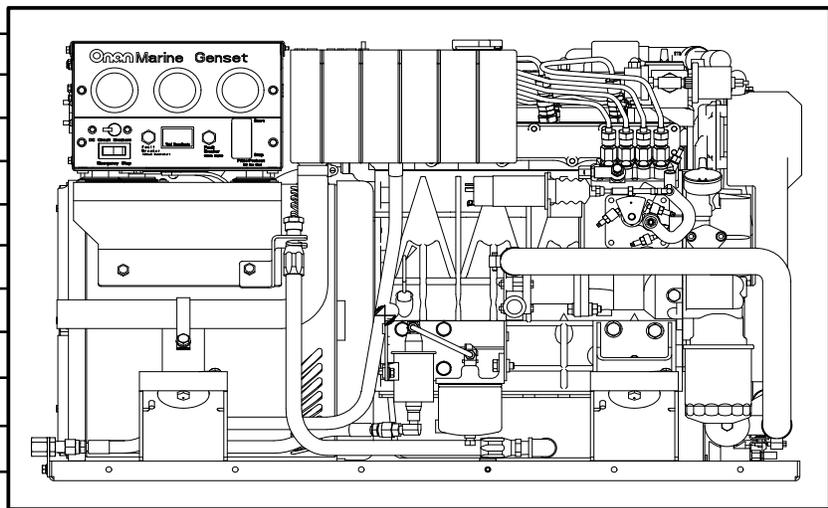
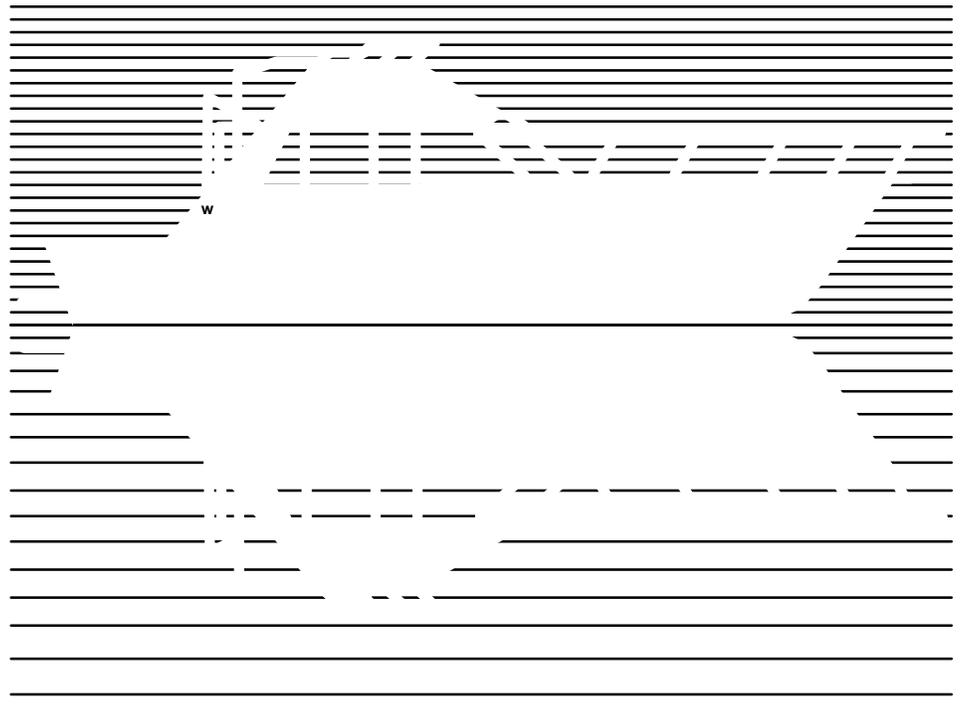




MARINE

Operator's Manual

MDKAL, MDKAA, MDKAB



California

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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Safety Precautions

Thoroughly read the **OPERATOR'S MANUAL** before operating the genset. Safe operation and top performance can be obtained only by proper operation and maintenance.

The following symbols in this Manual alert you to potential hazards to the operator, 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.

Electricity, fuel, exhaust, moving parts and batteries 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.
- Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray out and cause severe burns.
- 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.
- Do not step on the genset, as when entering or leaving the engine room. The stress can break genset parts leading to possible fuel or exhaust leaks or electricution.

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, damage to equipment and fire. 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 on the ground or floor.

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.
- Use approved non-conductive flexible fuel hose for fuel connections at the genset.

ENGINE EXHAUST IS DEADLY!

- Learn the symptoms of carbon monoxide poisoning in this manual.
- Never sleep in the vessel with the genset running unless the vessel is equipped with a working carbon monoxide detector.
- The exhaust system must be installed in accordance with the genset Installation Manual and be free of leaks.
- Make sure the bilge is adequately ventilated with a power exhauster.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- When disconnecting or reconnecting battery cables, always disconnect the negative (-) battery cable first and reconnect it last to reduce arcing.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. ***Do not operate a diesel-powered genset where a flammable vapor environment can be created by fuel spill, leak, etc., unless the genset is equipped with an automatic safety device to block the air intake and stop the engine.*** The owners and operators of the genset are solely responsible for operating the genset safely. Contact your authorized Onan/Cummins dealer or distributor for more information.

POST THESE SUGGESTIONS IN POTENTIAL HAZARD AREAS OF THE VESSEL

Specifications

	MDKAL	MDKAA	MDKAB
GENERATOR: Single-Bearing, 4-Pole Rotating Field, Brushless, Electronically Regulated ($\pm 1\%$)			
60 Hz, 1-Ph Output @ 1.0 PF	8.0 kW, 8.0 kVA	10.5 kW, 10.5 kVA	12.5 kW, 12.5 kVA
50 Hz, 1-Ph Output @ 1.0 PF	6.5 kW, 6.5 kVA	8.5 kW, 8.5 kVA	10.0 kW, 10.0 kVA
60 Hz, 3-Ph Output @ 0.8 PF	8.0 kW, 10.0 kVA	10.5 kW, 13.1 kVA	12.5 kW, 15.6 kVA
50 Hz, 3-Ph Output @ 0.8 PF	6.5 kW, 8.13 kVA	8.5 kW, 10.6 kVA	10.0 kW, 12.5 kVA
FUEL CONSUMPTION:			
60 Hz: Full Load	0.8 gph (3.0 liter/hr)	1.0 gph (3.8 liter/hr)	1.2 gph (4.5 liter/hr)
Half Load	0.5 gph (1.9 liter/hr)	0.6 gph (2.3 liter/hr)	0.7 gph (2.6 liter/hr)
50 Hz: Full Load	0.7 gph (2.6 liter/hr)	0.8 gph (3.0 liter/hr)	0.9 gph (3.4 liter/hr)
Half Load	0.4 gph (1.5 liter/hr)	0.5 gph (1.9 liter/hr)	0.5 gph (1.9 liter/hr)
ENGINE: 4-Stroke Cycle, Indirect Injection Diesel, Water Cooled, Mechanically Governed (5% droop)			
Number of Cylinders	3	4	4
Bore	2.99 inch (76 mm)	2.99 inch (76 mm)	3.07 inch (78 mm)
Stroke	3.09 inch (78.4 mm)	2.90 inch (73.6 mm)	3.09 inch (78.4 mm)
Displacement	68 inch ³ (1124 cm ³)	81.5 inch ³ (1335 cm ³)	91.4 inch ³ (1498 cm ³)
Compression Ratio	22:1	22:1	22:1
Firing Order (Clockwise Rotation)	1-2-3	1-2-4-3	1-2-4-3
Fuel Injection Timing	15.5° - 17.5° BTDC	15.5° - 17.5° BTDC	15.5° - 17.5° BTDC
Valve Lash (cold)	0.0071 - 0.0087 inch (0.18 - 0.22 mm)	0.0071 - 0.0087 inch (0.18 - 0.22 mm)	0.0071 - 0.0087 inch (0.18 - 0.22 mm)
Engine Oil Capacity	4.2 quart (4.0 liter)	4.5 quart (4.3 liter)	4.5 quart (4.3 liter)
Engine Oil Drain Connection	3/8 NPT	3/8 NPT	3/8 NPT
Coolant Capacity	4.2 quart (4.0 liter)	5.3 quart (5.0 liter)	5.3 quart (5.0 liter)
Coolant Flow Rate: 60 Hz	5.0 gpm (19 liter/min)	5.0 gpm (19 liter/min)	5.0 gpm (19 liter/min)
50 Hz	4.2 gpm (16 liter/min)	4.2 gpm (16 liter/min)	4.2 gpm (16 liter/min)
Sea Water Flow Rate: 60 Hz	6.0 gpm (23 liter/min)	6.0 gpm (23 liter/min)	6.0 gpm (23 liter/min)
50 Hz	5.0 gpm (19 liter/min)	5.0 gpm (19 liter/min)	5.0 gpm (19 liter/min)
Maximum Sea Water Pump Lift	4 feet (1.2 m)	4 feet (1.2 m)	4 feet (1.2 m)
Sea Water Inlet Connection	1.0 inch (25.4 mm) ID Hose	1.0 inch (25.4 mm) ID Hose	1.0 inch (25.4 mm) ID Hose
Maximum Fuel Pump Lift	4 feet (1.2 m)	4 feet (1.2 m)	4 feet (1.2 m)
Fuel Supply Connection	1/4 NPT female	1/4 NPT female	1/4 NPT female
Fuel Return Connection	1/4 NPT female	1/4 NPT female	1/4 NPT female
Maximum Exhaust Back Pressure	3 inch (76 mm) Hg	3 inch (76 mm) Hg	3 inch (76 mm) Hg
Wet Exhaust Outlet Connection	2.0 inch (50.8 mm) ID Hose	2.0 inch (50.8 mm) ID Hose	2.0 inch (50.8 mm) ID Hose
Dry Exhaust Outlet Connection	1-1/4 NPT	1-1/4 NPT	1-1/4 NPT
BATTERIES:			
Nominal Battery Voltage*	12 volts	12 volts	12 volts
Minimum CCA Rating	360 amps	500 amps	500 amps
Charging Alternator Output	10 amps	10 amps	10 amps
APPROXIMATE WEIGHTS AND DIMENSIONS:			
<i>Without Sound Shield</i>			
Wet Weight	540 lbs (245 kg)	625 lbs (284 kg)	625 lbs (284 kg)
Dimensions: L x W x H	32.5 x 18.9 x 22.1 inch (826 x 479 x 562 mm)	37.3 x 18.9 x 22.1 inch (946 x 479 x 562 mm)	37.3 x 18.9 x 22.1 inch (946 x 479 x 562 mm)
<i>With Sound Shield</i>			
Wet Weight	625 lbs (284 kg)	710 lbs (322 kg)	710 lbs (322 kg)
Dimensions: L x W x H	36.0 x 22.4 x 23.5 inch (915 x 568 x 596 mm)	40.8 x 22.4 x 23.5 inch (1037 x 568 x 596 mm)	40.8 x 22.4 x 23.5 inch (1037 x 568 x 596 mm)

* - Isolated ground and 24 volt battery systems are available as options.

Introduction

ABOUT THIS MANUAL

This manual covers operation and maintenance of the model MDKAL, MDKAA and MDKAB generator sets (gensets). Study this manual carefully and observe all of its instructions and precautions. Using the genset properly and maintaining it regularly will promote longer genset life, better performance, and safer operation. Each operator should become thoroughly familiar with this manual. Keep this manual in a convenient location for quick reference.

MODEL IDENTIFICATION

When you call for service or parts have the genset model number and serial number ready (Figure 1). For ready reference, record these numbers in the boxes shown.

FUEL RECOMMENDATIONS

High quality fuel is necessary for good performance and long engine life. Use No. 2 diesel fuel (ASTM 2-D) with a Cetane number of not less than 45 and sulfur content of not more than 0.5 percent (by weight). Where fuel is exposed to cold ambient temperatures, use fuel that has a cloud point (temperature at which wax crystals begin to form) at least 10 degrees below the lowest expected fuel temperature.

