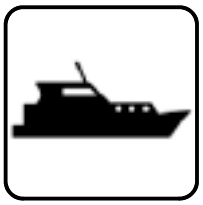
Operation

Marine Generator Sets



Models:

3.5EFOZ/4EOZ

ISO 9001
KOHLER GENERATORS
INTERNATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-6134 11/01

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.

Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Generator Set Identification Numbers

Record the product identification numbers from the generator set nameplate(s).

Model Designation _____

Specification Number _____

Serial Number _____

Accessory Number	Accessory Description

Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

x:in:007:001

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IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that ***will cause severe personal injury, death***, or ***substantial property damage***.

WARNING

Warning indicates the presence of a hazard that ***can cause severe personal injury, death,*** or ***substantial property damage***.

CAUTION

Caution indicates the presence of a hazard that ***will*** or ***can cause minor personal injury*** or ***property damage***.

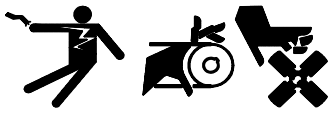
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set on/off button to shut down the generator set. All indicator lamps dim. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

Battery

WARNING

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

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Engine Backfire/Flash Fire

⚠ WARNING

Fire.
Can cause severe injury or death.

Do not smoke or permit flames or sparks near fuels or the fuel system.

Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

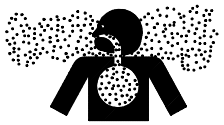
Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner/silencer removed.

Combustible materials. A sudden flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the fuel system. Keep the compartment and the generator set clean and free of debris to minimize the risk of fire. Wipe up spilled fuels and engine oil.

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System

⚠ WARNING



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

The exhaust system must be leakproof and routinely inspected.

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Copper tubing exhaust systems. Carbon monoxide can cause severe nausea, fainting, or death. Do not use copper tubing in diesel exhaust systems. Sulfur in diesel exhaust causes rapid deterioration of copper tubing exhaust systems, resulting in exhaust/water leakage.

Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. For the safety of the craft's occupants, install a carbon monoxide detector. Consult the boat builder or dealer for approved detector location and installation. Inspect the detector before each generator set use. In addition to routine exhaust system inspection, test the carbon monoxide detector per the manufacturer's instructions and keep the detector operational at all times.

Operating the generator set. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Use the following precautions when installing and operating the generator set. Do not install the exhaust outlet where exhaust can be drawn in through portholes, vents, or air conditioners. If the generator set exhaust discharge outlet is near the waterline, water could enter the exhaust discharge outlet and close or restrict the flow of exhaust. Never operate the generator set without a functioning carbon monoxide detector. Be especially careful if operating the generator set when moored or anchored under calm conditions because gases may accumulate. If operating the generator set dockside, moor the craft so that the exhaust discharges on the lee side (the side sheltered from the wind). Always be aware of others, making sure your exhaust is directed away from other boats and buildings. Avoid overloading the craft.

Fuel System

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.

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

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels 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 because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

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

Installing the fuel system. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Do not modify the tank or the propulsion engine fuel system. Equip the craft with a tank that allows one of the two pickup arrangements described in the installation section. The tank and installation must conform to USCG Regulations.

Pipe sealant. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Use pipe sealant on all threaded fittings to prevent fuel leakage. Use pipe sealant that resists gasoline, grease, lubrication oil, common bilge solvents, salt deposits, and water.

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

Hazardous Noise

⚠ CAUTION

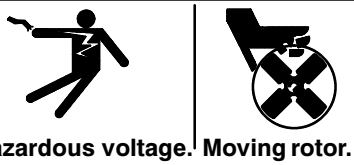
Hazardous noise.
Can cause hearing loss.

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

Engine noise. Hazardous noise can cause hearing loss. Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

Hazardous Voltage/ Electrical Shock

⚠ WARNING



Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Disconnecting the electrical load. Hazardous voltage can cause severe injury or death. Disconnect the generator set from the load by opening the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage. Do not use the safeguard circuit breaker in place of the line circuit breaker. The safeguard circuit breaker does not disconnect the generator set from the load.

Short circuits. Hazardous voltage/current 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 making adjustments or repairs. Remove all jewelry before servicing the equipment.

Handling the capacitor. Hazardous voltage can cause severe injury or death. Electrical shock results from touching the charged capacitor terminals. Discharge the capacitor by shorting the terminals together.
(Capacitor-excited models only)

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Connect the generator set to the building/marina electrical system only through an approved device and after the building/marina main switch is opened. Backfeed connections can cause severe injury or death to utility personnel working on power lines and/or personnel near the work area. Some states and localities prohibit unauthorized connection to the utility electrical system. Install a ship-to-shore transfer switch to prevent interconnection of the generator set power and shore power.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically.
(600 volts and under)

Hot Parts

⚠ WARNING

Hot engine and exhaust system.
Can cause severe injury or death.

Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

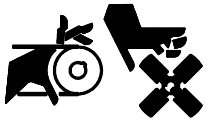
Moving Parts

⚠ WARNING

Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

Operate the generator set only when all guards, screens, and covers are in place.

⚠ WARNING

Airborne particles.
Can cause severe injury or blindness.

Wear protective goggles and clothing when using power tools, hand tools, or compressed air.

Tightening the hardware. Flying projectiles can cause severe injury or death. Loose hardware can cause the hardware or pulley to release from the generator set engine and can cause personal injury. Retorque all crankshaft and rotor hardware after servicing. Do not loosen the crankshaft hardware or rotor thrubolt when making adjustments or servicing the generator set. Rotate the crankshaft manually in a clockwise direction only. Turning the crankshaft bolt or rotor thrubolt counterclockwise can loosen the hardware.

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

Sound shield removal. Exposed moving parts can cause severe injury or death. The generator set must be operating in order to perform some scheduled maintenance procedures. Be especially careful if the sound shield has been removed, leaving the belts and pulleys exposed.
(Sound-shield-equipped models only)

Notice

NOTICE

This generator set has been rewired from its nameplate voltage to

246242

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

NOTICE

Hardware damage. The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

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

NOTICE

Fuse replacement. Replace fuses with fuses of the same ampere rating and type (for example: 3AB or 314, ceramic). Do not substitute clear glass-type fuses for ceramic fuses. Refer to the wiring diagram when the ampere rating is unknown or questionable.

NOTICE

Saltwater damage. Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

Notes

Introduction

This manual provides operation instructions for 3.5EFOZ/4EOZ model generator sets.

Refer to the engine operation manual for generator set engine scheduled maintenance information.

This manual may be used for models not listed on the front cover.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect the parts often and perform required service at the prescribed intervals. Obtain service from an authorized service distributor/dealer to keep equipment in top condition.

Before installing a marine generator set, obtain the most current installation manual from your local distributor/dealer. Only qualified persons should install the generator set.

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Service Assistance

Please contact a local authorized distributor/dealer for sales, service, or other information about Kohler Co. Generator Division products.

- Look on the product or in the information included with the product
- Consult the Yellow Pages under the heading Generators—Electric
- Visit the Kohler Co. Generator Division web site at www.kohlergenerators.com
- Inside the U.S.A. and Canada, call 1-800-544-2444
- Outside the U.S.A. and Canada, call the nearest regional office

Africa, Europe, Middle East
London Regional Office
Langley, Slough, England
Phone: (44) 1753-580-771
Fax: (44) 1753-580-036

Australia
Australia Regional Office
Queensland, Australia
Phone: (617) 3893-0061
Fax: (617) 3893-0072

China
China Regional Office
Shanghai, People's Republic of China
Phone: (86) 21-6482 1252
Fax: (86) 21-6482 1255

India, Bangladesh, Sri Lanka
India Regional Office
Bangalore, India
Phone: (91) 80-2284270
(91) 80-2284279
Fax: (91) 80-2284286

Japan
Japan Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Latin America
Latin America Regional Office
Lakeland, Florida, U.S.A.
Phone: (941) 619-7568
Fax: (941) 701-7131

South East Asia
Singapore Regional Office
Singapore, Republic of Singapore
Phone: (65) 264-6422
Fax: (65) 264-6455

X:in:008:001

Maintenance and Service Parts/Related Literature

Maintenance and Service Parts

Figure 1 identifies maintenance and service parts for your generator set. Obtain a complete list of maintenance and service parts from your authorized generator distributor/dealer.

Part Description	Models	
	3.5EFOZ	4EOZ
Air Filter Element	GM20848	
Battery Charging Fuse, 10 A	GM20849	
Fuel Filter	GM20850	
Input Fuse, 25 A	GM20851	
Seawater Pump Impeller Kit	GM20852	
Spray Paint (White)	221335	
Touch-Up Paint (White)	GM19490	
Zinc Anode	GM20853	

Figure 1 Maintenance and Service Parts

x:in:001:004

List of Related Literature

Figure 2 identifies related literature available for the generator sets covered in this manual. Only trained and qualified personnel should install or service the generator set.

