Operation and Installation Manual

RV/Mobile Generator Sets

Models:

7CCO
7CCFO
7CCOZ
7CCFOZ
10CCO
10CCFO
10CCOZ
10CCFOZ

KOHLER® POWER SYSTEMS

ANNIVERSARY

ISO 9001 KOHLER GENERATORS INTERNATIONALLY REGISTERED

TP-5594 5/95

Table of Contents

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.

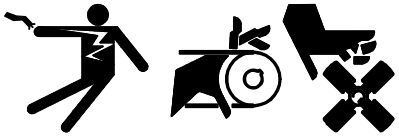
NOTE

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

⚠ 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.

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 changed. 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.

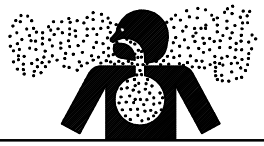
Do not smoke or permit flame or spark to occur near fuel or fuel system.

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. Do not use copper tubing in diesel exhaust systems. Diesel fumes can rapidly destroy copper tubing in diesel exhaust systems. Exhaust sulfur causes rapid deterioration of copper tubing resulting in exhaust leakage.

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. Spilled fuel can cause an explosion. Use a container to catch fuel when draining fuel system. Wipe up all spilled fuel after draining system.

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.

Moving rotor.

Can cause severe injury or death.

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 voltage can cause severe injury or death. Engine block heater can cause electrical shock. Remove engine block heater plug from electrical outlet before working on block heater electrical connections.

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 coolant and steam.
Can cause severe injury or death.

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

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

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

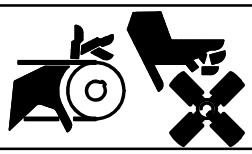
Hazardous voltage.

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 thrubolt 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 thrubolt 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:

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

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

NOTE

Pay special attention to the coolant level. After the coolant has been drained, some time is required before complete refill of the engine water jacket takes place.

NOTE

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

NOTE

Do not turn on block heater before filling cooling system. Run engine until warm and refill radiator to purge air from the system before energizing block heater. Block heater failure occurs if heater element is not immersed in water.

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

For standby service connect output of generator set to a suitably rated transfer switch in accordance with Canadian Electrical Code, Part 1.

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.

Introduction

All information in this publication represents data available at time of printing. Kohler Co. reserves the right to change this literature and the products represented without incurring obligation.

Read through this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Keep this manual with equipment for future reference.

Equipment service requirements are minimal but are very important to safe and efficient operation; therefore, inspect parts often and perform required services at the prescribed intervals. An authorized service distributor/dealer should perform required servicing to keep equipment in top condition.

Service Assistance

For sales and service in the U.S.A. and Canada check the yellow pages of the telephone directory under the heading GENERATORS– ELECTRIC for an authorized service distributor/dealer or call 1-800-544-2444.

For sales and service outside the U.S.A. and Canada, contact your local distributor.

For further information or questions, contact the company directly at:

KOHLER CO., Kohler, Wisconsin 53044 U.S.A.
Phone: 414-565-3381
Fax: 414-459-1646 (North American Sales)
414-459-1614 (International)

To ensure supply of correct parts or information, make note of the following identification numbers in the spaces provided:

GENERATOR SET

MODEL, SPEC, and SERIAL numbers are found on the nameplate attached to the generator set.

Model No. _____

Specification No. _____

Serial No. _____

GENERATOR SET ACCESSORIES

An alternate nameplate inside the junction box identifies factory-installed generator set accessories.

Accessory Nos. _____

_____

_____

_____

_____

_____

_____

_____

_____

ENGINE

The engine serial number is found on the engine nameplate.

Engine Serial No. _____

Routine Service Parts

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

Part Description	Kohler Part No.
Air Cleaner Element	258646
Oil Filter	322422
Metal-Type Fuel Filter Element	322536
Plastic-Type Fuel Filter (Supplied Loose)	322056
Alternator V-belt	322456
Black spray paint	221292

Section 1. Specifications

General Specifications

	7 kW (60Hz)	10 kW (60Hz)
Dimensions L x W x H in. (mm):		
Remote Radiator (Single Phase)	30.49 x 18.43 x 25.09 (774 x 468 x 637)	35.37 x 20.22 x 25.60 (898 x 514 x 650)
Inline Radiator (Single Phase/Suction Fan)	34.68 x 18.68 x 25.09 (881 x 475 x 637)	40.29 x 20.72 x 25.60 (1023 x 526 x 650)
Inline Radiator (Three Phase/Suction Fan)	35.68 x 18.68 x 25.09 (906 x 475 x 637)	41.29 x 20.72 x 25.60 (1049 x 526 x 650)
Inline Radiator (Single Phase/Pusher Fan)	35.82 x 21.18 x 26.56 (910 x 538 x 675)	40.99 x 21.18 x 27.68 (1041 x 538 x 703)
Inline Radiator (Three Phase/Pusher Fan)	36.82 x 21.18 x 26.56 (935 x 538 x 675)	41.99 x 21.18 x 27.68 (1067 x 538 x 703)
Weight– dry, lbs. (kg):		
Remote Radiator (Single Phase)	472 (214)	576 (261)
Inline Radiator (Single Phase/Suction Fan)	482 (219)	586 (266)
Inline Radiator (Three Phase/Suction Fan)	496 (225)	606 (275)
Inline Radiator (Single Phase/Pusher Fan)	482 (219)	586 (266)
Inline Radiator (Three Phase/Pusher Fan)	496 (225)	606 (275)
Air Requirements (Suction Fan) CFM (M^3/min):		
Combustion.	25 (0.71)	36 (1.02)
Cooling	1050 (29.7)	1300 (36.8)
Air Requirements (Pusher Fan) CFM (M^3/min):		
Combustion	25 (0.71)	36 (1.02)
Cooling	1000 (28.3)	1800 (51.0)
Fuel Inlet Size in. (mm)	5/16 (8)	5/16 (8)
Fuel Return Size in. (mm)	3/16 (5)	3/16 (5)

Fuel Consumption gph (Lph):

Model:	25% Load	50% Load	75% Load	100% Load
7 kW	0.34 (1.3)	0.44 (1.7)	0.57 (2.2)	0.79 (3.0)
10 kW	0.46 (1.7)	0.60 (2.3)	0.80 (3.0)	1.07 (4.0)

DERATION: All units are rated 1.0 power factor. The kilowatts of the generator set will decrease 3.5% for each 1,000 feet (305 meters) above 500 feet (152 meters) above sea level and 1% for each 10°F (5.5°C) above 85°F (30°C).

Engine

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

	7 kW	10 kW
Manufacturer	Kubota	
Model	D905BG-2	V1305BG-2
Type	Water-cooled, 4-cycle diesel engine	
Number Cylinders	3	4
Firing Order	1-2-3	1-3-4-2
Compression Ratio	22:1	
Displacement cu. in. (cm^3)	54.86 (898)	81.46 (1335)
Rated Horsepower (60 Hz)	12.6	18.6
RPM (60 Hz)	1800	
Bore in. (mm)	2.83 (72)	2.99 (76)
Stroke in. (mm)	2.90 (73.6)	2.90 (73.6)
Combustion System	Indirect injection	
Valve Clearance– cold in. (mm)	0.0057–0.0072 (0.145–0.185)	
Cylinder Block Material	Cast iron	
Cylinder Head Tightening Torque ft. lbs (Nm)	47.0–50.6 (63.7–68.6)	
Cylinder Head Material	Cast iron	
Connecting Rod	Forged carbon steel	
Piston Rings	2 compression/1 oil	
Main Bearings	Replaceable sleeve	
Governor	Mechanical	
Lubrication System	Pressure	
Oil Capacity (with filter) qts. (L)	5.4 (5.1)	6.3 (6.0)
Oil Type (API)	MIL-L-2104C, or API classification CC, CD, or CE	
Oil Pressure psi (kPa)	36–64 (248–441)	
Fuel Recommendation	Diesel fuel no. 2-D (ASTM D975)	
Fuel Injection Pump	Bosch MD	
Battery Voltage	12	
Battery Ground	Negative	
Battery Recommendation (min.)	625 cold cranking amps	
Starter Motor	Gear-reduction type	
Cooling System Capacity qts. (L)		
Inline Radiator	2.44 (2.3)	5.1 (4.8)
Air Cleaner	Dry paper element	
Cold Weather Starting Aids	Glow plugs	

Generator

Models 7CCO/CCFO/CCOZ/CCFOZ

Model Series	Voltage Code	Voltage	Wire	Amps/ Pole	kW	PH
60 Hz Models:						
7CCO	61	120/240	3	29.2	7.0	1
7CCO	101	100/200	3	35.0	7.0	1
7CCO	11	100	2	70.0	7.0	1
7CCOZ	01	120/240	4	21.0	7.0	3
7CCOZ	51	139/240	4	21.0	7.0	3
7CCOZ	51	127/220	4	23.0	7.0	3
7CCOZ	71	227/480	4	10.5	7.0	3
7CCOZ	71	240/416	4	12.1	7.0	3
7CCOZ	81	120/208	4	24.3	7.0	3
50 Hz Models:						
7CCFO	101	120/240	3	24.3	5.8	1
7CCFO	61	110/220	3	26.5	5.8	1
7CCFO	11	100/200	3	29.2	5.8	1
7CCFO	41	220	2	26.5	5.8	1
7CCFOZ	51	110/190	4	22.2	5.8	3
7CCFOZ	51	115/200	4	21.0	5.8	3
7CCFOZ	71	220/380	4	11.1	5.8	3
7CCFOZ	71	230/400	4	10.5	5.8	3
7CCFOZ	71	240/416	4	10.1	5.8	3
7CCFOZ	81	120/208	4	20.2	5.8	3
7CCFOZ	81	110/220	4	19.1	5.8	3

Models 10CCO/CCFO/CCOZ/CCFOZ

Model Series	Voltage Code	Voltage	Wire	Amps/ Pole	kW	PH
60 Hz Models:						
10CCO	61	120/240	3	41.7	10.0	1
10CCO	101	100/200	3	50.0	10.0	1
10CCOZ	01	120/240	4	30.1	10.0	3
10CCOZ	51	139/240	4	30.1	10.0	3
10CCOZ	51	127/220	4	32.8	10.0	3
10CCOZ	71	227/480	4	15.0	10.0	3
10CCOZ	71	240/416	4	17.3	10.0	3
10CCOZ	81	120/208	4	34.7	10.0	3
50 Hz Models:						
10CCFO	101	120/240	3	34.7	8.3	1
10CCFO	61	110/220	3	37.9	8.3	1
10CCFO	11	100/200	3	41.7	8.3	1
10CCFO	41	220	2	37.9	8.3	1
10CCFOZ	51	110/190	4	31.7	8.3	3
10CCFOZ	51	115/200	4	30.1	8.3	3
10CCFOZ	71	220/380	4	15.8	8.3	3
10CCFOZ	71	230/400	4	15.0	8.3	3
10CCFOZ	71	240/416	4	14.5	8.3	3
10CCFOZ	81	120/208	4	28.9	8.3	3
10CCFOZ	81	110/220	4	27.3	8.3	3

Generator Models 7/10 kW

	Single-Phase Models	Three-Phase Models
RPM (60-Hz Models)	1800	
RPM (50-Hz Models)	1500	
7 kW:		
Stator Resistance (ohms)** Leads:		
1-2, 3-4, 33-44	0.13	
55-33	1.60	
B1-B2	0.08	
1-4, 2-5, 3-6, 7-10, 8-11, 9-12		0.1
B1-B2		0.1
V0-V7, V0-V8, V0-V9		0.1
55-66		2.3
Rotor Resistance (ohms)	3.9	5.1
10 kW:		
Stator Resistance (ohms)** Leads:		
1-2, 3-4, 33-44	0.12	
55-33	1.50	
B1-B2	0.07	
1-4, 2-5, 3-6, 7-10, 8-11, 9-12		0.1
B1-B2		0.1
V0-V7, V0-V8, V0-V9		0.1
55-66		2.0
Rotor Resistance (ohms)	4.3	3.9
Excitation Method	Static excited	Rotating exciter
Overbolt Torque	25 ft. lbs. (300 in. lbs.)	
Voltage Regulator Type	PowerBoostä IIIE	PowerBoostä V
Insulation (Rotor and Stator)	Class 155, epoxy varnish, vacuum impregnated	
Winding Material	Copper	
Bearing (Number and Type)	1, replaceable ball	
Circuit Protection:		
Controller	10-amp fuse	10-amp circuit breaker
Optional AC Output	Manual-reset circuit breaker	
Voltage Regulator	10-amp fuse	8-amp fuse
Fuel Solenoid	10-amp fuse	

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

Notes

Service View Components
Remote-Radiator Model (See Figure 1-1)

1. Optional AC Circuit Breaker
2. Voltage Regulator Fuse
3. Start/Stop-Preheat Switch
4. Fuel Solenoid Fuse
5. Controller Fuse
6. Hourmeter
7. Controller
8. Remote Connection (at rear of controller)
9. Air Cleaner
10. Lifting Eye
11. High Water Temperature Shutdown
12. Fuel Solenoid
13. Oil Fill
14. Lifting Eye
15. Oil Fill
16. Generator Nameplate
17. Mechanical Governor
18. Oil Filter
19. Fuel Filter
20. Ground Connection
21. Oil Drain
22. Fuel Pump
23. Oil Check
24. Fuel Inlet Connection Point
25. Fuel Return Connection Point
26. Glow Plug Relay
27. Voltage Regulator (inside junction/circuit breaker box)
28. Battery Charging Alternator (behind guard)
29. Low Oil Pressure Shutdown
30. Exhaust Outlet
31. Coolant Outlet
32. Coolant Inlet
33. Starter

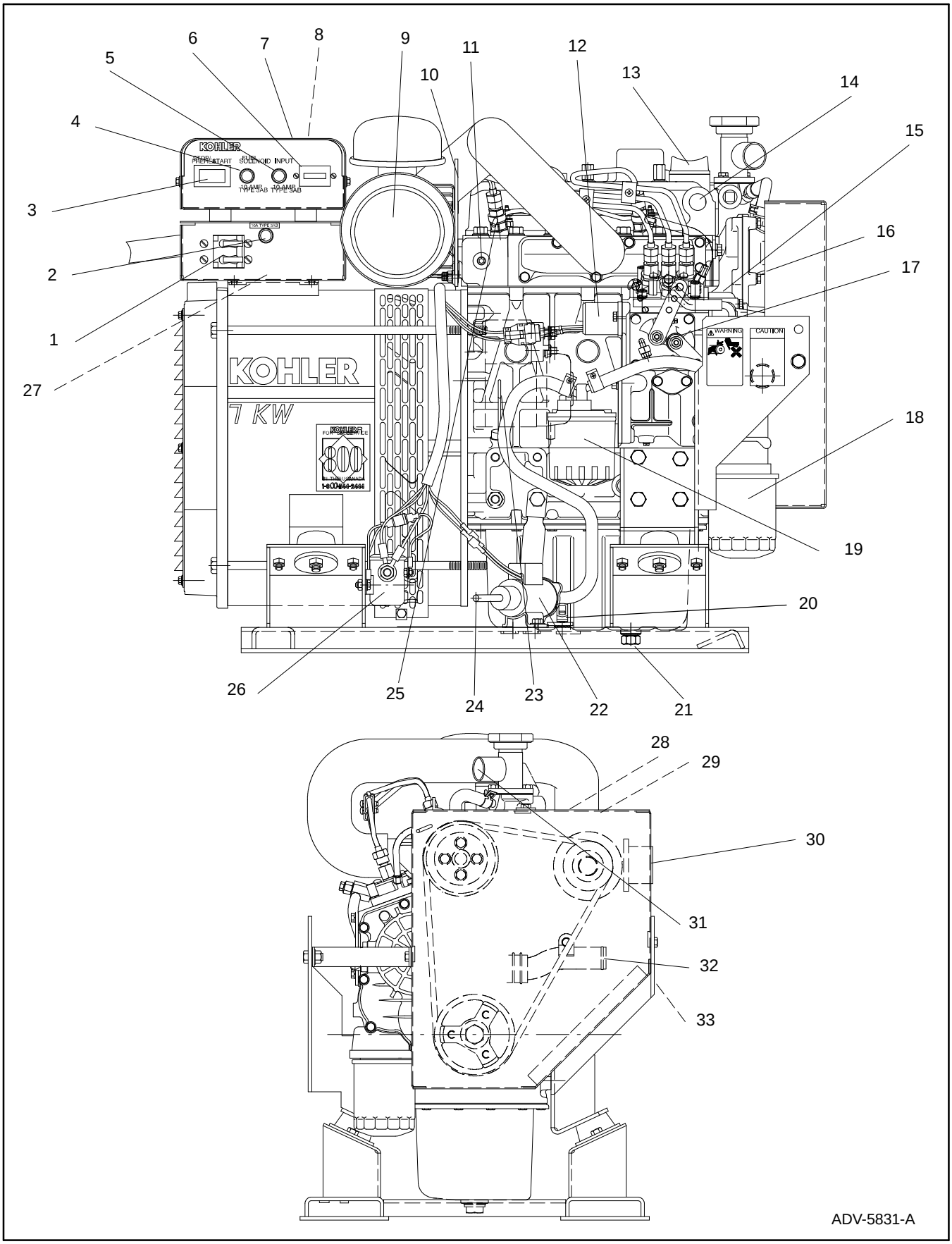


Figure 1-1. Service View of 7CCO-RV Remote Radiator (Typical)

