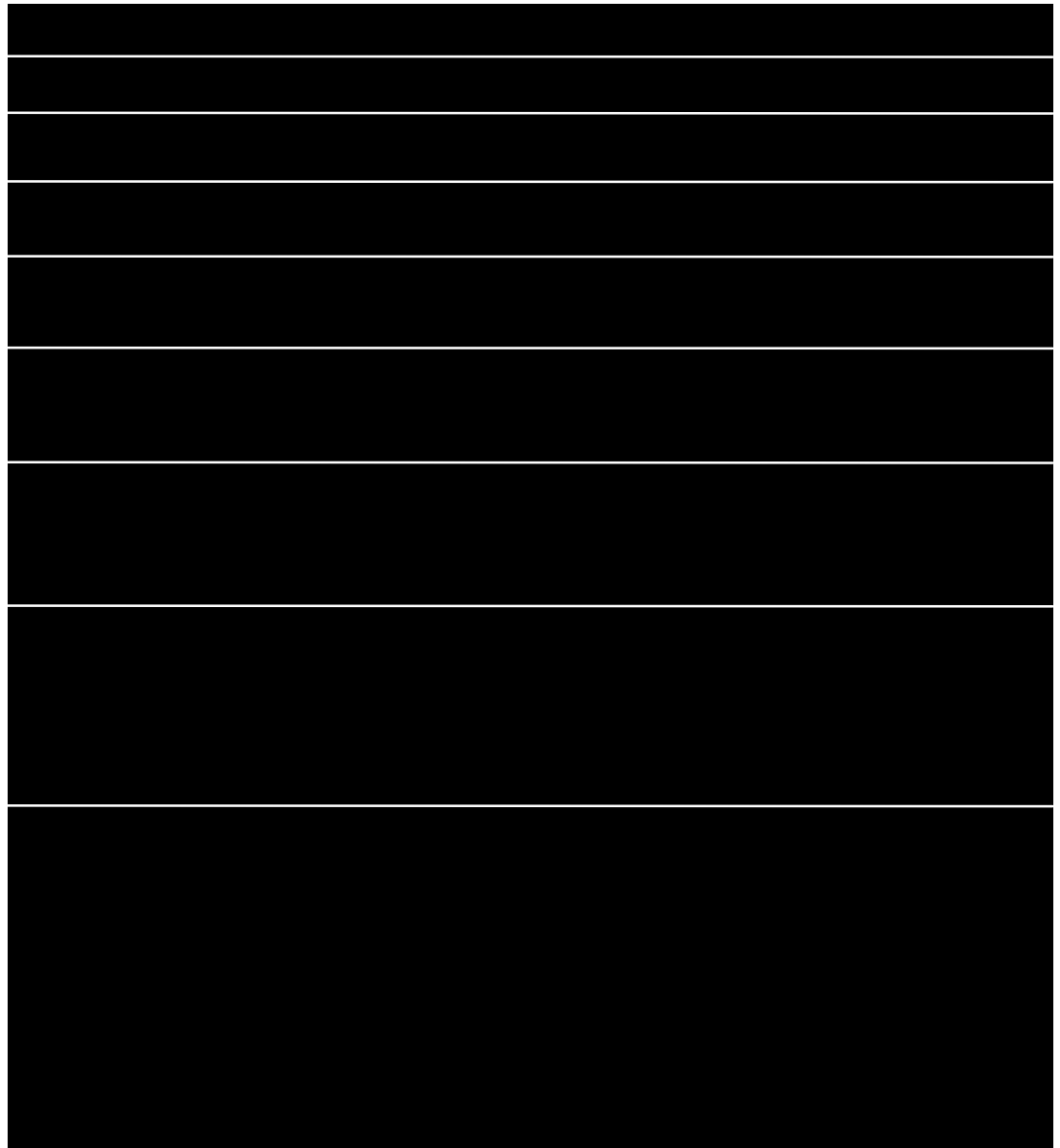




# INSTALLATION MANUAL

**MCGBA, MCGCA, MCGCB,  
MCGGA, MCGDA, MCGDB**



# Safety Precautions

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**Before operating the generator set**, read the Operator's Manual and become familiar with it and your unit. **Safe and efficient operation can be achieved only if the unit is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

Throughout this manual you will notice symbols which alert you to potentially dangerous conditions to the operator, service personnel, or the equipment itself.

**⚠ DANGER** *This symbol warns of immediate hazards which will result in severe personal injury or death.*

**⚠ WARNING** *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or 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 gas 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.

## EXHAUST GASES ARE DEADLY

- Provide adequate ventilation. Equip the bilge with a power exhauster.
- Be sure propulsion and generator set engine exhaust systems are free of leaks. Perform thorough, periodic inspections of the exhaust system and repair leaks immediately. Exhaust gases are deadly.
- Never sleep in the vessel with the generator set running unless the vessel is equipped with an operating carbon monoxide detector.

## HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- 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.** Electrocutation 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.

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

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# Section 1. Introduction

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## GENERAL

A generator set must be installed properly if you are to expect safe, reliable and quiet operation. Read through this manual completely before starting the installation. It is a guide only. You must decide how to address the considerations peculiar to your installation.

Decisions you have to make will concern:

- Location and Mounting of the set
- Engine exhaust discharge and silencing
- Engine cooling
- Engine room ventilation
- Fuel connections
- Starting batteries
- Electrical connections
- Bonding for grounding
- Accessibility for operation and maintenance
- Attenuation of noise and vibration.

Refer to Operator's Manual 960-0148 regarding operation and maintenance.

## STANDARDS FOR SAFETY

You must find out which standards for safety are applicable to the installation. The American Boat and Yacht Council (ABYC) and the National Fire Protection Association (NFPA) are typical of agencies that publish safety standards for the installation of marine equipment. The United States Coast Guard (USCG) is a typical regulatory agency.

It is suggested that you obtain the following standards if you build for the U.S. domestic market:

- *"Standards and Recommended Practices For Small Craft"*

American Boat and Yacht Council, Inc.  
P.O. Box 747  
Millersville, MD 21108

- NFPA No. 302, *"Pleasure and Commercial Motor Craft"*

National Fire Protection Association  
Batterymarch Park  
Quincy, MA 02269

- USCG regulations are found under Titles 33 and 46 of the Code of Federal Regulations (CFR).