⚠WARNING *Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near fuel tanks or fuel-burning equipment or in areas sharing ventilation with such equipment. Keep flames, sparks, pilot flames, electrical arcs and switches and all other sources of ignition well away. Keep a type ABC fire extinguisher handy.*

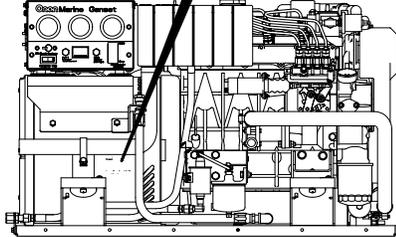
IMPORTANT ENGINE INFORMATION

	ONAN CORPORATION 1400 73rd Ave. NE Minneapolis, MN 55432 Made in U.S.A.	
Model No.: 10.5MDKAA/92989A		
S/N: A980123456		
AC Volts:	Ph: kW:	
Amps:	Pr: RPM:	
Fuel:	Hz: Bat: 12V	
Insulation - NEMA Class	Ambient: 40°C	INI 3461 URC

REFER TO OPERATOR'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS.

THIS ENGINE MEETS 1995-1998 CALIFORNIA EMISSIONS REGULATIONS FOR ULGE ENGINES.

SKB1.3U6D2RA



RECORD MODEL AND SERIAL NUMBERS HERE

MODEL NUMBER

SERIAL NUMBER

FIGURE 1. TYPICAL NAMEPLATE

ENGINE OIL RECOMMENDATIONS

Use premium quality motor oil. Look for the API (American Petroleum Institute) classification and use Class CG-4, CF-4, CF or better oil. Also look for the SAE (Society of Automotive Engineers) viscosity grade. Referring to Figure 2, choose the viscosity grade appropriate for the range of ambient temperatures expected before the next scheduled oil change. Multi-grade oils such as SAE 15W-40 are recommended for year-round use.

BATTERIES

The genset requires either a 12 volt or 24 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* for battery requirements and *Periodic Maintenance* for battery care.

FIRE EXTINGUISHER PORT—GENSETS WITH SOUND SHIELDS

Gensets with sound shields have a fire extinguisher port accessible by breaking through the circle on the warning label located as shown in Figure 3. **Make sure that the nozzle of the fire extinguisher that will be used in the event of fire is smaller than the circle so that it will fit through the port.** The fire extinguisher must be of the gaseous type.

In the event of fire:

1. Do not open the genset sound shield.
2. Shut down engines, generators and blowers.
3. Break through the circle on the label with the nozzle and discharge the full contents of the fire extinguisher.

TYPICAL GENSET CONFIGURATION

Figures 4 and 5 illustrate the typical configuration of a genset, showing the components on the service and non-service sides.

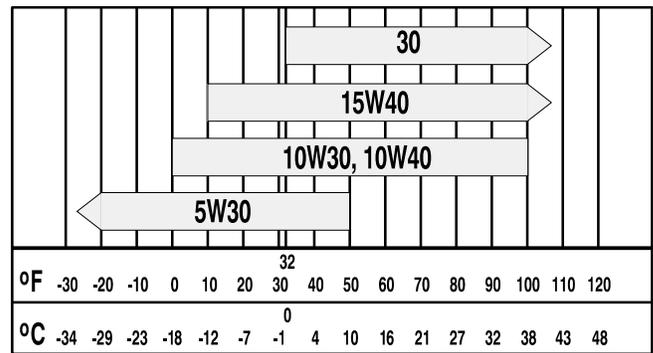


FIGURE 2. SAE VISCOSITY GRADE vs. AMBIENT TEMPERATURE

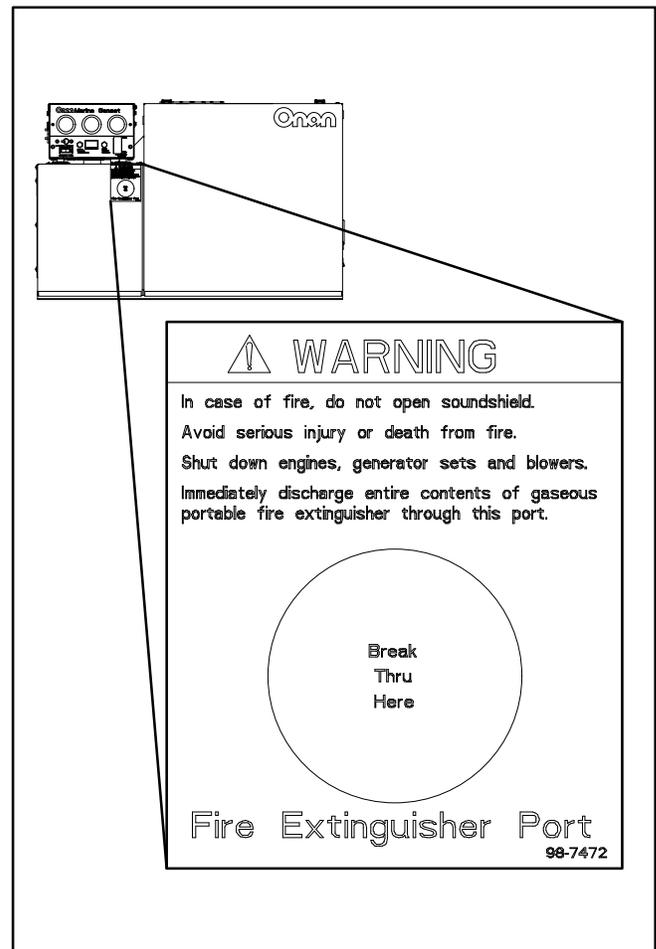


FIGURE 3. FIRE EXTINGUISHER PORT

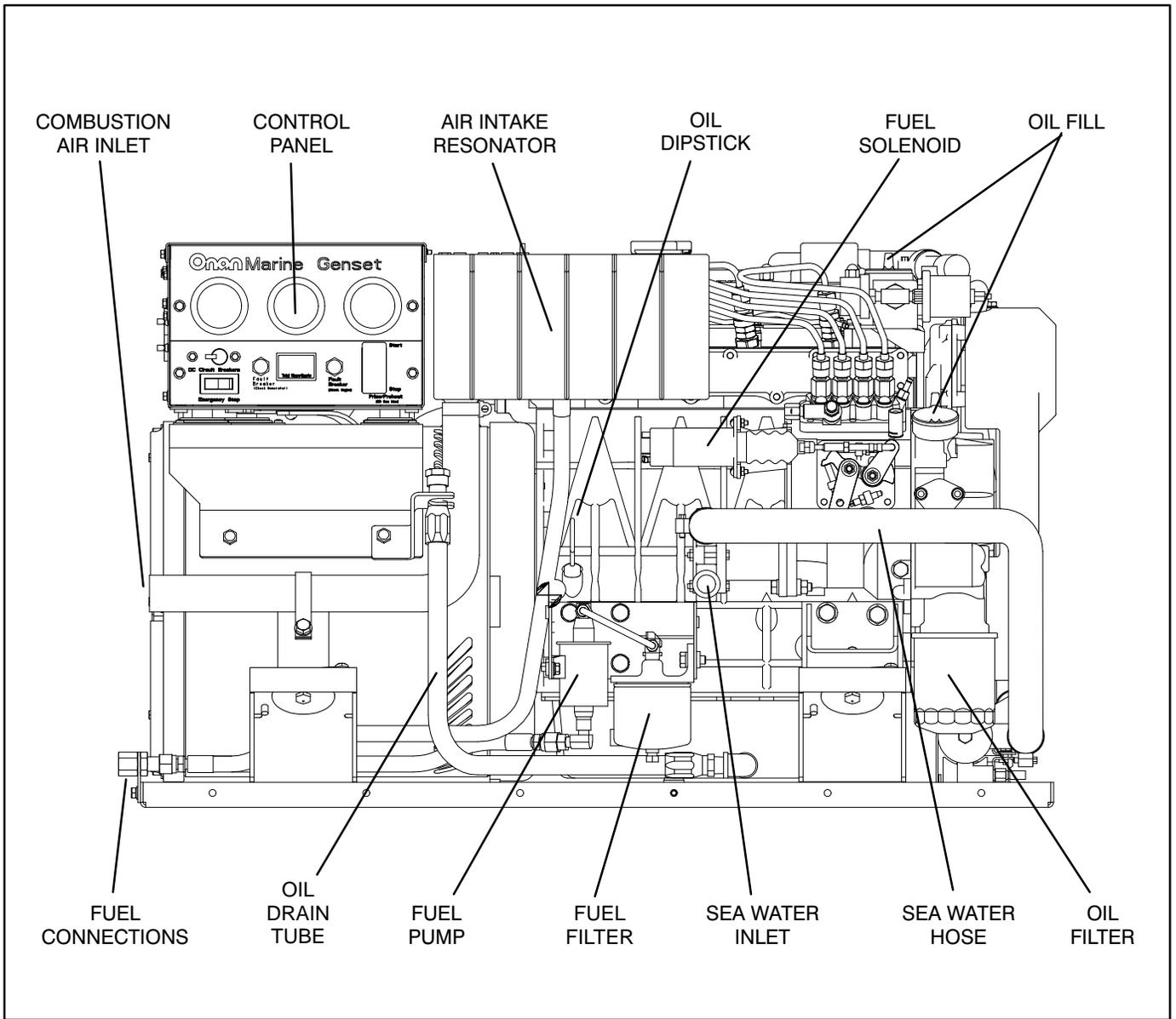


FIGURE 4. TYPICAL GENSET CONFIGURATION—COMPONENTS ON SERVICE SIDE

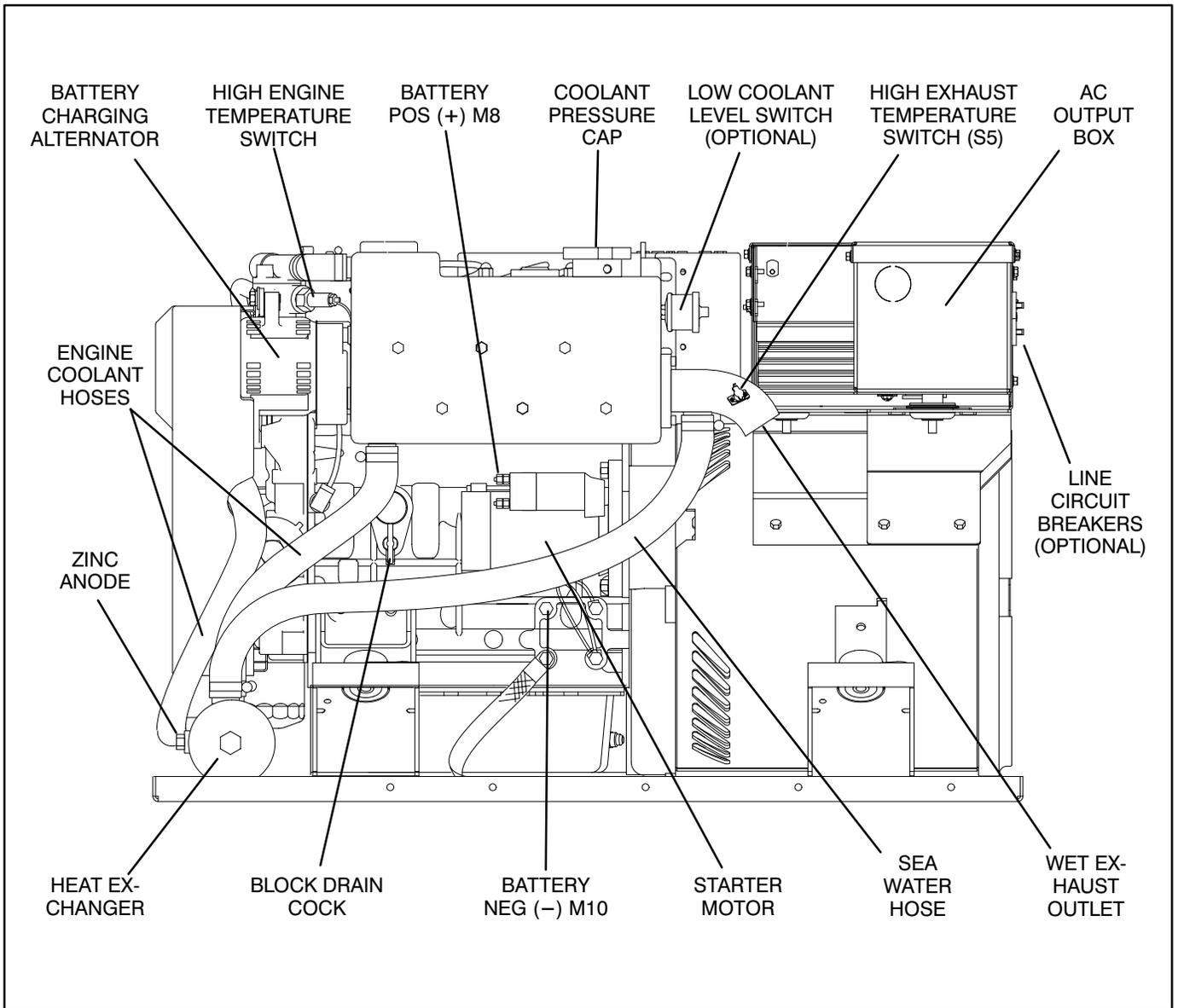


FIGURE 5. TYPICAL GENSET CONFIGURATION—COMPONENTS ON NON-SERVICE SIDE

GENSET-MOUNTED CONTROL PANEL

Figure 6 illustrates a typical control panel with optional engine gauges.

