

Service

RV/Mobile Generator Sets



Models:

4CKM

4CFKM

5CKM

4CKMR

4CFKMR

5CKMR



KOHLER®

POWER SYSTEMS

TP-5394 12/94a

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Safety Precautions and Instructions

A generator set, like any other electromechanical 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. Below are some general precautions relating to the operation of a generator set. **SAVE THESE INSTRUCTIONS.**

DANGER

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

WARNING

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

CAUTION

Caution indicates the presence of a hazard that will or can cause minor personal injury or property damage if the caution is ignored.

NOTE

Note communicates installation, operation, or maintenance information that is important but not hazard related.

Safety decals are affixed to the generator set in prominent places to advise the operator or service technician of potential hazards. The decals are reproduced here to improve operator recognition. For a further explanation of decal information, refer to the safety precautions throughout this manual. Before operating or servicing the generator set, be sure you understand the messages of these decals. Replace decals if missing or damaged.

Accidental Starting



**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 set. The generator set can be started by the remote start/stop switch unless this precaution is followed.

Battery

WARNING



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

Use protective goggles and clothes. Battery acid 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. Seek immediate medical aid in the case of eye contact. Never add acid to a battery once the battery has been placed in service. This 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 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. Sparks could ignite battery gases or fuel vapors. Ventilate any compartment containing batteries to prevent accumulation of explosive gases. To avoid sparks, do not disturb battery charger connections while battery is being charged. Always turn battery charger off before disconnecting battery connections. Remove negative lead first and reconnect it last when disconnecting battery.

Engine Backfire/Flash Fire

WARNING



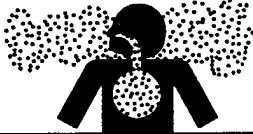
Fire.
Can cause severe injury or death.

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. Use a suitable container to catch all fuel when removing fuel line or carburetor.

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

Exhaust System

⚠ WARNING

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

Carbon monoxide can cause severe nausea, fainting, or death. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate in any area where exhaust gas could accumulate and seep back inside an occupied building or vehicle. Be careful when parking your vehicle to avoid obstructing the exhaust outlet. The exhaust gases must discharge freely to prevent carbon monoxide from deflecting into the vehicle. Avoid breathing exhaust fumes when working on or near the generator set. Carbon monoxide is particularly dangerous because it is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short period of time.

Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas which is 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

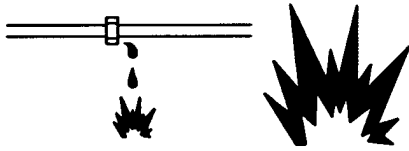
If any of these symptoms is experienced and carbon monoxide poisoning is possible, affected persons should seek fresh air immediately. They should remain active. They should not be permitted to sit, lie down, or fall asleep. Alert others to the situation. If the condition of affected persons does not improve within minutes of breathing fresh air, they should seek medical attention.

Carbon monoxide can cause severe nausea, fainting, or death. Install exhaust system tail pipe so discharged exhaust gases will not be drawn into vehicle interior through windows, doors, air conditioners, etc. Do not use flexible tail piping since this type could crack and allow lethal exhaust fumes to enter the vehicle.

Carbon monoxide can cause severe nausea, fainting, or death. In addition to routine inspection of the exhaust system, install a carbon monoxide detector. Consult your coach builder or dealer for installation of approved detectors. Inspect your detector before each generator set use.

Fuel System

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 and storing 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. Do not replace flexible fuel lines with rigid lines. Flexible sections are used to avoid breakage due to vibration. If any fuel leakage, fuel accumulation, or electrical sparks are noted, DO NOT OPERATE GENERATOR SET. Repair systems before resuming generator set operation

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

Gasoline—Store gasoline only in approved red containers clearly marked GASOLINE.

Propane (LP)—Adequate ventilation is mandatory. Propane is heavier than air; install gas detectors low in room. Inspect detectors often.

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. Check LP vapor gas fuel system for leakage using a soap-water solution with fuel system test pressurized to 6-8 ounces per square inch (10-14 inches water column). Do not use test solutions that contain ammonia or chlorine, since the soap will not bubble for an accurate leakage test.

Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check LP liquid withdrawal gas fuel system for leakage using a soap-water solution with fuel system test pressurized not less than 90 psi (621 kPa). Do not use test solutions that contain ammonia or chlorine, since the soap will not bubble for an accurate leakage test.

Hazardous Noise



CAUTION




Hazardous noise.
Can cause loss of hearing.

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

Hazardous Voltage/ Electrical Shock

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

⚠ WARNING

Hazardous voltage. Backfeed to utility system can cause severe injury, death, or property damage.
Do not connect to any building electrical system without connecting through an approved device and after building main switch is open.


Hazardous voltage can cause severe injury or death. Whenever electricity is present, there is the hazard of electrocution. Open main circuit breaker on all power sources before servicing equipment. Electrically ground the generator set and electrical circuits when in use. Never come into contact with electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution is increased under such conditions.

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 voltage can cause severe injury or death. High voltage is present at the heat sink of the voltage regulator. Do not touch voltage regulator heat sink when testing or electrical shock will occur. (*PowerBoost™, PowerBoost™ III, and PowerBoost™ V voltage regulator models only.*)

Hazardous backfeed voltage can cause severe injury or death. Do not connect generator set to any building/campground electrical system without connecting through an approved device and after building/campground 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 to utility electrical system may be unlawful in some states and/or localities. A transfer switch must be installed to prevent interconnection of generator set power and other sources of power.

Heavy Equipment

⚠ WARNING

Unbalanced weight. Improper lift can cause severe injury or death or equipment damage.
Do not use lifting eyes. Use a sling under skid to lift generator set.

Hot Parts



⚠ WARNING

Hot engine and exhaust system. Can cause severe injury or death. Do not work on generator set until it is allowed to cool.

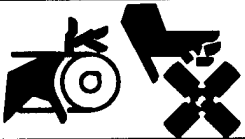
Hot parts can cause severe injury or death. Do not touch hot engine parts. An engine gets hot while running and exhaust system components get extremely hot.

Fire can cause severe injury or death. Hot exhaust system can ignite adjacent combustible materials. Do not locate electrical wiring, fuel lines, or combustible material above the exhaust muffler. Exercise caution when parking your vehicle to prevent grass fires started by exhaust system and hot exhaust gases.

Fire can cause severe injury or death. Hot generator set can ignite debris in compartment. Keep the compartment and generator set clean and free of debris and combustible materials to minimize chances of fire. Do not block fuel/oil drain opening in generator set mounting tray. Cut a corresponding hole in the subflooring for drain opening if subflooring is used.

Moving Parts

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

⚠ WARNING

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

Flying projectiles can cause severe injury or death. Retorque all crankshaft and rotor hardware after servicing. Do not loosen crankshaft hardware or rotor throbolt when making adjustments or servicing generator set. Rotate crankshaft manually in a clockwise direction only. Loose hardware can result from turning crankshaft bolt or rotor throbolt counterclockwise. Personal injury can occur from loose hardware causing hardware or pulley to come off engine when generator set is running.

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

Notes

NOTICE
This generator set has been rewired from its nameplate voltage to:
<div style="border: 1px solid black; height: 40px; width: 100%;"></div>
246242

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

NOTE

Affix notice to generator set after reconnecting to a voltage different than the nameplate. Order voltage reconnection decal 246242 from authorized service distributors/dealers.

NOTE

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

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 identification.

NOTE

This generator set does not comply with United States Coast Guard (U.S.C.G.) requirements and must not be used for marine applications. Use only generator sets specified for marine use in marine installations. U.S.C.G. Regulation 33CFR183 requires a generator set to be ignition protected when used in a gasoline-fueled environment.

NOTE

Do not tee into fuel injected fuel systems. Use a two dip tube arrangement for fuel supply. Consult an authorized service dealer for further fuel system installation information.

NOTE

Do not leave generator sets equipped with the optional swing-down tray in the tilted position for any extended period (30 minutes or more). Always place unit in the normal mounting position when not performing service.

Introduction

Your vehicle is equipped with a dependable Kohler alternating-current generator set. Service requirements of the generator set are minimal but it is important to perform the required services at the prescribed intervals. Please take a few moments to read through

this manual then carefully follow all service recommendations to keep your set in top condition. Keep this manual in your vehicle for future reference. See Figure 1-1 and Figure 1-2 to identify and locate major components.

Service Assistance

Check the yellow pages of your telephone directory under the heading GENERATORS-ELECTRIC for Kohler Generator Service Dealers/Distributors in your area.

KOHLER CO., Kohler, Wisconsin 53044

Phone: 414-565-3381

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

For sales and service in U.S.A. and Canada

Phone: 1-800-544-2444

Provide MODEL, SPECIFICATION, SERIAL, and ENGINE numbers from the generator nameplate to receive current parts and information for your generator set.