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

**▲WARNING** *Improper installation can lead to severe personal injury or loss of life and property by fire, electrocution, mechanical breakdown or exhaust gas asphyxiation. You must be qualified to install marine generator sets, having knowledge of fuel, electrical and machinery hazards.*

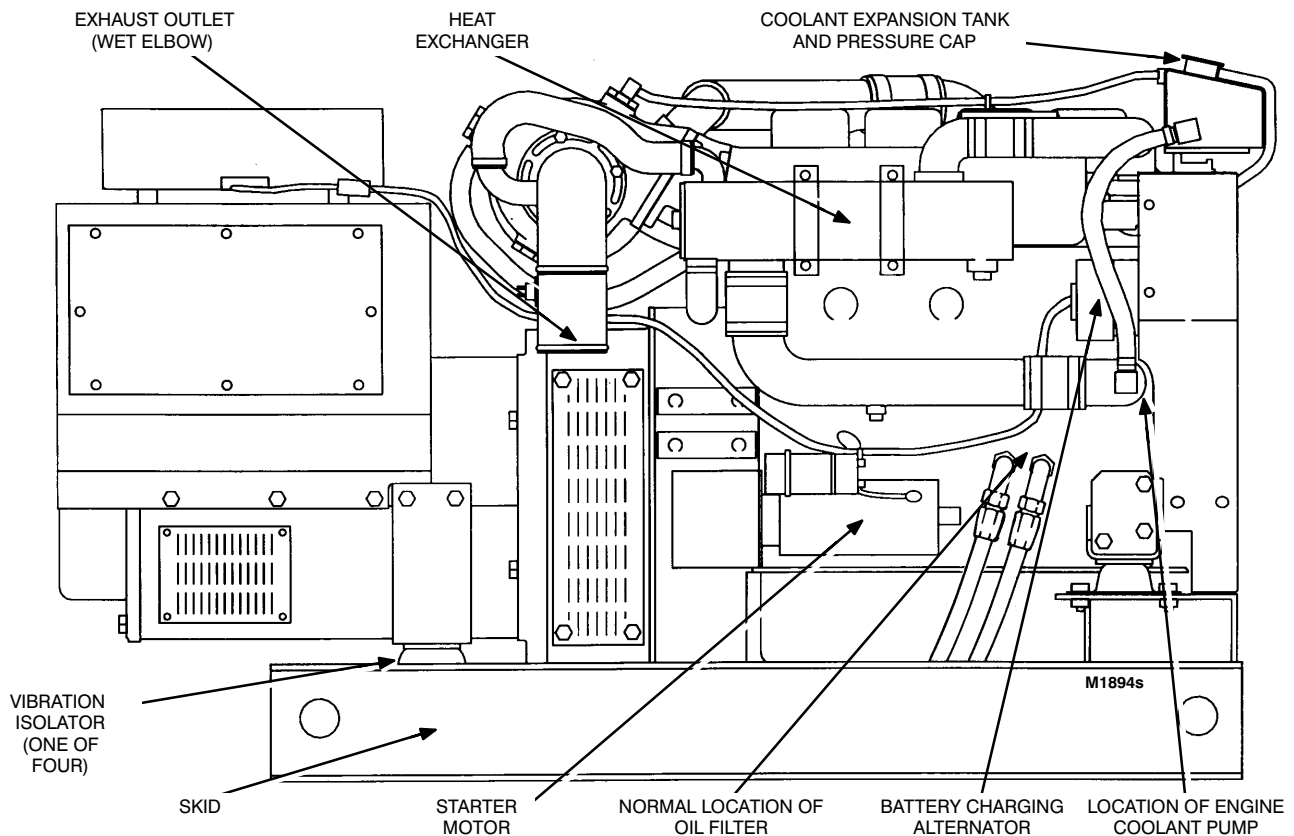
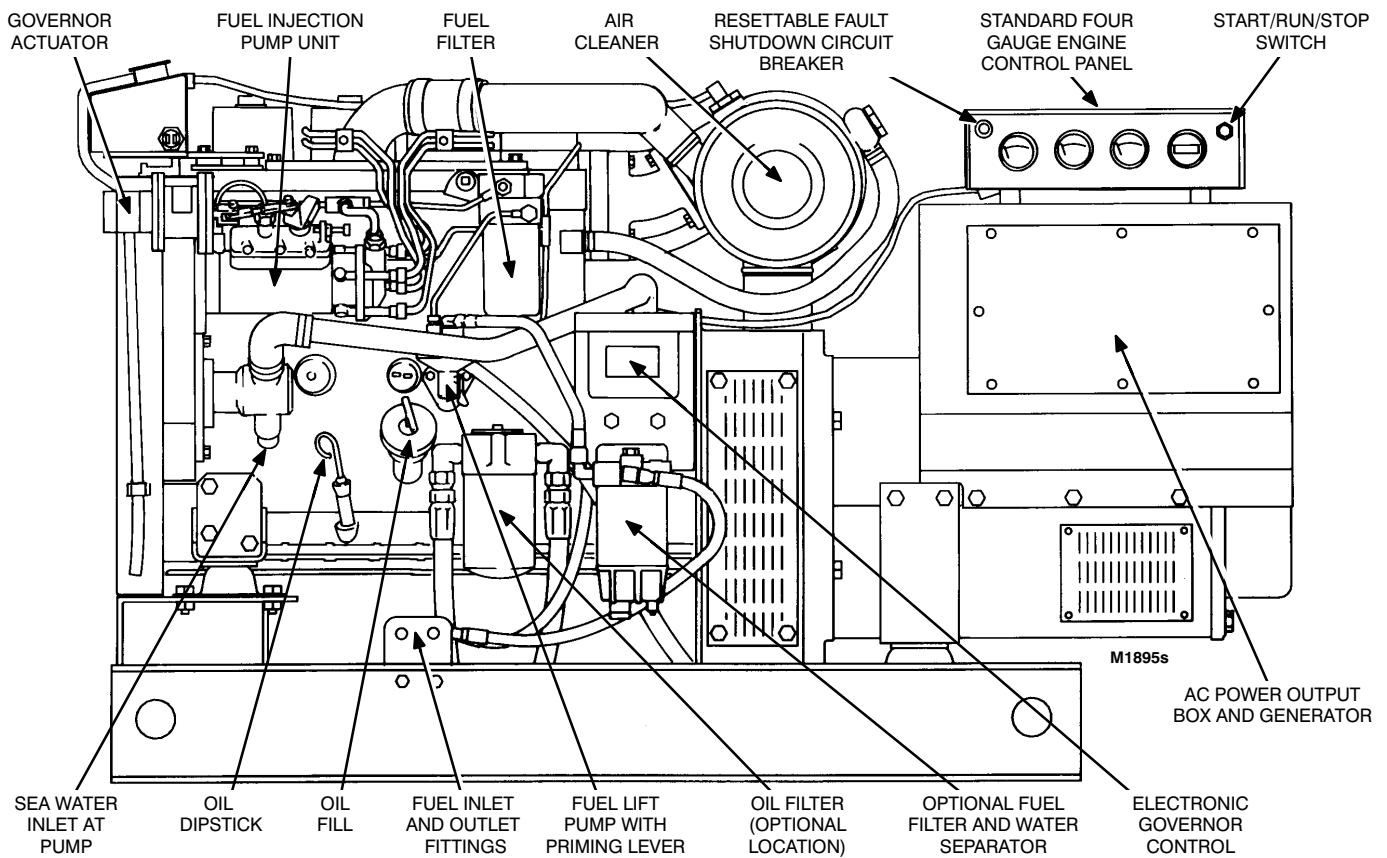


