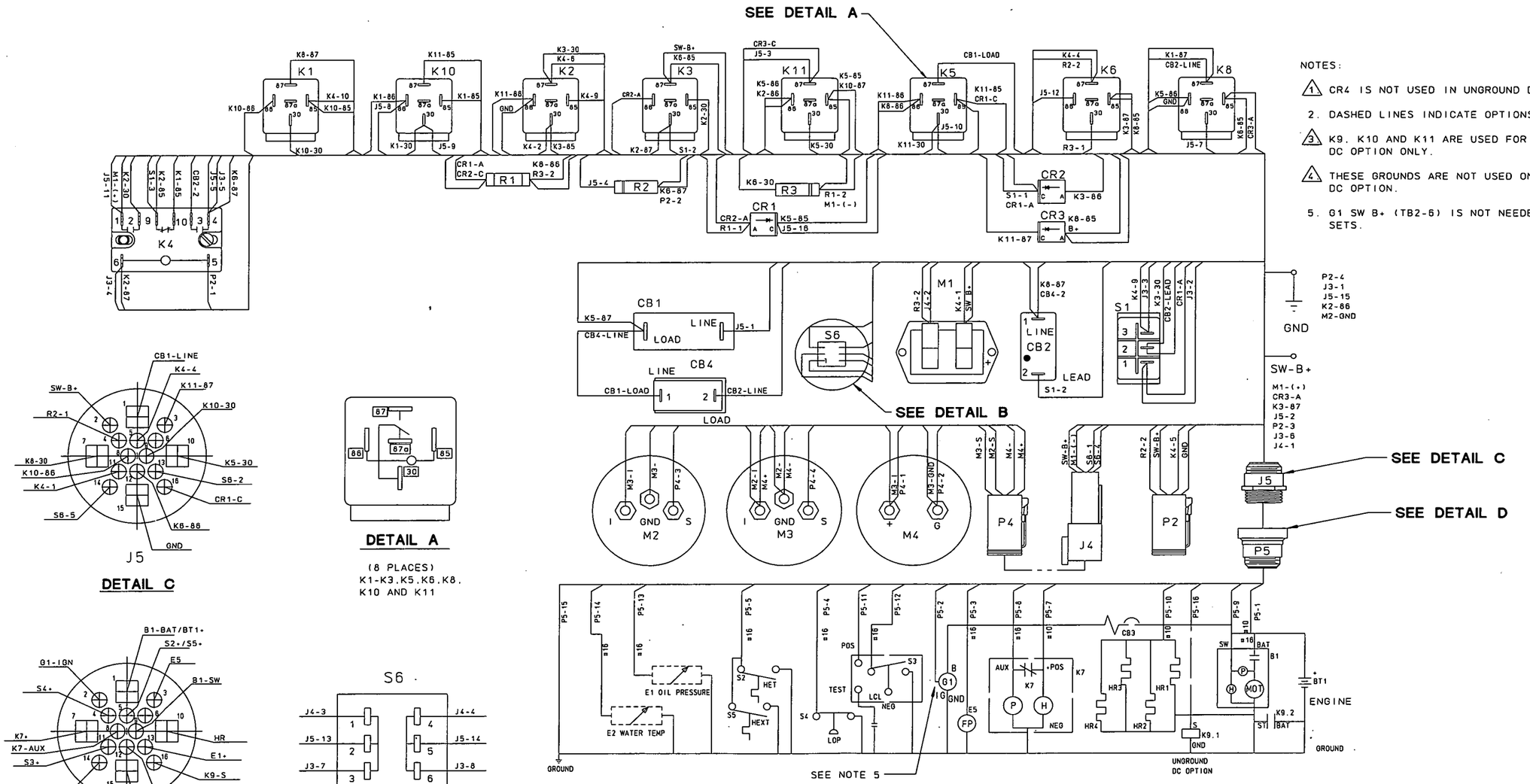


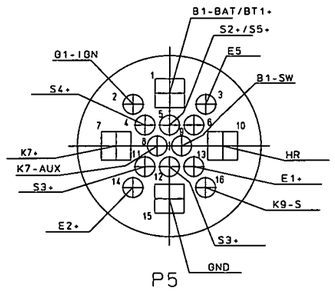
NOTES:

1. CR4 IS NOT USED IN UNGROUND DC OPTION.
2. DASHED LINES INDICATE OPTIONS.
3. K9, K10 AND K11 ARE USED FOR UNGROUND DC OPTION ONLY.
4. THESE GROUNDS ARE NOT USED ON THE UNGROUND DC OPTION.
5. G1 SW B+ (TB2-6) IS NOT NEEDED ON UNGROUNDED SETS.

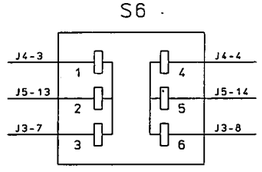
DETAIL C

DETAIL A

(8 PLACES)
K1-K3, K5, K6, K8, K10 AND K11



DETAIL D



DETAIL B

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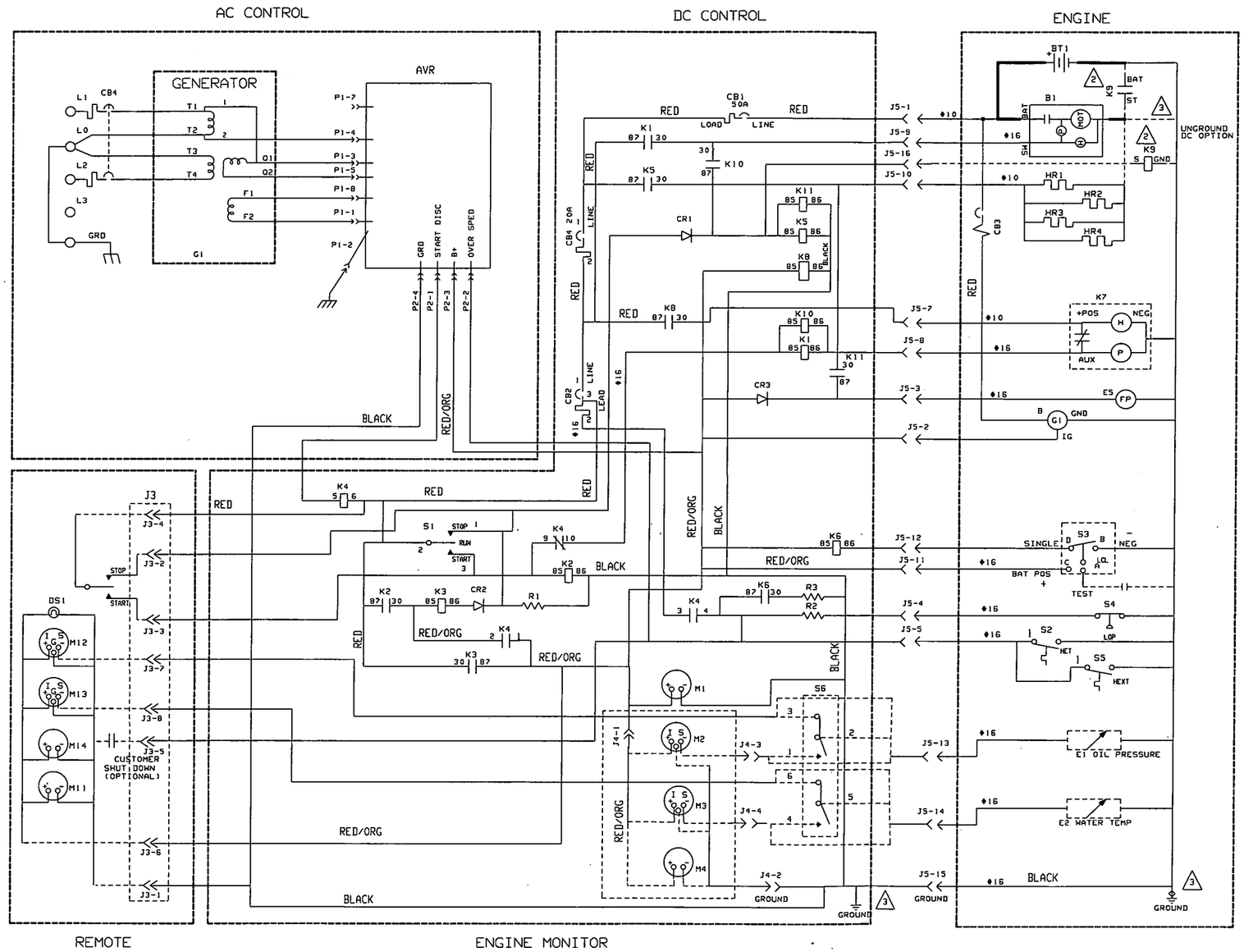

NOTES;

1. DASHED LINES INDICATE OPTIONS.

2 K9 IS USED FOR UNGROUNDED DC OPTION ONLY.

3 THESE GROUNDS ARE NOT USED ON UNGROUNDED DC OPTIONS.

	Description	Ref
1	RELAY, 12V OR 24V (STARTER)	K1
2	RELAY, 12V OR 24V (GLOW PLUG)	K5
3	RELAY, 12V OR 24V (FUEL SHUT OFF)	K8
4	BRIDGE RECTIFIER, 1/2 WAVE	CR1
5	CIRCUIT BREAKER,50 AMPS DC	CB1
6	LAMP-RUN LIGHT	L1
7	ACR, SRA-1900 MODIFIED	AVR1
8	TERMINAL STRIP 3PL	TB1
9	TERMINAL STRIP 14 PL	TB2
10	SWITCH, STOP/START,PREHEAT	S1
11	RELAY, START	K2
12	RELAY, RUN	K3
13	RELAY, START DISCONNECT	K4
14	RELAY, LOW COOLANT SWITCH	K6
15	RESISTOR 10 OHMS 10 W (12V) RESISTOR 36 OHMS 15 W (24V)	R1 R1
16	CIRCUIT BREAKER, FAULT	CB2
17	METER, RUN TIME	M1
18	METER, OIL PRESSURE	M2
19	METER, WATER TEMPERATURE	M3
20	METER, DC VOLTAGE	M4
21	FUEL SHUT OFF SOLENIOD	K7
22	FUEL PUMP (FP)	E5
23	LOW COOLANT LEVEL (LCL)	S3
24	LOW OIL PRESSURE (LOP)	S4
25	HIGH ENGINE TEMPERATURE (HET)	S2
26	HIGH EXHAUST TEMP	S5
27	OIL PRESSURE SENDER	E1
28	WATER TEMP SENDER	E2
29	RECTIFIER RECTIFIER	CR2, 3, 4 CR2, 3, 4
30	RESISTOR 10 OHMS 5W (12V) RESISTOR 24 OHMS 10W (24V)	R2 R2
31	RESISTOR 8.5 OHMS 5W (12V) RESISTOR 18 OHMS 10W (24V)	R3 R3
32	ALTERNATOR (12V)	G1
33	CIRCUIT BREAKER (CHARGING)	CB3
34	CIRCUIT BREAKER DC/EMER STOP	CB4
35	BATTERY 12V OR 24V	BT1
36	RELAYS FOR UNGROUND DC	K9
37	SWITCH-2 POLE DOUBLE THROW	S6
38	RELAY	K10
39	RELAY, PRIME FUEL	K11

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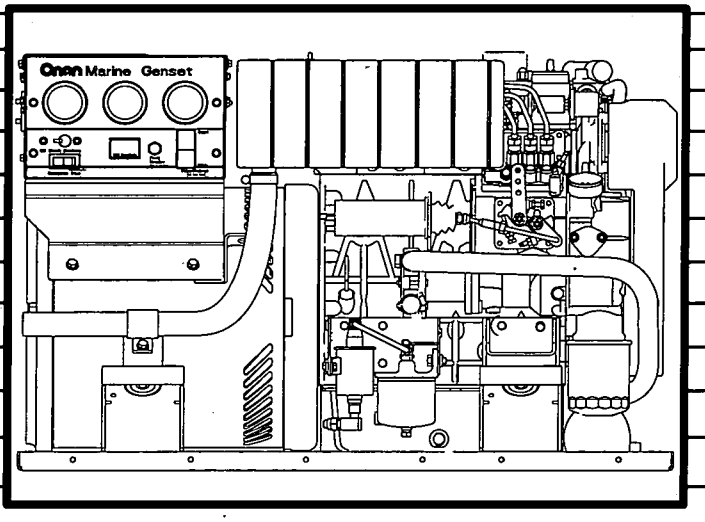
Rev. A Sys: HP
Modified

Onan MARINE

Installation Manual

MDKAL



Printed in U.S.A.

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Safety Prec

Print
Inside
Front
Cover

Before operating the generator set, re Manual and become familiar with it and your **cient operation can be achieved only if th operated and maintained.** Many accidents ure to follow fundamental rules and precaut

Throughout this manual you will notice symb to potentially dangerous conditions to the op sonnel, or the equipment itself.

⚠ DANGER ***This symbol warns of i ards which will result in severe per death.***

⚠WARNING ***This symbol refers to a h practice which can result in severe pe... death.***

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

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC. Fire, explosion, and personal injury can result from improper practices.

- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Do not fill fuel tanks with the engine running. Do not smoke around the generator set area. Wipe up any oil or fuel spills. Do not leave oily rags in engine compartment or on the generator set. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip the engine fuel supply with a positive fuel shutoff.
- Always disconnect the battery ground (–) lead first and reconnect it last. Make sure you connect the battery correctly. A direct short across the battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is very explosive.
- Keep a fire extinguisher available in or near the engine compartment and in other areas throughout the vessel. Use the correct extinguisher for the area. For most types of fires, an extinguisher rated ABC by the NFPA is available and suitable for use on all types of fires except alcohol.

EADLY

tion. Equip the bilge with a power

enerator set engine exhaust sys- erform thorough, periodic inspec- em and repair leaks immediately. ly.

el with the generator set running ipped with an operating carbon

USE SEVERE PERSONAL

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any belt guards or covers with the generator set running.
- Keep hands and loose clothing away from moving parts. Do not wear jewelry while servicing any part of the generator set.
- Never step on the generator set (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions.from leaking fuel, leaking exhaust fumes, etc.
- Before performing any maintenance on the generator set, disconnect its batteries to prevent accidental starting. do not disconnect or connect battery cables if fuel vapors are present. Ventilate the generator set compartment or bilge thoroughly with the power exhauster.

ELECTRICAL SHOCK WILL CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not make adjustments in the control panel or on engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel standing on dry surfaces to reduce shock hazard.
- DO NOT CONNECT THE GENERATOR SET TO THE PUBLIC UTILITY OR TO ANY OTHER ELECTRICAL POWER SYSTEM. Electrocution or damage to property can occur at a site remote from the boat where line or equipment repairs are being made if the set is connected to the power system. An approved transfer switch must be used if more than one power source is to be made available to service the boat.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

M8

Copy and post these precautions in potential hazard areas of the vessel.

Table of Contents

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.

1. Introduction

GENERAL

Each marine genset must be installed properly if it is to operate reliably, quietly, and safely. Therefore, read this entire manual before starting the installation. The manual should be used only as a guide, as each installation must be considered on an individual basis. For operation and maintenance procedures, refer to the Operator's Manual that accompanies each genset.

Proper installation is very important. Requirements to consider include:

- Adequate cooling air
- Adequate combustion air
- Discharge of exhaust gases
- Discharge of circulated air
- Electrical connections and bonding
- Fuel connections
- Sea water connection
- Accessibility for operation and servicing
- Level mounting surface
- Adequate support under mounting points
- Noise levels

INSTALLATION CODES AND SAFETY RECOMMENDATIONS

The installation must follow all applicable codes and standards including the American Boat and Yacht Council (ABYC) and the National Fire Protection Association (NFPA).

The installer should be familiar with the appropriate guidance found in the following publications:

ABYC *"Safety Standards for Small Craft"* from:

ABYC
15 East 26th St.
New York, NY 10010

NFPA 302 *"Fire Protection Standard for Motor Craft"* from:

NFPA
470 Atlantic Ave.
Boston, MA 02210

USCG 33CFR183 from:

U.S. Government Printing Office
Washington, D.C. 20404

⚠WARNING

INCORRECT 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.

COMPONENT LOCATIONS

Figures 1-1, 1-2, and 1-3 illustrate the control panel, components, and most routine maintenance items.