Start-Stop-Prime/Preheat Switch (S1): Starts the genset when held at **Start** and stops the genset when momentarily touched to **Stop**. Holding the switch at **Stop** causes the glow plugs to preheat the combustions chambers and the fuel lift pump to prime the fuel system.

Hour Meter (M1): Indicates the number of hours the genset has run. It cannot be reset.

Engine Gauges (M2, M3, M4): Optional—indicate engine oil pressure, coolant temperature and control system DC voltage. If remote gauges have been installed, push gauge switch (S6) in to read M2 and M3 at the genset.

Gauge Switch (S6): Momentary contact switch used only when remote gauges have been

installed. Push the button to read M2 and M3 at the genset.

“Check Engine” Fault Breaker (CB2): Shuts down the genset when one of the following fault conditions causes it to trip: overvoltage, overspeed, low oil pressure, high exhaust temperature, high coolant temperature and low coolant level (optional). *Push the reset button to reset.*

“Check Generator” Fault Breaker (CB5): Shuts down the genset when high generator quadrature winding current causes it to trip. *Push the reset button to reset.*

DC Circuit Breaker (CB1): Protects the high-current (DC) glow plug circuits from shorts to ground. The genset will stop if tripped. *Reset with handle.*

Emergency Stop Breaker (CB4): A rocker-switch type of circuit breaker that protects the genset control circuits (DC) from shorts to ground. The genset will stop if the circuit breaker trips or the rocker is pushed to **Stop**. *Push the rocker **On** to reset.*

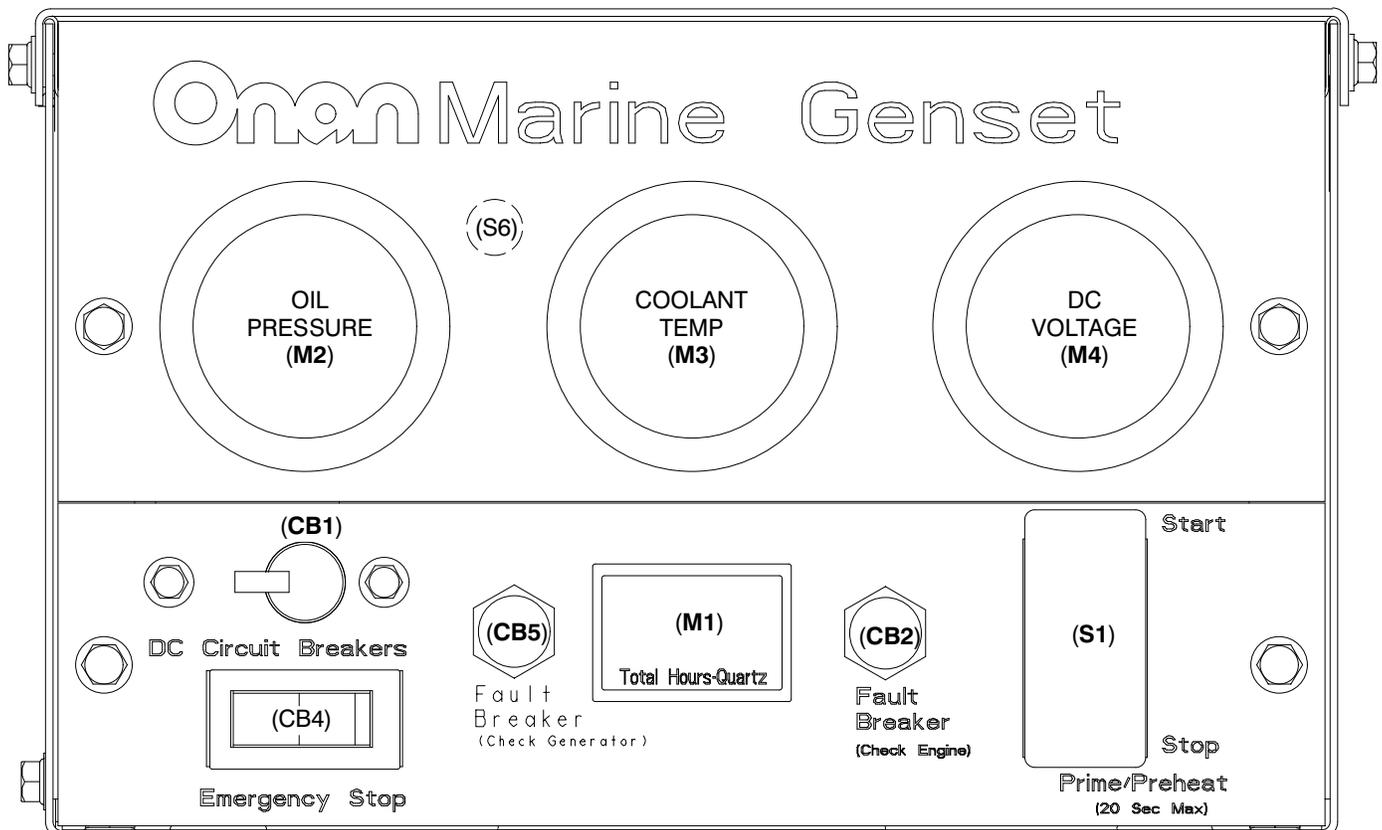


FIGURE 6. GENSET-MOUNTED CONTROL PANEL

REMOTE CONTROL PANELS

Available remote control panels are shown in Figure 7. The switch and gauges function the same way as the ones on the genset-mounted control panel. When a remote panel with gauges is

installed, oil pressure and coolant temperature normally display at the remote panel rather than at the genset. A momentary gauge switch on the genset panel (Figure 6) can be provided to read the gauges on the genset panel.

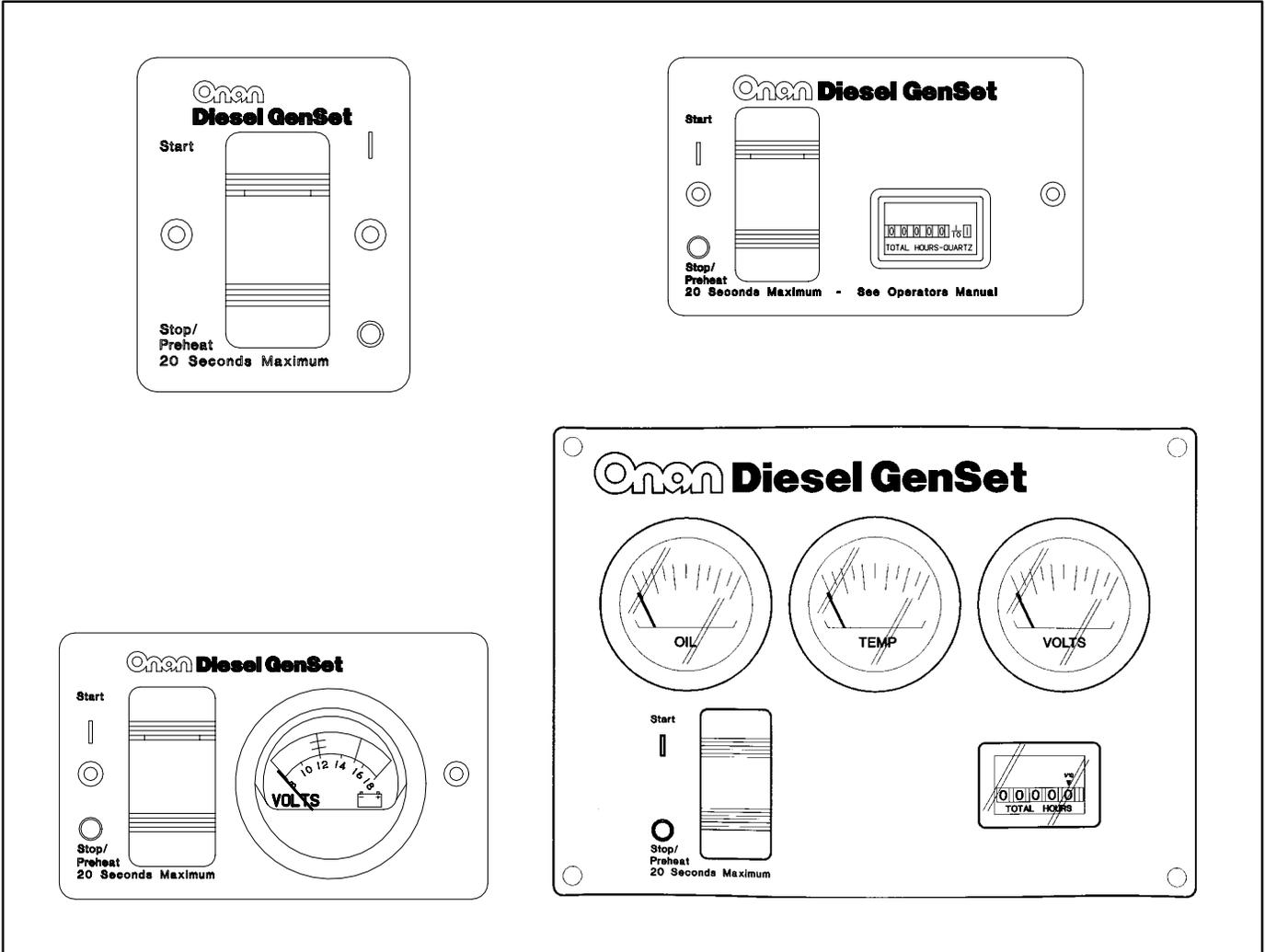


FIGURE 7. AVAILABLE REMOTE CONTROL PANELS

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 the vessel when the genset is running unless the cabin has an operating carbon monoxide detector.

Look and listen for leaks along the entire run of the exhaust system every time you start up the genset and every eight hours if the genset is being run continuously. Shut down the genset immediately if there is a leak and do not run it until the leak has been repaired.

The installation of the exhaust system must be in accordance with the genset Installation Manual.

PRE-START CHECKS

Perform General Inspection (p. 16). **Check for fuel, exhaust, oil and coolant leaks every eight hours if the genset is being run continuously.**

Check the *Maintenance Record* and perform any maintenance due (*Periodic Maintenance Schedule*). Also see GENSET BREAK-IN if the genset is new and RETURNING THE GENSET TO SERVICE if the vessel has been in storage.

STARTING

1. Disconnect all loads from the genset.
2. **Preheat** - If ambient temperature in the generator room is above freezing, hold the control switch in the **PREHEAT** position for **5 seconds**. If below, hold the switch up to **20 seconds**.

⚠ CAUTION *Preheat times longer than 20 seconds can damage the glow plugs.*

3. **Start** - Immediately after **PREHEAT** push the control switch to **START** and hold it there until the engine starts. The starter will automatically disconnect as the engine starts up.