Model No. _____

Specification No. _____

Serial No. _____

Engine No. _____

Section 1. Specifications

General Specifications

	4CKM/4CKMR (60 Hz)	5CKM/5CKMR (60 Hz)
Dimensions—L x W x H—in. (mm.)	24.83 x 18.46 x 13.98 (631 x 469 x 355)	24.83 x 18.46 x 13.98 (631 x 469 x 355)
Weight—lbs. (kg)	258 (117)	268 (121.5)
Air requirements:		
Combustion—cfm (m ³ /min.)	20 (0.6)	20 (0.6)
Cooling—cfm (m ³ /min.)	340 (9.6)	340 (9.6)
Free air opening—sq. in. (sq. cm)	85 (548)	85 (548)

	4CFKM/4CFKMR (50 Hz)
Dimensions—L x W x H—in. (mm)	24.83 x 18.46 x 13.98 (631 x 469 x 355)
Weight—lbs. (kg)	258 (117)
Air requirements:	
Combustion—cfm (m ³ /min.)	20 (0.6)
Cooling—cfm (m ³ /min.)	340 (9.6)
Free air opening—sq. in. (sq. cm)	85 (548)

Fuel Consumption	Gasoline—gph (Lph)			
Load	25%	50%	75%	100%
4CKM/4CKMR (60 Hz)	0.48 (1.8)	0.58 (2.2)	0.70 (2.6)	0.89 (3.4)
4CFKM/4CFKMR (50 Hz)	0.39 (1.5)	0.48 (1.8)	0.59 (2.2)	0.75 (2.8)
5CKM/5CKMR (60 Hz)	0.45 (1.7)	0.58 (2.2)	0.75 (2.8)	1.04 (3.9)
	LP gas—gph (Lph)			
4CKM/4CKMR (60 Hz)	0.46 (1.7)	0.69 (2.6)	0.77 (2.9)	0.99 (3.8)
4CFKM/4CFKMR (50 Hz)	0.39 (1.5)	0.58 (2.2)	0.65 (2.5)	0.82 (3.1)
5CKM/5CKMR (60 Hz)	0.54 (2.0)	0.80 (3.0)	0.90 (3.4)	1.15 (4.4)

Engine

Below lists some general engine specifications. Refer to the appropriate service section and the engine service manual for specific service details.

	4CKM/4CFKM/ 4CKMR/4CFKMR	5CKM/ 5CKMR
Manufacturer	Kohler	
Model	M18	M20
Cycle	4	
Number cylinders	2	
Compression ratio	6.0:1	6.6:1
Displacement—cu. in. (L)	42.18 (0.69)	46.98 (0.77)
Rated horsepower:		
60 Hz	8.9	9.5
50 Hz	7.4	7.9
RPM:		
60 Hz	1800	
50 Hz	1500	
Bore—in. (mm)	3.12 (79.25)	3.12 (79.25)
Stroke—in. (mm)	2.75 (69.85)	3.06 (77.72)
Valve material	Stellite®	
Valve clearance—in. (mm):		
Intake	0.003-0.006 (0.076-0.152)	
Exhaust	0.011-0.014 (0.279-0.355)	
Cylinder block material	Aluminum crankcase with cast iron cylinders (not sleeved)	
Cylinder head tightening torque—ft. lbs. (Nm)	15-20 (20-27)	
Cylinder head material	Aluminum	
Piston rings	2 compression/1 oil	
Crankshaft material	Heat treated ductile iron	
Bearings, number & type	2, replaceable sleeve	
Governor	Electronic	
Governor magnetic pickup air gap in. (mm)	0.040 (1.02) ± 0.005 (0.127)	
Lubrication system	Full pressure	
Oil capacity (with filter)—qts. (L)	1.5 (1.4)	2.5 (2.36)
Oil type (API)	SF or SG	
Oil pressure—psi (kPa)	30-40 (207-276)	

Engine (Continued)

	4CKM/4CFKM/ 4CKMR/4CFKMR	5CKM/ 5CKMR
Fuel type:		
Gasoline (octane rating)	87 octane unleaded (90 research rating method)	
LP vapor gas (inlet pressure)	7-11 in. water column, 4-6 oz. per sq. in.	
LP liquid withdrawal (inlet pressure)	50 psi	
Fuel pump pressure rating (gasoline models only)	2-3.5 psi (14-24 kPa)	
Battery voltage	12	
Battery ground	Negative	
Battery recommendation	290 cold cranking amp @ 0° F (-18° C) 55 amp hr.	
Spark plug type	Kohler part number 52 132 02	
Spark plug gap:		
Gasoline—in. (mm)	0.025 (0.64)	
LP gas—in. (mm)	0.018 (0.46)	
Spark plug tightening torque—ft. lbs. (Nm)	10-15 (13.6-20)	
Ignition system	Electronic	
Ignition module to magnet air gap	0.008-0.012	
Engine firing order	1-2-1	
Ignition timing (@ 1800 rpm)—60 Hz	Ignition module controlled	
Ignition timing (@ 1500 rpm)—50 Hz	Ignition module controlled	
Primary resistance	1.0-1.5 ohms	
High tension leads	22,000-42,000 ohms max. per lead	
Starter motor	Bendix-drive electric starter motor	
Cranking current at 70° F (21° C)	100 amps	
Cooling system	Air cooled	
Intake manifold bolt torque—ft. lbs. (Nm)	12.5 (17)	

Generator

	4CKM/4CKMR	5CKM/5CKMR
Rated kW	4	5
Rated kW (LP liquid withdrawal)	4	4.6
Rated kW (LP liquid withdrawal with battery charging)	3.7	4.3
Frequency—Hz	60	
Rated voltage	120 volt, 2-wire, single phase 120/240 volt, 3-wire, single phase	
Rated amps (120 volt)	33.3	41.7
Rated amps (240 volt)	16.7	20.8
Rated amps 12-volt battery charging system	0-15 amps—regulated	
Generator type	4-pole rotating field	
Shaft rpm, 60 Hz	1800	
Voltage regulation	± 2%	
Frequency regulation	± 0.5%	
Minimum recommended clearance for vibration and cooling—(front, side*, top, rear)	0.6 in. (15.2 mm)	
Number of output leads	4, reconnectable	
Stator resistance (ohms)** leads:		
1-2, 3-4, 33-44	0.34	
55-33	2.8	
B1-B2	0.15	
C1-CP, C2-CP	0.14	
Rotor field voltage/current readings at rated voltage (hot) 240v		
No load	17v/3.1a	17v/ 3.1a
Full load	27v/4.6a	32v/5.3a
Stator output voltages with separately excited rotor using 12-volt battery		
1-2, 3-4, 33-44	90	
33-55	135	
B1-B2	14	
	4CFKM/4CFKMR	
Rated kW	3.3	
Frequency—Hz	50	
Rated voltage	110 volt, 2-wire, single phase 110/220 volt, 3-wire, single phase	
Rated amps (110 volt)	30.0	
Rated amps (220 volt)	15.0	
Generator type	4-pole rotating field	
Shaft rpm, 50 Hz	1500	
Voltage regulation	± 2%	
Frequency regulation	± 0.5%	
Minimum recommended clearance for vibration and cooling—(front, side*, top, rear)	0.6 in. (15.2 mm)	
Number of output leads (single phase)	4, reconnectable	
Number of output leads (three phase)	12, reconnectable	

* If using floor or end free-air opening, refer to the Operation and Installation Manual for correct clearances.

** Most ohmmeters will not give accurate readings when measuring less than 1 ohm. Consider the stator good if obtaining a low resistance reading (continuity) and there is no evidence of shorted windings (discoloration). Do not confuse a low resistance reading with a reading indicating a shorted winding.

Generator (Continued)

4CFKM/4CFKMR	
Stator resistance (ohms)** leads:	
1-2, 3-4, 33-44	0.40
55-33	2.8
B1-B2	0.15
C1-CP, C2-CP	0.14
Rotor field voltage/current readings at rated voltage (hot) 220v	
No load	21v/3.9a
Full load	33v/5.8a
Stator output voltages with separately excited rotor using 12-volt battery	
1-2, 3-4, 33-44	90
33-55	114
B1-B2	14
All Models	
Rotor resistance (ohms)	3.5-5.5
Excitation method	Solid state brush
Coupling type	Tapered shaft, thrubolt
Overbolt torque—in. lbs. (Nm)	60 (7)
Voltage regulator type (single-phase models)	PowerBoost™ III E
Voltage regulator type (three-phase models)	PowerBoost™ V
Insulation (rotor and stator)	Class 155, epoxy varnish, vacuum impregnated
Winding material	Copper
Bearing, number and type	1, replaceable ball
Circuit protection:	
Controller	15-amp fuse
Voltage regulator	5-amp fuse
Battery charging (if equipped)	25-amp circuit breaker
Deicing module (if equipped—newer models)	5-amp fuse

** Most ohmmeters will not give accurate readings when measuring less than 1 ohm. Consider the stator good if obtaining a low resistance reading (continuity) and there is no evidence of shorted windings (discoloration). Do not confuse a low resistance reading with a reading indicating a shorted winding.

DERATION: All units are rated 1.0 power factor. Derate approximately 4.0% per 1000 ft. (300 m) above sea level and 1% for each 10°F (5.5°C) increase in temperature above 85°F (29°C).