Literature Type	Models	
	3.5EFOZ	4EOZ
Installation Manual	TP-6069	
Operation Manual	TP-6134	
Operation Manual (Engine)	TP-6143	
Parts Catalog*	TP-6138	
Service Manual (Engine)	TP-6163	
Service Manual (Generator)	TP-6137	
* Includes the generator and engine information.		

Figure 2 Generator Set Literature

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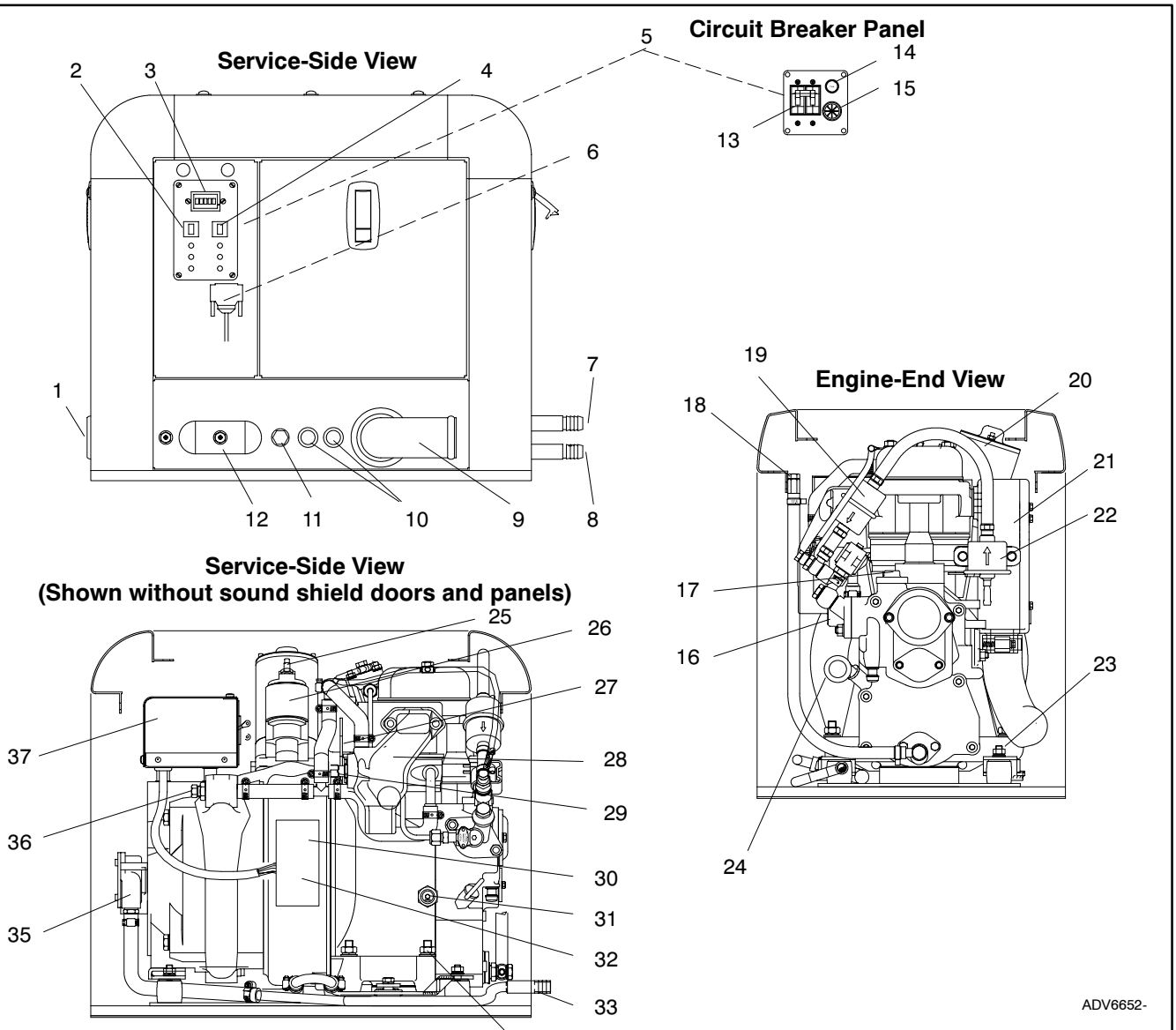


1. Cooling air inlet
2. On/off button
3. Hourmeter
4. Start button
5. Circuit breaker panel
6. Remote panel connector
7. Fuel inlet
8. Fuel return
9. Water outlet/exhaust outlet
10. Siphon break connection
11. Customer load lead access
12. Remote panel harness access
13. AC circuit breaker
14. Input fuse
15. Customer load lead access connection
16. Fuel injection pump
17. Oil fill
18. Oil drain valve and hose
19. Fuel filter
20. High engine water temperature safety shutdown switch
21. Air cleaner
22. Fuel feed pump
23. Battery connection (-)
24. Oil check
25. Battery connection (+)
26. Starter solenoid/starter motor
27. Lifting eye
28. Mixing elbow
29. High exhaust temperature safety shutdown switch
30. Nameplate
31. Low oil pressure safety shutdown switch
32. Control panel connector
33. Seawater inlet
34. Ground lug (equipment ground)
35. Seawater pump (water inlet)
36. Zinc plug
37. Controller

Figure 1-1 Service Views, Typical

Note: Consult an authorized distributor/dealer or the service manual for items not shown.

Notes

2.1 Prestart Checklist

To ensure continued satisfactory operation perform the following checks or inspections before or at each startup, as designated, and at the intervals specified in the service schedule. In addition, some checks require verification after the unit starts.

Air Cleaner. Check for a clean and installed air cleaner element to prevent unfiltered air from entering the engine.

Air Inlets. Check for clean and unobstructed air inlets.

Air Shrouding. Check for securely installed and positioned air shrouding.

Battery. Check for tight battery connections. Consult the battery manufacturer's instructions regarding battery care and maintenance.

Exhaust System. Check for exhaust leaks and blockages. Check the silencer and piping condition and check for tight exhaust system connections.

Inspect the exhaust system components (exhaust manifold, mixing elbow, exhaust line, hose clamps, silencer, and outlet flapper) for cracks, leaks, and corrosion.

- Check the hoses for softness, cracks, leaks, or dents. Replace the hoses as needed.
- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps. Tighten or replace the hose clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Visually inspect for exhaust leaks *(blowby)*. Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.
- Ensure that the carbon monoxide detector(s) is (1) in the craft, (2) functional, and (3) energized whenever the generator set operates.

Note: Never operate the generator set without a functioning carbon monoxide detector.

Fuel Level. Check the fuel level and keep the tank(s) full to ensure adequate fuel supply.

Oil Level. Maintain the oil level at or near, not over, the full mark on the dipstick.

Operating Area. Check for obstructions that could block the flow of cooling air. Keep the air intake area clean. Do not leave rags, tools, or debris on or near the generator set.

Seawater Pump Priming. Prime the seawater pump before initial startup. To prime the pump: (1) close the seacock, (2) remove the hose from the water-filter outlet, (3) fill the hose and seawater pump with clean water, (4) reconnect the hose to the water filter outlet, and (5) open the seacock. Confirm seawater pump operation on startup as indicated by water discharge from the exhaust outlet.

2.2 Marine Inspection

Kohler Co. recommends that all boat owners have their vessels—especially the exhaust system attached to the generator set—inspected at the start of each boating season by the local Coast Guard Auxiliary. If there is no Coast Guard Auxiliary in the area, contact an authorized Kohler distributor/dealer for the inspection.

2.3 Angular Operation

See Figure 2-1 for angular operation limits for units covered in this manual.

Continuous	Intermittent— 3 minutes or less
25°	30°
Maximum value for all directions	

Figure 2-1 Angular Operation

m:op:001:004

2.4 Operation in European Union Member Countries

This generator set is specifically intended and approved for operation below the deck in the engine compartment. Operation above the deck and/or outdoors would constitute a violation of European Union Directive 2000/14/EC noise emission standard.

2.5 Exercising the Generator Set

Operate the generator set under load once each week for one hour with an operator present.

The operator should perform all of the prestart checks before starting the exercise procedure. Start the generator set according to the starting procedure in the controller section of this manual. While the generator set is operating, listen for a smooth-running engine and visually inspect the generator set for fluid or exhaust leaks.

x:op:001:005

2.6 Starting and Stopping Procedure

Note: Opening seacock. Before starting the generator set, open the seacock to allow cooling water passage. Failure to do so could damage the seawater pump impeller and cause serious engine overheating damage.

Note: Transfer switch. Check that the marine ship-to-shore transfer switch, if equipped, is in the ship position.

Note: Close seacock if engine fails to start. If the engine fails to start after the first attempt, close the seacock before the next starting attempt. Failure to close the seacock may cause seawater to enter the exhaust piping, silencer, and/or engine. A water-filled exhaust piping and silencer may further hinder generator starting and cause seawater entry into the engine cylinders through the exhaust valve. Water ingested into the engine may cause major engine damage that the Kohler Co. warranty does not cover.