Service View Components
Inline-Radiator Model (See Figure 1-2)

1. Optional AC Circuit Breaker
2. Voltage Regulator Fuse
3. Start/Stop-Preheat Switch
4. Fuel Solenoid Fuse
5. Controller Fuse
6. Hourmeter
7. Controller
8. Remote Connection (at rear of controller)
9. Air Cleaner
10. Lifting Eye
11. High Water Temperature Shutdown
12. Fuel Solenoid
13. Oil Fill
14. Coolant Fill (Initial)
15. Lifting Eye
16. Inline Radiator
17. Oil Fill
18. Generator Nameplate
19. Mechanical Governor
20. Oil Filter
21. Coolant Drain
22. Fuel Filter
23. Oil Drain
24. Ground Connection
25. Fuel Pump
26. Oil Check
27. Fuel Inlet Connection Point
28. Fuel Return Connection Point
29. Glow Plug Relay
30. Voltage Regulator (inside junction/circuit breaker box)
31. Exhaust Outlet
32. Battery Charging Alternator (behind guard)
33. Low Oil Pressure Shutdown
34. Starter

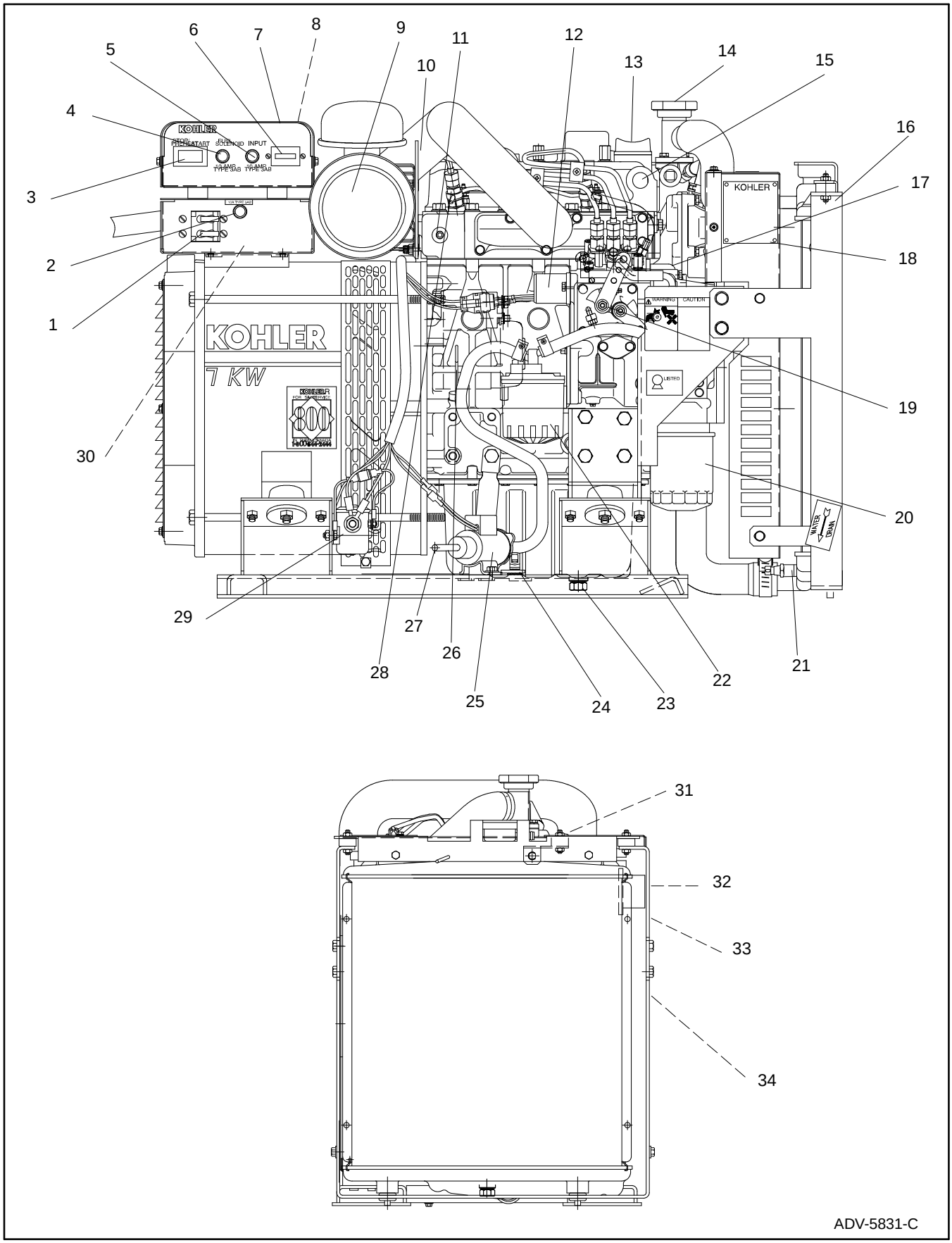


Figure 1-2. Service View of 7CCO-RV Inline Radiator (Typical)

Section 2. Operation

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

Prestart Checklist

Oil Level. Must be at or near full mark (not over).

Air Inlets. Must be clear and unobstructed.

Compartment. Interior must be clean. Check the condition of fuel system, exhaust piping, hoses, and muffler. If fuel leaks, fumes, exhaust gases, or electrical sparks are noted, contact a qualified service technician before operating generator set.

Air Cleaner. Must be clean and properly installed to prevent unfiltered air from entering the engine.

Electrical. All connections (including battery) must be tight.

Fuel Levels. Make sure the fuel tank(s) are full and the fuel system primed for operation.

Drive Belt. Check radiator fan, water pump and battery charging belt to make sure it is properly tensioned and in good condition.

Coolant Level: If the cooling system is equipped with a coolant recovery tank, check coolant level (and refill coolant as necessary) at tank. Maintain level according to markings on the tank. Coolant level should be just below the filler neck [approx. 3/4 to 1 1/2 in. (19.38 mm)] when the engine is cold.

Battery. Check connections and level of battery electrolyte.

Operating Area. Make sure there are no obstructions blocking the flow of cooling air. Make sure the area is clean. Rags, tools, or debris must not be left on or near the generator set.

Exhaust System. Exhaust outlet must be clear; silencer and piping must be tight and in good condition. Exhaust gas must be vented safely outside.

Exercising the Generator

Run the generator set once a week for one hour (under load). The operator must be in attendance during this period. Be sure to make all Prestart Checks before starting the exercise procedure. Start the generator set according to the procedure given for the generator controller.

Controller (Single Phase)

Depending on application, the Kohler relay controller may be located at the set or at a location remote from the generator. Remote harnesses for the controller are available in 7.5- and 15-foot (2.3- and 4.6-meter) lengths. If the generator set automatically stops due to high water temperature (230°F/110°C) or low oil pressure (7 psi/48.3 kPa or less), correct the cause before restarting the generator set.

Refer to Figure 2-1 and the following descriptions to identify controller components.

1. **Generator Start/Stop-Preheat Switch.** This switch serves the dual function of generator operation and generator preheat. When pressed to the preheat position, the preheat switch aids in cold weather starting. Refer to Start/Stop and Preheating procedures following.
2. **Fuel Solenoid Fuse**. A replaceable 10-amp fuse protects fuel solenoid circuitry.
3. **Controller Fuse**. A replaceable 10-amp fuse protects controller circuitry against damage if a short develops in the engine wiring system or the wiring to the remote start/stop switch.
4. **Remote Switch Connection** (located at rear of controller). Connect the remote start/stop switch to operate the generator set at a location remote from the set. Controller connections are made through the plug connector at the rear of the unit.
5. **Hourmeter.** The meter records total generator set operating hours for reference in maintenance schedule.

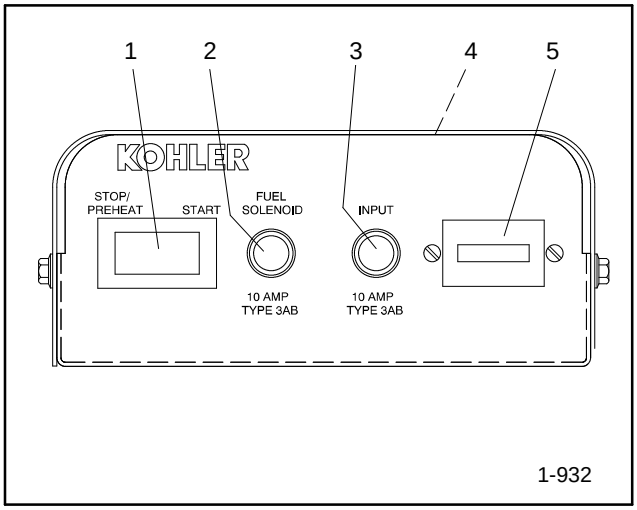


Figure 2-1. Single-Phase Controller

Controller (Three Phase)

For identification of three-phase controller, see Figure 2-2.

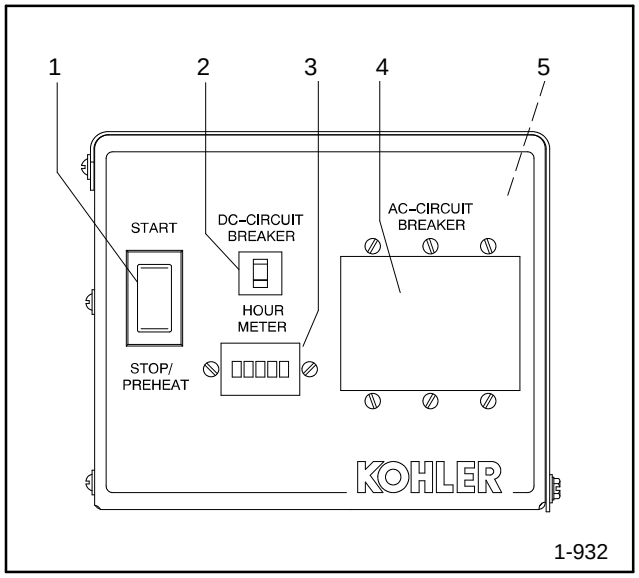


Figure 2-2. Three-Phase Controller

1. **Generator Start/Stop-Preheat Switch.** This switch serves the dual function of generator operation and generator preheat. When pressed to the preheat position, the preheat switch aids in cold weather starting. Refer to Start/Stop and Preheating procedures following.
2. **DC Circuit Breaker**. The generator set will shutdown automatically after fault. See Circuit Protection following.
3. **Hourmeter.** This meter records total generator set operating hours for reference in maintenance schedule.
4. **AC Circuit Breaker (optional).** This circuit breaker trips when a fault is detected in the output circuit. Use the breaker to disconnect generator set during maintenance of vehicle wiring. To close circuit breaker(s), place in ON position.
5. **Fuel Solenoid Fuse** (located inside the controller). A replaceable 10-amp fuse protects fuel solenoid circuitry.

Starting Procedure

The generator is equipped with a preheat feature. Place controller start switch in Stop-Preheat position for the amount of time shown in Figure 2-3 before attempting to start the generator set. This provides energizing of the glow plugs. Do not energize preheat feature for more than 20 seconds or damage may occur. Move the Start/Stop switch to 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. A 60-second cooldown period must be allowed between cranking attempts if the engine does not start. If the unit fails to start after three attempts, contact an authorized service dealer or distributor for repair. Failure to follow these guidelines may result in burnout of the starter motor.

Ambient Temperature	Preheating Time
Above 23° F (–5° C)	Approx. 5 Seconds
Below 23° F (–5° C)	Approx. 10 Seconds
Limit of Continuous use	20 Seconds

Figure 2-3. Preheating Time

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

Allow a brief cooling period by running the set at low or no load for a few minutes just prior to shutdown. To stop, move 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.

NOTE

Do not place Start/Stop-Preheat switch in Stop-Preheat position for more than 20 seconds or damage to the preheat feature may occur.

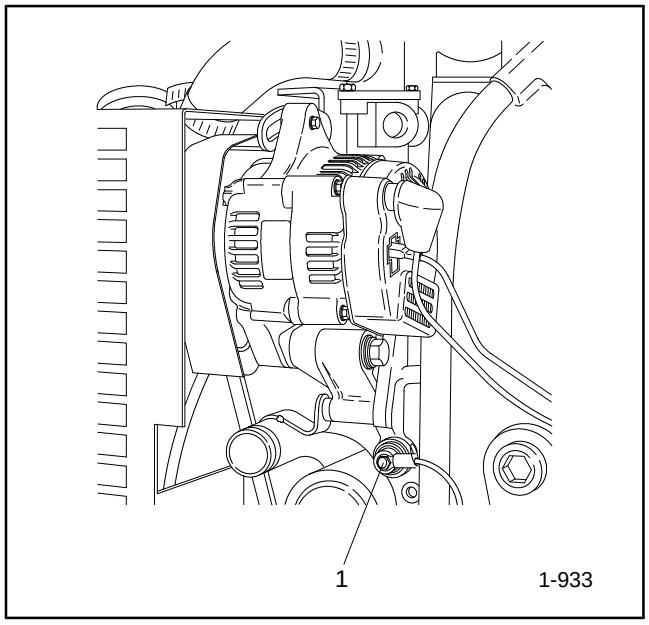
Fault Shutdowns

Low Oil Pressure Shutdown Switch

The low oil pressure (LOP) shutdown feature protects the engine against internal damage if the oil pressure drops below 7 psi (48.3 kPa) due to an oil pump fault or other engine malfunction. The LOP shutdown does not protect the set from 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 to check the oil level regularly and add oil as needed. Location of the LOP shutdown switch is shown in Figure 2-4.

NOTE

This is not a low oil *level* shutdown. Proper oil level must be maintained for low oil pressure shutdown switch to function.



1. Low Oil Pressure Switch

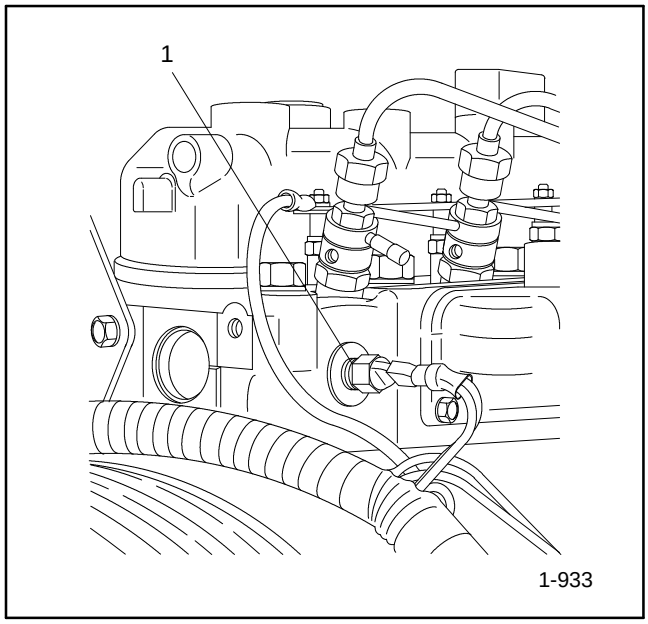
Figure 2-4. Low Oil Pressure Shutdown Switch

High Water Temperature Shutdown Switch

The generator set is also equipped with a high water temperature (HWT) shutdown switch. See Figure 2-5. The unit will automatically shut down when the engine coolant temperature exceeds 230°F (110°C). Cause of the shutdown must be corrected before the generator can be restarted.