FIGURE 1-1. TYPICAL GENERATOR SET

# Section 2. Location and Mounting

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Draw up plans for location and mounting on the basis of the applicable outline drawing of the set. See your distributor.

## LOCATION

Locate the set where there will be enough room to perform periodic maintenance and service. Because of noise, vibration and fumes, the generator room should be located as far from living quarters as possible. The requirements for ventilation, engine cooling and exhaust discharge must also be considered when locating the set.

The set is equipped with a single lifting eye for lowering it into the vessel. If the set has a sound shield, remove the cover in the top of the cabinet for access to the lifting eye.

**▲WARNING** *Do not install these generator sets in conjunction with gasoline fueled equipment. They are not “ignition protected” and can therefore ignite gasoline fumes.*

## MOUNTING

The set should be mounted as level as possible. The skid can usually be bolted directly to the hull frame members when integral vibration isolators are provided between the engine/generator assembly and the skid.

# Section 3. Engine Cooling System

Figure 3-1 is a schematic of a typical cooling system. Liquid coolant is pumped through passages in the cylinder block, head, exhaust manifold and turbocharger housing. A liquid-to-liquid heat exchanger and an expansion tank with a pressure cap (15 psi) are mounted on the engine. Coolant is pumped through the engine - heat exchanger circuit by the engine coolant pump. Sea water (the flotation water) is pumped through the heat exchanger by a second engine-driven pump. Cathodic protection of all sea water wetted metal parts of the heat exchanger system is provided by a replaceable zinc plug in the heat exchanger.

Locate the set within the 6 foot (1.7 M) lifting capability of the sea water pump. The sea water intake fitting and sea cock should be as close to the engine as possible and provide positive water intake under all operating conditions.

A sea water strainer must be provided to remove debris larger than 0.06 inches (1.6 mm) to protect the pump and reduce heat exchanger fouling.

There should be as few bends in the piping as possible. However, to maintain prime when the set is not in use, it is recommended that the piping loop between the sea water pump and the strainer, to create a water trap. The pump must be primed before startup. See *Startup*.

**CAUTION** *The sea water pump has a neoprene impeller that can disintegrate in a matter of seconds after the engine starts if pump prime has been lost.*

Use approved flexible hose to connect the engine and piping to take up movement of the set.

The sea water is discharged through the wet exhaust system. See *Exhaust System* for connections.