Torque Specifications	
Generator	
Overbolt torque—in. lbs. (Nm)	60 (7)
Thrubolt torque—ft. lbs. (Nm)	40-55 (54-75)
Engine	
Cylinder head torque—ft. lbs. (Nm)	15-20 (20-27)
Spark plug torque—ft. lbs. (Nm)	10-15 (14-20)
Intake manifold bolt—ft. lbs. (Nm)	12.5 (17)

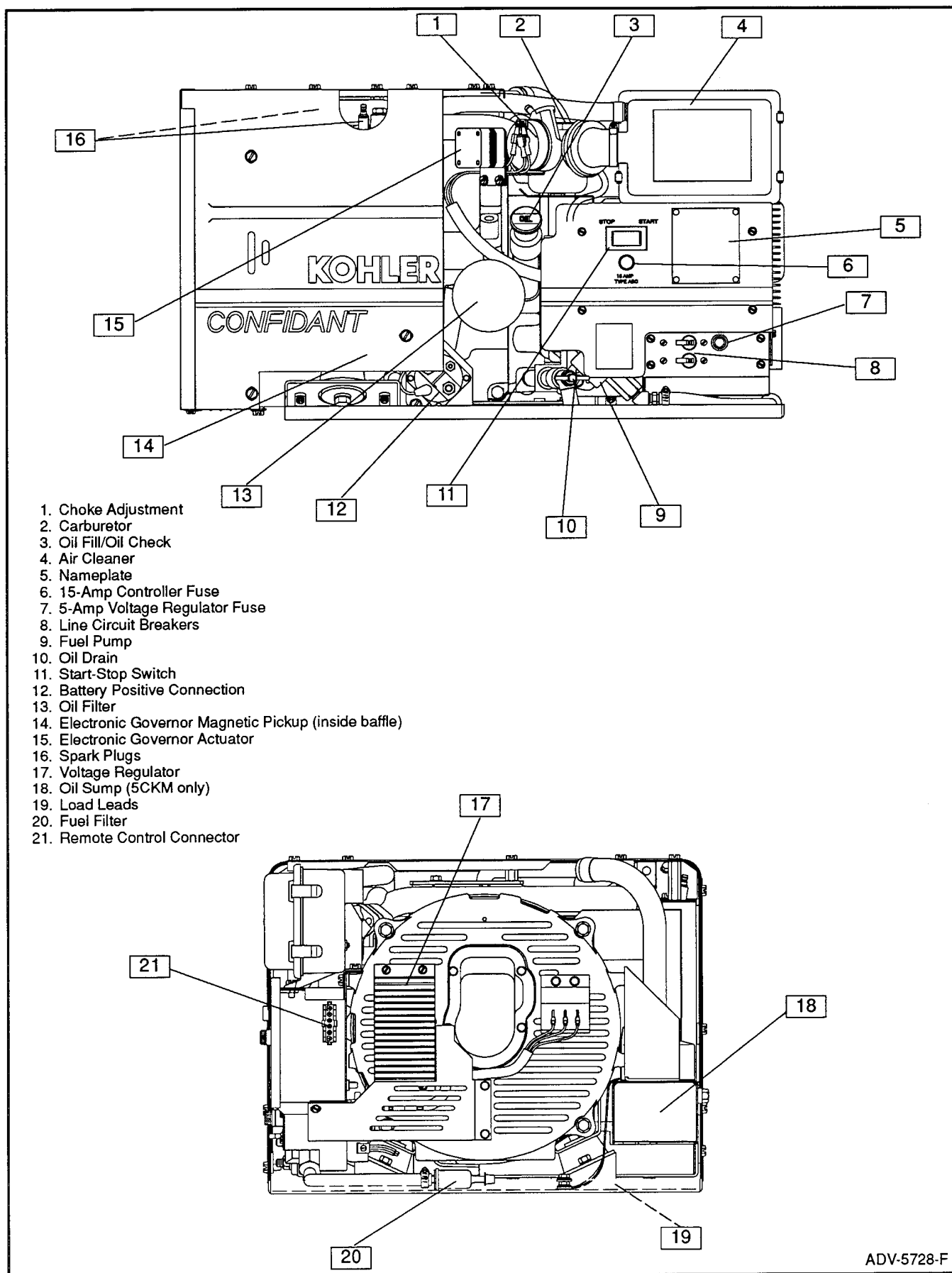


Figure 1-1. Service View 4/5CKM-RV or 4CFKM-RV

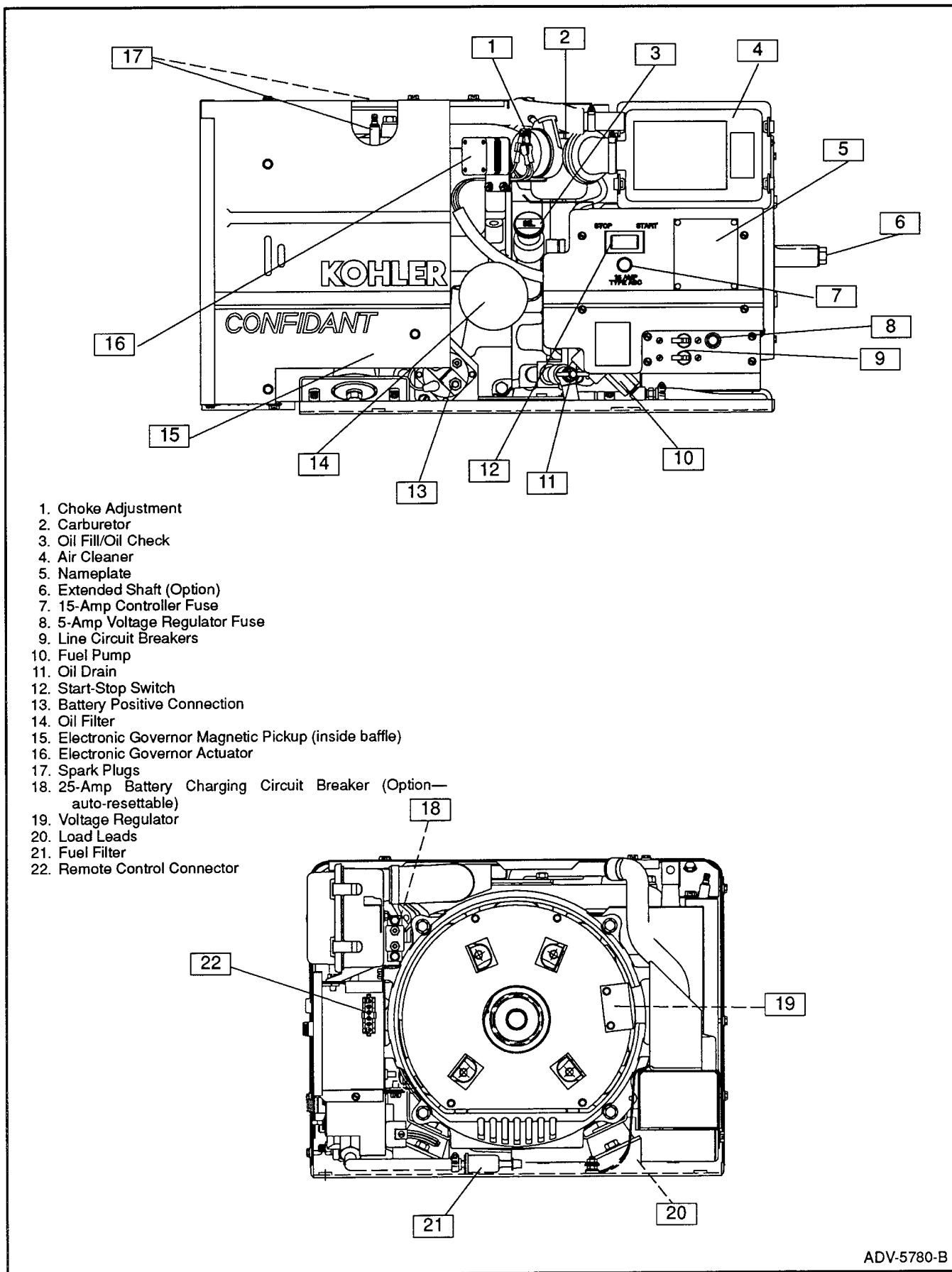


Figure 1-2. Service View 4/5CKMR-Mobile or 4CFKMR-Mobile

Accessories

Several accessories are available to finalize the installation or to add convenience to operation and service. Obtain the most current information by contacting your local Kohler dealer/distributor. Following are accessories available at the time of print of this publication.

Remote Panels

Kohler offers optional remote panels for mounting wherever convenient inside the motorhome. Remote panel harness plug has the *four-square* configuration. Remote panels require an extension wiring harness for hookup to the generator set controller.

Remote Start/Stop Panel

Allows starting/stopping from a location remote of the generator set. 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).

Remote Start/Stop Panel With Hourmeter

Allows starting/stopping from a location remote of the generator set. Overall mounting dimensions are 4 in. (102 mm) by 2 in. (51 mm) with a minimum mounting depth of 2 5/16 in. (59 mm). Refer to TT-798 instructions for assembly.

