

Operation and Installation Manual

Marine Generator Sets



Models:

3.5CFZ

4CZ

5CFZ

6.5CZ

KOHLER[®]
POWER SYSTEMS

ISO 9001
KOHLER
GENERATORS
INTERNATIONALLY REGISTERED

California Proposition 65

 WARNING

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

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Safety Precautions and Instructions

A generator set, like any other electro-mechanical device, can pose potential dangers to life and limb if improperly maintained or imprudently operated. The best way to prevent accidents is to be aware of the potential dangers and to always use good common sense. In the interest of safety, some general precautions relating to the operation of a generator set follow. Keep these in mind. This manual contains several types of safety precautions which are explained below.

DANGER

Danger is used to indicate the presence of a hazard that will cause severe personal injury, death, or substantial property damage if the warning is ignored.

WARNING

Warning is used to indicate the presence of a hazard that can cause severe personal injury, death, or substantial property damage if the warning is ignored.

CAUTION

Caution is used to indicate the presence of a hazard that will or can cause minor personal injury or property damage if the warning is ignored.

Safety decals are affixed to the generator set in prominent places to advise the operator or service technician of potentially hazardous situations. The decals are reproduced here to improve operator recognition and thereby increase decal effectiveness. For a further explanation of decal information, reference the accompanying safety precautions. Before operating or servicing the generator set, be sure you understand the message of these decals. Replace decals if missing or damaged.

NOTE

Note is used to notify people of installation, operation, or maintenance information that is important but not hazard-related.

HAZARDOUS VOLTAGE/ ELECTRICAL SHOCK

 WARNING	
	
Hazardous voltage.	Moving rotor.
Can cause severe injury or death.	
Do not operate generator set without all guards and electrical enclosures in place.	

Hazardous voltage can cause severe injury or death. Wherever electricity is present, there is the hazard of electrocution. Take the same precautions with electrical appliances in your craft that you would observe in your home. Open main circuit breaker on all power sources before servicing equipment. Make sure unqualified persons, especially children, cannot gain access to your set— keep the compartment door locked or securely latched at all times. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions.

Hazardous voltage can cause severe injury or death. Use caution when handling the capacitor; possible electrical shock can result. Discharge capacitor by shorting terminals together.

Hazardous voltage can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

Hazardous “backfeed” voltage can cause severe injury or death. Do not connect to any building/marina electrical system without connecting through an approved device and after building main switch is open. Backfeed connections can cause serious injury or death to utility personnel working to repair a power outage and/or personnel in the vicinity. Unauthorized connection may be unlawful in some states and/or localities. A ship-to-shore transfer switch must be installed to prevent interconnection of generator set power and shore power.

EXHAUST SYSTEM

⚠ WARNING

<p>Carbon monoxide. Can cause severe nausea, fainting, or death.</p> <p>The exhaust system must be leakproof and routinely inspected.</p>

Carbon monoxide can cause severe nausea, fainting, or death. Use the following precautions when installing and operating generator set. Carbon monoxide is particularly threatening in that it is an odorless, colorless, tasteless, nonirritating gas. Be especially careful if operating the generator when moored or anchored under calm conditions as gases may accumulate. If operating the set dockside, moor your craft so that the exhaust discharges on the lee side (the side sheltered from the wind), and always be mindful of others— make sure your exhaust is directed away from other boats and occupied buildings. Do not install exhaust outlet where exhaust can be drawn through portholes, vents, or air conditioners. If generator set's exhaust discharge hole is near to your craft's water line, **DO NOT OVERLOAD CRAFT** so as to close or restrict exhaust discharge hole.

Carbon monoxide can cause severe nausea, fainting, or death. In addition to routine inspection of the exhaust system, a carbon monoxide detector should be considered. Consult your boat builder or marina for installation of approved detectors. It is essential that all detectors be routinely inspected for proper operation.

BATTERY



Sulfuric acid in batteries.

Can cause severe injury or death.

Use protective goggles and clothes. Can cause permanent damage to eyes, burn skin, and eat holes in clothing.

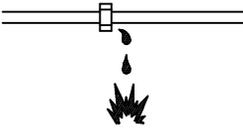
Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in battery can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working around the battery. If battery electrolyte is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In the case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in hazardous spattering of electrolyte.

Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flame or spark to occur near a battery at any time, particularly when it is being charged. Avoid contacting terminals with tools, etc. to prevent burns and to prevent sparks that could cause an explosion. Remove wristwatch, rings, and any other jewelry before handling battery. Never connect negative (-) battery cable to positive (+) connection terminal of starter solenoid. Do not test battery condition by shorting terminals together or sparks could ignite battery gases or fuel vapors. Any compartment containing batteries must be well ventilated to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged and always turn charger off before disconnecting battery connections. When disconnecting battery, remove negative lead first and reconnect it last.

FUEL SYSTEM

 WARNING

<p>Explosion. Gasoline vapors can cause explosion and severe injury or death.</p> <p>Before starting generator set, operate blower 4 minutes and check engine compartment for gasoline vapors.</p>

 WARNING		
<p>Explosive fuel vapors. Can cause severe injury or death.</p> <p>Use extreme care when handling, storing, and using fuels.</p>		

Explosive fuel vapors can cause severe injury or death. All fuels are highly explosive in a vapor state. Use extreme care when handling, storing, and using fuels. Store fuel in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running since spilled fuel may ignite on contact with hot parts or from ignition spark. Do not smoke or permit flame or spark to occur near potential sources of spilled fuel or fuel vapors. Keep fuel lines and connections tight and in good condition— don't replace flexible fuel lines with rigid lines. Flexible sections are used to avoid breakage due to vibration. Should any fuel leakage, fuel accumulation, or electrical sparks be noted, **DO NOT OPERATE GENERATOR SET.** Have systems repaired before resuming generator operation.

Explosive fuel vapors can cause severe injury or death. Additional precautions must be taken when using the following fuels:

Gasoline— Store gasoline only in approved red containers clearly marked GASOLINE. Do not store gasoline in any occupied building.

Explosive fuel vapors can cause severe injury or death. Gasoline vapors can explode and can cause death or severe injury. USCG Regulation 33CFR183 requires all electrical devices (ship-to-shore transfer switch, remote start panel, etc.) to be "ignition protected" when used in a gasoline (gaseous)-fueled environment. These electrical devices are not "ignition protected" and are not certified to operate in a gasoline (gaseous)-fueled environment such as engine room or near fuel tanks. Acceptable locations would be wheelhouse or other living areas sheltered from rain and water splash.

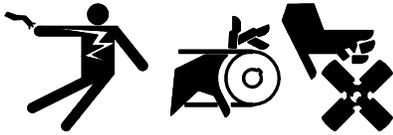
Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining fuel system. Wipe up all spilled fuel after draining system.

Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Do not modify the tank or propulsion engine fuel system. Craft must be equipped with a tank allowing one of the two pickup arrangements described. Tank and installation must conform to U.S.C.G. Regulations.

Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. To prevent fuel leakage, use pipe sealant on all threaded fittings. Pipe sealant must be suitable for use in marine applications having oil and gasoline environments.

ACCIDENTAL STARTING

 **WARNING**



Accidental starting.

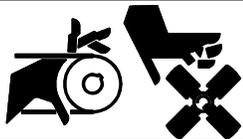
Can cause severe injury or death.

Disconnect battery cables before working on generator set (negative lead first and reconnect it last).

Accidental starting can cause severe injury or death. Disconnect battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator. The generator set can be started by remote start/stop switch unless this precaution is followed.

MOVING PARTS

 **WARNING**



Rotating parts.

Can cause severe injury or death.

Do not operate generator set without all guards, screens, or covers in place.

Flying projectiles can cause severe injury or death. Retorque all crankshaft and rotor hardware after servicing. When making adjustments or servicing generator set, do not loosen crankshaft hardware or rotor thru-bolt. If rotating crankshaft manually, direction should be clockwise only. Turning crankshaft bolt or rotor thru-bolt counterclockwise can loosen hardware and result in serious personal injury from hardware or pulley flying off engine while unit is running.

Exposed moving parts can cause severe injury or death. *Additional Precautions Regarding Sound Shield Equipped Models:*

Some scheduled maintenance procedures require the generator set to be running while performing service. If the sound shield has been removed leaving belts and pulleys exposed, be especially careful of this area.

Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from belts and pulleys when unit is running. Replace guards, covers, and screens before operating generator set.

HOT PARTS

 **WARNING**



Hot engine and exhaust system.

Can cause severe injury or death.

Do not work on generator set until unit is allowed to cool.

Hot parts can cause severe injury or death. Do not touch hot engine parts. An engine gets hot while running and exhaust system components get extremely hot.

 **WARNING**



Hot coolant and steam.

Can cause severe injury or death.

Before removing pressure cap stop generator, allow to cool and loosen pressure cap to relieve pressure.

Hot coolant can cause severe injury or death. Allow engine to cool and release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth then turn it slowly counterclockwise to the first stop. After pressure has been completely released and the engine has cooled, remove cap. If generator set is equipped with a coolant recovery tank, check coolant level at tank.

ENGINE BACKFIRE/FLASH FIRE

⚠ WARNING



Fire.

Can cause severe injury or death.

Do not smoke or permit flame or spark to occur near fuel or fuel system.

A flash fire can cause severe injury or death. Do not smoke or permit flame or spark to occur near carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuel or fuel vapors. When removing fuel line or carburetor, use a proper container to catch all fuel.

A sudden backfire can cause severe injury or death. Do not operate with backfire flame arrestor removed.

A sudden backfire can cause severe injury or death.
Do not operate with air cleaner/silencer removed.

A sudden flash fire can cause severe injury or death.
Do not smoke or permit flame or spark to occur near fuel system. Keep the compartment and generator set clean and free of debris to minimize chances of fire. Wipe up all spilled fuel and engine oil.

HAZARDOUS NOISE

⚠ CAUTION



Hazardous noise.

Can cause loss of hearing.

Never operate generator without a muffler or with faulty exhaust system.

NOTES

NOTE

HARDWARE DAMAGE! Engine and generator may make use of both American Standard and metric hardware. Be sure to use the correct size tools to prevent rounding of bolt heads and nuts.

NOTE

Special attention should be given when checking for proper coolant level. After the coolant has been drained, it normally requires some time before complete refill of the engine water jacket takes place.

NOTE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. American Standard hardware uses a series of markings and metric hardware uses a numeric system to indicate hardness. Check markings on bolt head and nuts for proper identification.

NOTE

When a fuse replacement is required, be sure fuse has the same ampere rating and is the same type (for example: ABC or 3AB, ceramic). Do not substitute "clear" glass-type fuses for ceramic fuses. If ampere rating is unknown or questionable, see Wiring Diagram.

NOTE

High-mineral content sea water (salt water) can cause rapid destruction of all metals. Wipe up all salt water spillage on and around generator set and keep metal surfaces free from accumulated salt deposits.

NOTICE

This generator set has been rewired from its nameplate voltage to:

246242

NOTICE

**This is a positive terminal only.
Do not attach negative lead!**

NOTICE

Check zinc anode every 100 hours or 3 months.

NOTICE



Do not use as a step.

Standing on genset could impair operation of unit.

NOTE

Split lock washers may be supplied with some kits. If split lock washers are supplied with kit, their use is optional.

Reference Material

It is recommended that the following Regulations and Standards be followed when installing Marine Generator Sets.

Pleasure Craft

Designed and manufactured to meet U.S. Coast Guard Title 33.

U.S. Coast Guard Code of Federal Regulations
Title 33
Subparts I–Electrical Systems
Subparts J–Fuel Systems

Title 46
Subchapter F–Marine Engineering
Part 58–Main and Auxiliary Machinery and Related Systems

Order the above publications from:
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
1-202-783-3238

Boating Safety Circular Commandant (G-BC)
Boating Statistics (G-BP-1)

U.S. Coast Guard Headquarters
2100 Second Street, S.W.
Washington, DC 20593-0001
Boating Safety Hotline: 1-800-368-5647

American Bureau of Shipping
“Rules for Building and Classing Steel Vessels”
45 Eisenhower Drive
Paramus, N.J. 07652
201-368-9100

Lloyds Registry of Shipping
“Rules for Classification of Ships”
17 Battery Place
New York, N.Y. 10004
212-425-8050

Underwriters Laboratories, Inc. (UL)
Publications Stock
333 Pfingsten Road
Northbrook, IL 60062
Marine Department: 1-919-549-1400

NFPA 302
National Fire Protection Association
60 Batterymarch Park
Quincy, MA 02269

Customer Service
Society of Automotive Engineer’s (SAE)
400 Commonwealth Drive
Warrendale, PA 15096
1-412-776-4970

American Boat and Yacht Council, Inc. (ABYC)
3069 Solomon’s Island Rd.
Edgewater, MD 21037
1-410-956-1050
1-410-974-8112
1-410-956-2737 FAX

IEEE 45
The Institute of Electrical and
Electronics Engineer’s Inc.
345 East 47th Street
New York, NY 10017

Commercial Vessels

In order to use these generator sets for commercial applications where U.S. Coast Guard Title 46 Certificate is required, additional modifications will be necessary.

U.S. Coast Guard Code of Federal Regulations
Title 46
Subchapter F—Marine Engineering
 Part 58—Main and Auxiliary Machinery and Related Systems
Subchapter J—Electrical Engineering
 Part 111—Electrical Systems—General Requirements
 Part 112—Emergency Lighting and Power Systems
Subchapter T—Small Passenger Vessels
 (Under 100 Gross Tons)
 Part 182—Machinery Installation
 Part 183—Electrical Installation

Order the above publications from:
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Washington, DC 20402
1-202-783-3238

American Bureau of Shipping (ABS)
65 Broadway
New York, NY 10006

Order ABS publications from:

American Bureau of Shipping
Book Order Section
45 Eisenhower Drive
P.O. Box 910
Paramus, NJ 97653-0910

Lloyd's Register of Shipping
71 Fenchurch Street
London, EC3M 4BS England

Midwest Office:
Lloyd's Register of Shipping
100 South York Street, Room 226
Elmhurst, IL 60126
1-312-279-5414

Additional References

The following organizations provide a service which may be useful to the generator set installer. These organizations are not regulatory in nature but rather provide guidelines and assistance. They are listed only as a source for additional information. No solicitation or representation is hereby given.

Yacht Corrosion Consultants, Inc.
2970 Seaborg Ave.
Ventura, CA 93003
1-805-644-1886

Ward's Marine Electric, Inc.
630 S.W. Flagler Ave.
Ft. Lauderdale, FL 33301
1-305-523-2815
1-800-545-9273
1-305-523-1967 FAX

Routine Service Parts

Contact your Kohler generator dealer/distributor for a complete listing of service parts for your generator set.

Part Description	Kohler Part No.
Engine:	
Air Filter	278612
Oil Filter	267714
Belt, Timing	267722
Ignition System:	
Spark Plug	267713
Sea Water Pump Impeller	229826
Zinc Anode	267928
White Spray Paint	221318

Glossary of Abbreviations

Abbreviations are used throughout this manual. Normally in the text they will appear in complete form with the abbreviation following in parenthesis the first time they are used. After that they will appear in the abbreviated form. The commonly used abbreviations are shown below.

Abbreviation	Description	Abbreviation	Description
AC	alternating current	FM	frequency modulation
AHWT	anticipatory high water temp.	fs	full scale
ALOP	anticipatory low oil pressure	ft.	foot, feet
AM	amplitude modulation	ft. lbs.	foot pound, foot pounds
Amp	ampere	ga.	gauge
Amps	amperes	gal., gals.	gallon, gallons
ANSI	American National Standard Institute	gal./hr.	gallons per hour
API	American Petroleum Institute	gph	gallons per hour
approx.	approximate, approximately	gpm	gallons per minute
A/R	as required, as requested	gr.	grade
A/S	as supplied, as stated, as suggested	grd.	ground
ASA	American Standards Association	HCHT	high cylinder head temperature
assy.	assembly	HET	high exhaust temperature
ASTM	American Society for Testing Materials	Hg	mercury (element)
ATDC	after top dead center	H ₂ O	water
ATS	automatic transfer switch	hp	horsepower
aux.	auxiliary	hr, hrs	hour
AWG	American Wire Gauge	HWT	high water temperature
AWM	appliance wiring material	Hz	hertz (cycles per second)
bhp	brake horsepower	ID	inside diameter
bmep	brake mean effective power	in.	inch(es)
Btu	British thermal unit	inc.	incorporated
°C	Celsius degree	in. lbs.	inch pounds
cc	cubic centimeter	int.	internal
CCA	cold cranking Amps.	int.-ext.	internal-external
CEC	Canadian Electrical Code	ISO	International Standards Organization
cfh	cubic feet per hour	J	joule, joules
cfm	cubic feet per minute	JIS	Japanese Industry Standard
CID	cubic inch displacement	kg	kilogram, kilograms
cm	centimeter, centimeters	kg/cm ²	kilograms per square centimeter
cmm	cubic meters per minute	kgm	kilogram meter(s)
co.	company	km	kilometer, kilometers
cont'd.	continued	kPa	kiloPascal, kiloPascals
C.S.A.	Canadian Standards Association	kph	kilometers per hour
cu. in.	cubic inch, cubic inches	kV	kilovolt
cyl.	cylinder	kVA	kilovolt amperes
dBA	decibels	kW	kilowatt, kilowatts
DC	direct current	kWH	kilowatt hour
DCR	direct current resistance	L	liter, liters
deg.	degree	LxWxH	length x width x height
dept.	department	LED, LEDs	light emitting diode
dia.	diameter	lb., lbs.	pound, pounds
e.g.	example given	L/hr.	liter per hour, liters per hour
EMI	electromagnetic interference	L/min.	liter(s) per minutes
etc.	etcetera, (and so forth)	LOP	low oil pressure
ext.	external	LP	liquefied petroleum
°F	Fahrenheit degree	LWT	low water temperature
fl. oz.	fluid ounce, fluid ounces	m	meter, meters

Abbreviation	Description
m ³	cubic meter, cubic meters
max.	maximum
MCM	one thousand circular mils.
mi.	mile, miles
mil	one one-thousandth of an inch
min.	minimum
mJ	millijoule, millijoules
MJ	mega joule, mega joules
mm	millimeter, millimeters
m ³ /min	cubic meters per minute
MPa	megaPascal
mph	miles per hour
MS	military standard
mW	milliwatt, milliwatts
MW	megawatt, megawatts
N/A	not available
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	Newton meter, Newton meters
no., nos.	number, numbers
NPT	National Standard taper pipe thread per general use
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed, oversize
OV	overvoltage
oz.	ounce, ounces

Abbreviation	Description
PF	power factor
pot.	potentiometer
ppm	parts per million
psi	pounds per square inch
pt., pts.	pint, pints
qt., qts.	quart, quarts
qty.	quantity
ref.	reference
RFI	radio frequency interference
rms	root mean square
rpm	revolutions per inch
SAE	Society of Automotive Engineers
sec.	second, seconds
SCR	silicon controlled rectifier
spec, specs	specification
sq.	square
sq. cm	square centimeters
sq. in.	square inch, square inches
tach	tachometer
TDC	top dead center
temp.	temperature
TIF	telephone influence factor
turbo	turbocharger
UNC	Unified coarse thread (was NC)
UNF	Unified fine thread (was NF)
UL	Underwriter's Laboratories, Inc.
US	undersize
V	volt, volts
VAC	Volts alternating current
VDC	volts direct current
W	watt, watts

Section 1. Specifications

Introduction

The craft is equipped with a dependable 110 volt (reconnectable to 110/220 volt), 50 Hz; or 120 volt (reconnectable to 120/240 volt), 60 Hz single-phase alternating current marine generator set. Service requirements are minimal but are very important to the safe and efficient operation of the generator set; therefore, inspect associated parts often. It is recommended that an authorized service

dealer/distributor perform required servicing to assure the unit continues to meet U.S.C.G. requirements.

Please take a few moments to read this manual, then carefully follow all service recommendations to keep the set in top condition. Keep this manual aboard the craft for future reference. See Figure 1-1 for identification and location of components.

Specifications

General Specifications

	3.5CFZ	5CFZ
Dimensions–L x W x H–in. (mm)	27.87 x 17.50 x 16.60 (708 x 445 x 422)	31.07 x 18.10 x 17.50 (789 x 460 x 445)
with Sound Shield	31.07 x 18.10 x 17.50 (789 x 460 x 445)	31.07 x 18.10 x 17.50 (789 x 460 x 445)
Weight–(wet), lbs. (kg)	208 (94)	231 (104)
with Sound Shield	231 (104)	231 (104)
Air Requirements–cfm (L/min.)	18 (510)	18 (510)
Fuel Consumption U.S. gal./hr. (L/hr.)		
Load		
25%	0.42 (1.59)	0.44 (1.67)
50%	0.50 (1.89)	0.54 (2.04)
75%	0.59 (2.23)	0.66 (2.50)
100%	0.68 (2.57)	0.80 (3.03)
	4CZ	6.5CZ
Dimensions–L x W x H –in. (mm)	27.87 x 17.50 x 16.60 (708 x 445 x 422)	31.07 x 18.10 x 17.50 (789 x 460 x 445)
with Sound Shield	31.07 x 18.10 x 17.50 (789 x 460 x 445)	31.07 x 18.10 x 17.50 (789 x 460 x 445)
Weight–(wet), lbs. (kg)	190 (86)	231 (104)
with Sound Shield	213 (96)	231 (104)
Air Requirements–cfm (L/min.)	18 (510)	18 (510)
Fuel Consumption U.S. gal./hr. (L/hr.)		
Load		
25%	0.48 (1.81)	0.53 (2.00)
50%	0.55 (2.08)	0.62 (2.34)
75%	0.62 (2.34)	0.86 (3.25)
100%	0.68 (2.57)	1.02 (3.86)

Generator

	3.5CFZ	5CFZ
Rated kW	3.5	5
Frequency-Hz	50	50
Rated Voltage	110 Volt, 2&3 Wire, Single Phase or 110/220 Volt, 3 Wire, Single Phase	
Rated Amps (110 Volt)	31.8	45.5
Rated Amps (220 Volt)	15.9	22.7
Rotor Resistance (cold) (ohms)	4-5	4-5
Stator Resistance (cold) (ohms)*		
Leads:		
1-2, 3-4	0.8	0.8
55-66	4.2	4.2
B1-B2	0.08	0.08
	4CZ	6.5CZ
Rated kW	4	6.5
Frequency-Hz	60	60
Rated Voltage	120 Volt, 2&3 Wire, Single Phase or 120/240 Volt, 3 Wire, Single Phase	
Rated Amps (120 Volt)	33.3	54.2
Rated Amps (240 Volt)	16.7	27.1
Rotor Resistance (cold) (ohms)	3-4	4-5
Stator Resistance (cold) (ohms)*		
Leads:		
1-2, 3-4	0.06	0.04
55-66	1.9	2.4
B1-B2	0.09	0.06
	3.5CFZ/4CZ	5CFZ/6.5CZ
Generator Type	Two-Pole, Rotating Field	
Voltage Regulation	±5%	
Frequency Regulation	±5%	
Angular Operation (Max.) (in all directions)	20° Continuous	
Excitation Method	Brushless, Exciter Winding/Capacitor	
Coupling Type	Tapered Shaft-Thru-Bolt	
Stator Bolt Torque in. lbs. (Nm)	260 (29)	
Thru-Bolt Torque ft. lbs. (Nm)	37 (50)	
Number of Output Leads	4, Reconnectable	
Insulation (Rotor and Stator)	Class F, Epoxy Varnish, Vacuum Impregnated	
Winding Material	Copper	
Bearing, Number and Type	1, Replaceable Ball	
Circuit Protection:		
Controller	Replaceable 10-Amp Fuse	
Battery Charging	Replaceable 10-Amp Fuse	
AC Circuit Breakers	Optional	
* Most ohmmeters will not give accurate readings when measuring less than 1 ohm. The stator can be considered good if a low resistance reading (continuity) is obtained and there is no evidence of shorted windings (discoloration). Do not confuse a low resistance reading with a reading indicating a shorted winding.		

DERATING: All units are rated 1.0 power factor. Derate approximately 3.5% per 1000 ft. (300 m) above 500 ft. (150 m) above sea level.

3.5CFZ, 50 Hz: 3.5 kW at 77° F (25° C) and 3.5 kW at 122° F (50° C).

4CFZ, 60 Hz: 4 kW at 77° F (25° C) and 3.5 kW at 122° F (50° C).

5CFZ, 50 Hz: 5 kW at 77° F (25° C) and 4.85 kW at 122° F (50° C).

6.5CZ, 60 Hz: 6.5 kW at 77° F (25° C) and 6 kW at 122° F (50° C).

Engine

Some general engine specifications are listed below. Refer to the appropriate service section and the engine service manual for specific service details.

	3.5CFZ/4CZ	5CFZ/6.5CZ
Manufacturer	Honda	
Model	GX360EV	
Cycle	4	
Number Cylinders	2	
Compression Ratio	8:5:1	
Displacement–cu. in. (L)	21.9 (359)	
Rated Horsepower–50 Hz	10.7 (3.5CFZ)	10.7 (5CFZ)
–60 Hz	12.8 (4CZ)	12.8 (6.5CZ)
RPM–50 Hz	3000 (3.5CFZ)	3000 (5CFZ)
–60 Hz	3600 (4CZ)	3600 (6.5CZ)
Bore x Stroke–in. (mm)	2.28 x 2.68 (58 x 68)	
Valve Material	Steel Alloy (JIS SUH3)	
Valve Clearance–in. (mm) (cold)	0.004–0.006 (0.10–0.14)	
Cylinder Block Material	Aluminum	
Cylinder Head Cover Tightening Torque–ft. lbs. (Nm)	7(10)	
Cylinder Head Material	Aluminum	
Connecting Rod Material	Steel	
Piston Rings	2 Compression/1 Oil Control	
Crankshaft Bearings	Replaceable Inserts	
Governor	Gear-Driven Centrifugal	
Lubrication System	Pressure	
Oil Capacity (with filter)–U.S. qts. (L)	1.48 (1.4)	
Oil Type (API)	SF, SF/CC, or SF/CD	
Oil Pressure–psi (kPa)	30–50 (207–345)	
Fuel Type	Gasoline, 86 or Higher, Octane Unleaded	
Fuel System	Single-Barrel, Horizontal Carburetor	
Carburetor Choke	Automatic, Electric	
Fuel Pump	Electric	
Fuel Pump Lift (max.)	3 ft. (0.9 m)	
Battery Voltage	12	
Battery Ground	Negative	
Battery Recommendation	250 Cold Cranking Amps (Min.)	