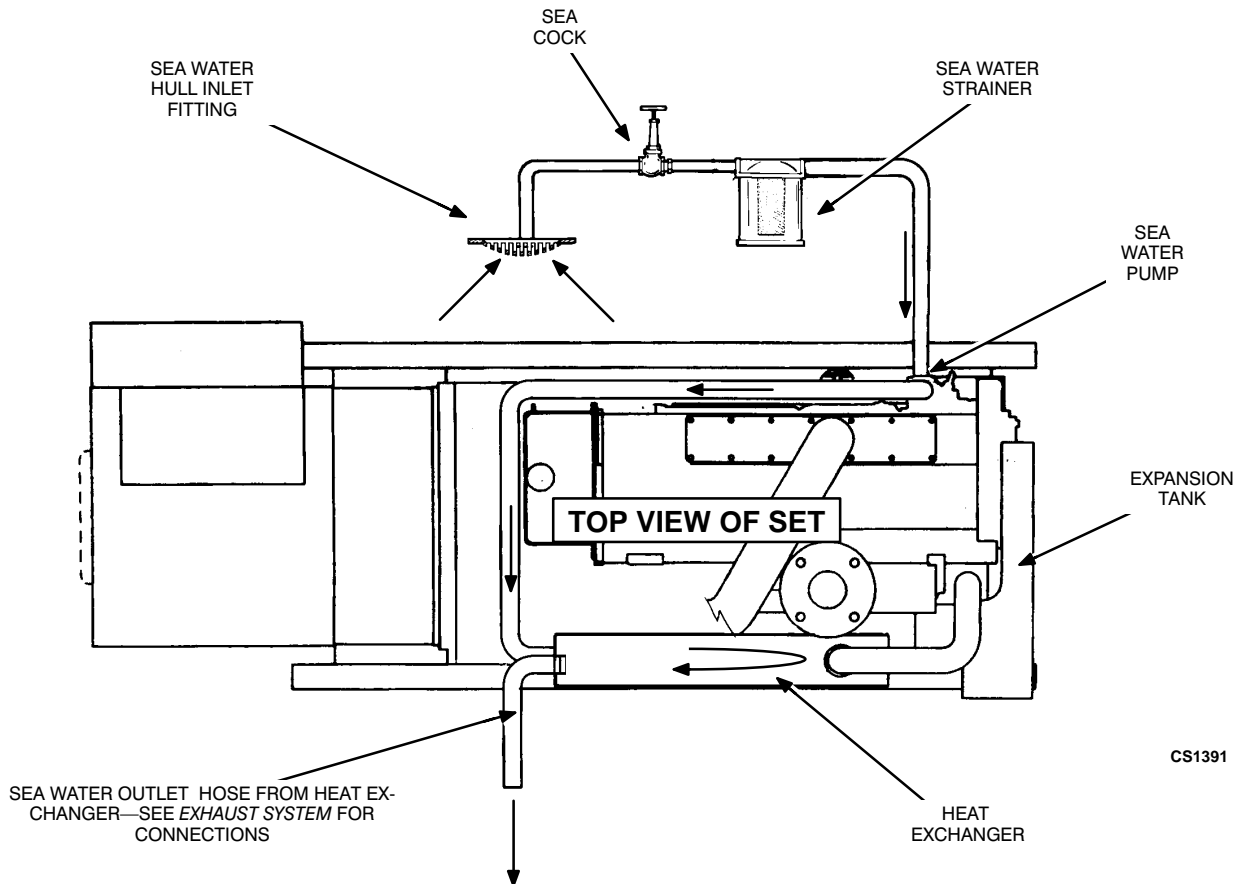


FIGURE 3-1. SCHEMATIC OF A TYPICAL COOLING SYSTEM

# Section 4. Ventilation

---

Generator set compartment air temperature must not exceed 122° F (50° C). Higher temperatures will result in overheating of the generator windings, tripping of circuit breakers and loss of engine power. Ventilation is also required to prevent dangerous concentrations of fuel vapors and exhaust fumes.

Coast Guard requirements for minimum ventilation in passenger vessels are summarized in Table 4-1.

**TABLE 4-1. USCG REGULATIONS FOR VENTILATION OF EQUIPMENT ROOMS IN PASSENGER VESSELS**

SIZE OF COMPARTMENT Cu. Ft. (m <sup>3</sup> )	MAXIMUM TIME ALLOWED TO EXCHANGE TOTAL AIR VOLUME (MINUTES)
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

It should be noted that air flow required for preventing excessive generator compartment air temperature will usually be greater than that required for meeting USCG requirements for evacuating vapors and fumes.

For best results, fresh air should enter near the bottom of the generator set compartment, at the generator end. Warm compartment air should exit near the top, at the other end of the compartment.

See the applicable Specification Sheet for data necessary for ventilating air flow calculations. Application Manual T-030 has example air flow calculations.

Carbon monoxide (CO) detectors, listed for marine applications, should be installed in the living quarters of the vessel. Wind shifts, boat motion, exhaust from other boats at dockside, etc. can cause exposure to harmful concentrations of carbon monoxide even when proper ventilation is provided and living quarters are separated from machinery compartments.



# Section 5. Exhaust System

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These sets have a “wet elbow” for a wet exhaust system. The full flow of sea water that is pumped through the heat exchanger passes through the wet elbow into the exhaust gas stream. The sea water is thereby discharged to the outside along with the exhaust gas through the exhaust hull fitting. The water cools the exhaust gas enough so that rubber hose can be connected directly to the wet elbow. (The exhaust system is protected in the event of a pump failure, blockage or other such event by a high exhaust temperature shutdown switch). The wet elbow is adjustable to point down between 30 and 90 degrees. Figure 5-1 shows typical wet exhaust systems.

**⚠WARNING** *Engine exhaust includes deadly carbon monoxide gas (CO). The exhaust system must be gas tight and discharge all engine exhaust outside.*

The exhaust hull fitting must always be located above the load water line. The transom is the preferred location, where water is less likely to enter because of waves and vessel roll. The exhaust fitting must also be aft of all other openings to reduce the likelihood of recirculating exhaust gas through the other openings.

Where at all possible, it is recommended that the set be located so that the outlet of the turbocharger is at least 12 inches (305 mm) above the load water line. A blind tee should then be connected to the wet elbow to prevent water from backing up into the turbocharger. Exhaust piping should have as few bends as possible and slope down from the engine at least 1/2 inch per foot (2 degrees).

There should be enough support so that the piping does not sag or dip.