Do not crank for more than 20 seconds at a time. Wait two minutes before trying again. See *Troubleshooting* if the engine does not start on the second try.

⚠ CAUTION *Excessive cranking can over-heat and damage the starter. Do not crank for more than 20 seconds at a time and wait two minutes before trying again.*

4. Connect the electrical loads after the genset has warmed up for a few minutes.
5. Check for fuel, exhaust, oil and coolant leaks and complete General Inspection (p. 16). Check the engine gauges regularly (if provided) while the genset is running.
 - **Oil Pressure Gauge:** Normal engine oil pressure is 28 - 64 psi (194 - 442 kPa) at normal operating temperature.
 - **DC Voltmeter:** Normal DC system voltage is 12.5 - 15 volts (12 volt system) or 24 - 27 volts (24 volt system) depending on battery condition and state-of-charge.
 - **Coolant Temperature Gauge:** Normal engine coolant temperature is 160 -195° F (71 - 91° C) depending on load and sea water* temperature.

* In this manual, "sea water" refers to floatation water.

STOPPING

Before stopping let the genset cool down by running at no-load for three to five minutes. Then touch the control switch momentarily to **STOP**.

⚠ CAUTION *Failure to let the engine cool down before stopping can lead to engine damage. Let the genset run three to five minutes at no-load before stopping.*

POWERING APPLIANCES

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

To avoid overloading the genset and causing shut-downs, compare the sum of the loads of the appliances that are likely to be used at the same time to the power rating of the genset. Use Table 1 or the ratings on the appliances themselves (if so marked) to obtain the individual appliance loads. ***It may be necessary to run fewer appliances at the same time so that the sum of the loads is not 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 last or cycles off and then on again. The reason for this is that motor startup load is much larger than running load. ***It may be necessary to run fewer appliances when large motors and air conditioners are cycling on and off.***

CONNECTIONS TO SHORE POWER

A vessel that has provisions for connection to shore power must be equipped with an approved transfer switch to keep the genset and shore power from being interconnected.

⚠ WARNING *Backfeed to shore power can cause electrocution and damage to equipment. Use an approved device to prevent the genset from being interconnected with shore power.*

TABLE 1. TYPICAL APPLIANCE LOADS

Appliance	Load (watt)
Air Conditioner	1400-2000
Battery Charger	Up to 800
DC Converter	300-1500
Refrigerator	600-1000
Microwave Oven	1000-1500
Electric Frying Pan/Wok	1000-1500
Electric Stove Element	350-1000
Electric Water Heater	1000-1500
Electric Iron	500-1200
Electric Hair Dryer	800-1500
Coffee Percolator	550-750
Television	200-600
Radio	50-200
Electric Drill	250-750
Electric Broom	200-500
Electric Blanket	50-200

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

RESETTING LINE CIRCUIT BREAKERS

If a circuit breaker in the main power distribution panel in the vessel or on the genset (Figure 8) trips, there is either a short circuit or too much load. Note that the genset will continue to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as many appliances as possible and reset the circuit breaker. (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 or the circuit breaker is faulty. Call a qualified electrician.

If the circuit breaker does not trip, reconnect a combination of appliances that does not overload the genset or cause the circuit breaker to trip. An appliance that causes a circuit breaker to trip right away probably has a short.

Electrical appliances must be properly grounded and in good working condition.

⚠WARNING *Electrical shock can cause severe personal injury or death. Read and follow the appliance manufacturer's instructions and warnings.*

ENGINE BREAK-IN

Change the oil and oil filter after the first 35 hours of operation. See *Maintenance Procedures*.

NO-LOAD OPERATION

Keep no-load operation to a minimum. During no-load operation combustion chamber temperatures drop to the point where fuel does not burn completely, causing slobbering and white smoke. Always have some load connected when the genset is run for long periods.

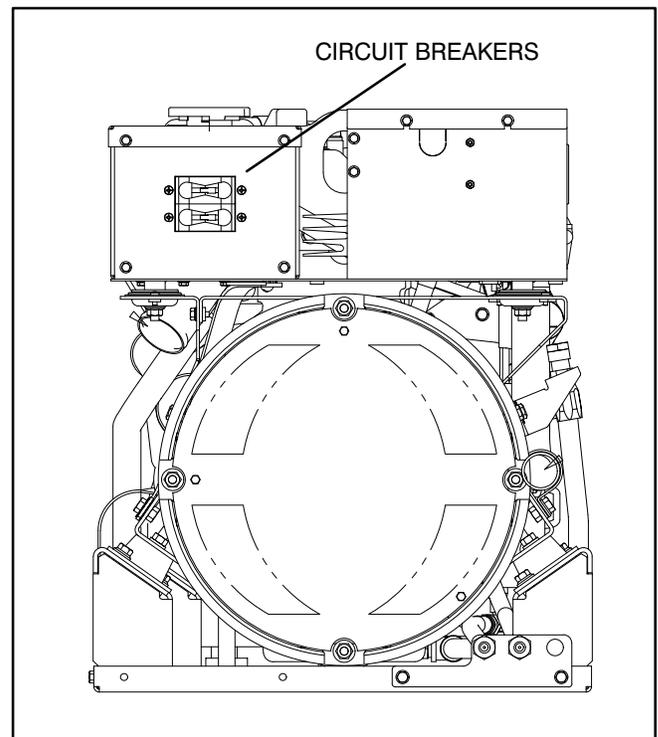


FIGURE 8. GENSET MOUNTED LINE CIRCUIT BREAKERS

GENSET EXERCISE

If use is infrequent, run the genset at approximately 1/2 rated power for an hour every week. Exercising the genset results in better starting, longer engine life and increased genset reliability by driving off moisture, re-lubricating the engine, using up fuel before it becomes stale and removing oxides from electrical contacts. One longer period during which the engine and generator warm up thoroughly is better than several shorter periods.

GENSET STORAGE

If the genset will be inactive for more than 30 days and it is impractical to have someone exercise it, prepare it for storage as follows:

1. Run the genset until it has thoroughly warmed up and shut it down.

⚠WARNING *Crankcase pressure can blow out hot oil and cause severe burns. Stop the engine before checking the oil level or opening the fill cap.*

2. Change the oil and oil filter while still warm and attach a tag to the dip stick indicating the oil viscosity grade. See CHANGING OIL AND OIL FILTER in *Maintenance Procedures*.

⚠WARNING *Arcing at battery terminals or in a light switch or other equipment, flames and sparks can ignite battery gas causing severe personal injury. Ventilate the battery compartment before connecting or disconnecting battery cables—Disconnect the negative (-) cable first and reconnect it last—Wear safety glasses—Do not smoke—Switch lights ON and Off away from the battery.*

3. Disconnect the battery cables (negative [-] cables first) and store the battery(ies) in accor-

dance with the manufacturer's recommendations.

⚠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 the coolant level and add coolant as necessary. Test the coolant mixture if freezing temperatures are possible and change if necessary. See ENGINE COOLING SYSTEM in *Maintenance Procedures*.
5. If freezing temperatures are expected, drain the heat exchanger of sea water by removing the drain plug in the bottom of the heat exchanger (Figure 10). Replace the plug when the water has drained.
6. Clean the genset and lightly oil parts that can rust.

RETURNING THE GENSET TO SERVICE

1. Check the tag on the dipstick and change the oil if the viscosity is not suitable for present and anticipated ambient temperatures.
2. Reconnect the battery(ies) (negative [-] cables last) and service as necessary in accordance with the manufacturer's instructions.
3. Prime the fuel system (p. 24).
4. Replace the sea water pump impeller if it was installed more than a year ago. If less, remove the impeller cover and wet the internal surfaces of the pump with water to establish initial lubrication and pump suction. See Replacing the Sea Water Pump Impeller (p. 22).
5. Perform PRE-START CHECKS and start and run the genset according to STARTING. Perform maintenance or service as required before placing the genset in service.

Periodic Maintenance Schedule

Periodic maintenance is essential for top genset performance and long service life. Use Table 2 as a guide, follow *Maintenance Procedures* and record maintenance performed in *Maintenance Record*.

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

TABLE 2. PERIODIC MAINTENANCE SCHEDULE

PROCEDURE	FREQUENCY								Page
	After first 35 Hrs	Every Day/ 8 Hrs	Every Month/ 100 Hrs	Every 6 Months/ 200 Hrs	Every Year/ 500 Hrs	Every 800 Hrs	Every 2 years	Every 5 years	
Inspect Genset		x ¹							16
Check Oil Level		x							16
Check Coolant Level		x							16
Check Fuel Level		x							16
Check Exhaust System		x							16
Check Battery			x ²						25
Check V-Belt Tension			x ³						20
Drain Water in Fuel			x						23
Check Siphon Break			x						21
Clean Genset				x					16
Change Oil & Oil Filter	x			x					17
Change Fuel Filter				x					23
Change Zinc Anode					x				21
Replace Sea Water Impeller					x				22
Adjust Valve Lash						x ⁴			-
Change Coolant, Pressure Cap, Thermostat, Hoses, V-belt							x		18
Replace Generator Bearing								x ⁴	-
1 - Check for oil, fuel, coolant and exhaust system leaks. 2 - See battery manufacturer's recommendations. 3 - Check for slippage. 4 - Must be performed by an authorized Onan dealer.									

Maintenance Procedures

GENERAL INSPECTION

Perform these checks and inspections every time the genset is started or every eight hours if the genset is being run continuously.

Oil Level Check

⚠WARNING *Crankcase pressure can blow out hot oil and cause severe burns. Stop the engine before checking the oil level or opening the fill cap.*

Shut down the genset to check engine oil level and wait a few minutes for the oil to drain down to the crankcase to get an accurate indication of oil level.

Keep the oil level between FULL and ADD on the dipstick (Figure 9). See ENGINE OIL RECOMMENDATIONS in *Introduction* for the type of oil to add.

⚠CAUTION *Too little oil can lead to severe engine damage and too much oil to high oil consumption and foaming, which can cause engine shutdown. Keep the oil level between FULL and ADD.*

Coolant Level Check

Replenish the normal loss of coolant by keeping the level in the coolant recovery tank between COLD and HOT. See COOLING SYSTEM for the recommended mixture of antifreeze and if it is necessary to refill the system.

Sea Water Pump, Strainer and Sea Cocks

Clean out the sea water strainer if necessary and make sure the sea cock is open. When a water separator is part of the exhaust installation (Figure 13), make sure the exhaust water sea cock is open.

If the sea water pump is located higher than the load water line and it has been a week or more since the genset was run, it is recommended that the impeller cover be removed and the internal surfaces of the pump be wetted with water to establish initial lubrication and pump suction. See Replacing the Sea Water Pump Impeller (p. 22).

⚠CAUTION *Wet the internal surfaces of the pump as often as necessary to prevent dry startups, which severely shorten impeller life.*

Exhaust System Inspection

Wet 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.

Dry Exhaust System: Inspect the exhaust system for leaks at all joints, welds and gaskets. Replace rusted sections of exhaust pipe.

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

Fuel System Inspection

Check for leaks at all fuel line fittings and gaskets. Replace fuel hose that has been abraded or cut and install new hose in such a way that it will not become kinked, rub against other parts or come in contact with sharp edges, hot surfaces or wiring.

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

Prime the fuel system if the genset ran out of fuel or a fuel filter was replaced. See FUEL SYSTEM.

Battery Inspection

Check for clean, tight battery connections. Loose and corroded connections make for hard starting because of high electrical resistance. See BATTERIES.

⚠WARNING *Arcing at battery terminals or in a light switch or other equipment, flames and sparks can ignite battery gas causing severe personal injury. Ventilate the battery compartment before connecting or disconnecting battery cables—Disconnect the negative (-) cable first and reconnect it last—Wear safety glasses—Do not smoke—Switch lights ON and Off away from the battery.*

Mechanical Inspection

Check for unusual noises and vibrations, loose genset mounts and signs of mechanical damage. Check the engine gauges regularly (if provided) while the genset is running. See *Operation* for normal gauge readings.