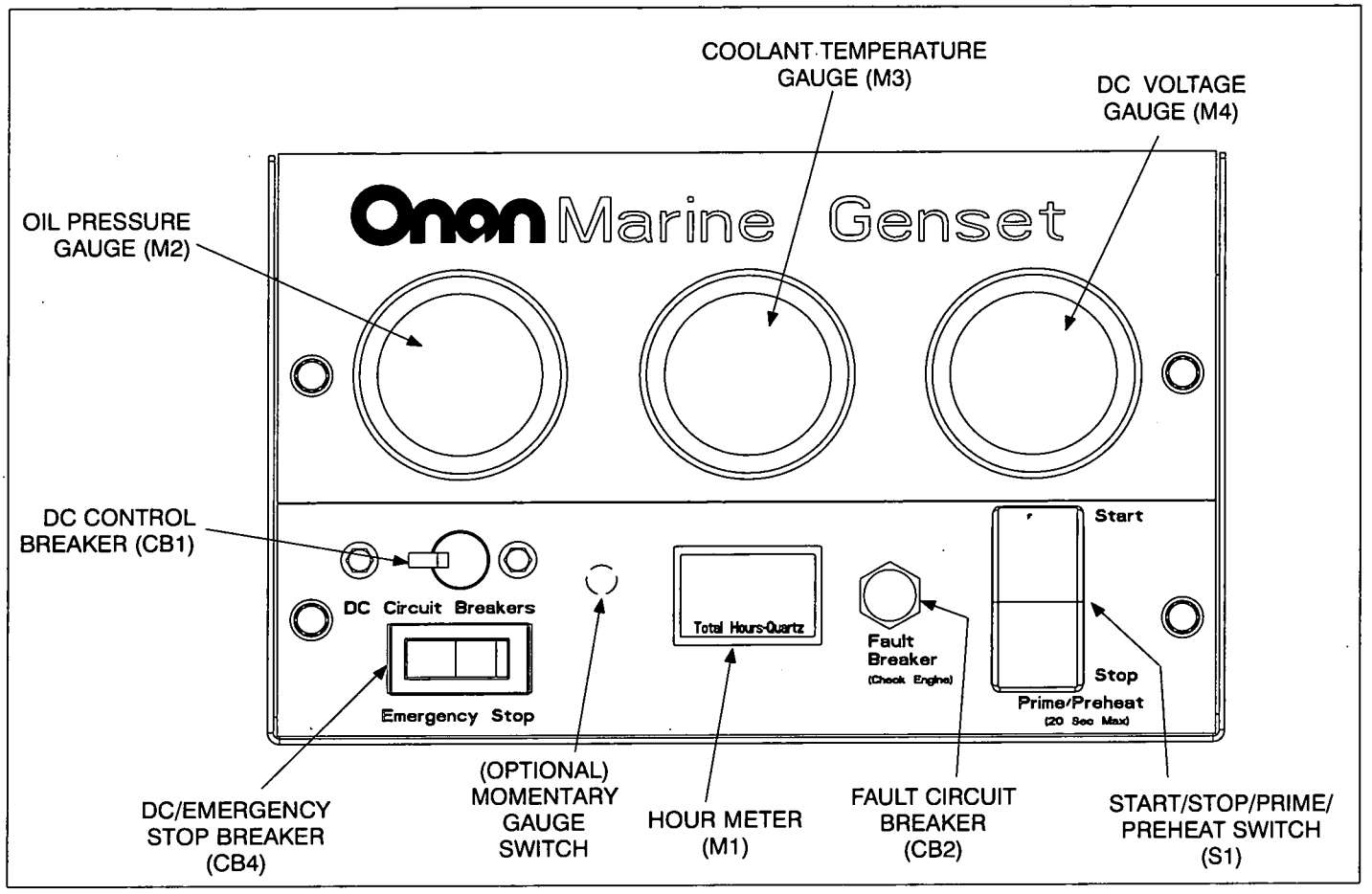


FIGURE 1-1. CONTROL PANEL

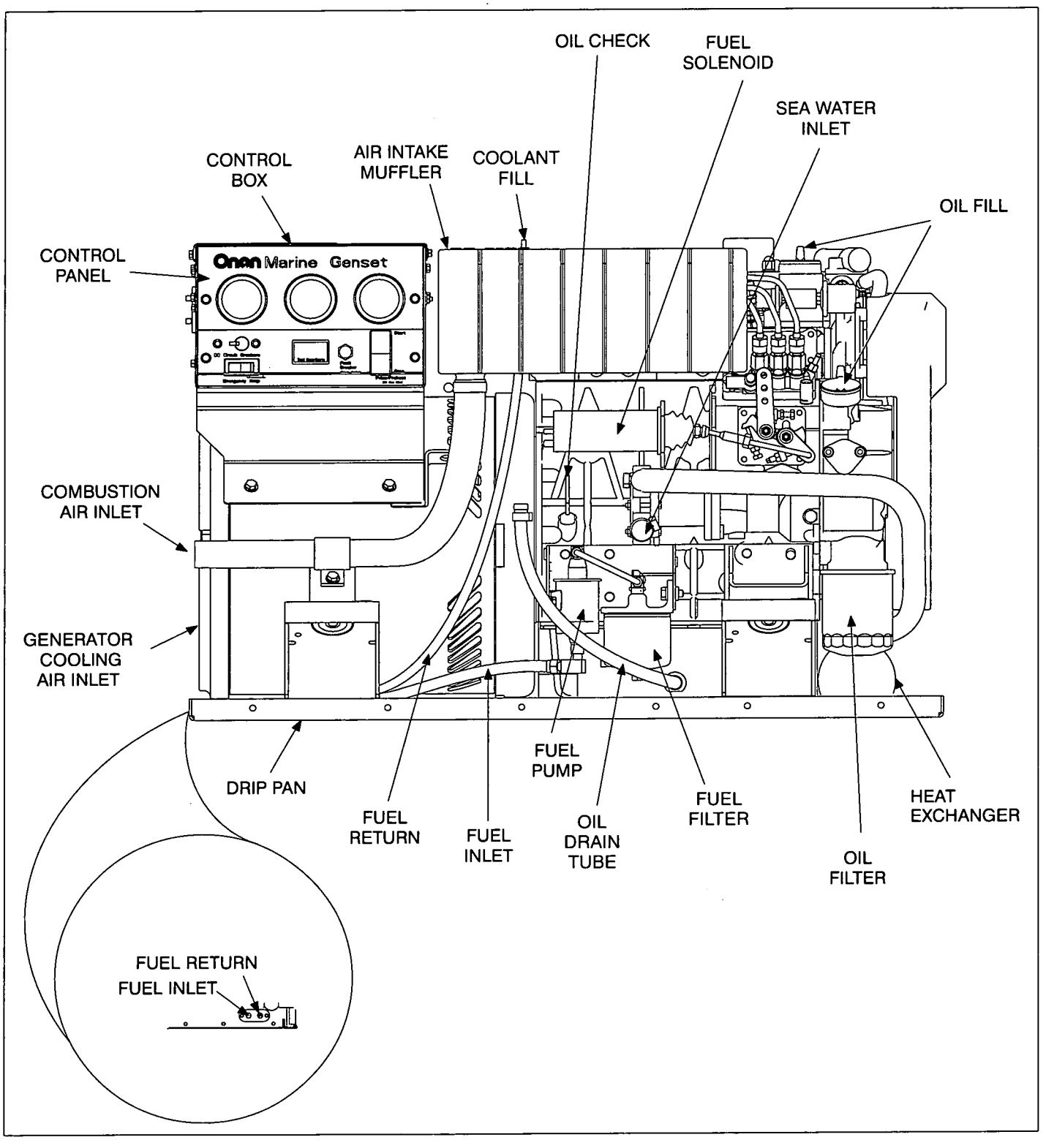


FIGURE 1-2. COMPONENT LOCATIONS, SERVICE SIDE OF SET

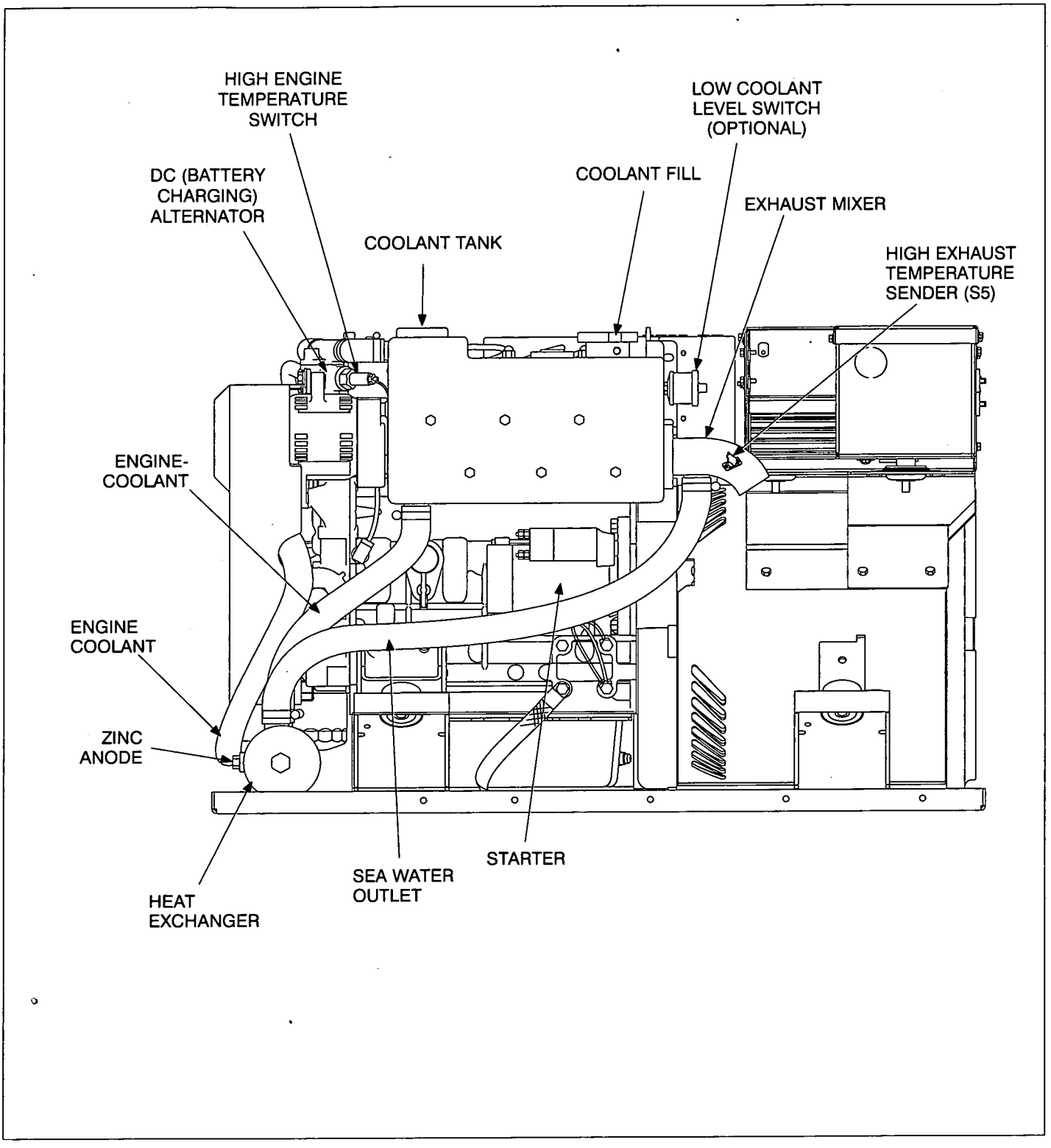


FIGURE 1-3. COMPONENT LOCATIONS, NON-SERVICE SIDE OF SET

2. Specifications

MDKAL GENSET:

DIMENSIONS AND WEIGHT

Without sound shield:

Length	32.5 in. (826 mm)
Width	18.5 in. (470 mm)
Height	22.2 in. (564 mm)
Weight	525 lbs (238 kg)

With sound shield:

Length	36.0 in. (915 mm)
Width	22.0 in. (568 mm)
Height	23.5 in. (596 mm)
Weight	625 lbs (284 kg)

ENGINE

Engine type:	Kubota® D1005, diesel, 3 cylinder, vertical in-line
Bore:	2.99 in. (76 mm)
Stroke:	2.90 in. (73.6 mm)
Displacement:	61.08 in^3 (1001 cm^3)
Compression ratio:	23:1
Lube oil capacity:	4.5 qt. (4.25L) Including Filter
Power (maximum) at 1800 rpm:	13.1 bhp
Fuel consumption (No. 2 diesel fuel) average @ full load:	0.84 gph (3.2 L/h)
Fuel pump lift (self-priming)	4 ft. (1.2 meters)
Fuel inlet	1/8-27, NPT, Female
Fuel return	1/8-27, NPT, Female
Total combustion air per minute required	1500 rpm: 25 ft^3/min. (0.71 m^3/min.) 1800 rpm: 30 ft^3/min. (0.86 m^3/min.)
Total cooling air per minute required (housed set)	1500 rpm: 75 ft^3/min. (2.15 m^3/min.) 1800 rpm: 90 ft^3/min. (2.55 m^3/min.)
Total cooling air per minute required (unhoused set)	1500 rpm: 125 ft^3/min. (3.54 m^3/min.) 1800 rpm: 150 ft^3/min. (4.24 m^3/min.)
Minimum compartment air opening (inlet)	35 in^2 (225.8 cm^2)
Minimum compartment air opening (outlet)	35 in^2 (225.8 cm^2)
Battery charge alternator maximum output (regulated)	35 amperes
Battery voltage (nominal)	12 volts
Battery recommendation minimum cranking performance @ 0° F (-18° C)	360 CCA
Coolant capacity	4 qt. (3.78 l)
Coolant flow rate (60 Hz)	5.0 gpm (19 l/min)
Coolant flow rate (50 Hz)	4.2 gpm (16 l/min)
Sea water flow (60 Hz)	6.0 gpm (23 l/min)
Sea water flow (50 Hz)	5.0 gpm (19 l/min)
Sea water lift capability	4 ft. (1.2 m) from water line to pump inlet

Kubota is a registered trademark of the Kubota Engine Company.

GENERATOR

Type ..... 4-pole revolving field, 4-wire reconnectible (1-phase)
12–wire reconnectible (3-phase), 1500/1800 rpm

Single-phase ratings:
60 hertz general marine rating ..... 8.0 kW, 10.0 kVA at 1.0 PF
50 hertz general marine rating ..... 6.5 kW, 6.5 kVA at 1.0 PF

Three-phase ratings:
60 hertz general marine rating ..... 8.0 kW, 8.0 kVA at 0.8 PF
50 hertz general marine rating ..... 6.5 kW, 8.125 kVA at 0.8 PF

Frequency regulation, no load-rated load: ..... 5 percent (± 1.5 Hz @ 5060 Hz)
Voltage regulation under varying load: ..... ± 1 percent

3. Location and Mounting

LOCATION

The genset location must be a well ventilated area, sound insulated, close to the fuel supply and the center of electrical load distribution. Usually those conditions are in the same room or compartment as the propulsion engine. However, a genset cannot be installed in the propulsion engine compartment unless specific conditions are met.

USCG regulation 33CFR183 pertains to gasoline fuel systems, and requires a genset operating in a gasoline fuel environment to be "ignition protected." This means a genset capable of operating in an explosive environment without igniting that environment.

The MDKAL genset is not "ignition protected" and cannot be operated in a gasoline-fueled environment. They can, however, be operated in a diesel-fuel environment.

⚠WARNING ***Gasoline fire or explosion can result in severe personal injury or death. Do not install a diesel generator set in the same room or compartment of a gasoline propulsion engine or generator set. The diesel unit is not ignition protected and can ignite gasoline fumes.***

Mount the set on and parallel with the keel or vessel center line if possible. Keep the genset away from living quarters, and away from bilge splash and vapors.

The compartment must be equipped with ventilation fans for exhausting fumes prior to starting the set, and with natural ventilation for exhausting fumes while underway.

There are significant differences between below load-waterline and above load-waterline installations. Be sure to review and follow the guidelines in *Section 6* of this manual.

MOUNTING

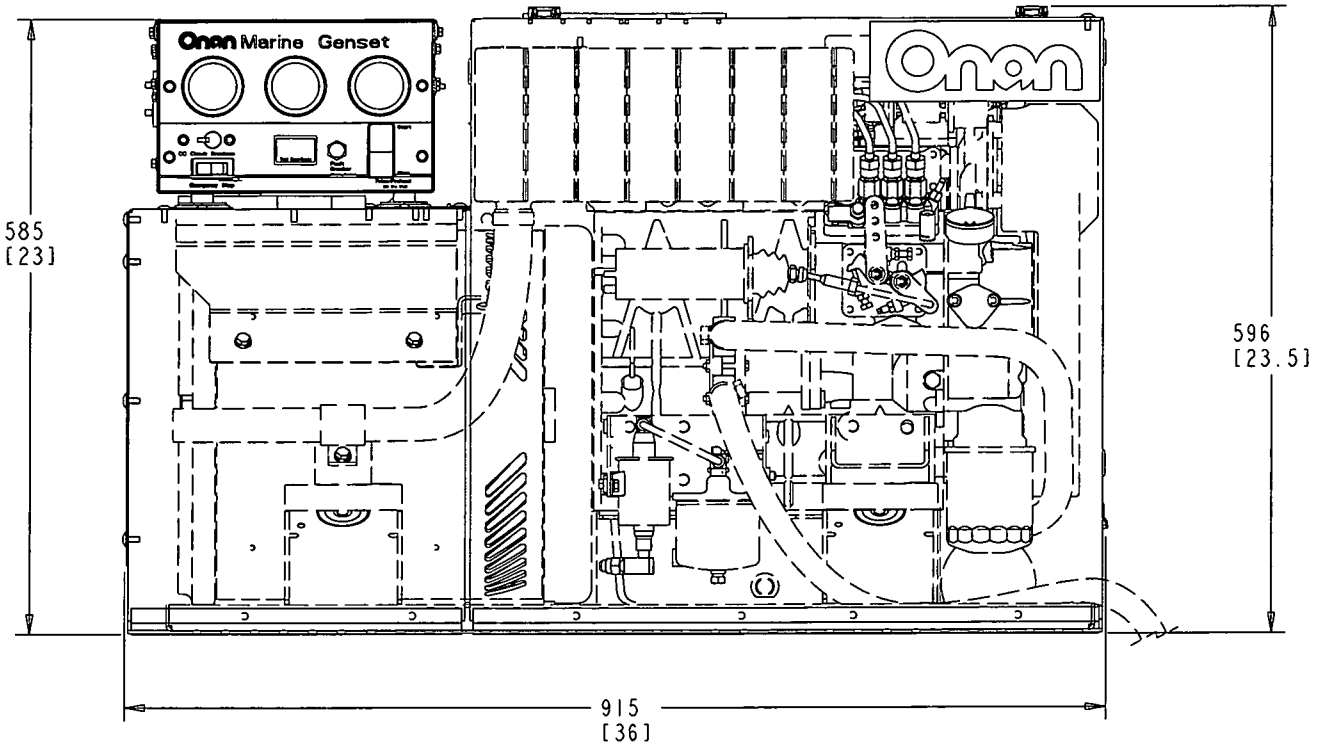
The mounting area must be flat and give adequate support for the genset weight directly under the genset mounting feet. This will maximize the effectiveness of the vibration isolator system.

Adequate space must be left on all sides of the genset for service access as well as ventilation and air flow. The service side door of the sound housing requires several inches minimum for removal and may require more space so as not to impede access for routine inspection and maintenance. Two inches minimum clearance is recommended on the other sides. Two inches of clearance is required above sound shield for the door latches.

Figure 3-1 illustrate the generator set outside dimensions with and without the generator set housing ("sound shield"). Figure 1-2 illustrates the service points on the generator set. Pay particular attention to the positions of these functions on the generator set:

- Battery positive and negative connections
- Fuel inlet and outlet connections
- Oil fill and drain
- Sea (cooling) water inlet and outlet

Make certain that these points can be easily accessed without removing the generator set. Openings at the ends of the set provide access for fuel and electrical connections.