Note: Close seacock if water enters the exhaust system. If water enters the exhaust system, close the seacock and drain the water from the exhaust system at the silencer's drain plug before attempting to start the generator set. If excessive cranking is a chronic problem, have the unit, including the exhaust system, serviced by an authorized Kohler® distributor/dealer.

Note: Starter motor cooldown. Do not crank the engine continuously for more than 10 seconds at a time. Allow a 60-second cooldown period between cranking attempts if the engine does not start. If the unit fails to start after 3 attempts, contact an authorized Kohler® distributor/ dealer for repair. Failure to follow these guidelines may result in starter motor burnout.

2.6.1 Controls and Indicators

The following table describes the controls and indicators located at the controller.

Name	Description
On/Off Button	Use this button to initiate the start procedure or to stop the generator set. Press the button to the ON position before starting the generator set. Press the button to the OFF position to stop the generator set.
Start Button	Use this button to start the generator set. Press the start button to start the generator set.
Hourmeter	The meter records total generator set operating hours for reference in maintenance scheduling.
AC Circuit Breaker	The circuit breaker trips when a fault occurs in the output circuit. During maintenance of craft or generator set wiring, the circuit breaker disconnects the generator set. Place the circuit breaker(s) in the ON position to close the circuit breaker.
Oil Pressure Lamp	The lamp illuminates if the generator set shuts down because of low oil pressure.
Engine Lamp	The lamp illuminates if the generator set shuts down because of high engine temperature.
Exhaust Lamp	The lamp illuminates if the generator set shuts down because of high exhaust temperature.
Remote Start Connectors	A 4-pin connector on the controller's side allows the connection of the (optional) remote start/stop switch and hourmeter panel kit.
	A 25-pin connector underneath the controller allows the connection of the (optional) remote start/stop switch, hourmeter, and indicator panel kit.

2.6.2 Starting the Generator Set

The following table describes the actions required to start the generator set.

Step	Action
1	**Fuel shutoff valve** Open the manual fuel shutoff valve, if equipped.
2	**Initiate Starting** Press the controller on/off button to the ON position. Note: The controller's oil pressure, engine, and exhaust lamps illuminate.
3	**Starting** Hold the generator set controller start button until the generator set starts.

2.6.3 Stopping the Generator Set

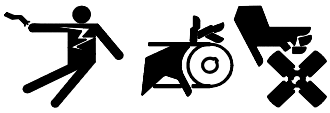
The following table describes the actions required to stop the generator set.

Step	Action
1	**Cooldown** Run the generator set at no load for 5 minutes to ensure adequate engine cooldown.
2	**Stopping** Press the controller on/off button to the OFF position to stop the generator set. Note: The controller's oil pressure, engine, and exhaust lamps darken.
3	**Fuel shutoff valve** Close the manual fuel shutoff valve, if equipped.

Notes

3.1 General Maintenance

⚠ WARNING

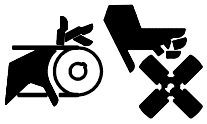


Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set on/off button to shut down the generator set. All indicator lamps dim. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

Operate the generator set only when all guards, screens, and covers are in place.

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

Sound shield removal. Exposed moving parts can cause severe injury or death. The generator set must be operating in order to perform some scheduled maintenance procedures. Be especially careful if the sound shield has been removed, leaving the belts and pulleys exposed.
(Sound-shield-equipped models only)

NOTICE

Saltwater damage. Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

NOTICE

Hardware damage. The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

See the Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set. Have an authorized distributor/dealer perform generator set service.

Engine Service. Perform generator set engine service at the intervals specified by the engine operation manual.

Generator Set Service. Perform generator set service at the intervals specified by the generator set operation manual.

If the generator set operates under dusty or dirty conditions, use *dry* compressed air to blow dust out of the alternator. With the generator set running, direct the stream of air in through the cooling slots at the alternator end.

Routine Maintenance. Refer to the following generator set service schedule, the engine service schedule, and the hourmeter located on the generator set controller to determine when to schedule routine maintenance. Service more frequently generator sets that are subject to extreme weather or dusty or dirty conditions.

Service Log. Use the Operating Hour Service Log located in the back of this manual to document performed services.

Service Schedule. Perform maintenance on each item in the service schedule at the designated intervals for the life of the generator set. For example, an item requiring service every 100 hours or 3 months also requires service after 200 hours or 6 months, 300 hours or 9 months, and so on.

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3.2 Service Schedule—3.5EFOZ and 4EOZ Models

Perform Service at Intervals Indicated (X)	Reference Section	Daily	Every 50 Hrs. or 1 Month	Every 100 Hrs. or 3 Months	Every 200 Hrs. or 6 Months	Every 400 Hrs. or 12 Months	Every 600 Hrs. or 18 Months
FUEL SYSTEM							
Check the fuel level and fill as necessary	3.4.1	X (Before operation)					
Check for any abnormal fuel injection sound †		X (During operation)					
Remove the sediment from the fuel tank and drain the fuel tank †§				X			
Clean the filter inserts of the fuel transfer pump *†	Eng. O/M						X
Replace the fuel filter *	3.4.2				X		
Check the fuel injection nozzles/check the injection spray condition *†‡						X	
LUBRICATION SYSTEM							
Check the crankcase oil level and add oil as necessary	3.3.2	X (Before operation)					
Replace the oil in the crankcase *	3.3.3		X (Break-in period)	X			
Clean the oil strainer *†	3.3.3 Eng. O/M				X		
COOLING SYSTEM							
Check the seawater outlet and clean as necessary	3.6	X					
Check the function of the siphon break, if equipped	3.7.3			X			
Check the anticorrosion zinc anode's condition *	3.7.4			X			
Check/replace the seawater pump seal & impeller *†	3.7.2			X (Check)		X (Replace)	
Replace the anticorrosion zinc anode *†	3.7.4						X

* Requires removal of the sound shield, if installed
† Consult your local distributor/dealer for service
‡ Read the WARNING found at the beginning of the manual
§ Consult the operating instructions supplied with the craft
‖ Should be performed by your local distributor/dealer

Perform Service at Intervals Indicated (X)	Reference Section	Daily	Every 50 Hrs. or 1 Month	Every 100 Hrs. or 3 Months	Every 200 Hrs. or 6 Months	Every 400 Hrs. or 12 Months	Every 600 Hrs. or 18 Months
INTAKE/EXHAUST SYSTEM							
Inspect the exhaust system components *†	3.6	X (Before operation)					
Check the exhaust gas condition. If the exhaust is blue or black, contact your local distributor/dealer	3.6	X (During operation)					
Clean the intake silencer element *	3.5			X			
Clean the exhaust/water mixing elbow *†	3.6				X		
Replace the intake silencer element *	3.5					X	
Inspect the complete exhaust system ‖	2.2					X	
ELECTRICAL SYSTEM							
Keep the battery charged and in good condition §	3.8	X (Before operation)					
Check and tighten the electrical connections *			X				
Clean the battery cables †						X	
ENGINE AND MOUNTING							
Check for water, fuel, and oil leakage *†‡		X (After operation)					
Retighten any loose nuts and bolts *		X (Before operation)					X
Check the mounting bolts/vibromounts and tighten if necessary *					X		
Adjust the intake/exhaust valve clearance *†	Eng. O/M			X			
REMOTE CONTROL SYSTEM							
Check the remote control operation			X (Break-inperiod)			X	
GENERATOR							
Test run the generator set	2.5		X (Weekly)				
Blow dust out of the generator *†	3.1					X	

* Requires removal of the sound shield, if installed
† Consult your local distributor/dealer for service
‡ Read the WARNING found at the beginning of the manual
§ Consult the operating instructions supplied with the craft
‖ Should be performed by your local distributor/dealer

3.3 Lubrication System

See Section 3.2, Service Schedule, for oil change and oil filter replacement intervals. See Section 1 for the oil drain, oil check, and oil fill locations.

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3.3.1 Oil Specifications

Use HD oil that meets the American Petroleum Institute (API) classification of CD, CC/CD, or CC. Using an unsuitable oil or neglecting an oil change may result in damage and a shorter engine life. Figure 3-1 shows the recommended Society of Automotive Engineers (SAE) viscosity designation for given operating temperature ranges.