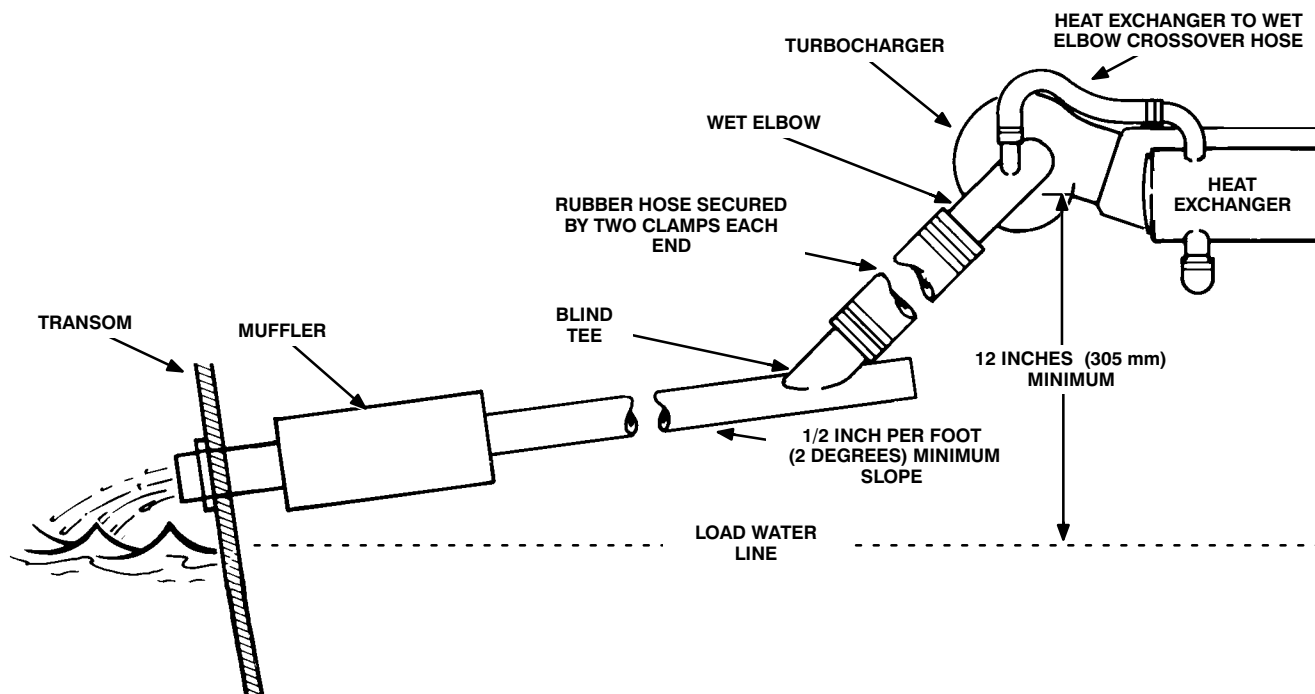
If the set must be located so that the outlet of the wet elbow is less than 12 inches (305 mm) above the load water line, it will be necessary to provide a water lift muffler below the exhaust outlet and an anti-siphon break at least 12 inches (305 mm) above the load water line.

Use approved hose, piping, fittings, clamps and muffler. Rubber exhaust hose must be Certified for marine use. To facilitate hose connections and to take up engine movement, there should be a gap of one pipe diameter between the end of the rigid exhaust piping and the engine exhaust outlet. Double clamp each hose connection. The entire exhaust system must be accessible for inspection and repair.

Exhaust back pressure must not exceed 41 inches WC (10.2 kPa). See the applicable Specification Sheet for data necessary for exhaust back pressure calculations. Application Manual T-030 has example dry exhaust back pressure calculations. Wet exhaust back pressure tends to be higher than dry exhaust back pressure because of the extra water and steam. The calculated value, based on dry exhaust, should therefore be doubled to obtain the wet exhaust back pressure. It should be noted that water lift mufflers impose high exhaust back pressure.

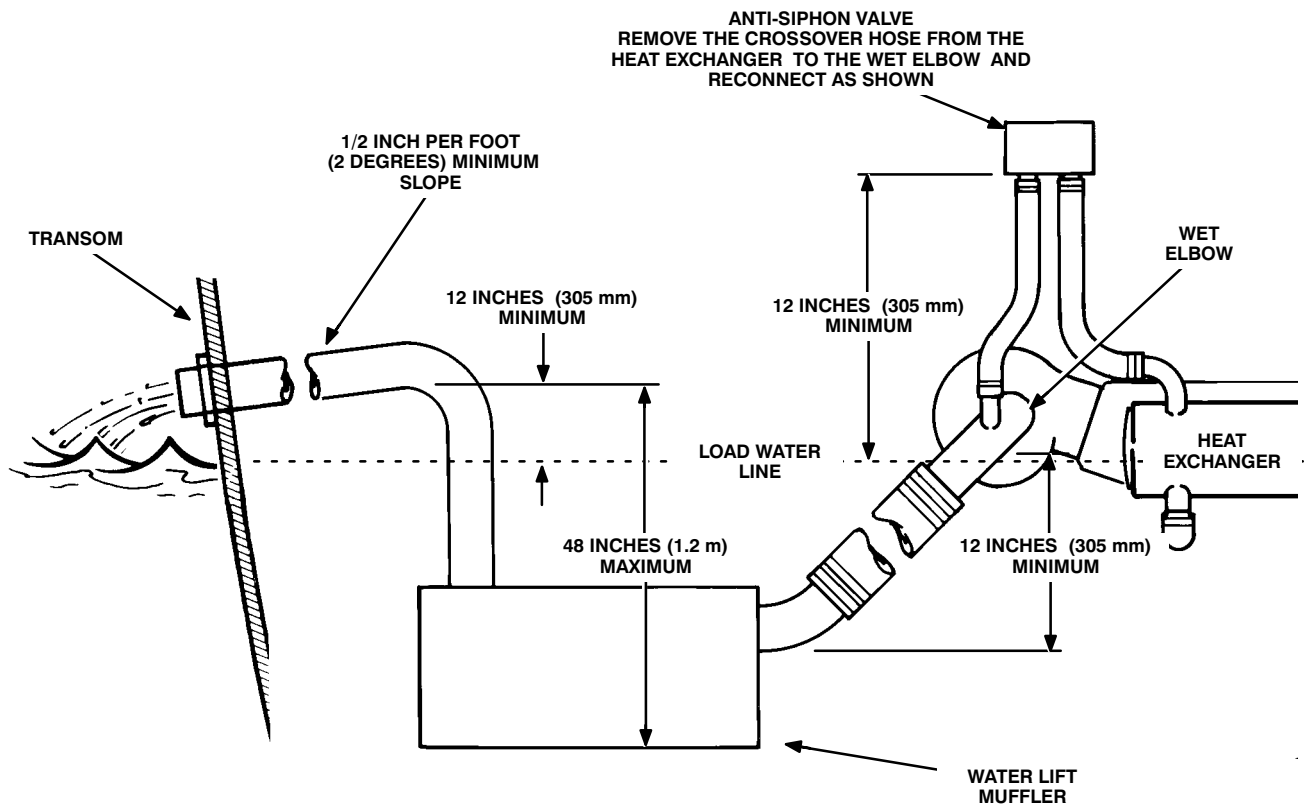
**⚠CAUTION** *Excessive exhaust back pressure reduces the air-fuel ratio - resulting in reduced power, smoke, high exhaust temperature and reduced engine life.*

**INSTALLATIONS ABOVE LOAD WATER LINE**



EXS1183

**INSTALLATIONS BELOW LOAD WATER LINE**



EXS1183-1

**FIGURE 5-1. TYPICAL WET EXHAUST SYSTEMS**

# Section 6. Fuel Supply System

---

These generator sets are rated utilizing ASTM No. 2 diesel fuel. Check the engine Operation Manual for the range of acceptable fuels.