NOTE

This is not a low coolant level switch. Proper coolant level must be maintained for high water temperature shutdown switch to function.



1. High Water Temperature Switch

Figure 2-5. High Water Temperature Shutdown Switch

Circuit Protection

Refer to Figure 2-6 and the following descriptions to identify controller components.

1. **10-Amp Fuel Solenoid Fuse.** A replaceable 10-amp fuse protects the fuel solenoid. (On three-phase models the inline fuse is mounted inside the controller.) If this fuse is blown, the generator will shut down. If the fuse is replaced then blows again, have the generator set examined by an authorized Kohler service dealer/distributor.

2. **10-Amp Controller-Input Fuse (Single Phase) or Circuit Breaker (Three Phase).** The controller circuitry is protected by a replaceable 10-amp fuse or circuit breaker. If the generator will not crank and the battery and/or connections appear okay, the controller fuse/breaker may be blown or tripped. Contact an authorized Kohler service dealer/distributor if fuse/breaker blows/trips repeatedly.

3. **10-Amp PBIIIE Voltage Regulator Fuse (Single-Phase Models Only).** A replaceable 10-amp fuse protects the voltage regulator circuitry. If this fuse is blown, the generator set will shut down. If this fuse is replaced then blows again, have the generator set examined by an authorized Kohler service dealer/distributor.

4. **Optional AC Circuit Breaker(s).** Circuit breaker trips when a fault is detected in the AC output circuit. See Section 4– Troubleshooting to determine cause of fault. After fault is corrected, reset AC circuit breaker by placing in ON position.

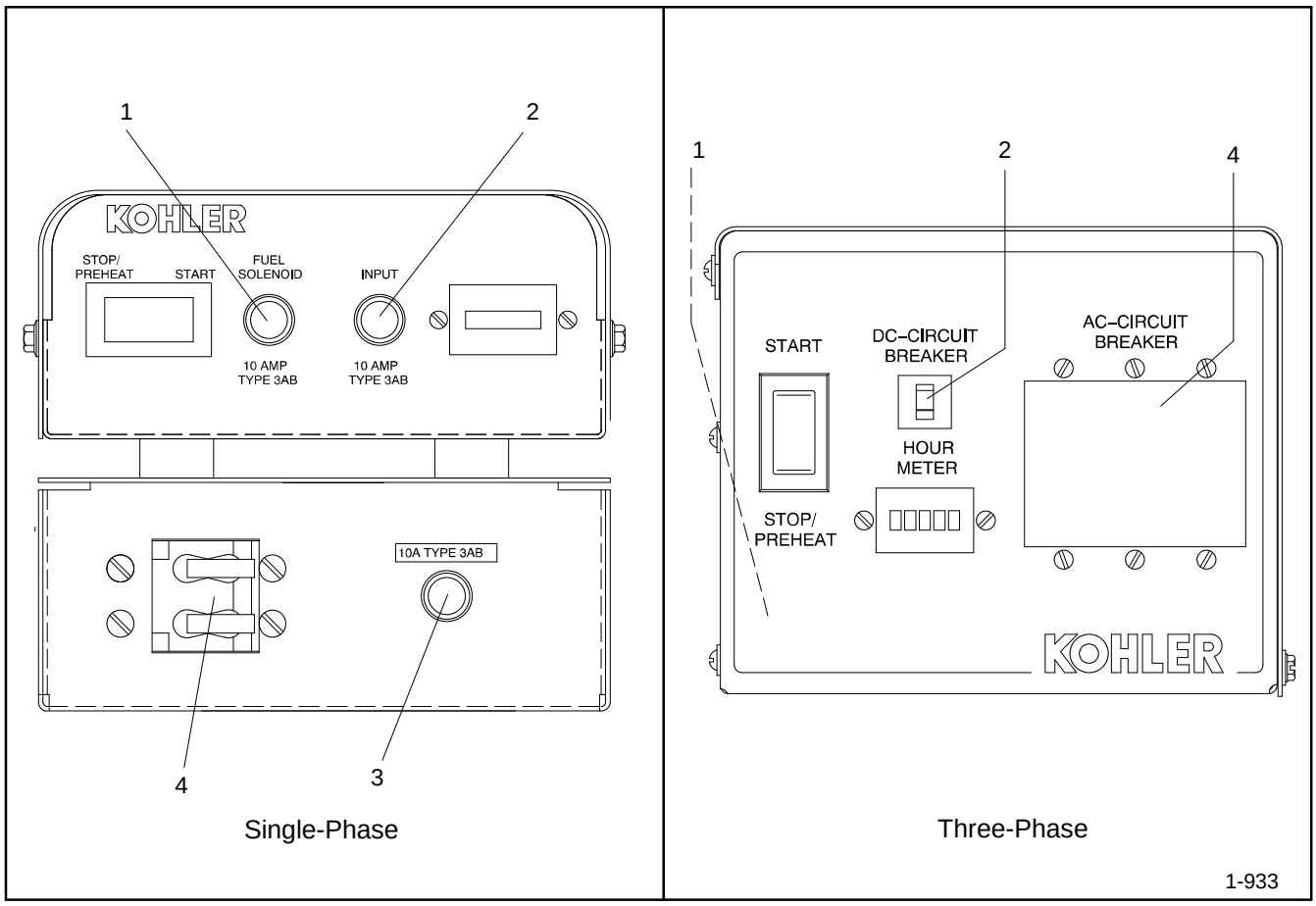


Figure 2-6. Circuit Protection

Section 3. Scheduled Maintenance

General

Schedule routine maintenance using the Maintenance Schedule following and the hourmeter located on the generator controller. If the generator will be subject to extreme operating conditions, service the unit more frequently. Instructions to perform most of the scheduled services are provided in the following pages. Items in the maintenance schedule marked with an asterisk (*) must be performed more often if the generator set is operated in dirty, dusty conditions. Have items identified with asterisks (**) performed by an authorized Kohler service dealer/distributor. Tools and instruments required for these additional steps 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.

NOTE

The items listed in the maintenance schedule must be performed at the designated intervals for the life of the generator. For example, an item to be serviced Every 100 Hours or 3 Months must also be serviced after 200 Hours or 6 Months, 300 Hours or 9 Months, 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 serious problem exists.

Perform Service at Intervals Indicated (X)	Before Each Startup	Every 50 Hours or 1 Month	Every 100 Hours or 3 Months	Every 400 Hours or 6 Months	Every 500 Hours or Yearly
FUEL SYSTEM					
Check the fuel level	X				
Fill fuel tank	X				
Check fuel pipes and clamps		X			
Remove sediment from fuel tank				X	
Replace the fuel filter element (metal spin-on type)				X	
Check governor operation and adjust as necessary**					X
Check the nozzle injection pressure**					X (1000 Hrs)
Check and/or replace fuel filter (plastic in-line type supplied loose)			X		
LUBRICATION SYSTEM					
Check the oil level in crankcase	X				
Replace the oil in crankcase*		X (Break-in Period)	X		
Replace the oil filter element*		X (Break-in Period)	X		
COOLING SYSTEM					
Check coolant level	X				
Check water pipes and clamps			X		
Adjust the tension of water pump V-belt		X (Break-in Period)	X		
Change coolant					X
Clean radiator fins, inspect hoses			X		
AIR CLEANER, ETC.					
Replace the air cleaner element*				X (300 Hrs)	
Clean the breather pipe*			X		
ELECTRICAL SYSTEM					
Verify proper operation of gauges (if equipped)	X				
Check the electrolyte level in the battery	X				
Check the electrical connections		X			
Check the battery specific gravity			X		
Adjust battery charging alternator V-belt			X		
CYLINDER HEAD, ETC.					
Check for leakage of water and oil	X	X			
Retighten all major nuts and bolts		X (Break-in Period)			X
Check mounting bolts and vibro mounts for tightness				X	
Retighten the cylinder head bolts**					X
Adjust intake exhaust valve clearance**					X (800 Hrs)
GENERATOR					
Blow dust out of generator*					X
Clean slip rings and inspect brushes (single-phase models only)**					X

* Service more frequently if operated in dusty areas.
** Should be performed by an authorized Kohler Service Dealer/Distributor.

Lubrication System

Your engine has a positive pressure lubrication system and low oil pressure shutdown.

Oil Selection

The selection of engine oil is very important to a diesel engine. If an unsuitable oil is used or an oil change is neglected, damage and a shorter engine life may result. Oil must meet the American Petroleum Institute (API) classification of CC, CD or CE. Avoid mixing different brands of oils and lubricants; oils of different manufacturers may be incompatible and deteriorate when mixed. Recommended SAE viscosity designations for given temperature ranges in which the generator set will be operated are listed in Figure 3-1.

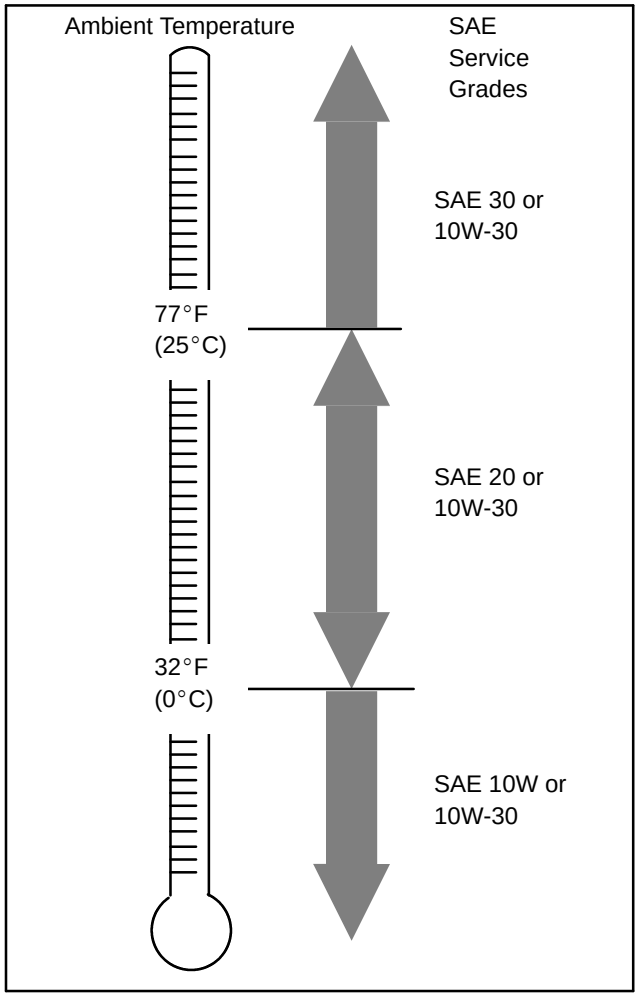


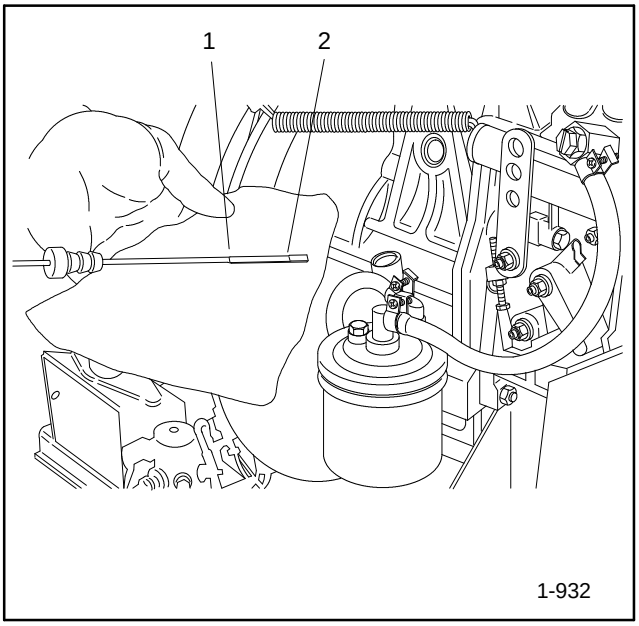
Figure 3-1. Engine Oil Selection

NOTE

Failure to observe these standards may cause inadequate oil pressure and cold-starting difficulties.

Oil Check

Check crankcase oil level daily or before each start to ensure that the level is in the safe range. To check oil level, remove oil dipstick and wipe dipstick clean (see Figure 3-2). Reposition dipstick in crankcase and push it all the way down into the tube. Remove dipstick and check the level. Oil level must read between MIN and MAX marks on dipstick. Do not operate set if oil level exceeds the MAX mark or registers below the MIN mark on dipstick.



1. MAX Level
2. MIN Level

Figure 3-2. Oil Level Check

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. Most accurate oil reading is obtained by shutting down the generator and waiting several minutes before checking oil.

Oil Change

On a new engine, change the oil after the first 50 hours of operation and thereafter at 100-hour intervals or 3 months, whichever occurs first. Change oil more frequently under dirty, dusty conditions. Change oil while the engine is still warm.

1. Place a container below the oil drain hole and remove oil drain plug. Allow sufficient time for the old oil to drain completely. Replace oil drain plug. Dispose of used engine oil in an environmentally safe manner. Take used oil to a suitable collection facility in your area. *Do not pour used oil on the ground, down sewers, or into streams or other bodies of water.*
2. Remove oil fill cap. One is located on the rocker-arm cover and one is located near the fuel injector pump. See Figure 3-4.
3. If the engine oil filter is to be replaced, see Oil Filter following.
4. Fill crankcase with proper amount and type of oil, see Figure 3-3 and Oil Selection.
5. Replace oil fill cap. 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.

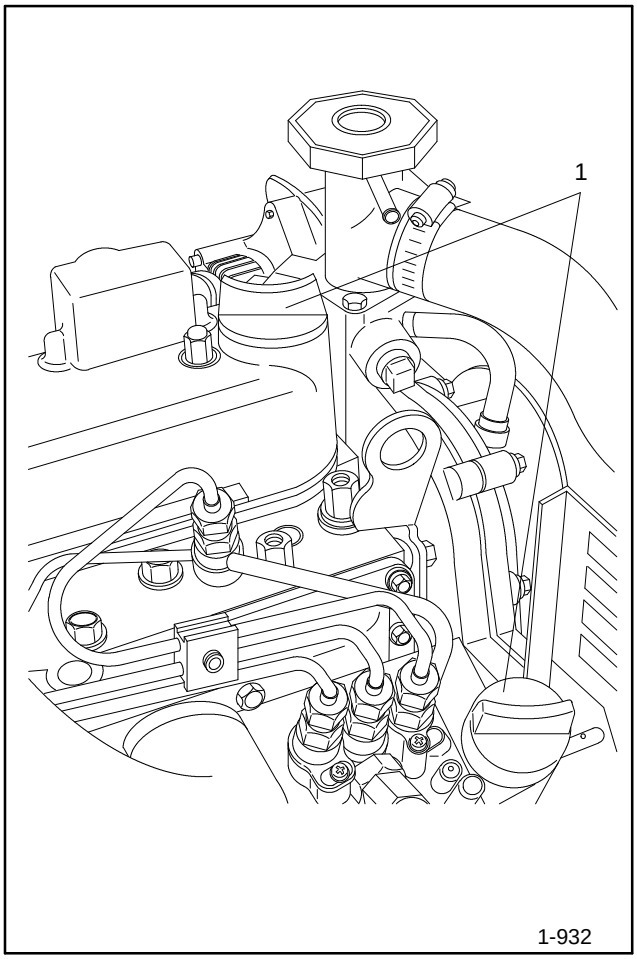
OIL CAPACITY
(with Filter)
qts. (L)

7 kW	5.4 (5.1)
10 kW	6.3 (6.0)

Figure 3-3.