Keep the genset clean. Do not clean the genset while running. Protect the generator, control panel, and electrical connections from cleaning solvents.

CHANGING OIL AND OIL FILTER

⚠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. Use protective gloves and wash exposed skin.*

See Table 2 for frequency of oil and oil filter change. See ENGINE OIL RECOMMENDATIONS in *Introduction* for the oil to use and *Specifications* for the amount.

⚠WARNING *Crankcase pressure can blow out hot oil and cause severe burns. Stop the engine before checking the oil level or opening the fill cap.*

Draining Engine Oil: To drain the engine oil, run the engine until thoroughly warm and then stop it. If an oil pump-out system is installed, follow the instructions provided. If not, unscrew the plug on the end of the drain hose (Figure 9) and drain the oil into a suitable container. When the oil is completely

drained, reinstall the plug and return the hose to its storage position. Two wrenches are necessary to keep from twisting the hose when removing and tightening the plug.

Changing Oil Filter: To change the oil filter, place a container under the oil filter (Figure 9) to catch oil that drips out and then spin off the oil filter. Clean the filter mounting surface, apply oil to the new filter gasket and spin the filter on until the gasket just touches the mounting pad. Then tighten an additional 3/4 turn.

Refilling Engine Oil: Refill with the proper amount of oil, start the engine and check for leakage around the filter gasket. **Tighten the filter only enough to stop leakage.** Shut off the genset, recheck the oil level and add oil as necessary.

⚠CAUTION *Too little oil can lead to severe engine damage and too much oil to high oil consumption and foaming, which can cause engine shutdown. Keep the oil level between FULL and ADD.*

Disposing of Used Oil and Oil Filter: Dispose of the used oil and oil filter according to local environmental regulations.

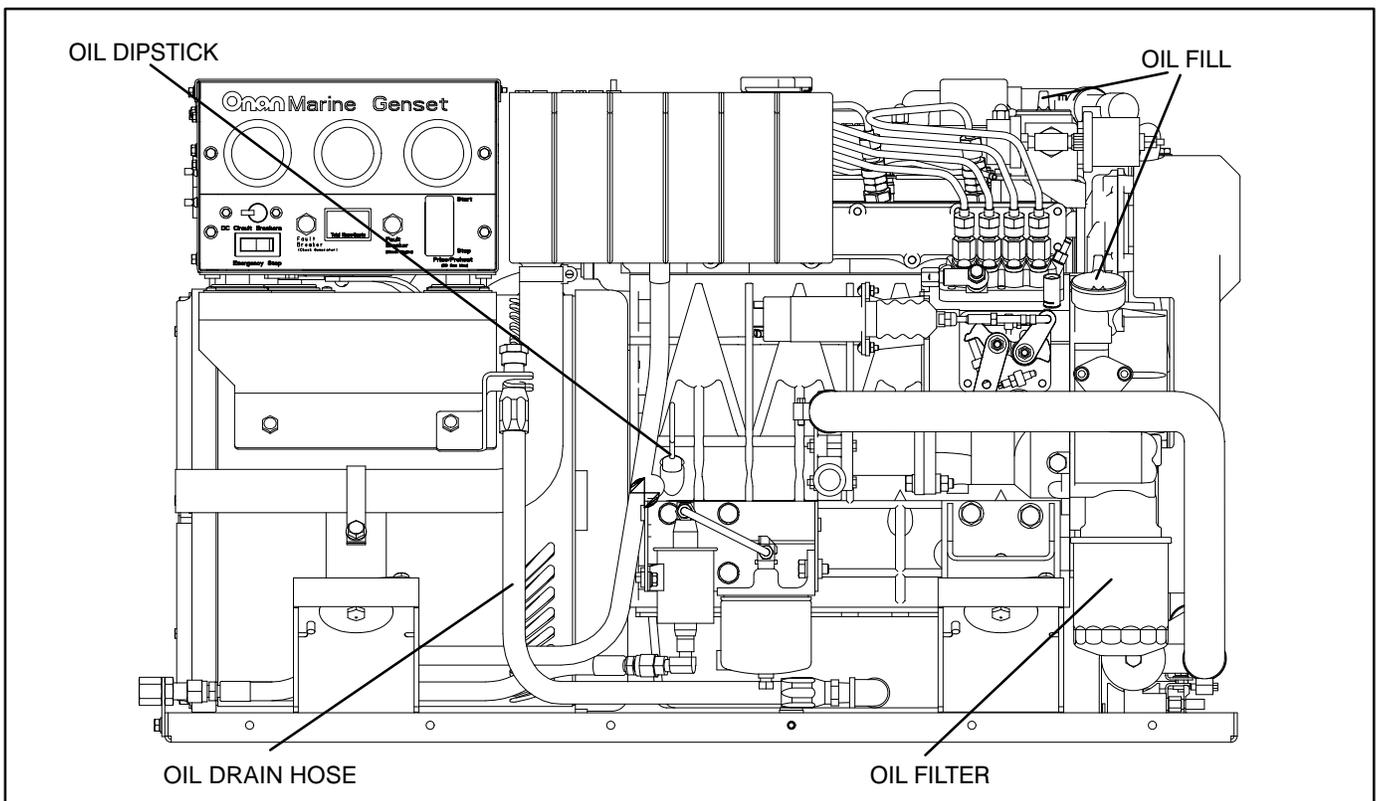


FIGURE 9. OIL CHECK, FILL, DRAIN AND FILTER

ENGINE COOLING SYSTEM

See Table 2 for frequency of coolant, pressure cap, thermostat, hose, V-belt and zinc anode replacement.

Cooling System Overview

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 and is cooled in a genset-mounted heat exchanger or keel cooler. The top V-belt pulley drives the coolant pump.

If the genset has a heat exchanger and/or a wet exhaust elbow, the engine is equipped with a sea water* pump driven by a power takeoff on the engine. The sea water cools the heat exchanger and/or exhaust gases and exits the vessel through the exhaust system. (There is no sea water pump if the genset is equipped for keel cooling and dry exhaust.) Figure 10 illustrates a typical installation of a genset equipped with a heat exchanger, wet exhaust elbow and sea water pump.

Recommended Coolant Mixture

Use the best quality ethylene or propylene glycol antifreeze solution available. It should be fully formulated with rust inhibitors and coolant stabilizers **but not with stop-leak additives**. Use fresh water that is low in minerals and corrosive chemicals. Distilled water is best. Unless prohibited by shipping regulations, gensets with heat exchangers are shipped with the recommended 50/50 mixture of water and ethylene glycol, which is good for -34° F (-37° C).

See *Specifications* for coolant system fill capacity if the genset is equipped with a heat exchanger. If the genset is keel cooled, system capacity also depends on the capacity of the keel cooler.

Coolant Recovery Tank

Replenish the normal loss of coolant by keeping the level in the recovery tank between COLD and HOT. Use the recommended mixture of antifreeze. See Changing Coolant if it is necessary to fill the system.

Changing Coolant

⚠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.*

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

Draining the System: Let the engine cool down, disconnect the negative (-) cable(s) at the battery(ies) to prevent the engine from starting, remove the system pressure cap and open the block and heat exchanger drain cocks (Figure 10). See the manufacturer's instructions regarding a keel cooler. Collect used coolant in containers for proper disposal.

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

Cleaning and Flushing the System: Use radiator cleaning chemicals to clean and flush the cooling system before new coolant is added. Follow the 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: Close all drain cocks and secure all hose clamps and fill the system through the fill opening. 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 minute to dislodge air pockets and shut it down. Add as much coolant as necessary and secure the pressure cap.

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

Pressure Cap

Replace the pressure cap as recommended (Table 2) to maintain optimal engine cooling and minimal coolant loss.

* In this manual, "sea water" refers to floatation water.

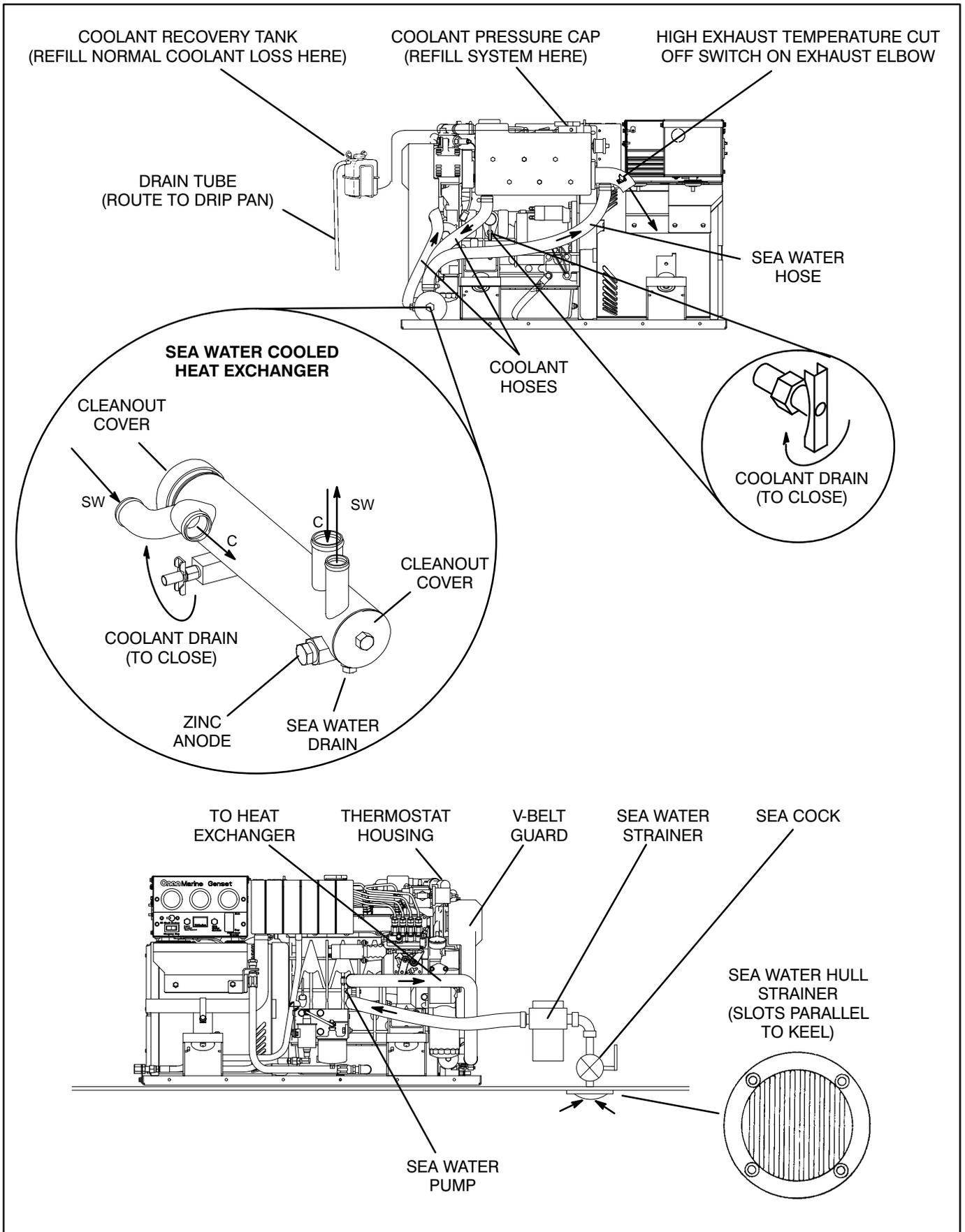


FIGURE 10. TYPICAL HEAT EXCHANGER-TYPE COOLING SYSTEM

Adjusting V-Belt Tension

The V-belt (Figure 11) drives the coolant pump and battery charging alternator.

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

1. Disconnect the negative (-) cable(s) at the battery(ies) to prevent the engine from starting and remove the belt guard or sound shield door.
2. Loosen the alternator pivot bolt first and then the adjusting bracket bolt on top.
3. Tighten belt tension by pivoting the alternator outwards. Hold tension by tightening the adjusting bracket bolt. Apply 20 pounds (10 kg) as shown to the middle of the pulley span and measure belt deflection, which should be 0.4 inch (10 mm). Tighten the alternator bolts when tension is correct.
4. Secure the belt guard or sound shield door and reconnect the battery cables (negative [-] last).