**⚠WARNING** *Diesel fuel is highly combustible. The fuel supply system must not leak. The installation, inspection and testing of the fuel supply system must be done by qualified persons in accordance with applicable regulations.*

There must be access for priming the engine-mounted fuel lift pump on the left side of the engine (looking from the alternator end).

An approved fuel / water separator must be installed ahead of the engine fuel lift pump since the lift pump as well as fuel injection pump can be damaged by water. A fuel / water separator kit that mounts on the flywheel housing is available from your distributor.

**⚠CAUTION** *Failure to provide an approved fuel/water separator and filter upstream of the engine-mounted fuel lift pump can lead to pump and injection unit failures and consequent disabling of the set.*

A skid mounted plate on the fuel pump side of the engine carries 1/4 - 18 NPTF fuel supply and return fittings. Rigid fuel lines may be connected to these fuel fittings only if the skid is rigidly secured to the hull frame members. USCG Type A1 nonmetallic fuel hose or equivalent

should be used for supply and return connections to take up movement of the set when the skid is mounted on external vibration isolators. The hose should be nonmetallic to prevent accidental passage of cranking current, which can melt metal wire braided hose, causing leakage and possible fire.

The fuel supply tank may be connected directly if the bottom is not more than 5 feet (1.5 M) below the engine fuel lift pump or the top more than 6 feet (1.8 M) above the fuel injectors. The fuel return line must be run to the bottom of the tank to prevent the system from draining back.

A fuel transfer pump and auxiliary tank will be necessary if the bottom of the supply tank is more than 5 feet (1.5 M) below the engine fuel lift pump.

An auxiliary tank with float valve will be necessary if the top of the supply tank is more than 6 feet (1.8 M) above the fuel injectors. A fuel strainer must be installed to protect the float valve seat from debris that could cause it to leak.

Fuel tank construction, location, installation, venting, piping, inspection and testing must comply with applicable regulations.

**⚠CAUTION** *Do not use galvanized fuel tanks, fittings or pipes. Diesel fuel has sulfur residue that attacks the galvanized (zinc) coating, causing debris that can clog fuel filters and pumps.*

# Section 7. AC Connections

---

The AC power supply system must be installed and inspected in accordance with the applicable regulations.

**⚠WARNING** *Improper power supply wiring can cause fire and electrocution, resulting in severe personal injury or death.*

## TRANSFER SWITCH

Use an approved transfer switch if provision is made for connecting shore power.

**⚠WARNING** *Interconnecting the generator set with shore power can cause dangerous transient voltages, damage to the generator set and electrocution, resulting in severe personal injury or death.*

## CONNECTIONS

Flexible conduit and stranded conductors must be used for connections to take up movement of the set.

Most models have 12 leads and a terminal block to reconnect the generator to provide the voltages required for the

installation. See Figure 7-1. Reconnections may require rerouting the leads through current transformers CT 21, CT 22 and CT 23 (if provided) and change of line circuit breaker (if provided).

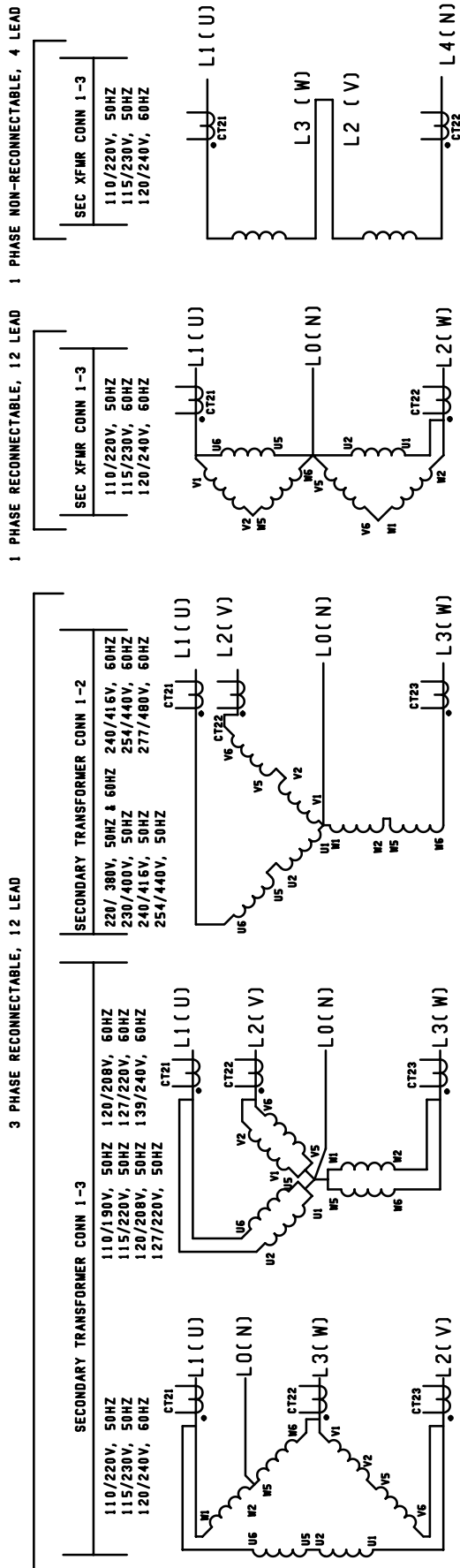
The loads must be balanced within ten percent of the average phase load in three phase power systems.

A 20 foot (6 M) long plug-in extension harness is available so that the AC meter panel (if provided) can be mounted at a convenient location in the generator room.

## GROUNDING

The generator set, power supply wiring and all connected electrical utilizing equipment must be bonded to the common bonding conductor of the vessel in accordance with the applicable regulations.