Wiring Harnesses

Kohler Co. supplies wiring harnesses of varying lengths to simplify electrical connections between the generator set controller and the remote panel. Top quality gold-plated contacts are used for greatest corrosion resistance. Harnesses of 3 ft. (91 cm), 15 ft. (38 cm), 30 ft. (76 cm), and 40 ft. (102 cm) are offered with keyed (error-proof) plugs for the controller and the Kohler remote panel. One end has the *four-square* plug for connection to remote panel. The other plug end has the *six in-line* configuration for connection to the generator set controller.

Kohler offers a one foot (0.3 m) wiring harness with a keyed plug for the controller and pigtails for connection to customer-supplied start switch, generator ON light, hourmeter, etc. Pigtail harness plug has the *six in-line* configuration for hookup to the generator set controller.

Exhaust Systems

Aluminum coated for durability, all Kohler mufflers are designed for minimal back pressure to allow full rated power output. The U.S. Forestry approves Kohler spark arrestors. All required elbows, clamps, brackets, etc., are provided in kits. Refer to TT-870 instructions for assembly.

Available muffler kits include:

Right-side exhaust outlet for generator set mounted above floor.

Left-side exhaust outlet for generator set mounted above floor.

Front exhaust outlet for generator set mounted below floor.

Rear exhaust outlet for generator set mounted below floor.

Side exhaust outlet for generator set mounted below floor.

Center tap bottom exhaust outlet for generator set mounted below floor.

LP Conversion Kit

An LP vapor withdrawal kit is available with all of the necessary components for installation. This kit applies only to certain models—consult factory. Refer to TT-1034 instructions for assembly.

Below-Floor Mounting Trays

A below-floor mounting kit for use with the standard tray is available. Housing kit and hinge kit for use with the below-floor mounting kit are also available. Refer to TT-802 instructions for enclosure and hinge kit assembly and TT-835 instructions for mounting tray assembly.

Section 2. Operation

Prestart Checklist

To ensure continued satisfactory operation; check the following items before each startup.

Oil Level: Keep at or near full mark (not over).

Air Inlets: Keep clear and unobstructed.

Compartment: Maintain a clean interior.

Air Cleaner: Clean and properly installed.

Air Shrouding: Keep tight and in proper position.

Exhaust: Clear and unobstructed tail pipe. Tight muffler and piping connections.

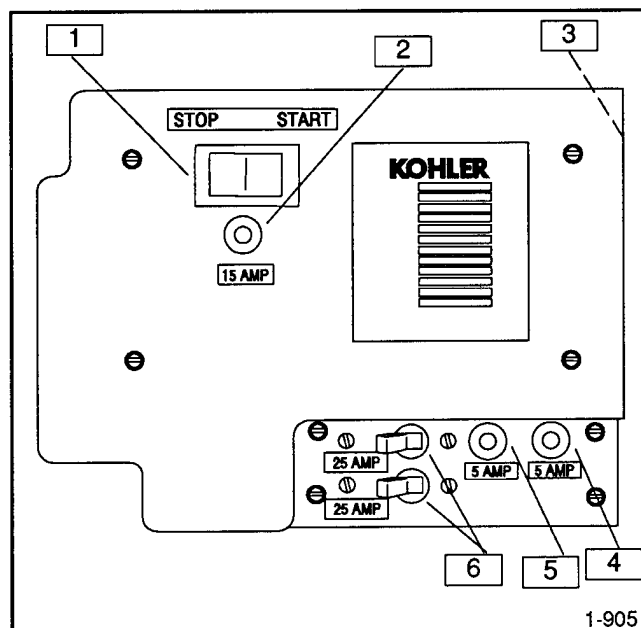
Electrical: Tighten connections (including battery).

Controller

The Kohler relay controller, located on the generator set, includes the components required for generator set operation. See Figure 2-1 for components and the paragraphs below for component description. If the generator set stops automatically during operation, determine if the shutdown is due to low oil pressure. If so, determine and correct the cause of the low oil pressure shutdown before restarting the set.

1. **Generator Start/Stop Switch.** Placing this switch in the Start position starts the generator set engine. Placing switch to Stop position stops the engine. In either case, switch returns to neutral center position when released.
2. **Controller Fuse.** A 15-amp fuse protects controller circuitry against damage in the event of a short circuit.
3. **Remote Panel Connector.** A 6-pin connector on controller side panel allows connection of remote panels to controller.

4. **Deicing Module Fuse.** A 5-amp fuse protects the deicing module in the event of a short circuit. (Newer gasoline models only.)
5. **Voltage Regulator Fuse.** A 5-amp fuse protects the voltage regulator circuitry against damage in the event of a short circuit.
6. **AC Circuit Breaker(s).** The circuit breakers protect the generator against damage in the event of a sustained overload. These circuit breakers are also used to disconnect the load from the generator set. To close the circuit to the load, place the circuit breaker(s) in the ON position.



1. Generator Start/Stop Switch
2. Controller Fuse
3. Remote Panel Connection
4. Deicing Module Fuse
5. Voltage Regulator Fuse
6. AC Circuit Breaker(s)

Figure 2-1. Controller

Starting Procedure

Place the Start/Stop switch in the start position and hold in this position until the engine is running, then release. Do not crank 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 three attempts, contact an authorized service dealer/distributor for repair. Follow the instructions below to start/stop the generator set. The starter motor may burn out if these instructions are not followed.

NOTE

If the engine starts and then stops, allow the engine to come to a complete stop before making a restart attempt. If the flywheel ring gear is still rotating when the starter pinion gear is engaged, the pinion gear will clash which may damage the ring gear teeth.

Stopping Procedure

Whenever possible, allow a brief cooling period by running the set at low or no load for a few minutes just prior to shutdown. To stop, rock the switch to the stop position and hold until the set comes to a complete halt. If the generator set shuts down automatically, identify and correct the problem before attempting to restart.

Anti-icing (For Gasoline Models Only)

When operating the generator set in cold conditions, moisture in the incoming air may condense in the carburetor assembly, especially after stopping the generator set. The condensed moisture can then freeze, creating ice crystals that inhibit normal carburetor operation. To avoid these conditions, each generator set has one of three types of anti-icing systems detailed in the following paragraphs.

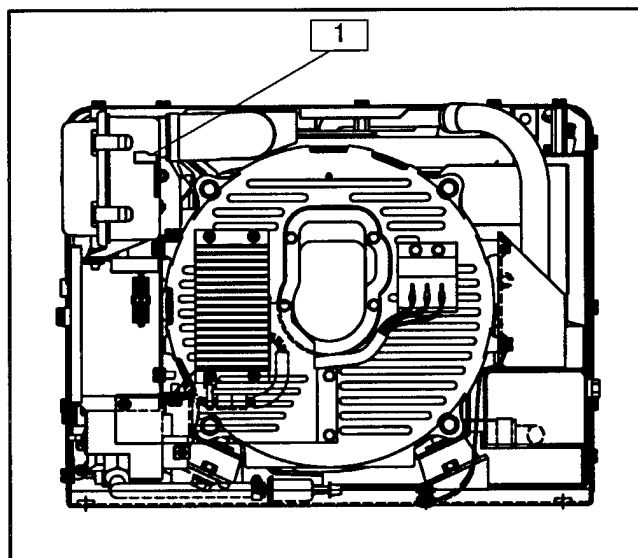
Manual Anti-icing System (Air Cleaner Preheat)

The manual anti-icing system permits the user to route heated manifold air to the carburetor intake when ambient temperatures are low. The manual system is identified by the anti-icing adjustment lever found on the air cleaner. See Figure 2-2.

When operating a generator with manual anti-icing at temperatures of approximately 40° F (4° C) or less, move the anti-icing lever up to the winter position. At temperatures of approximately 70° F (21° C) or above, move the anti-icing lever down to the summer position. For ambient temperatures between 40° and 70° F (4° and 21° C), the anti-icing lever may be left in either position.

NOTE

Be aware of reduced generator output if operating the set in temperatures above 70° F (21° C) with the adjustment lever in the winter position.



1. Winter/Summer Lever

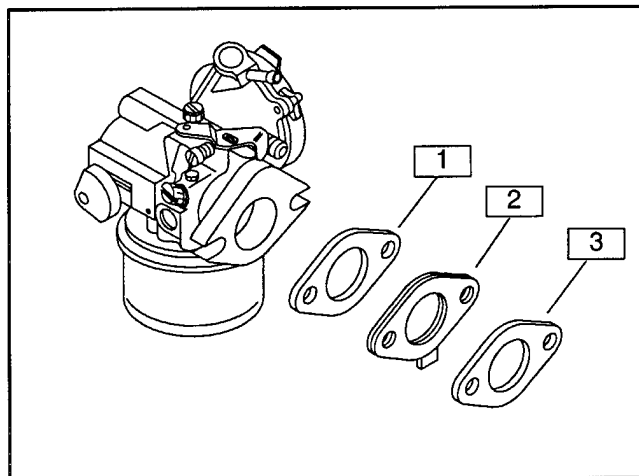
Figure 2-2. Manual Anti-icing System

Positive Temperature Coefficient Plate Anti-icing System (Anti-icing Plate) Early Models

The positive temperature coefficient (PTC) anti-icing system consists of an electric-heating element mounted between the intake manifold and the carburetor. See Figure 2-3. This device operates at 12 vdc.