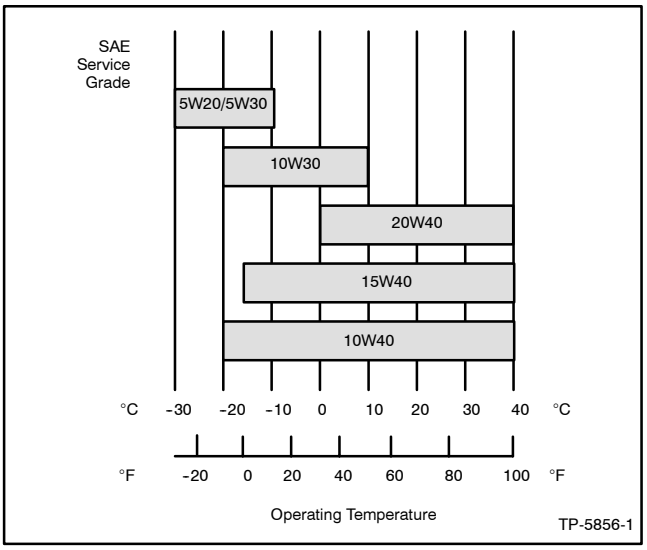
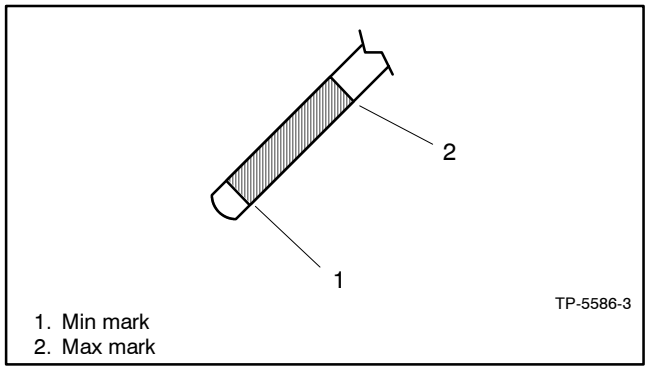


Figure 3-1 Engine Oil Selection

Note: Failure to observe the oil specifications may cause inadequate lubrication/oil pressure and cold-starting difficulties.

3.3.2 Oil Check

Check the oil level in the crankcase daily or before each startup to ensure that the level is in the safe range. To check the oil level, remove the dipstick and wipe the end clean, reinsert as far as possible, and remove. Maintain the oil level between the Min and Max marks on the dipstick, as shown in Figure 3-2. See See Section 1, Figure 1-1, for dipstick location.



1. Min mark
2. Max mark

Figure 3-2 Oil Level Check Marks

Note: Do not operate the set if the oil level is below the Min mark or above the Max mark.

3.3.3 Oil Change

Change the oil more frequently if the generator operates under dirty, dusty conditions. See Figure 3-3 for oil capacities.

Model	L (Qts.)
3.5EFOZ/4EOZ	1.25 (1.32)

Figure 3-3 Oil Capacities

Oil Change Procedure

Whenever possible, drain the oil while it is still warm.

1. **Drain the oil.**

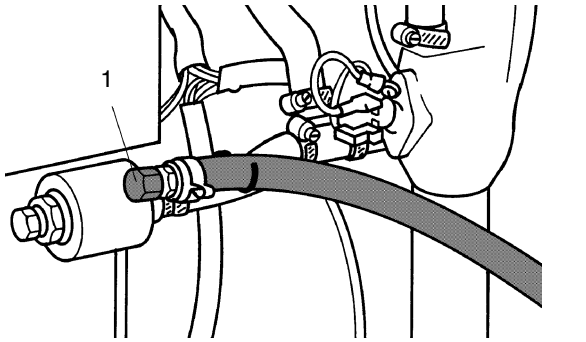
   a. Press the generator set on/off button to stop the generator set.

   b. Disconnect the power to the battery charger, if equipped.

   c. Disconnect the generator set engine starting battery, negative (–) lead first.

d. Remove the oil drain hose from its retaining clip. See Figure 3-4. Remove the cap from the oil drain hose and lower the hose into an oil collection container.

Electric Oil Drain/Oil Fill Pump Procedure: Connect the pump to the end of the oil drain hose. Place the outlet of the pump into an oil collection container. Remove the oil fill cap.



1. Oil drain hose

Figure 3-4 Oil Drain Hose

e. Open the oil drain valve on the engine.

f. Allow time for the engine oil to drain completely.

Electric Oil Drain/Oil Fill Pump Procedure: Activate the pump until all of the oil is removed. Go to step 2.

g. Close the oil drain valve.

h. Replace the cap on the oil drain hose. Replace the oil drain hose in its retaining clip.

Note: Dispose of all waste materials (engine oil, fuel, filter, etc.) in an environmentally safe manner.

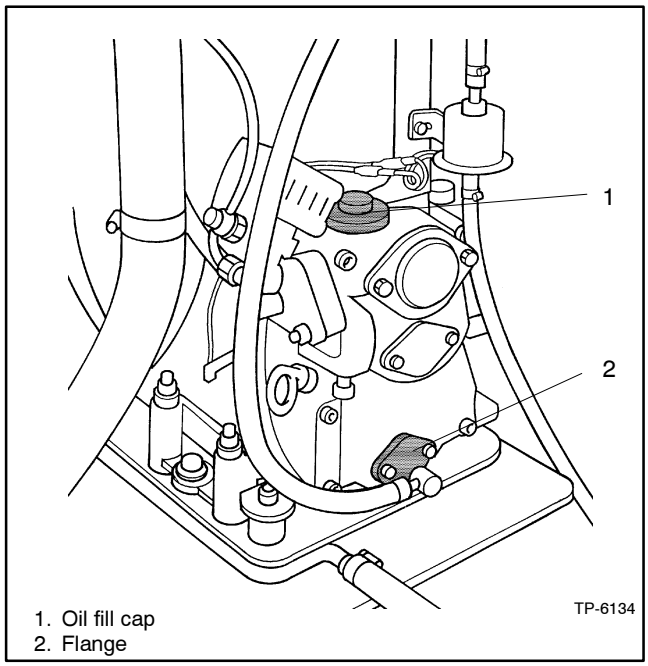
2. **Oil Strainer Service.** Clean the oil strainer at the interval listed in the Service Schedule.

a. Remove the flange on the crankcase. See Figure 3-5 for location.

b. Remove the end of the oil drain hose.

c. Remove the metallic screen (oil strainer).

d. Clean the oil stainer using diesel oil, but no gasoline. Consult the engine operation manual.



1. Oil fill cap
2. Flange

Figure 3-5 Oil Strainer

3. **Fill with oil.** Add new oil of the weight, grade, and quantity specified in Section 3.3.

Electric Oil Drain/Oil Fill Pump Procedure: Disconnect the pump. Close the oil drain valve. Replace the cap on the oil drain hose.

4. **Check for leaks.**

a. Check that the generator set on/off button is in the OFF position.

b. Reconnect the generator set engine starting battery, negative (–) lead last.

c. Reconnect the power to the battery charger, if equipped.

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3.4 Fuel System

3.4.1 Fuel Specifications

Use a clean, good quality diesel fuel oil with a cetane number of 45 or greater. Clean fuel prevents the diesel fuel injectors and pumps from clogging.

Fuel Recommendation
DIN 51601 (ASTM D 975-67 ID + 2D/BS 2869 1967 A1 + A2)

Note: Never store diesel fuel in galvanized containers; diesel fuel and the galvanized coating react chemically to produce flaking that quickly clogs filters or causes fuel pump or injector failure.

Avoid storing fuel for more than one month. Take special precautions to keep all dirt, water, and other contaminants out of fuel to prevent the growth of microbes. Microbes form slime that clogs the fuel filter and lines.

Do not run the generator set out of fuel because the fuel lines will draw in air and necessitate bleeding the fuel system before restarting the unit.

3.4.2 Fuel Filter

The quality and condition of the fuel largely determine the filter's useful life. Replace the fuel filter element as listed in the service schedule. See Figure 3-6.

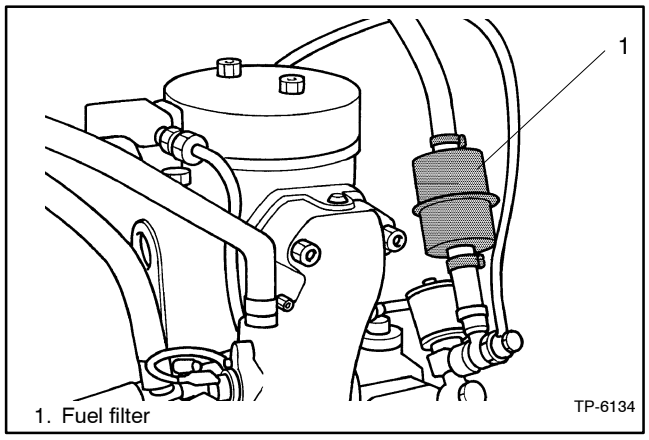


Figure 3-6 Fuel Filter

Fuel Filter Cleaning/Replacement Procedure

1. Close the fuel supply valve.
2. Clamp off the fuel supply line.
3. Remove the pipes from the filter filter.
4. Remove and discard the fuel filter.

Note: Dispose of all waste materials (engine oil, fuel, filter, etc.) in an environmentally safe manner.

5. Replace the fuel filter with the arrow on the fuel filter housing indicating the direction of fuel flow.
6. Reconnect the pipes to the fuel filter.
7. Remove the clamp from the fuel supply line.
8. Open the fuel supply valve.
9. Bleed the system. See Section 3.4.3, Bleeding the Fuel System.

3.4.3 Bleeding the Fuel System

Bleed air from the fuel system to prevent starting failures and/or erratic operation. One or more of the following causes air to collect in the fuel system:

- Operating the generator set until the fuel supply is emptied.
- Developing air leaks in the suction side of the fuel system.
- Replacing the fuel filter.