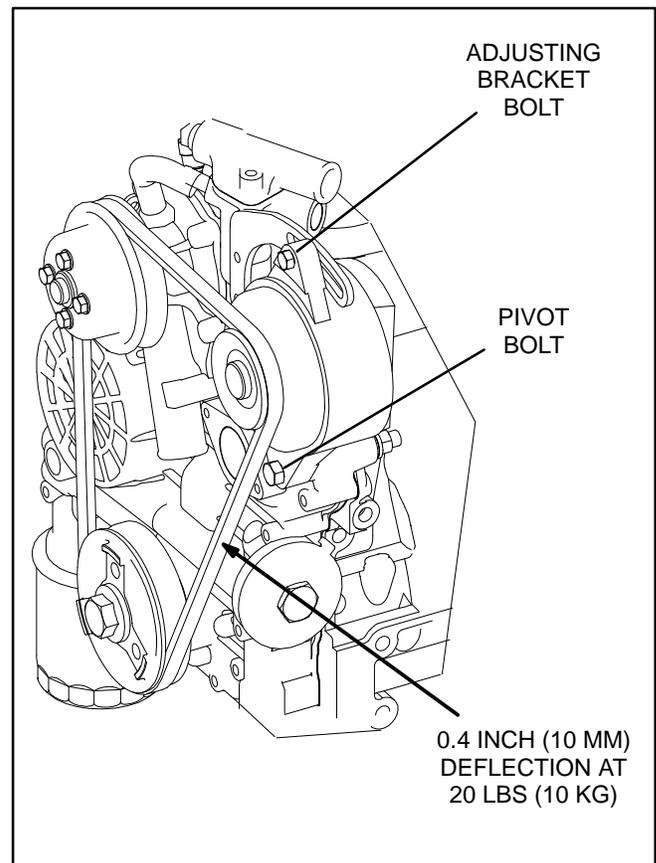


FIGURE 11. ADJUSTING V-BELT TENSION

Replacing Thermostat

Replace the thermostat (Figure 10) at the recommended frequency (Table 2) to maintain optimal engine cooling.

⚠WARNING *Accidental starting can cause severe personal injury or death. Disconnect the negative (-) cable(s) at the battery(ies) 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. Let the engine cool, loosen the pressure cap and disconnect the negative (-) cable(s) at the battery(ies) to prevent the engine from starting.
2. Remove the two thermostat housing bolts (Figure 12) and pull off the housing, thermostat and gasket. The hose does not need to come off.
3. Clean off the gasket area and reassemble as shown with the new thermostat and gasket. Apply Three Bond 1215 liquid sealant or equivalent to the top side of the gasket.

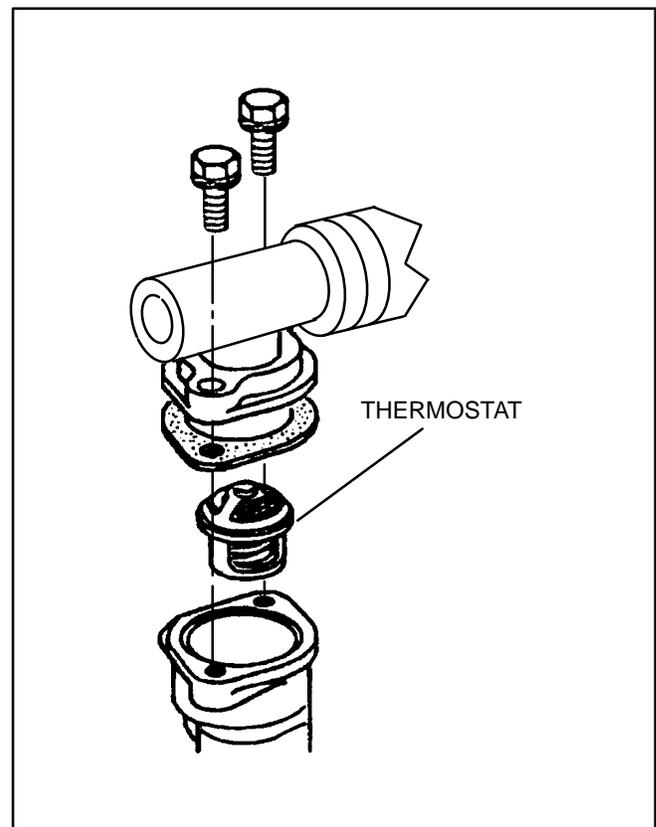


FIGURE 12. REPLACING THERMOSTAT

Heat Exchanger and Zinc Anode

The heat exchanger has cleanout covers on both ends to clean the sea water tubes. Remove the covers to clean out seaweed and pump debris. If necessary, take the heat exchanger to a radiator shop for chemical cleaning of hard deposits. Replace the zinc anode as recommended (Table 2).

Siphon Break

A siphon break is installed when the exhaust elbow is below, or less than 6 inches (152 mm) above, the load water line (Figure 13) to prevent flooding when the engine is not running. If of the spring-loaded

valve design, check for free movement of the plunger. Replace the device if the plunger does not move freely or the body is encrusted with deposits from leakage past the valve seat. If of the bleed-vent type, check that the vent hose is properly connected on both ends. If the vent is connected to a hull fitting, check for normal water flow whenever the engine is running.

⚠ WARNING *Bypassing a siphon break or failing to maintain it can lead to engine flooding and damage to the engine not covered under Warranty.*

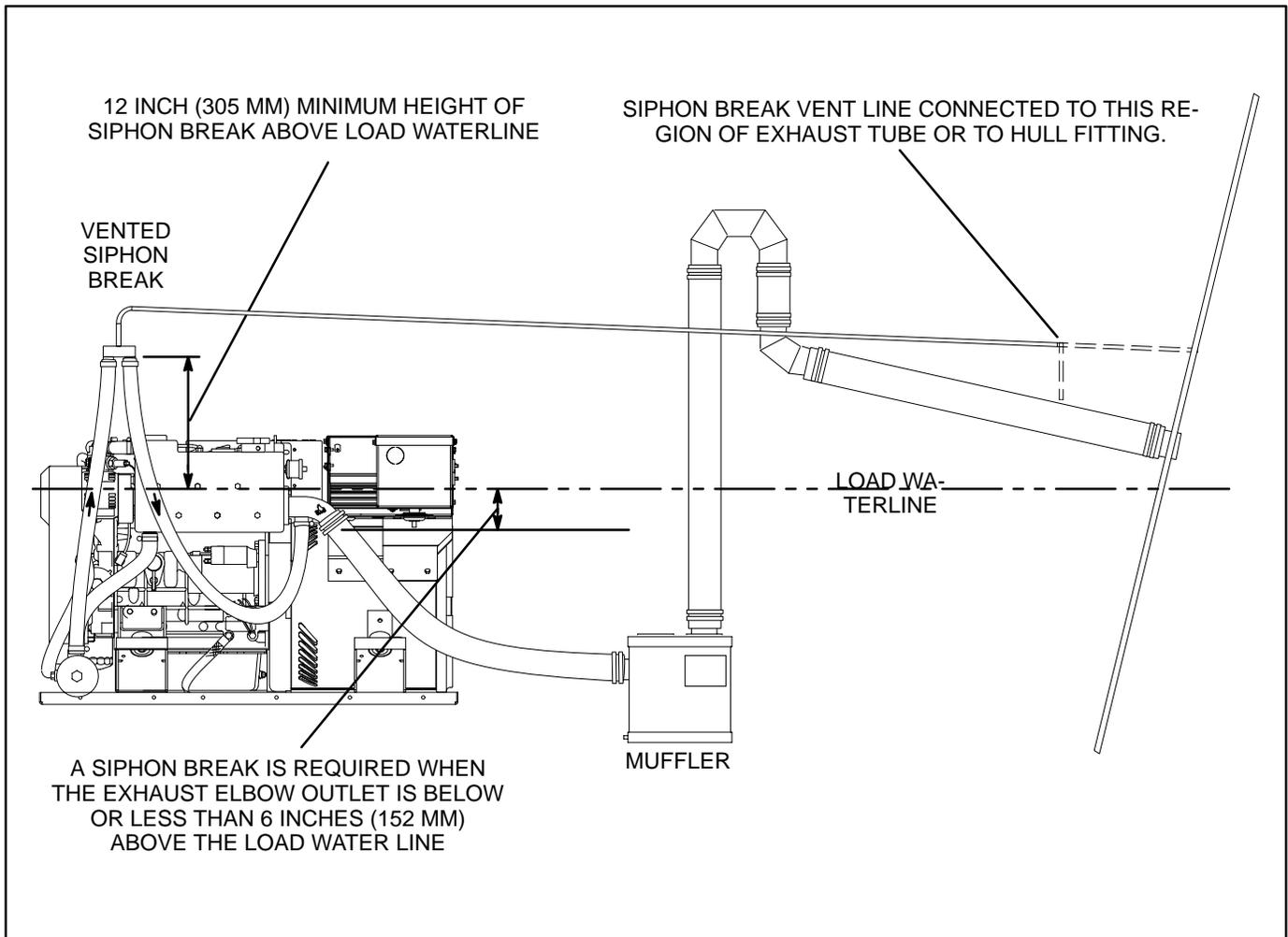


FIGURE 13. TYPICAL INSTALLATION OF A VENT-TYPE SIPHON BREAK AND WET EXHAUST SYSTEM

Replacing the Sea Water Pump Impeller

The sea water pump (Figure 14) is driven off a power takeoff on the engine. To replace the flexible impeller:

1. Disconnect the negative (-) cable(s) at the battery(ies) to prevent the engine from starting.

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

2. Close the sea cock and remove the impeller cover and O-ring.
3. Using two pairs of pliers to grip vanes on opposite sides, pull out the old impeller. *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.*
4. Install the new impeller. It helps to twist the impeller clockwise while squeezing it into the housing. Push it in all the way when the keyway lines up with the key in the shaft. The vanes should all incline backwards, that is, counter-clockwise; the impeller turns clockwise.
5. 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.*

6. If the sea water strainer is above the water line, remove the strainer element cover, fill it with water (which also fills the hose to the pump) and reinstall the cover.
7. Open the sea cock, reconnect the battery cables (negative [-] last) and start the genset. *Shut down the genset within 30 seconds if there is no water flow from the exhaust hull fitting. (Flow will not be visible if an exhaust water separator has been installed. In that case, feel the pump cover and shut down the genset if the pump gets hot.)* If there is no flow, find and remove the blockage before the genset is started again.