MDKAL GENSET (8.0 kW @ 50/60 Hz)

Without sound shield:

Length	32.5 inches (826 mm)
Width	18.5 inches (470 mm)
Height	22.2 inches (564 mm)
Weight	525 pounds (238 kg)

With sound shield:

Length	36.0 inches (915 mm)
Width	22.0 inches (568 mm)
Height	23.5 inches (596 mm)
Weight	625 pounds (284 kg)

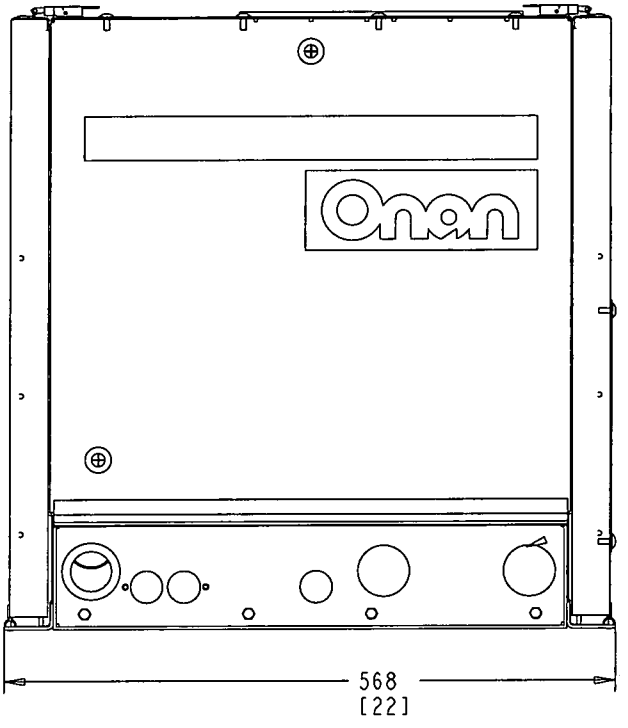


FIGURE 3-1. MDKAL DIMENSIONS

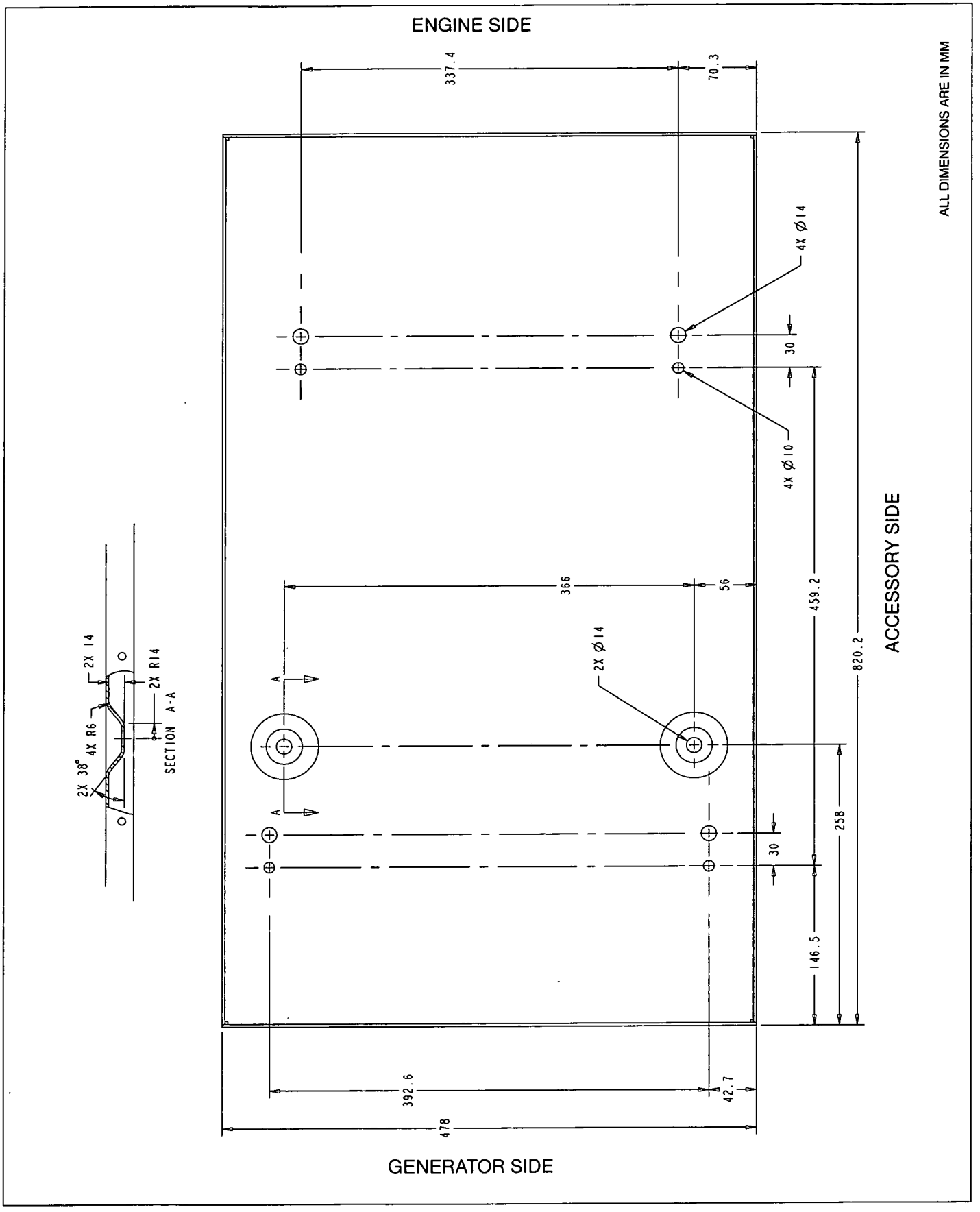


FIGURE 3-2. MDKAL DRIP PAN DIMENSIONS AND MOUNTING BRACKET LOCATIONS

CABLE AND FUEL LINE ROUTING

Unhoused GenSet

Unhoused generator sets have fuel bulkhead connectors mounted on the drip pan. The standard location for the fuel connectors is on the generator end, but the connector plate can be relocated to positions on either side or engine end of the drip pan. Note that the connector plate may need to be reversed or a bulkhead connector may need to be relocated to the third hole to permit proper fuel hose routing. Fuel hoses must not be kinked, chafe, rub, or make contact with moving parts that may cause a leak.

When making fuel connections, confirm that the fuel supply is plumbed to the fuel inlet connector and the fuel return is plumbed to the fuel outlet connector.

The fuel bulkhead connectors are 1/4 inch NPT (female). 1/4 inch to 1/8 inch adapters are provided with each generator set to allow connection to 1/8 inch NPT (female). Kit 149-2612 is available from Onan to adapt from 1/4 inch NPT to 8 mm fuel lines. See *Fuel System* section for additional installation requirements.

The sea water hose is connected to the 1.0 inch (25.4 mm) inlet on the sea water pump. See *Cooling System* section for cooling system details.

The battery connections are made on the non-accessory (exhaust manifold) side of the engine. The battery positive connection is made on the starter 5/16 inch (B+) terminal. The battery negative connection (B–) is made at the ground connection on the engine block. The ground fastener is 10 mm. A 5/16 inch ring terminal is acceptable on the ground terminal.

NOTE: Always disconnect the positive terminal first and reconnect last.

When isolated ground is specified, the battery negative connection is made on the K9 relay. The engine block is connected through the relay to battery negative during prestart glow and prime, and during starter cranking.

Remote gauge and start/stop kits are available, as well as harnesses of various lengths. These kits include installation instructions. When installing a remote panel kit, the waterproof 8-pin connector inside the GenSet control box is used and a strain relief grommet is attached. The connector can be routed to either side of the DC ControlBbox, where a "U" shaped knockout is removed.

NOTE: If both GenSet DC Control Box gauges and remote gauges are used, a momentary gauge switch kit must be installed.

The standard arrangement is for the DC Control Box to face the accessory side of the GenSet. The DC Control Box can also be mounted to face the generator end of the GenSet. Two fasteners in the bottom of the DC Control Box are removed, the box rotated and the fasteners reinstalled. The DC Control Box can be remotely mounted up to 10 feet (2.54 m) with two special harnesses. See *Electrical System* section for additional installation requirements.

The exhaust connection is made to the 2 inch (50.8 mm) O.D. exhaust mixer. When the optional dry stack exhaust adapter is used, special precautions must be taken to insulate the exhaust system components as noted in the kit installation instructions. See *Exhaust System* section for additional installation requirements.

Housed GenSet

When a sound shield (housing) is used, the standard location for the fuel bulkhead connectors is at the generator end of the GenSet. A different connector plate is used to mount the connectors than on the unhoused GenSets. If fuel connectors are desired at the engine end of the sound shield, the fuel hoses are disconnected from the connector plate and routed to the engine end of the GenSet where the connector plate is reinstalled. If the fuel supply and return are located at opposite ends of the GenSet, the hoses can be routed through grommets and the connector plate can be omitted. See *Fuel System* section for additional installation requirements.

The sea water supply hose can be routed into the sound shield at either end of the GenSet through a grommeted opening. A 90 degree elbow hose and a stainless steel connector are provided to permit connection to the sea water pump when the sea water inlet hose cannot be bent tight enough to connect to the sea water pump.

Mount locations are provided on both ends of the sound shield for the coolant expansion tank. Grommeted openings are provided on each end of the sound shield for the tube connecting the engine overflow to the expansion tank. A grommeted opening is provided on the engine end to mount an expansion tank overflow to the drip pan. On the generator end, any extra opening can be used.

Through holes are provided on the engine end of the sound shield for heat exchanger access. See *Cooling System* for additional installation requirements.

Battery connections can be made in the sound shield in several ways. A grommeted opening is provided under the exhaust outlet at the generator end for battery cables. A second opening is provided at the engine end. This location requires the removal of a plastic plug, installation of a grommet and routing the battery cables under the heat exchanger. A third option is a bulkhead connector located at the generator end. Battery cables are provided inside the sound shield. B+ and B– terminals are available for connection outside the sound shield. See Electrical System for additional installation requirements.

There are two options for routing the exhaust hose from the sound shield. The standard arrangement is to route the exhaust through the baffle at the generator end. A second method is to remove and discard the cover plate on the non–accessory side of the GenSet. The exhaust hose can exit the sound shield and may be routed down, or to either end of the GenSet, depending on installation requirements.

The sound shield is not designed for a dry stack exhaust system. Dry stack systems require insulation wrap and clearance to sound absorption foam and the sheet metal of the sound shield. See Exhaust System for additional installation requirements.

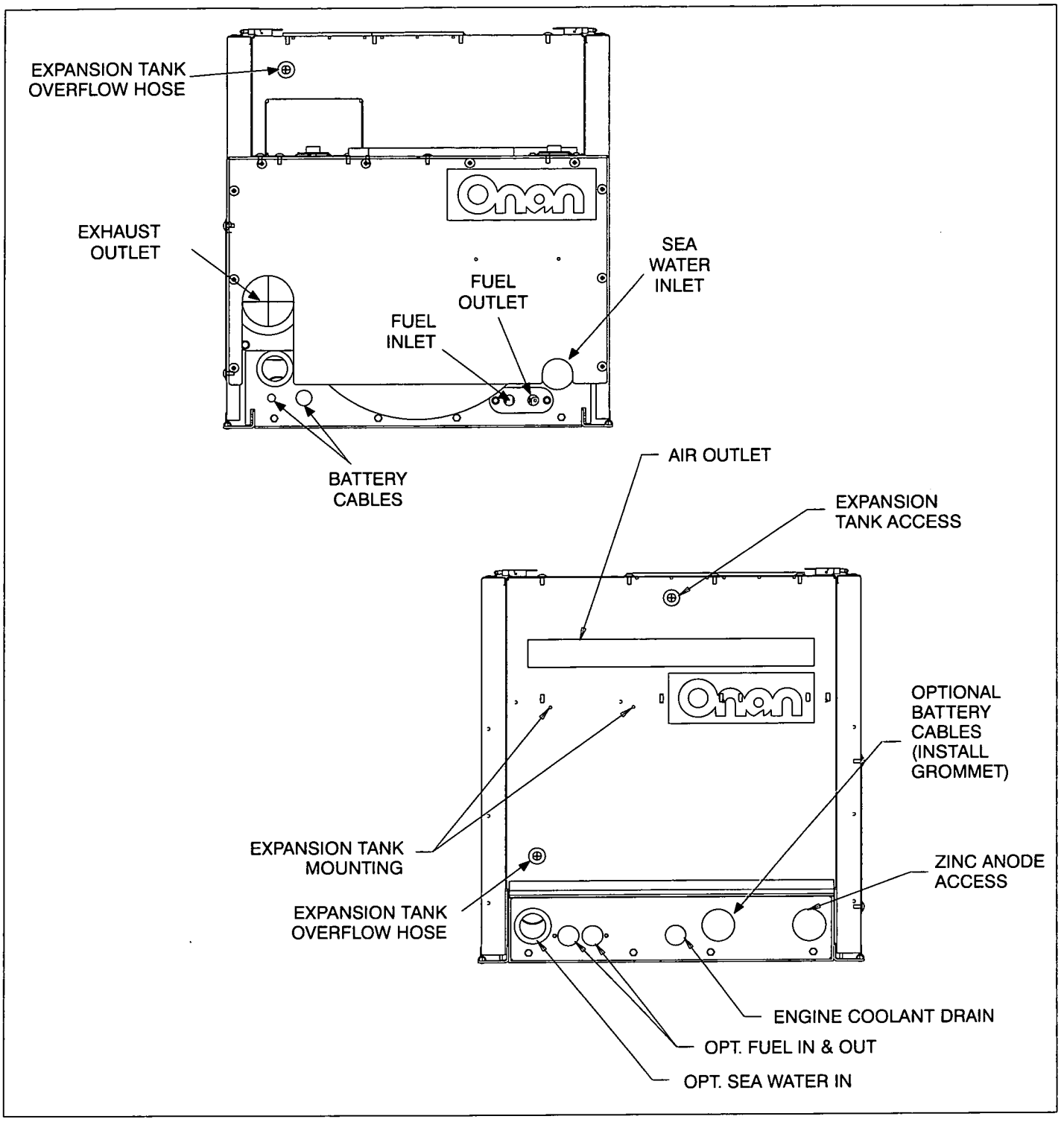


FIGURE 3-3. HOUSING OPENINGS FOR CABLES AND FUEL LINES (GENSET ENDS SHOWN)

4. Ventilation

⚠WARNING

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- *Dizziness*
- *Nausea*
- *Headache*
- *Weakness and Sleepiness*
- *Throbbing in Temples*
- *Muscular Twitching*
- *Vomiting*
- *Inability to Think Coherently*

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Never sleep in the vessel with the generator set running unless the vessel interior is equipped with an operating carbon monoxide detector. Protection against carbon monoxide inhalation also includes proper exhaust system installation and visual and audible inspection of the complete exhaust system at the start of each generator set operation.

GENERAL

The installation of boat ventilation systems must meet all Coast Guard and NFPA requirements. Establishing the correct air flow quantity is particularly important with small compartments under 1000 cubic feet (28 m^3), or installations in close quarters. Ventilation systems meeting Coast Guard requirements for passenger vessels (Table 4-1) will normally suffice for operation under all conditions.

TABLE 4-1. PASSENGER VESSEL VENTILATION REQUIREMENTS

SIZE OF COMPARTMENT Cu. Ft. (m^3)	MINUTES REQUIRED TO EXCHANGE TOTAL AIR VOLUME
Less than 500 (14)	2
500 to 1000 (14 to 28)	3
1000 to 1500 (28 to 42)	4
1500 and Up (42 and Up)	5

REQUIREMENTS

Marine gensets must have air ventilation for three very important reasons:

1. **To remove flammable or other harmful gases.** Coast Guard regulations require power blowers in the genset and propulsion engine rooms be run at least four minutes prior to starting the engine and during operation. The operator must also inspect the engine room for the presence of fuel vapors prior to starting, especially when gasoline fueled equipment is used (see text under Coast Guard and NFPA Requirements).

2. **To provide engine combustion air and generator cooling air.** Coast Guard regulations require power exhausters in all installations, and one blower in each exhaust duct. Exhausters must have an air capacity 1.5 to 2 times the minimum genset total air requirements (see Specifications *Section 2*).

3. **To control compartment temperature during genset operation.** This will avoid overheating which can result in shutdown, engine and related control component damage, and power loss. As a general rule, the operating environment for a diesel marine genset should be maintained below a maximum of 122° F (50° C). While marine gensets can operate for extended periods at higher temperatures, maintaining a lower maximum will result in better performance and longer life. Often an operating power blower is required to maintain temperature when the genset is operating, especially when the boat is not moving.

⚠WARNING ***Failure to provide proper ventilation can result in fire, explosion, asphyxiation, and equipment damage.***

The compartment must have air inlets and outlets to provide this air. Inlet ducts should have cowls or equivalent fittings of twice the area of the duct, larger if the opening is screened. Do not use recessed or flushed inlets, or louvered-transom outlets.

COAST GUARD AND NFPA REQUIREMENTS

The Coast Guard requires that diesel gensets have at least one ventilation air inlet and one outlet. The total inlet area must not be less than one square inch per foot (21.2 cm^2/m) of boat beam.

A separate diesel tank compartment must be ventilated with a large gooseneck vent, or by some similar means. The ventilating system must meet current Coast Guard and NFPA requirements.

Boats classified as pleasure vessels by the Coast Guard must have sufficient ventilation to eliminate accumulation of flammable gases. Boats under 65 feet (20 m) long classified as passenger vessels require ventilation be sufficient to change the compartment air within a given time interval (Table 4-1).

For passenger vessels, the Coast Guard recommends a mechanical exhausting system to meet the requirement in Table 4-1. To prevent movement of fumes between living quarters and any compartment containing an engine or its exhaust system, seal all cracks, feed-through holes, and conduit ends.

A carbon monoxide (CO) detector listed for marine use should be installed in the living quarters of the vessel. The many ventilation variables (such as wind shifts, boat motion, at dockside where there can be exhaust gas from other vessels, etc.) make a CO detector an important accessory.

5. Cooling System

SYSTEM PLUMBING

NOTE: Throughout the manual, flotation water drawn into the boat for engine cooling is called "sea water".

To adequately cool the genset under all anticipated conditions, the plumbing system must be properly planned and installed. Excess plumbing length increases flow resistance and results in reduced cooling. An air leak in the sea water intake will reduce cooling, cause corrosion, and can even destroy the neoprene impeller in the sea water pump. The neoprene impeller must never be run dry, and the pump should be primed before initial start.

Water lines should be SAE 20R3 hose or equivalent. The water lines must be capable of withstanding a slight vacuum without collapse. The entire length must be supported and secured with clamps. A length of hose at the genset must be free to allow for set movement.

The inlet water line must have a minimum inside diameter of 1.0 inch. For runs of over 20 feet (5.2 m) or a lift of more than four feet (1.2 m), consult Onan application engineering.

Because sea water is not always clean, a water strainer or filter should be installed to protect the engine cooling system. See Figure 5-1.

Onan has a hull strainer (furnished with some muffler kits) that can be used with a flush through-hull fitting. The strainer (Figure 5-1), installed with the slots parallel to the keel, helps prevent pressure or vacuum when the boat is underway. Always use a flush-type inlet with a hydrodynamic marine muffler.

⚠ CAUTION ***Restriction in the sea water inlet line can cause engine overheating and shutdown. The flush-type, through-hull water inlet must have an opening at least as large as the water inlet line.***

Stagger the genset water inlet so it is not directly in line with other inlets. Not doing so can reduce the amount of sea water available to the genset when underway and cause overheating. Never use scoop type water inlet fittings along with a hydrodynamic muffler.