NOTE

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

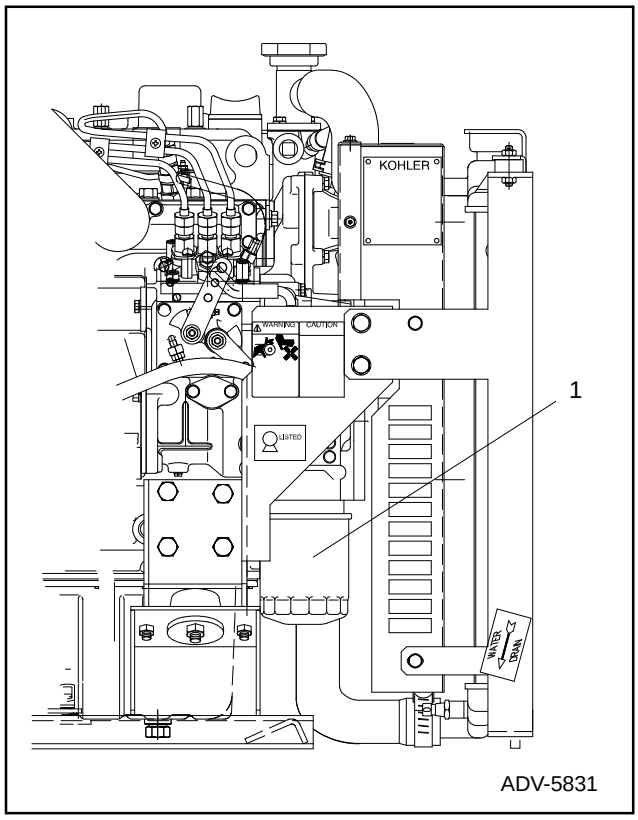


1. Oil Fill

Figure 3-4. Oil Fill Locations

Oil Filter

Replace the oil filter for the first time after 50 hours or 1 month of operation and then every 100 hours or 3 months. Change more frequently if operating in dirty, dusty conditions. See Figure 3-5 and refer to the following procedure.



1. Oil Filter

Figure 3-5. Oil Filter Location

1. With oil system drained, loosen oil filter by turning with a filter wrench in a counterclockwise direction. 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 onto adapter until gasket makes contact, hand tighten an additional one-half turn.
4. Replace engine oil. See Oil Change section for proper oil capacity.
5. Start the generator set and check for oil leaks.
6. Stop the generator set. Remove dipstick and wipe clean. Reinsert as far as possible, then remove to check oil level. Add oil as necessary to bring level up to MAX level.

Fuel System

Specification

Use a clean, good quality No. 2-D (DIN 51 601) diesel fuel oil. The fuel must meet the requirements of the American Society of Testing and Materials (ASTM) diesel fuel classification D975 (Federal Specification W-F-800a). Cleanliness of the fuel is especially important on diesel engines which have easily clogged, precision fuel injectors and pumps. See chart below.

United States	ASTM/D975	No. 2-D Diesel
United Kingdom	BS2869	Class A1

Other Considerations:
Sulfur Content . . . . . Less than 0.5%
Sediment/Water Content . . . . . Not to exceed 0.05%
Cetane Number . . . . . 45 minimum
Flash point . . . . . At least 125°F (52°C)

NOTE

Never store diesel fuel in galvanized containers; diesel fuel and the galvanized coating react chemically to produce flaking which quickly clogs filters or causes failure of the fuel pump or injectors. Do not run the generator set out of fuel; air will be drawn into the fuel lines and the entire system will have to be bled before the unit can be restarted.

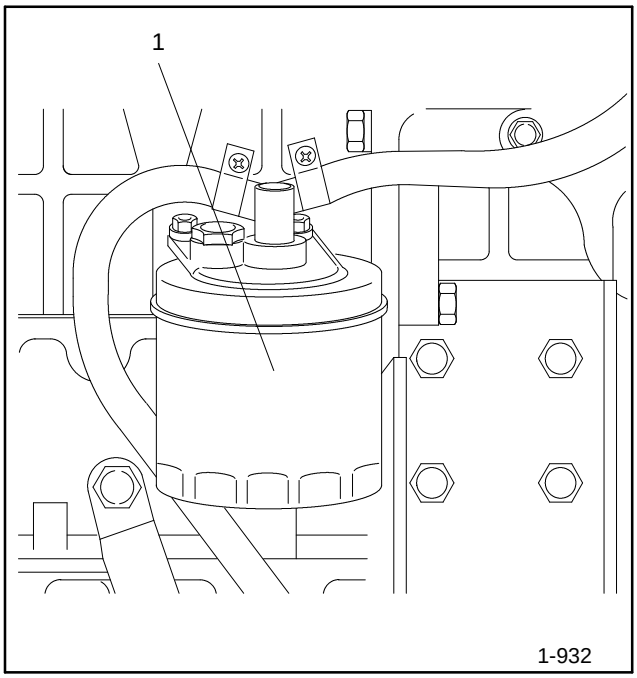
NOTE

Avoid storing fuel over long periods of time. Take special precautions to keep all dirt, water, and other contaminants out of the fuel. Storage tanks containing diesel fuel contaminated with water may cause the growth of microbes. The presence of microbes will form a slime which clogs fuel filters and lines.

Fuel Filter (Metal Spin-On Type)

The fuel filter serves to remove water and dirt contained in the fuel. Do not attempt to clean paper fuel filter element. Its useful life will be determined largely by the quality and condition of the fuel used. Under normal conditions, replace the fuel filter element for the first time after 50 hours or one month and then every 400 hours or six months. See Figure 3-6 for location and use the following procedure to service the fuel filter.

1. Loosen the fuel filter by turning in a counterclockwise direction. Use rags to clean up spilled fuel oil. Remove and discard filter.
2. Clean contact surface on the fuel filter adapter.
3. Lightly lubricate the gasket surface of the new fuel filter with fresh fuel oil. Thread the fuel filter onto the adapter until the gasket makes contact, hand tighten an additional one-half turn.
4. See Bleeding section following.



1. Fuel Filter

Figure 3-6. Fuel Filter Location

Fuel Filter (Plastic In-Line Type Supplied Loose)

The fuel filter, supplied loose with the unit, serves as a preliminary source to remove dirt and metal particles from the fuel system before they reach the electric fuel pump. If the fuel filter is clogged with debris, the generator may be difficult to start or may run rough. The service life of the fuel filter is solely dependent on the quality of the diesel fuel used and the amount of debris entering the fuel system when refueling. As part of a regular maintenance program, check and/or replace fuel filter every 3 months or 100 hours of operation. The fuel filter cannot be cleaned and must be replaced if fuel starvation or poor engine performance is evident.

Bleeding the Fuel System

If the generator set engine runs out of fuel, air leaks develop in the suction side of the fuel system, or the fuel filter is replaced, it will be necessary to bleed the entire system to prevent starting failures and/or erratic operation. See Figure 3-7 and refer to the following procedure.

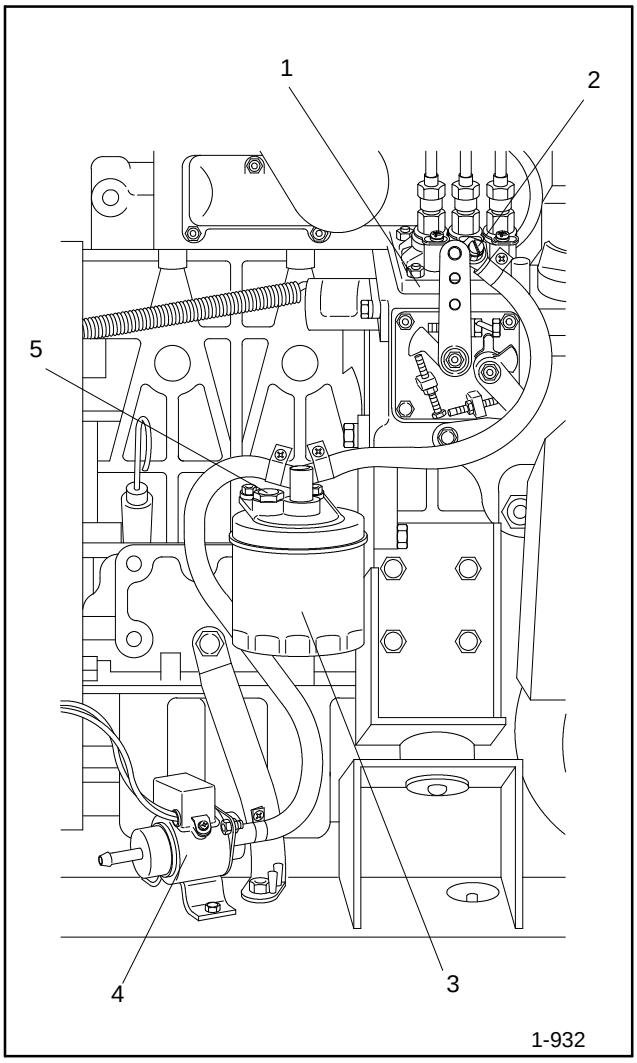
1. Fill the fuel tank.
2. Loosen the small vent screw a few turns on fuel filter.
3. Using start switch on the controller, operate the fuel pump until fuel, free from air bubbles, flows from this point. Tighten vent screw.
4. Loosen the line connection (bleed point) at fuel injection pump inlet.
5. Using start switch on the controller, operate the fuel pump until fuel, free from air bubbles, flows from this point. Tighten line connection.

⚠ 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. Spilled fuel can cause an explosion. Use a container to catch fuel when draining fuel system. Wipe up all spilled fuel after draining system.

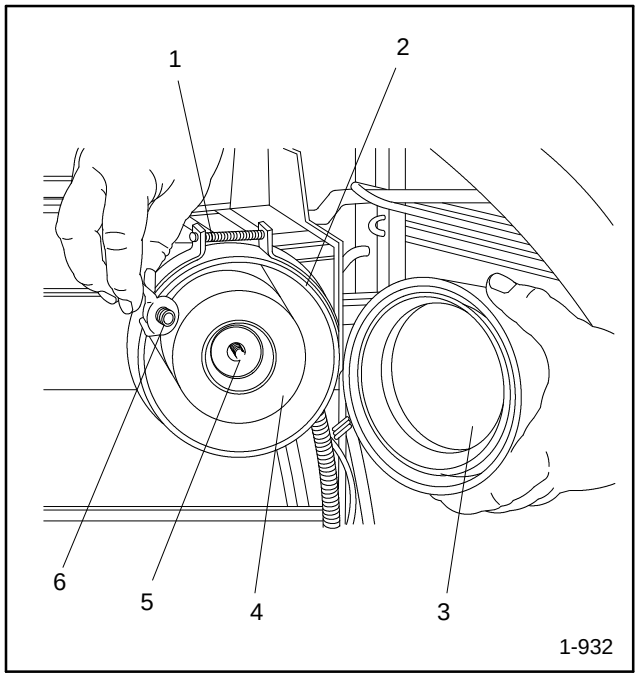


1. Fuel Injection Pump
2. Line Connection (Bleed Point)
3. Fuel Filter
4. Electric Fuel Pump
5. Vent Screw

Figure 3-7. Bleeding Fuel System

Air Cleaner Service

The paper element must be replaced at 400-hour or 6-month intervals; change more frequently if operating under dirty, dusty conditions. Operating the generator set with a dirty air cleaner element may cause engine damage and increased fuel consumption. At the time of service, clean the air cleaner breather pipe and remove all dust and foreign matter from the air cleaner housing. See Figure 3-8 and refer to the following procedure.



1. Eyebolt/Clamp
2. Base
3. Cover
4. Element
5. Threaded Rod
6. Wing Nut

Figure 3-8. Air Cleaner Components

1. Loosen eyebolt and clamp enough to remove the air cleaner cover.
2. Remove wing nut and slide air cleaner element from the threaded rod.
3. Clean dry element by tapping edges on a hard surface. Replace if damaged or very dirty.

NOTE

Do not attempt to clean dry-type element in any liquid or with compressed air as this will damage paper filter material.

4. Wipe dirt or dust accumulation from cover and base. Check that all clamps are tight on inlet/outlet connections.
5. Install air cleaner element on threaded rod. Tighten wing nut making sure parts fit properly.
6. Position cover with arrow up; place clamp over base and cover, and tighten eyebolt.

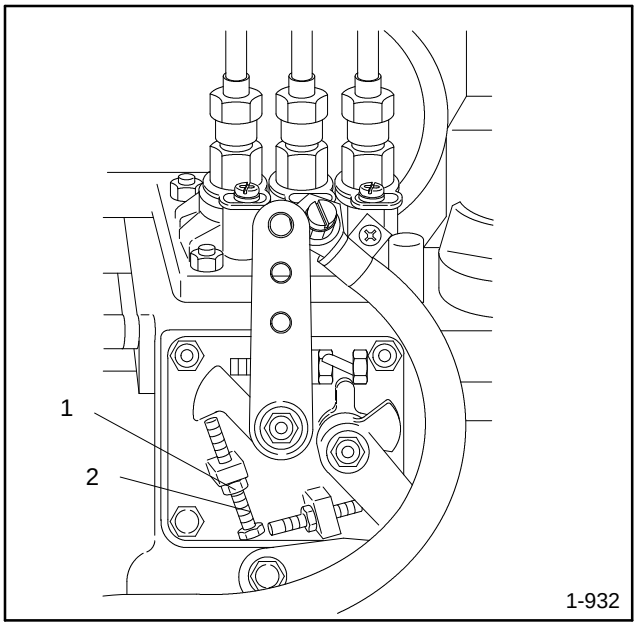
Governor

The centrifugal, mechanical-type governor serves to keep the engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load. No regular service is required on the unit. The governor is adjusted during run-in at the factory, and further adjustment is not needed unless greatly varying load conditions are encountered or if poor governor control develops after extended usage.

60-Hz generator sets are designed to operate at 60–63 Hz, 1800 rpm under full load and 1890 rpm under no load.

50-Hz generator sets are designed to operate at 50–52.5 Hz, 1500 rpm under full load and 1575 rpm under no load.

To check speed, use a hand-held tachometer or frequency meter. See Figure 3-9. Loosen the locking nut on the speed-adjusting screw. Turn the screw in clockwise direction to increase speed (and frequency) or in counterclockwise direction to decrease speed. Tighten the locknut to secure screw at new setting.



1. Locking Nut
2. Speed Adjusting Screw

Figure 3-9. Governor

Cooling System

⚠ WARNING

Hot coolant and steam.
Can cause severe injury or death.

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

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

To prevent the inconvenience of having the generator set shut down or become damaged due to overheating, keep the cooling air inlets clean and unobstructed at all times. Inspect the exterior of the radiator for obstructions; remove all dirt and foreign material with a soft brush or cloth (to avoid damaging radiator fins). Check all hoses and connections for leaks and replace any hoses that are cracked, frayed, or feel spongy. When coolant level checks are made, check condition of the radiator cap rubber seal; replace if cracked or deteriorating. Remove dirt and other debris from the radiator cap and filler neck.

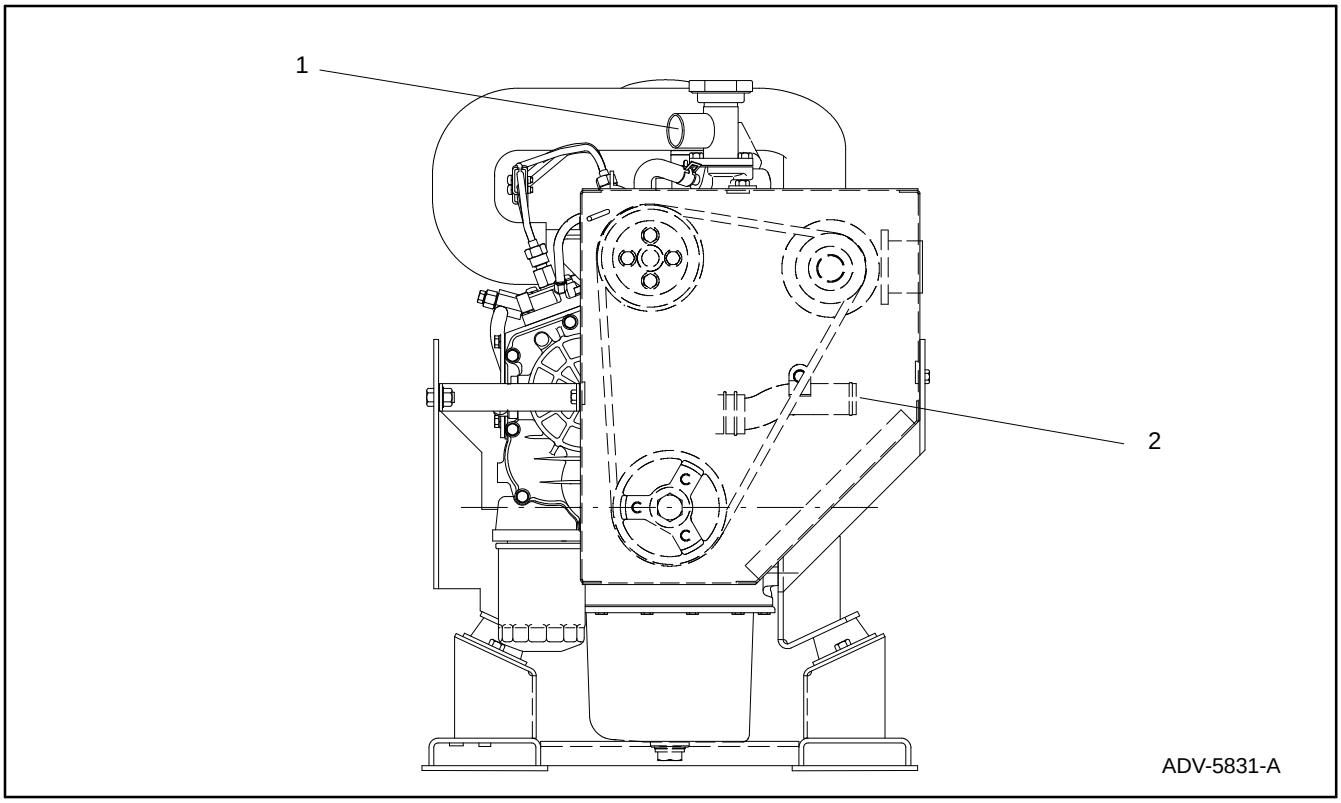
Coolant capacity for the 7 kW inline-radiator model is 2.44 qts. (2.3 L). The 10 kW inline-radiator model has a coolant capacity of 5.1 qts. (4.8 L). Consult the coach manufacturer for remote radiator cooling system capacity. Drain petcocks are provided on the bottom tank of the radiator and another in the engine block to drain the system. When draining the coolant, remove the radiator cap and open the block drain located near the flywheel housing; this will allow the entire system to drain and prevent air pockets from forming and restricting coolant passage in the block. To refill the cooling system, close the drain petcock and fill the radiator to the proper level with the recommended coolant mixture. See Figure 3-10 and Figure 3-11 for coolant fill and drain locations. Replace the radiator cap and operate the engine until the thermostat opens and the radiator upper hose becomes hot. Stop the engine and allow to cool. Add coolant to the radiator to just below the overflow tube on the filler neck. Replace the radiator cap.

