gph (2.9 liter/hr)	– –
Engine/Generator Speed:	60 Hz 50 Hz	2900/3600 rpm 2400/3000 rpm	2400/3600 rpm –
ENGINE: 4-Stroke Cycle, Spark-Ignited, Water Cooled, Microprocessor Governed (Isochronous)			
Number of Cylinders		3	3
Bore		2.68 inch (68 mm)	2.68 inch (68 mm)
Stroke		2.68 inch (68 mm)	2.68 inch (68 mm)
Displacement		45.2 inch^3 (740 cm^3)	45.2 inch^3 (740 cm^3)
Compression Ratio		9.2:1	9.2:1
Firing Order (Clockwise Rotation)		1-2-3	1-2-3
Ignition Timing		18° BTDC	18° BTDC
Spark Plug Gap		0.039 – 0.043 inch (1.0 – 1.1 mm)	0.039 – 0.043 inch (1.0 – 1.1 mm)
Valve Lash (cold)		0.0059 – 0.0073 inch (0.145 – 0.185 mm)	0.0059 – 0.0073 inch (0.145 – 0.185 mm)
Engine Oil Capacity		2.0 quart (1.9 liter)	2.0 quart (1.9 liter)
Engine Oil Drain Connection		3/8 NPT	3/8 NPT
Coolant Capacity		3.3 quart (3.1 liter)	3.3 quart (3.1 liter)
Coolant Flow:	60 Hz 50 Hz	3.5 gpm (13 liter/min) 3.0 gpm (16 liter/min)	3.5 gpm (13 liter/min) –
Raw Water Flow:	60 Hz 50 Hz	5.0 gpm (19 liter/min) 4.0 gpm (15 liter/min)	5.0 gpm (19 liter/min) –
Maximum Raw Water Pump Lift		4 feet (1.2 m) with 5/8 inch ID hose	4 feet (1.2 m) with 5/8 inch ID hose
Raw Water Inlet Connection		5/8 inch (15.9 mm) ID Hose	5/8 inch (15.9 mm) ID Hose
Maximum Fuel Pump Lift		4 feet (1.2 m) with 1/4 inch ID fuel line	4 feet (1.2 m) with 1/4 inch ID fuel line
Required Fuel Line Size		1/4 inch (6.4 mm) ID	1/4 inch (6.4 mm) ID
Fuel Supply Connection		1/8 NPT female	1/8 NPT female
Wet Exhaust Outlet Connection		2.0 inch (50.8 mm) ID Hose	2.0 inch (50.8 mm) ID Hose
Maximum Exhaust Back Pressure		3 inch (76 mm) Hg	3 inch (76 mm) Hg
Combustion Air Flow:	60 Hz 50 Hz	32 cfm (0.91 m^3/min) 26.7 cfm (0.76 m^3/min)	26.7 cfm (0.76 m^3/min) –
Generator Cooling Air:	60 Hz 50 Hz	100 cfm (2.83 m^3/min) 80 cfm (2.26 m^3/min)	100 cfm (2.83 m^3/min) –
BATTERIES:			
Nominal Battery Voltage		12 volts	12 volts
Minimum CCA Rating		360 amps	360 amps
Battery Charging Output (Optional)		3 amps	3 amps
SIZE, WEIGHT, NOISE:			
Size: L x W x H		26.6 x 23 x 21.1 inch (676 x 583 x 535 mm)	26.6 x 23 x 21.1 inch (676 x 583 x 535 mm)
Weight (dry)		425 lbs (193 kg)	425 lbs (193 kg)
Noise (Full Load @ 1 m):	60 Hz 50 Hz	71 dB(A) 69 dB(A)	69 dB(A) –

Emissions

This genset meets the requirements of California's Exhaust Emissions Standards as stated on the nameplate. Figure 1 (Page 6) illustrates where this information appears on the nameplate.

California users of this genset should 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 engine label is prohibited.

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

California genset users may use Table 3 as an aid in locating information related to the California Air Resources Board requirements for emissions control.

TABLE 3. EMISSIONS CONTROL INFORMATION

Emissions 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 Fuel Requirements	The engine is certified to operate on unleaded gasoline. See FUEL RECOMMENDATIONS (Page 7).
Engine Valve Lash	See *Specifications* (Page 40).
Engine Ignition Timing	See *Specifications* (Page 40).
Engine Lubricating Oil Requirements	See ENGINE OIL RECOMMENDATIONS (Page 7).
Engine Adjustments	None.
Engine Emission Control System	The engine emission control system consists of engine design and precision manufacture.

How to Obtain Service

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

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

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

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

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

Before calling for service, have the following information available:

1. *The complete genset model number and serial number. See Nameplate (Page 6).*
2. *The date of purchase.*
3. *The nature of the problem. See Troubleshooting (Page 29).*

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

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

Maintenance Record

Record all periodic and unscheduled maintenance and service. See *Periodic Maintenance* (Page 14).

DATE	HOUR METER READING	MAINTENANCE OR SERVICE PERFORMED

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

Cummins Power Generation
1400 73rd Ave. NE
Minneapolis, MN 55432 USA

Phone 1 763 574 5000
Toll-free 1 800 888 6626
Fax 1 763 574 5298
Email ask.powergen@cummins.com
www.cumminspower.com