Procedure to Bleed the Fuel System

1. Loosen the vent screw. See Figure 3-7.

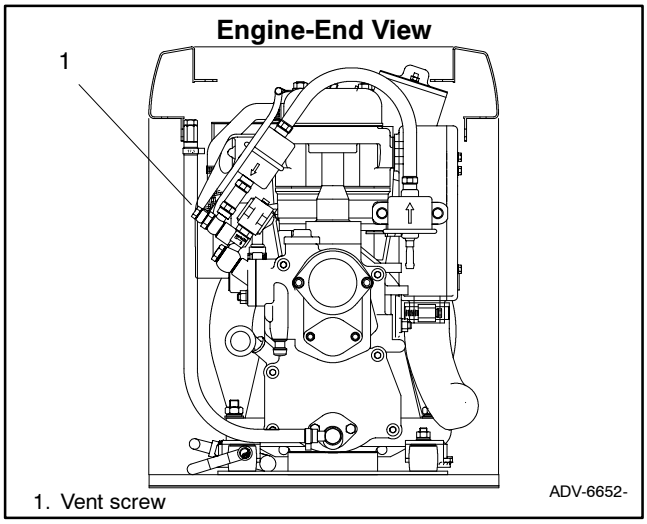


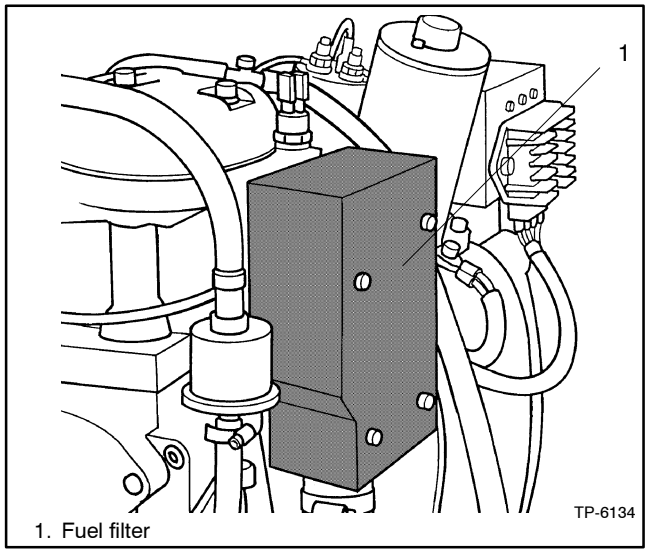
Figure 3-7 Vent Screw Location

2. Operate the generator set until fuel, free of air bubbles, flows from the vent screw.
3. Tighten the screw.

Note: Wipe up all spilled diesel fuel after bleeding the system. Wash hands after any contact with fuel oil.

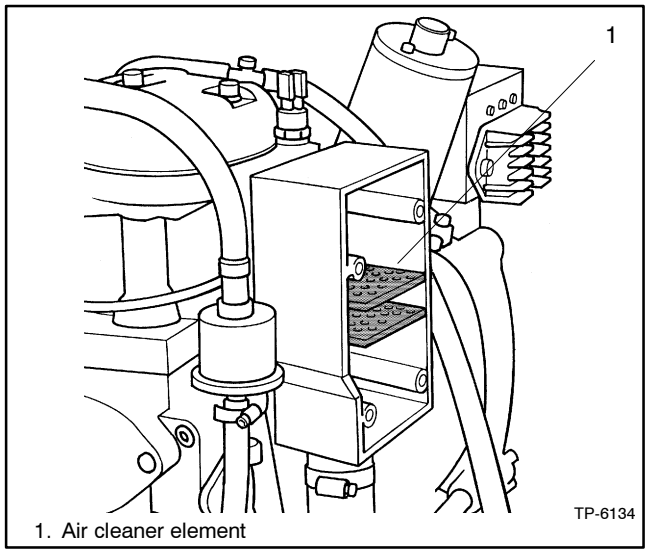
3.5 Air Intake Silencer/Cleaner

At the interval specified in the service schedule, clean *or replace* the air intake silencer. Clean the silencer more frequently if the generator set operates in dirty, dusty conditions.



1. Fuel filter

Figure 3-8 Air Cleaner



1. Air cleaner element

Figure 3-9 Air Cleaner Element

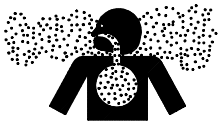
Air Cleaner Service/Replacement

A dry-type air cleaner silences and filters the intake air. The air intake silencer assembly connects to the intake manifold via a flexible hose.

1. Remove the four screws to remove the air cleaner cover.
2. Remove the air silencer element.
3. Tap the element lightly against a flat surface to dislodge loose surface dirt. Do not clean in any liquid or use compressed air as these will damage the filter element.
4. Examine the element and housing for damage and wear. Replace the element or housing if necessary.
5. Wipe the air cleaner cover and base with a clean rag to remove any dirt. Ensure that dirt does not enter the intake port.
6. Make sure that the sealing surfaces fit correctly, and replace the four screws.

3.6 Exhaust System

⚠ WARNING



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

The exhaust system must be leakproof and routinely inspected.

Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. For the safety of the craft's occupants, install a carbon monoxide detector. Consult the boat builder or dealer for approved detector location and installation. Inspect the detector before each generator set use. In addition to routine exhaust system inspection, test the carbon monoxide detector per the manufacturer's instructions and keep the detector operational at all times.

At the interval specified in the service schedule, inspect the exhaust system. See Section 1 for the exhaust outlet location.

Inspection Points

Inspect the the exhaust system components (exhaust manifold, mixing elbow, exhaust line, hose clamps, silencer, and outlet flapper) for cracks, leaks, and corrosion.

- Check the hoses for softness, cracks, leaks, or dents. Replace the hoses as needed.
- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps. Tighten or replace the hose clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Visually inspect for exhaust leaks *(blowby)*. Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.
- Ensure that the carbon monoxide detector is (1) in the craft, (2) functional, and (3) energized whenever the generator set operates.

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3.7 Cooling System

3.7.1 Thermostat

In a direct seawater cooling system, the impeller pump circulates the seawater around the cylinder and through the cylinder head. A thermostat controls the cooling water circuit temperature. See Figure 3-10 for thermostat settings. Consult the engine operation manual for the thermostat cleaning and checking procedures.

Thermostat Settings (Max. Temp.)	
Seawater	50°C (122°F)
Freshwater	75°C (167°F)

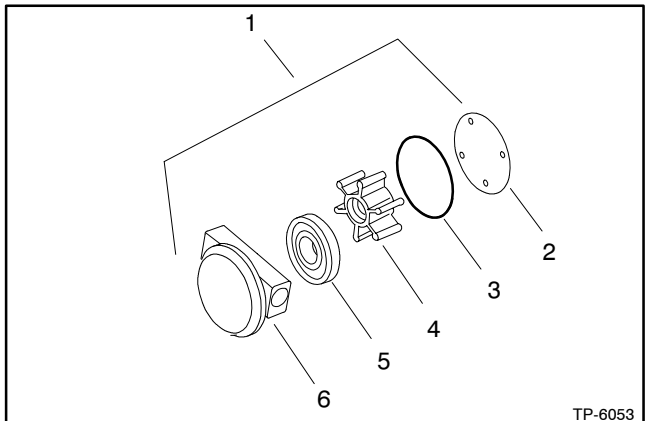
Figure 3-10 Thermostat Settings

3.7.2 Seawater Pump and Impeller

The gear driven seawater pump is located on the alternator side of the generator set. Check and change the seawater pump impeller at the interval specified in the service schedule. Follow the instructions included with the impeller kit. If the instructions are not included with the kit, use the following procedure:

Impeller Inspection and Replacement Procedure:

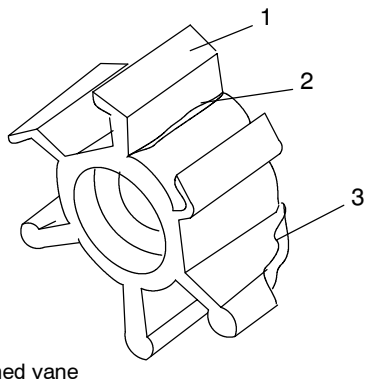
1. Close the seacock.
2. Remove the seawater pump coverplate. See Figure 3-11.



1. Seawater pump
2. Coverplate
3. Gasket
4. Impeller
5. Bearing
6. Housing

Figure 3-11 Seawater Pump, Typical

3. Remove the impeller.
4. Inspect the impeller for damaged, cracked, broken, missing or flattened vanes. The impeller vanes should be straight and flexible. See Figure 3-12. Replace the impeller if it is damaged.



1. Flattened vane
2. Crack
3. Broken vane

Figure 3-12 Worn Impeller

5. Lubricate the impeller with soapy water before installation.

6. Install the impeller.

   Note: During installation push and rotate the impeller in the same direction as the engine rotation until it is thoroughly seated in the impeller housing.