A coolant solution of 50% ethylene glycol and 50% clean, softened water is required to inhibit corrosion, prevent freezing to −34°F (−37°C), and to improve cooling. Use antifreeze that contains a rust inhibitor. Change coolant every two years. Do not use alcohol or methanol antifreeze or mix them with the coolant. Do not add coolant to an engine that has overheated until the engine has cooled. Adding coolant to an extremely hot engine can cause a cracked block or cylinder head.

Check coolant level frequently and add antifreeze solution as needed to maintain level just below the overflow tube and at the min. level in the coolant recovery tank when cold (max. when hot).

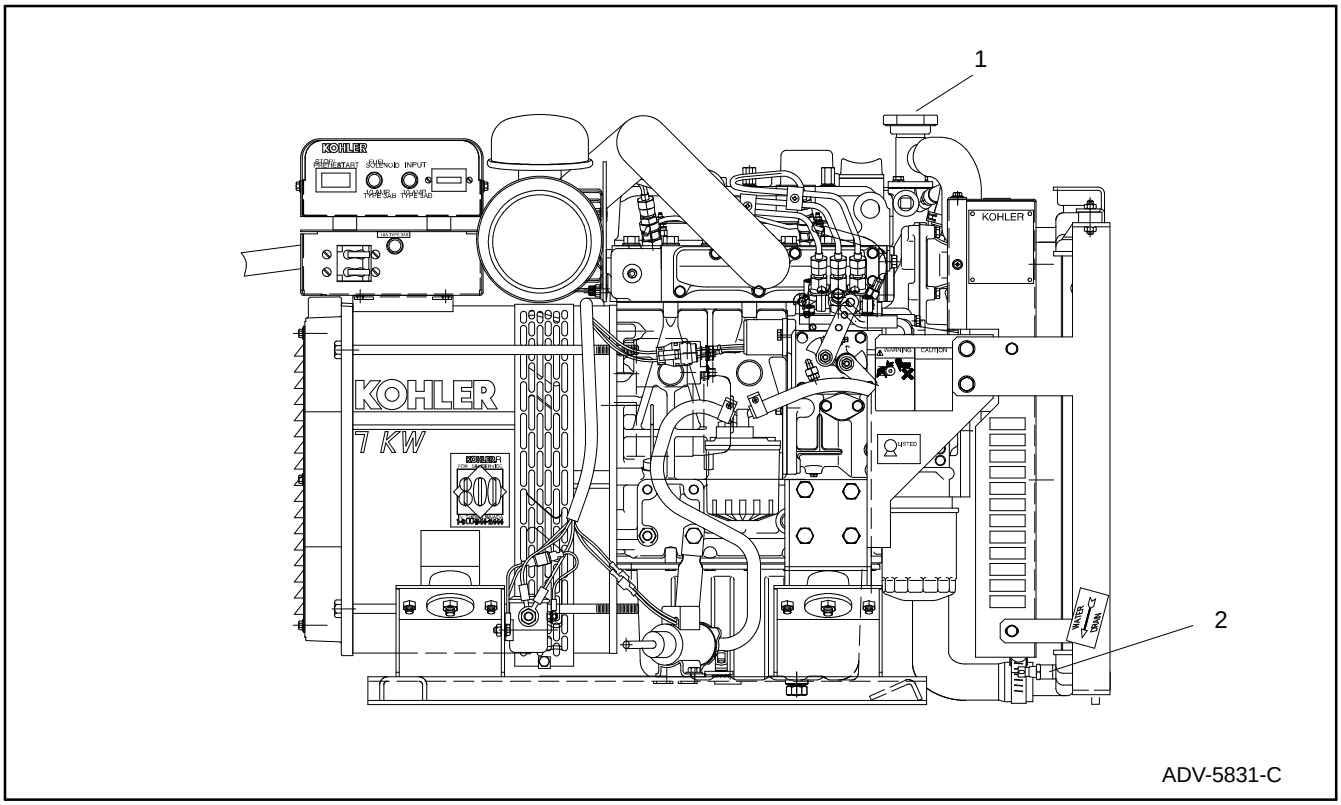
NOTE

Pay special attention when checking for proper coolant level. After a radiator has been drained, some time is normally required before complete refill of all air cavities take place.



1. Coolant Outlet
2. Coolant Inlet

Figure 3-10. Coolant Fill and Coolant Drain Connections (Remote-Radiator Model)

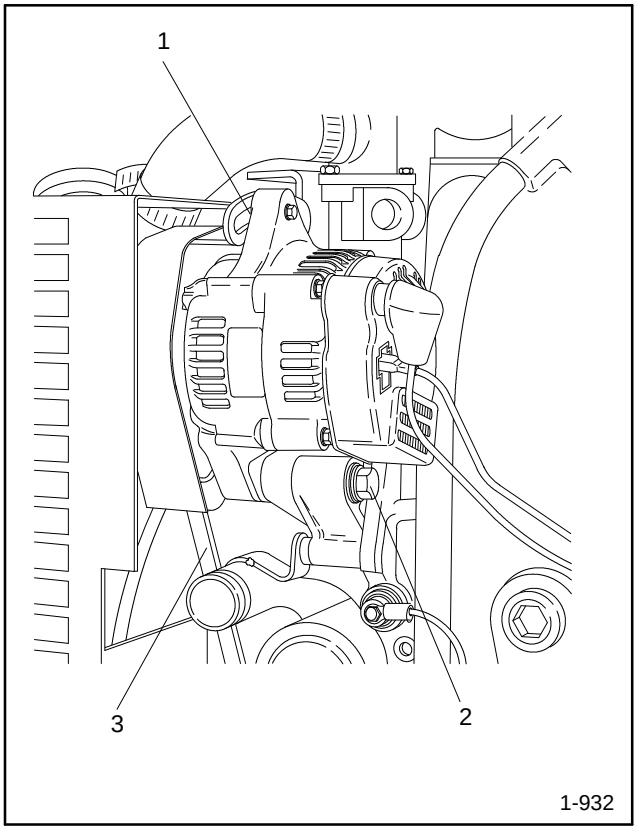


1. Initial Coolant Fill
2. Coolant Drain

Figure 3-11. Initial Coolant Fill and Coolant Drain Locations (Typical Inline-Radiator Model)

Belt Tension

Adjust the belt tension so that the belt can be depressed about 0.28 to 0.35 in (7 to 9 mm) with about 22 lbs. (10 kg) of force, see Figure 3-12.



1. Adjusting Screw
2. Pivot Screw
3. Fan Belt

Figure 3-12. Belt Tension

1. Disconnect battery, negative lead first.
2. Loosen pivot and adjusting screws.
3. While prying battery-charging alternator outward, tighten adjusting screw.
4. Tighten pivot screw.
5. Recheck and adjust as necessary.
6. Reconnect battery, negative lead last.

NOTE

Check fan belt for cracks or tears and replace if necessary.

⚠ WARNING

Hazardous voltage.

Moving rotor.

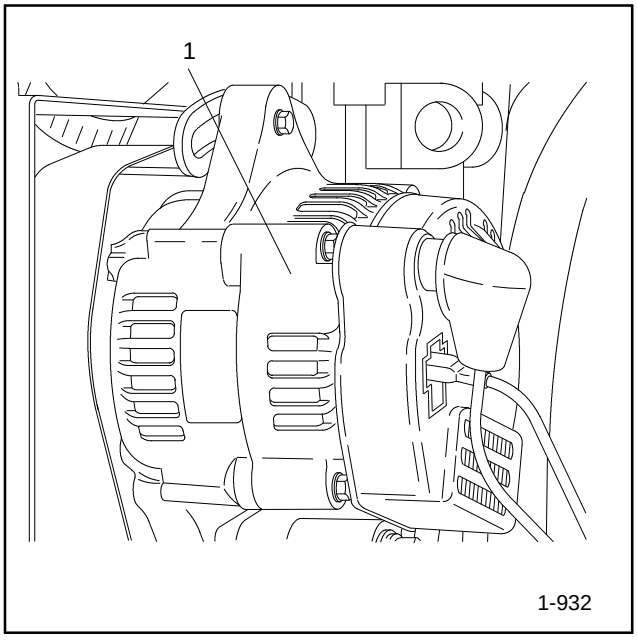
Can cause severe injury or death.

Do not operate generator set without all guards and electrical enclosures in place.

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

Battery Charging

Your generator is equipped with a 20-amp, belt-driven battery charging alternator. See Figure 3-13. It is attached to the engine block by a bracket and serves to keep the battery constantly charged. Be sure to observe battery polarity when connecting the battery to the generator set. The alternator requires no maintenance other than maintaining belt tension. To adjust the alternator belt tension, see Belt Tension.



1. Battery Charging Alternator

Figure 3-13. Battery Charging Alternator

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 changed. Always turn battery charger off before disconnecting battery connections. Remove negative lead first and reconnect it last when disconnecting battery.

Use a 12-volt battery with a rating of at least 625 cold cranking amps/100 amp hour. When using a maintenance-free battery, it is not necessary to check the specific gravity or electrolyte level. Otherwise these procedures should be done at the intervals specified in the Maintenance Schedule. A negative ground system is used. Battery connections are shown on the wiring diagrams. Make sure that the battery is properly connected and the terminals are tight.

NOTE

The generator set will not start if the battery connections are made in reverse.

Cleaning

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

Checking Electrolyte Level

Check the level of electrolyte before each startup. Remove filler caps and check to see that electrolyte level is up to bottoms of filler holes. See Figure 3-14. Refill as necessary with distilled water or clean tap water. Do not add fresh electrolyte! Be sure filler caps are tight.

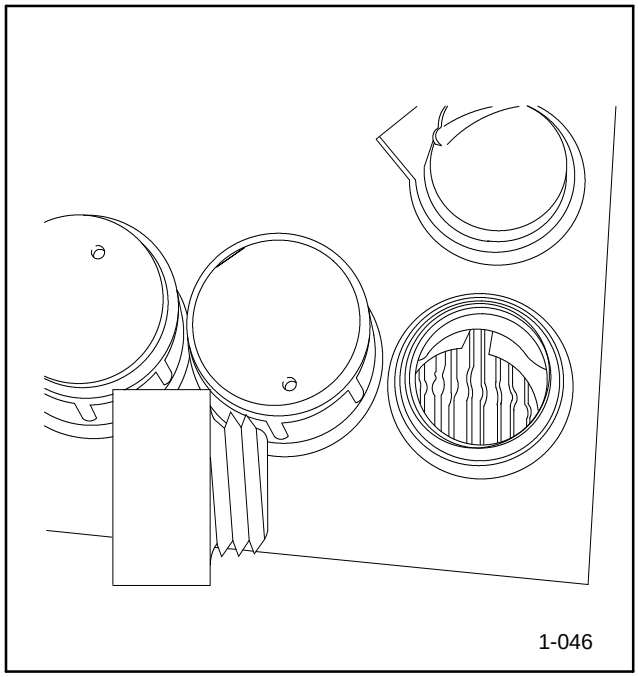


Figure 3-14. Battery Electrolyte Level

Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell. While holding the hydrometer vertical, read the number on the glass bulb at the top of the electrolyte level. If the hydrometer used does not have a correction table, use the one in Figure 3-15. Determine specific gravity and electrolyte temperature of battery cells. Locate temperature in Figure 3-15 and adjust specific gravity by amount shown. The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 80°F (26.7°C). The difference between specific gravities of each cell should not exceed ±0.01. The battery should be charged if the specific gravity is below 1.215 at an electrolyte temperature of 80°F (26.7°C).