The heater within the PTC runs whenever the generator set is running. A thermistor, also within the PTC, controls the amount of heat produced by the electric heater. When it is cold, the thermistor automatically allows maximum current (approximately 3 amperes) to flow through the heater and thus produces the maximum amount of heat. As the thermistor temperature increases, current flow to the heater decreases (to a minimum of 0.75 amperes), reducing the heater output.

No manual operation is required because the operation of this anti-icing system is completely automatic.



1. Graphite Spacer
2. Heater
3. Gasket

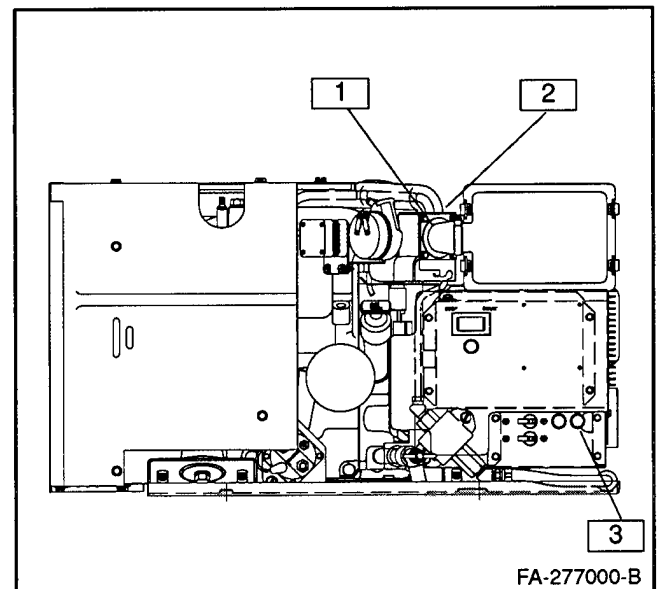
Figure 2-3. PTC Anti-icing System

Automatic Deicing System (Combustion and Preheater) Current Models

The automatic deicing system consists of a deicing module and two temperature switches. An electric heater within the module automatically warms the incoming air when the generator set is running and the ambient temperature is low. This device operates at 120 vac. The system can be recognized by the module mounted between the carburetor air horn and air cleaner. See Figure 2-4.

Two temperature switches control the operation of the heater. A low-level switch turns on power to the heater only when the ambient air temperature is approximately 60° F (16° C) or less. A high-level switch cycles off heater power when the deicing module temperature climbs to approximately 185° F (85° C).

No manual operation is required because the operation of this anti-icing system is completely automatic.



1. Deicing Module (includes high-limit thermostat and heater)
2. Low-Limit Thermostat (located on manifold)
3. 5-amp Deicing Fuse

Figure 2-4. Automatic Deicing System

Circuit Protection

Refer to Figure 2-5 and the following descriptions to identify circuit protection components.

1. **Input (Controller) Fuse (15 Amp).** A replaceable 15-amp fuse protects the controller circuitry. If the generator engine will not crank and the battery and/or other connections are tight, the controller fuse may be blown.
2. **Deicing Module Fuse (5 Amp) (on newer gasoline models only).** A replaceable 5-amp fuse protects the controller circuitry against shorts in the deicing module. If fuse blows again after replacement, check and repair the deicing module and its wiring.
3. **Voltage Regulator Fuse (5 Amp).** A replaceable 5-amp fuse protects the voltage regulator circuits. If the fuse is blown, the generator will not continue running.
4. **AC Circuit Breakers.** These circuit breakers trip when faults occur in the AC output (load) circuits to protect the generator stator windings. If a circuit breaker trips, check the load circuits for shorts or excessive wattage requirements. After fault is corrected, reset AC circuit breaker to the ON position.
5. **Battery-Charging Circuit Breaker (25 Amp).** This circuit breaker trips to protect the battery-charging circuit, including the battery-charging windings of the generator stator, in the event of a short. If this circuit breaker trips, refer to the troubleshooting procedures to isolate and repair the problem. This breaker automatically resets. See Figure 1-2 for location.

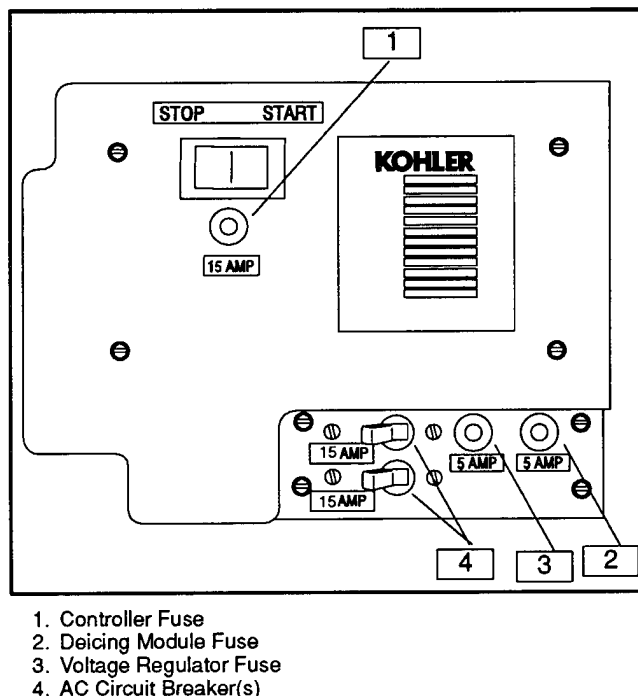
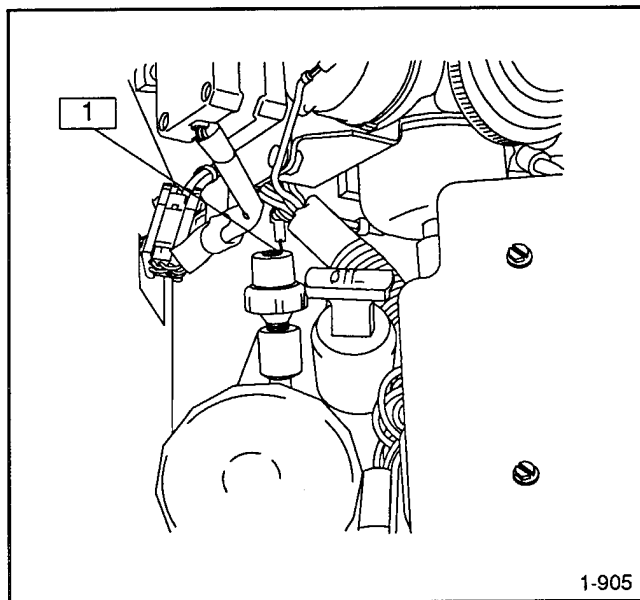


Figure 2-5. Controller Circuit Protection Components

Engine Safety Shutdowns

Low Oil Pressure Shutdown

The low oil pressure shutdown feature protects the engine against internal damage if the oil pressure drops below $3 \frac{1}{2}$ psi $\pm 1 \frac{1}{2}$ psi (24.1 kPa) due to oil pump fault or other malfunction. It does not protect against damage due to operating with the oil level below the safe range—it is *not a low oil level shutdown*. The only protection against running out of oil is checking the level regularly and adding oil as needed. Figure 2-6 shows the location of the low oil pressure (LOP) switch.



1. Low Oil Pressure Switch

Figure 2-6. Low Oil Pressure Switch

Overspeed Shutdown

The generator set employs an electronic governor to regulate the engine speed. This regulation assures that generator output remains within ± 0.25 percent of the specified frequency (50 or 60 Hz). The electronic governor also monitors for overspeed conditions in order to prevent engine runaway. The governor shuts down the generator set engine if the output frequency exceeds 60 Hz (for 50 Hz models) or 72 Hz (for 60 Hz models).

Optional Remote Panels

Remote Start Panel

The remote start panel (Figure 2-7) allows starting/stopping from a location remote of the generator set. A 6-pin connector on the controller permits connection of the panel to the generator set. Procedures for starting and stopping from the remote panel are the same as those given for the controller panel.

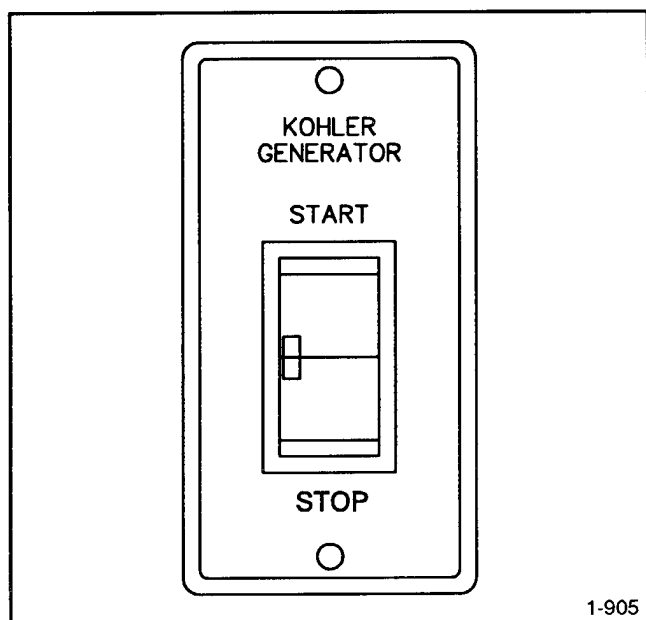


Figure 2-7. Remote Start Panel

Remote Start Panel With Hourmeter

The remote start panel with hourmeter (Figure 2-8) allows starting/stopping from a location remote of the generator set. The hourmeter on the panel records total generator operating time to facilitate scheduling of maintenance. The panel also includes a light. If the light is lit, the generator is running. A 6-pin connector on the controller permits connection of this panel to the generator set. Procedures for starting and stopping from the remote panel are the same as those given for the controller panel.