Engine (Continued)

	3.5CFZ/4CZ	5CFZ/6.5CZ
Spark Plug Type	Resistor, Radio Suppression, 14 mm	
	BPR4HS (NGK)	
	Kohler Part Number L92YC (Champion)	
	R43CFS (AC-Delco)	
Spark Plug Gap-in. (mm)	0.028-0.031 (0.7-0.8)	
Spark Plug Tightening Torque-ft. lbs. (Nm)	15-22 (20-30)	
Ignition System	Transistorized, Breakerless	
Starter Motor	Bendix Automotive Type	
Cooling System	Water-Cooled, Closed/Heat Exchanger	
Cooling System Capacity-U.S. qts. (L)	1.10 (1.00)	
Coolant Recovery Tank-U.S. qts. (L)	0.38 (0.35)	
Thermostat	180 °F (82° C)	
Pressure Cap Rating	15 psi (103 kPa)	
Engine Firing Order	1-2	
Ignition Timing B.T.D.C.	24° ± 2 degrees	
Exhaust Manifold to Cylinder Head Torque	16 ft. lbs. (22 Nm)	
Water Pump Assembly to Cylinder Block Torque	7 ft. lbs. (10 Nm)	
Cooling Fan Torque	16 ft. lbs. (22 Nm)	
Air Cleaner Elbow to Carburetor Stud Torque	6 ft. lbs. (8.5 Nm)	
Timing Belt Cover Torque	6 ft. lbs. (8 Nm)	
Governor Arm Shaft Nut Torque	7 ft. lbs. (10 Nm)	
Governor Case to Cylinder Head Torque	7 ft. lbs. (10 Nm)	
Fuel Pump Pressure Rating	2.0-3.5 psi (13.8-24.1 kPa)	
Battery Charging Winding Resistance-10 Amp	0.16-0.24 Ohms	
Ignition Coil Primary Wire Resistance	0.9-1.1 Ohms	
Ignition Coil Secondary (Spark Plug Wire Side) Resistance	0.9-1.1 Ohms (With Spark Plug Boot/Cap Removed)	
Transistorized Ignition Air Gap	0.016 ±0.008 in. (0.4 ±0.2 mm)	
Timing Belt Deflection	0.16-0.20 in. (4.5 mm) @ 4.4 lbs. (2 kg)	

Accessories

Several accessories are available to finalize the installation or to add convenience to operation and service. All the most current information can be obtained by contacting the local authorized Kohler dealer/distributor. Available accessories at the time of print of this publication are as follows.

Sound Shield (Optional on 3.5CFZ/4CZ; Standard on 5CFZ/6.5CZ)

Provides for highly effective silencing, ease of access for engine/generator servicing, low maintenance, excellent durability, and safety.

Seawater Strainer

The seawater strainer with clear viewing container, allows easy cleaning and maintenance. Threaded for 1/2 NPT fittings.

Ship-to-Shore Transfer Switch

The ship-to-shore transfer switch allows immediate switching to generator set power or shore power protecting the electrical system from the possibility of simultaneous connection of both power sources.

Remote Start Panel

Allows starting/stopping from a location remote of the generator set. Supplied with 15 foot (4.6 m) connection harness. Overall mounting dimensions are 4 1/16 in. (103 mm) by 2 1/8 in. (54 mm) with a minimum mounting depth of 2 1/4 in. (57 mm).

Sender Kit

Provides gauge senders for the remote start and two-meter panel kit and the remote start and four-meter panel kit. The gauge sender kit is required to make the oil pressure and water temperature gauges functional.

Circuit Breakers

See price list or dealer/distributor for proper application of circuit breakers.

Model	Amps	Poles
4CZ/3.5CFZ	18	2
4CZ/3.5CFZ	35	1
4CZ/3.5CFZ	20	1
6CZ/5CFZ	30	2
6CZ/5CFZ	55	1
6CZ/5CFZ	25	2
6CZ/5CFZ	20	1

Remote Start and Four-Meter Panel Kit

Allows starting/stopping from a location remote of the generator set. The illuminated meters/gauges include a DC voltmeter, engine oil pressure gauge, water temperature gauge, and an hourmeter which records total generator set operating hours. Overall dimensions are 9 in. (229 mm) by 6 in. (152 mm) with a minimum mounting depth of 4 in. (102 mm). Requires remote connection/extension harness and sender kit.

Remote Start and Two-Meter Panel Kit

Allows starting/stopping from a location remote of the generator set. The illuminated gauges include engine oil pressure gauge and water temperature gauge. Overall dimensions are 6 in. (152 mm) by 6 in. (152 mm) with a minimum mounting depth of 2 3/4 in. (70 mm). Requires remote connection/extension harness and sender kit.

Remote Connection/ Extension Harness

Provides additional wiring between all remote panels and controller connector. One required for each remote meter panel kit. Available in 15 ft. (46 m) and 25 ft. (76 m) lengths. Extension limited to a total of four kits and 75 ft. (23 m).

12-Inch Remote Wiring Harness

This one foot (0.3 m) wiring harness has a 6-pin connector on one end which is keyed to controller box connector. The other end has pigtails for connection to customer-supplied start switch, generator "on" light, hourmeter, etc.

Siphon Break

Prevents the siphoning of water into the engine on generator sets installed below the waterline.

Service Views

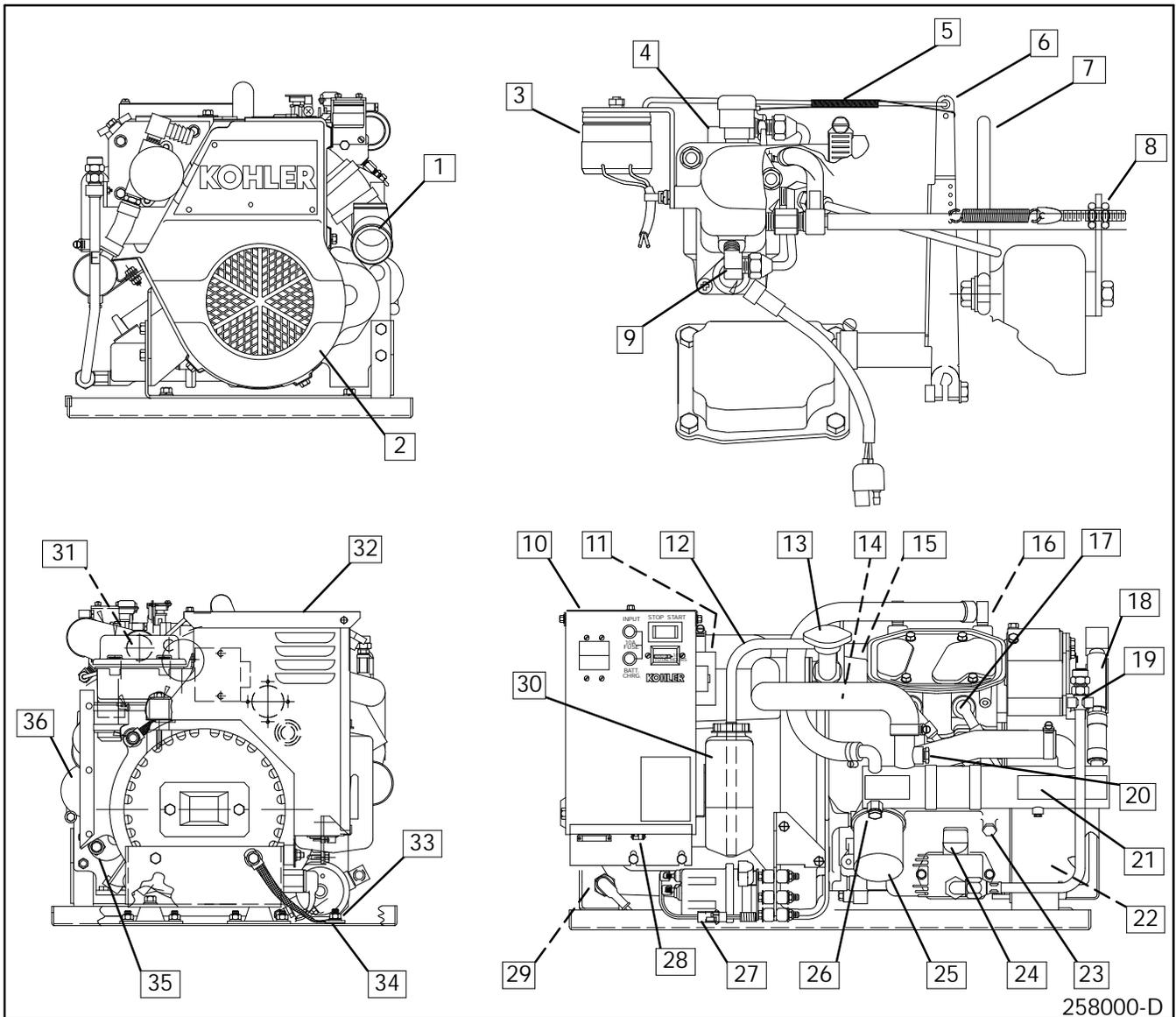


Figure 1-1. Service Views (typical)

- | | |
|--|---|
| 1. Mixer Elbow (Exhaust Water Outlet) | 19. Oil Drain |
| 2. Belt Guard | 20. Water Temperature Sender (Optional) |
| 3. Electric Choke Rotary Solenoid | 21. Heat Exchanger |
| 4. Carburetor | 22. Ignition Coil/Module |
| 5. Governor Linkage | 23. Low Oil Pressure Shutdown Switch/Sender (Sender Optional) |
| 6. Governor Arm | 24. Oil Dipstick (Oil Check/Oil Fill) |
| 7. Lifting Eye | 25. Oil Filter |
| 8. Speed Adjustment (Idle Speed) | 26. Anticorrosion Zinc |
| 9. Antidieseling Solenoid | 27. Electric Fuel Pump |
| 10. Controller | 28. Remote Panel Connector |
| 11. Battery Charger Voltage Regulator | 29. Positive Battery Lead Connection |
| 12. Coolant Overflow Hose | 30. Coolant Recovery Tank |
| 13. Cooling System Pressure Cap | 31. Air Filter |
| 14. High Water Temperature Safety Shutdown Switch | 32. Nameplate |
| 15. Thermostat | 33. Negative Battery Lead Connection |
| 16. High Exhaust Temperature Shutdown Switches (2) | 34. Equipment Ground Lug |
| 17. Spark Plugs | 35. Starter Solenoid |
| 18. Seawater Pump | 36. Starter Motor |

Section 2. Operation

Prestart Checks

To insure continued satisfactory operation, the following items should be checked before each start-up.

BACKFIRE FLAME ARRESTOR: Air cleaner must be clean and properly installed to prevent unfiltered air from entering engine. See Maintenance–Air Cleaner.

BATTERY: Remove caps and check the electrolyte level of each cell (batteries with filler caps only); add distilled water if necessary. Check to make sure it is connected correctly. Battery installation and connections must meet Coast Guard Standards. Battery should be serviced by authorized personnel only. See Maintenance–Battery.

COMPARTMENT: Keep the engine room or compartment clean and dry. Check for fuel or oil leaks. Check the condition of fuel system, exhaust piping, hoses, and muffler; have any faulty components repaired before getting underway. Open hatch to air out compartment and use “ignition-protected” bilge blowers, if required, to clear fumes from area before each start-up. If fuel leaks, fumes, exhaust gases, or electrical sparks are noted, arrange for qualified personnel to make necessary repairs before operating generator set.

FUEL LEVEL: Make sure the fuel tanks are full and the fuel system primed for operation. See Maintenance–Fuel System.

OIL LEVEL: Should be at or near Max. mark. Add oil as needed to bring level up to this range. See Maintenance Lubrication System.

COOLING: The coolant level on closed-type heat exchanger systems can be checked using the coolant recovery tank, if used. The MIN mark indicates full when cold and the MAX mark indicates full when hot. Maintain the coolant level between these marks. It is recommended that coolant level on closed systems be periodically checked by removing pressure cap. Do not solely rely on level in coolant recovery tank.

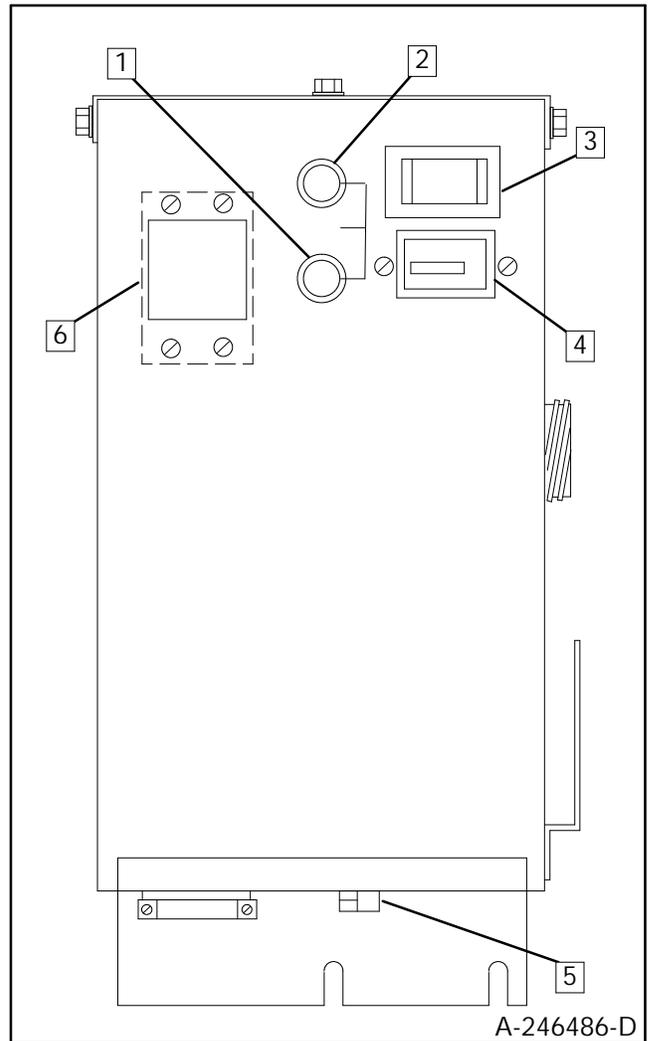
Add fresh coolant until level is just below overflow tube opening. See Maintenance–Cooling Systems.

SEAWATER PUMP PRIMING: The seawater pump must be primed before initial start-up. To prime pump, close seacock and remove the hose from water filter outlet. Fill hose and pump with clean water. Replace hose and open seacock. Check for pump operating on start-up by observing water discharge from exhaust outlet.

Controller

For identification and location of controller operating features, refer to the text below and Figure 2-1.

1. **Battery Charging Fuse** protects battery charging circuitry from short circuits.
2. **Input (Controller) Fuse** protects controller circuitry from short circuits.
3. **Start/Stop Switch** is used to stop and start generator set. Rock to start or stop position and hold to start or stop engine. Switch automatically returns to neutral center position when released.
4. **Hourmeter** records total generator set operating hours. Use as a reference to schedule maintenance.
5. **Remote Start Connector** provides connection point for optional remote start kits.
6. **Optional AC Circuit Breaker(s)** protects generator set from short circuits in load. Also used to disconnect generator set from loads during maintenance. To close circuit breaker, place in ON position.



- | | |
|----------------------------|-----------------------------------|
| 1. Battery Charging Fuse | 4. Hourmeter |
| 2. Input (Controller) Fuse | 5. Remote Start Connector |
| 3. Start/Stop Switch | 6. Optional AC Circuit Breaker(s) |

Figure 2-1. Controller

Starting

WARNING



Explosion.

Gasoline vapors can cause explosion and severe injury or death.

Before starting generator set, operate blower 4 minutes and check engine compartment for gasoline vapors.

NOTE

For reliable starting, allow at least 30 seconds after shutdown before restarting a hot engine.

Ensure that the manual fuel shutoff valve (if equipped) is open. Then rock the master Start/Stop Switch on controller (or use Start/Stop Switch on remote panel) to the Start position for a maximum of 7 seconds or until the engine starts.

NOTE

Do not crank the engine continuously for more than 7 seconds at a time. Allow a 5-second period between starting attempts if the engine does not start. If the engine fails to start after three attempts, contact an authorized Kohler dealer/distributor for repair. Failure to follow these guidelines may result in burn-out of the starter motor from overheating.

If the engine fails to start after the first attempt, close the seacock before a second start-up attempt. This action will help prevent seawater from entering the engine cylinders through the exhaust valve. Once the engine starts, the seacock must be re-opened to allow passage of cooling water.

NOTE

Failure to open the seacock after the generator set is running will result in serious engine damage due to overheating.

NOTE

Ensure that the marine ship-to-shore transfer switch, if used, is in proper position.

Stopping

Disconnect the load from the generator set and allow the generator set to run at no-load for 5 minutes to cool down the engine. Then rock the master Start/Stop switch on the controller (or the Start/Stop Switch on a remote panel) to the Stop position and hold it in the Stop position until the generator set comes to a complete stop.

NOTE

Allow unit to come to a complete stop before attempting to start the generator set again.

Circuit Protection

AC Circuit Breaker (Optional)

The optional AC circuit breaker(s) located on the front panel of the controller protect the generator output windings. If a load circuit loses power, the cause may be a tripped AC circuit breaker. If a tripped circuit breaker is reset and then trips again, find and correct the short in the load circuit that is causing the problem.

Input (Controller) Fuse (10 Amp)

The input fuse protects the controller circuitry. If the generator set engine will not crank and the battery and battery connections appear okay, the input fuse may be blown. If this fuse, located on the front panel of the controller, is replaced and then blows again, find and correct the short that is causing the problem.

Battery-Charging Fuse (10 Amp)

The battery-charging fuse protects the battery-charging circuit. If the battery goes dead and the battery and battery-charging alternator are otherwise normal, the battery-charging fuse may be blown. If this fuse, located on the front panel of the controller, is replaced and blows again, find and correct the short in the charging circuit that is causing the problem.

NOTE

When a fuse replacement is required, be sure fuse has the same ampere rating and is the same type (for example: ABC or 3AB, ceramic). Do not substitute "clear" glass-type fuses for ceramic fuses. If ampere rating is unknown or questionable, see Wiring Diagram.



Accidental starting.

Can cause severe injury or death.

Disconnect battery cables before working on generator set (negative lead first and reconnect it last).

Accidental starting can cause severe injury or death. Disconnect battery cables (remove negative lead first and reconnect it last) to disable generator set

before working on any equipment connected to generator. The generator set can be started by remote start/stop switch unless this precaution is followed.

Engine Safety Shutdown Switches

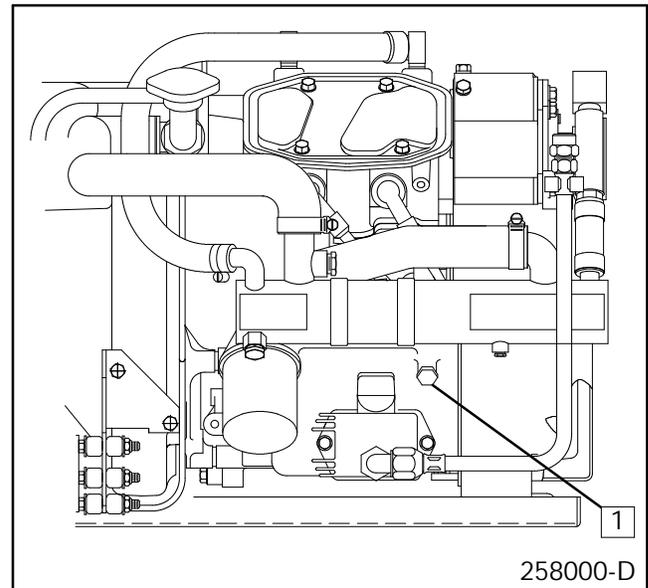
The engine is protected by three engine safety shutdown switches. Activating any of these switches while the generator set is running, results in an immediate, automatic shutdown. During start-up, the engine safety shutdown feature is inhibited until a generator output is sensed in order to allow the oil pump output to reach normal operating pressure.

Low Oil Pressure Shutdown Switch

The low oil pressure shutdown switch protects the engine against internal damage, if the oil pressure drops below 20 psi (138 kPa), due to an engine oil pump failure or other engine malfunction. The location of the low oil pressure shutdown switch is shown in Figure 2-2.

NOTE

The low oil pressure shutdown switch does not act as a low oil level switch. The only way to protect against engine damage due to low oil level is to check the oil level regularly.

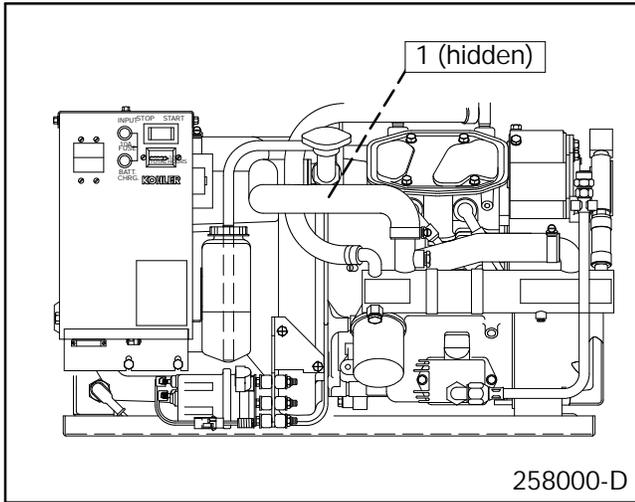


1. Low Oil Pressure Shutdown Switch

Figure 2-2. Low Oil Pressure Shutdown Switch

High Water Temperature Shutdown Switch

The high water temperature shutdown switch protects the engine against internal damage if the cooling water temperature in the engine block is too high due to cooling water or coolant circulation problems. The switch is set to trip at 248–266° F (120–130° C). The location of the high water temperature shutdown switch is shown in Figure 2-3.

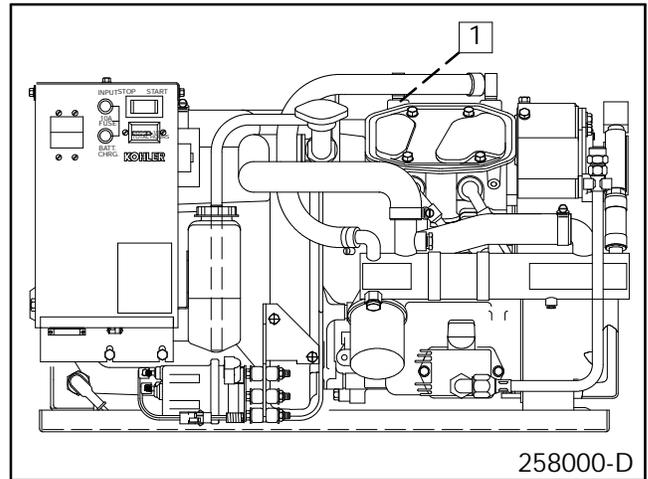


1. High Water Temperature Shutdown Switch

Figure 2-3. High Water Temperature Shutdown Switch

High Exhaust Temperature Shutdown Switches

The two high exhaust temperature shutdown switches protect the engine against internal damage due to excessive exhaust temperatures. The switches are set at 210–220° F (99–105° C). The locations of the high exhaust temperature shutdown switches are shown in Figure 2-4.



1. High Exhaust Temperature Shutdown Switches
(one located on each manifold)

Figure 2-4. High Exhaust Temperature Shutdown Switches

Remote Panels (Optional)

Remote Start Panel

Remote start panel allows starting-stopping from a location remote of the generator set. Generator sets are equipped with a 6-pin connector on controller bottom for connection of the kit. See Figure 2-5.

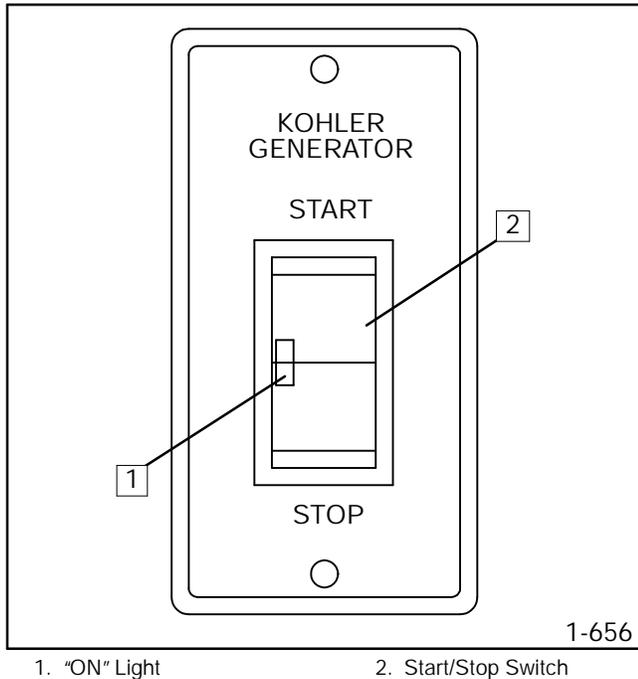
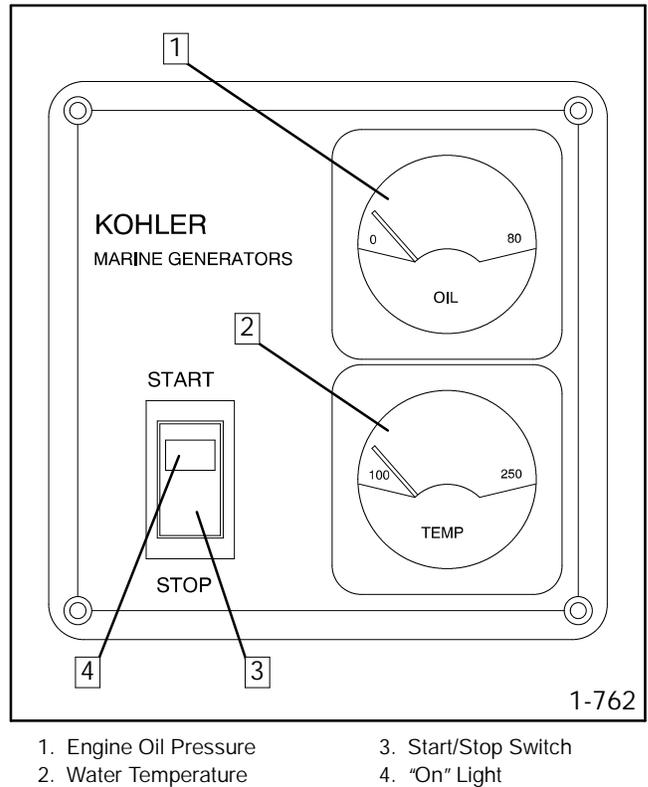


Figure 2-5. Remote Panel Features

Remote Start and Two-Meter Panel Kit

Allows starting-stopping from a location remote of the generator set. The illuminated gauges include an engine oil pressure gauge and a water temperature gauge. Generator sets come equipped with a 6-pin connector on controller bottom for connection of the kit. See Figure 2-6 for remote start and meter panel kit.