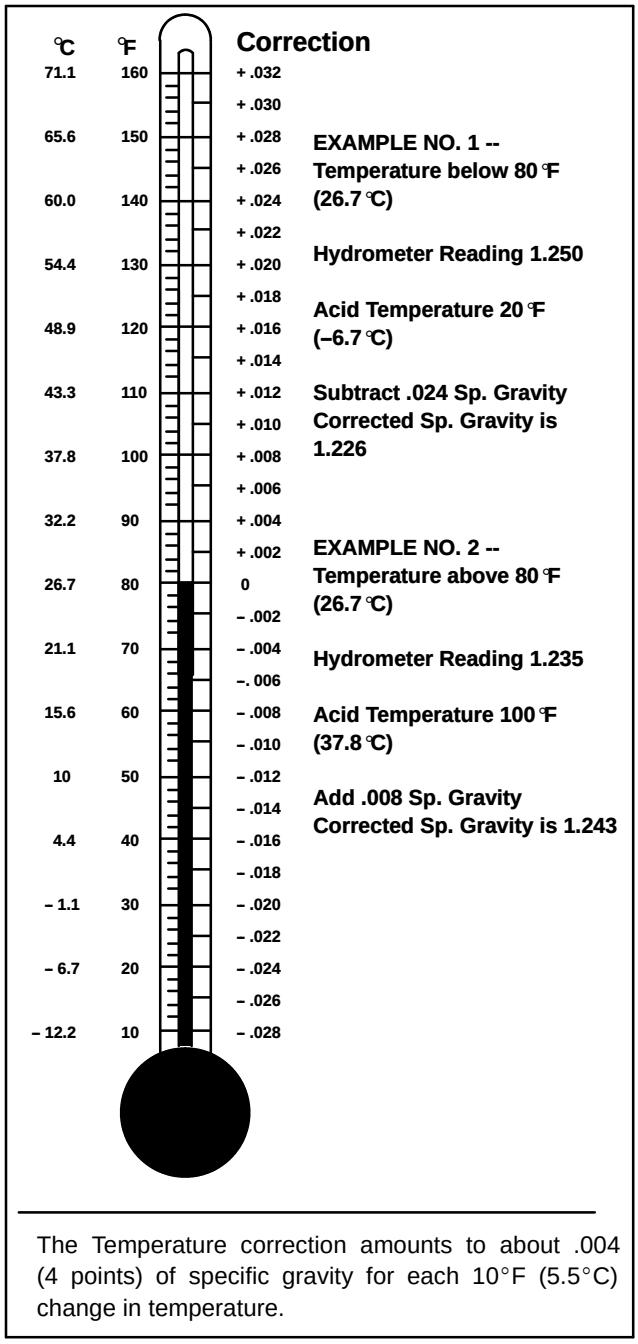
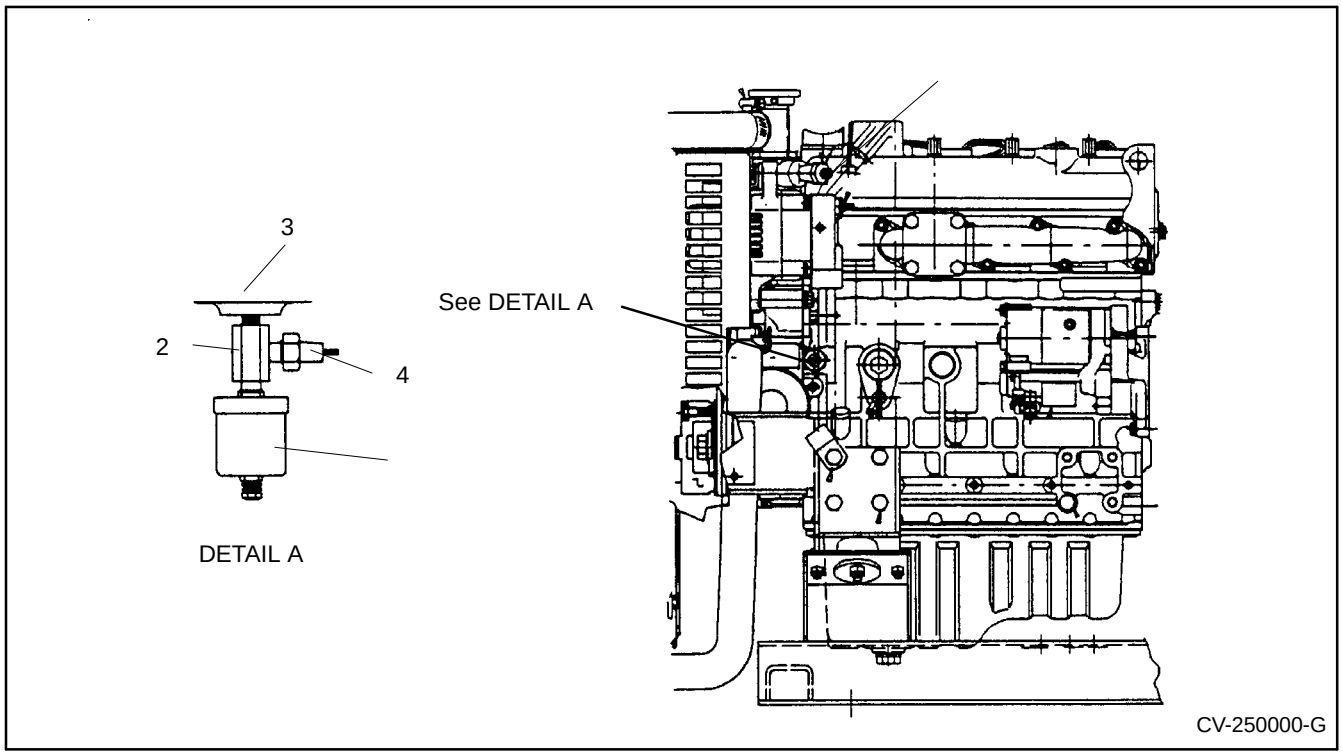


Figure 3-15. Specific Gravity Temperature Correction

Gauge Connections

The 7 and 10 kW generator sets may be equipped with sending devices for connection to oil pressure and water temperature gauges (not provided). Locations of the oil pressure and water temperature senders are shown in Figure 3-16.



1. Water Temperature Sender
2. Adapter
3. Engine Block
4. Oil Pressure Switch
5. Oil Pressure Sender

Figure 3-16. Engine Temperature & Oil Pressure Senders

Since lead 10 (from water temperature sender) and lead 11 (from oil pressure sender) may not appear at controller plug J4 or P4, it may be necessary to add these leads in the engine harness or remote harness (if used). Leads 10 and 11 do not run the full length of the remote harness. Retrieve the ends of these leads from the harness for connection to the oil pressure and water temperature senders. The installer may also elect to run separate leads from each sender directly to the gauges and bypass the harnesses entirely. See Figure 3-17 and refer to the wiring diagram in Section 5. Use insulink or similar connectors at all spliced connections to ensure reliable operation of the senders and gauges.

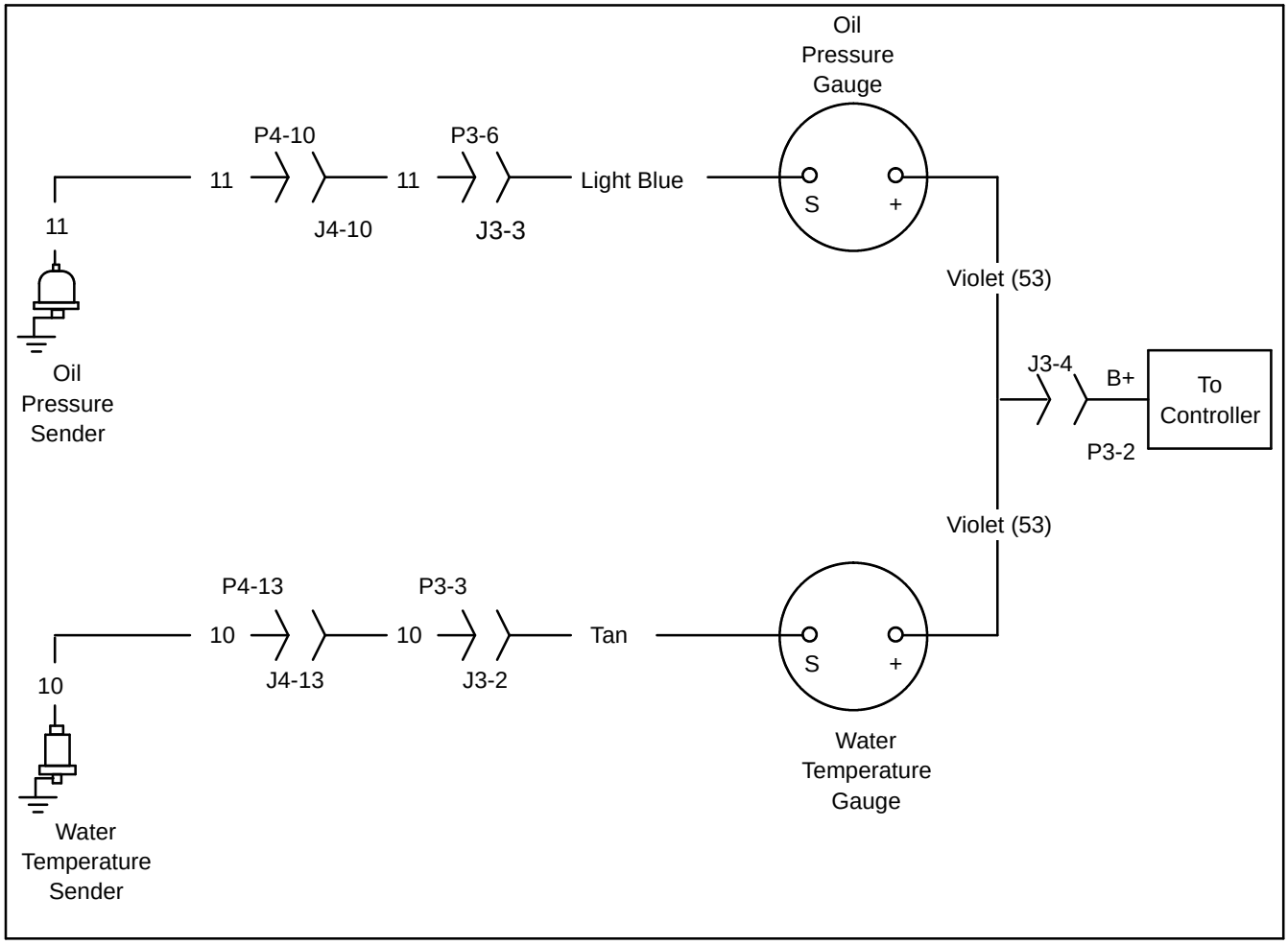


Figure 3-17. Oil Pressure/Water Temperature Sender Connections

Wattage Requirements

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

The average wattage requirements of some common RV/Mobile appliances/tools and motor loads are listed in the following charts. Use these figures to calculate the total load on your set to avoid the inconvenience of having the circuit breaker trip due to overload. The lighting load is easily determined by adding the wattage rating of each bulb in the circuit. Check the nameplate rating on motors and appliances in your vehicle for exact wattage requirements.

Electrical Appliance	Rating (Watts)
Blanket	50-250
Blender	600
Broiler	1350
Fan, Air Circulating	25-100
Fan, Furnace	270
Heater, Space	750-1500
Heater, Water	1500
Pan, Frying	1200
Percolator, Coffee	650
Radio	50-100
Television	300-750
Toaster	750-1200

Figure 3-18. Appliance Average Wattage Ratings

Construction Tools	Motor Starting Watts	Running Watts
Air Compressor (Small)	1500	725
Air Compressor 3/4 hp	4000+	2000
Drill, 1/4 in.	500	250
Drill, 3/8 in.	600	350
Drill, 1/2 in.	800	600
Grinder 1/2 hp	1500	1200
Hammer, Demolition	2000	1800
Hammer, HD Rotary	1500	1200
Paint Sprayer (Airless)	400	240
Polisher, Orbit	500	360
Power Paint Roller	120	90
Power Plane	600	450
Router	900	700
Saw, Circular 6 1/2 in.	2200	1000
Saw, Circular 7 1/4 in.	2500	1200
Saw, Table 10 in.	4000	1500
Saw, Sabre (Worm Drive)	2500	1200
Sander, Belt	1500	600
Sander, Finishing	900	360
Screwdriver, Power	1000	530
Shear, 12 gauge	1800	720
Soldering Gun	–	250
Vacuum Cleaner, Wet/Dry	1500	1260
Wrench, Impact 1/2 in.	2000	840

Figure 3-19. Construction Tool Average Wattage Ratings.

NOTE

Motor driven equipment generally takes 2 to 3 times the listed running amperage or wattage to start the motor. Always check the tool or motor nameplate to be sure.

Generator Service

General

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

Storage Procedure

If your generator set is to be out of service for a considerable length of time (2 months or more), perform the following steps to preserve the set before placing it in storage.

1. Drain the oil (while hot) from the crankcase then refill with regular grade oil. See Section 3, Oil Selection in this manual.
2. Drain the fuel from the fuel tank to prevent accumulated moisture from mixing with the fuel.
3. Check the engine coolant protection. See Section 3, Cooling System for additional information.
4. Disconnect battery (negative lead first) and place in storage.
5. Seal all openings in the engine with non-absorbent adhesive tape. Mask off all areas to be used for electrical contact.
6. Clean exterior surface of the generator. Spread a light film of oil over unpainted metallic surfaces which could rust or corrode.

Section 4. Troubleshooting

When troubles occur, don t overlook simple causes. A starting problem could be caused, for example, by improper fuel or an empty fuel tank. Make sure all electrical connections are secure. Remember the battery negative must have a good ground. The following charts list some common problems. If procedures in this manual do not correct the problem, take the generator set to a service dealer/distributor. Tell the service dealer/distributor personnel exactly what happened when the problem occurred and any adjustments made to the set.

Engine

Problem	Possible Cause	Corrective Action
Engine hard to start or will not start	Weak or dead battery	Recharge or replace
	Battery connections made in reverse	Correct
	Faulty ground	Clean and retighten
	Fuse blown	Replace
	Out of fuel	Replenish
	Improper type of fuel	Use proper type of fuel; consult fuel supplier
	Fault shutdown	Check low oil pressure and high water temperature shutdown switches
	Clogged fuel filter	Replace filter element
	Air cleaner clogged	Clean or replace element
	Defective fuel feed pump	Replace fuel feed pump
	Air in fuel system	Bleed air from fuel system
	Improper type of crankcase lube oil	Use proper lube oil
	Water, dirt in fuel system	Drain, flush fuel system and replace fuel
	Dirty or faulty injectors	See authorized service dealer/distributor
	Improper compression	See authorized service dealer/distributor
	Injection pump malfunctioning	See authorized service dealer/distributor
	Improper valve clearance	See authorized service dealer/distributor

Engine (Continued)

Problem	Possible Cause	Corrective Action
Engine knocks	Faulty injector	See authorized service dealer/distributor
	Improper type of fuel	Use proper type of fuel; consult fuel supplier
	Incorrect fuel injection timing	See authorized service dealer/distributor
	Improper cylinder top clearance	See authorized service dealer/distributor
	Defective piston or piston ring	See authorized service dealer/distributor
	Defective crankshaft bearing or piston pin bearing	See authorized service dealer/distributor
	Improper valve clearance	See authorized service dealer/distributor
	Air in injectors	Bleed air in fuel system
Engine runs irregularly or stalls frequently	Vent in fuel tank cap obstructed	Clean cap in solvent, blow dry
	Clogged fuel filter	Replace fuel filter element
	Water, dirt, or air in fuel system	Drain, flush, fill, and bleed air in fuel system
	Dirty or faulty injectors	See authorized service dealer/distributor
	Faulty governor linkage	See authorized service dealer/distributor
	Defective fuel feed pump	Replace fuel feed pump
	Improper valve clearance	See authorized service dealer/distributor
	Improper compression	See authorized service dealer/distributor
Stops suddenly	Out of fuel	Replenish fuel supply
	Air intake restriction	Service air cleaner
	Fuse blown in controller	Replace fuse. If fuse blows again, See authorized service dealer/distributor
	High water temperature (HWT) shutdown*	Check engine coolant level, loose fan belt, radiator obstructions, etc.
	Low oil pressure (LOP) shutdown*	Check engine lube oil level
	Defective fuel pump	See authorized service dealer/distributor
	Clogged fuel filter	Replace filter
Lack of engine power	Engine overloaded	Reduce load
	Air intake restriction	Service air cleaner

* See Section 2 Fault Shutdowns

Engine (Continued)

Problem	Possible Cause	Corrective Action
Lack of engine power (Continued)	Clogged fuel filter	Replace filter element
	Improper type of fuel	Use proper fuel
	Improper valve clearance	See authorized service dealer/distributor
	Dirty or faulty injectors	See authorized service dealer/distributor
	Incorrect fuel injection timing	See authorized service dealer/distributor
	Improper engine compression	See authorized service dealer/distributor
	Vent in fuel tank cover obstructed	Clean cap in solvent; blow dry
	Overfueling (rich)	See authorized service dealer/distributor
Engine overheats	Engine overloaded	Reduce load
	Defective cooling system	Check water pump
	Loose or defective water pump V-belt	Adjust belt tension or replace belt
	Cooling system needs flushing	Flush cooling system
	Defective thermostat	Replace thermostat
	Defective high water temperature switch	Replace switch
	Cooling water leaks from water passages	Check water passages
	Radiator clogged with dirt or oil	Clean with water soluble grease remover and flush cooling system
	Radiator cap defective	Replace
	Cylinder head gasket defective	See authorized service dealer/distributor
Engine emits black or gray exhaust smoke	Fuel filter clogged	Clean or change
	Overload	Lessen the load
	Improper type of fuel	Use proper fuel
	Clogged or dirty air cleaner	Service air cleaner element
	Defective injection pump	See authorized service dealer/distributor
	Faulty injectors	See authorized service dealer/distributor
	Incorrect fuel injection timing	See authorized service dealer/distributor

Engine (Continued)

Problem	Possible Cause	Corrective Action
Engine emits black or gray exhaust smoke (Continued)	Improper valve clearance	See authorized service dealer/distributor
	Lube oil level too high	Drain out surplus
	Improper lube oil	Use proper viscosity oil
Engine emits white or blue exhaust smoke	Excessive engine oil	Reduce to specified level
	Piston ring and liner worn	See authorized service dealer/distributor
	Incorrect injection timing	See authorized service dealer/distributor
	Improper compression	See authorized service dealer/distributor
Low lube oil pressure	Low lube oil level	Add lube oil
	Improper lube oil viscosity	Drain, fill with proper viscosity oil
	Defective lube oil pump	See authorized service dealer/distributor
	Defective oil pressure switch	Replace switch
	Worn engine components	Rebuild– Consult Engine Service Manual
High lube oil consumption	Too light viscosity oil	Use proper viscosity oil
	Oil leaks	Check for leaks in lines, around gaskets, and drain plug
	Improper type of oil	Use oil of proper viscosity
	Clogged breather system	Clean breather system
	Defective piston ring, piston cylinder liner, valve guide, or valve seat	See authorized service dealer/distributor
High fuel consumption	Improper type of fuel	Use proper fuel
	Clogged or dirty air cleaner element	Service air cleaner element
	Engine overloaded	Reduce load
	Improper valve clearance	See authorized service dealer/distributor

Engine (Continued)

Problem	Possible Cause	Corrective Action
High fuel consumption (Continued)	Incorrect fuel injection timing	Check injection timing
	Low engine temperature	Check thermostat
	Improper compression	See authorized service dealer/distributor
	Fuel leakage	Check for leaks at fuel tank, lines, and engine fuel system

Electrical System

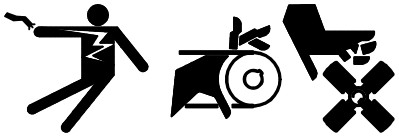
Problem	Possible Cause	Corrective Action
Battery will not charge	Loose or corroded connections	Clean and tighten connection
	Sulfated or worn-out battery	Check electrolyte level and specific gravity (batteries with filler caps only)
	Defective alternator	Replace alternator
	Loose or defective alternator belt	Adjust belt tension or replace belt
Starter does not work properly	Loose or corroded connections	Clean and tighten connection
	Low battery output	Check electrolyte level and specific gravity (batteries with filler caps only)
	Defective starter solenoid	Replace starter solenoid
	Defective starter switch	Replace starter switch
	Defective wiring	Check wiring
Starter cranks slowly	Low battery output	Check electrolyte level and specific gravity (batteries with filler caps only)
	Too heavy viscosity lube oil	Use proper viscosity oil
	Loose or corroded wiring	Clean and tighten loose connections
	High starter current draw	Rebuild or replace starter

Generator

Problem	Possible Cause	Corrective Action
No AC output	AC circuit breaker(s) in OFF position	Reset to ON position
	No DC power to controller	Check battery connections
	Fuse blown	Replace fuse
	AC circuit breaker tripping due to overload on generator set	Reduce load (see Wattage Requirements)
	Short circuit in vehicle circuit causing breaker to trip	Reset– if it trips repeatedly, stop set and contact authorized service dealer/distributor
	General malfunction such as faulty component or other internal fault	Contact authorized service dealer/ distributor for repairs
Low output or excessive drop in voltage	Engine speed too low	Contact authorized service dealer/ distributor for repairs
	Generator overloaded	Reduce load
Engine in poor condition		If routine services are performed and condition persists, see authorized service dealer/distributor

Section 5. Wiring Diagrams

⚠ 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.