7. Inspect the coverplate and gasket for corrosion and/or damage. Replace components as necessary.

8. Lubricate the gasket with silicon grease and attach the gasket and coverplate to the seawater pump housing.

9. Open the seacock.

10. Start the generator set and check for leaks.

11. Stop the generator set and repair leaks or replace damaged or worn components.

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3.7.3 Siphon Break

A siphon break prevents seawater entry into the generator set's engine when the engine exhaust manifold outlet is less than 230 mm (9 in.) above the waterline of a fully loaded, docked or stationary craft. The siphon break may malfunction when the generator set operates while the craft is in contaminated waters or saltwater. Use the following procedure to inspect the siphon break at the intervals listed in the service schedule.

Siphon Break Inspection

1. Stop the generator set.

2. Remove the retaining cap and remove the reed valve for inspection. See Figure 3-13.

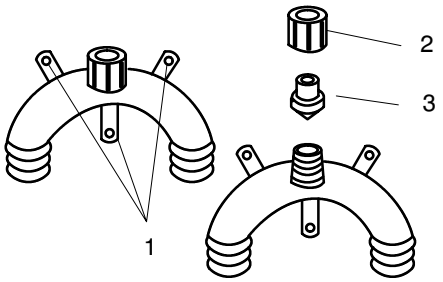
3. Use a mild detergent to remove residue and oxidation from the reed valve.

4. Clear blockages from the reed valve opening.

5. Replace the siphon break if the reed valve is cracked or if the reed valve material has hardened or deteriorated.

6. Install the reed valve into the mounting base with the valve downward. See Figure 3-13, item 3.

7. Install and only finger tighten the retaining cap. Do not overtighten it.



1. Mounting base
2. Retaining cap
3. Reed valve

Figure 3-13 Siphon Break

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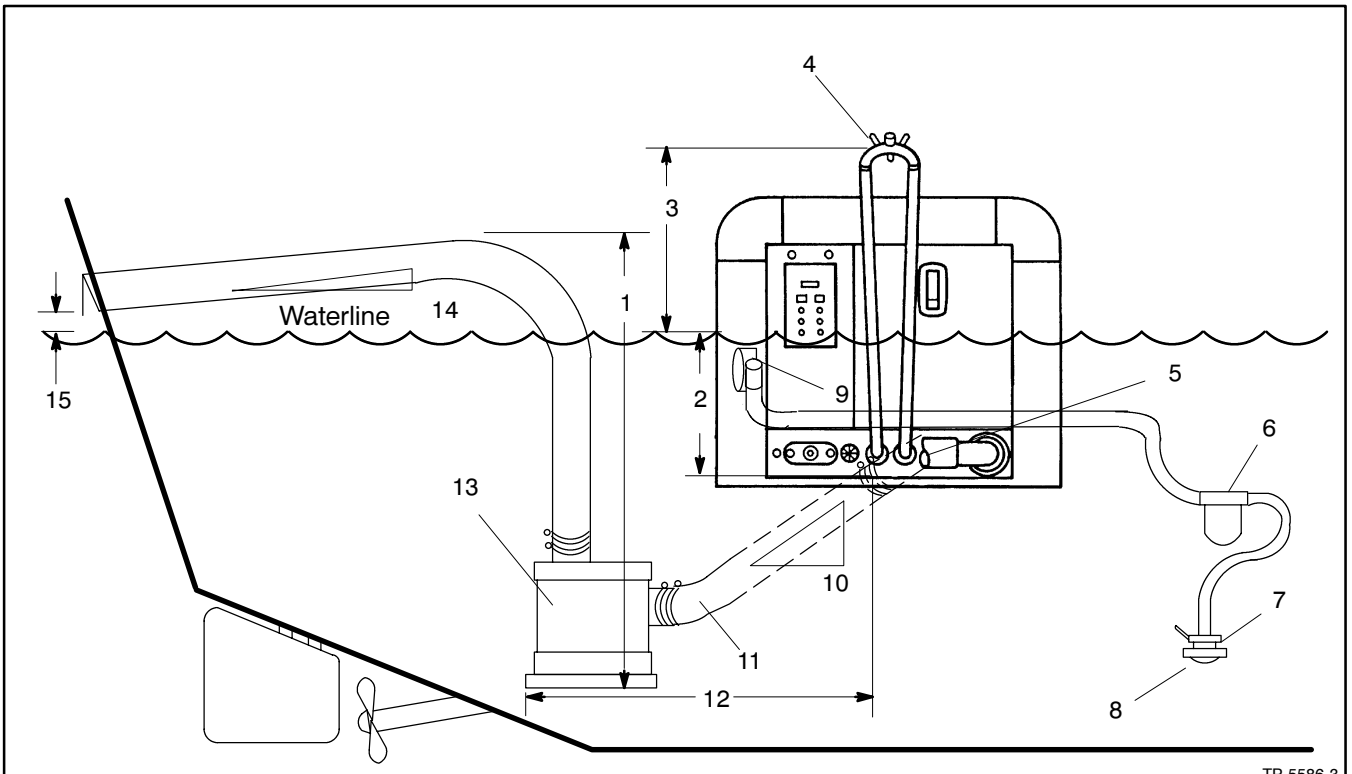


1. Silencer vertical lift 1.2 m (4 ft.) max.
2. Exhaust outlet distance from the waterline. Use a siphon break if the exhaust mixer outlet is located less than 23 cm (9 in.) above the waterline.
3. Siphon break distance above waterline 30.5 cm (1 ft.) min.
4. Siphon break
5. Exhaust outlet
6. Seawater strainer
7. Seacock
8. Intake strainer
9. Gear-driven seawater pump
10. Exhaust hose pitch 1.3 cm per 30.5 cm (0.5 in. per ft.) min.
11. Water lock (optional)
12. Silencer distance from exhaust outlet 3 m (10 ft.) max.
13. Silencer (customer supplied)
14. Exhaust hose pitch 1.3 cm per 30.5 cm (0.5 in. per ft.) min.
15. Exhaust outlet distance above the waterline 10 cm (4 in.) min.

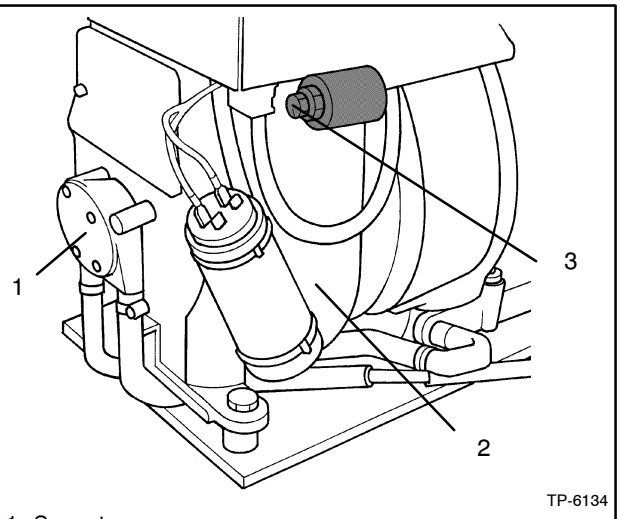
Figure 3-14 Siphon Break, Plastic “U” Type

Note: Do not locate the siphon break directly above the generator set.

3.7.4 Anticorrosion Zinc Anode

The generator set includes an anticorrosion zinc anode (plug) to prevent electrolytic corrosion by seawater.

Check and replace the anticorrosion zinc anode at intervals recommended in the service schedule. Depending upon operating conditions and seawater properties, the anticorrosion zinc anode may require more frequent replacement. See See Section 1, Figure 1-1, and Figure 3-15 for the location and use the following procedure.



1. Seawater pump
2. Water-cooled alternator
3. Anticorrosion zinc anode (seawater drain)

Figure 3-15 Anticorrosion Zinc Anode

Anticorrosion Zinc Anode Replacement

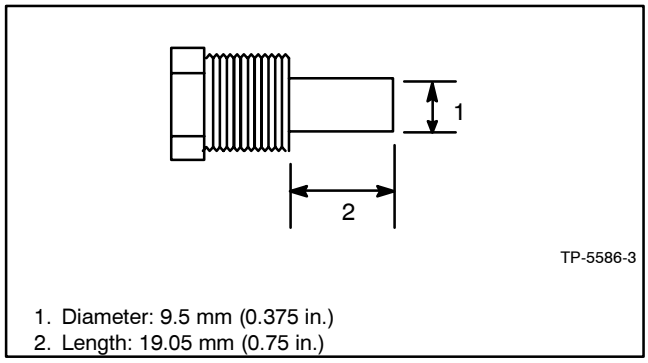
1. With the generator set cooled, close the seacock, open the petcock on the engine, and drain the coolant into a suitable container.

2. Remove the anticorrosion zinc anode (plug).

3. Use a wire brush to remove the loose corrosion on the anticorrosion zinc anode. Replace the anode according to Figure 3-16 and Figure 3-17.