- 1. Engine Oil Pressure
- 2. Water Temperature
- 3. Start/Stop Switch
- 4. "On" Light

Figure 2-6. Remote Start and Two-Meter Panel Features

Start/Stop Switch is a rocker-type switch with "ON" light used to start and stop generator set.

Engine Oil Pressure Gauge measures engine oil pressure. Normal engine operating range is 30–50 psi (207–345 kPa).

NOTE

During the engine break-in period, it is normal for the engine to produce higher oil pressure readings.

Water Temperature Gauge measures engine coolant temperature. Normal engine operating range is 170–195°F (77–91°C).

Remote Start and Four-Meter Panel Kit

Allows starting-stopping from a location remote of the generator set. The illuminated gauges include a DC voltmeter, engine oil pressure gauge, water temperature gauge, and generator running time hourmeter. Generator sets come equipped with a 6-pin connector on controller bottom for connection of the kit. See Figure 2-7 for remote start and four-meter panel features.

Start/Stop Switch is a rocker-type switch with “ON” light used to start and stop the generator set.

DC Voltmeter measures voltage of starting battery(ies). Normal battery operating range is 12–14 volts.

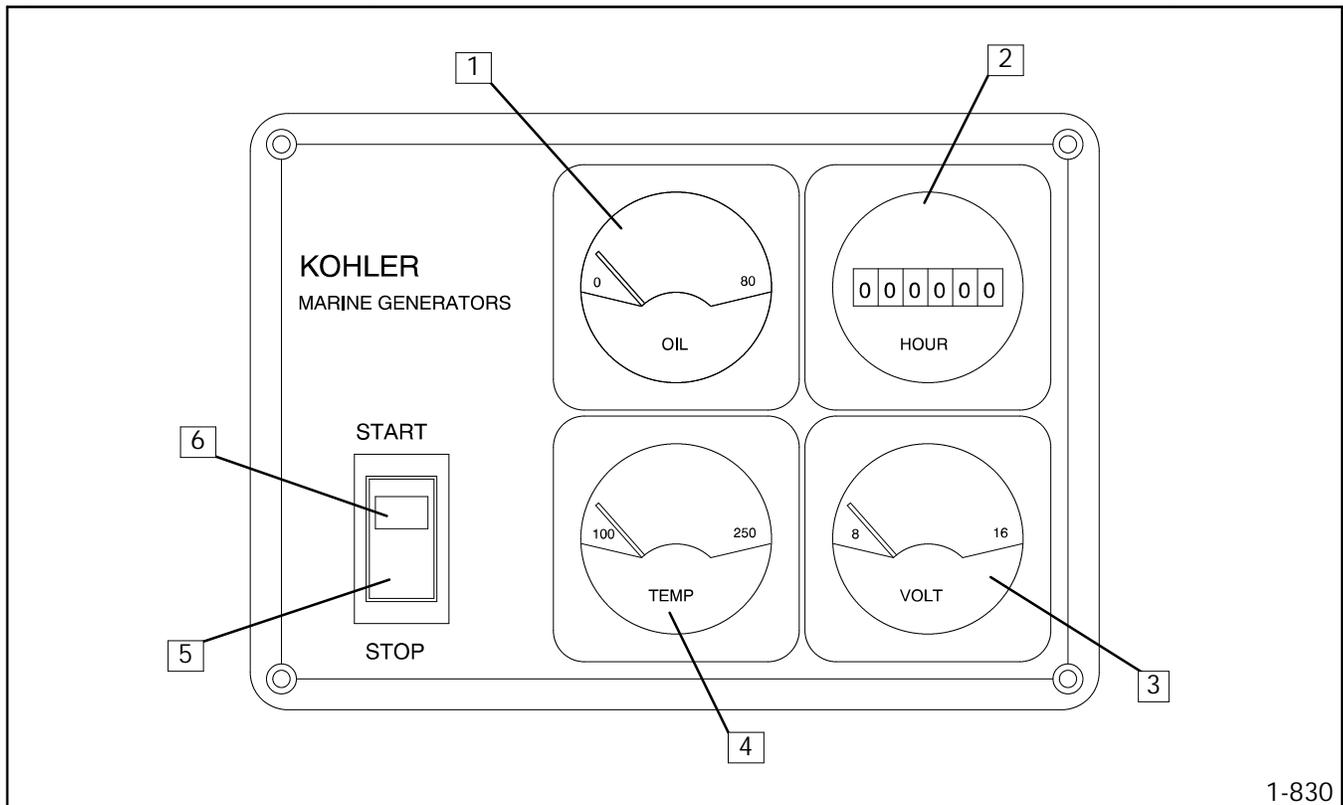
Engine Oil Pressure Gauge measures engine oil pressure. Normal engine operating range is 30–50 psi (207–345 kPa).

NOTE

During the engine break-in period, it is normal for the engine to produce higher oil pressure readings.

Water Temperature Gauge measures engine coolant temperature. Normal engine operating range is 170–195°F (77–91°C).

Hourmeter records total generator set operating hours for reference in maintenance scheduling.



1-830

1. Engine Oil Pressure
2. Hourmeter
3. Voltmeter

4. Water Temperature
5. Start/Stop Switch
6. “ON” Light

Figure 2-7. Remote Start and Four-Meter Features

Section 3. Scheduled Maintenance

Use the following service schedule and the hourmeter on the controller to schedule routine maintenance. In addition to the routine services listed in this manual, there are other important steps that should be taken to keep a generator set in top condition. Usually tools and instruments required for these additional steps are not available to the generator set owner. For this reason, the set should be returned periodically to an authorized service dealer/distributor for complete servicing and tune-up. The benefits of such service will be improved performance and continuous satisfactory operation during a long trouble-free service life. Use the Operating Hour Service Log in the back of this manual to document services performed.

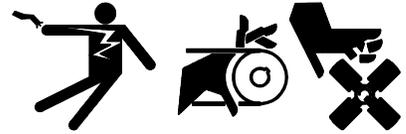
Service intervals are located on the top rows of the Service Schedule chart. It indicates how often maintenance tasks need to be done. Each service item is to be repeated at the specified interval. For example, an item required at 50 hours will again need to be performed at 100 hours, 150 hours, etc.

For continued satisfactory operation and longevity of the engine and generator set, proper maintenance and eventual overhaul by a competent mechanic/technician are essential. While it is not possible to anticipate component failure, rough operation, metallic noises, and excessive oil loss are among the indicators of potential problems. Do not ignore these conditions!

NOTE

Operate the generator set with load applied at least once a month. Allow generator set to run about one hour to reach operating temperature. This prevents the formation of corrosion on internal engine components when exposed to the breakdown of exhaust gases and seawater for long periods of generator inactivity. If unit is to be out of service for several months, see Storage Procedure.

 **WARNING**



Accidental starting.

Can cause severe injury or death.

Disconnect battery cables before working on generator set (negative lead first and reconnect it last).

Accidental starting can cause severe injury or death.

Disconnect battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator. The generator set can be started by remote start/stop switch unless this precaution is followed.

NOTE

HARDWARE DAMAGE! Engine and generator make use of both American Standard and metric hardware. Be sure to use the correct size tools to prevent rounding of bolt heads and nuts.

NOTE

High-mineral content seawater (salt water) can cause rapid destruction of metals. Wipe up all salt water spillage on and around generator set and keep metal surfaces free from accumulated salt deposits.

Service Schedule

	Before Starting	After 20 Hrs. or One Month	Every 50 Hrs. or 3 Months	Every 100 Hrs. or 6 Months	Every 200 Hrs. or Yearly	Every 300 Hrs. or 2 Years
LUBRICATION SYSTEM						
Check oil level	X					
Change oil		X (Break-in Period)			X	
Change oil filter					X	
FUEL SYSTEM						
Check the fuel level	X					
Fill fuel tank	X					
Lubricate carburetor and choke linkage		X (Break-in Period)			X	
Clean fuel screen						X
Service fuel lines						X
IGNITION SYSTEM						
Replace spark plugs					X	
COOLING SYSTEM						
Check coolant level	X					
Check seawater outlet	X (During Operation)					
Inspect exhaust system components for cracks and corrosion (exhaust manifold, mixing elbow, exhaust line, hose clamps, silencer, and outlet flapper)	X			X		
Check function of siphon break (if equipped)			X			
Check condition of heat exchanger anticorrosion zinc				X (100 Hrs. or 3 Months)		
Replace heat exchanger anticorrosion zinc					X	
Replace the impeller of seawater pump						X
Check thermostat function						X
INTAKE/EXHAUST SYSTEM						
Check exhaust gas condition	X (During Operation)					
Clean the exhaust/water mixing elbow				X		
Clean air filter element			X			

Service Schedule (Continued)

	Before Starting	After 20 Hrs. or One Month	Every 50 Hrs. or 3 Months	Every 100 Hrs. or 6 Months	Every 200 Hrs. or Yearly	Every 300 Hrs. or 2 Years
ELECTRICAL SYSTEM						
Check electrolyte level (Batteries with filler caps only)	X		X			
Check and tighten electrical connections				X		
Check specific gravity (Batteries with filler caps only)				X		
Clean battery cables					X	
ENGINE AND MOUNTING						
Check for leakage of water, fuel, or oil	X		X			
Lubricate governor linkage		X (Break-in Period)			X	
Retighten all major nuts and bolts		X (Break-in Period)			X	
Check and tighten mounting bolts and vibromounts					X	
Check intake/exhaust valve clearance						X
REMOTE CONTROL SYSTEM, ETC.						
Check compartment condition (fuel, oil, or water leaks)	X					
Check the remote control operation		X (Break-in Period)				
Test run generator set		X (Monthly)				
GENERATOR						
Blow dust out of generator						X

Lubrication System

Specifications

Use high quality detergent oil of API (American Petroleum Institute) service class SF, SF/CC, or SF/CD. This information can be found on most oil containers, see Figure 3-1. The symbol illustrated identifies the API service class in the upper portion. The center indicates the SAE (Society of Automotive Engineers) viscosity grade. The bottom portion (when used) signifies the oil is intended to improve fuel economy and displays the phrase "Energy Conserving." Select viscosity based on the air temperature at the time of operation. (See Figure 3-2.)

SAE 10W40 is the preferred oil for general use where temperatures permit.

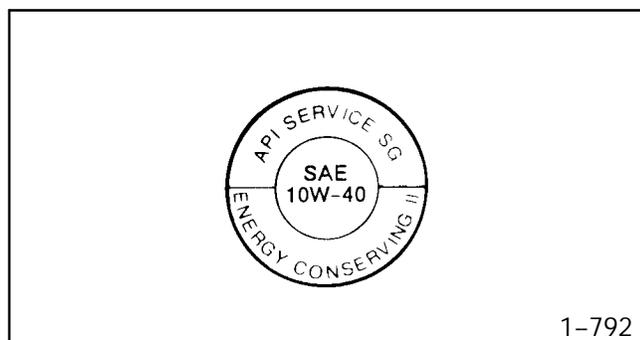


Figure 3-1. Oil Service Class and SAE Viscosity Grade Symbol

When Outside Temperature is Consistently:	Use SAE Viscosity Grade:
Below 5°F (-15°C)	5W30
-5°F (-21°C) to 90°F (32°C)	10W30
Above 15°F (-10°C)	20W40 or 20W50
Above -5°F (-21°C)	10W40 (Preferred)

Figure 3-2. Recommended SAE Viscosity Grades

Using other than the appropriate service class oil or extended oil change intervals could cause engine damage which is not covered by the engine warranty.

Do not mix oils of different viscosities. It is also best not to mix different brands of oils. Possible incompatibility could cause a breakdown of lubricating ingredients and reduce engine protection.

Oil Check

Check oil level in crankcase daily or before each startup to insure that the level is in the safe range.

NOTE

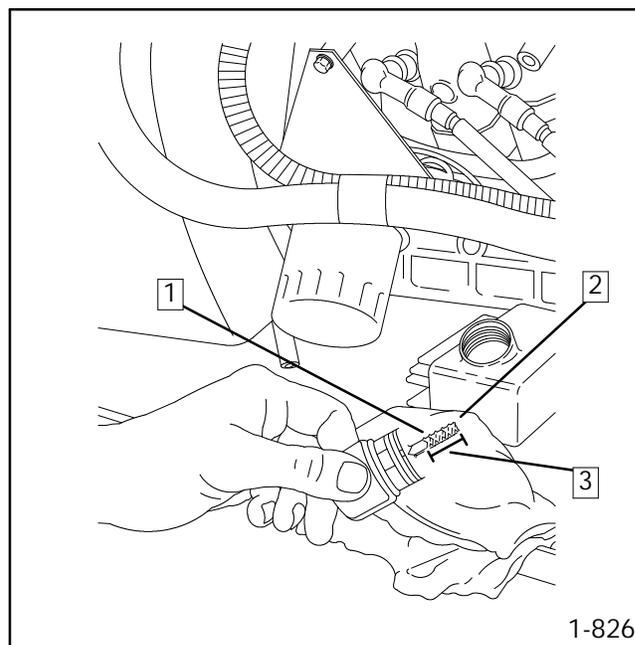
Do not check oil level when unit is running. Generator set must be stopped and level to get an accurate reading.

If generator set has just been run, allow a few minutes for the oil to return to the oil pan before checking level.

To check oil level, remove dipstick and wipe the end clean, place bottom thread of dipstick against oil fill hole and remove. Do not screw in dipstick when checking oil level. Level should be between MIN and MAX marks on dipstick. See Figure 3-3.

NOTE

Do not operate the set if the level is below the MIN mark or above the MAX mark. Oil above the MAX mark is wasted due to increased oil consumption.



- 1. MAX Limit
- 2. MIN Limit
- 3. Safe Range

Figure 3-3. Checking Oil Level

Adding Oil

It is normal to add some oil between oil changes. The amount will vary with the usage. Open fill cap and pour a small amount of oil using a funnel or other suitable pouring device. See Figure 3-4. Wait a few minutes and check level. If necessary, add more oil and then check again. Each time be sure to add small quantities and check to prevent overfilling.

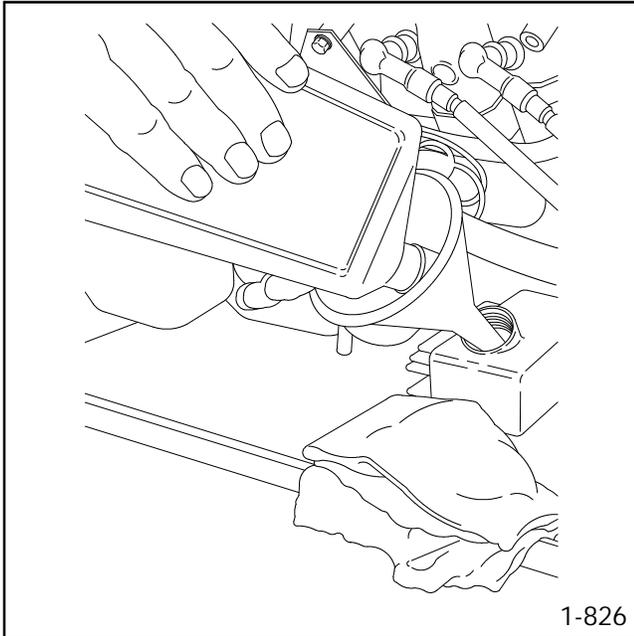
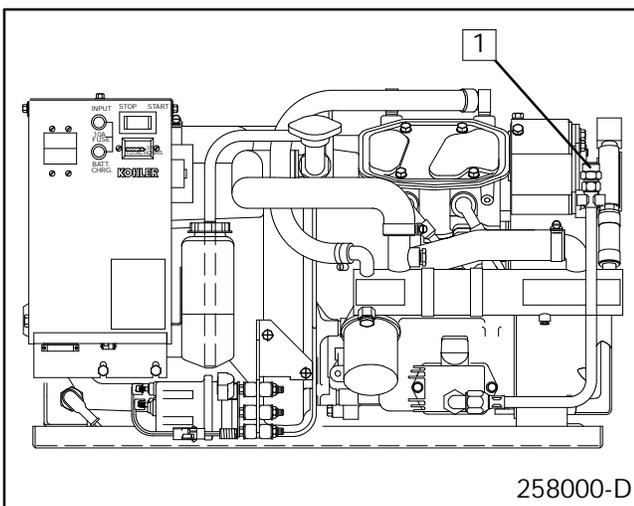


Figure 3-4. Adding Oil

Oil Change/Oil Filter Change

Change oil and oil filter every 200 hours or yearly. Change oil more frequently under dirty, dusty conditions. Change oil while the engine is still warm. See Figure 3-5 and use the following procedure.



1. Oil Drain Cap

Figure 3-5. Oil Drain Cap

1. Place oil drain hose in a proper container. Remove oil drain cap. If a drain pump is used, remove oil drain cap and connect oil drain hose to drain pump.
2. Allow ample time for all oil to drain into container. If drain pump is used, activate pump until oil is removed.
3. Loosen oil filter by turning in a counterclockwise direction. Oil filter is 2 1/2 in. (64 mm) dia. with 14 flutes. Use oil filter wrench, if necessary. See Figure 3-6. Use rags to handle hot oil filter and clean up spilled oil. Remove filter from oil filter adapter on engine and discard oil filter in a proper container.
4. Clean contact surface of oil filter adapter.
5. Lightly lubricate the gasket surface of new oil filter with fresh engine oil. Thread oil filter onto oil filter adapter until gasket makes contact; then hand-tighten oil filter an additional 3/4 turn.

NOTE

If an automatic oil drain/oil fill pump is used, omit Step 6. Fill with proper amount and type of oil, see Step 6. When complete, replace cap and disconnect pump.

6. Replace oil drain cap. Remove oil fill cap. Add oil using a funnel or other suitable pouring device. See Specifications— Engine for oil capacity and Lubrication System— Specifications for proper service class and SAE viscosity of oil. Replace oil fill cap.
7. Start generator set and check for leaks at oil drain cap and oil filter.
8. Stop generator set. Wait a few minutes for oil to return to oil pan. Remove dipstick and wipe clean, reinsert as far as possible and remove to check oil level. Add oil, as necessary, to bring level up to MAX mark.

Fuel System

Specifications

For best results, use only clean fresh, regular grade unleaded gasoline. Use fuel with a minimum octane rating as designated by the following:

Antiknock Index (Average of Research Octane Number and Motor Octane Number)	86
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Unleaded fuel is recommended since it leaves less combustion chamber deposits. Oil must not be mixed with fuel.

If using a gasoline containing alcohol (gasohol), be sure the octane rating is at least 86 (Antiknock Index). There are two types of gasohol: one containing ethanol, and another containing methanol.

Do not use gasohol that contains more than 10% ethanol. Do not use gasohol containing methanol (methyl or wood alcohol) that does not also contain cosolvents and corrosion inhibitors for methanol. Never use gasoline containing more than 5% methanol, even if it has cosolvents and corrosion inhibitors.

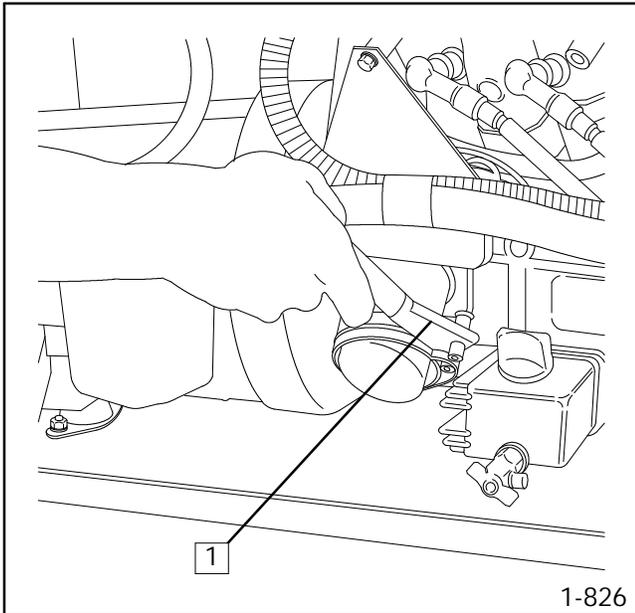
NOTE

Fuel system damage and engine performance problems resulting from the use of such fuels are not covered under Warranty. Honda cannot endorse the use of fuels containing methanol since evidence of suitability is as yet incomplete. Before purchasing fuel from an unfamiliar station, try to confirm whether the fuel contains alcohol, and to what percentage. If any undesirable operating symptoms are noticed after using a gasoline that contains alcohol, or one that contains alcohol, switch to a gasoline that does not contain alcohol.

NOTE

Discontinue use of any gasohol or alcohol/gasoline blend if engine performance or fuel system problems occur. Do not use such fuel unless it is UNLEADED.

Use fresh gasoline to ensure it is blended for the season and to prevent the formation of gum deposits which could clog the fuel system. Do not use gasoline left over from the previous season.



1. Oil Filter Wrench 2 1/2 in. (64 mm) Dia.

Figure 3-6. Removing Oil Filter

Fuel Pump Screen



WARNING



**Explosive fuel vapors.
Can cause severe injury or death.**

Use extreme care when handling, storing,
and using fuels.

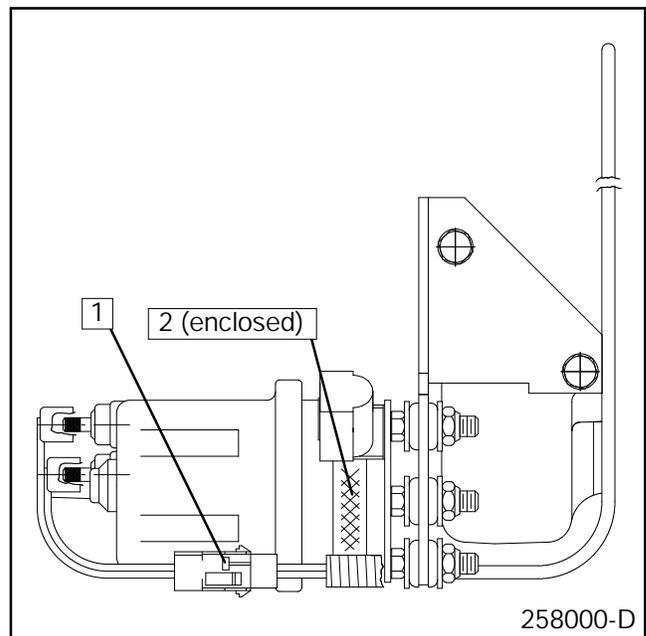
Explosive fuel vapors can cause severe injury or death. All fuels are highly explosive in a vapor state. Use extreme care when handling, storing, and using fuels. Store fuel in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running since spilled fuel may ignite on contact with hot parts or from ignition spark. Do not smoke or permit flame or spark to occur near potential sources of spilled fuel or fuel vapors. Keep fuel lines and connections tight and in good condition— don't replace flexible fuel lines with rigid lines. Flexible sections are used to avoid breakage due to vibration. Should any fuel leakage, fuel accumulation, or electrical sparks be noted, **DO NOT OPERATE GENERATOR SET.** Have systems repaired before resuming generator operation.

Gasoline— Store gasoline only in approved red containers clearly marked **GASOLINE**. Do not store gasoline in any occupied building.

The electric fuel pump includes a screen. (See Figure 3-7.) At the recommended interval or when clogging is suspected, inspect and clean the screen as follows:

1. Shut off fuel flow to electric fuel pump at tank or at in-line shutoff valve. Disconnect harness plug (see Figure 3-7 for location).
2. Disconnect fuel lines from electric fuel pump, draining fuel from the lines and pump into a suitable container to prevent spillage into the bilge.

3. Remove the three nuts that secure the electric fuel pump to the mounting bracket.
4. Remove the three mounting studs from the electric fuel pump.
5. Remove the cover plate and inspect the screen. Remove any debris or residue. Be sure the screen is intact. If the screen is damaged, replace the fuel pump.
6. Check the O-ring seal. Replace the O-ring if it is nicked or eroded.
7. Reinstall the cover plate and secure it to the fuel pump by reinstalling the three mounting studs.
8. Insert the three mounting studs on the fuel pump through the mating holes in the mounting bracket. Reinstall the three nuts to secure the fuel pump in place.
9. Reconnect the fuel lines to the fuel pump.
10. Open fuel line at tank or in-line shutoff valve and check for leaks from the fuel pump at fuel line connections and cover plate.



1. Harness Plug

2. Fuel Pump Screen

Figure 3-7. Fuel Pump Screen

Carburetor/Choke Lubrication

The only maintenance required is to lubricate carburetor and choke linkage at the specified interval using white lithium grease or lubriplate.

Carburetor Adjustments

The carburetor is a single-barrel, horizontal design and uses an electric choke.

Lack of power usually indicates that the fuel mixture is too rich. An overrich mixture may also be caused by a clogged air intake (backfire flame arrestor)— check this before readjusting carburetor. Fuel mixture may be too lean if engine skips or backfires. Minor carburetor adjustment may be necessary to compensate for differences in altitude, fuel, and temperature.

1. With **ENGINE STOPPED**, turn fuel mixture screw in (clockwise) until it seats lightly. **DO NOT FORCE!** Turn fuel mixture screw out 2 to 2 1/2 turns. See Figure 3-8.
2. Start engine and let it run at no load for about 5 minutes. Before making adjustments engine should be thoroughly warmed up running at governed speed, and connected to full load.
3. Turn low speed mixture screw in until engine instability (hunting) develops and then screw out until engine instability is again apparent. Turn screw back in until it is positioned halfway between the points of increasing stability. When properly adjusted, engine will operate with steady governor action.
4. To adjust the idle speed, run the generator set at no load. Push the throttle lever counterclockwise until it hits the idle speed screw. Holding the throttle lever against the screw, adjust the idle speed screw until unit runs at 55 Hz (3300 rpm) for 60 Hz models or 45 Hz (2700 rpm) for 50 Hz models.

NOTE

If engine runs poorly after adjusting carburetor and doing scheduled maintenance, return generator set to an authorized service dealer/distributor to have problem corrected.