⚠ CAUTION ***DO NOT USE SCOOP TYPE WATER INLET FITTINGS WITH A HYDRODYNAMIC MUFFLER. Forward facing scoops can develop sufficient ram pressure to force water past the generator set sea water pump. This can flood the exhaust system and the engine cylinders. This happens when the generator set is not running and the boat is underway. Rear facing scoops develop vacuum which can impede cooling water flow.***

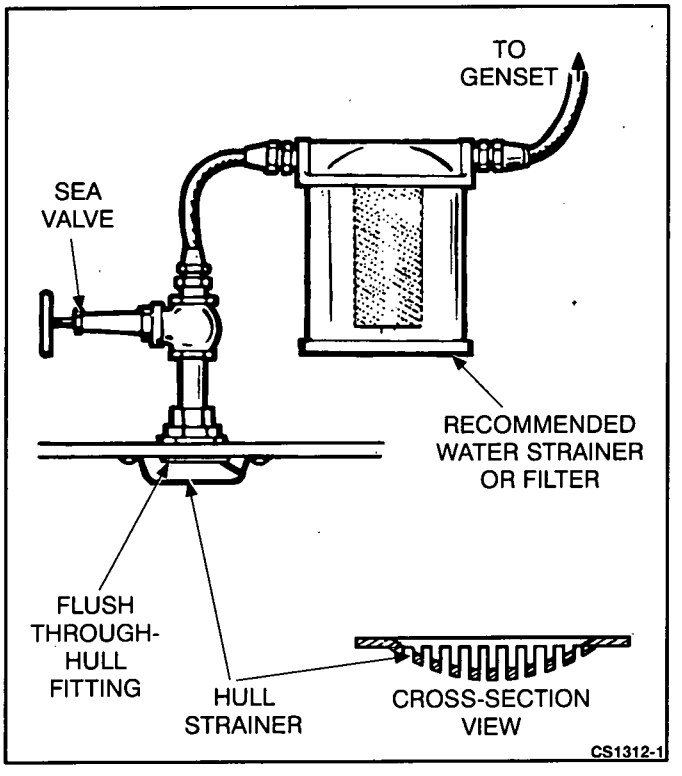


FIGURE 5-1. SEA WATER INLET

HEAT EXCHANGER COOLING

The cooling system keeps sea water and any sediment deposits (salt, silt, etc.), away from the engine cooling jacket. As a result, the engine water jacket stays clean for optimum heat transfer. Figure 5-2 shows the flow direction of sea water and engine coolant.

The sea water pump constantly renews the sea water in the heat exchanger, then dumps it into the exhaust elbow. The exhaust water flow cools the elbow, connecting hoses, and muffler in the exhaust system.

The engine coolant is circulated by a pump through the engine block, heat exchanger, and the exhaust manifold. The engine coolant temperature and flow rate are controlled by a thermostat. The engine cooling system should always use a 50-50 mixture of coolant (ethylene glycol or propylene glycol) and distilled water to help prevent corrosion. See the Installation Checkout section for filling instructions.

⚠ CAUTION ***Some propulsion engines use scoop-type water inlet fittings which must not be used on a generator set with a hydrodynamic muffler. When the set is not operating, ram pressure may force water past the generator set's sea water pump and flood the exhaust system. From there it can flow back, flooding the engine cylinders and possibly the engine compartment.***

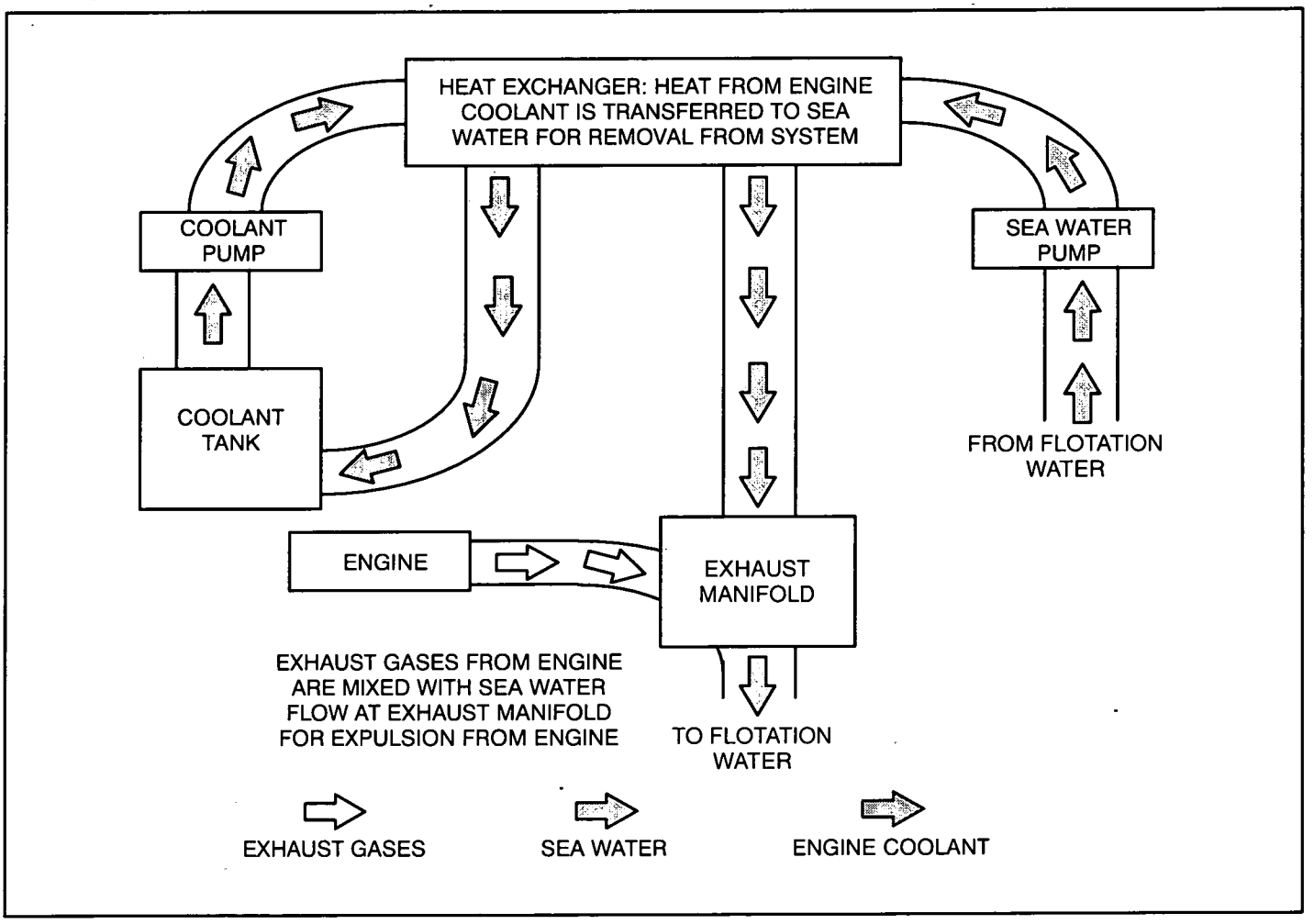


FIGURE 5-2. COOLANT FLOW, HEAT EXCHANGER COOLING SYSTEM

COOLING SYSTEM CHECK

Before initial operation, cooling system checks must be performed, as follows.

Sea Water System

Before initial operation, prime the sea water pump. This lubricates the neoprene impeller and prevents dry operation, especially on above-water-line installations. Prime the pump by removing the inlet hose at the pump connection. Fill the pump with water, then replace the inlet hose. When the genset is started, check the exhaust outlet for delivery of water to the system. Flow should be as listed in the Specifications.

The lift pump will prime with 4 feet (1.2 m) of lift from the water line to the inlet of the sea water pump. The pump impeller must be wet at initial startup (see priming instructions, above). Raising the heat exchanger outlet point (where the sea water is injected into the exhaust system) decreases lift capacity.

⚠ CAUTION ***Do not operate the generator set if the cooling system is faulty. Doing so can result in damage to water-cooled exhaust system components and engine.***

Engine Coolant System

The genset has a high coolant temperature shutdown switch. This switch can prevent engine damage only if the cooling system is kept clean and properly maintained.

A coolant recovery tank kit is supplied with the genset and must be connected per the instructions. Be sure the system is full of coolant, and the recovery tank filled to the COLD mark before the genset is placed in service.

Installing Coolant Recovery Tank

A coolant recovery tank is in the accessory kit furnished with each generator set. Figure 5-3 shows a typical installation with the tank accessible on the service side of the engine. It should be located so the hose between the genset and tank is pitched slightly downward.

Use the bracket as a template to locate mounting holes. Allow at least 2 inches (51 mm) from the top of the tank to any upper structure so the tank can be lifted off the bracket for servicing.

Use a length of hose from the kit between the engine overflow and the connector on the recovery tank. This hose resists collapse from vacuum. Allow sufficient hose lengths so the tank can be easily removed from the bracket to add coolant.

NOTE: Route the end of the drain tube to the drip pan to avoid coolant spills to the bilge.

Engine coolant is at proper level when the recovery tank level is between HOT and COLD (engine cold).

Use a 50-50 mixture of coolant (ethylene glycol or propylene glycol) and distilled water as an engine coolant—even when freezing temperatures are not expected. In addition to lowering the freezing point, these coolants contain rust inhibitors that help prevent corrosion and scale, and lubricate the water pump.

⚠ CAUTION ***Do not exceed a 50-50 mixture of coolant (ethylene glycol or propylene glycol) and water. A stronger mixture of coolant will alter heat transfer properties of the coolant.***

Filling the Cooling System

Verify that all drain valves are closed and all hose clamps secure. Remove the cooling system pressure cap and slowly fill the cooling system with the coolant mixture described above.

⚠ WARNING ***Hot coolant can cause burns and severe personal injury. Be certain that the engine is cool before removing the pressure cap.***

Leave the pressure cap off and start the engine. As trapped air is expelled, the coolant level will drop and additional coolant should be added. Replace the pressure cap when the coolant level is stable.

At the recovery tank, add coolant mixture to the COLD mark. Operate the genset for approximately 15 minutes, until normal operating temperature is maintained. Shut off the genset and let it cool down. Add coolant to the recovery tank until the level stabilizes at the COLD mark. This may require several operation cycles until air is purged from the system.

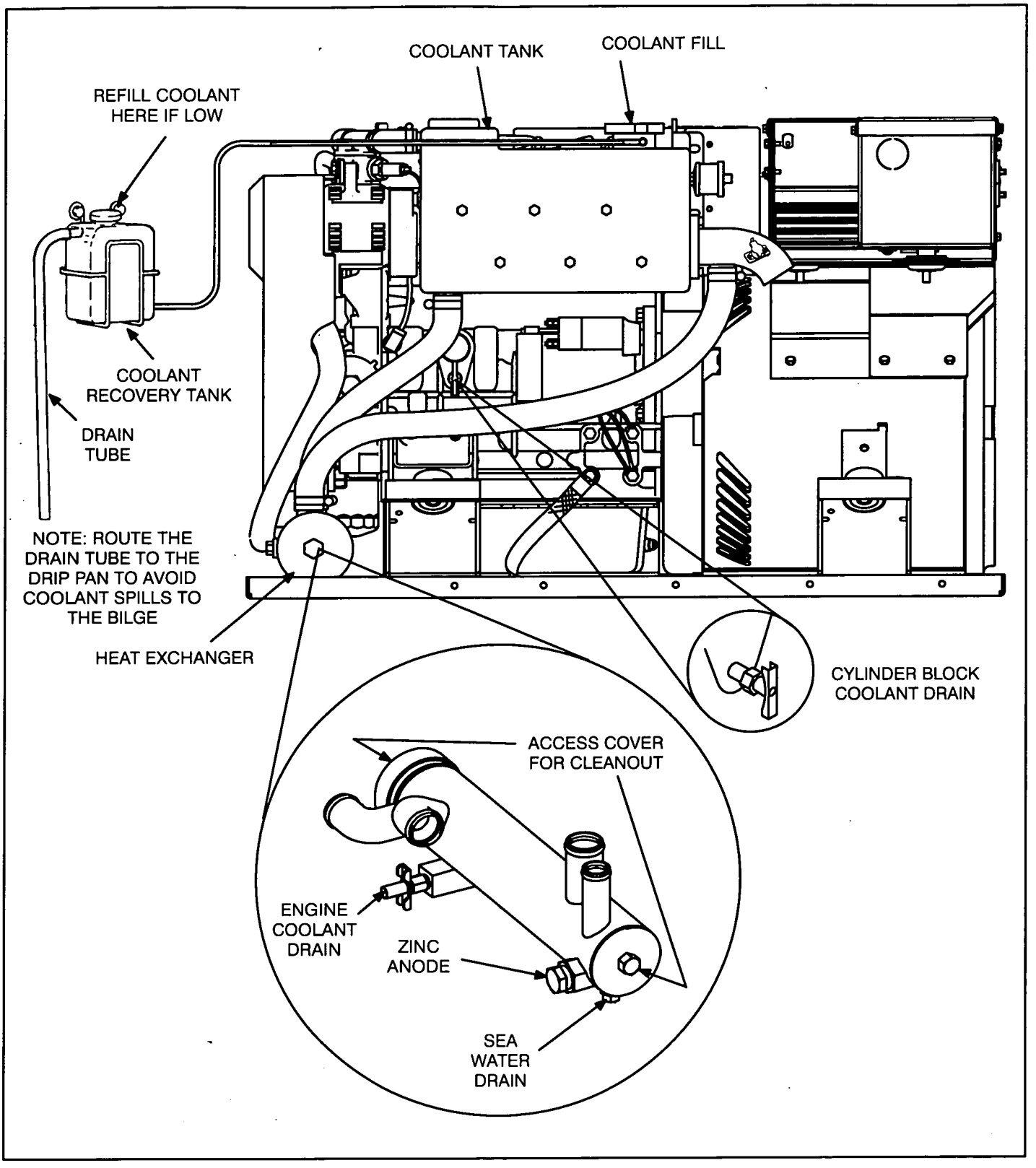


FIGURE 5-3. GENSET COOLING SYSTEM

6. Exhaust System

GENERAL

The installation of two different water-cooled exhaust systems are covered in this section. All marine water-cooled exhaust systems must meet each of the following requirements.

⚠WARNING ***Failure to meet these requirements and any applicable codes can result in severe property damage, personal injury or death.***

- The entire exhaust system must be accessible so a periodic visual and audible leakage-check can be done by the operator.
- The exhaust system must be water cooled.
- The exhaust line must be installed to prevent back flow of water to the engine under any condition. The exhaust outlet must be above the load waterline, because water backflow into the engine will damage it.
- The genset exhaust system must not be combined with the exhaust system of another engine.
- A flexible section of marine exhaust hose must be used near the engine to allow for engine movement and vibration during operation. All exhaust system hoses must be designed for marine use.
- The exhaust system must be of sufficient size to prevent excessive back pressure. See Back Pressure data in this section.
- Make sure all sink, shower or other cabin drains are properly trapped to prevent entrance of exhaust gas.
- Seal all cracks and holes between the engine compartment and living quarters.
- The exhaust hose must be adequately supported so it does not sag or put pressure on the manifold.

⚠WARNING ***Exhaust gas contains carbon monoxide, an odorless, colorless, highly-poisonous gas that presents the hazard of severe personal injury or death. Place special emphasis on the following:***

Never sleep in the vessel with the generator set running unless the vessel interior is equipped with an operating carbon monoxide detector. Protection against carbon monoxide inhalation also includes proper exhaust system installation and visual and audible inspection of the complete exhaust system at the start of each generator set operation.

⚠ CAUTION ***Backflow of water can cause severe engine damage and possible flooding of the boat. Make sure the hose from the exhaust manifold to the muffler slopes a minimum of 1/2 inch per linear foot (42 mm/m). An uphill section between the exhaust manifold and muffler can cause backflow of water and is not permissible—NO EXCEPTIONS.***

Be sure that the vertical rise of the exhaust hose exiting the muffler, measured from the bottom of the muffler to its peak, is not more than 48 inches (1.2 m) as shown in Figures 6-1 and 6-2. The vertical rise must not slope; it must be vertical in relation to the base of the hydrodynamic muffler.

The exhaust tubing (on both above and below load-waterline installations) must be pitched downward to the through-hull outlet fitting at a minimum downgrade of 1/2 inch per linear foot (42 mm/m). There must also be a 12-inch (305 mm) minimum drop from this peak to the through-hull outlet fitting as shown.

Provide adequate support for hose lengths to prevent sagging, bending, and formation of water pockets. The use of vibration-isolated pipe hangers will help stop noise transmission to the boat hull.

Allow space between the marine muffler and its mounting surface by using spacers under the mounting flanges. This allows air circulation under the muffler and reduces condensation.

Material

Use material recommended by ABYC in "Safety Standard for Small Craft," Section P1. The exhaust line must be at least as large as the engine exhaust manifold outlet. See the following section on Back Pressure.

- ***Be sure the flexible exhaust hose is designed and certified for marine exhaust-line use.***
- ***Use two stainless steel clamps at each end of all flexible exhaust hose connections.***
- ***Do not make sharp bends in the exhaust hose, and protect it from sharp, abrasive and hot surfaces.***
- ***Position exhaust outlet to prevent backflow of exhaust gases into the vessel.***

Use flexible hose designed for marine exhaust-line use to ease installation, and for flexibility. The muffler must be at the lowest point of the entire exhaust system. The muffler inlet should be at least 12 inches (305 mm) below the engine exhaust manifold outlet. If this distance is less, backflow of water toward the manifold is more likely.

Use two stainless steel clamps at each end of exhaust hoses as shown in Figure 6-2. The clamps must be corrosion resistant metal, and a minimum of 1/2 inch (12.7 mm) wide. They should be spaced at least one clamp-width apart, and at least one clamp-width from the end of the hose. Clamps depending solely on spring tension must not be used.

Back Pressure

Exhaust back pressure is an important measure of an adequate exhaust system. If the exhaust installation requires a long run of pipe (more than 30 feet [9 m] overall), back pressure should be checked. Exhaust back pressure of the genset should not exceed 3.0 inches (76 mm) of mercury (10 kPa).

Increase the exhaust pipe diameter from the muffler to the hull outlet one standard pipe size for every 10 feet (3 m) beyond 30 feet (9 m) of overall length.

Exhaust Cooling Water Injection

The neoprene impeller pump moves the sea water through the heat exchanger and into the exhaust elbow. The injected water cools the exhaust and prevents exhaust system damage. A temperature operated switch on the exhaust mixing manifold shuts down the genset if overheating occurs. Figure 6-1 illustrates the sea water inlet.

If high exhaust temperature shutdown occurs, the entire exhaust system should be checked for any signs of overheating, especially the exhaust hoses. Replace defective components immediately, and do not operate the genset until system is repaired.