⚠ WARNING

Hazardous voltage.

Moving rotor.

Can cause severe injury or death.

Do not operate generator set without all guards and electrical enclosures in place.

Hazardous voltage can cause severe injury or death. 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.

Four-Lead (Single-Phase) Generator Sets where Generator Output can be 120/240 or 100/200 Volt, 60 Hz; or 110/220 or 100/200 Volt, 50 Hz

The following information is provided to illustrate the proper connection of generator sets. In all cases, follow the National Electrical Code (NEC).

NOTE

When connecting a generator set to a voltage different than nameplate voltage, place a notice on the unit indicating this change. A decal (part no. 246242) is available to indicate reconnected voltage from authorized Kohler dealers/distributors.

120/240-Volt (or 110/220-Volt, 100/200-Volt) Configurations– Figure 5-1

Circuit breaker must be a circuit breaker manufacturer two-pole circuit breaker. Two single-pole circuit breakers do not conform to NEC requirements when supplying a 240-volt (or 220-volt) load. This is true even if they are mechanically attached together. Leads L1 and L2 are different phases and must never be connected together.

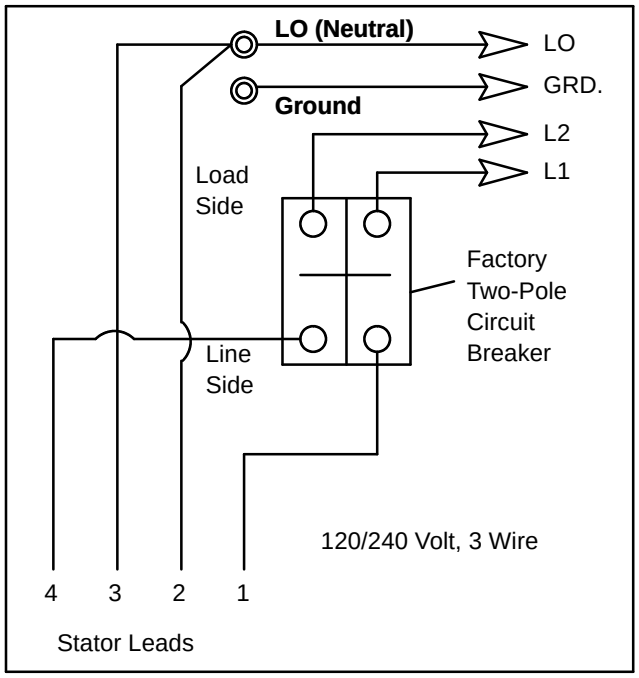


Figure 5-1.

Leads	60 Hz	50 Hz
L0-L1	120 volt	110 volt
L0-L2	120 volt	110 volt
L1-L2	240 volt	220 volt

200-240-Volt Configurations– Figure 5-2

This system uses a single-pole circuit breaker with 200-240 Volt, 2 Wire.

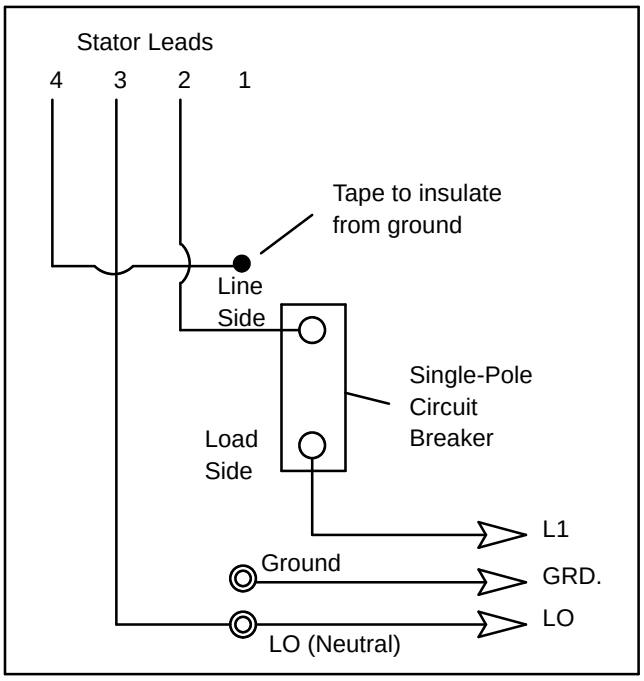
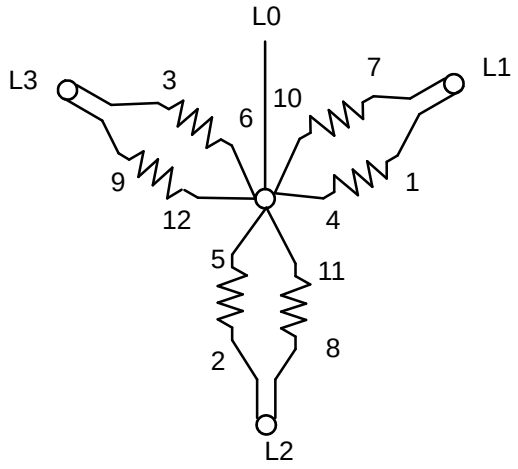


Figure 5-2.

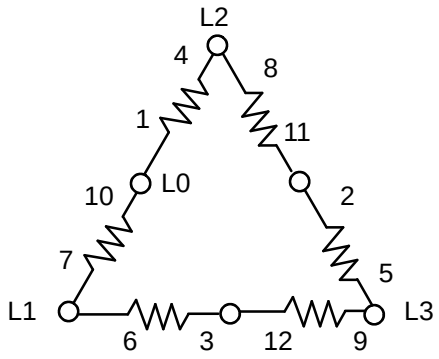
Leads	60 Hz	50 Hz
L0-L1	Not used	200-240 volt

Twelve-Lead (Three-Phase) Generator Sets

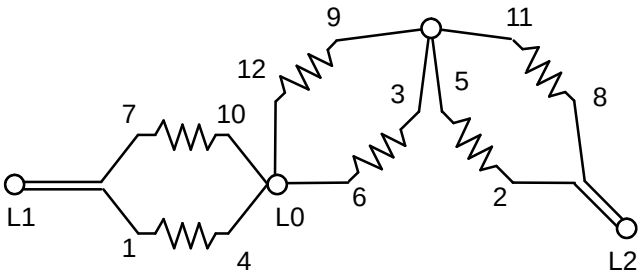
12 LEAD STATOR
60 Hz– 120/208 volt or 139/240 volt
3 PH. 4 WIRE LOW WYE
50 Hz– 120/208 volt or 110/190 volt
3 PH. 4 WIRE LOW WYE



12 LEAD STATOR
60 Hz– 120/240 volt 3 PH. 4 WIRE DELTA
50 Hz– 110/220 volt 3 PH. 4 WIRE DELTA



60 Hz– 120/240 volt, 1 PH. 3 WIRE
50 Hz– 110/220 volt, 1 PH. 3 WIRE



12 LEAD STATOR
60 Hz– 277/480 volt, 3 PH. 4 WIRE HIGH WYE
50 Hz– 220/380 volt, 3 PH. 4 WIRE HIGH WYE

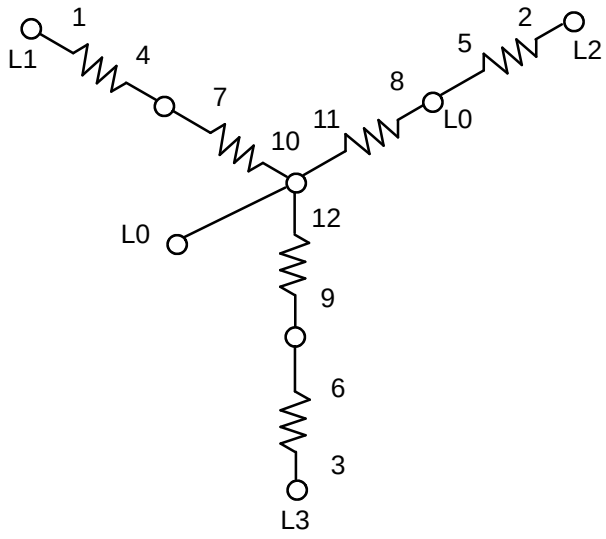


Figure 5-3. Three-Phase Voltage Reconnections

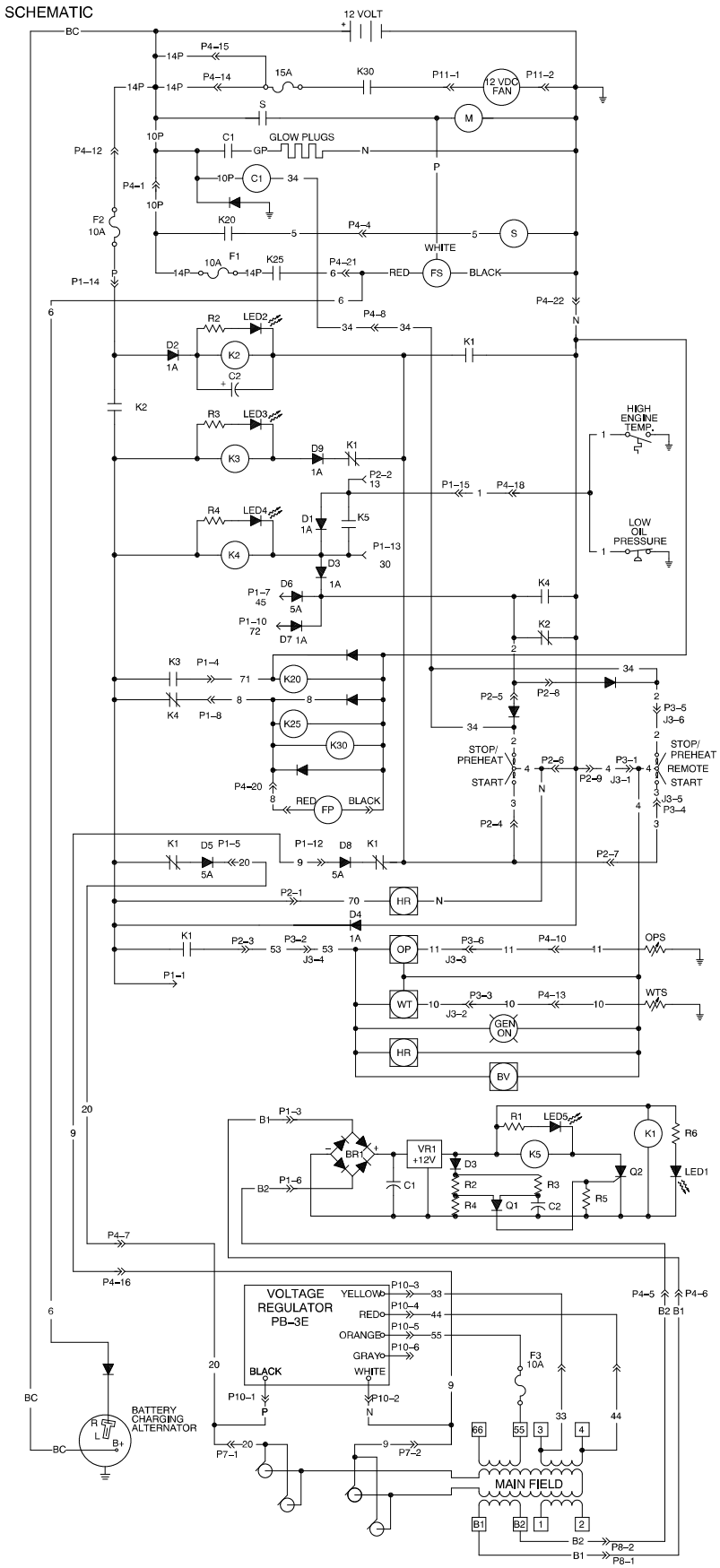


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Figure 5-4. Wiring Diagram (Schematic) for 7/10CCO-RV Single Phase.

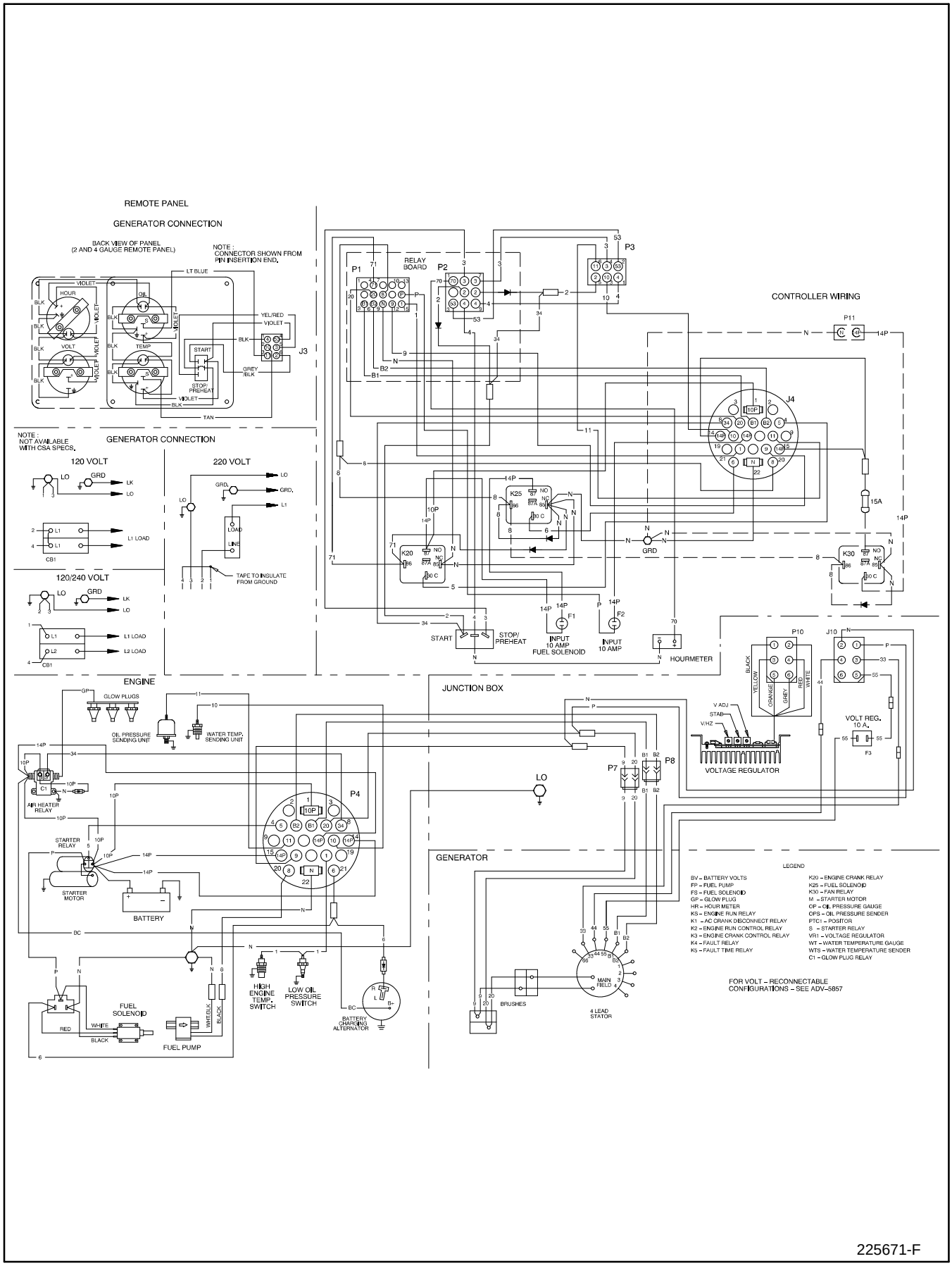


Figure 5-5. Wiring Diagram (Point-to-Point) for 7/10CCO-RV Single Phase.