WARNING

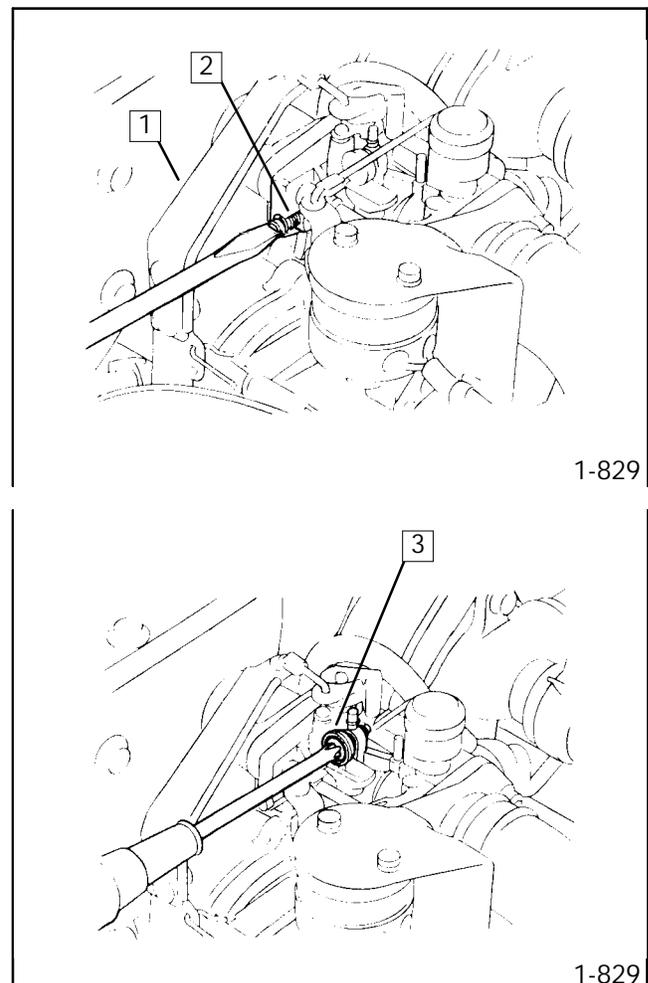


Fire.
Can cause severe injury or death.

Do not smoke or permit flame or spark to occur near fuel or fuel system.

A sudden flash fire can cause severe injury or death.

Do not smoke or permit flame or spark to occur near fuel system. Keep the compartment and generator set clean and free of debris to minimize chances of fire. Wipe up all spilled fuel and engine oil.



1. Governor Arm
2. Low Speed Mixture Screw
3. Idle Speed Screw

Figure 3-8. Fuel Mixture Adjustment

Ignition System

Ignition System Service

The ignition system is transistorized and breakerless. Under normal conditions, only the spark plugs need service on a regular basis. The electronic ignition module requires no maintenance and should give years of trouble-free service. If a module problem is suspected, have service performed by an authorized service dealer/distributor.

Spark Plugs

At the recommended interval (shown in the service schedule) service spark plugs.

1. Remove spark plug wires by grasping boot and turning slightly while pulling. Do not pull wire. See Figure 3-9.

NOTE

Pulling wire rather than boot may cause damage to wire or terminal.

2. Where possible, use compressed air to remove dirt from around each spark plug before removal. This procedure will prevent dirt particles from falling into combustion chamber. Loosen spark plug with a ratchet and spark plug socket with a rubber insert to prevent damage to spark plug. See Figure 3-10. Remove spark plugs one at a time and examine. See Figure 3-11 to evaluate engine conditions by color/condition of spark plugs.
3. Clean spark plugs by wiping with a rag and then file the center electrode so that it is parallel to the side electrode. Should replacement be necessary, see "Specifications" for spark plug type.

NOTE

Do not sandblast, wire brush, scrape, or otherwise service spark plug in poor condition. Best results are obtained with a new plug.

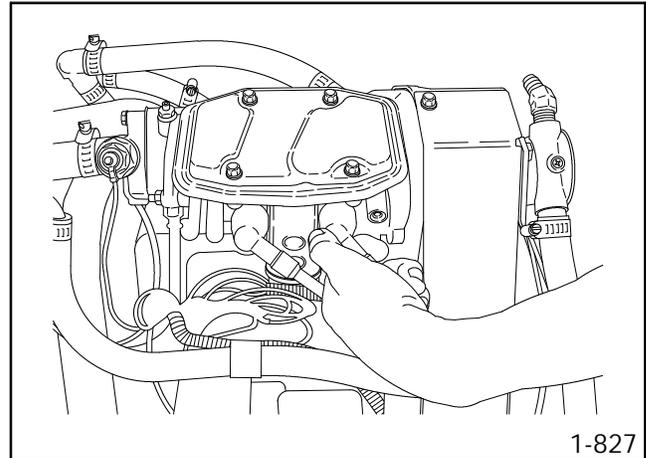
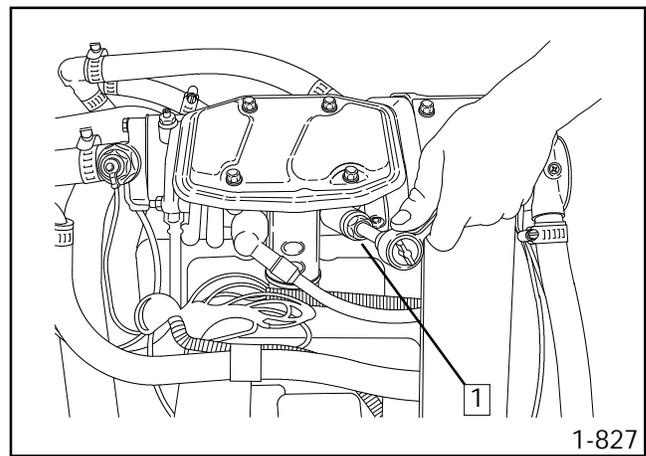


Figure 3-9. Removing Spark Plug Wires



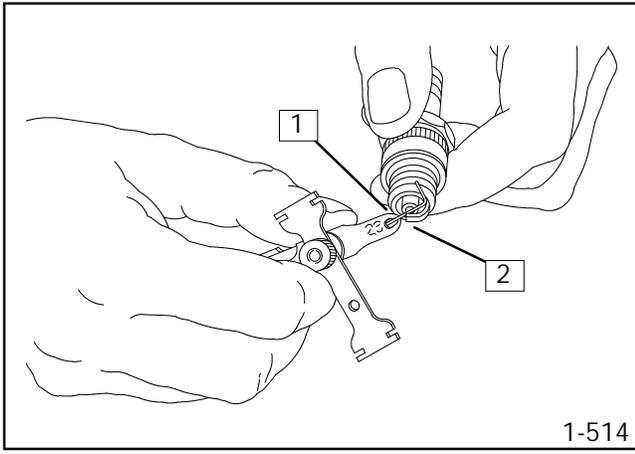
1. 13/16 in. Spark Plug Socket

Figure 3-10. Removing Spark Plug

Problem	Means of Identification	Possible Cause
Normal	Light tan or gray deposit on the firing tip.	Good operating conditions and maintenance.
Gap bridged	Deposits built-up and closing gap between electrodes.	Oil or carbon fouling. Clean and regap.
Oil fouled	Wet black deposits on the insulator shell bore electrode.	Excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings. Replace plug.
Carbon fouled	Black, dry fluffy carbon deposits on insulator tips, exposed shell surfaces, and electrodes.	Using too cold range plug, weak ignition, clogged air intake or improper carburetor adjustments, defective fuel pump, overrich fuel mixture, or excessive no load operation. Clean and regap.
Lead fouled	Dark gray, black, yellow, or tan deposits; or a glazed coating on the insulator tip.	Caused by highly leaded fuel. Replace plug.
Pre-ignition	Melted electrodes and possibly blistered insulator. Metallic deposits on insulator suggests internal engine damage.	Wrong type of fuel, incorrect timing or advance, too hot of a plug, burnt valves, or engine overheating. Replace and plug.
Overheating	White or light gray insulator with small black or gray/brown spots with bluish (burnt) appearance on electrodes.	Engine overheating, wrong type of fuel, loose spark plugs, too hot a plug, low fuel pump pressure or incorrect ignition timing. Replace plug.
Worn	Severely eroded or worn electrodes.	Caused by normal wear and failure to replace at proper interval. Replace plug.

Figure 3-11. Spark Plug Condition

4. Before installing any spark plug, check the gap. See Figure 3-12. The proper gap is attained when the feeler (or wire) gauge just passes between the spark plug electrodes. It should pass easily, but with some resistance or drag. The correct gap is 0.028–0.031 in. (0.7–0.8 mm).
5. To readjust the spark plug gap, use gapping tool to gently bend the side electrode closer to or further from the center electrode. See Figure 3-13. The side electrode must be centered over the center electrode.
6. Being careful not to bump the electrode, hand thread spark plug clockwise into cylinder head until resistance is felt.
7. Using a torque wrench, tighten each spark plug to a torque of 18–22 ft. lbs. (20–30 Nm). If a torque wrench is not available, hand-tighten spark plug until resistance is felt and then use a ratchet wrench to tighten the plug an additional 1/2 turn (if installing a new plug) or 1/8–1/4 turn (if reinstalling a used plug). Do NOT overtighten as this may strip threads or alter electrode gap setting.
8. Check spark plug wire connector in boot for accumulated dirt, grease, etc., and clean as necessary. Firmly push spark plug connector and boot onto spark plug.



1. 0.028–0.031 in.
(0.7–0.8 mm) Gap
2. Spark Plug Electrodes

Figure 3-12. Checking Spark Plug Gap

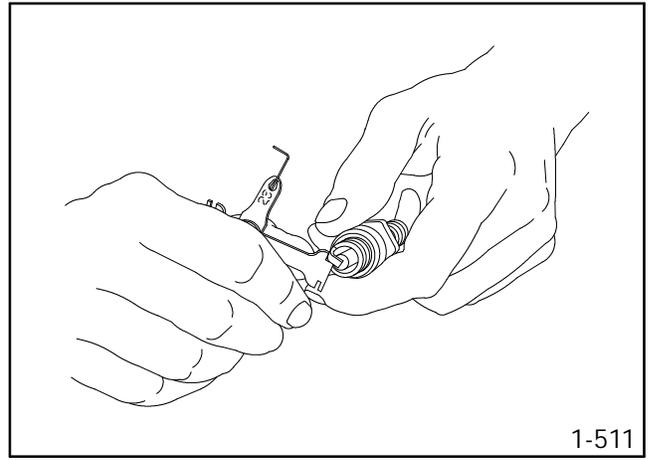


Figure 3-13. Adjusting Spark Plug Gap

Cooling Systems– Closed/Heat Exchanger

In a closed cooling system, the seawater does not circulate through the engine but circulates through separate chambers within the heat exchanger to cool the engine coolant. The seawater is then mixed with engine exhaust and ejected out the exhaust outlet. The coolant is circulated through cooling passages to cool the engine. All models make use of a coolant thermostat and a coolant recovery tank. The coolant capacity of the engine with heat exchanger is 0.72 U.S. qts. (0.68 L) for all models. A solution of 50% ethylene glycol and 50% clean, softened water is recommended to inhibit rust/corrosion. A coolant solution of 50% ethylene glycol will provide freezing protection to -34°F (-37°C) and overheating protection to 265°F (129°C). A coolant solution with less than 50% ethylene glycol may not provide adequate freezing and overheating protection. A coolant solution with more than 50% ethylene glycol can cause damage to engine and components. Do not use alcohol or methanol antifreeze or mix them with the coolant.

Filling and Checking

 WARNING

<p>Hot coolant and steam. Can cause severe injury or death.</p> <p>Before removing pressure cap stop generator, allow to cool and loosen pressure cap to relieve pressure.</p>

Hot coolant can cause severe injury or death. Allow engine to cool and release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth then turn it slowly counterclockwise to the first stop. After pressure has been completely released and the engine has cooled, remove cap. If generator set is equipped with a coolant recovery tank, check coolant level at tank.

NOTE

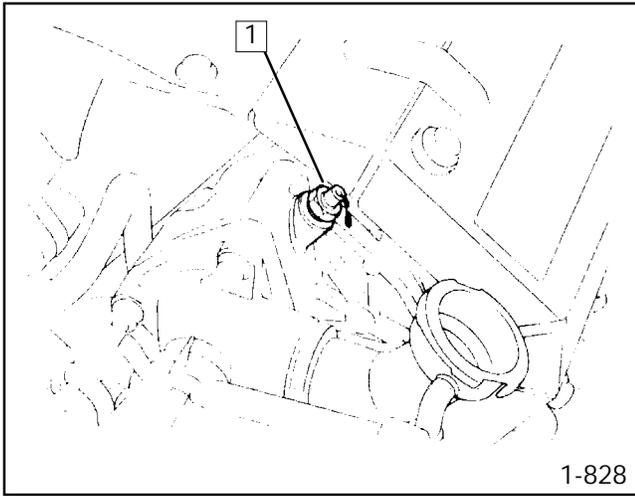
ENGINE DAMAGE! Failure to bleed air from cooling system may cause overheating and subsequent damage to engine.

NOTE

Special attention should be given when checking for proper coolant level. After the coolant has been drained, it normally requires some time before complete refill of the engine water jacket takes place.

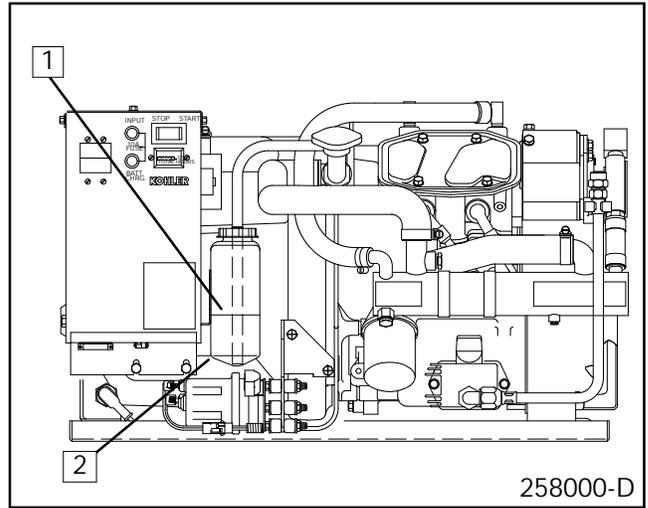
Before filling the cooling system, verify that all hose clamps are tight. Loosen air-bleed screw located on top of the engine to allow trapped air to escape. See Figure 3-14. Place a rag around the screw to prevent coolant spillage onto the block. Remove pressure cap located on the top of the engine (see Figure 3-15) and fill with the recommended coolant until level is just below overflow tube opening. Tighten air-bleed screw when coolant, free of air bubbles, starts to flow. Replace pressure cap. Start generator set and allow to run for about 20–30 seconds. STOP generator set and recheck coolant level by removing pressure cap. Repeat procedure, as necessary, until coolant can no longer be added.

A coolant overflow bottle is provided. Fill bottle to just below the MAX mark. See Figure 3-16. Maintain proper coolant level in coolant overflow bottle. The MIN mark indicates full when cold and the MAX mark indicates full when hot. Coolant level should always be between these marks. The coolant level can be checked using the overflow bottle markings, but it is recommended to periodically remove the coolant pressure cap and check coolant level.



1. Air-Bleed Screw; Use 12 mm Wrench

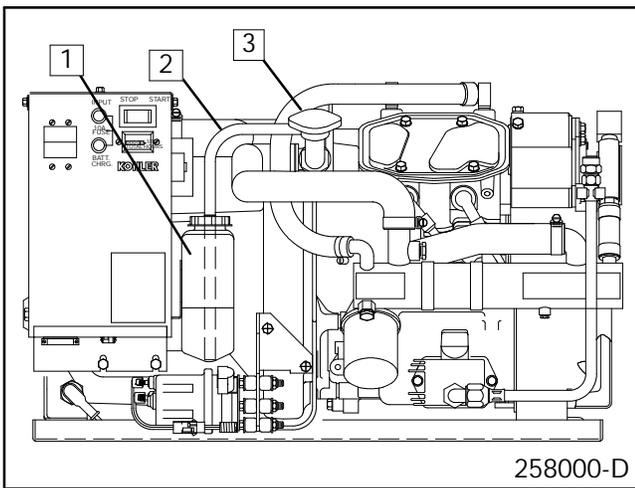
Figure 3-14. Air-Bleed Screw



1. MAX. Mark

2. MIN. Mark

Figure 3-16. Checking Coolant Level



1. Coolant Recovery Tank
2. Overflow Hose

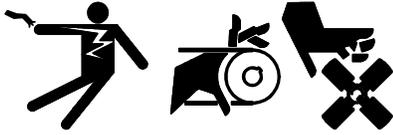
3. Coolant Pressure Cap

Figure 3-15. Coolant Pressure Cap

Flushing and Cleaning

If required, flush coolant from generator set. To properly flush coolant, obtain Kit #267999 and use the following procedure:

WARNING



Accidental starting.

Can cause severe injury or death.

Disconnect battery cables before working on generator set (negative lead first and reconnect it last).

Accidental starting can cause severe injury or death. Disconnect battery cables (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator. The generator set can be started by remote start/stop switch unless this precaution is followed.

WARNING



Hot coolant and steam.

Can cause severe injury or death.

Before removing pressure cap stop generator, allow to cool and loosen pressure cap to relieve pressure.

Hot coolant can cause severe injury or death. Allow engine to cool and release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth then turn it slowly counterclockwise to the first stop. After pressure has been completely released and the engine has cooled, remove cap. If generator set is equipped with a coolant recovery tank, check coolant level at tank.

1. Disconnect the battery, negative lead first.
2. With engine cooled, remove the air-bleed screw and the high water temperature safety shutdown switch from the thermostat housing.
3. Connect kit hose fittings to the engine. Install kit hoses to fittings (if not already done).

4. Connect a garden hose to the female connector of large kit hose. Place the free end of the small kit hose in a 1–2 gal. (min.) bucket.

NOTE

Heat exchanger pressure cap **MUST** be installed.

5. Turn on water supply to flush coolant from engine block. Turn off water supply when clean water is observed coming from hose in bucket.
6. Disconnect garden hose. Place free end of large kit hose into bucket and connect an air hose to the free end of the smaller kit hose. Apply air pressure (40 psi [276 kPa] min.) until water stops flowing from kit hose in bucket. This will remove about 16 fl. oz. (0.47 L) of water from engine block.

NOTE

Engine coolant capacity is 23 fl. oz. (0.68 L).

NOTE

Some small air compressors may not maintain pressure under the required flow conditions. In these cases, it is recommended that the end of the kit hose in the bucket be closed off momentarily until pressure is allowed to build up. After pressure has accumulated, open end to allow water to flow into bucket. Repeat closing and opening end of kit hose, as required.

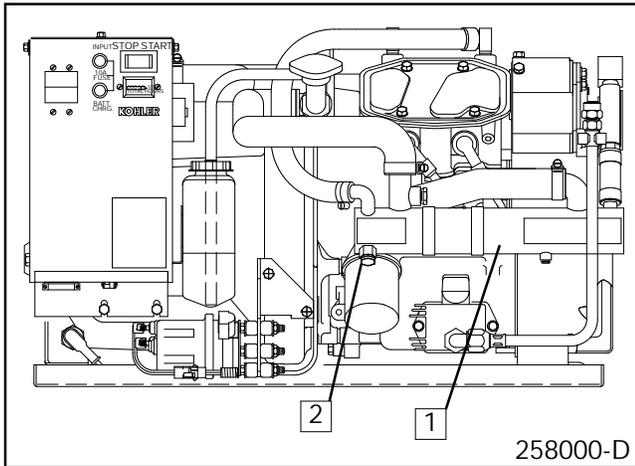
7. Remove kit hoses with hose fittings from engine.
8. Apply pipe sealant to threads of high water temperature safety shutdown switch and install switch in thermostat housing. Reconnect wiring harness lead to switch.
9. Apply pipe sealant to the air-bleed screw and install screw into engine. Do not final tighten!
10. Remove cap of coolant overflow bottle and pour contents into a suitable container. Reinstall bottle on unit.
11. Add fresh coolant to coolant overflow bottle. A solution of 50% ethylene glycol and 50% clean, softened water is recommended to inhibit rust/corrosion and provide freezing protection. Fill to MIN mark. Install coolant overflow bottle cap.
12. Remove heat exchanger pressure cap and add about 5 fl. oz. (0.15 L) of clean, softened water. Then fill remainder of engine with straight coolant (100%) until level is just below the overflow tube opening. Final tighten the air-bleed screw when coolant, free of air bubbles, starts to flow. Install the heat exchanger pressure cap.

13. Reconnect battery, negative lead last.
14. Start generator set and allow the set to run for about 20–30 seconds. Stop generator set and recheck coolant level by removing heat exchanger pressure cap. Add straight coolant, if necessary, until level is just below the overflow tube opening, then reinstall pressure cap. Repeat this step until coolant can no longer be added. This procedure should give an approximate mixture of 50% ethylene glycol and 50% water.
15. Wipe up spilled coolant and water with rags. Dispose of rags in a proper container.
16. Test run generator set for about five minutes and check for coolant leaks. This will allow the coolant mixture to mix completely. Stop generator set.
17. Rinse coolant flush kit hoses and fittings with clean water. Store kit for future use.
18. Dispose of used coolant in a proper manner. Do NOT pollute waterways!

Anticorrosion Zinc

An anticorrosion zinc anode is installed in the heat exchanger to prevent electrolytic corrosion by seawater. When different metals, such as iron and copper, are placed in a highly conductive liquid (seawater), the iron gradually rusts. The zinc has chemical properties which cause the seawater to react to it rather than the engine components.

The anticorrosion zinc anode should be checked every 100 hours or three months and replaced every 200 hours or yearly. Depending upon operating conditions and seawater properties, the anticorrosion zinc anode may have to be replaced more frequently. See Figure 3-17 and use the following procedure.



1. Heat Exchanger

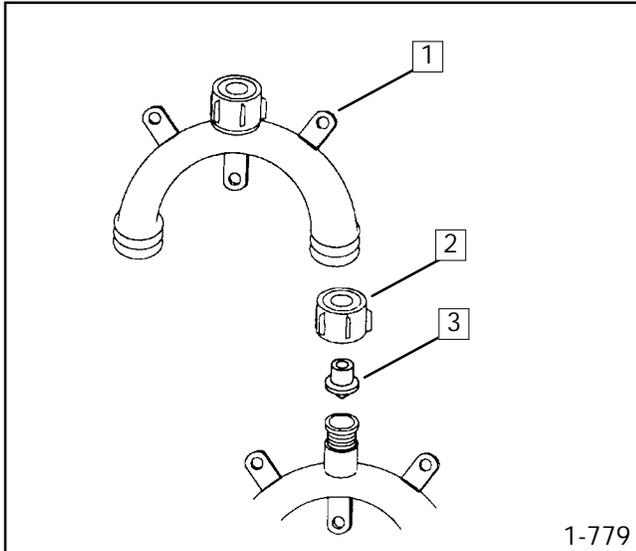
2. Anticorrosion Zinc

Figure 3-17. Removing Anticorrosion Zinc

1. With generator set cooled, drain the cooling seawater system. Close seacock, remove anticorrosion zinc anode from heat exchanger.
2. Use a wire brush to remove the loose corrosion on the anticorrosion zinc anode. Replace the anode when less than 50% of the 11/32 in. (9 mm) dia. by 9/16 in. (14 mm) long portion of zinc remains.
3. Clean threaded hole of heat exchanger and coat threads of anticorrosion zinc anode with pipe sealant (suitable for marine applications). Install anticorrosion zinc anode into heat exchanger.
4. Open seacock. Start generator set and check for leaks at the anticorrosion zinc anode location. Check for seawater flow by observing water discharge from exhaust outlet.

Pressure Cap

Closed-loop cooling systems incorporate a pressurized cap to raise the boiling point of the coolant and make use of higher operating temperatures. If leakage or malfunction occurs, replace the pressurized cap with one supplied by Kohler Co. part number 229958.



1. Mounting Base
2. Retaining Cap
3. Reed Valve Assembly

Figure 3-18. Siphon Break

Siphon Break

An optional siphon break is used to prevent seawater entry into the engine when the generator set is shut down. Corrosion buildup may not allow the siphon break to function properly. Therefore, if used, the siphon break must be inspected and cleaned periodically.

NOTE

To prevent siphoning of seawater, run the generator while performing this inspection.

Remove the retaining cap to inspect the reed valve. See Figure 3-18. Clean the reed valve to remove residue and oxidation. Check that the reed valve (opening) is clear. Replace the siphon break if the material has hardened or deteriorated. Install the reed valve with the

valve downward into the mounting base. Install retaining cap and tighten finger-tight only. Do NOT overtighten.

Air Cleaner and Mixing Elbow

Servicing Air Cleaner

The engine is equipped with a dry-type air cleaner. Every 50 hours (more often if operating under dusty or dirty conditions) remove element and service by tapping element lightly against flat surface to dislodge loose surface dirt. Do not clean in any liquid or blow out with compressed air as this will ruin filter material in element. Service air cleaner after each 50 hours of operation. If dirty, bent, or damaged replace element with genuine Kohler replacement. See Figure 3-19.

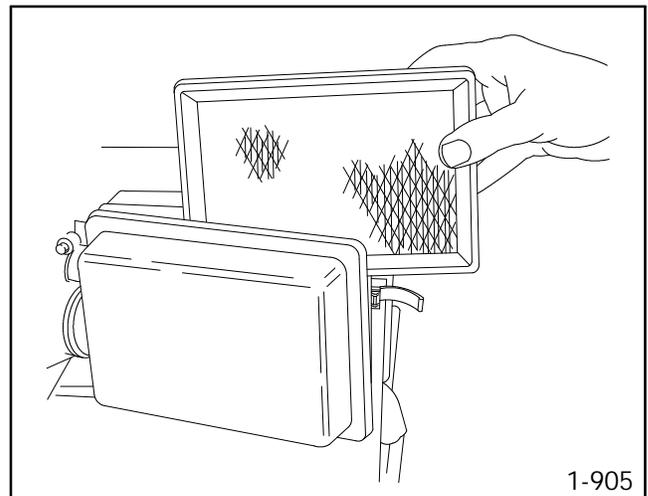


Figure 3-19. Air Cleaner Service

Servicing Mixing Elbow

The mixing elbow combines high temperature exhaust and cooling seawater. These conditions are conducive to rapid deterioration and, combined with engine vibrations, premature failures if not properly maintained. Check the mixing elbow for carbon buildup and corrosion inside the pipe. Clean or replace the mixing elbow as necessary. Inspect the exhaust manifold mounting threads for cracking and corrosion.

Battery

The starting battery should be a 12-volt unit with a minimum 250 CCA (cold cranking Amps) at 0°F (-18°C). When using a maintenance-free battery it is not necessary to check the specific gravity or electrolyte level. Otherwise, these procedures should be done at the intervals specified in the Service Schedule.

WARNING

Sulfuric acid in batteries.
Can cause severe injury or death.

Use protective goggles and clothes. Can cause permanent damage to eyes, burn skin, and eat holes in clothing.



Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in battery can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working around the battery. If battery electrolyte is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In the case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in hazardous spattering of electrolyte.