⚠WARNING ***Inhalation of exhaust gas can cause severe personal injury or death. Do not operate the generator set after a high exhaust temperature shutdown until the entire exhaust system has been checked and serviced as required.***

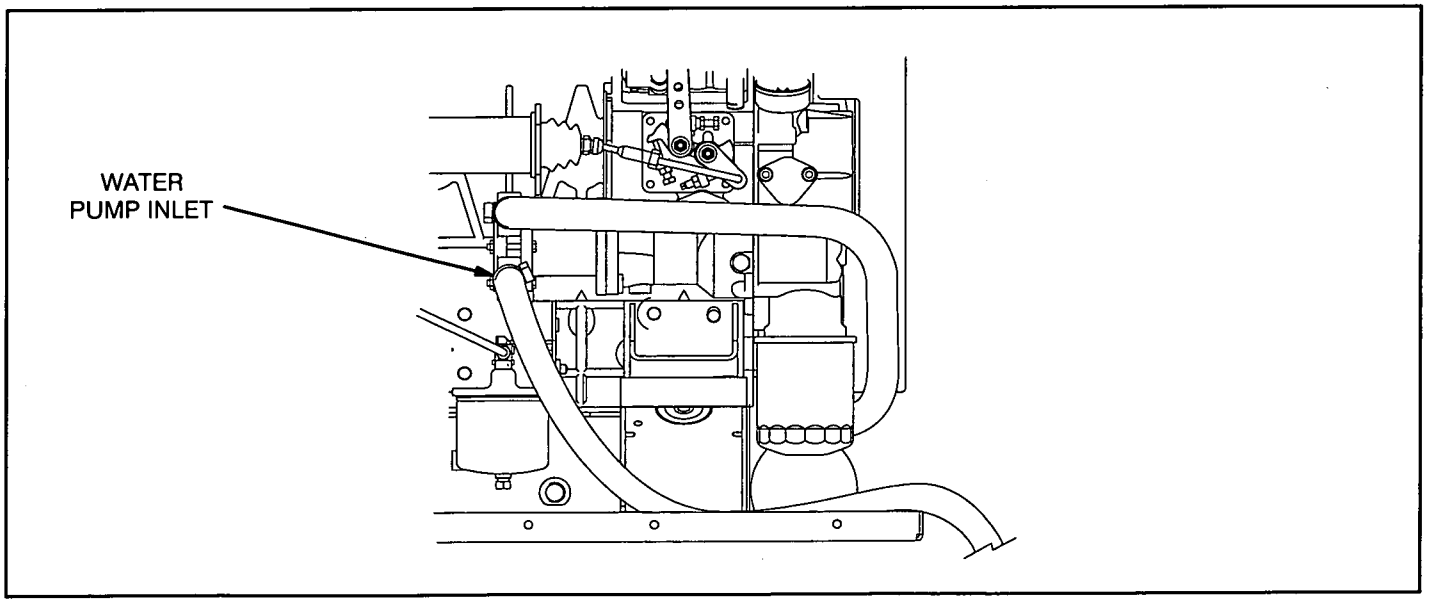


FIGURE 6-1. SEA WATER PUMP, SERVICE SIDE OF GENERATOR SET

BELOW LOAD-WATERLINE INSTALLATION

Figure 6-2 shows details of a recommended below-load waterline installation. Review and apply data from the preceding GENERAL section, plus the following.

Siphon Break

Install a siphon break (anti-siphon) if the sea water injection port on the exhaust mixing manifold is at or below the load-waterline. The siphon break is a vacuum-operated vent valve that opens the exhaust water discharge line to the atmosphere when the engine is not operating. The open vent valve prevents sea water from being siphoned into the exhaust manifold and engine cylinders installed at or below load-waterline.

The siphon break hose ends connect to the exhaust mixing manifold water-injection port and the sea water outlet on the heat exchanger.

Locate the siphon break in a vertical position at least 12 inches (305 mm) above the load-waterline. See Figure 6-2. Remote mounting is permissible within a 5 foot (1.5 m) radius of the injection port. The vertical position and height of the valve must be maintained.

The siphon break must be mounted vertically with the hose fitting pointing down. Use pipe strap material to secure the assembly to the frame or bulkhead. Be sure the slotted opening in the siphon break valve is open to atmospheric pressure. The valve will not function if the opening is closed in any way.

⚠ CAUTION ***Failure to use a siphon break when the exhaust manifold injection-port is at or below the load-waterline will result in sea water damage to the engine and possible flooding of the vessel.***

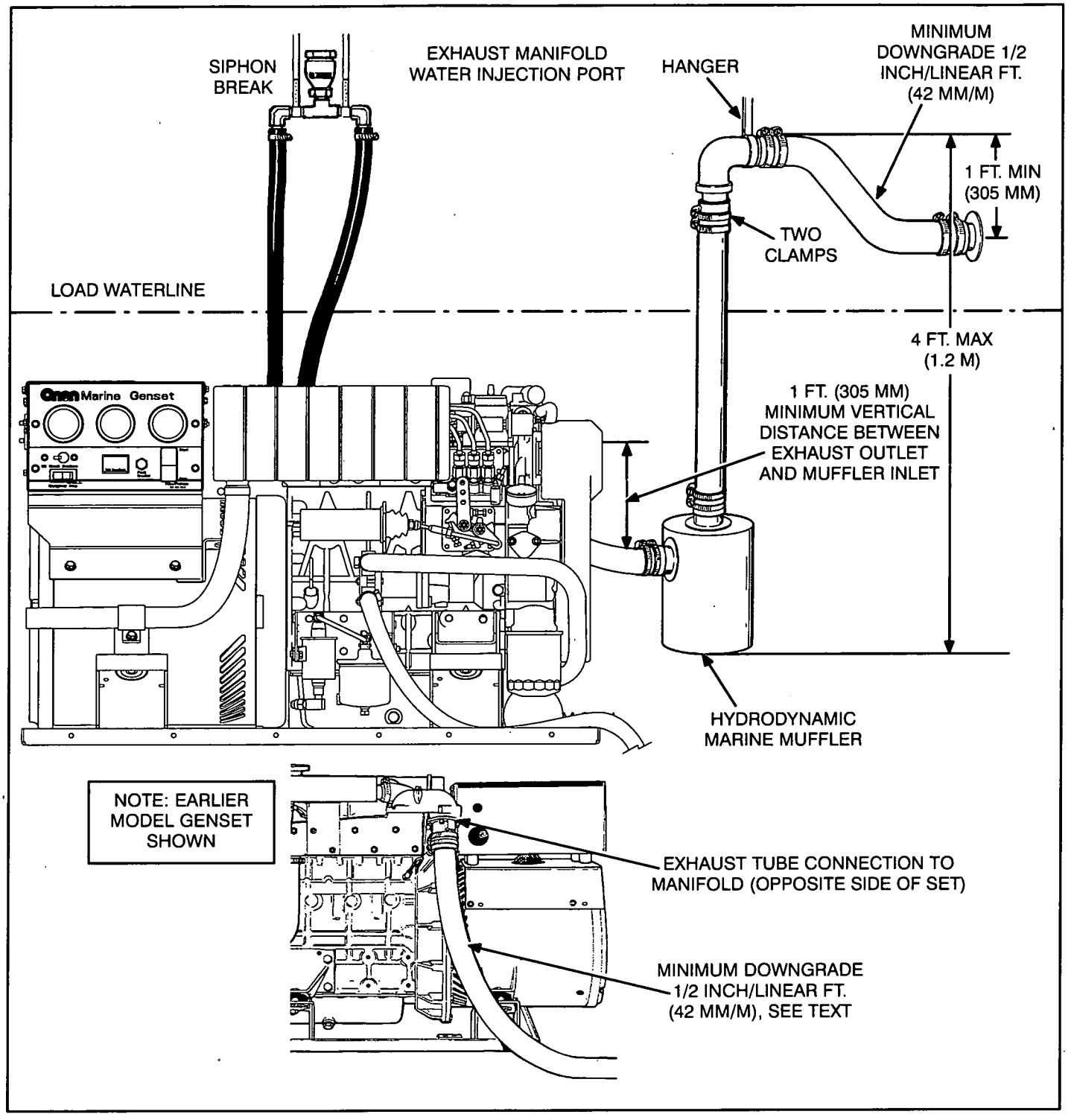


FIGURE 6-2. BELOW LOAD-WATERLINE INSTALLATION

ABOVE LOAD-WATERLINE INSTALLATION

Figure 6-3 shows a recommended above load-waterline installation. A siphon break valve is not required with this type installation. Review and apply data from the preceding GENERAL section. Be sure the minimum drop and downward pitch of exhaust runs are applied as shown, and that all hose end connections have two clamps.

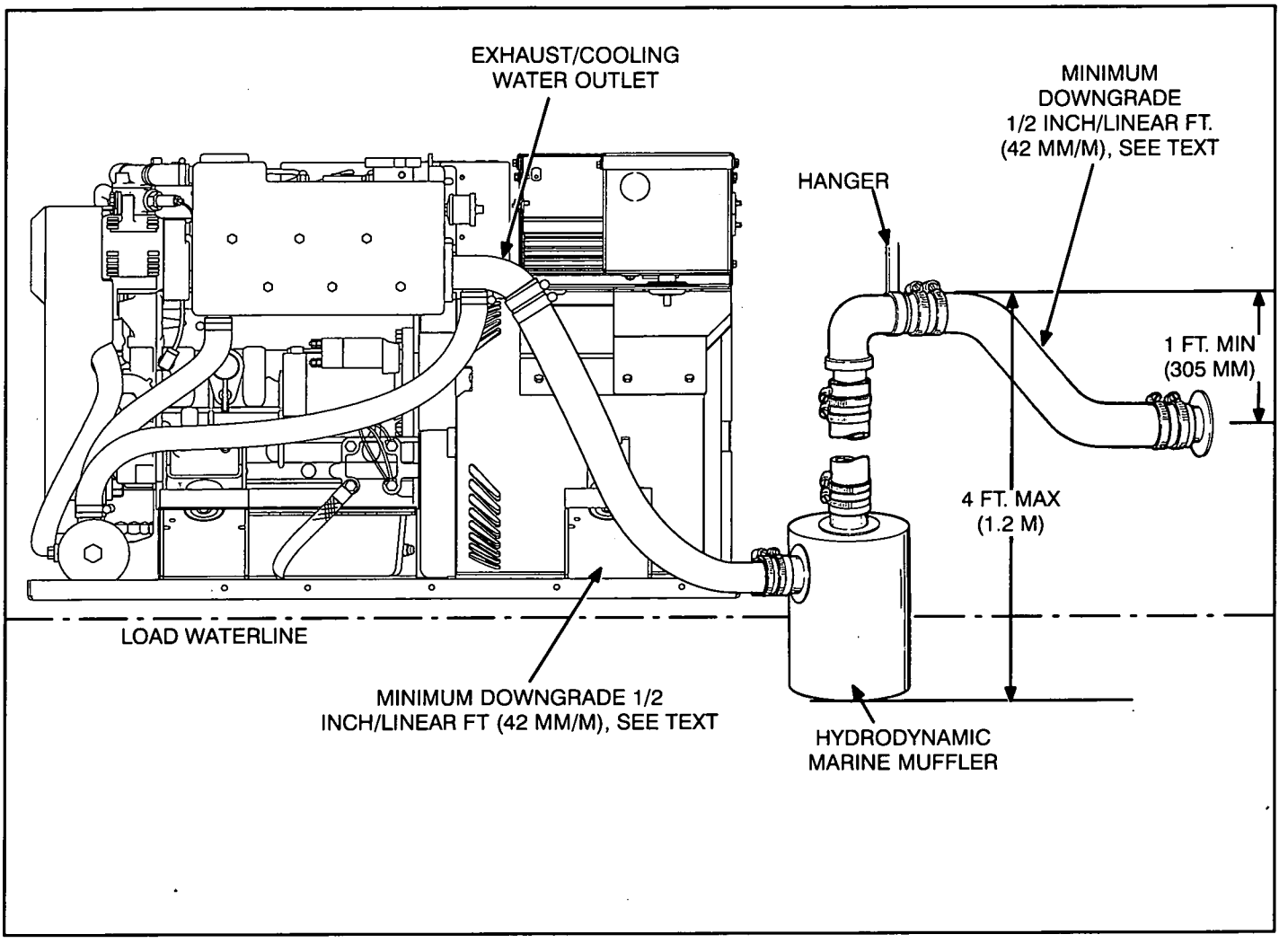


FIGURE 6-3. ABOVE LOAD-WATERLINE INSTALLATION

HOUSING CONSIDERATIONS

Figure 6-4 illustrates the roof panel of the generator set housing. Knock out the holes shown in the illustration and install grommets provided in the siphon break kit.

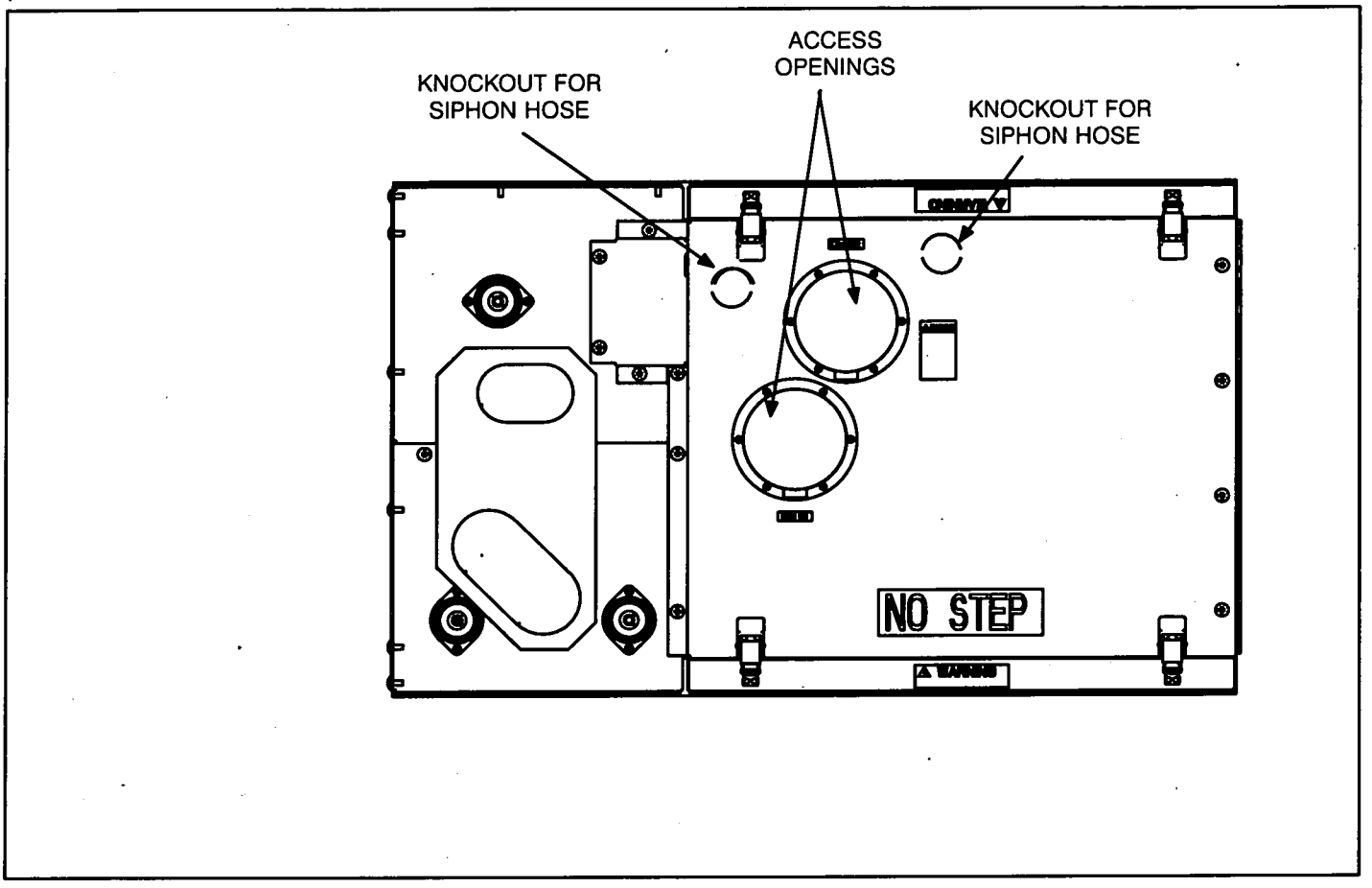


FIGURE 6-4. HOUSING ROOF OPENING FOR SIPHON HOSES

7. Fuel System

GENERAL

In all diesel engine installations, fuel system cleanliness is of utmost importance. Make every effort to prevent entrance of moisture or other contaminants. Carefully clean all diesel fuel system components before installation and putting the genset into operation.

⚠CAUTION ***Dirt or water in the fuel system is the major cause of diesel engine failure. A tiny piece of dirt or a few drops of water in the injection system can stop the genset.***

⚠WARNING ***Fuel leakage in boats presents fire and explosion hazards that can result in severe personal injury or death. Material, design, construction and installation of all fuel system components must meet all applicable standards. Use only products specified for marine application. Do not permit any flame, spark, cigarette, pilot light, or other ignition source near the generator set. The ventilation system must provide a constant flow of air to safely expel all fuel vapors.***

If the propulsion engine uses diesel fuel, it is possible to use the same fuel tank for the genset. However, before that decision is made, the following factors must be considered:

- Adequate fuel capacity for both engines. See Specifications in *Section 2* for genset requirements.
- The fuel is warm when it is returned to the tank after cooling the injectors. To obtain maximum engine efficiency, fuel delivered to the injectors must be cool. The fuel tank volume must be adequate to cool the returned fuel.
- Distance of tank from the genset. The pump self-priming lift capacity is 4 ft. (1.2 m). If this height is exceeded, either an additional fuel pump or a separate tank is required.

FUEL LINES

Make sure all fuel lines are properly supported and connections tightened securely. The line should be supported throughout its length with clips or straps spaced no more than 14 inches (355 mm) apart. Use a pipe-joint compound approved for use with diesel fuel at all thread fittings. Fuel lines must have as few connections as possible, and be protected against mechanical injury and vibration. Do not allow the fuel line to touch sharp, hot or abrasive surfaces.

A flexible fuel line installed between the fuel tank and the genset must meet USCG requirement 33CFR183.558 and be stamped "USCG TYPE A". There must not be any electrical connection between the hose end fittings. A bad ground in the cranking circuit will cause a wire reinforced hose to become hot, and ignite the fuel during cranking. If a metallic fuel line is run into the genset compartment, a length of flexible hose meeting the above specifications must be installed to absorb vibration of the genset.

⚠WARNING ***Ignition of fuel can cause fire and severe personal injury or death. Be sure the flexible section of fuel line used at the generator set meets USCG requirement 33CFR183.558 and is stamped "USCG TYPE A".***

The fuel line should be run at- or above-level of the tank top to a point close to the engine connection to prevent siphoning. See Figure 7-1. A separate fuel line is recommended for the genset as shown.