**⚠WARNING** *Faulty bonding for grounding can cause fire and electrocution, resulting in severe personal injury or death.*



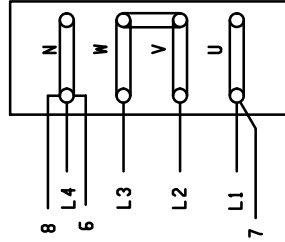
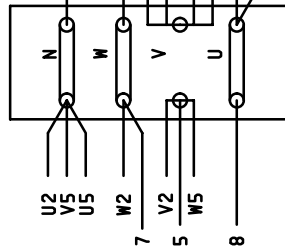
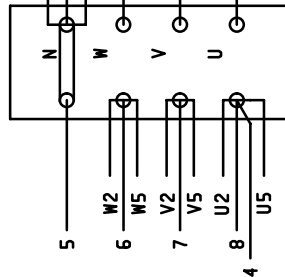
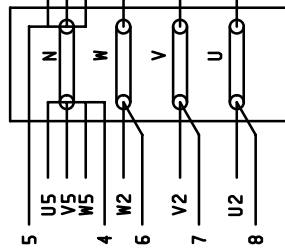
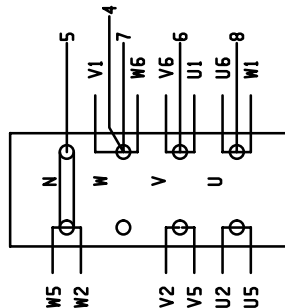
**SERIES DELTA**  
 3 PHASE 4 WIRE  
 OUTPUT TERMINALS  
 U, V, W, N.

**PARALLEL STAR**  
 3 PHASE 4 WIRE  
 OUTPUT TERMINALS  
 U, V, W, N.

**SERIES STAR**  
 3 PHASE 4 WIRE  
 OUTPUT TERMINALS  
 U, V, W, N.

**DOUBLE DELTA**  
 1 PHASE 3 WIRE  
 OUTPUT TERMINALS  
 U, N

**1 PHASE 3 WIRE**  
 OUTPUT TERMINALS  
 U, N



CONTROL INPUT				
CONTROL INPUT TB21	SERIES DELTA	PARALLEL STAR	SERIES STAR	DOUBLE DELTA
22	8	8	8	8
23	7	7	7	7
24	4	4	4	4
25	6	6	6	6
26	5	5	5	5
JUMPER	—	—	—	—

**NOTE:**  
 1. UVW PHASE SEQUENCE WITH C.W. ROTATION FACING DRIVE END.

FIGURE 7-1. AC RECONNECTION DIAGRAM

# Section 8. DC Connections

These sets have either a 12 VDC or a 24 VDC system for cranking and engine control. The system has either a negative ground or an isolated ground. Check the nameplate.

## BATTERY CONNECTIONS

See *Specifications* for the required battery cold cranking amp rating. Mount the batteries in accordance with regulations as close as possible to the set.

The battery cables must be sized so that voltage drop between the batteries and the starter motor is not more than 2 volts for 24 volt systems and 1 volt for 12 volt systems. Application Manual T-030 has example battery cable sizing calculations.

Figure 8-1 illustrates how to connect two 12 volt batteries for 24 volt systems. The negative battery cable should be secured to the starter, as shown, or to the engine block. Remove any paint, rust or grease under the connector so that it will touch bare metal.

To prevent accidental starting, the last step in the installation should be to connect the negative (-) battery cable to the engine.

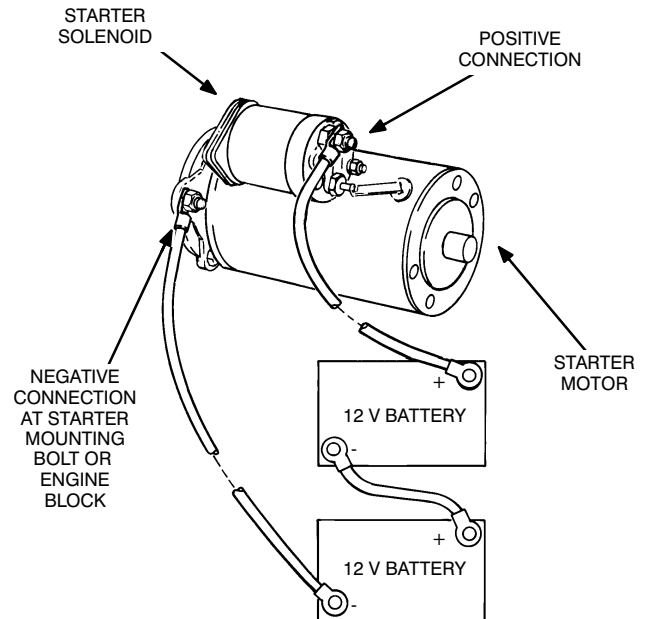
**⚠WARNING** *Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative (-) first).*

*Always disconnect the negative (-) battery cable first, and reconnect it last, to prevent arcing if a tool accidentally touches the frame or other grounded metal part while disconnecting or reconnecting the positive (+) battery cable. Arcing can ignite the explosive gas given off by batteries, causing severe personal injury.*

*Do not smoke near batteries. A cigarette can ignite the hydrogen gas given off by batteries.*

## REMOTE CONTROL CONNECTIONS

A 20 foot (6 M) long plug-in extension harness is available so that the engine control panel can be mounted at a convenient location in the generator room. A pilot house control panel with 20 foot (6M) plug-in extension harness is also available.



ES1693

FIGURE 8-1. BATTERY CONNECTIONS FOR 24 VOLT, NEGATIVE GROUND SYSTEMS

## GROUNDING

Check the applicable regulations to determine whether the negative battery terminal should be bonded to the common bonding conductor of the vessel or be isolated. A kit is available, if necessary, to convert the engine control system for isolated battery grounding.

# Section 9. Startup

Read Operator's Manual 960-0148 before startup, and observe all the instructions and precautions.