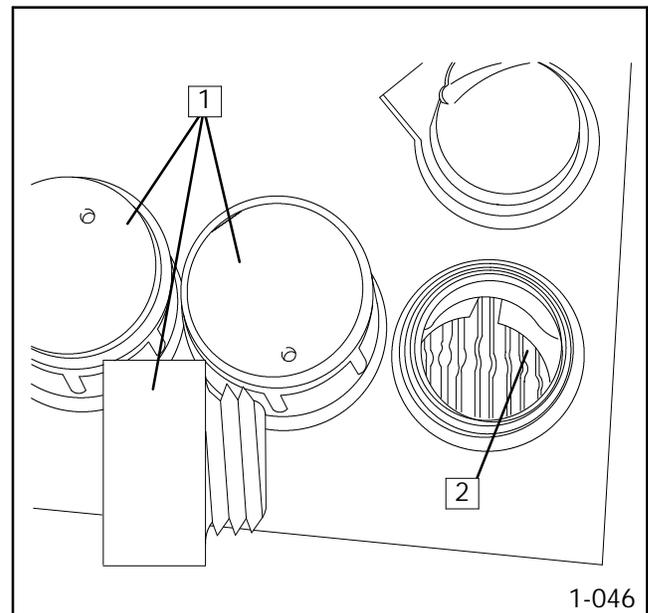
Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flame or spark to occur near a battery at any time, particularly when it is being charged. Avoid contacting terminals with tools, etc. to prevent burns and to prevent sparks that could cause an explosion. Remove wristwatch, rings, and any other jewelry before handling battery. Never connect negative (-) battery cable to positive (+) connection terminal of starter solenoid. Do not test battery condition by shorting terminals together or sparks could ignite battery gases or fuel vapors. Any compartment containing batteries must be well ventilated to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged and always turn charger off before disconnecting battery connections. When disconnecting battery, remove negative lead first and reconnect it last.

Cleaning

Keep battery clean by wiping it with a damp cloth. Keep all electrical connections dry and tight. If corrosion is present, disconnect cables from battery and remove corrosion with a wire brush. Clean battery and cables with a solution of baking soda and water. Be careful that cleaning solution does not enter battery cells. When cleaning is complete, flush battery and cables with clean water and wipe with a dry cloth. After the battery cables are reconnected, coat terminals with petroleum jelly, silicon grease, or other nonconductive grease.

Checking Electrolyte Level

Check the level of electrolyte before each startup. Remove filler caps and check to see that electrolyte level is up to bottoms of filler holes, see Figure 3-20. Refill as necessary with distilled water or clean tap water. **DO NOT** add fresh electrolyte! Then reinstall and tighten filler caps. If water is added during freezing temperatures, run generator set 20–30 minutes to allow mixing of added water and electrolyte. This will prevent damage to battery due to freezing.



1. Filter Caps

2. Electrolyte Level

Figure 3-20. Checking Electrolyte Level

Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell. Correct actual hydrometer readings for temperature. If the hydrometer used does not have a correction table, use the one in Figure 3-21. The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 80°F (26.7°C). The difference between specific gravities of

each cell should not exceed ± 0.01 . The battery should be charged if the specific gravity is below 1.215 at an electrolyte temperature of 80°F (26.7°C).

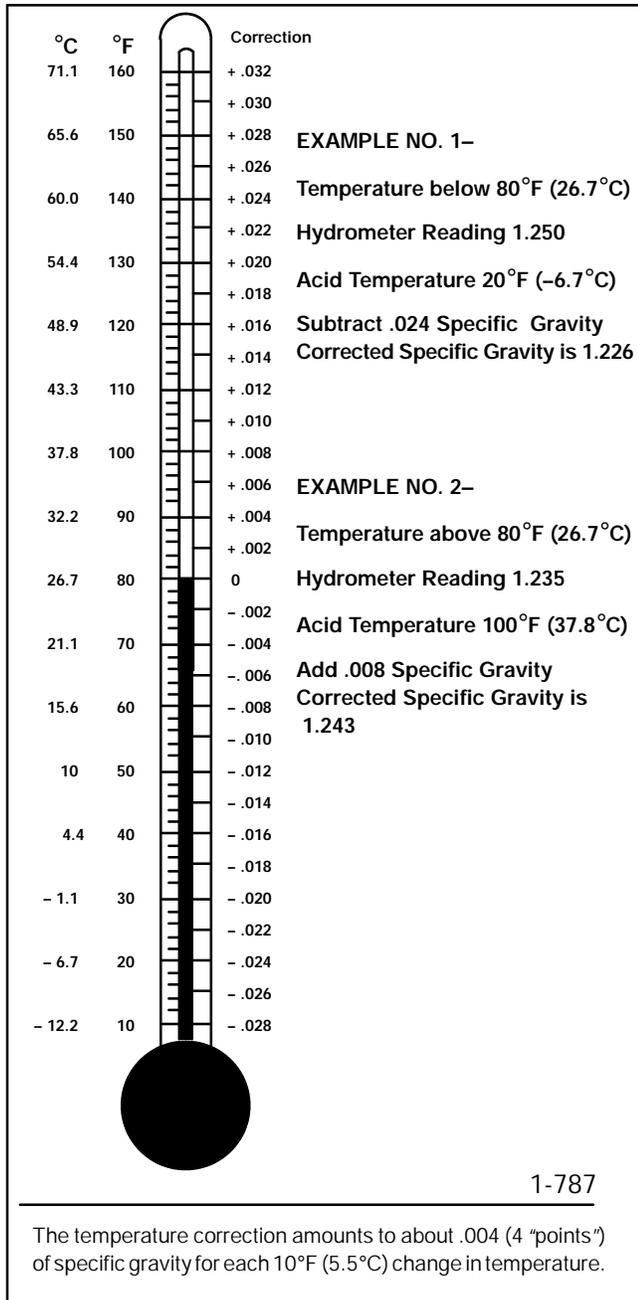


Figure 3-21. Specific Gravity Temperature Correction

NOTE

Some battery testers simply have four or five beads in a tube. Draw electrolyte into the tube. Use instructions with tester; otherwise see the following chart.

- Five Beads Floating– Overcharged
- Four Beads Floating– Fully Charged
- Three Beads Floating– A Good Charge
- One or Two Beads Floating– A Low Charge
- No Beads Floating– A Dead Battery

Charging

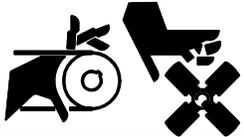
The engine battery charging circuit will provide a charge of 12 volts at up to 10 amps.

NOTE

If the battery is used while the craft is docked and the generator set is not running i.e., auxiliary lights, two-way radio, etc., the battery will be drained and may not have enough power to start the generator set later. Therefore, it may be necessary to connect a battery charger while the craft is docked and running on shore power.

Valve Adjustment

With overhead cam engines, each valve is spring-held in the closed position until forced open by the action of the rocker arm in contact with the camshaft. Rocker arms have adjusting screws and locknuts for adjusting valve stem-to-rocker arm clearance. Check clearance with the engine cold. See Specifications— Engine for intake and exhaust valve clearances.

⚠ WARNING

Rotating parts. Can cause severe injury or death. Do not operate generator set without all guards, screens, or covers in place.

Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from belts and pulleys when unit is running. Replace guards, covers, and screens before operating generator set.

Flying projectiles can cause severe injury or death. Retorque all crankshaft and rotor hardware after servicing. When making adjustments or servicing generator set, do not loosen crankshaft hardware or rotor thru-bolt. If rotating crankshaft manually, direction should be clockwise only. Turning crankshaft bolt or rotor thru-bolt counterclockwise can loosen hardware and result in serious personal injury from hardware or pulley flying off engine while unit is running.

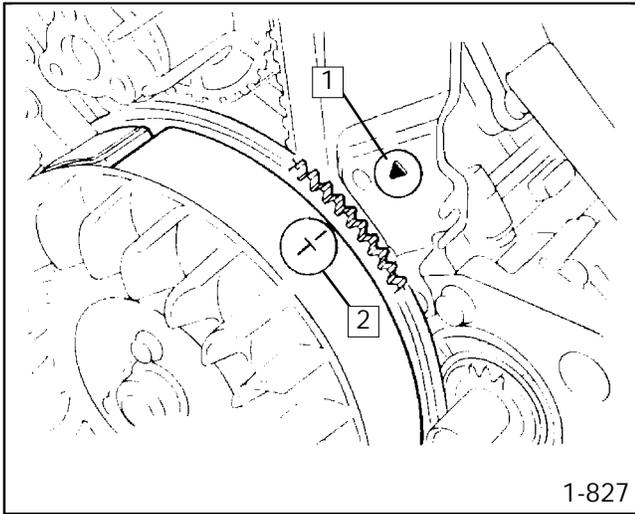
1. Remove rocker arm cover screws using a 10 mm wrench. Carefully pry rocker arm cover off cylinder cover. Wipe excess oil from components using a clean rag.
2. Expose timing belt:
 - a. Close seacock and drain seawater from hoses. Remove seawater pump hoses at seawater pump.

- b. Remove two screws to release seawater pump bracket.
- c. Remove housing enclosing ignition coil.
- d. Remove seawater pump from camshaft pulley.
- e. Remove timing belt cover (belt guard).

NOTE

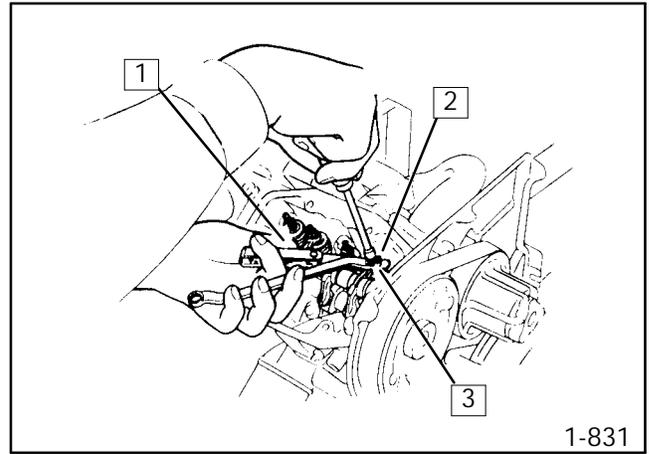
To reduce force needed to rotate crankshaft, remove the spark plugs.

3. Using a ratchet wrench on the crankshaft nut, rotate the crankshaft clockwise (as viewed from engine end) until No. 1 cylinder is at the top of its compression stroke and the 'T' mark on flywheel is aligned with the triangle symbol on the engine block. See Figure 3-22. The compression stroke is the period between the closing of the intake valve and the opening of the exhaust valve. The marks define the TDC (top dead center) point where both intake and exhaust valves will be closed.
4. Insert feeler gauge between rocker arm and exhaust valve for No. 1 cylinder. If necessary, adjust screw so that very slight drag is felt on the feeler gauge as it is withdrawn. Loosen the adjusting screw locknut and turn the adjusting screw to obtain the specified clearance. Retighten the locknut while holding the adjusting screw. See Figure 3-23. Recheck the valve clearance after tightening the locknut. Repeat step for intake valve of No. 1 cylinder.
5. Rotate crankshaft 360 degrees clockwise and set valve clearances on No. 2 cylinder.
6. Reassembly of timing belt components:
 - a. Install timing belt cover (belt guard).
 - b. Install seawater pump to camshaft pulley.
 - c. Install housing for ignition coil.
 - d. Mount seawater pump bracket using two screws.
 - e. Install seawater pump hoses to seawater pump. Open seacock.
7. With mating surfaces clean and gasket properly aligned, install rocker arm cover and screws. Remove ratchet wrench from crankshaft nut.



- 1. "Y" Mark
- 2. "T" Mark

Figure 3-22. Determining Top Dead Center



- 1. Feeler Gauge
- 2. Adjusting Screw 3 mm Square Head
- 3. Locknut; Use 9 mm Wrench

Figure 3-23. Valve Adjustment

Governor

The gear-driven centrifugal type governor serves to keep engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in load.

Lubrication

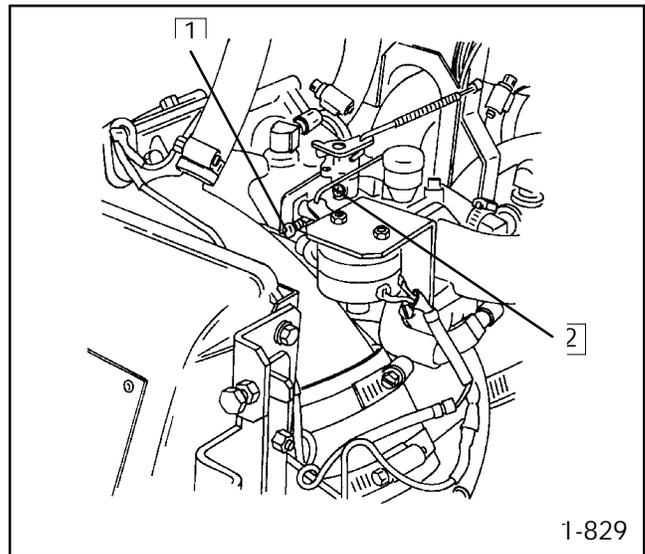
Lubricate governor linkage at the specified interval using white lithium grease or lubriplate.

Governor Adjustment

The gear-driven centrifugal type governor serves to keep engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in load. No regular service is required on the unit. The governor is adjusted during run-in at the factory and further adjustment should not be needed unless greatly varying load conditions are encountered or if poor governor control develops after extended usage. See Figure 3-25 for correct placement of governor linkage (models may vary).

60 Hz generator sets are designed to operate at 60-63 Hz, 3600 rpm under full load and 3780 rpm under no load. 50 Hz generator sets are designed to operate at 50-52.5 Hz, 3000 rpm under full load and 3150 rpm under no load. To check speed, use hand tachometer or frequency meter. Use the following procedure to adjust governor.

2. Move the governor arm end fully in the direction shown (toward the electric choke solenoid) and readjust governor screw. Tighten locking nut.
3. Start engine and run to reach operating temperature.
4. Apply full load and turn engine speed adjustment screw to 3600 rpm for 60 Hz generator set, 3000 rpm for 50 Hz set.
5. Check regulation by applying and removing full load.
6. STOP generator set.



1. Mixture Screw
2. Idle Speed Screw
3. Governor Adjustment

1. Loosen governor arm locking nut. See Figure 3-24.

Figure 3-24. Governor Adjustment

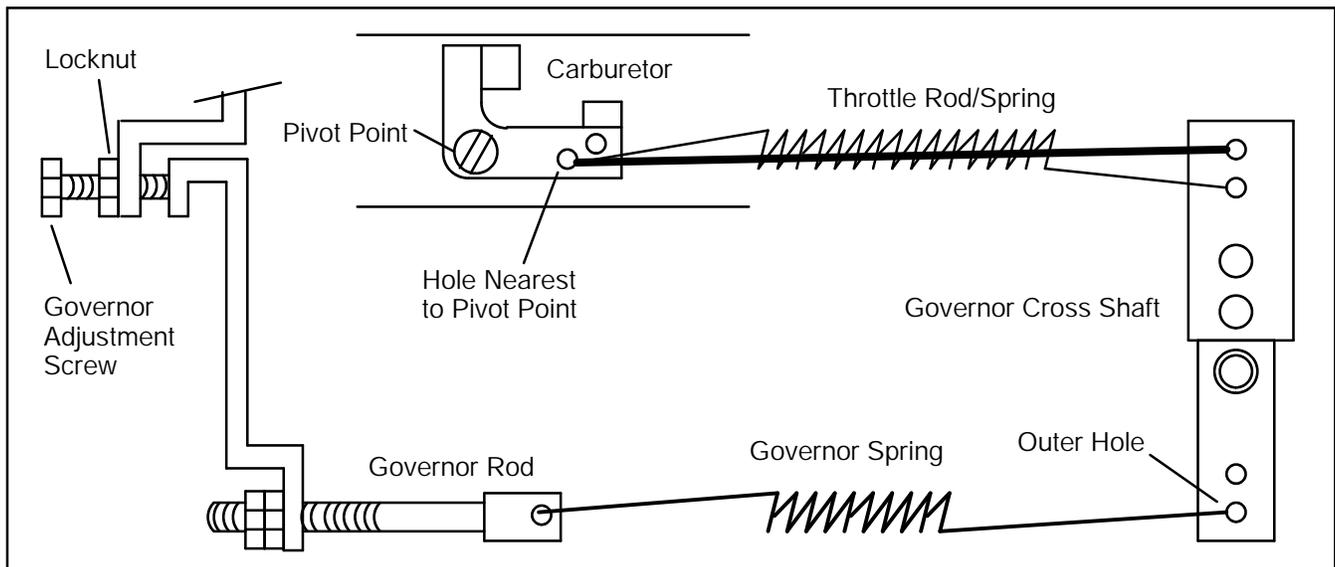


Figure 3-25. Governor Linkage

Wattage Requirements

If the rated capacity of the generator set is exceeded, the circuit breaker located on the controller will trip to protect the generator against damage. Tripping could be caused by a short in the AC circuit in the craft or simply by having too many appliances on at the same time resulting in an overload condition. If the circuit breaker trips, the set may continue running but there will be no AC output to the protected circuit. Before resetting the circuit breaker, turn off some of the appliances and lights inside the craft to bring the load down within the rated limits of the set. If this is done and the circuit breaker trips again after being reset, see a qualified electrician.

For more information regarding generator set capacity, see Installation– Generator Selection and Wattage Requirements.

Generator Service

General

Under normal conditions generator service will not be required on a regular basis. If operating under dusty and dirty conditions, use DRY compressed air to blow dust out of the generator at frequent intervals. Do this with the generator set operating and direct the stream of air in through the cooling slots at the end of the generator.

The end bracket bearing should be replaced every 10,000 hours of operation. Have bearing replaced sooner if bearing inspection indicates excessive rotor end play or bearing damage from corrosion or heat buildup. The end bracket bearing is sealed and requires no additional lubrication. All generator service must be performed by an authorized service dealer/distributor.

Storage Procedure

It is recommended that the craft be afloat when the generator set is prepared for storage since the engine must be started.

1. Add fuel stabilizer to fuel tank. Use recommendations of fuel stabilizer manufacturer.
2. Start generator set and run until operating temperature is reached or about 15 minutes. Stop generator set. Drain oil from crankcase while engine is still warm. Replace oil filter. Refill crankcase with specified weight oil.

NOTE

For storage, seawater must be replaced with antifreeze as described in steps 3a–c or drained as described in steps 4a–c.

3. Close seacock and remove hose at seacock. Place hose in a container of coolant/antifreeze. Container should have approximately 1–2 U.S. gallons (3.7–7.5 L) of antifreeze. A mixture of 50% ethylene glycol and 50% clean, softened water is sufficient.
 - a. With a suitable container at exhaust outlet, run generator set until coolant discharge is observed at exhaust outlet or until coolant mixture is used up. Do not allow coolant mixture to flow into waterways. Stop generator set.
 - b. Connect hose to seacock. Leave seacock closed.
 - c. Check coolant level of heat exchanger and add if necessary.

NOTE

If steps 3a–c were performed to replace seawater with antifreeze, omit steps 4a–c.

4. Close seacock and drain all seawater out of cooling system.
 - a. Drain seawater from strainer and seawater pump.
 - b. Remove zinc anode or end cap on heat exchanger, whichever is more convenient, to drain only seawater. Use an air hose to blow out any remaining seawater, if necessary. Check coolant level of heat exchanger and add if necessary.
 - c. Drain seawater from exhaust waterline.

NOTE

If freezing temperatures will be encountered during storage, be sure engine coolant is capable of withstanding the lowest possible temperatures. Generally, a mixture of 50% ethylene glycol and 50% clean, softened water is sufficient.

5. Remove spark plugs and pour one teaspoon of engine oil into each cylinder. Crank the engine several times to coat the cylinder walls with oil. Reinstall the spark plugs.
6. If fuel stabilizer was not added to fuel tank, drain fuel completely from fuel tank. Gum deposits will develop if gasoline is stored for the season.
7. Clean exterior of generator set and spread a light film of oil or silicon spray over any exposed surfaces which may be subject to rust or corrosion.
8. Using tape, seal air inlet, exhaust pipe, and fuel tank cap.
9. Disconnect and remove battery. Battery should be placed in a warm, dry location for period of storage. Recharge battery once a month to maintain full charge.
10. Cover entire unit with a dust cover.

Section 4. Troubleshooting

When troubles occur, do not overlook simple causes. A starting problem, for example, could be caused by improper fuel or an empty fuel tank. The following charts list some common problems. If procedures in this manual do not explain how to correct the problem, take

the generator set to an authorized service dealer/distributor. Tell the dealer exactly what happened when the problem occurred and of any adjustments made to the set.

Engine

Problem	Possible Cause	Corrective Action
Unit will not crank	Weak or dead battery	Recharge or replace battery
	Reversed or poor battery connections. Poor ground.	Check connections
	Fuse blown in controller	Replace fuse
	Defective start/stop switch	Check function, replace as necessary.
	Defective starter solenoid	Check starter solenoid and wiring. Replace as necessary.
	Defective starter	Attempt starting by direct connection to battery. Replace/repair as necessary.
Unit cranks but will not start	Out of fuel	Replenish
	Clogged fuel screen	Clean fuel screen
	Faulty antidiesseling solenoid	Replace solenoid
	Air intake clogged	Clean or replace
	Faulty spark plug(s)	Replace (and regap) spark plug(s)
	Loose spark plug connection	Reconnect wires
	Faulty ground (-) connection	Clean and retighten
	Carburetor adjustment wrong	Adjust carburetor
	Defective electric fuel pump	Check pressure. Replace as necessary.
	Shorted or open ignition coil	Replace coil
	Weak or dead battery	Recharge or replace
	Bad fuel mixture	Replace fuel; clean carburetor
	Flooded carburetor	Wait a few minutes and attempt restart
	Engine malfunction	See authorized Kohler service dealer/distributor
Engine starts, but does not continue to run after start switch is released	No generator output voltage	Check AC voltage
	No/low oil pressure	Check oil pressure and pump
	Defective low oil pressure (LOP) safety shutdown switch	Check LOP shutdown switch
	High temperature shutdown	Check cooling system
	Defective high exhaust temp. (HET) and/or high water temp. (HWT) safety shutdown switch(es)	Check HET and/or HWT shutdown switch(es)
Hard starting	Stale or bad fuel	Replace fuel
	Fuel vapor lock	Check fuel line routing
	Faulty spark plug(s)	Replace (and regap) plug(s)
	Weak ignition coil	Replace
	Carburetor adjustment wrong	Adjust carburetor
	Air intake clogged	Clean

Engine (Continued)

Problem	Possible Cause	Corrective Action
Stops suddenly	Out of fuel	Replenish
	Air intake clogged	Clean
	Fuse blown in controller	Replace fuse
	Defective seawater pump impeller	Replace
	Clogged seawater strainer	Clean strainer
	Ignition coil failure	Check for spark
	Fuel line restriction	Check fuel lines and tank
	Fuel vapor lock	Check fuel line routing
	Defective electric fuel pump	Check pump
	Dirty fuel screen	Clean fuel screen
	Faulty spark plug(s)	Replace spark plug(s)
	No/low oil pressure	Check oil pressure and pump
	Defective low oil pressure (LOP) safety shutdown switch	Check LOP shutdown switch
	High temperature shutdown	Check engine coolant system
	Defective high exhaust temp. (HET) and/or high water temp. (HWT) safety shutdown switch(es)	Check HET and HWT shutdown switch(es)
Loss of AC output	See authorized Kohler service dealer/distributor	
Faulty antidiesseling solenoid	Replace solenoid	
Lacks power	Air intake clogged	Clean
	Bad or stale fuel	Replace fuel
	Faulty spark plug(s)	Replace (and regap) plug(s)
	Improper timing	Check timing
	Choke solenoid defective	Check and/or change
	Engine not operating at rated RPM	Check governor
	Governor adjustments incorrect	Adjust governor
	Carbon build-up	Clean carbon from cylinder heads
	Improper cooling	Inspect cooling system
	Dirty fuel screen	Clean screen
	Defective ignition coil	Replace coil
	Fuel line restricted	Check fuel lines
	Engine overloaded	Reduce load
	Carburetor adjustment wrong	Adjust carburetor
Operates erratically	Air intake clogged	Clean
	Stale or bad fuel	Replace fuel
	Fuel pump vapor lock	Allow unit to cool and attempt restart
	Clogged fuel screen	Clean screen
	Faulty spark plug(s)	Replace spark plug(s)
	Carburetor adjustment incorrect	Adjust carburetor

Engine (Continued)

Problem	Possible Cause	Corrective Action
Overheats	Improper cooling	Check intake and outlet openings. Check coolant level and pressure cap. Check raw water strainer.
	Thermostat defective	Replace
	Sea strainer clogged	Clean sea strainer
	Carburetor adjustment too lean	Adjust carburetor mixture
	Engine ignition timing incorrect	Adjust timing
Unit is noisy	Exhaust system leak	Check exhaust system
	Exhaust system not securely installed	Check for loose parts
	Broken or damaged vibromounts	Check vibromounts
	No installation clearance (unit hits craft structure or compartment)	Check clearances
	No compartment sound insulation	Install approved insulation
	Excessive vibration engine/ generator (internal imbalance)	See authorized Kohler service dealer/distributor
	Loose or vibrating sheet metal	Check shrouds

Electrical System

Problem	Possible Cause	Corrective Action
Battery will not charge	Loose or corroded connections	Clean and tighten connections
	Sulfated or worn-out battery	Check electrolyte level and specific gravity (batteries with filler caps only)
	Defective battery charging system	Check charging system
	Battery charging fuse blown	Replace fuse. If fuse blows again see authorized Kohler service dealer/distributor
Starter does not work properly	Loose or corroded connections	Clean and tighten loose connections
	Low battery output	Check electrolyte level and specific gravity (batteries with filler caps only). Check battery voltage.
	Defective starter solenoid	Replace starter solenoid
	Defective start/stop switch	Replace switch
	Defective wiring	Check wiring
Starter cranks slowly	Low battery output	Check electrolyte level and specific gravity (batteries with filler caps only)
	Too heavy viscosity lube oil	Use proper viscosity oil
	Loose or corroded wiring	Clean and tighten loose connections
	High starter current draw	Rebuild or replace starter
	Battery cable undersize	See Installation Section–Electrical Systems

Generator

Problem	Possible Cause	Corrective Action
No AC output	Circuit breaker in OFF position	Reset breaker to ON position
	Circuit breaker tripped due to overload on generator set	Reduce load. See Wattage Requirements. Reset breaker to ON position.
	Ship-to-shore transfer switch in "OFF" or "SHORE" position	Turn switch to generator power
	No DC power to controller	Check battery connections
	Controller fuse blown	Replace fuse
	Generator malfunction such as capacitor or other internal fault	See authorized Kohler service dealer/distributor
Low output or excessive drop in voltage	Engine speed too low	Adjust governor
	Generator overloaded	Reduce load. See Wattage Requirements.
	Engine in poor condition	If routine services are performed and condition persists, see authorized Kohler dealer/distributor
	Defective capacitor	See authorized Kohler service dealer/distributor
High generator output voltage	Defective capacitor and/or poor wiring connections	See authorized Kohler service dealer/distributor
	Excessive speed or frequency	Adjust governor. Check governor linkage and spring for damage or binding.
Will not crank	No DC power to controller	Check battery connections
	Controller circuit fuse blown	Replace fuse and attempt start-up. If fuse blows again, contact authorized Kohler service dealer/distributor.