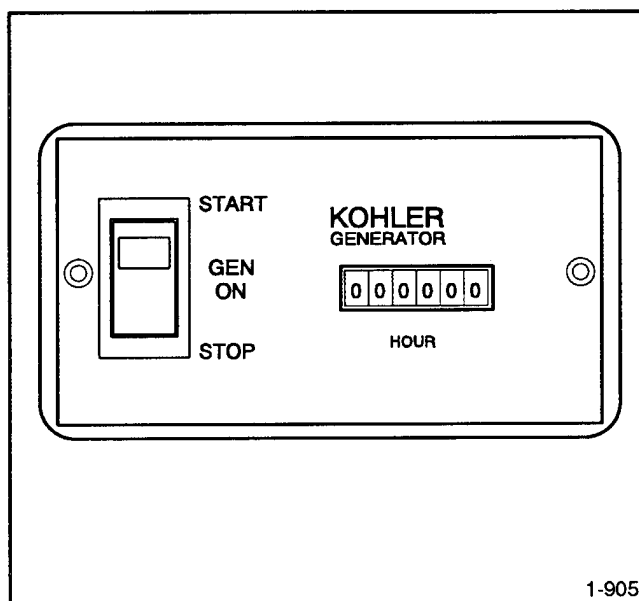


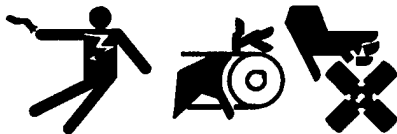
Figure 2-8. Remote Start Panel With Hourmeter

Section 3. Scheduled Maintenance

General

Schedule routine maintenance according to the Service Schedule following and the hourmeter located on the controller. If subjecting the generator to extreme operating conditions, service the unit more frequently. The following pages provide instructions for performing most of the scheduled services. If tools and instruments required for these services are not available to the generator set owner, 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.

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 set. The generator set can be started by the remote start/stop switch unless this precaution is followed.

NOTE

Perform the items listed in the service schedule at the designated intervals for the life of the generator. For example, an item to be serviced "every 50 hours or 6 months" must also be serviced after 100 hours or 12 months, 500 hours or 2 years, etc. The generator will eventually accumulate enough hours to warrant a complete overhaul. The exact time at which extensive service will be necessary cannot be predicted. However, rough operation, lack of power, and excessive oil use indicate serious generator set problems. As part of a preventive maintenance program, service the engine (clean cylinder head, inspect valves, check compression, etc.) and generator (replace bearing, inspect wiring, remove debris, etc.) at the earliest indication that a problem exists.

NOTE

Do not leave generator sets equipped with the optional swing-down tray in the tilted position for any extended period (30 minutes or more). Always place unit in the normal mounting position when not performing service.

Service Schedule

Perform Service at Intervals Indicated (•)	Before Each Startup	Every 50 Hours or 6 Months	Every 100 Hours or 12 Months	Every 500 Hours or Two Years
Check exhaust outlet	•			
Check oil level	•			
Check fuel supply	•			
Keep cooling air inlets and outlets clean and unobstructed	•			
Remove loose dirt from compartment	•			
Check electrolyte level in battery	•			
Check air cleaner (replace if dirty)		•		
Drain collection pipe (LP liquid-fueled units only—if equipped)		•		
Change lube oil (change oil initially after first five hours of operation)		• *	• **	
Replace lube oil filter		• *	• **	
Service or replace spark plugs			•	
Check battery specific gravity			•	
Check and tighten electrical connections			•	
Check and tighten mounting bolts and vibromounts			•	
Blow dust out of generator			•	
Clean spark arrestor			•	
Check for stepper motor/throttle shaft coupling wear				• (250 hours)
Check valve-tappet clearance				•
Service cylinder heads				• ***
Check compression				• ***
Inspect liquid withdrawal LP fuel filter				•
Replace fuel filter				•

* Applies to 5 kW

** Applies to 4 kW

*** Performed by an authorized Kohler service dealer/distributor

NOTE

Unleaded gasoline is recommended. If using leaded gasoline, service cylinder heads every 250 hours.

Lubrication System

Description

The engine has a positive-pressure lubrication system that includes an internal oil pump, a replaceable oil filter, and a low oil pressure shutdown switch.

Oil Check

Check crankcase oil level daily or before each start. To check oil level, remove oil cap/dipstick assembly and wipe dipstick clean. See Figure 3-1. Reposition dipstick in crankcase and insert it all the way down into the tube. Remove dipstick and check the level. Oil level should read between max and min marks on dipstick. See Figure 3-2. Do not operate set if oil level exceeds the max mark or registers below the min mark on dipstick.

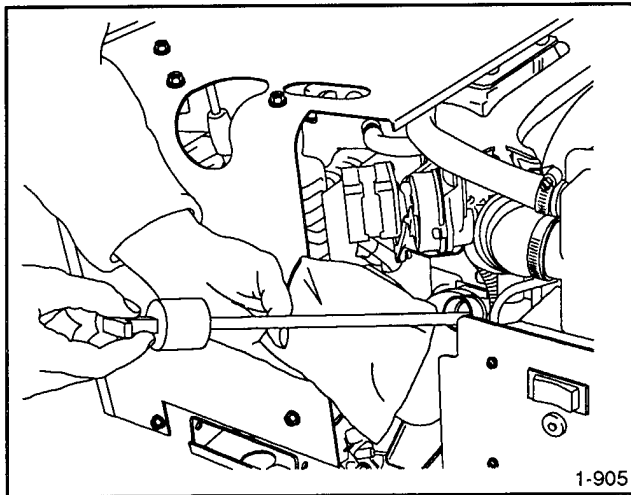
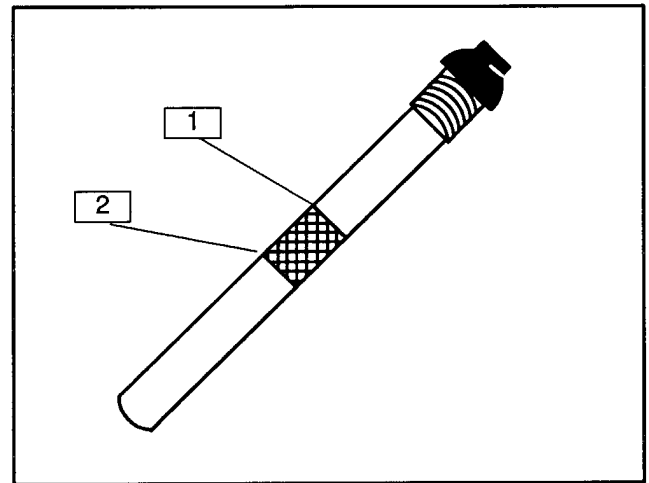


Figure 3-1. Oil Check



- 1. Max Mark
- 2. Min Mark

Figure 3-2. Lube Oil Level

NOTE

Do not check oil level when the set is in operation. The engine must be stopped and on a level surface when checking oil. Shut down the generator and wait several minutes before checking oil to ensure an accurate oil reading.

Oil Specifications

Oil used in factory generator set testing is drained before shipping. Before operating a new set, fill the engine crankcase to the specified capacity with a straight-weight oil having a viscosity appropriate for your particular climate. Do not use synthetic oils during the first five hours of operation or the rings may not seat properly. Change the oil immediately after the first five hours of operation.

Use high-quality detergent oils meeting the requirements of SAE service class SF or SG in Kohler M18 and M20 engines. Straight-weight 30 oil is preferred. If using multi-viscosity oil in temperatures above 32° F (0° C), be aware of the resulting increase in oil consumption and combustion deposits. Base oil type selection on air temperature at time of operation. Consult the SAE viscosity grade chart (see Figure 3-3).

Do not mix different brands of oils. Possible incompatibility could cause a breakdown of lubricating ingredients and reduce engine protection.