Anticorrosion Zinc Anode Replacement	
New Anode Dimensions mm (in.)	**Replace When Percent of Zinc Remaining Is:**
10 (0.39) x 20 (0.79)	<50% of length/diameter

Figure 3-16 Anticorrosion Zinc Anode (Plug) Measurements



1. Diameter: 9.5 mm (0.375 in.)
2. Length: 19.05 mm (0.75 in.)

Figure 3-17 Anticorrosion Zinc Anode (Plug)

4. If necessary, cut the anticorrosion zinc to the correct length. Clean the threaded hole of the engine and coat the threads of the anticorrosion zinc anode (plug) with pipe sealant suitable for marine applications. Install the anticorrosion zinc anode into the threaded hole.

5. Close the petcock on the engine and open the seacock.

6. Start the generator set and check for leaks at the anticorrosion zinc anode location. The pump is operating if the cooling water flows from the exhaust outlet. If water is not discharging at the exhaust outlet, see Section 2.1, Prestart Checklist, Seawater Pump Priming.

3.8 Battery

Consult the battery manufacturer's instructions regarding battery care and maintenance.

⚠ WARNING

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

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

3.9 Generator Storage Procedure

Perform the following storage procedure before taking a generator set out of service for three months or longer. Follow the engine manufacturer's recommendations, if available, for fuel system and internal engine component storage.

x:sm:002:001

3.9.1 Lubricating System

Prepare the engine lubricating system for storage as follows:

1. Run the generator set for a minimum of 30 minutes to bring it to normal operating temperature.
2. Stop the generator set.
3. With the engine still warm, drain the oil from the crankcase.
4. Refill the crankcase with oil suited to the climate.
5. Run the generator set for two minutes to distribute the clean oil.
6. Stop the generator set.
7. Check the oil level and adjust, if needed.

x:sm:002:002

3.9.2 Fuel System

Prepare the fuel system for storage as follows:

Diesel-Fueled Engines

1. Fill the fuel tank with #2 diesel fuel.
2. Condition the fuel system with compatible additives to control microbial growth. See the engine operation manual.
3. Change the fuel filter and bleed the fuel system. See Section 3.4.

x:sm:002:004

3.9.3 Cooling System

Prepare the cooling system for storage as follows:

1. Unscrew the seawater pump cover to drain the cooling water from the engine.
2. Remove the hose from the fitting to drain the cooling water from the alternator.

3.9.4 Exterior

Prepare the exterior for storage as follows:

1. Clean the exterior surface of the generator set.
2. Seal all engine openings except for the air intake with nonabsorbent adhesive tape.
3. To prevent impurities from entering the air intake and to allow moisture to escape from the engine, secure a cloth over the air intake.
4. Mask electrical connections.
5. Spread a light film of oil over unpainted metallic surfaces to inhibit rust and corrosion.

x:sm:002:006a

3.9.5 Battery

Perform battery storage after all other storage procedures.

1. Place the generator set master switch in the OFF/RESET position.
2. Disconnect the battery(ies), negative (–) lead first.
3. Clean the battery. Refer to 3.2, Scheduled Maintenance for the battery cleaning procedure.
4. Place the battery in a cool, dry location.
5. Connect the battery to a float/equalize battery charger or charge it monthly with a trickle battery charger. Refer to the battery charger manufacturer's recommendations.

   Maintain a full charge to extend battery life.

x:sm:002:007

Notes

Section 4 Troubleshooting

This section contains generator set troubleshooting, diagnostic, and repair information.

Use the following chart as a quick troubleshooting reference. The table groups generator set faults and suggests likely causes and remedies. The table also refers you to more detailed information including sections of this manual, the generator set service manual (S/M), the generator set installation manual (I/M), and the engine service manual (Engine S/M) to correct the indicated problem.

Corrective action and testing often require knowledge of electrical and electronic circuits. To avoid additional problems caused by incorrect repairs, have an authorized service distributor/dealer perform service.

NOTICE

Fuse replacement. Replace fuses with fuses of the same ampere rating and type (for example: 3AB or 314, ceramic). Do not substitute clear glass-type fuses for ceramic fuses. Refer to the wiring diagram when the ampere rating is unknown or questionable.

Maintain a record of repairs and adjustments performed on the equipment. If the procedures in this manual do not explain how to correct the problem, contact an authorized distributor/dealer. Use the record to help describe the problem and repairs or adjustments made to the equipment.

x:gt:001:002a:

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Controller												
x										Controller on/off button in the OFF position	Press the controller on/off button to the ON position.	Section 2
x	x			x						Controller fuse blown	Replace the blown controller fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D
x				x						Controller circuit breaker tripped	Reset the controller circuit breaker.	Section 2
x										Controller on/off button inoperative	Replace the controller on/off button.	—
				x						Controller fault	Troubleshoot the controller.†	Gen. S/M
x	x									Controller circuit board(s) inoperative	Replace the controller circuit board.	Gen. S/M
Cooling System												
						x		x		Air openings clogged	Clean the air openings.	—
						x				Impeller inoperative	Replace the impeller.	Section 3
						x		x		Seawater strainer clogged or restricted	Clean the strainer.	Section 3
				x						High temperature shutdown	Allow the engine to cool down. Then troubleshoot the cooling system.	Sec. 3, Eng. O/M
						x				Thermostat inoperative	Replace the thermostat.	Eng. O/M

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Electrical System (DC circuits)												
x	x									Battery connections loose, corroded, or incorrect	Verify that the battery connections are correct, clean, and tight.	Section 3
x	x									Battery weak or dead	Recharge or replace the battery. The spec sheet provides recommended battery CCA rating.	Section 3, S/S
x				x						Engine harness connector(s) not locked tight	Disconnect the engine harness connector(s), then reconnect it to the controller.	W/D
				x						Fault shutdown	Reset the fault switches and troubleshoot the controller.	—
				x						High exhaust temperature switch inoperative	Replace the inoperative switch.	Gen. S/M or W/D
x	x									Starter/starter solenoid inoperative	Replace the starter or starter solenoid.	Eng. S/M
				x						High cylinder head temperature switch inoperative	Replace the inoperative switch.	Gen. S/M
Engine												
	x	x			x			x		Air cleaner clogged	Clean or replace the filter element.	Section 2
	x	x				x		x	x	Compression weak	Check the compression.†	Eng. S/M
			x		x	x		x	x	Engine overload	Reduce the electrical load. See the generator set installation manual for wattage specifications.	I/M
									x	Exhaust system leak	Inspect the exhaust system. Replace the inoperative exhaust system components.†	Section 3, I/M
									x	Exhaust system not securely installed	Inspect the exhaust system. Tighten the loose exhaust system components.†	Section 3, I/M
		x	x		x			x		Governor inoperative	Adjust the governor.†	Gen. S/M
					x				x	Valve clearance incorrect	Adjust the valves.†	Eng. O/M
									x	Vibration excessive	Tighten all loose hardware.	—

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Fuel System												
	x			x						Fuel tank empty or fuel valve shut off	Add fuel and move the fuel valve to the ON position.	—
	x	x		x	x					Fuel filter restriction	Replace the fuel filter.	Section 3 or Eng. O/M
	x	x			x					Air in fuel system (diesel only)	Bleed the diesel fuel system.	Section 3
	x	x			x					Fuel or fuel injectors dirty or faulty (diesel only)	Clean, test, and/or replace the inoperative fuel injector.†	Eng. S/M
	x	x			x			x		Fuel injection timing out of adjustment (diesel only)	Adjust the fuel injection timing.†	Eng. S/M
	x				x			x		Fuel feed or injection pump inoperative (diesel only)	Rebuild or replace the injection pump.†	Eng. S/M
Generator												
			x							AC output circuit breaker open	Reset the breaker and check for AC voltage at the generator side of the circuit breaker.	—
x										Transfer switch test switch in the OFF position	Move the transfer switch test switch to the AUTO position.	—
			x							Inoperative capacitor	See an authorized service distributor/dealer.	—
			x							Wiring, terminals, or pin in the exciter field open	Check for continuity.	Gen. S/M, W/D
			x							Main field (rotor) inoperative (open or grounded)	Test and/or replace the rotor.†	Gen. S/M
			x							Stator inoperative (open or grounded)	Test and/or replace the stator.†	Gen. S/M
									x	Vibration excessive	Tighten loose components.†	—

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

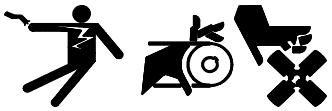
Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Lube System												
						x	x		x	Oil level low	Restore the oil level. Inspect the generator set for oil leaks.	Section 3
				x						Low oil pressure shutdown	Check the oil level.	Section 3 or Eng. O/M
	x	x					x		x	Crankcase oil type incorrect for ambient temperature	Change the oil. Use oil with a viscosity suitable for the operating climate.	Section 3

* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

Notes

⚠ WARNING

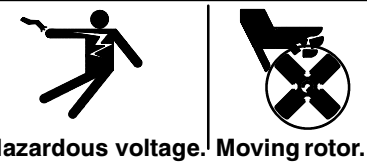


Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set on/off button to shut down the generator set. All indicator lamps dim. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