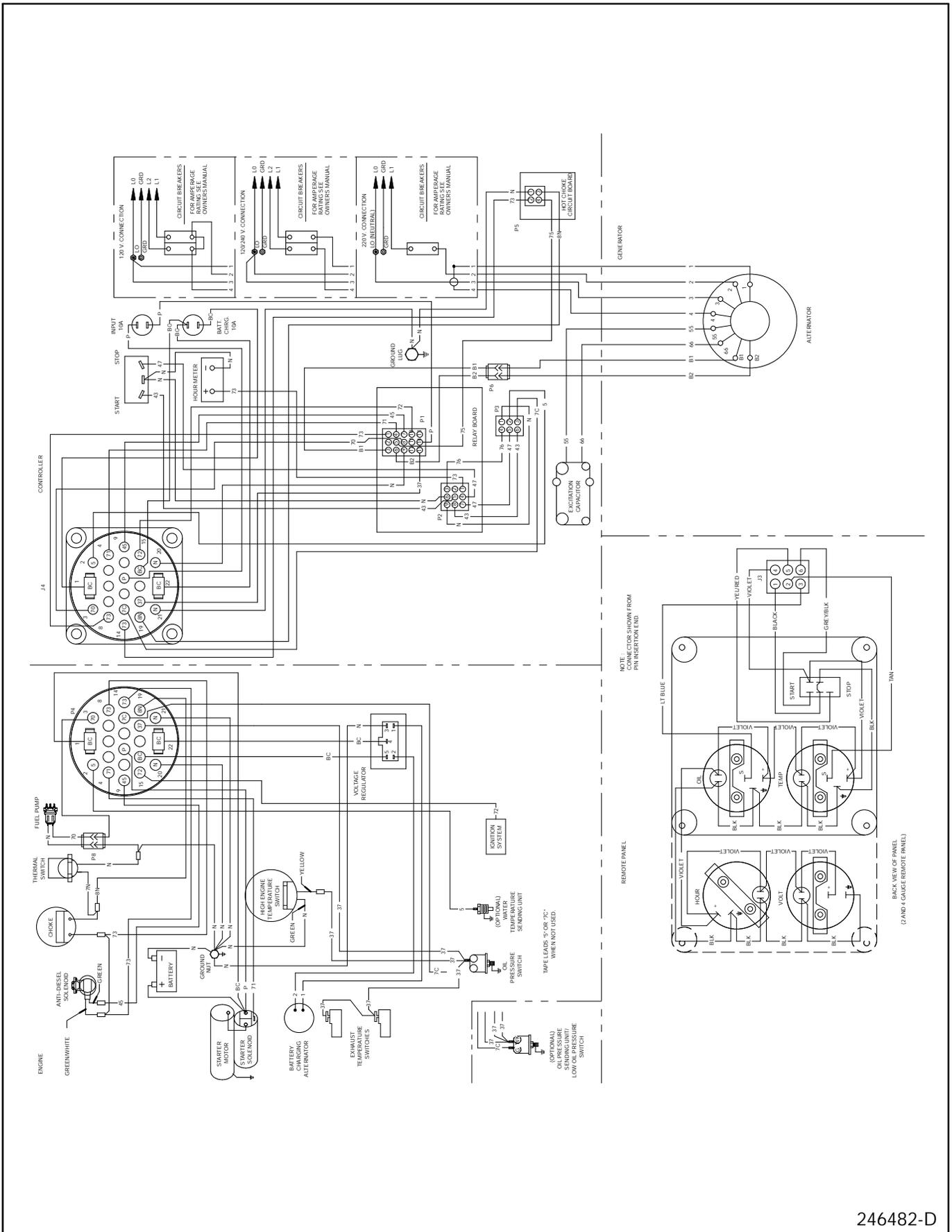
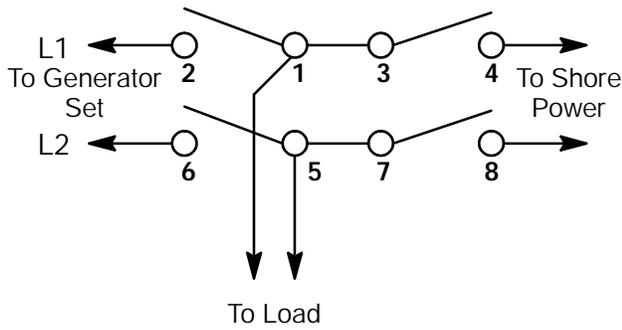


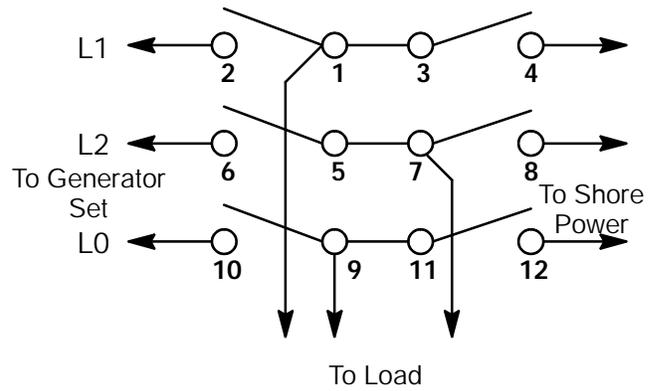
Figure 5-2. Point-to-Point Wiring Diagram—3.5CFZ, 4CZ, 5CFZ, and 6.5CZ

Electro Switch

2-Wire Generator Sets

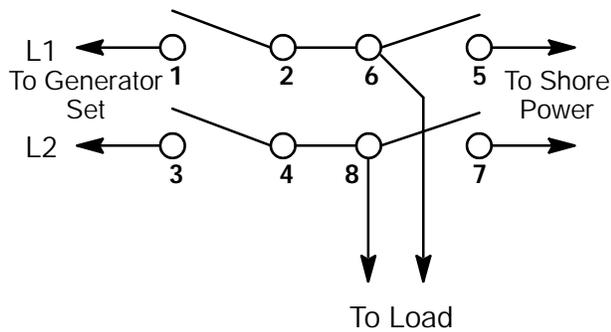


3-Wire Generator Sets

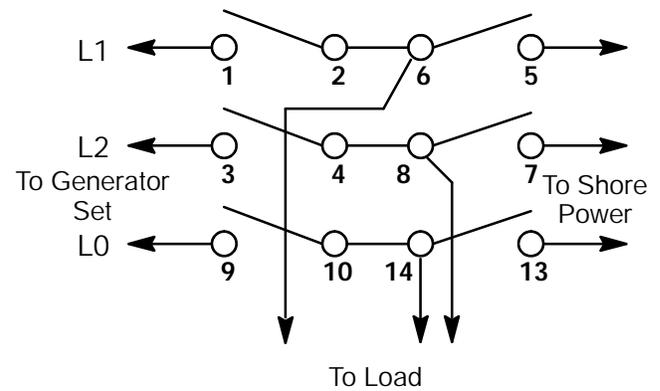


Kraus Naimler/American Solenoid (Early Rectangular Design)

2-Wire Generator Sets

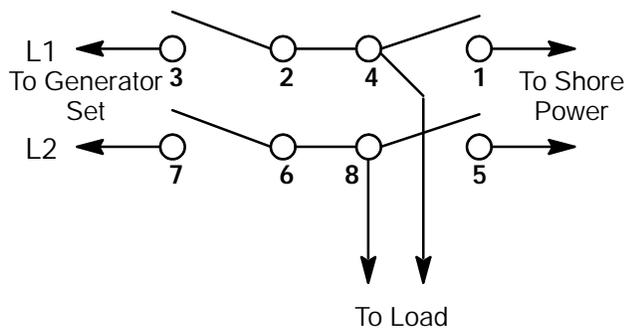


3-Wire Generator Sets



Kraus Naimler/American Solenoid (Newer Round Design)

2-Wire Generator Sets



3-Wire Generator Sets

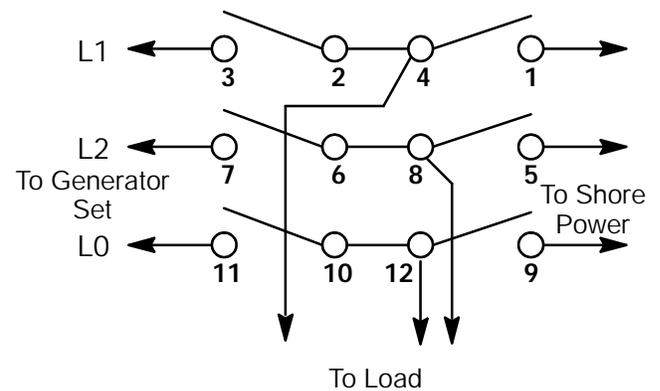


Figure 5-3. Marine Manual (Ship-to-Shore) Transfer Switch

Four-Lead Reconnectable (Single-Phase) Generator Sets Where Generator Output Can Be Reconnected For 120 volt or 120/240 volt, 60 Hz, 110 volt or 110/220 volt, 50 Hz

NOTE

When a generator set is reconnected to a voltage different than nameplate voltage, notice should be placed on the unit indicating this change. Decals for this purpose are available from authorized Kohler dealers/distributors.

120- or 110-Volt 3-Wire 2-Pole Configuration—Figure 5-4

Jumper lead to be placed on line side of circuit breaker. Leads L1 and L2 can either be left as separate leads or can be connected together depending upon which is practical for the given application. Regardless of the number of phase (black) leads used in the application, both circuit breakers must have leads attached to the load side. It is recommended that jumper lead be maintained for all straight 120- or 110-volt systems since it helps balance the load of the generator set.

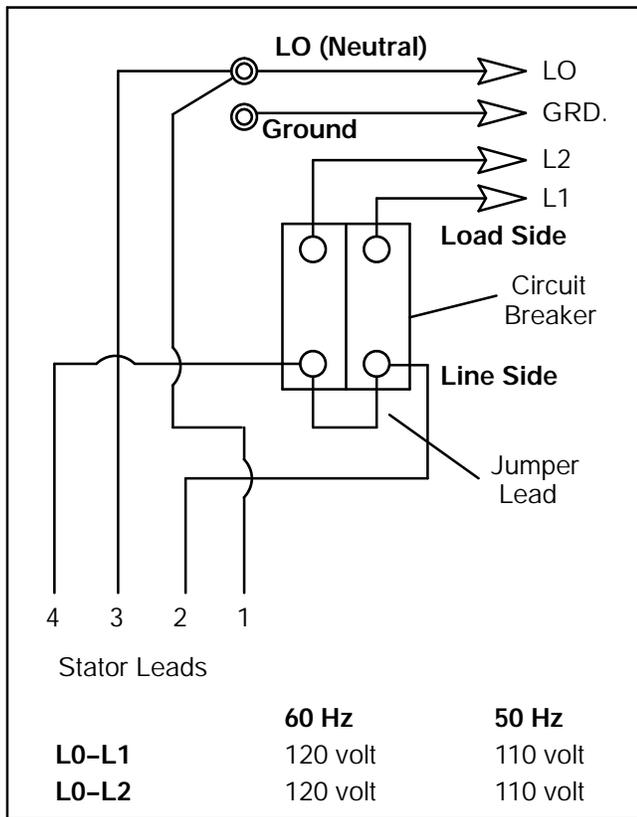


Figure 5-4. With Jumper Lead

120- or 110- Volt 2-Wire Configuration Figure 5-5 (Single Pole)

If the installation requires a 120 or 110 volt, 2-wire system, a single-pole circuit breaker must be used. See Figure 5-5. When connecting stator phase leads together, the output lead (L1) must be sized accordingly.

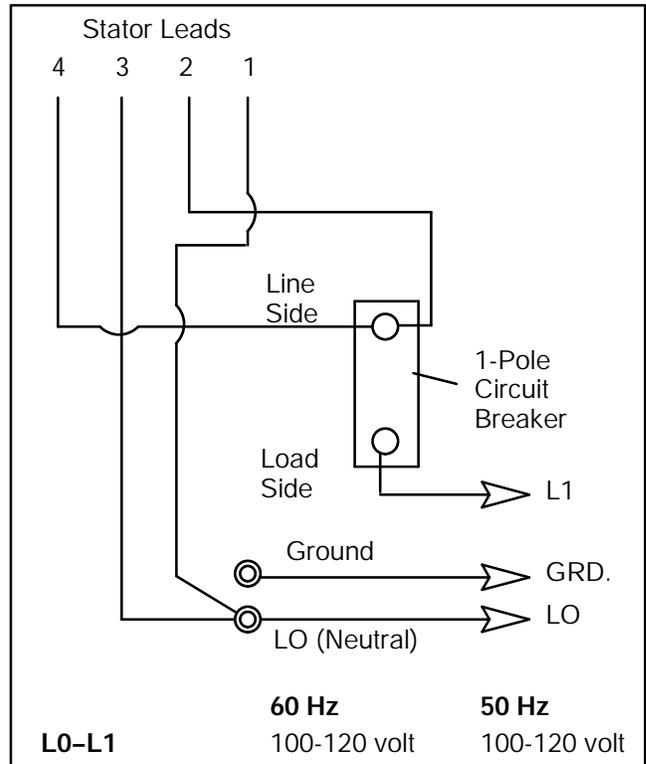


Figure 5-5. 120 Volt, 2-Wire

120/240- or 110/220-Volt Configuration—Figure 5-6

Jumper lead not used. If unit was originally wired for straight 120 or 110 volt, be sure jumper lead is removed (see Figure 5-6 for location). Leads L1 and L2 are different phases and must never be connected together.

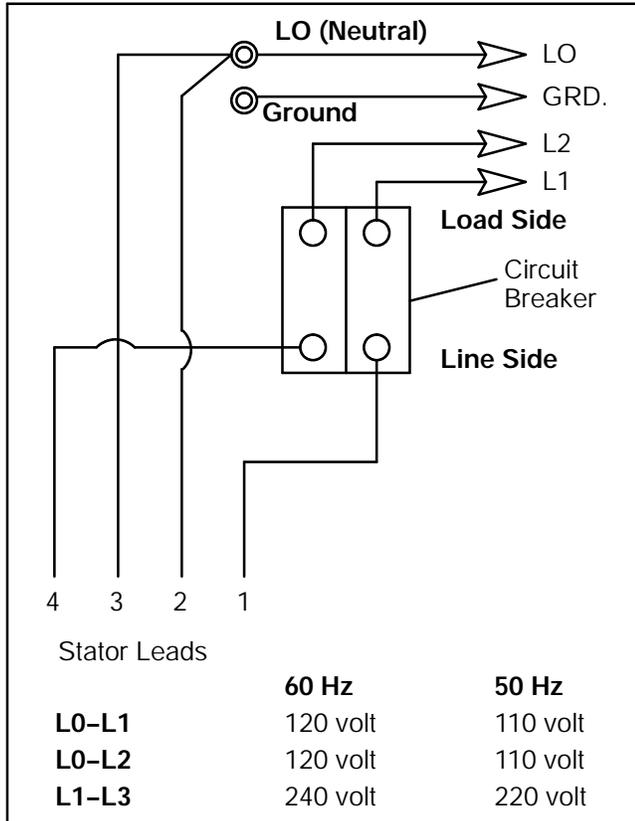


Figure 5-6. Without Jumper Lead

Section 6. Installation

Introduction

Use this section as a guide when installing the Marine generator set, then refer to Section 2. Operation for specific service instructions. Reliable and safe generator set operation depends largely upon proper installation. Remember that the generator set will probably be the craft's sole source of electrical power.

When installing a marine generator set, it is recommended that the installation comply with all applicable Regulations and Standards. See Reference Material for documents issued by governing agencies. Information presented here should be followed in planning and making installations. Specifications given should be used only in initial planning. Use current dimension drawings and wiring diagrams.

NOTE

A wood block is located under some generator set end brackets to prevent damage during shipment. For the same reason, metal brackets are used to attach some generator sets to their wood shipping bases. These items **MUST** be removed prior to installation in order to provide adequate vibration clearance during generator set operation. Check that all packing material, literature, and loose accessories are removed from generator set prior to operation.

Generator Selection and Wattage Requirements

Total wattage requirements (lights, motors, appliances) must be considered when selecting a generator set, or when sizing wattage usage where available space and construction limit the size of the generator set. The 4-lead reconnectable generator set can be connected for 120 volt or 120/240 volt 60 Hz (110 volt or 110/220 volt 50 Hz), see Section 5. Wiring Diagrams.

NOTE

When a generator set is reconnected to produce a voltage different than nameplate voltage, notice should be placed on the unit indicating this change. Decals (part number 246242) for this purpose are available from authorized Kohler dealers/distributors.

Lighting Load

The lighting load is usually easiest to calculate. In most cases, simply add the wattage of each lamp to be operated off the generator set. Note that in many applications, not all of the lights or lamps are in the generator set AC circuit— some are DC powered by the 12-volt battery in the craft. Make sure the total includes only lights actually on the generator set AC circuit.

Motor Loads

When figuring generator set capacity requirements that include electric motors, do not overlook the high current demanded by the motors during start-up. The in-rush or starting current is typically 2–3 times higher than that required when the motor reaches normal operating speed. Reserve capacity must be allowed for in-rush demands plus other loads which could be on the line as the electric motor starts.

Air conditioning units are perhaps the most common type of motor load for generator sets in marine applications. The starting characteristics of the different varieties of air conditioners vary greatly— one particular 12,000 Btu unit has, for example, lower starting requirements than a 10,000 Btu unit of another make. When only one unit is involved, there is usually no starting problem, provided the lighting and appliance load is not too high when the unit is started.

Simultaneous starting of two air conditioning units, however, can present problems if the capacity is marginal. Because of the variation in starting characteristics of the various makes of air conditioners, no definite statements are made in this publication regarding multiple-motor starting capabilities of the marine generator set covered. Delayed starting or use of easy-starting devices on air conditioner units should be considered whenever simultaneous starting of more than one motor is involved.

The starting and running requirements of some motor loads common to marine applications are listed in Figure 6-1; use this as a guide when selecting generator set capacity requirements involving motor loads. See Figure 6-2 for generator set capabilities regarding air conditioners.

Capabilities will vary according to Kilowatt Derating following.

Motor Requirements (HP)	Starting (In-Rush) Watts	Running Watts
1/4	750	330
1/3	1000	400
1/2	1500	600
3/4	2000	750
1	3300	1100
2	4000	2000
3	5000	3000

Figure 6-1. Motor Requirements

Model	Wattage	Will Operate Air Conditioner of Size Indicated	“Power to Spare” for Lighting Appliances, Tools
4CZ	4000	One 13,500 Btu	2100
6.5 CZ	6500	One 13,500 Btu	4600
		Two 13,500 Btu	2700

Figure 6-2. Air Conditioner Requirements (50 Hz units will have slightly lower “power to spare” figures than those indicated)

Appliance Loads

Marine generator sets are often used to furnish AC for appliances such as TV, stereo, electric water heaters, etc. With the exception of the resistance-type loads such as the water heater, requirements for appliances are usually low. Such loads must not, however, be overlooked when figuring total requirements. Reserve capacity should be available for anticipated appliance loads to avoid overloading of a set. The average power requirements of some common electrical appliances are given in Figure 6-3.

Kilowatt Derating

Units are rated as listed below at 1.0 power factor. Derate the listed rating by approximately 3.5% per 1000 ft. (300 m) when the unit is operated at altitudes of 500 ft. (150 m) or more above sea level.

3.5CFZ, 50 Hz: 3.5 kW at 77_F (25_C) and 3.5 kW at 122_F (50_C).

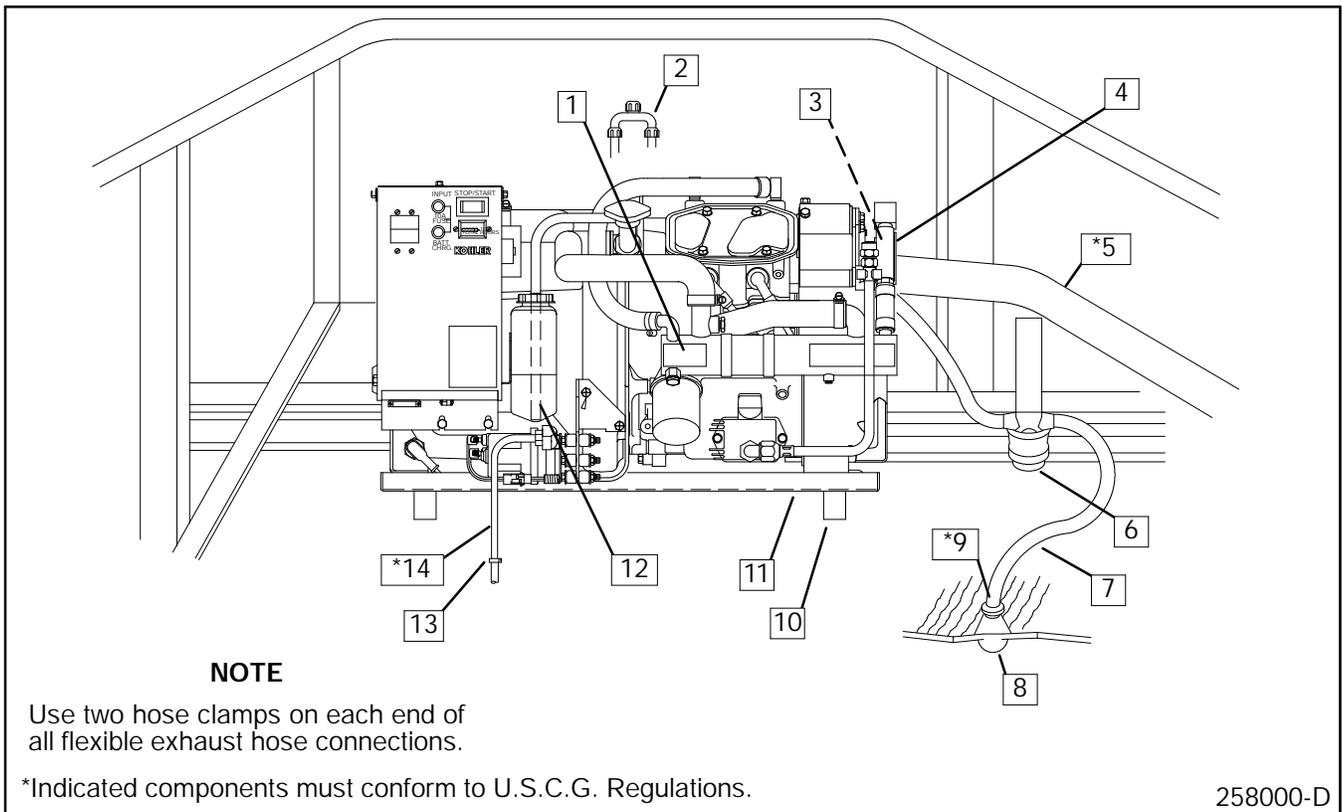
4CZ, 60 Hz: 4 kW at 77_F (25_C) and 3.5 kW at 122_F (50_C).

5CFZ, 50 Hz: 5 kW at 77_F (25_C) and 4.85 kW at 122_F (50_C).

6.5CZ, 60 Hz: 6.5 kW at 77_F (25_C) and 6 kW at 122_F (50_C).

Electrical Appliance	Motor Starting Watts	Running Watts
Automatic Pilot	–	150–250
Blanket, Electric	–	50–250
Blender	800	600
Broiler	–	1350
Depthometer	–	25–1000
Drill, 3/8”	600	350
Dryer, Hair	–	850–1200
Fan, Air Circulating	50–200	25–100
Food, Mixer	400	235
Heater, Space	–	750–1500
Heater, Water	–	1500
Iron	–	900–1200
Light Bulbs	–	(as indicated)
Pan, Frying	–	1200
Percolator, Coffee	–	650
Radar	–	750–1500
Radio	–	50–100
Radiophone	–	100–200
Range, Electric (per element)	–	1000–1500
Soldering Gun	–	250
Television	–	300–750
Toaster	–	750–1200
Water System	500–1500	300–1250

Figure 6-3. Appliance Average Wattage Ratings (60 Hz)



- | | |
|---|---------------------------------|
| 1. Heat Exchanger | 8. Intake Through-Hull Strainer |
| 2. Siphon Break (See Instruction Sheet TT-927 for Proper Installation.) | 9. Seacock |
| 3. Exhaust Mixer | 10. Mounting Base |
| 4. Engine-Driven Seawater Pump | 11. Mounting Tray |
| 5. Exhaust Hose | 12. Coolant Recovery Tank |
| 6. Seawater Strainer | 13. Hose Clamp |
| 7. Raw Waterline | 14. Fuel Line |

Figure 6-4. Typical Location and Mounting

Location

General

Consider the following in selecting or constructing a generator set location.

Compartment/location must allow adequate space for ventilation, cooling and exhaust system installation, service access to the engine and generator, and proper fuel system installation.

Engine stringers or other available structural members must provide adequate support for the generator set weight.

A generator set compartment must be sealed to prevent exhaust gases and fuel vapors from entering cabins.

Generator sets located above deck must have a protective cover to prevent damage from rain and water splash. This cover must not affect cooling air flow and serviceability.

See Figure 6-4 for a typical installation and Section 1. for dimensions and weights.

Space

Location should allow easy access to the generator set's engine, controller, cooling, and fuel system components for routine service. Engine compartments are often ideal generator set locations, but access should not be obstructed by propulsion engines or generator and controller. Also allow clearance for vibration during operation. Minimum recommended clearance for vibration and cooling of top, front, rear, and sides of generator set is 1 1/2 in. (38 mm).

Mounting

Engine stringers generally provide the best support for a generator set. Any structural members considered for mounting must support the generator set weight and withstand engine vibration. The generator set includes vibration mounts and mounting trays; additional vibration isolating pads may be installed between trays and bases.

A generator set should be mounted as high as possible to avoid bilge splash and lower-lying vapors and also to allow downward pitch of the exhaust line. For angular installation, the maximum operation angle of the engine/generator set is 20° (in all directions).