RECOMMENDED SAE VISCOSITY GRADES

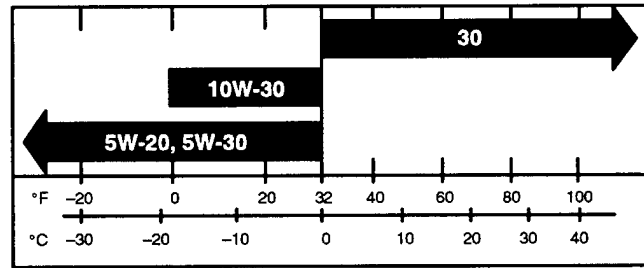


Figure 3-3. Temperature Range Expected Before Next Oil Change

Adding Oil

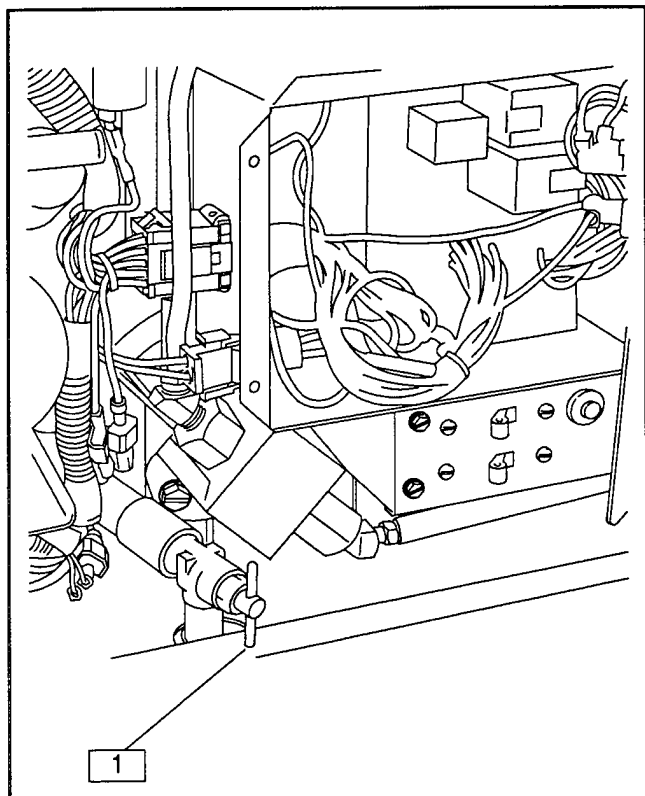
It is normal to add some oil between oil changes. The amount will vary with the usage. Open fill cap and pour in a small amount of oil using a funnel or other suitable pouring device. Wait a few minutes and check level. If necessary, add more oil and then check again. Each time add small quantities and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

OIL CAPACITY (with Filter)	
Generator Model	Qts. (L)
4 kW	1.5 (1.4)
5 kW	2.5 (2.4)

Figure 3-4. Engine Oil Capacity

Oil Change

On a new engine, change the oil after the first 5 hours of operation and thereafter at the intervals specified in the service schedule. Whenever possible, change oil while the engine is still warm.



1. Oil Drain Petcock

Figure 3-5. Oil Drain Petcock

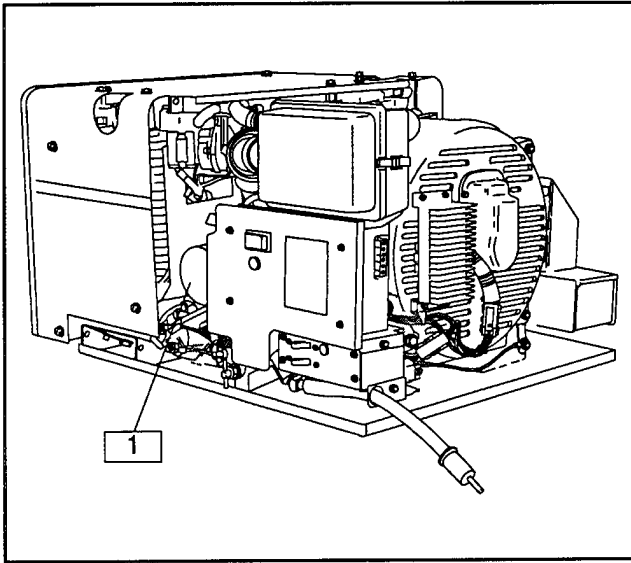
1. Place a container below the oil drain hole and open the oil drain petcock (located beneath the dipstick). See Figure 3-5. Allow sufficient time for the old oil to drain completely. Close oil drain petcock. Dispose of used engine oil in an environmentally safe manner.
2. Remove oil fill cap dipstick. See Figure 3-1.
3. If the engine oil filter is to be replaced, see Oil Filter following.
4. Fill crankcase with amount and type of oil as specified in Figure 3-3 and Figure 3-4.
5. Start the generator set and check for oil leaks.
6. Stop the generator set. Remove the 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.

NOTE

Too high an oil level causes high oil consumption and carbonizing in the engine. Low oil level will cause engine damage.

Oil Filter

Replace the oil filter every time the oil is changed. See Figure 3-6 and refer to the following procedure.



1. Oil Filter

Figure 3-6. Oil Filter Location

1. Loosen oil filter by turning it with a filter wrench in a counterclockwise direction. Oil filter is 3 in. (76 mm) dia. and has 14 flutes (sides). Use rags to clean up spilled oil. Remove and discard.
2. Clean contact surface on oil filter adapter.
3. Lightly lubricate the gasket surface of the new oil filter with the fresh engine oil. Thread oil filter to adapter until gasket makes contact, hand tighten an additional one-half turn.
4. Fill crankcase with fresh oil and check for leaks as detailed in steps 4-6 of Oil Change procedure on previous page.

Cooling System

To prevent generator set overheating damage, keep the compartment cooling air inlets clean and unobstructed at all times.

A fan on the rotor of the generator draws cooling air into the compartment through the generator cooling slots and expels it at the engine-generator adapter. The engine of the generator set features an Air-Vac™ reverse-flow cooling system. Fins on the engine flywheel pull cooling air past the fins of the cylinder heads and heated air is discharged downward and out of the compartment through the discharge chute. See Figure 3-7.

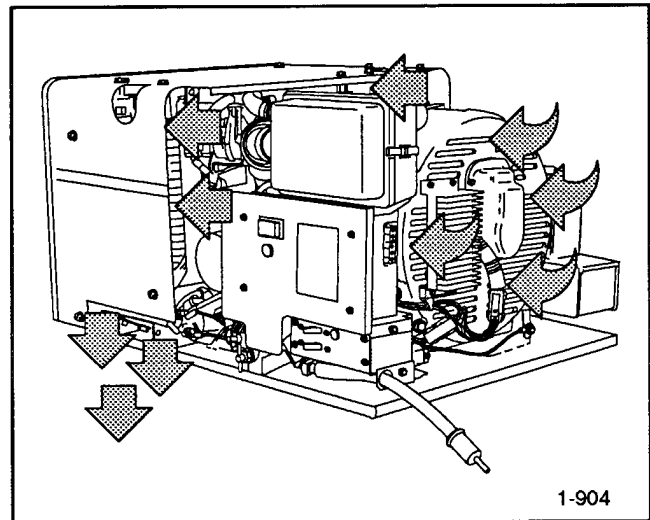


Figure 3-7. Cooling Air Circulation

Ignition System

Description

The 4 kW and 5 kW generator sets are equipped with a dependable electronic magneto ignition system (Figure 3-8) containing the following:

- A magnet assembly permanently affixed to the flywheel.
- An electronic magneto ignition module mounted to the #1 side cylinder barrel.
- A controller which stops the engine by grounding the ignition module.

As the flywheel rotates and the magnet assembly moves past the ignition module, a low voltage is induced in the primary windings of the module. When the primary voltage is precisely at its peak, the module induces a high voltage in its secondary windings. This high voltage creates a spark at the tip of the spark plugs, igniting the fuel-air mixture in the combustion chambers. Other than periodically checking/replacing the spark plugs, no maintenance, timing, or adjustments are necessary with this ignition system.