⚠ WARNING



Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

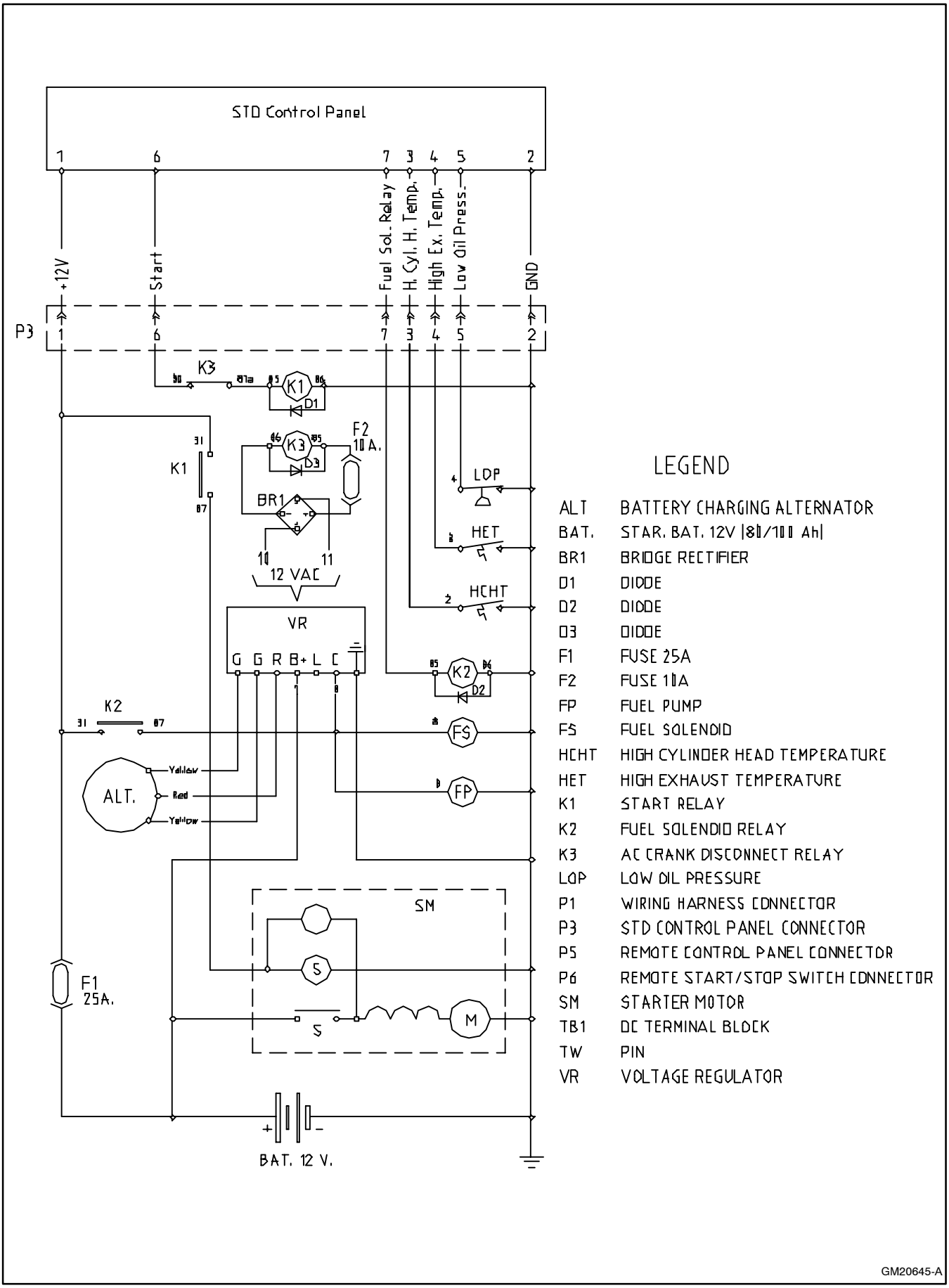
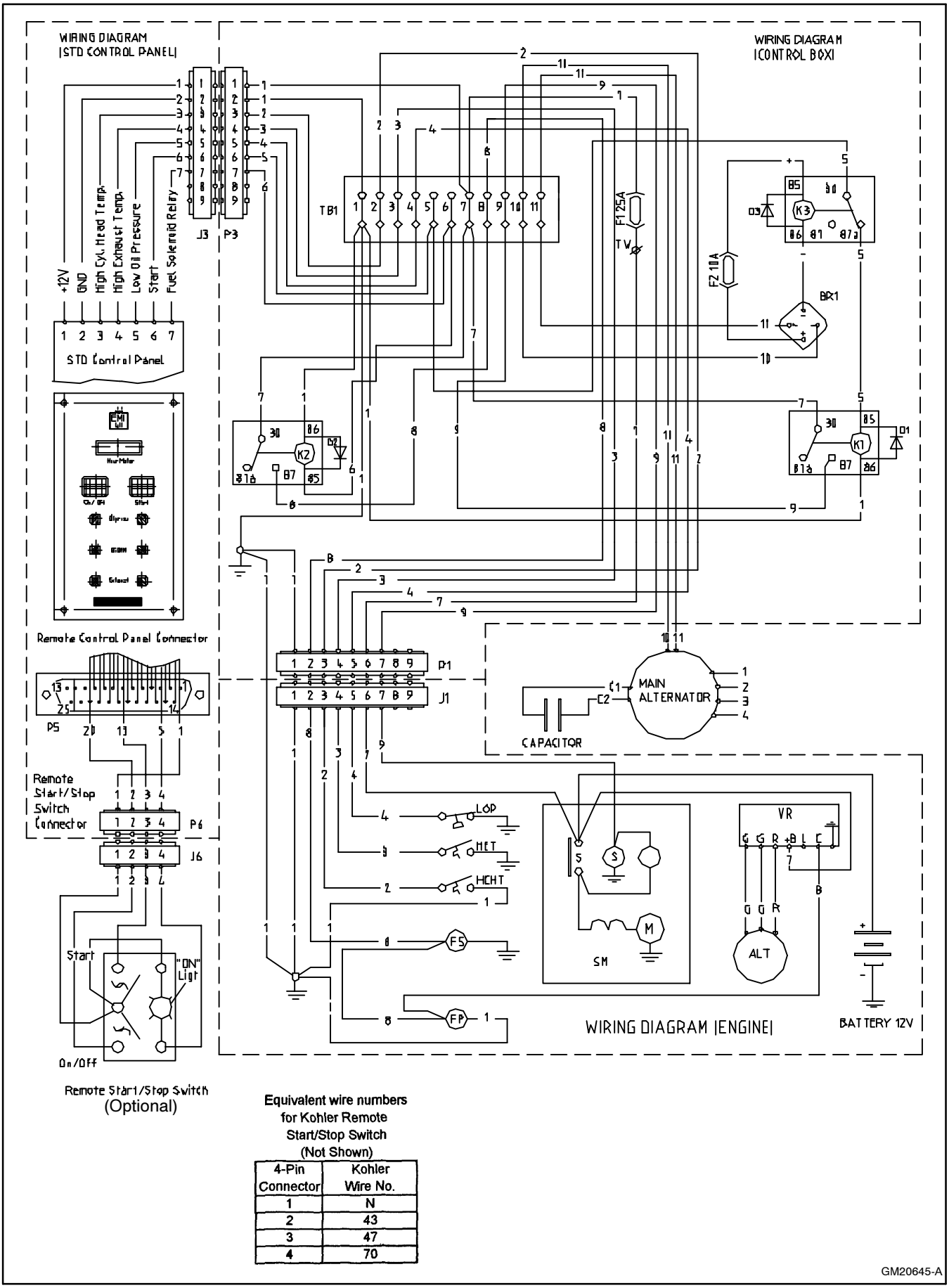


Figure 5-1 Schematic Wiring Diagram—3.5EFOZ and 4EOZ



Equivalent wire numbers for Kohler Remote Start/Stop Switch (Not Shown)

4-Pin Connector	Kohler Wire No.
1	N
2	43
3	47
4	70

Figure 5-2 Point-to-Point Wiring Diagram—3.5EFOZ and 4EOZ

Notes

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
API	American Petroleum Institute
approx.	approximate, approximately
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
A/V	audiovisual
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
cogen.	cogeneration
Com	communications (port)
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dBA	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
fglass.	fiberglass
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lbs.	foot pounds (torque)
ft./min.	feet per minute
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temperature
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lbs.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard
k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)

kg	kilogram
kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
m^3/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCM	one thousand circular mils
MCCB	molded-case circuit breaker
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MW	megawatt
mW	milliwatt
μF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips head crimptite (screw)
PHH	Phillips hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent-magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTV	room temperature vulcanization
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec, specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

Appendix B Operating Hour Service Log

Use the log below to keep a cumulative record of operating hours on your generator set and the dates required services were performed. Enter hours to the nearest quarter hour.

	OPERATING HOURS		SERVICE RECORD	
DATE RUN	HOURS RUN	TOTAL HOURS	SERVICE DATE	SERVICE

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TP-6134 11/01

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