Ventilation

Ventilation is required to support engine combustion, generator cooling, and expulsion of flammable and lethal fumes. Ventilation provisions must comply with U.S.C.G. Regulations governing sizing of vents and operator requirements.

As a rule, inlet and outlet vent areas should each be sized to a minimum of 2 sq. in. per ft. (13 sq. cm/30.5 cm) of craft's beam. Should this rule in any instance conflict with U.S.C.G. Regulations, appropriate Regulations should be followed. If any screening is used in inlets, size of hull/deck openings should be doubled. Vent ducts should extend to bilges to expel heavier-than-air fumes. If the generator set is to be mounted in the engine compartment, air flow must be increased to allow for generator set's requirements. UL-listed ignition-protected blowers should be installed in outlet vents, and wired to operate before engine(s) are started. Sniffer devices may also be optionally installed to cause alarm, warning, or engine shutdown should dangerous fumes accumulate in the compartment.

⚠ WARNING

<p>Explosion. Gasoline vapors can cause explosion and severe injury or death.</p> <p>Before starting generator set, operate blower 4 minutes and check engine compartment for gasoline vapors.</p>

Air requirements for various models are given in Figure 6-5. The air intake silencer provides combustion air to the engine. It is imperative that the recommended minimum clearance of 1 1/2 in. (38 mm) between duct opening and any enclosure wall not be compromised. Engine/generator performance will be affected adversely if these guidelines are not followed.

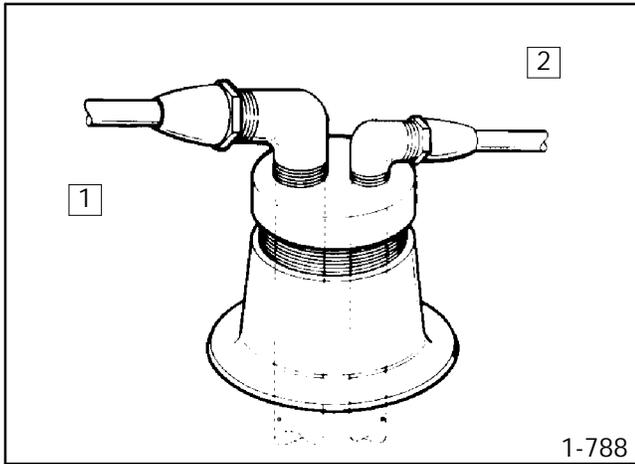
Model	Air Requirements CFM (L/min.)	
	Combustion	Cooling
3.5CFZ	18 (510)	323 (9145)
4CZ	18 (510)	323 (9145)
5CFZ	18 (510)	600 (16988)
6.5CZ	18 (510)	600 (16988)

Figure 6-5. Air Requirements

Fuel Systems

Fuel Supply

Generator sets, in most cases, must draw fuel from the same tank as the propulsion engines. If the tank's fuel pickup opening allows, a multiple dip tube arrangement (Figure 6-6) may be used. An alternate tank, if used, should have a smaller separate pickup opening allowing a single dip tube (Figure 6-7).



1. Fuel Line to Propulsion Engine

2. Fuel Line to Generator Set

Figure 6-6. Dual Dip Tubes

For installations where the highest point of the gasoline source (fuel tank) is above the generator set carburetor, an auxiliary fuel shutoff valve is required. This fuel shutoff valve should be closed when the generator is not in use to prevent fuel leakage resulting from fuel flow through the fuel pump and into the carburetor should the float valve not seat properly.

NOTE
Fuel systems must conform to U.S.C.G Regulations and tests.

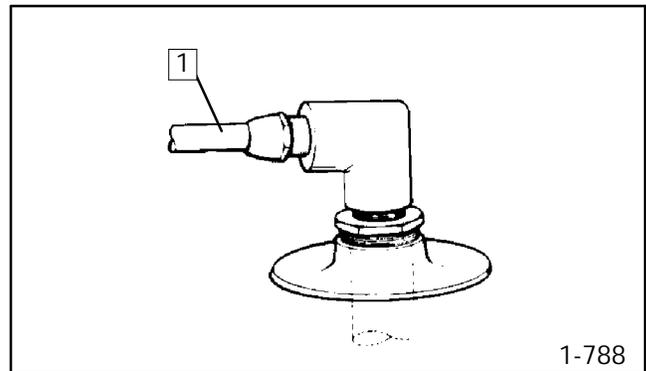
WARNING



**Explosive fuel vapors.
Can cause severe injury or death.**

Use extreme care when handling, storing, and using fuels.

Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Do not modify the tank or propulsion engine fuel system. Craft must be equipped with a tank allowing one of the two pickup arrangements described. Tank and installation must conform to U.S.C.G. Regulations.



1. Fuel Line to Generator Set

Figure 6-7. Single Dip Tube

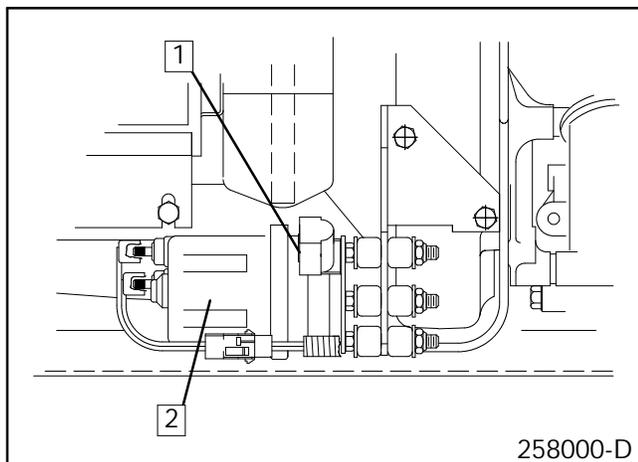
Anti-Siphon Provisions

Anti-siphon devices must be installed if any section of fuel line lies below the highest point of the fuel tank. The anti-siphon device should be either a spring-loaded check valve (tested to function with the particular installation's siphon head), or an electrically operated shutoff valve (UL ignition-protected, tested to U.S.C.G. Regulations) which may be operated manually. A check valve should be installed at a point above fuel tank's highest point, secured to craft's structure, and be accessible without removing any permanent structure. The fuel line section between the tank and check valve must be located above the tank's highest point. An electric shutoff valve should be installed at the tank's fuel withdrawal fitting, and be wired to open when the generator set engine is cranking or running.

Anti-siphon holes drilled in fuel dip tubes within the tank are not reliable anti-siphon devices as they become ineffective when restricted by dirt or gum.

Fuel Lines

Metallic lines should be used from the tank to a flexible hose section connecting metallic line to the engine fuel pump. Metallic lines must have wall thickness of at least 0.029 in. (0.74 mm). Seamless annealed nickel copper, copper-nickel, or copper tubing must be used. The flexible section (necessary to allow vibrational motion of the generator set during operation) must be U.S.C.G. TYPE A HOSE, marked and tagged according to Regulations. Metallic line must be supported within 4 in. (102 mm) of its connection to the flexible section. See Figure 6-8 for fuel pump inlet connection.



1. 1/4 in. NPT Female
Pipe Thread

2. Electric Fuel Pump
Pipe Thread

Figure 6-8. Fuel Pump Inlet Connection

Any in-line fuel filters or strainers must conform to U.S.C.G. Regulations, must be independently mounted to the craft's structure, and must be accessible for servicing without removing any permanent structures.

NOTE

If a fuel strainer is installed, each fuel filter and strainer must be supported on the engine or boat structure independent from its fuel line connections, unless the fuel filter or strainer is inside a fuel tank.

Fuel Pump Lift Capabilities and Fuel Consumption

Figure 6-9 lists electric fuel pump lift capabilities and fuel line sizes. Figure 6-10 shows generator set fuel consumption rates.

Model	Fuel Pump Max. Lift ft. (m)	Fuel Inlet Size I.D. in. (mm)
3.5CFZ	3 (0.9)	3/8 (9.5)
4CZ	3 (0.9)	3/8 (9.5)
5CFZ	3 (0.9)	3/8 (9.5)
6.5CZ	3 (0.9)	3/8 (9.5)

Figure 6-9. Fuel Pump Lift and Fuel Line Size

Model	Load and GPH (L/hr.)			
	1/4	1/2	3/4	Full
3.5 CFZ	0.42 (1.59)	0.50 (1.89)	0.59 (2.23)	0.68 (2.57)
4CZ	0.48 (1.81)	0.55 (2.08)	0.62 (2.34)	0.68 (2.57)
5CFZ	0.44 (1.67)	0.54 (2.04)	0.66 (2.50)	0.80 (3.03)
6.5CZ	0.53 (2.00)	0.62 (2.34)	0.86 (3.25)	1.02 (3.86)

Figure 6-10. Fuel Consumption

Cooling Systems

General

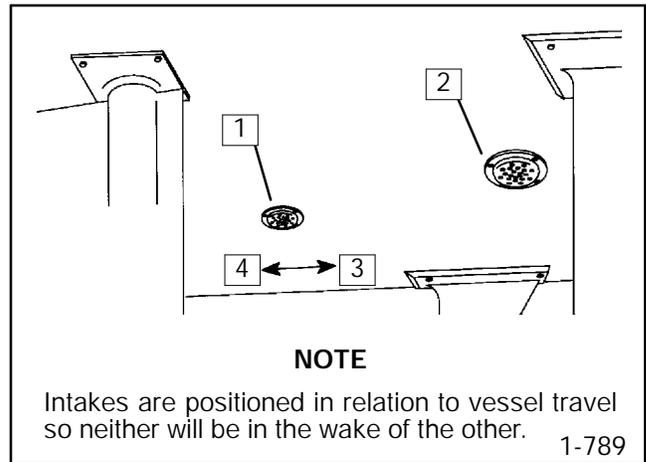
The following features are necessary in the cooling system.

An intake thru-hull strainer (seacock cover) must be screened to prevent entry of foreign objects and must not be aligned (in relation to direction of travel) with the propulsion engine intake. See Figure 6-11. The recommended thru-hull strainer should be flush mounted. Strainers with slotted holes must be installed with their slots parallel to the direction of vessel movement. The area of the strainer opening(s) must be equal to or greater than the inside diameter of the waterline hose to the seawater pump.

An intake thru-hull strainer must not be of the scoop or cup design. This style can cause a ramming effect and force water upward, past the seawater pump, and into the engine cylinders when the vessel is moving and the generator set is shut down. Hull designs incorporating sea chests are also not suitable for intake thru-hull strainers. A sea chest is a concave molded-in-the-hull chamber that is also aligned to the direction of travel. A sea chest configuration applies a positive pressure similar to a scoop-type thru-hull strainer.

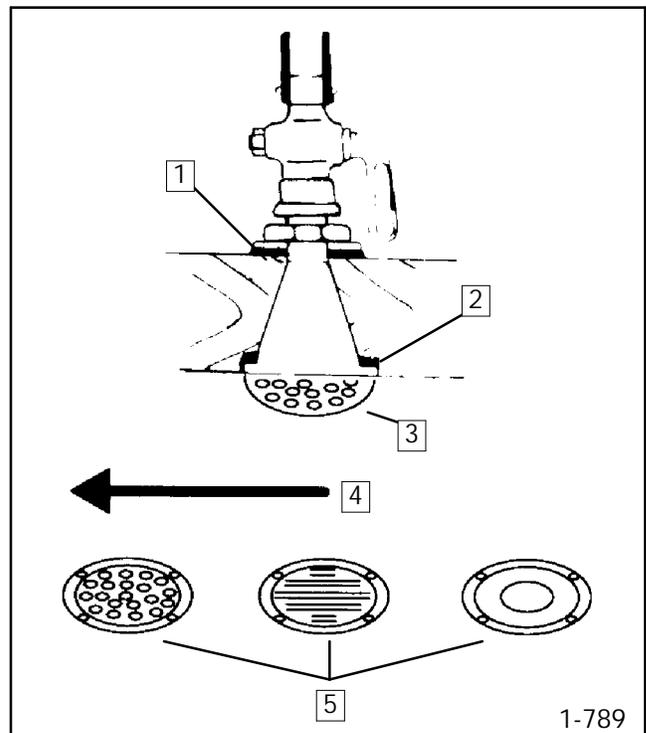
A seacock is to be mounted to hull, assembled onto the intake and accessible for operation. Figure 6-12 shows a typical installation. Install the canvas on the outside of the hull, and the canvas or rubber packing on the inside of the hull.

If caulking is used to seal the seacock, be sure not to apply an excessive amount. Excess caulk can cause improper water flow and in some cases develop a barrier which can force water upward, past the seawater pump, and into the engine cylinders when the vessel is moving and generator set is shut down.



- 1. Generator Set Intake
- 2. Propulsion Engine Intake
- 3. Aft Intake
- 4. Fore Intake

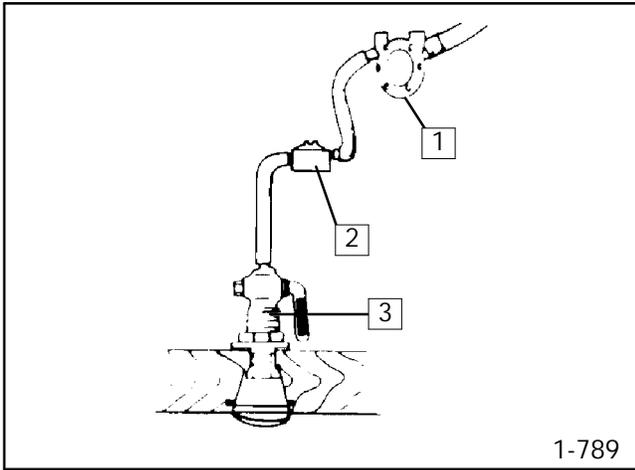
Figure 6-11. Intake Strainer



- 1. Inside Packing
- 2. Outside Packing
- 3. Seacock Cover
- 4. Direction of Vessel Movement
- 5. Typical Intake Thru-Hull Strainers

Figure 6-12. Seacock Installation

A **seawater strainer** of sufficient capacity should be mounted to the seacock or permanent structure at a point not higher than the seawater pump. The strainer should be accessible for servicing. See Figure 6-13 for a typical installation. The optional Kohler seawater strainer is threaded for 1/2 NPT fittings.



- 1. Seawater Pump
- 2. Seawater Strainer
- 3. Seacock

Figure 6-13. Seawater Strainer

NOTE

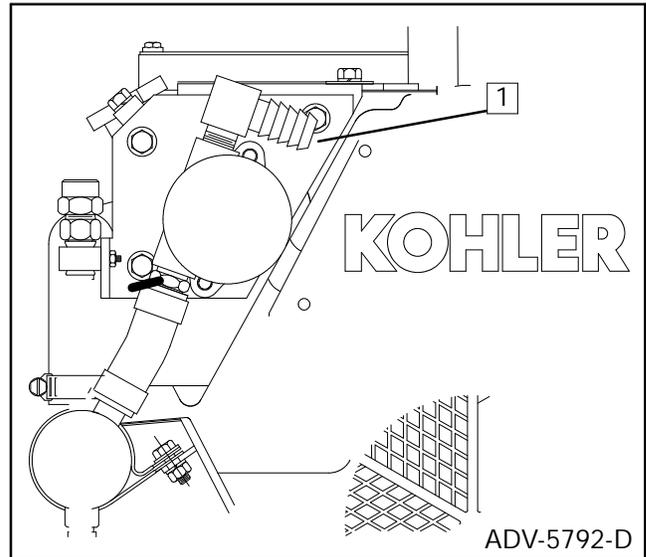
Some seawater strainers include seacock and intake thru-hull strainer.

Waterlines from the seacock to the engine-driven seawater pump can be copper tubing or flexible hose. A flexible section of hose is used for the actual connection to the seawater pump to allow vibrational motion of the generator set during operation. The hose should have an inside diameter of 3/4 in. (19 mm). Copper line should be supported within 4 in. (102 mm) of its connection to the flexible section.

NOTE

A 5/8 in. (16 mm) waterline hose can be substituted for the recommended 3/4 in. waterline hose.

Piping should be kept straight and as short as possible. See Figure 6-14 for the seawater connection to the seawater pump inlet. The seawater outlet is combined with engine exhaust gases. (On sound shielded units, a small section of molded hose is required for the seawater inlet connection.)



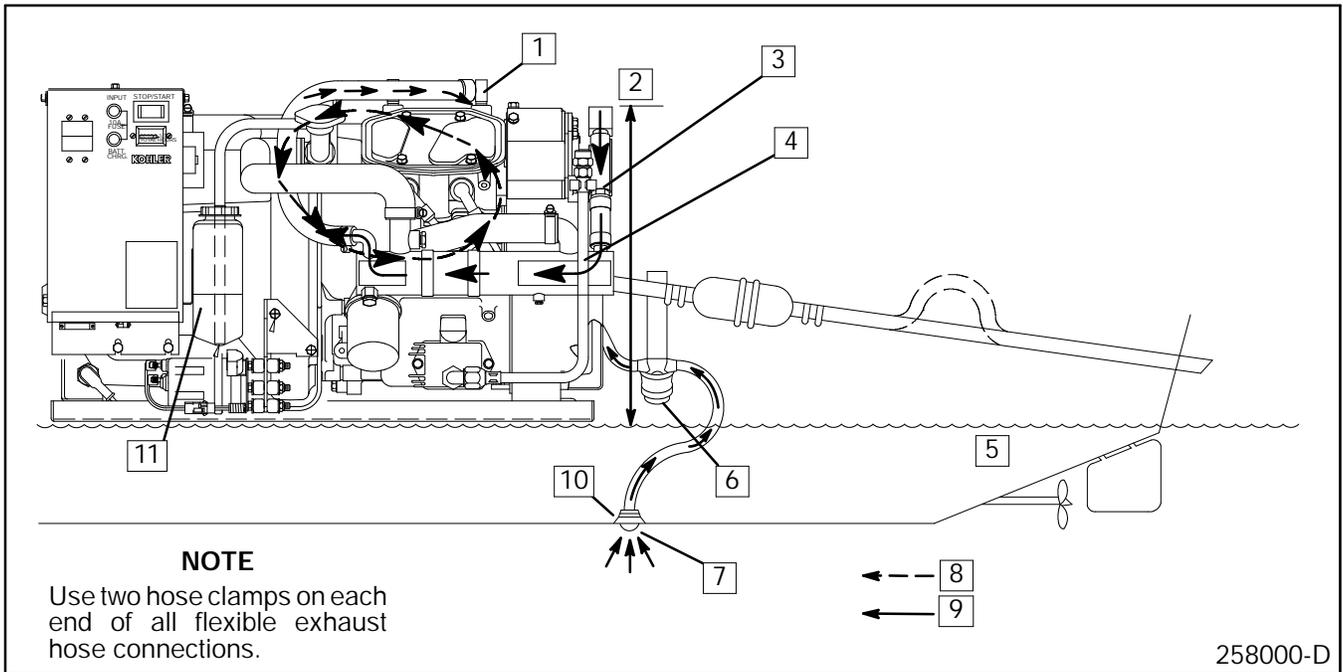
- 1. 3/4 in. Seawater Pump Inlet

Figure 6-14. Seawater Inlet Connection

Closed/Heat Exchanger

A closed, heat exchanger cooling system, the best alternative for most applications especially if craft is to be operated in salt waters or waters with high silt content, is provided as part of the generator set.

Service accessibility must be provided for the heat exchanger pressure cap. See Figure 6-15.



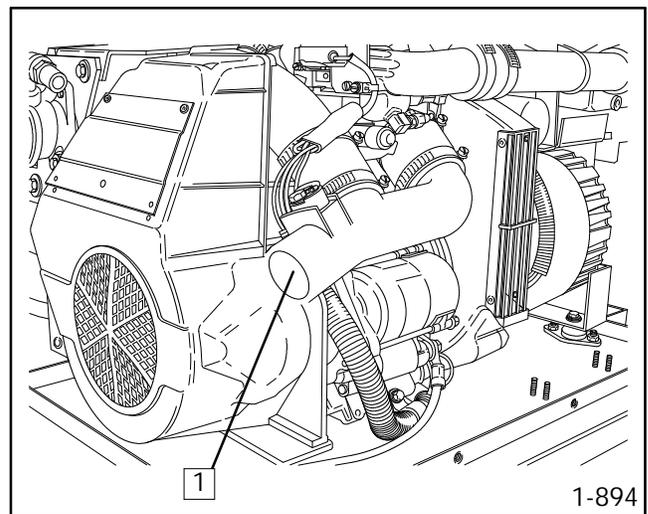
- | | |
|--------------------------------|---------------------------|
| 1. Exhaust Manifold | 6. Seawater Strainer |
| 2. 3 ft. (1 m) Max. | 7. Intake Strainer |
| 3. Engine-Driven Seawater Pump | 8. Engine Coolant |
| 4. Heat Exchanger | 9. Seawater |
| 5. Waterline | 10. Seacock |
| | 11. Coolant Recovery Tank |

Figure 6-15. Closed/Heat Exchanger Cooling System

Exhaust Systems

General

Water-cooled exhaust lines should be used in all marine installations. The hose used for the lines should have a 2 in. (51 mm) inside diameter. Keep the lines as short and straight as possible. The use of two hose clamps on each end of flexible exhaust hose connections is highly recommended. ABYC Safety Standards P-1.6.c recommend a pitch of at least 1/2 in. (12.8 mm) per running foot (30.5 cm). Use flexible steam hose conforming to UL Standard 1129 for "Engine wet exhaust components" between the mixing elbow and the exhaust outlet. A silencer should be independently mounted to eliminate any stress on the exhaust system and exhaust manifold/mixer elbow. See Figure 6-16 for the exhaust connection to the mixer elbow.



1. Seawater/Exhaust Outlet

Figure 6-16. Mixer Elbow/Exhaust Connection

Locate the exhaust outlet at least 4 in. (10 cm) above the waterline when the craft is loaded to maximum capacity. Usually a flapper is installed at exhaust (transom) outlet to prevent water backup in following seas or when going astern (backward).

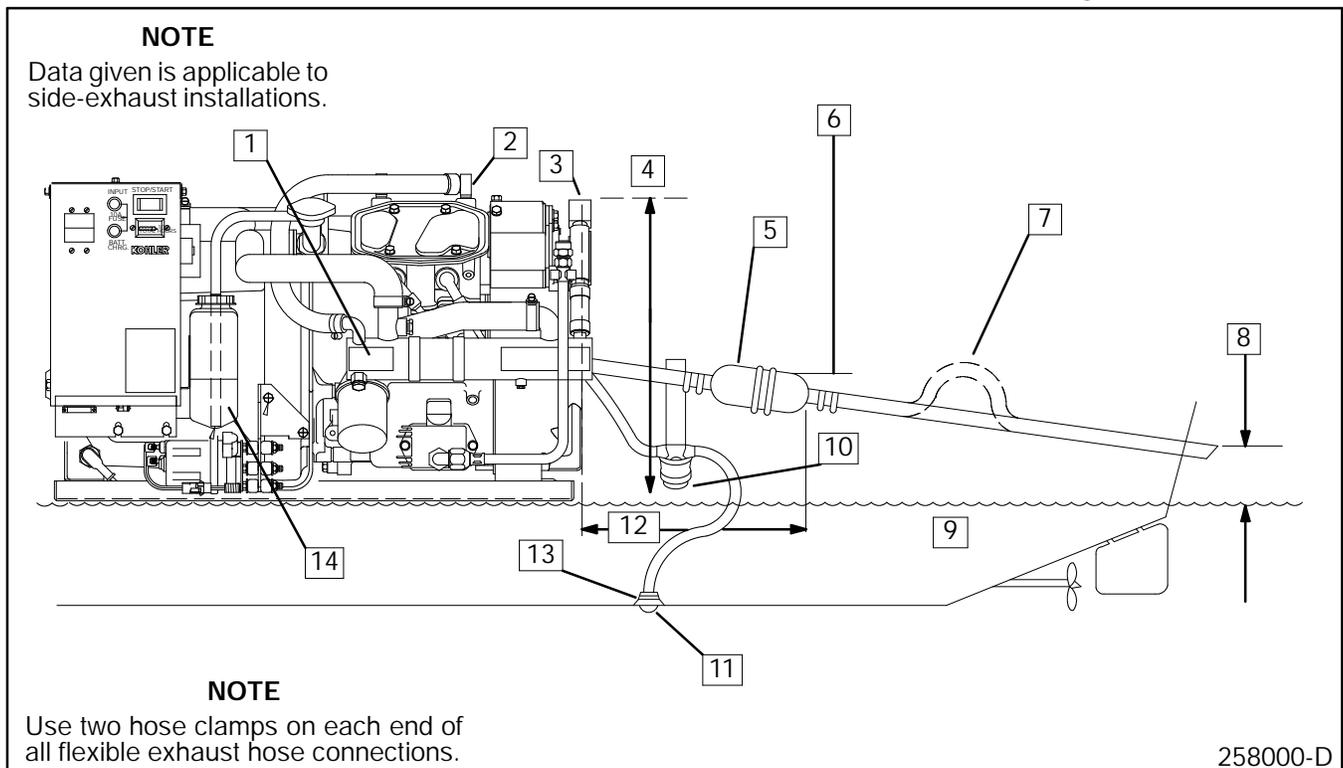
Carbon monoxide can cause severe nausea, fainting, or death. Use the following precautions when installing and operating generator set. Carbon monoxide is particularly threatening in that it is an odorless, colorless, tasteless, nonirritating gas. Be especially careful if operating the generator when moored or anchored under calm conditions as gases may accumulate. If operating the set dockside, moor your craft so that the exhaust discharges on the lee side (the side sheltered from the wind), and always be mindful of others— make sure your exhaust is directed away from other boats and occupied buildings. Do not install exhaust outlet where exhaust can be drawn through portholes, vents, or air conditioners. If generator set's exhaust discharge hole is near to your craft's waterline, **DO NOT OVERLOAD CRAFT** so as to close or restrict exhaust discharge hole.

⚠ WARNING



Carbon monoxide.
Can cause severe nausea, fainting, or death.

The exhaust system must be leakproof and routinely inspected.