⚠ WARNING *The pump gets hot quickly if there is no flow and can burn your fingers. Be cautious when touching the pump.*

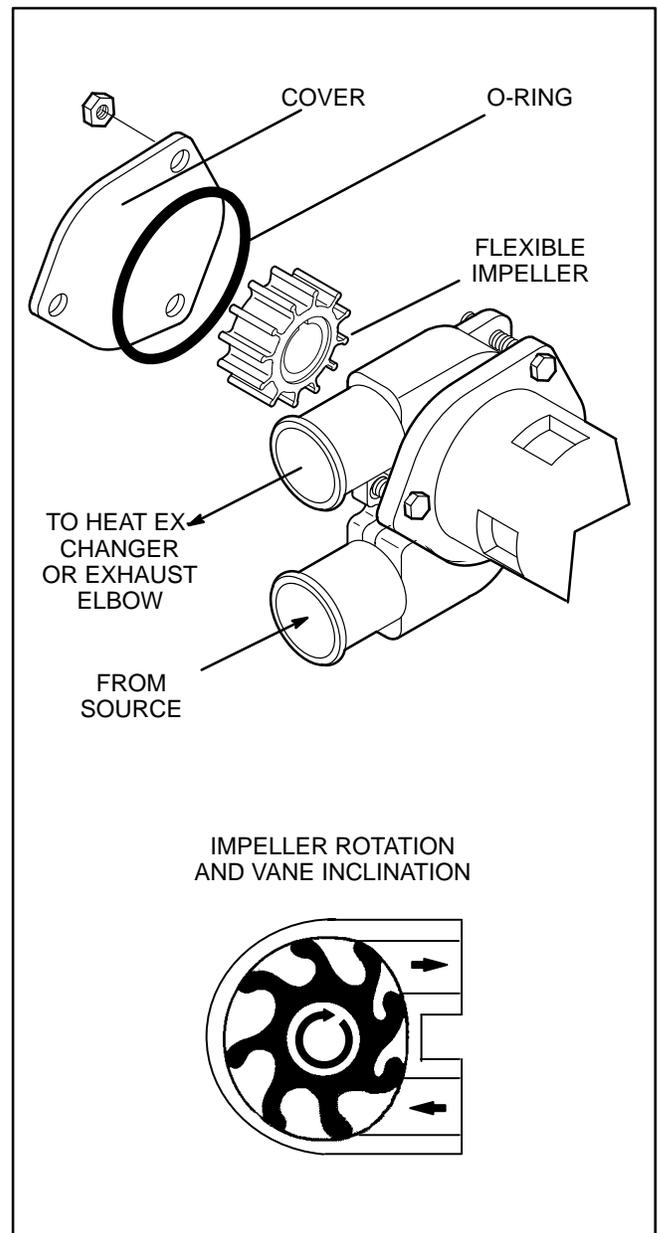


FIGURE 14. REPLACING SEA WATER PUMP IMPELLER

FUEL SYSTEM

Fuel Handling Precautions

Keep dirt, water and other contaminants from entering the fuel system and damaging, corroding or clogging fuel injection components. The genset has a water-separator type of fuel filter but the fuel supply system should have a filter and water separator installed ahead of connections at the genset.

A primary source of water in fuel, which can clog fuel passages by freezing and cause corrosion by forming sulfuric acid with the sulfur in the fuel, is the condensation of humid air on the walls of the fuel tank. Keeping fuel tanks as full as possible reduces condensation by reducing the area on which condensation can take place.

Fuel Filter

Draining Water and Sediment: See Table 2 for the regular frequency of draining water and sediment.

Drain more often if fuel quality is poor or condensation cannot be avoided. To drain the filter, remove the plug (Figure 15), collect the water and sediment (about 1/2 cup [120 ml]) in a suitable container and dispose of properly. **Reinstall the plug securely.**

Replacing the Filter Element: See Table 2 for the regular frequency of fuel filter change. Replace the filter sooner if the engine lacks power or surges.

1. Drain the filter as explained above and spin off the element.
2. Clean the contact surface of the base.
3. Lubricate the new element and its gasket, and fill the element with clean diesel fuel.
4. Spin the new element onto the base and hand tighten.
5. Start and run the genset and check for fuel leakage. Tighten the filter only enough to stop leakage. See Priming the Fuel System if the genset does not start.

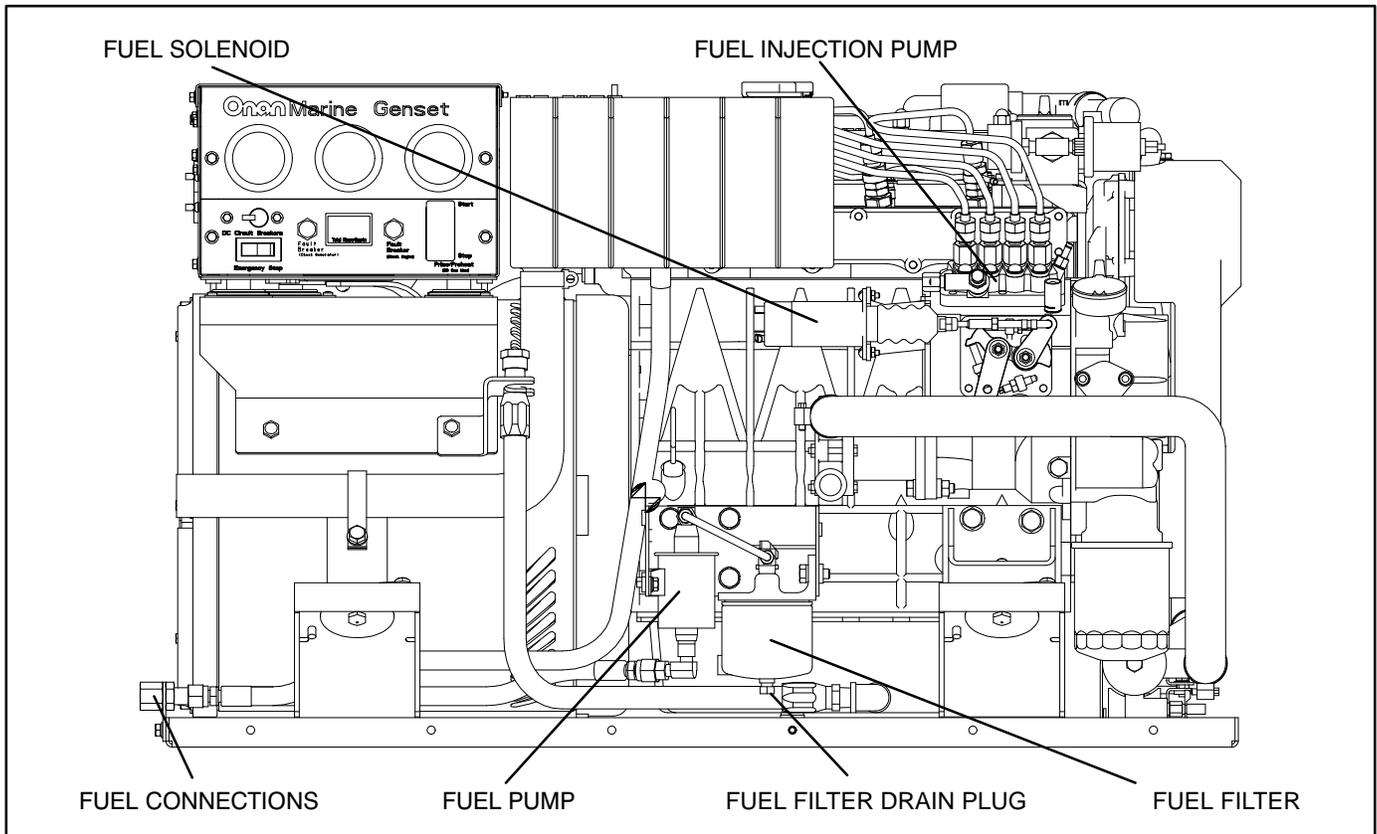


FIGURE 15. FUEL SYSTEM

Priming the Fuel System

Priming the Low-Pressure Side: The fuel lift pump (Figure 15) primes during preheat when the control switch is held in the stop position. Priming purges air from the low-pressure side of the fuel injection system.

CAUTION Preheating for more than 20 seconds at a time reduces the life of the glow plugs. Let the glow plugs cool for at least one minute before trying again.

If priming for 20 seconds at a time is not enough, open the bleed screw and disconnect the engine harness lead from the glow plug bus bar (Figure 16) and make sure it cannot ground on the block. Then press **STOP** until fuel just starts to appear at the bleed opening and tighten the bleed screw. Reconnect the lead to the glow plugs.

Priming the High-Pressure Side: This procedure should only be performed by a diesel mechanic.

WARNING The high pressure oil spray from an injector line fitting can penetrate the skin, leading to possible blood poisoning. Wear safety glasses and keep your hands away from the spray. Do not delay getting proper medical attention if your hands do get in the way.

1. Loosen the high pressure fittings at the nozzles. Use two wrenches to keep from twisting the return fittings. Use flare-nut wrenches to keep from rounding the shoulders.
2. Crank the genset until fuel appears at the loosened fittings and then snug up each fitting. The engine should start and run when the first fitting is snugged.
3. Shut down the engine and torque the fittings to 19 - 25 lb-ft (25 - 34 N-m).

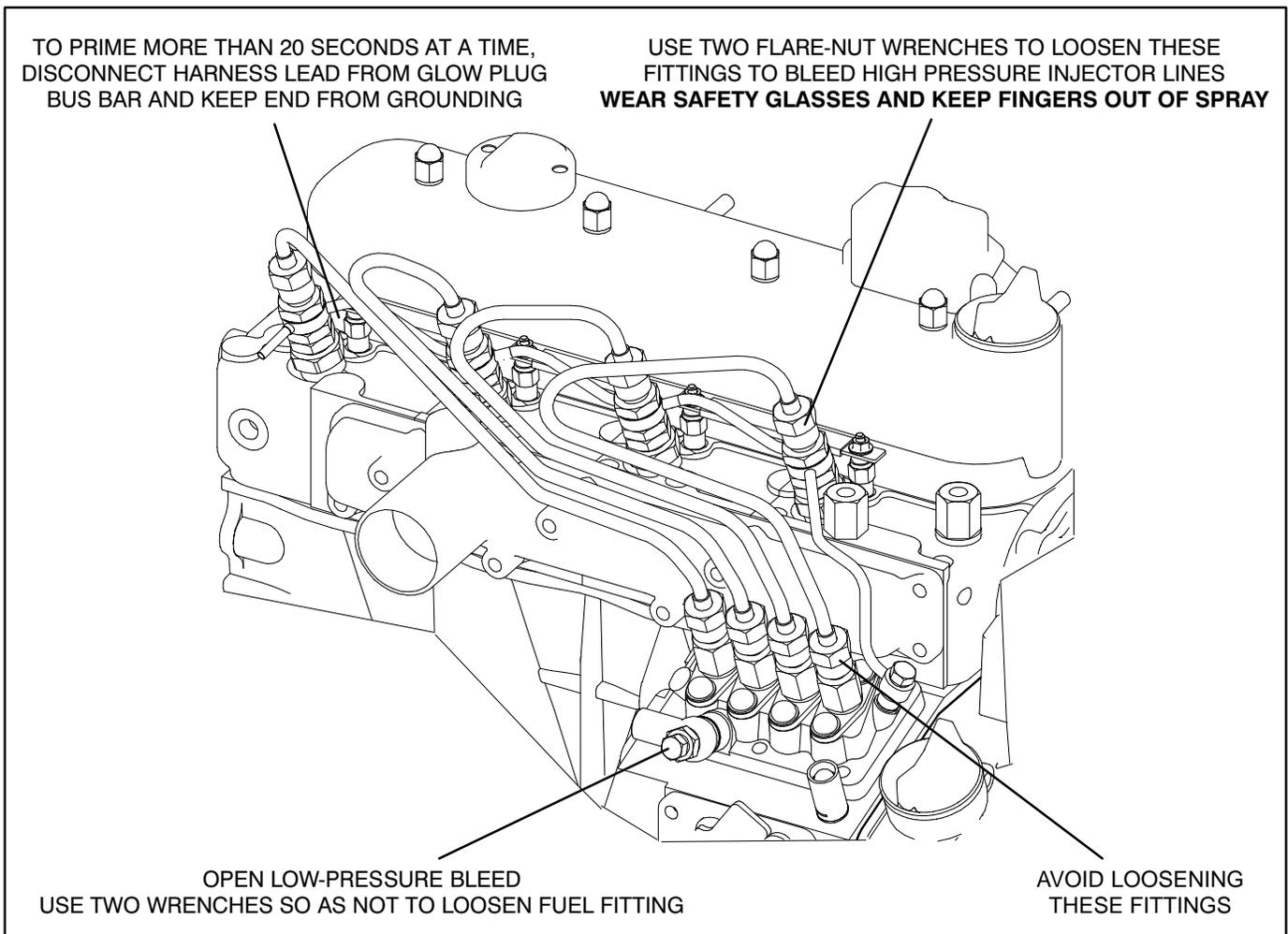


FIGURE 16. PRIMING THE FUEL SYSTEM

BATTERIES

Sealed, maintenance-free batteries are recommended. Follow the manufacturer's instructions for battery care. Keep the terminals clean and tight.