## FILLING ENGINE OIL AND COOLANT

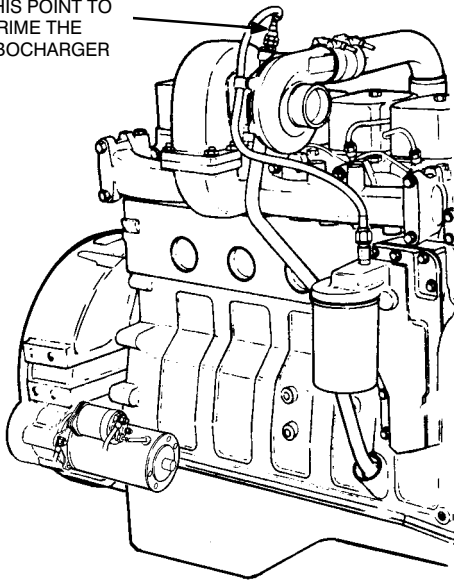
The engine must be filled with oil and coolant before starting. If the set is heat exchanger-cooled, prime the sea water pump. See *Maintenance* in the Operator's Manual for instructions on how to fill engine oil and coolant and prime the sea water pump.

**CAUTION** *The engine will be severely damaged if run without oil or coolant.*

## PRIMING THE TURBOCHARGER

When the engine is equipped with a turbocharger, disconnect the oil supply line at the turbocharger housing and fill the bearing with engine oil. Reconnect the oil line.

DISCONNECT THE OIL SUPPLY LINE AT THIS POINT TO PRIME THE TURBOCHARGER



LS1167

FIGURE 9-1. PRIMING THE TURBOCHARGER BEARING

## FUEL

See *Maintenance* in the Operator's Manual for instructions on how to bleed air from the fuel supply line and filters.

The fuel injection system is self venting and will probably not need to be bled. See the *engine* Operation Manual if it is necessary to bleed the fuel injection system.

## STARTING

Hold the control panel switch in the **START** position. Release the switch when the engine starts. (The starter will disengage automatically when the engine starts up.) See *Troubleshooting* in the Operator's Manual if the engine does not start, or starts but does not continue to run.

**CAUTION** *Excessive cranking can overheat the starter motor and cause it to fail. Do not crank the engine for more than 30 seconds at a time. Wait two minutes before trying again.*

## ENGINE GAUGES

Check the engine gauges while the engine is running.

### Oil Pressure Gauge

Engine oil pressure should be between 35 and 60 psi when the engine is at normal operating temperature.

### Coolant Temperature Gauge

Engine coolant temperature should be between 170°F and 210°F during normal operation.

### DC Voltmeter

Battery charging voltage should be between 24 and 28 volts for 24 volt systems and 12 and 14 volts for 12 volt systems.

## OUTPUT FREQUENCY

See the Operator's Manual for checking and adjusting output frequency.

## OUTPUT VOLTAGE

See the Operator's Manual for checking and adjusting output voltage.

## INSTALLATION CHECK LIST

Before putting the set into service, check each of the following areas while the set is running under load.

### Mechanical

Check for loose mounting bolts, damaged components and interference with bulkheads or other equipment.

## Lubrication

Check for oil leaks. When the engine has been stopped for at least ten minutes, check the oil level.

## Cooling

Check for coolant leaks. When the engine has cooled down, check the coolant level.

**⚠WARNING** *To prevent severe scalding, always let the engine cool down before removing the coolant pressure cap. Turn the cap slowly, and do not open it fully until the pressure has been relieved.*

## Fuel

Check for leaks in all fuel lines, fittings, filters and tanks. Check for cuts, abrasions and rubbing in flexible fuel lines.

**⚠WARNING** *Diesel fuel is highly combustible. The fuel supply system must not leak and must have safeguards to prevent accidental flooding of engine*

*and bilge with fuel. The installation, inspection and testing of the fuel supply system must be done by qualified persons in accordance with applicable regulations.*

## Control

Start and run the set several times from the local control panel. Also start and run the set from the pilot house control panel, if provided.

## Wiring

Check all line, control, battery and grounding connections.

## Exhaust

Check the entire exhaust system by looking and listening for leaks.

**⚠WARNING** *Engine exhaust includes deadly carbon monoxide gas (CO). The exhaust system must be gas tight and discharge all engine exhaust outside.*



# Section 10. Specifications

MODEL NUMBER	MCGBA	MCGCA	MCGCB	MCGGA	MCGDA	MCGDB
<b>FUEL SPECIFICATION</b>	No. 2 Diesel	No. 2 Diesel	No. 2 Diesel	No. 2 Diesel	No. 2 Diesel	No. 2 Diesel
<b>FUEL SUPPLY AND RETURN FITTINGS</b>	1/4-18 NPTF	1/4-18 NPTF	1/4-18 NPTF	1/4-18 NPTF	1/4-18 NPTF	1/4-18 NPTF
<b>ENGINE OIL CAPACITY</b>	11.5 qts. (11L)	11.5 qts. (11 L)	11.5 qts. (11 L)	16 qts. (15 L)	16 qts. (15 L)	16 qts. (15 L)
<b>BATTERY VOLTAGE*</b>	12 or 24	12 or 24	12 or 24	12 or 24	12 or 24	12 or 24
<b>RECOMMENDED BATTERY RATING**</b>	625	625	625	625	625	625
<b>COOLANT CAPACITY (H. E. and Engine)</b>	3.5 gal (13 L)	3.5 gal (13 L)	3.5 gal (13 L)	5.4 gal (20 L)	5.5 gal (21 L)	5.5 gal (21 L)
<b>WET EXHAUST HOSE SIZE</b>	3-1/2 in. I.D.	3-1/2 in. I.D.	3-1/2 in. I.D.	3-1/2 in. I.D.	3-1/2 in. I.D.	3-1/2 in. I.D.
<b>SEA WATER INLET HOSE SIZE</b>	1-1/4 in. I.D.	1-1/4 in. I.D.	1-1/4 in. I.D.	1-1/4 in. I.D.	1-1/4 in. I.D.	1-1/4 in. I.D.
* - See Nameplate ** - SAE J537 cold cranking amps (CCA)						



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