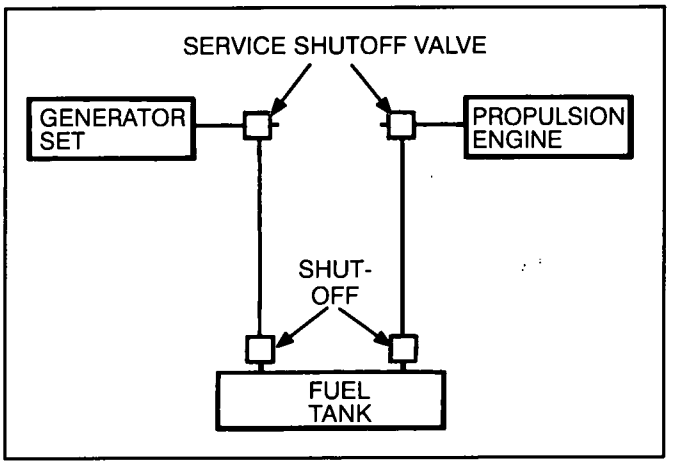


FIGURE 7-1. INSTALLATION ABOVE TANK LEVEL

If a fuel tank is shared, a fuel line tee is ***NOT*** recommended. A tee can cause erratic genset operation due to fuel starvation. The genset's fuel pump does not have the capacity to overcome the draw of the propulsion-engine fuel pump.

This is also true of the return lines. Pressure from one engine could be higher than from the other and force return fuel back into the lower-pressure engine injector. The return line should enter the tank as far as possible from the supply lines. Maximum back pressure at the injector fuel return line fitting (shown in Figure 7-4) should not exceed 15 psi (103 kPa). This pressure is a function of fuel flow rate, tank height, line size and length.

If the fuel tank fitting is large enough, a second, shorter dip tube may be installed as shown in Figure 7-2. The required fittings can be built by a machine shop. Install an anti-siphon device at the tank fitting as shown.

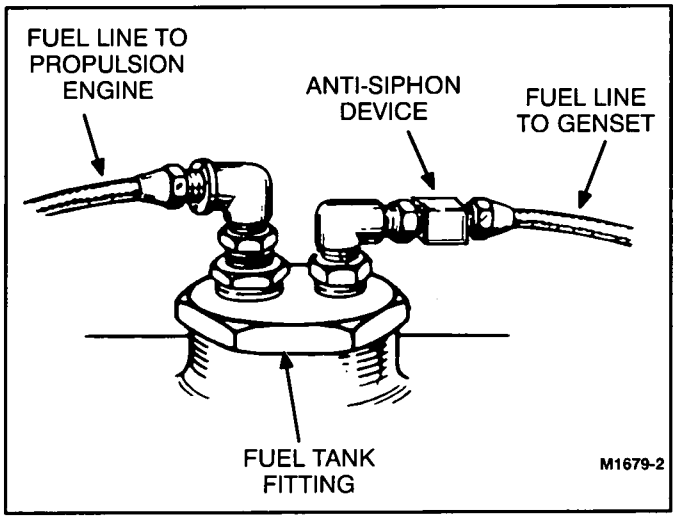


FIGURE 7-2. TWO FUEL LINES IN TANK FITTING

If the tank does not have an unused outlet, a new outlet can be installed. The metal tank must be removed to braze or weld a new outlet fitting. This procedure requires the service of a welder familiar with the essential safety measures.

⚠WARNING ***Ignition of fuel vapors can cause severe personal injury or death. Welding a fuel tank, empty or not, is extremely dangerous! Vapors may ignite causing an explosion and fire. Have welding done only by experienced personnel.***

FUEL FILTER

The Operator's Manual contains information on cleaning/draining the filter and replacing the filter element. Consult your Onan distributor for fuel filters and kits.

SIPHON PROTECTION

When the fuel tank is installed above the engine level, an anti-siphon device is needed to prevent siphoning if the line breaks at a point below the fuel level. See Figures 7-2 and 7-3. This device can be installed at the tank withdrawal fitting, or at a location where the line from the tank will no longer remain above the fuel tank top level. The device can be either a mechanical check valve, or an electric valve with mechanical override. The electric valve is connected to open only when the engine fuel solenoid is on.

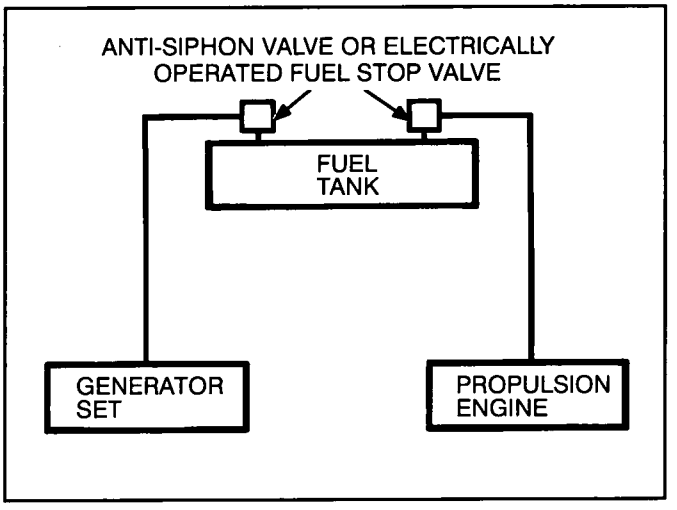


FIGURE 7-3. SIPHON PROTECTION

FUEL TANKS

A valve must be installed directly at the tank connection to shut off fuel flow. This valve may be electrically or manually operated. If electrically operated, it must be energized only during engine operation, and have a manual override to comply with USCG regulations. This electric valve can be purchased from Onan and is listed in the parts manual.

The manual valve must have an arrangement for operating it outside the compartment in which the tank is located, preferably from above deck.

A USCG approved service shutoff valve must be installed at the engine end of the fuel line under conditions listed below. This valve stops fuel flow when the genset is serviced.

- When fuel tanks are located in a compartment other than the engine.

- When the engine and fuel tanks are separated more than 12 feet (3.7 m).

If the propulsion engines and genset use different fuels, a separate fuel tank will be required. Use only an approved fuel tank designed for marine application. Be sure that the compartment is well ventilated (see Ventilation System section). Fuel consumption data in the Specifications section is useful for determining the tank size.

When installing a separate tank, locate it as close as possible to the genset compartment. Be sure it is accessible and can be removed for inspection.

⚠ CAUTION ***Fuel starvation can cause marginal operation of the generator set. Fiberglass fuel tanks can present a problem if the fuel pickup tube is too close to the tank bottom. Fiberglass fibers can settle and form a mat with time. Make a diagonal cut on the bottom of the pickup tube and install 1/2 to 2 inches (13 to 51 mm) from the tank bottom.***

Mount the fuel tank and secure into position. The NFPA recommends that flat bottom tanks be installed on slatted wooden platforms to help reduce moisture condensation. Cylindrical tanks should be set in chocks or cradles and securely fastened.

Small fuel tanks can be suspended from deck beams. Support and brace the tank to prevent any movement. Line up braces with the tank internal baffle plates. Insulate all wood or metal surfaces from the tank surface with a non-abrasive and non-absorbent material. Heavy rubber-impregnated cotton fabric or oil- and acid-resistant plastics work well.

⚠ WARNING ***Ignition of fuel when filling the tank can result in severe personal injury or death. All metallic fuel tanks MUST be electrically bonded to the boat common ground. Also bond the filler neck or opening to the tank if a hose is used between them. This helps prevent static spark when filling that can ignite the fuel.***

Position the tank fill and vent pipes so fuel or vapor cannot escape into the bilge. Run the vent and fill pipes from separate openings in the tank. If the fill pipe has a flexible section of fuel hose, install a separate grounding wire between the deck fuel plate and tank. Install the vent opening as far from other hull openings as possible, and with a gooseneck so water cannot enter. Install a flame arrester on the vent opening.

FUEL SYSTEM TEST

After installation, test the fuel system for tightness per USCG specification 33CFR183.542. Any leak must be found and corrected before putting the fuel system into service.

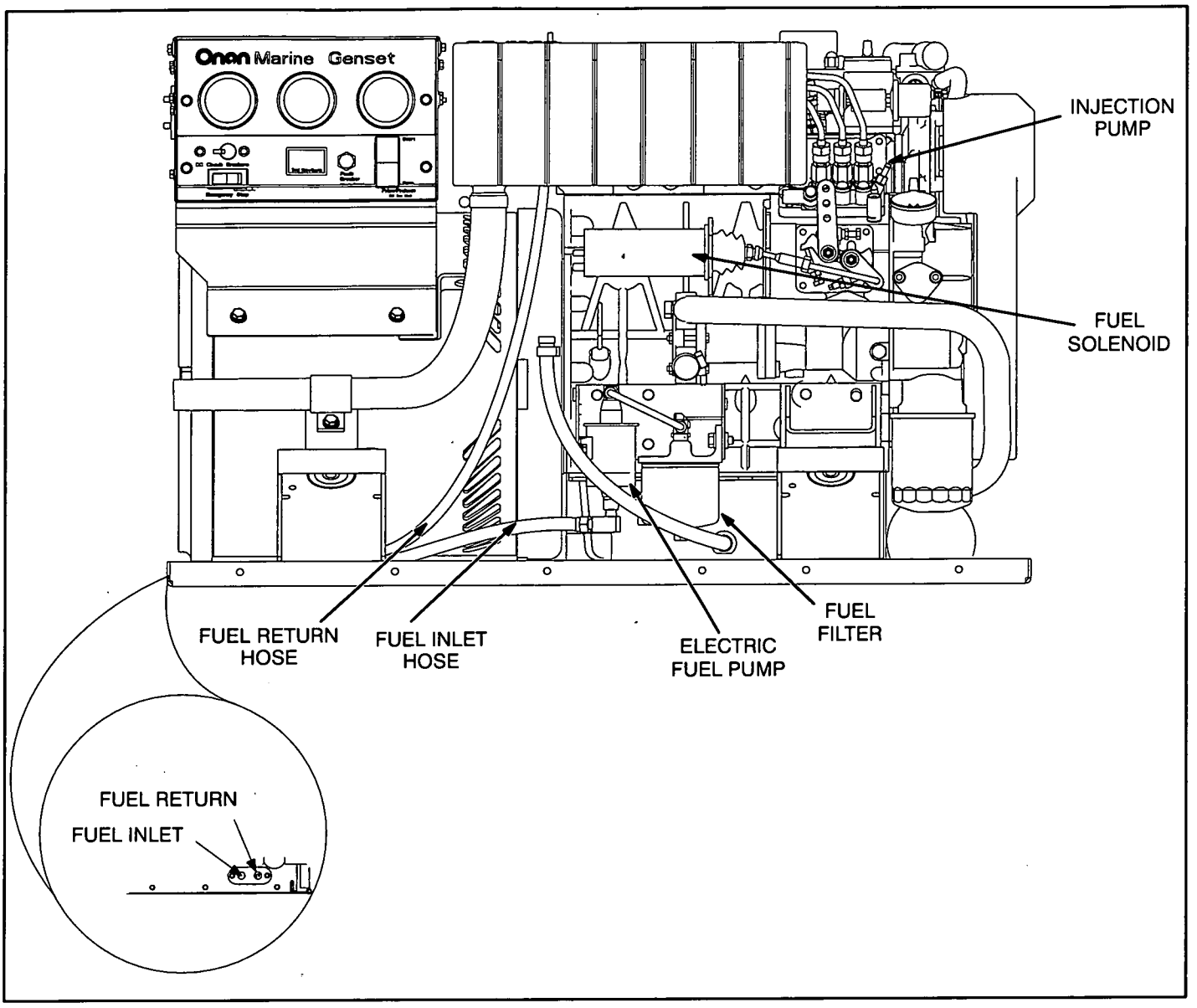


FIGURE 7-4. ENGINE FUEL SYSTEM COMPONENTS

8. Electrical System

GENERAL

Installing the genset electrical system consists of the following steps:

- Connecting the load
- Installing the remote start/stop/preheat control
- Connecting the battery
- (Optional) Installing the remote meter package

The battery must always be connected last to avoid accidental genset starting during the installation. All wiring must meet Coast Guard, NFPA, and all other applicable codes. **Note that wiring diagrams do not include customer-added components.**

⚠WARNING ***Accidental starting of the generator set during installation creates a hazard of serious personal injury or death. Do not connect the starting battery until instructed to.***

⚠WARNING ***Inhalation of exhaust gas or ignition of fuel vapor can cause severe personal injury or death. Be sure to vapor-seal flexible metal conduit, and all openings made during installation of the generator set, with a silicone/rubber-based sealant.***

⚠WARNING ***Faulty electrical equipment can cause shock and severe personal injury or death. Use only approved power supply assemblies, and never remove the grounding pin from the power cord. No ground, or an incorrect ground, can cause the vessel to become electrically "hot".***

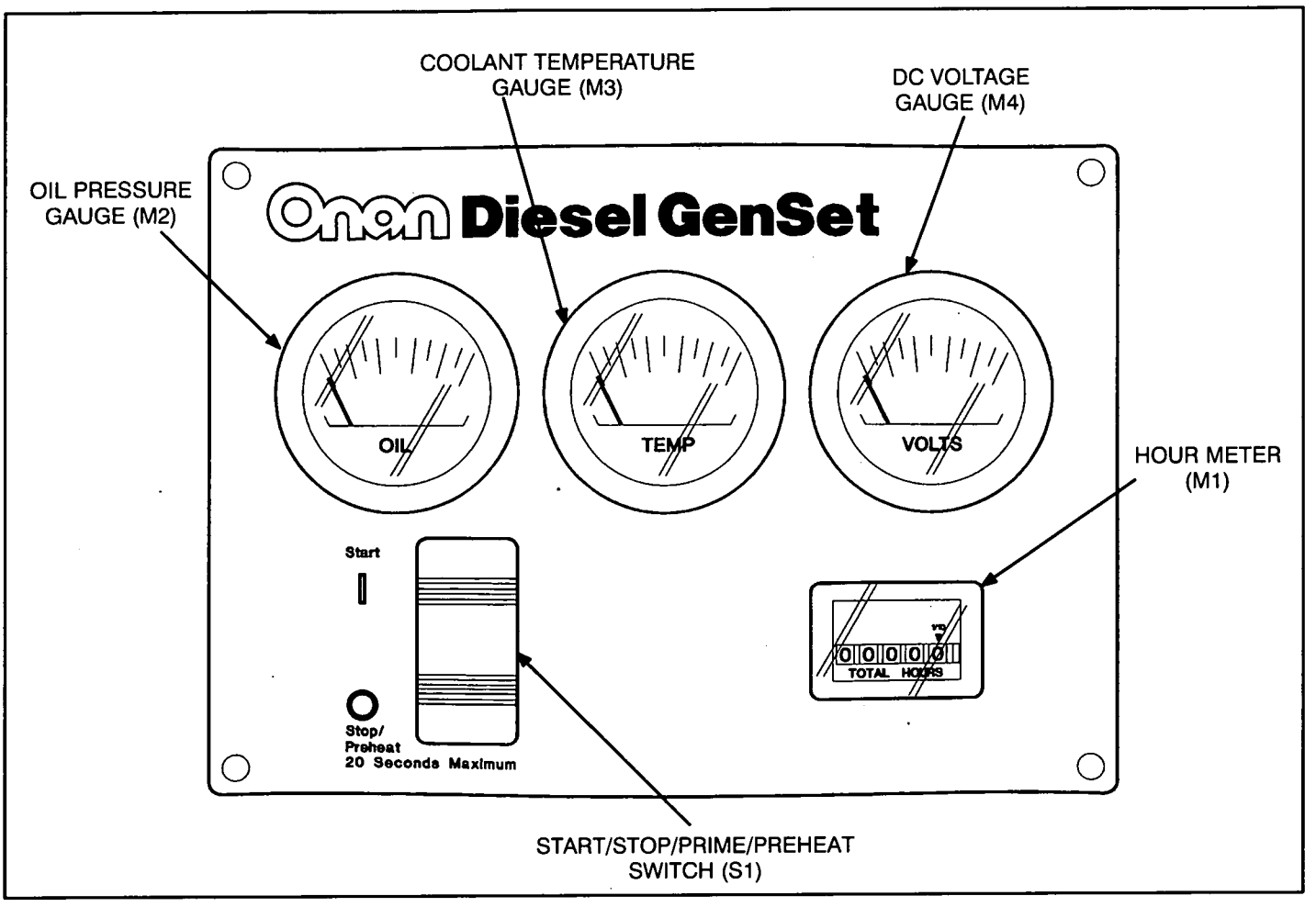
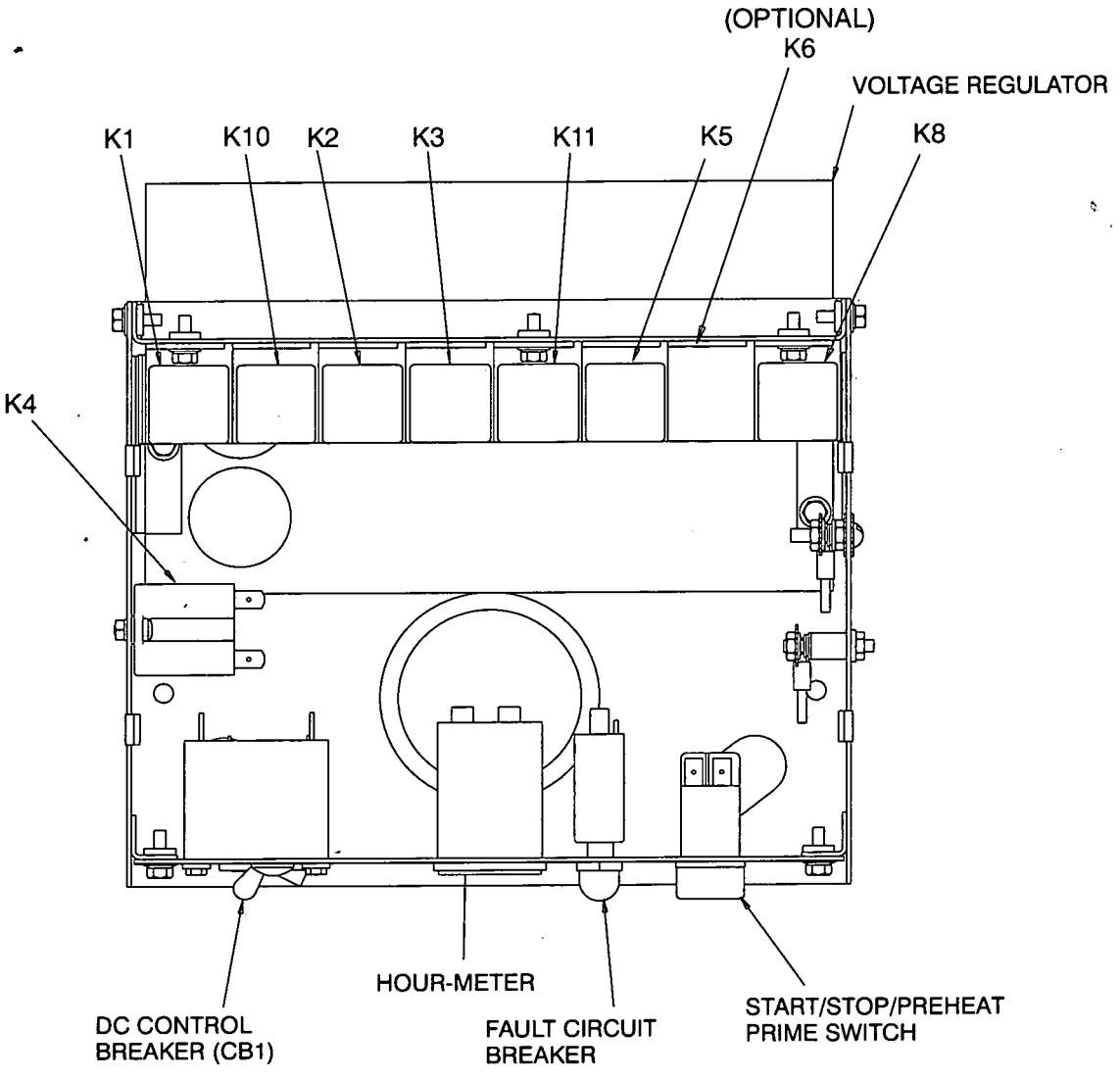


FIGURE 8-5. OPTIONAL CONTROL PANEL



NOTE: WIRE ROUTINGS ARE
OMITTED FOR CLARITY

K1 STARTER
K2 START/ONE TOUCH STOP
K3 START/ONE TOUCH STOP
K4 START DISCONNECT
K5 GLOW PLUGS
K6 (OPTIONAL) LOW COOLANT SHUT DOWN
K8 STOP SOLENOID PULL-IN
K10 ISOLATED GROUND
K11 ISOLATED GROUND

FIGURE 8-6. COMPONENTS INSIDE CONTROL BOX

OUTPUT VOLTAGE ADJUSTMENTS

Voltage adjustments are made by turning a trimmer pot on the voltage regulator board (see Figure 8-7).