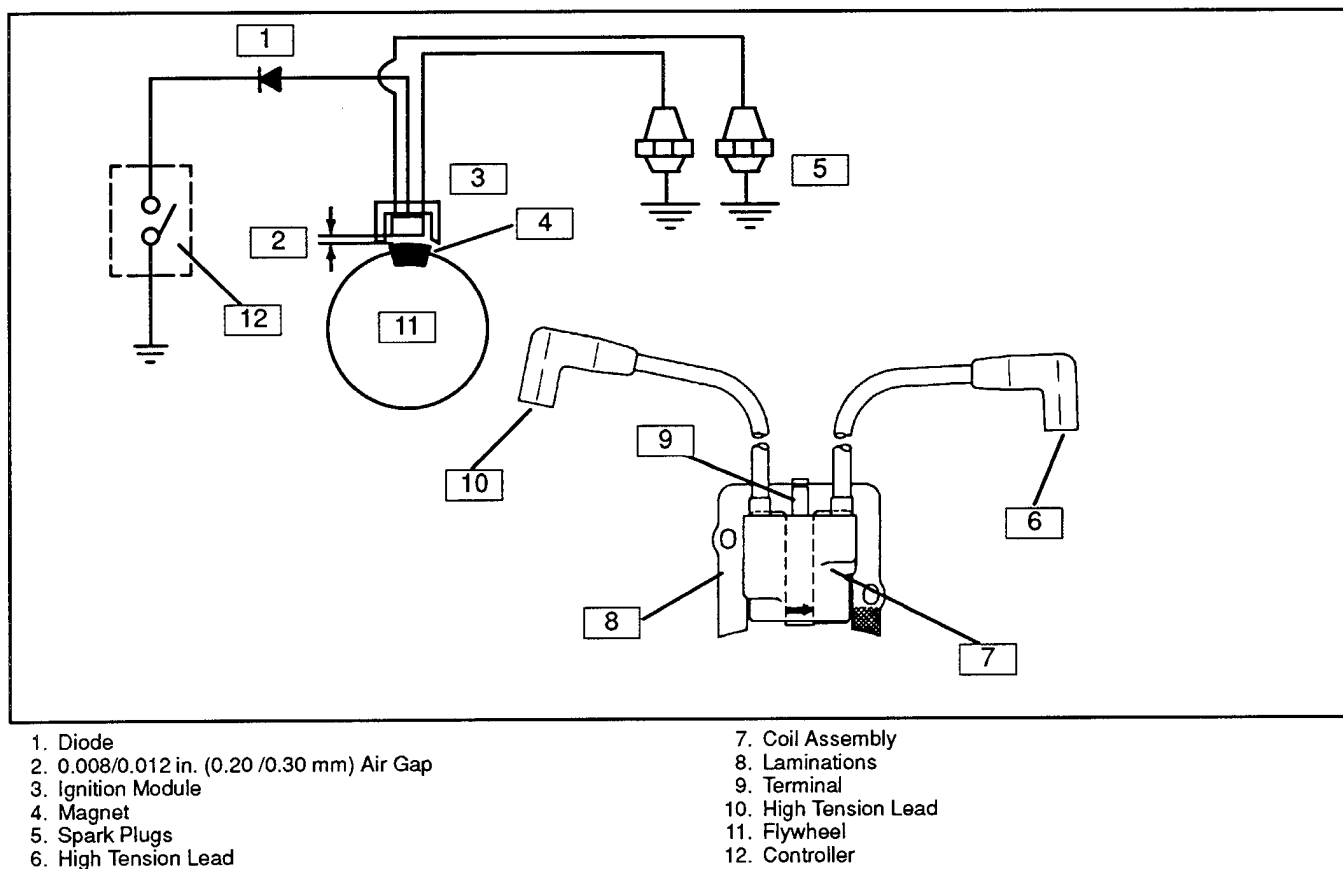


Figure 3-8. Electronic Magneto Ignition System

Spark Plugs

At the interval recommended in the service schedule, service spark plugs as follows:

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

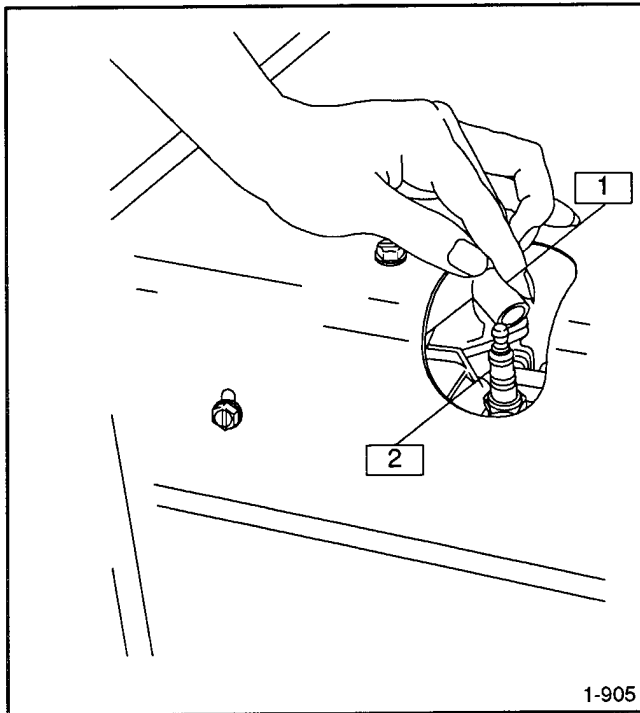
NOTE

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

2. Loosen spark plug with a ratchet and spark plug socket with a rubber insert to prevent damage to spark plug. If possible, use compressed air to remove dirt around each spark plug before completing spark plug removal. This procedure will prevent dirt from falling into combustion chamber.
3. Remove and examine each spark plug for conditions described in Figure 3-12.
4. Wipe spark plugs clean with a rag. Then file center electrode so its top is flat and perpendicular to the spark plug axis. Should replacement be necessary, see Specifications, Engine in Section 1 for spark plug type.

NOTE

Do not sandblast, wire brush, scrape, or otherwise service spark plug in poor condition. For best results replace the plug.

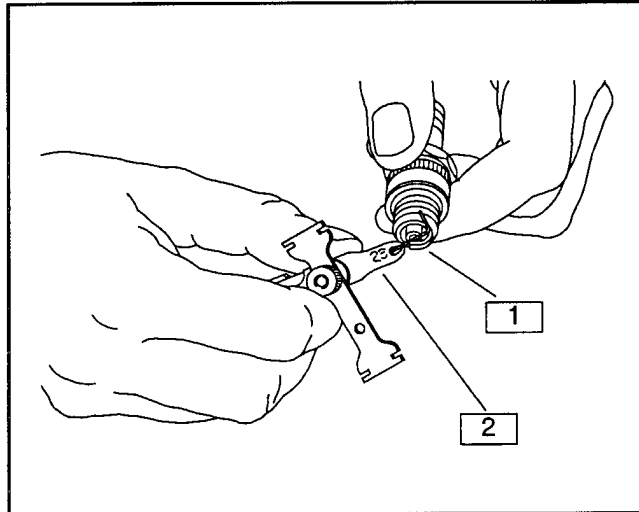


1. Boot
2. Spark Plug

Figure 3-9. Removing Spark Plug Boot

5. Before installing any spark plug, check the gap. See Figure 3-10. The proper gap is attained when the feeler gauge (or wire) passes between the spark plug electrodes. It should pass easily, but with some resistance or drag; otherwise, adjust as necessary.

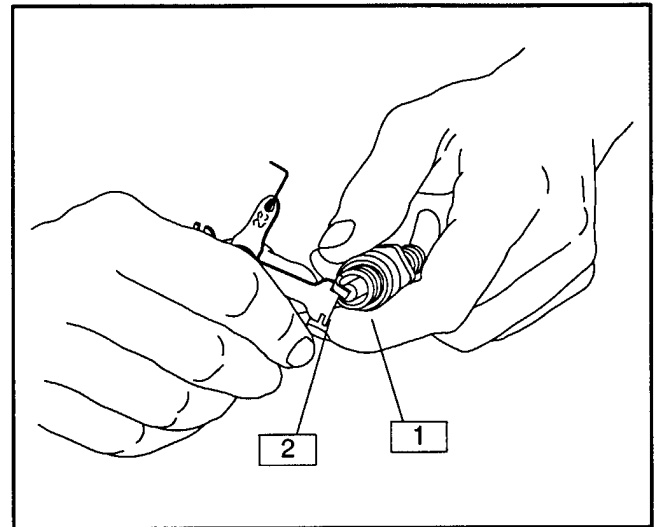
The correct gap is 0.025 in. (0.64 mm) for gasoline models and 0.018 in. (0.46 mm) for LP gas models.



1. Spark Plug
2. Gap Gauge

Figure 3-10. Checking Spark Plug Gap

6. If necessary use gapping tool to gently bend side electrode in order to correct gap. See Figure 3-11. Be sure side electrode remains centered over center electrode. Repeat steps 5 and 6 until gap is properly adjusted.



1. Spark Plug
2. Gapping Tool

Figure 3-11. Adjusting Spark Plug Gap

7. Install spark plug in cylinder head, be careful not to bump electrode and alter gap. Rotate spark plug clockwise until resistance is felt.
8. Tighten each spark plug with a torque wrench to a torque of 10-15 ft. lbs. (14-20 Nm). If a torque wrench is not available, tighten each spark plug until resistance is felt; then tighten with a ratchet an additional 1/4 turn. Do NOT overtighten as this may strip the cylinder head threads or alter the gap setting.
9. Check spark plug wire connector in boot for accumulated dirt, grease, etc., and clean as necessary. Firmly push spark plug boot onto spark plug.

Timing

The timing of the spark is automatically controlled by the ignition module. No ignition timing adjustments are necessary or possible with this system. If timing problems are encountered, check ignition module air gap. See Engine Service Manual for details.

Spark Plug Condition	Means of Identification	Possible Cause/ Recommended Action
Normal	Light gray or tan deposit on firing tip.	Good operating conditions and maintenance.
Gap bridged	Built-up deposits closing gap between electrodes.	Oil or carbon fouling. Clean and regap plug.
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 plug.
Lead fouled	Dark gray, black, yellow, or tan deposits; or a glazed coating on the insulator tip.	Highly leaded fuel. Replace plug.
Preignition	Melted electrodes and possibly blistered insulator. Metallic deposits on insulator suggest internal engine damage.	Wrong type of fuel, incorrect timing or advance, too hot of a plug, burnt valves or engine overheating. Replace plug.
Overheating	White or light gray insulator with small black or gray/brown spots with bluish (burnt) appearance on electrode.	Engine overheating, wrong type of fuel, loose spark plugs, too hot of 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 plug at prescribed interval. Replace plug.

Figure 3-12. Evaluating Spark Plug Condition