- | | |
|---|--|
| <ul style="list-style-type: none"> 1. Heat Exchanger 2. Exhaust Manifold 3. Engine-Driven Seawater Pump 4. 3 ft. (1 m) Max. Lift of Seawater Pump 5. Silencer (Customer Supplied) 6. Exhaust Hose Slope 0.5 in. (1.3 cm) per ft. (30.5 cm) 7. Slight Lift Improves Silencing (Keep Below Level of Exhaust Manifold Outlet) | <ul style="list-style-type: none"> 8. 4 in. (10 cm) Min. of Exhaust Line Above Waterline 9. Waterline 10. Seawater Strainer 11. Intake Strainer 12. 10 ft. (3 m) Max. Between Exhaust Outlet and Silencer 13. Seacock 14. Coolant Recovery Tank |
|---|--|

Figure 6-17. Typical Above Waterline Installation

Exhaust system guidelines for various generator set locations follow. Where exhaust lines would require passage through bulkheads, it may be more practical to use port (left) or starboard (right) side exhaust outlets. This would be especially true where long exhaust lines to the transom (rear) could cause excessive back

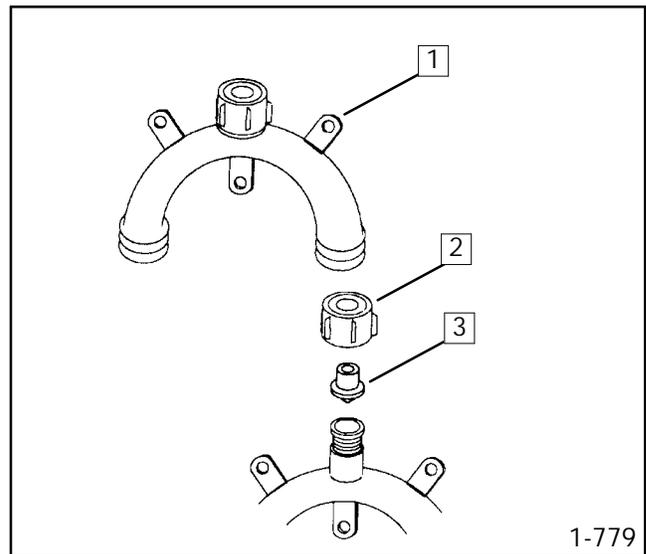
pressure. Information and illustrations of stern (rear) exhaust installations also apply to side exhaust installations. Should any information regarding installation conflict with U.S.C.G. Regulations, appropriate Regulations should be followed.

Above Waterline

In addition to considerations described earlier, a customer-supplied silencer should be installed with its outlet at a maximum of 10 horizontal ft. (3 m) from the center of the engine's exhaust outlet (see Figure 6-17). A typical silencer should be mounted with the inlet and outlet level and with the drain plug down. The silencer may require two supporting brackets or hanger straps for installation to stringers or other suitable structure. Any "lift" in the exhaust line to improve silencing must be below the engine exhaust manifold outlet.

Mid/Below Waterline

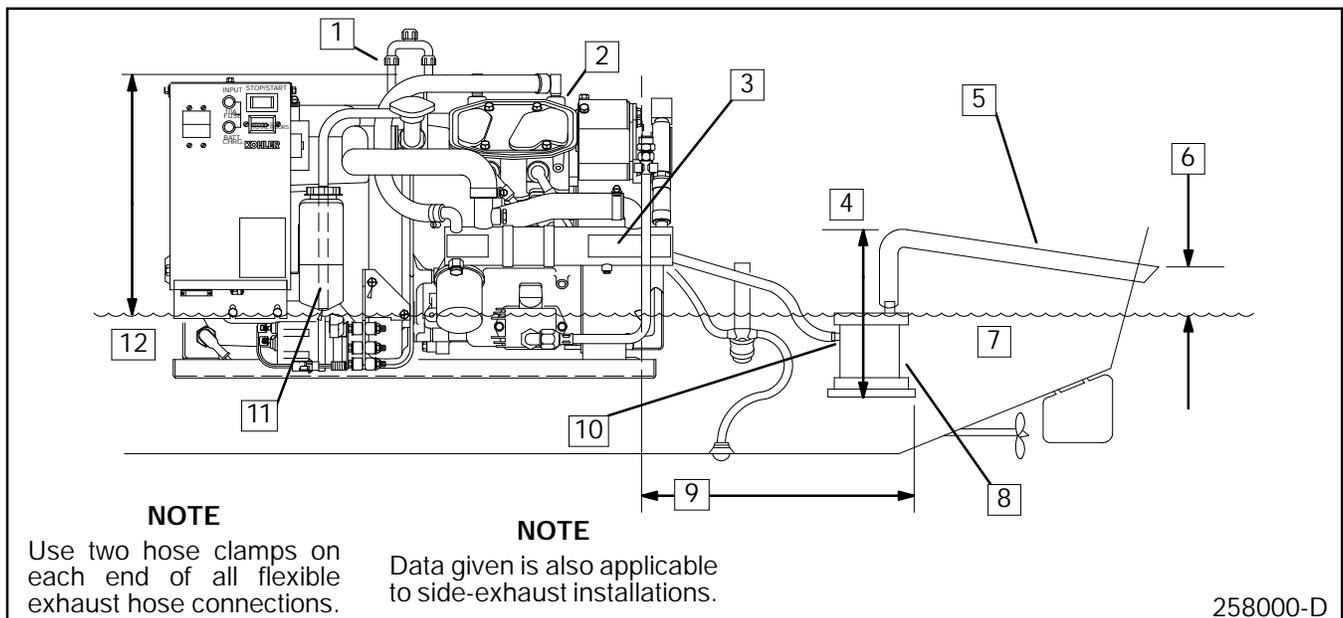
U.S.C.G. Regulations require that an anti-siphoning provision be used to prevent raw water entry into the engine if the exhaust manifold outlet is located less than 9 in. (23 cm) above the waterline when the craft is loaded to maximum capacity. Install a siphon break, see Figure 6-18, at least 1 ft. (31 cm) above waterline as shown in Figure 6-19.



1. Mounting Base
2. Retaining Cap
3. Reed Valve Assembly

Figure 6-18. Siphon Break Components

The siphon break must be located at least 1 foot above the waterline at maximum vessel capacity between the heat exchanger and water elbow (three-way fittings). The siphon break and fitting must be supported to maintain proper position and function. The siphon break should be mounted directly vertical of its connection to generator set where possible. Otherwise, a slight offset is allowable to clear stringers or other permanent structures.



NOTE

Use two hose clamps on each end of all flexible exhaust hose connections.

NOTE

Data given is also applicable to side-exhaust installations.

258000-D

- | | |
|--|-------------------------------------|
| 1. Siphon Break | 5. Waterline |
| 2. Exhaust Manifold | 6. Silencer (Customer Supplied) |
| 3. Heat Exchanger | 7. 10 ft. (3 m) Max. |
| 4. 4 ft. (1.2 m) Max. | 8. Install Optional Water Lock Here |
| 5. Exhaust Hose Slope 0.5 in. (1.3 cm) per ft. (30.5 cm) | 9. Coolant Recovery Tank |
| 6. 4 in. (10 cm) Min. | 10. 1 ft. (30.5 cm) Min. |

Figure 6-19. Typical Mid and Below Waterline Installation

A typical silencer should be mounted no more than 4 ft. (1.2 m) below the highest point in the exhaust line. Attach a separate wood mounting base to hull stringers or other suitable structure. Then secure the silencer to hull using silencer manufacturer's recommendation. Be sure the silencer outlet is not more than 10 horizontal ft. (3 m) from the engine exhaust manifold outlet. UL marine exhaust hose should be used.

Electrical Systems

AC Voltage Connections

⚠ WARNING

<p>Explosion. Gasoline vapors can cause explosion and severe injury or death.</p> <p>Before starting generator set, operate blower 4 minutes and check engine compartment for gasoline vapors.</p>

Explosive fuel vapors can cause severe injury or death. Gasoline vapors can explode and can cause death or severe injury. USCG Regulation 33CFR183 requires all electrical devices (ship-to-shore transfer switch, remote start panel, etc.) to be "ignition protected" when used in a gasoline (gaseous)-fueled environment. These electrical devices are not "ignition protected" and are not certified to operate in a gasoline (gaseous)-fueled environment such as engine room or near fuel tanks. Acceptable locations would be wheelhouse or other living areas sheltered from rain and water splash.

⚠ WARNING	
	
<p>Hazardous voltage. Can cause severe injury or death.</p>	<p>Moving rotor.</p>
<p>Do not operate generator set without all guards and electrical enclosures in place.</p>	

Hazardous "backfeed" voltage can cause severe injury or death. Do not connect to any building/marina electrical system without connecting through an approved device and after building main switch is open. Backfeed connections can cause serious injury or death to utility personnel working to repair a power outage and/or personnel in the vicinity. Unauthorized connection may be unlawful in some states and/or localities. A ship-to-shore transfer switch must be installed to prevent interconnection of generator set power and shore power.

AC connections to generator set are made inside the controller box. The generator set is usually connected to a ship-to-shore transfer switch which allows the use of shore/utility power when docked or generator set power when docked or at sea. The wiring is then connected to a main circuit breaker box (panelboard) which distributes branch circuits throughout the craft. See Section 5. Wiring Diagrams for reconnectability of generator set.

Installation in Steel or Aluminum Vessels

Installation of a generator set in a vessel constructed of a material capable of conducting current (e.g.: steel or aluminum) is subject to considerations not normally encountered in fiberglass or wood vessels. These differences include equipment grounding, grounding of neutral conductors, ground fault protection, and isolation of galvanic currents.

While the scope of these topics is too extensive to be fully discussed here, references to the appropriate governing bodies will be identified for further investigation.

The information provided here is intended to serve as a guideline to boat manufacturers and generator set installers. This information is not intended or implied to be limited to these sources and is subject to revision by the appropriate governing bodies.

Prior to installing the generator set, check the wiring diagrams to become familiar with the electrical system.

Generator sets installed in pleasure craft are governed by the U.S. Coast Guard and the American Boat and Yacht Council, Inc. Compliance with U.S. Coast Guard Regulations given in Title 33, Part 183 must be followed. Generator sets installed in pleasure craft require a grounded neutral system as specified in ABYC E-8.4.b. Various wiring configurations are illustrated in ABYC Standards E-8.22 through E-8.29. Grounding of appliances and equipment is covered in ABYC E-8.12. Galvanic corrosion prevention by means of galvanic

isolator or isolation transformer is referenced in ABYC E-8.20 and ABYC E-8.11.

Generator sets installed in commercial vessels are governed by U.S. Coast Guard Regulations, Title 46, the American Bureau of Shipping, and Lloyd's Register of Shipping. Grounding of equipment is covered in ABS 35.9.6 and Lloyd's Part 6, Chapter 2-1, Section 1.3. The types of permissible neutral grounding of generating equipment are referenced in ABS 35.125 and 35.95.1 and in Lloyd's Part 6, Chapter 2-1, Section 14.4. Ground fault protection information can be found in Lloyd's Part 6, Chapter 2-1, Section 14.5 and Part 6, Chapter 2-2, Section 13.6.

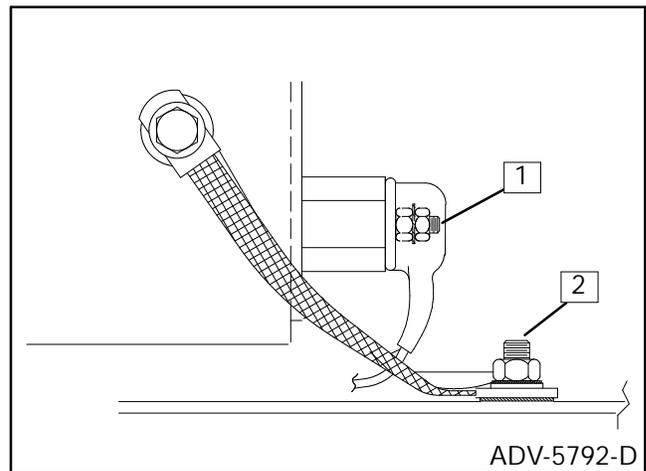
Battery

Batteries and their installation must conform to U.S.C.G. Regulations 183.420 (a) through (g). Generator sets should use batteries separate from the propulsion engines whenever possible. Both the generator set and the propulsion engines' starting/charging systems must have a common negative (-) ground.

U.S.C.G Regulation 183.415, Grounding, requires a common conductor to be connected to each grounded cranking motor circuit. This conductor should be sized to match the larger of the engines' two battery cables. (Cable sizes for generator set battery connections are given in Figure 6-20.) This requirement prevents the starting motor current from using alternative electrical paths should the cranking motor ground circuit be restricted or open due to oxidation or loose hardware. These alternative electrical paths include metallic fuel lines which can pose a fire hazard. See Figure 6-21 for battery connections to generator set.

Distance Between Generator Set and Battery	Cable Size (AWG)		
	At 0° F (-18° C)	At 32° F (0° C)	At 75° F (24° C)
40 ft. (12.2 m)	00	0	1
30 ft. (9.1 m)	0	1	2
25 ft. (7.6 m)	1	2	4
20 ft. (6.1 m)	2	2	6
15 ft. (4.6 m)	2	4	6
10 ft. (3.0 m)	4	6	8
5 ft. (1.5 m)	6	6	8
2.5 ft. (0.8 m)	8	8	8

Figure 6-20. Battery Cable Sizes



1. Battery Positive (+) Connection
2. Battery Negative (-) Connection

Figure 6-21. Battery Connection Bracket

Wiring

All wiring must be stranded copper. Wire gauges and insulation, conductor temperature ratings, sheath stripping, conductor support and protection, conductor terminals and splices, and overcurrent protection (circuit breakers, fuses) must conform to U.S.C.G. Regulations 183.425 through 183.460. Use rubber grommets and cable ties, as necessary, to protect and secure wiring from sharp objects, exhaust system, and any moving parts.

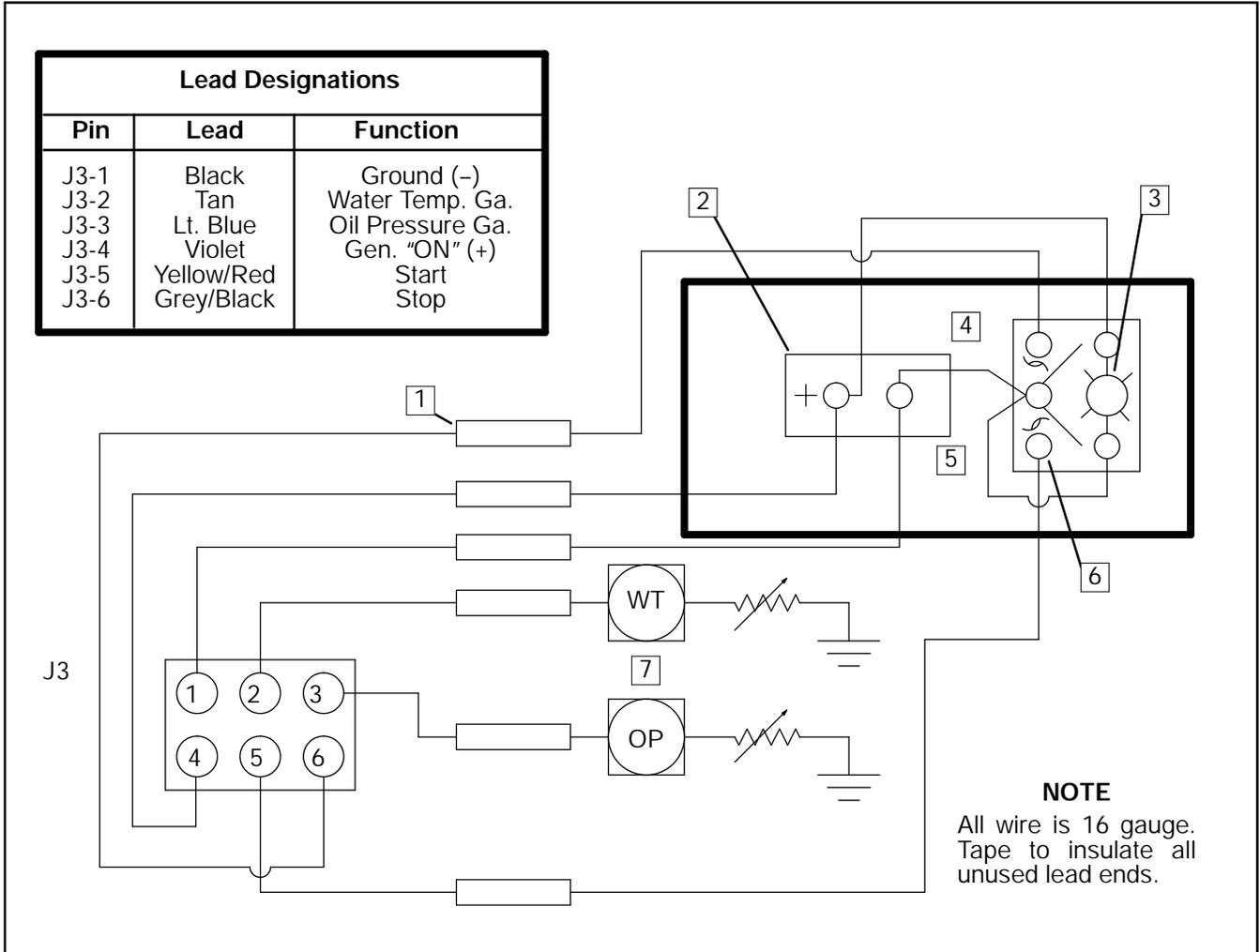
Remote Start Switch Connection

elects to use just a start-stop switch or separate lights and hourmeter. See Figure 6-22.

Kohler offers several remote panels for connection to the generator set. See Accessories for further detailed description. A wiring harness with a connector keyed to the controller box connector is available to connect these panels to the generator set. The other end of this harness has pigtails which can be used if the installer

NOTE

If gauges are to be used, there must also be generator set senders. Senders are optional on these generator sets. Gauges and senders are available as service items from an authorized Kohler service dealer/distributor.



- 1. Use Insulink or Solder Connection (Tape to Insulate)
- 2. Hourmeter
- 3. "ON" Light
- 4. Stop
- 5. Start
- 6. Rocker Switch
- 7. Gauges Senders

Figure 6-22. Remote Control Panel Wiring

Section 7. Installation Drawings

ADV-5792-D
Sheet 1

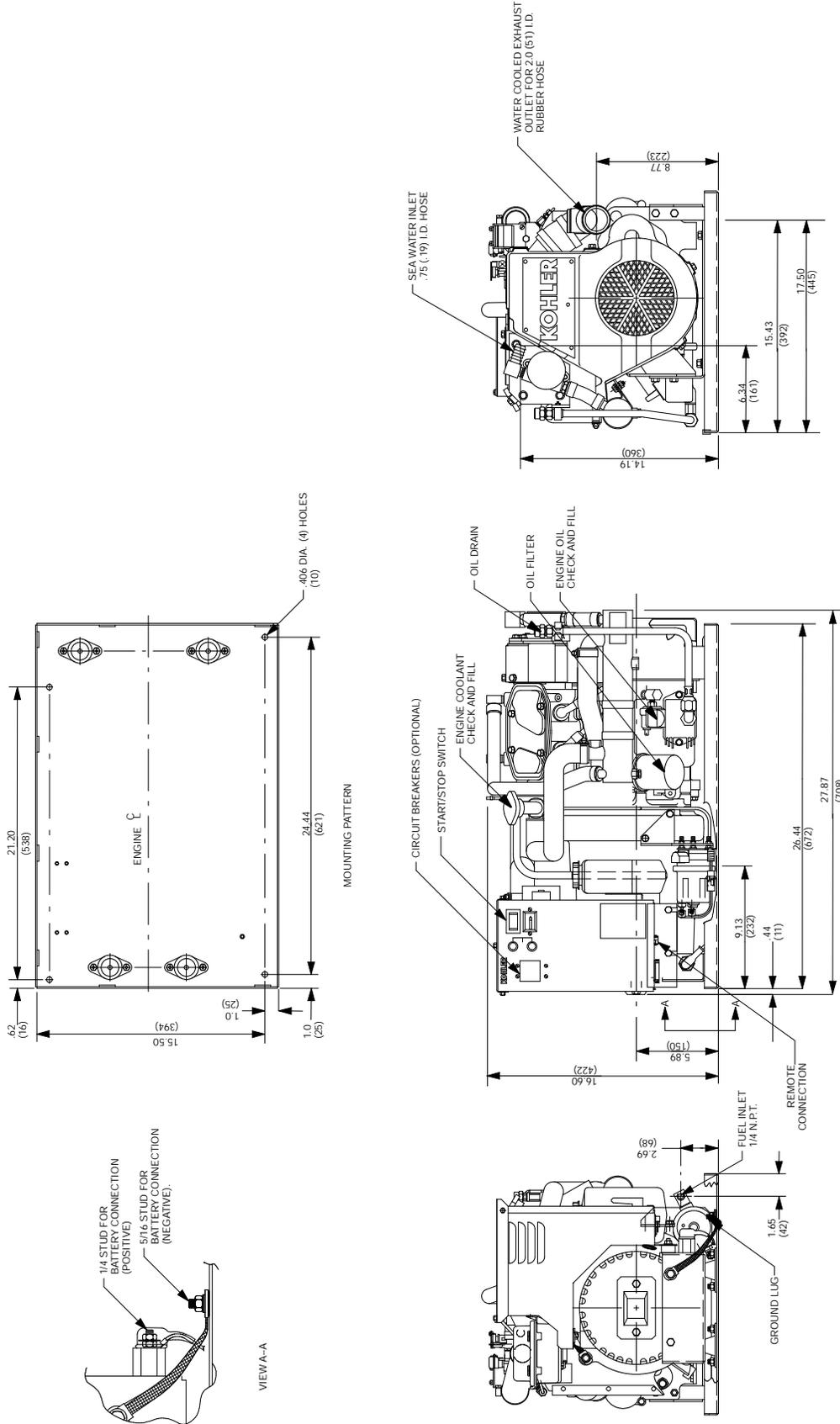


Figure 7-1. Dimension Drawing-3.5CFZ, 4CZ, 5CFZ, and 6.5CZ

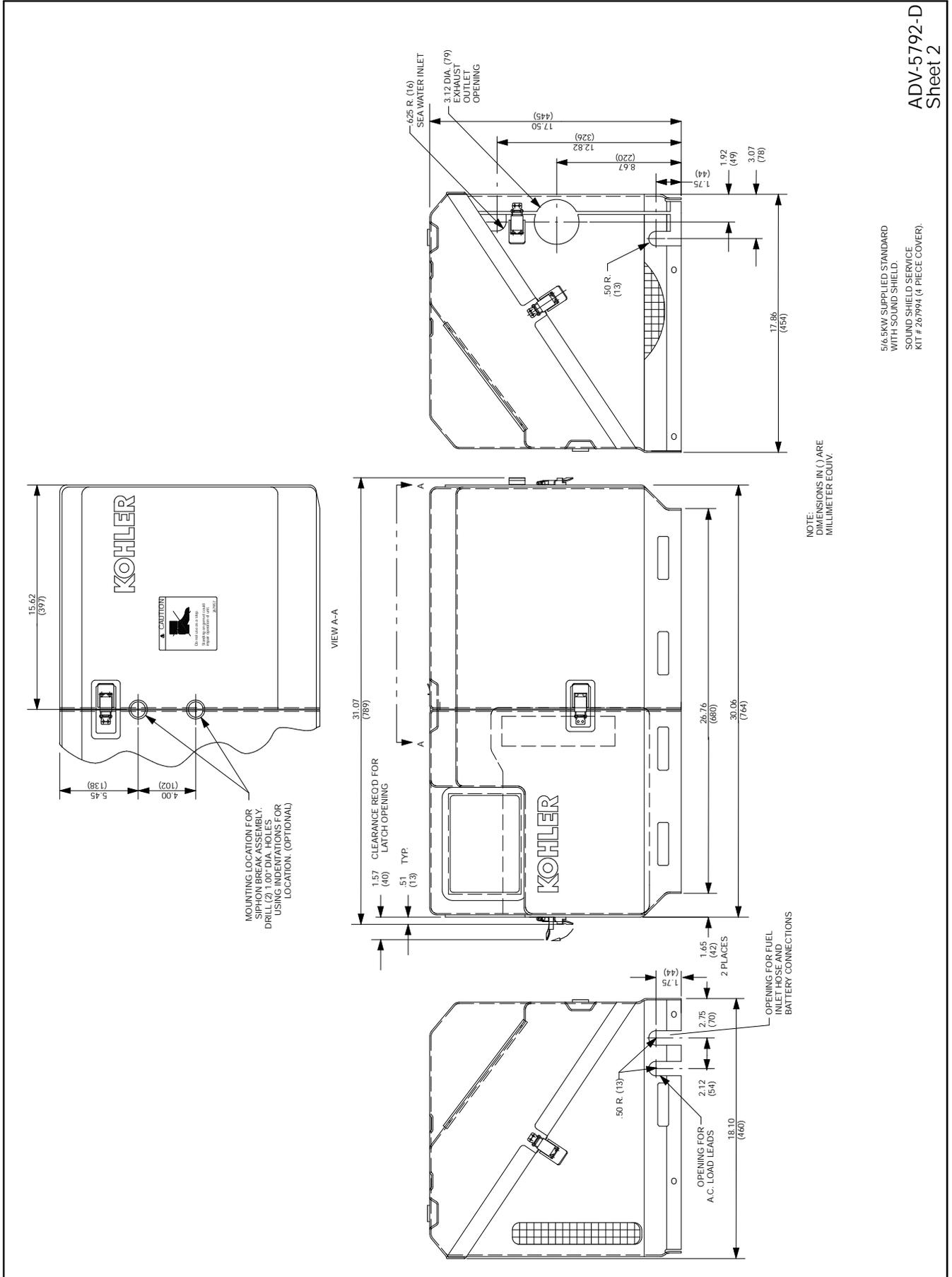


Figure 7-2. Sound Shield-Optional on 3.5CFZ and 4CZ; Standard on 5CFZ and 6.5CZ

Section 8. Parts Ordering Instructions

For service or information, check the yellow pages of the telephone directory under the heading GENERATORS-ELECTRIC or contact the local marina for the authorized Kohler service dealer/distributor in the area.

KOHLER CO. KOHLER, WISCONSIN 53044
PHONE 414-565-3381
FAX 414-459-1646 (North American Sales),
414-459-1614 (International)
FOR SALES & SERVICE IN U.S.A. & CANADA PHONE
1-800-544-2444

A major service manual and parts catalog may be ordered through an authorized Kohler service dealer/distributor. When ordering, state MODEL and

SPEC. numbers from the Generator Nameplate. (See NO TAG.)

In any communications regarding this generator set, please report the MODEL, SPEC. and SERIAL numbers as found on the nameplate attached to the generator and engine. Enter numbers in spaces provided below. This information will enable the authorized Kohler service dealer/distributor to supply the correct part or data for this particular model.

Model No.

Specification No.

Serial No.

Engine No.

TP-5695 12/93

PRINTED IN U.S.A.

KOHLER® POWER SYSTEMS

KOHLER CO. KOHLER, WISCONSIN 53044

PHONE 414-565-3381

FAX 414-459-1646 (North American Sales), 414-459-1614 (International)

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