⚠WARNING ***Lethal voltages are present inside the control box. Use extreme caution when adjusting the voltage or making any connections inside the box. Use a non-conductive screwdriver or trimpot adjustment tool when making this adjustment. Do not wear jewely or damp clothing. Stand on dry wooden platform or rubber mat.***

Voltage Adjustment Procedure (Set Running)

1. Connect a voltmeter to the set output.
2. Start the set.
3. Adjust the trimmer pot to the desired voltage.

Voltage Adjustment Procedure (Set Not Running)

1. Stop the generator set.
2. Open the control box.
3. Adjust the trimmer pot a small increment upward or downward depending on whether the voltage is low or high.
4. Close the control box. Start the set and check the output voltage.
5. Continue starting and stopping the set, adjusting the voltage while the set is stopped until the output voltage is correct.

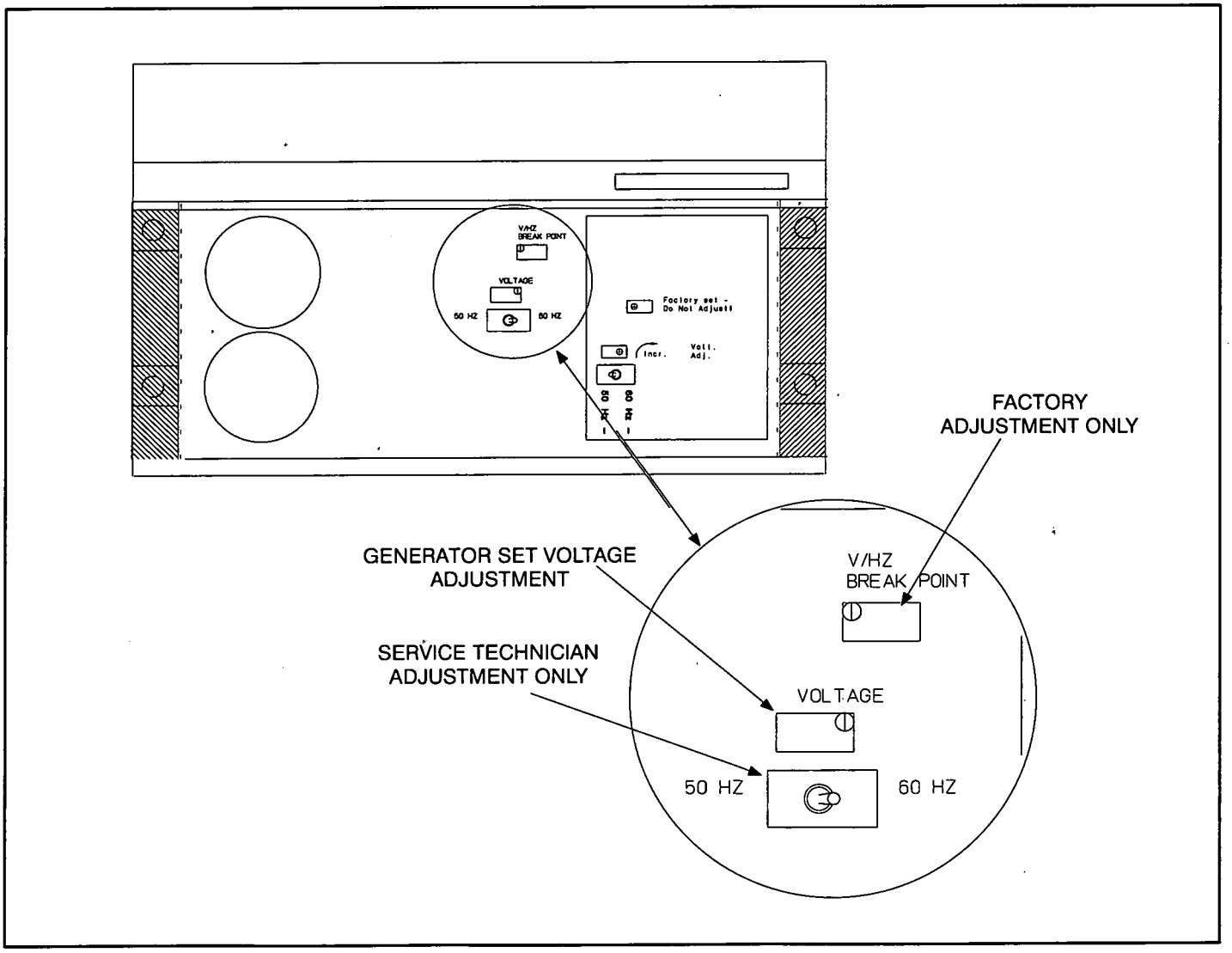


FIGURE 8-7. TOP VIEW OF SR VOLTAGE REGULATOR (AT BOTTOM OF CONTROL BOX)

LOAD CONNECTIONS

While at dock, most boats have a dockside connection for use of commercial power. These installations must have a transfer switch to isolate the genset and the commercial power. The two power sources must never be connected together. A single-phase, manual shoreline-transfer switch is available from Onan for this function. See Figure 8-8.

Use a section of flexible conduit at the genset to absorb movement and vibration. Flexible, multistrand wire must be used throughout to reduce the danger of breakage due to boat movement or vibration. Grounding must comply with wiring codes.

Output connections are shown on the Schematic/ Wiring diagrams in *Section 10* of this manual. The output circuit is shown in Figure 8-9. The generator is electronically regulated. The load leads are connected to the circuit breakers in the control box.

The generator is connected for 110/120 VAC or 240 VAC output. Note that output is taken from two generator windings. For this reason, the load should be balanced across the windings. Taking full load from one winding can cause poor voltage regulation and damage to the equipment or generator.

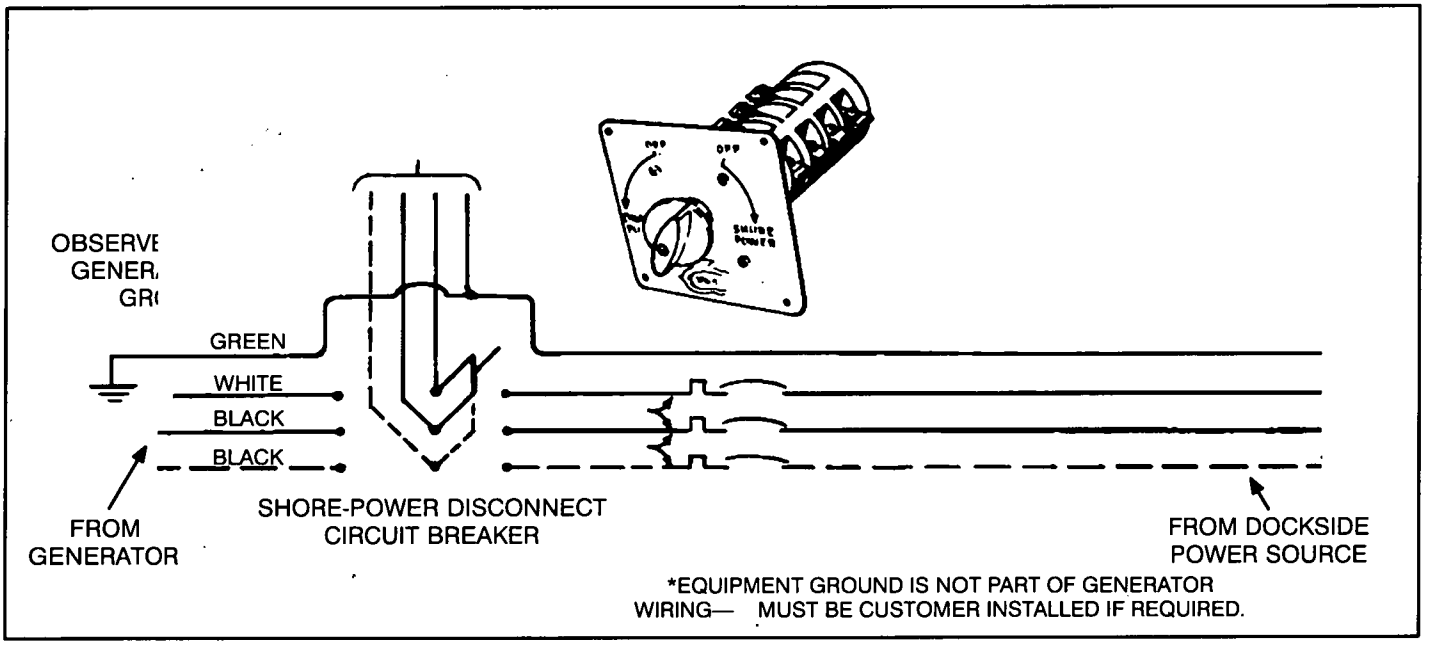


FIGURE 8-8. TYPICAL SINGLE-PHASE MANUAL SHORELINE-TRANSFER SWITCH CIRCUIT

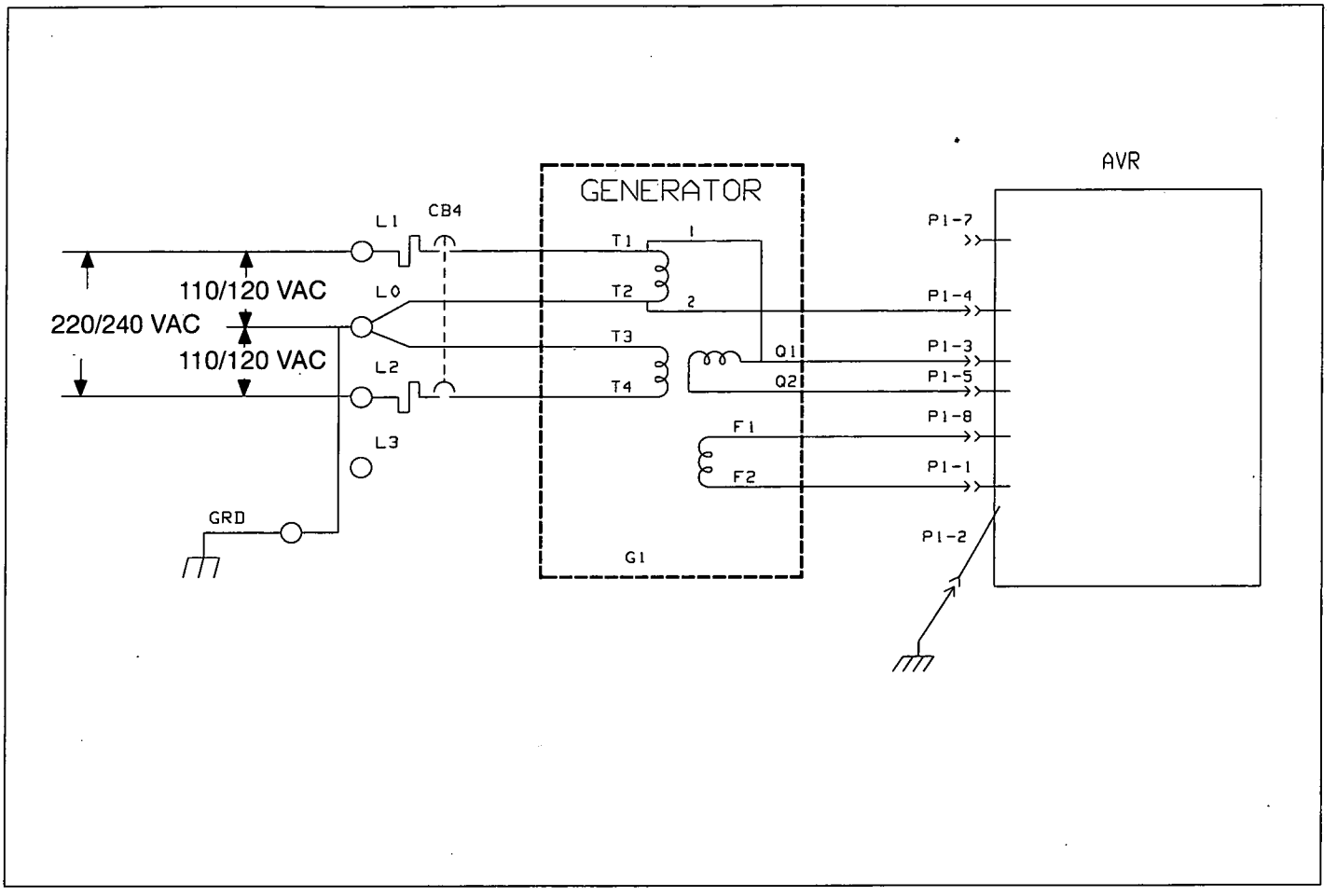


FIGURE 8-9. GENSET AC OUTPUT (SEE SECTION 10 OF MANUAL)

REMOTE START-STOP-PREHEAT PANEL (OPTIONAL)

A remote start/stop/preheat panel is available for the generator set. It contains a panel and wiring harness, and comes with installation instructions and wiring diagrams for connection.

The meter panels are prewired and terminate with a plug connector. Figure 8-10 illustrates the meter panel portion of the DC control circuit. See section 10 of this manual for the complete DC control schematic diagram and wiring diagram. Onan provides prewired harness assemblies that may be connected to the control box and the remote panel.

If prewired harnesses are not used, number 16-gauge wire is acceptable if runs do not exceed 25 feet (7.6 m) between the remote panel and the genset. Use number 14-gauge wire for longer runs.

⚠ CAUTION ***Interchanging connections other than shown on the generator set wiring diagrams can cause equipment damage.***

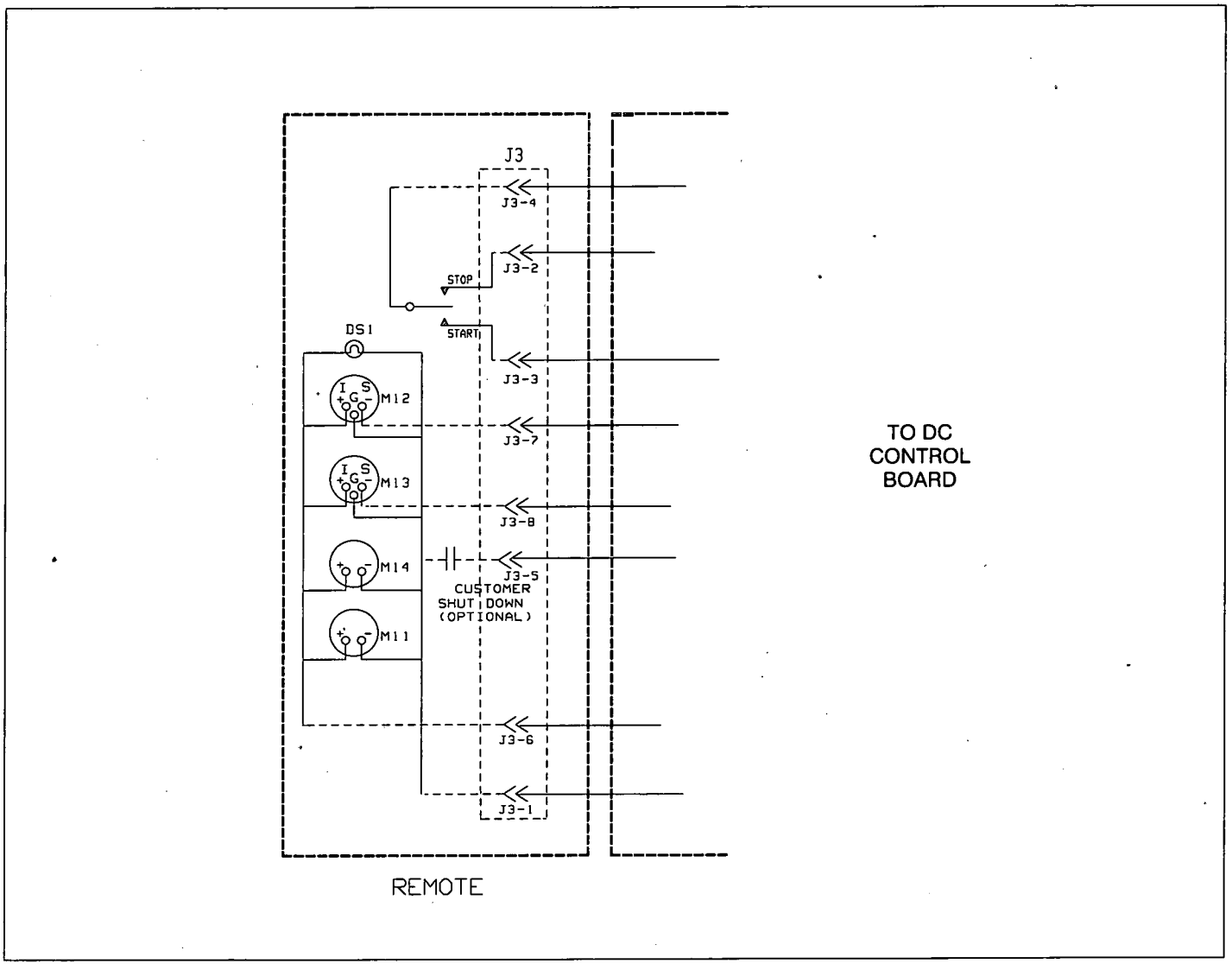


FIGURE 8-10. REMOTE METER PANEL CONNECTIONS (FROM 612-6713)

BATTERY

General

Use a battery with a minimum cranking performance of at least 360 amperes capacity at 0° F (-18° C). Install the battery close to the genset, preferably in a separate compartment. The compartment must be well ventilated to prevent accumulation of explosive battery gases.