⚠WARNING *Arcing at battery terminals or in a light switch or other equipment, flames and sparks can ignite battery gas causing severe personal injury. Ventilate the battery compartment before connecting or disconnecting battery cables—Disconnect the negative (-) cable first and reconnect it last—Wear safety glasses—Do not smoke—Switch lights ON and Off away from the battery.*

GENERATOR BEARING

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

Inspect the generator bearing every 1000 hours for evidence of outer race rotation. Because bearing grease deteriorates (oxidizes), have the generator bearing replaced every five years.

Troubleshooting

GENERAL

Fault Circuits

“Check Generator” Fault: If the “Check Generator” fault breaker on the control panel trips, as indicated by an extended reset button, the genset may have been overloaded. *Push the reset button to reset.*

“Check Engine” Fault: The genset control is connected to switches and sensors on the engine (Figure 17) that cause it to shut down the genset in the event of low engine oil pressure, high coolant temperature, high exhaust temperature or low coolant level (optional). The automatic voltage regulator (AVR), which is also inside the control box, causes the control to shut down the genset in the event of over-speed or over-voltage. If any of these fault shutdowns occurs the “Check Engine” fault breaker

on the control panel will trip, as indicated by an extended reset button. *Push the reset button to reset.*

Engine Gauges

Troubleshooting time can be saved if abnormal engine gauge readings were noted before shutdown; that is, whether shutdown was due to low oil pressure or to high engine temperature. Note that shutdown occurs when oil pressure falls below 14 psi (97 kPa) or engine temperature reaches 222° F (106° C).

Troubleshooting Tables

The following troubleshooting tables are designed to help you think through genset problems. The problem could be as simple as an empty fuel tank, closed fuel shutoff valve or tripped circuit breaker. If you fail to resolve the problem after taking the corrective actions suggested, see *How to Obtain Service*.

ENGINE DOES NOT STOP RUNNING

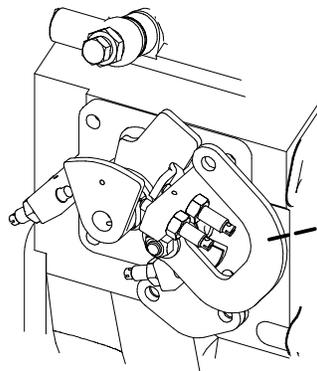
⚠ WARNING *There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read Safety Precautions and observe all instructions and precautions in this manual.*

Possible Cause

1. Malfunctioning fuel solenoid or linkage.

Corrective Action

Pull the stop lever to the right and hold it there until the engine stops (see figure).



PULL TO RIGHT
AND HOLD UNTIL
ENGINE STOPS

ENGINE DOES NOT CRANK FROM REMOTE PANEL

⚠ WARNING *There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read Safety Precautions and observe all instructions and precautions in this manual.*

Possible Cause	Corrective Action
1. Emergency Stop Switch OFF	Push ON.
2. "Check Generator" or "Check Engine" Fault	Service the fault as necessary and push fault reset button in. See "CHECK ENGINE" FAULT SHUTDOWN or "CHECK GENERATOR" FAULT SHUTDOWN.
3. Faulty remote circuit	Try starting at the genset control panel. If the genset starts, have the remote circuit repaired as necessary.

ENGINE DOES NOT CRANK FROM GENSET PANEL

⚠ WARNING *There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read Safety Precautions and observe all instructions and precautions in this manual.*

Possible Cause	Corrective Action
1. Emergency Stop Switch OFF	Push ON.
2. "Check Generator" or "Check Engine" Fault	Service the fault as necessary and push fault reset button in. See "CHECK ENGINE" FAULT SHUTDOWN or "CHECK GENERATOR" FAULT SHUTDOWN.
3. Cranking voltage too low	<ol style="list-style-type: none"> a. Clean and tighten or replace the positive (+) and negative (-) battery cable connectors and cables at the battery and the genset. b. Recharge or replace the battery. Specific gravity for a fully charged battery is approximately 1.260 at 80° F (27° C).

ENGINE CRANKS BUT DOES NOT START

⚠ WARNING *There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read Safety Precautions and observe all instructions and precautions in this manual.*

Possible Cause	Corrective Action
1. Engine not getting fuel	<ul style="list-style-type: none"> a. Open any closed shutoff valve. b. Check fuel level and refill as necessary. c. Prime the fuel system (p. 24). d. Check for fuel (air) leaks at all fittings and tighten as necessary. e. Replace the fuel filter (p. 23).
2. Blocked air inlet	Service as necessary.
3. Low engine temperature	<ul style="list-style-type: none"> a. Plug in, repair or install engine coolant and engine oil heaters. b. Replace the engine oil if it is not of the recommended viscosity for the ambient temperature.
4. Cranking voltage too low	<ul style="list-style-type: none"> a. Clean and tighten or replace the positive (+) and negative (-) battery cable connectors and cables at the battery and the genset. b. Recharge or replace the battery. Specific gravity for a fully charged battery is approximately 1.260 at 80° F (27° C).

“CHECK ENGINE” FAULT SHUTDOWN

⚠ WARNING *There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read Safety Precautions and observe all instructions and precautions in this manual.*

Possible Cause	Corrective Action
1. Low engine oil pressure	Check engine oil level, repair any leaks and fill to the proper level (p. 17).
2. High engine temperature	<ul style="list-style-type: none"> a. Check engine coolant level, repair any leaks and fill to the proper level (p. 18). b. Check V-belt tension (p. 20). c. Clean and service the cooling system as required to restore full cooling capacity (p. 18).
3. High exhaust temperature	<ul style="list-style-type: none"> a. Open the sea cock. b. Remove any blockage in the sea water strainer. c. Prime the sea water pump (p. 22). d. Replace the sea water pump impeller (p. 22). e. Clean seaweed and pump debris from heat exchanger (p. 22). f. Remove blockage covering the sea water hull strainer.

“CHECK GENERATOR” FAULT SHUTDOWN

⚠ WARNING *There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read Safety Precautions and observe all instructions and precautions in this manual.*

Possible Cause	Corrective Action
1. Generator overload.	Run with less load.

ENGINE LACKS POWER OR IS UNSTABLE

⚠ WARNING *There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read Safety Precautions and observe all instructions and precautions in this manual.*

Possible Cause	Corrective Action
1. Inadequate fuel delivery	a. Check for fuel (air) leaks at all fittings and tighten as necessary. b. Replace the fuel filter (p. 23).
2. Contaminated fuel	Connect the fuel lift pump to a container of fuel of known quality. Replace the contents of the fuel supply tank if there is a noticeable difference in performance.

NO OUTPUT VOLTAGE

⚠ WARNING *There are hazards present in troubleshooting that can cause equipment damage, severe personal injury or death. Troubleshooting must be performed by qualified persons who know about the hazards of fuel, electricity and machinery. Read Safety Precautions and observe all instructions and precautions in this manual.*

Possible Cause	Corrective Action
1. A line circuit breaker is Off .	Find out why the circuit breaker was turned Off , make sure it is safe to reconnect power, and then throw the circuit breaker On .
2. A line circuit breaker has Tripped .	Shut down the genset and have service performed as necessary to clear the short circuit or ground fault that caused tripping. Then Reset the circuit breaker and start the genset.

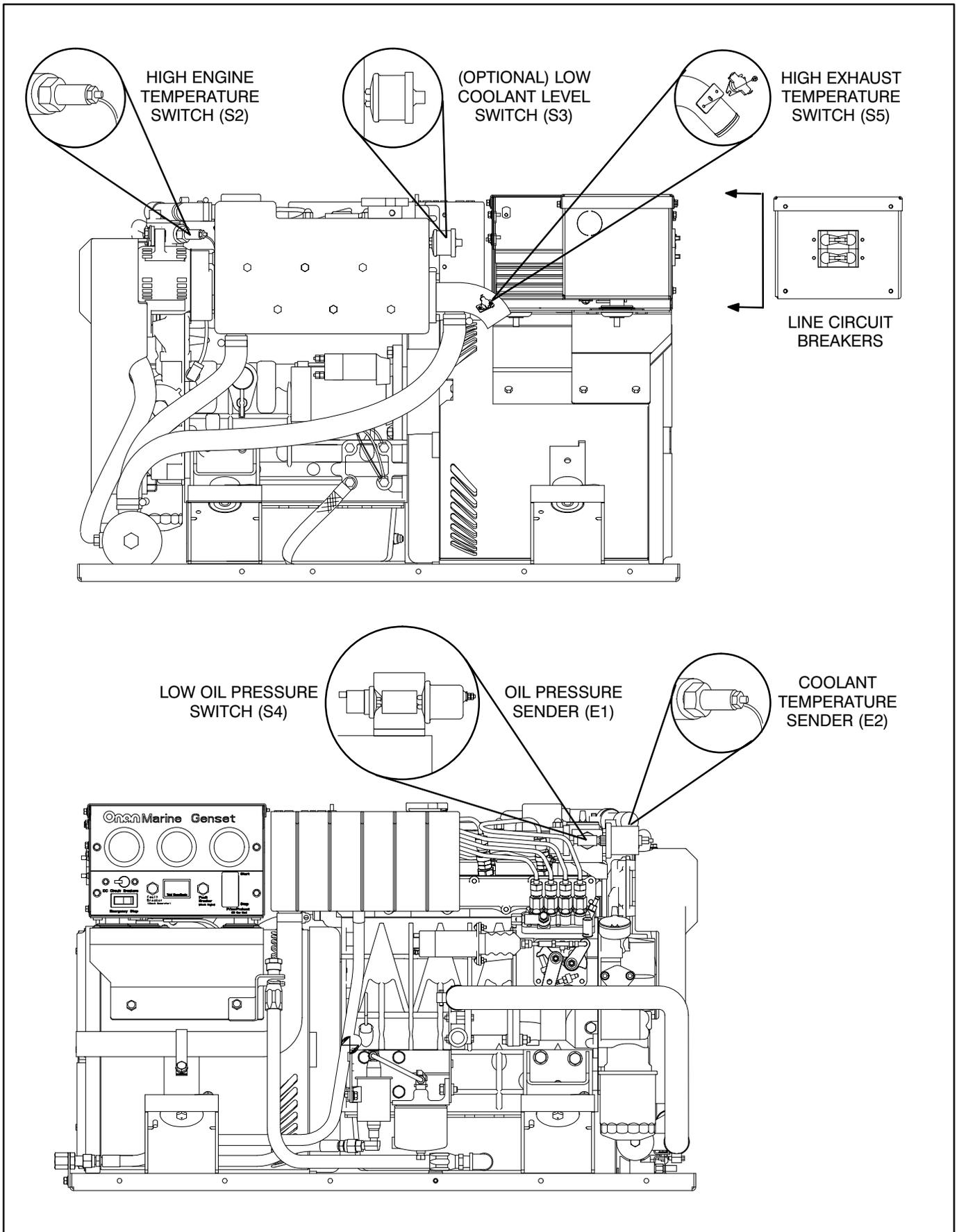


FIGURE 17. ENGINE GAUGE SENDERS, SHUTDOWN SWITCHES AND LINE CIRCUIT BREAKERS

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) and the International Sales and Service Directory (IN-1013) 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). By calling this number you can also request a directory of authorized RV servicing dealers: RV Sales and Service Directory F-919.

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. *Complete model number and serial number*
2. *Date of purchase*
3. *Nature of the problem.*

⚠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.*

Information for California Genset Users

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

As a California user of these gensets, please be aware that unauthorized modifications or replacement of fuel, exhaust, air intake, or speed control system components that affect engine emissions are prohibited. Unauthorized modification, removal or replacement of the genset label is prohibited.

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

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

TABLE 3. EMISSIONS CONTROL INFORMATION

Genset Warranty Information	The California emissions control warranty statement is located in the same packet of information as this manual when the engine is shipped from the factory.
Engine Fuel Requirements	The engine is certified to operate on diesel fuel. See FUEL RECOMMENDATIONS in <i>Introduction</i> .
Engine Lubricating Oil Requirements	See ENGINE OIL RECOMMENDATIONS in <i>Introduction</i> .
Engine Adjustments	High Idle Speed. This is a service procedure requiring trained personnel and proper tools. See the Service Manual.
Engine Emission Control System	The engine emission control system consists of engine design and precision manufacture. (IFI)



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

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