Mount the battery in an acid-resistant tray on a platform above the floor. It must be secured to prevent shifting. If mounted in an engine compartment, always install a non-metallic cover to prevent battery damage and arcing from accidentally dropped tools. Figure 8-11 shows a typical battery tray and cover.

⚠WARNING ***The ignition of diesel fuel or fumes or battery gases can result in severe personal injury or death. Connect the generator set battery ground (-) lead only at the location specified on the battery.***

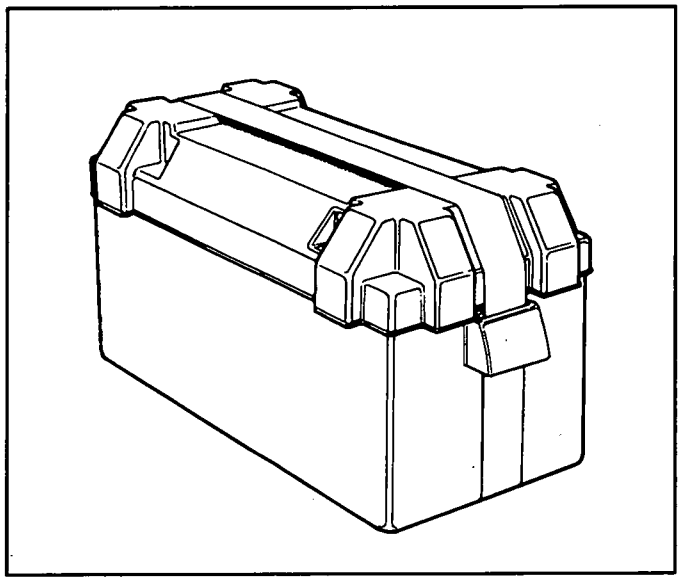


FIGURE 8-11. TYPICAL BATTERY TRAY AND COVER

Sealed, maintenance-free batteries are preferred for marine application. They offer higher output ratings (CCA), and better durability. Consult your Onan distributor for recommendations.

⚠WARNING ***Leakage of fuel in or around the generator set compartment presents a hazard of fire or explosion that can cause severe personal injury or death. Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the compartment thoroughly with the bilge blowers or power exhausters.***

Connect the battery positive (+) lead to the start solenoid as shown in Figure 8-12. Using the cable size specified in Table 8-1, connect the battery negative (-) lead to the genset at the location shown in Figure 8-12. Connection at any other location can cause arcing or resistance in the cranking circuit.

Connect the cables to the battery as shown, the negative (-) battery terminal last. Be sure the battery connections are clean and tight; then cover the battery terminals with a dielectric grease to retard corrosion.

NOTE: The positive and negative battery terminals are in close proximity. Use extreme caution when loosening or tightening the negative terminal, so the wrench does not contact both terminals at once. Disconnect both cables at the battery before connecting them at the generator set.

⚠WARNING ***Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).***

Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (-) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (-) cable first, and reconnect it last.

TABLE 8-1. BATTERY CABLE SIZE REQUIREMENTS
(Maximum Length of One Cable)

Cable Size	2	1	0	00	000	0000
Length	4 ft. (1.2 m)	5 ft. (1.5 m)	7 ft. (2.1 m)	9 ft. (2.7 m)	11 ft. (3.4 m)	14 ft. (4.3 m)

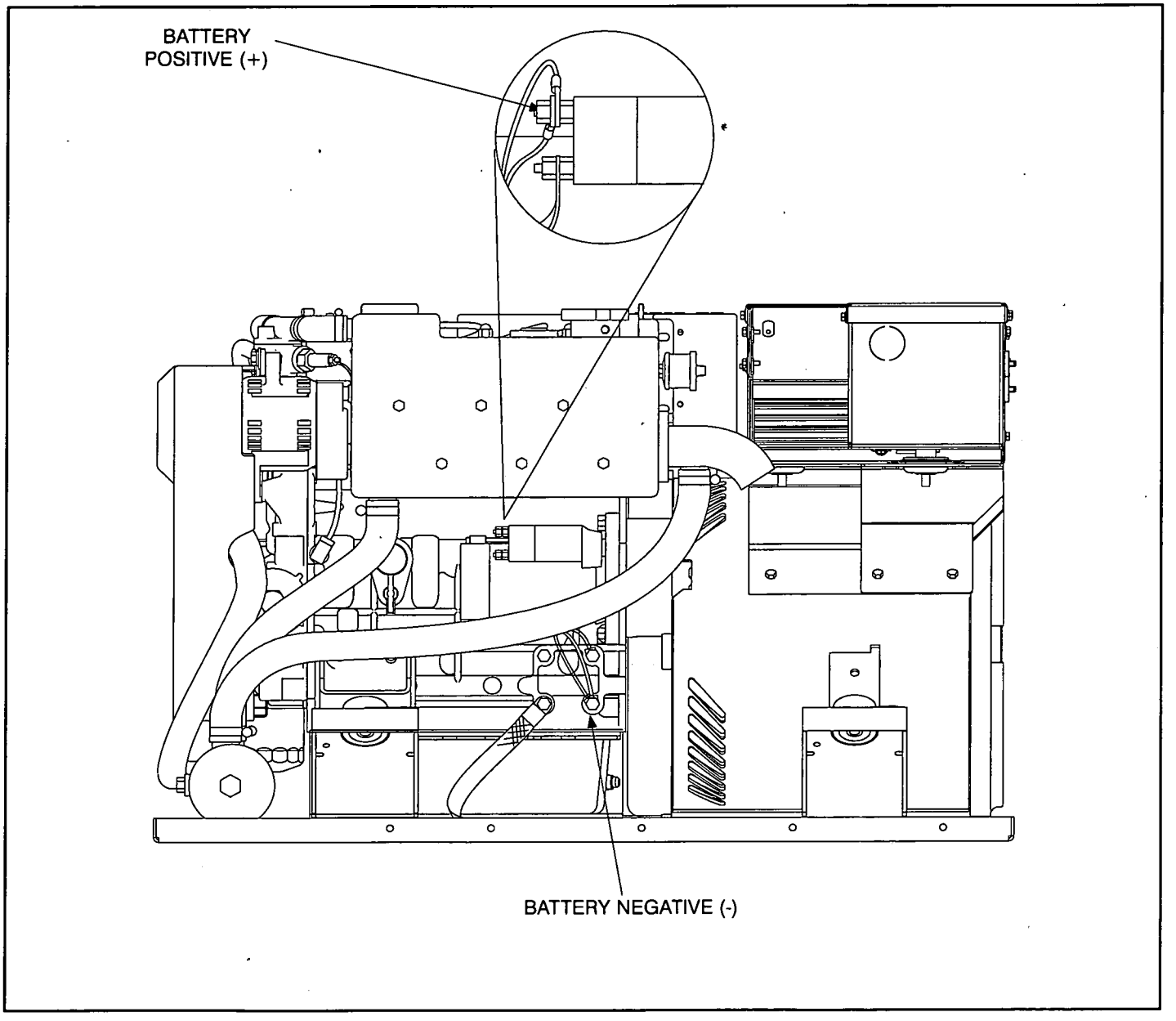


FIGURE 8-12. BATTERY CABLE CONNECTIONS

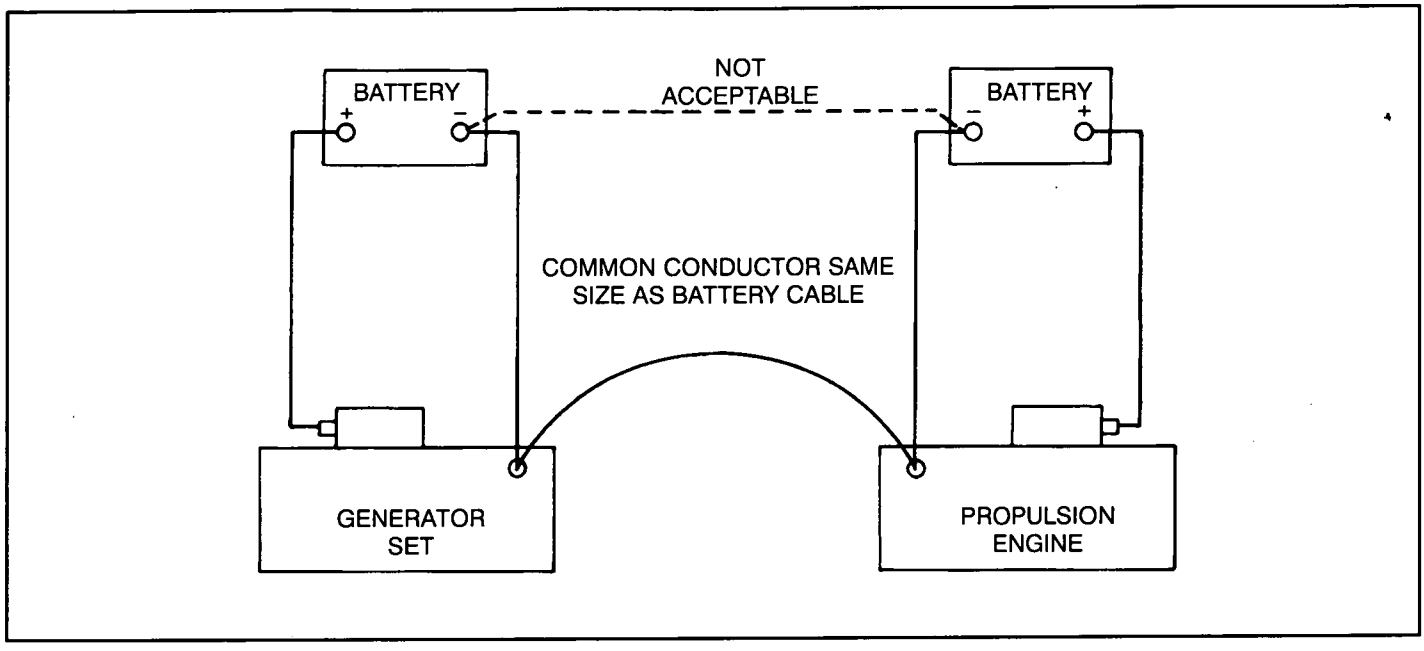


FIGURE 8-13. COMMON GROUND CONDUCTOR

Grounding

The genset requires the battery connected negative ground. Most propulsion engines and vessel electrical equipment have negative ground systems.

The genset and propulsion engine/s must be grounded in accordance with USCG regulation 33C FR183.415. The regulation requires a common ground conductor connected between the genset and propulsion engine cranking motor circuits. The conductor must be the same size as the largest battery cable. See Figure 8-13.

The conductor prevents accidental passage of cranking current through the fuel systems and smaller electrical conductors common to the engines. This can happen if a cranking motor ground circuit becomes resistive or opens from corrosion, vibration, bad cable, etc. Do not connect the battery negative lead at a genset location other than shown in Figure 8-12 .

⚠WARNING ***Improper ground can cause severe personal injury or death from fire or explosion. Be sure to install a common ground conductor between all on-board cranking circuits.***

BONDING

The genset must be bonded to the vessel common-bonding conductor with a bonding lead or strap attached to the engine block (same location as the negative battery cable). See Figure 8-14 for hardware used and the proper assembly.

If a metallic fuel line is installed between the fuel tank and the genset shutoff valve, it too must be bonded to the vessel common-bonding conductor.

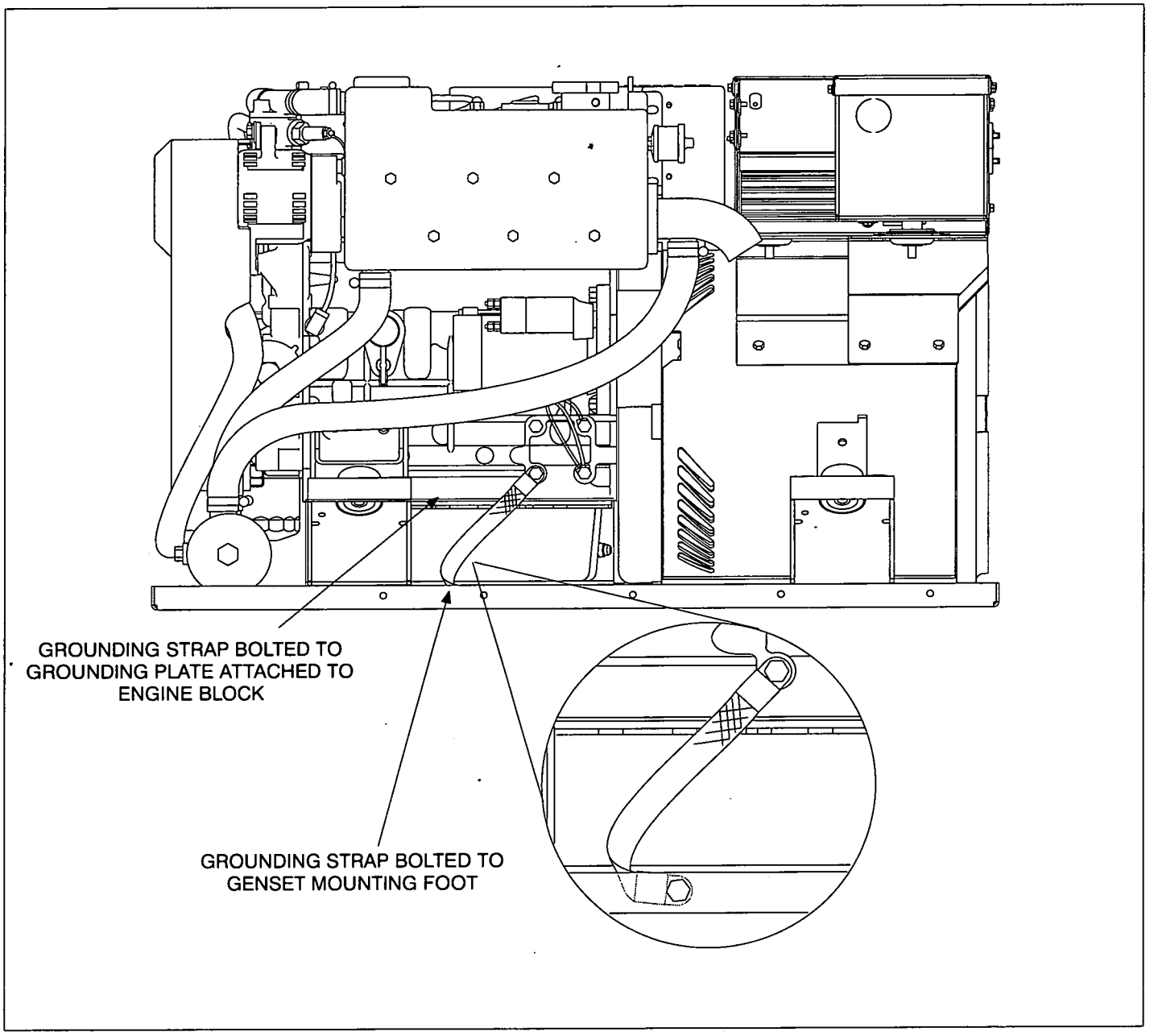


FIGURE 8-14. GROUNDING/BONDING STRAP

9. Final Installation Checks

INSTALLATION CHECKS

Before trying to start the genset, determine that the installation is complete by answering affirmatively the following questions:

- Is the exhaust system secure, properly routed, and are all connections tight?
- Is a flexible section of exhaust hose used between the genset and muffler?
- Is all exhaust hose certified for marine exhaust application, and adequately supported and protected?
- Is the exhaust outlet terminated away from windows, vents or other openings that might allow exhaust gases to enter the vessel, or be pulled into the vessel when in motion?
- Are the AC generator and load wires securely and correctly connected to the circuit breaker?
- Is the line circuit breaker the correct size for selected voltage and frequency?
- Are the battery cables connected correctly and securely at the genset and battery?
- Has engine coolant been added? (50/50 water/antifreeze mix)
- Has crankcase oil been added to the engine, and at the correct level? See the Maintenance section of the Operator's Manual.

⚠CAUTION ***Oil, coolant, and fuel have been drained from the engine at the factory prior to shipment. Operation without oil and coolant will damage the engine.***

INITIAL STARTING AND CHECKS

Refer to the Operator's Manual before trying to start the genset. Make sure the fuel shutoff valve and sea water cock are open and the sea water pump is primed. Operating the sea water pump without water will ruin the neoprene impeller.

- Start the genset by holding the Start/Stop switch in Start position. (Use the Preheat switch if needed: see Operator's Manual for details.) The genset should start within a few seconds. If not, check fuel supply and shutoff valve/s.
- Check water flow at the hull exhaust outlet, and operation of the genset. Refer to Operator's Manual for proper parameters.
- Check the exhaust system for leaks-visually and audibly. Note the security of the exhaust system supports. If any leaks are found, shut down the genset immediately and repair.

⚠WARNING ***Exhaust gas is deadly. For this reason, shut down the generator set immediately if an exhaust leak or exhaust component needs repair. Do not run the generator set until the exhaust system is repaired.***

- Check the genset for fuel, oil and coolant leaks. If any are found, shut down the genset and repair the leak before making any more checks.
- Connect an accurate AC voltmeter and frequency meter across two line terminals. Apply load to the generator and check the output.

Output frequency is determined by engine speed and normally does not require adjustment. Verify that frequency is correct before making voltage adjustments. Call an authorized Onan® distributor or dealer for assistance if needed.

VOLTAGE ADJUSTMENT

If the voltage is not within specifications, it can be adjusted using the procedure listed in Section 8 of this manual.

⚠WARNING ***High voltages within the control cabinet can cause severe personal injury or death. Proceed with care and do not touch electrical contacts with any tool, clothing, jewelry or body part.***

10. Schematic/Wiring Diagram

This section contains combined AC and DC schematic/wiring diagram #612-6713, sheets 1 and 2. Refer to this diagram when installing the generator set.

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