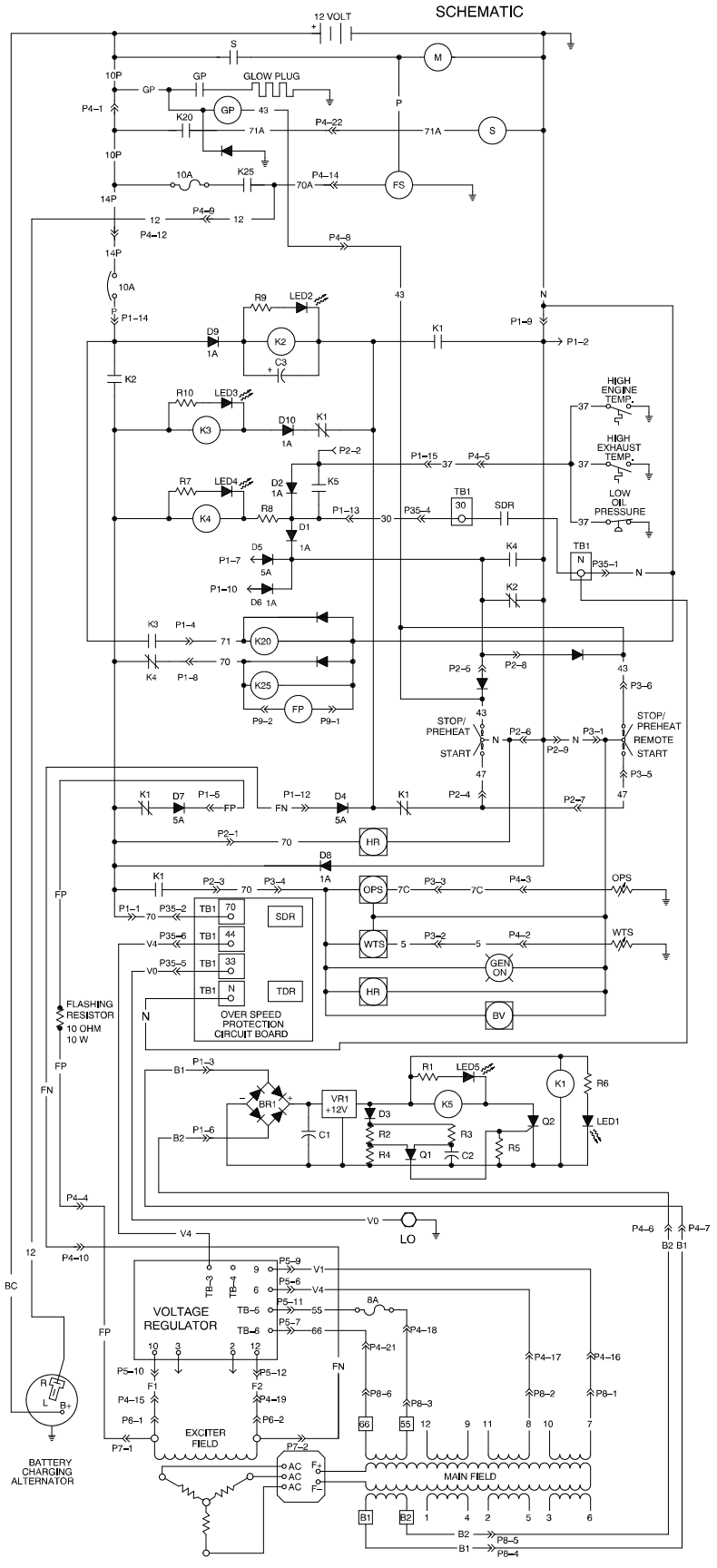


Figure 5-6. Wiring Diagram (Schematic) for 7/10CCOZ-Mobile Three Phase.

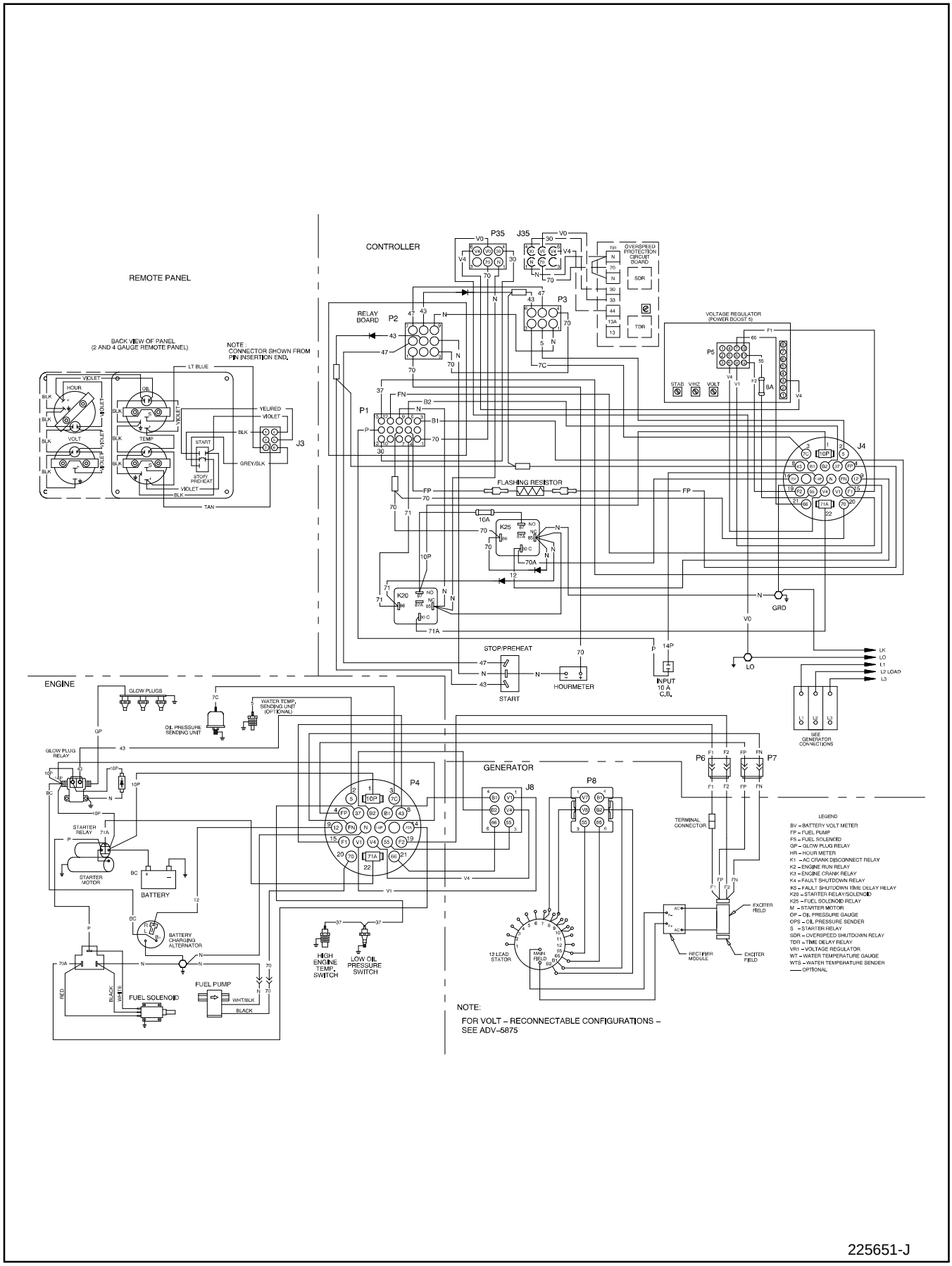


Figure 5-7. Wiring Diagram (Point-to-Point) for 7/10CCOZ-Mobile Three Phase.

Section 6. Installation

Introduction

Use this section as a guide when installing a generator set in the vehicle, then refer to the operation section for specific service instructions. When installing an RV/Mobile generator set, the installation must comply with the Kohler detailed installation instructions. Any additional requirements can also be found in the following sources: (1) ANSI A 119.2/NFPA 501 C, (2) article 551 of ANSI/NFPA 70, National Electrical Code, (3) C.S.A. (Canadian Standards Association) standard C22.2 #100, and (4) C.E.C. (Canadian Electrical Code) C22.1. Generator set installation must also comply with state and local requirements.

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.

Features

These generator sets feature Kubota D905BG-2 or V1305BG-2 diesel engines, rotating-field, alternating-current generator, and relay controller. The generator is directly connected to the engine for permanent alignment. Each controller includes a Start/Stop-Preheat switch for test operating the set at the controller. The single-phase controller also has a keyed connector for connecting a wiring harness to a remote start/stop switch (usually located on the dashboard of the vehicle). After the set is attached to the frame of the vehicle and the coach supplied radiator and hose connections are installed, all that is usually required to make it operational is the following:

- Attach exhaust system.
- Add proper amount of radiator coolant. Mount the coolant recovery tank.
- Add oil to crankcase until dipstick reads to MAX level.
- Connect fuel lines (inlet and return), remote switch, load leads, and battery terminals.

Generator Selection And Wattage Requirements

Total wattage requirements (lights, motors, appliances) must be considered in selecting a generator set, or sizing wattage requirements when available space and construction may limit the size of the generator set. Refer to the following when figuring wattage requirements.

Installation Factors

Each generator set is shipped as a unit except for the optional exhaust system components which are shipped loose for assembly after the set is installed in the vehicle.

When preplanning the installation, the following factors must be considered.

1. **Electrical Load.** Does the set selected have adequate capacity to handle the load?
2. **Compartment Size.** Will there be sufficient room around the set to maintain minimum clearances?
3. **Air Requirements.** Are the compartment air inlets and outlets sized to allow adequate circulation of air for cooling and combustion?
4. **Compartment Floor.** Is the compartment floor strong enough to support the weight of the generator set?
5. **Cooling System.** Is the cooling system large enough to adequately cool the generator set?
6. **Fuel System.** Is the system properly designed to prevent fuel starvation of either the main engine or generator set engine?
7. **Exhaust System.** Will the system meet all safety requirements after installation?
8. **Electrical Connections.** Will all systems (battery, load, and remote switch) be compatible with vehicle systems?

Each of these installation considerations is covered in detail on the following pages.

Electrical Load

While the electrical load of the vehicle should have been calculated prior to purchase of the generator set, you may want to recheck the load before installing the set to make sure that the capacity is ample to meet demands without possible overloading.

Lighting Load

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

The lighting load is usually not too heavy in mobile installations; however, it must be accurately calculated to prevent overloading which could occur, for example, if all lights happened to be on when the air conditioner or other motor loads startup.

Motor Loads

When figuring generator set capacity requirements for installation involving motor loads, do not overlook the high current demanded by the motor during startup. The in-rush or starting current may be 2-5 times higher than that required when the motor reaches normal operating speed. Allow reserve capacity for in-rush demands plus other loads which could be on the line as the motor starts.

Air conditioning units are perhaps the most common type of motor load for generator sets in recreational vehicles. The starting characteristics of the different makes of air conditioners vary greatly– one particular 13,500 Btu unit has, for example, lower starting requirements than an 11,000 Btu unit of another make. When only one unit is involved, there is usually no starting problem, provided of course, the lighting and appliance load is not too high when the unit is started.

The trend seems to be toward larger capacity air conditioners and the use of more than one unit in larger vehicles. Simultaneous starting of two units can present problems if the capacity is marginal. Because of the variation in starting characteristics of the various makes of air conditioners, no definite statements are made in this publication regarding multiple motor-starting capabilities of the mobile generator sets covered. Consider delayed starting or use of easy-starting devices on air conditioner units whenever simultaneous starting of more than one motor is involved. The starting and running requirements of some motor loads common to mobile applications are listed in Figure 6-1. Use this as a guide when selecting generator set capacity requirements involving motor loads. See Figure 6-2 for generator set capabilities regarding air conditioners. Capabilities will vary according to kilowatt derating (following). For specific information regarding simultaneous starting of two or more motors, contact an authorized Kohler dealer/distributor.

	1/4 HP Motor	1/3 HP Motor	1/2 HP Motor	3/4 HP Motor	1 HP Motor	2 HP Motor	3 HP Motor
Starting (In-Rush) Watts	750	1000	1500	2000	3300	4000	5000
Running Watts	350	400	600	750	1100	2000	3000

Figure 6-1. Single-Phase Motor Requirements

Kohler Model	Wattage Capacity	Will Operate Air Conditioner(s) of Sizes Indicated	Power To Spare for Lighting, Appliance, Tools, etc.
7 kW	7,000	Two 13,500 Btu	2800 Watts
10 kW	10,000	Two 13,500 Btu	N/A

Figure 6-2. Air Conditioner Ratings (60 Hz)

Electrical Appliance	Ratings (Watts)
Blanket	50-250
Blender	600
Dryer, Hair	500-1200
Fan, Air Circulating	25-100
Fan, Furnace	270
Heater, Space	750-1500
Heater, Water	1500
Pan, Frying	1200
Percolator, Coffee	650
Radio	50-100
Television	300-750
Toaster	750-1200

Figure 6-3. Appliance Ratings (60 Hz)

Construction Tools	Motor Starting Watts	Running Watts
Air Compressor (Small)	1500	725
Air Compressor 3/4 hp	4000+	2000
Drill, 1/4 in.	500	250
Drill, 3/8 in.	600	350
Drill, 1/2 in.	800	600
Grinder 1/2 hp	1500	1200
Hammer, Demolition	2000	1800
Hammer, HD Rotary	1500	1200
Paint Sprayer (Airless)	400	240
Polisher, Orbit	500	360
Power Paint Roller	120	90
Power Plane	600	450
Router	900	700
Saw, Circular 6 1/2 in.	2200	1000
Saw, Circular 7 1/4 in.	2500	1200
Saw, Table 10 in.	4000	1500
Saw, Sabre (Worm Drive)	2500	1200
Sander, Belt	1500	600
Sander, Finishing	900	360
Screwdriver, Power	1000	530
Shear, 12 gauge	1800	720
Soldering Gun	–	250
Vacuum Cleaner, Wet/Dry	1500	1260
Wrench, Impact 1/2 in.	2000	840

Figure 6-4. Construction Tool Ratings (60 Hz)

Appliance Loads

Generator sets in recreational vehicles are often used to furnish AC for appliances such as TV, stereo, electric water heaters, etc. With the exception of the resistance-type loads such as the water heater, requirements for appliances are usually low. Such loads must not, however, be overlooked when figuring total requirements. Reserve capacity should be available for anticipated appliance loads to avoid overloading of a set. The average power requirements of some electrical appliances are listed in Figure 6-3 and Figure 6-4.

Kilowatt Derating

All units are rated 1.0 power factor. The kilowatts of the generator set will decrease 3.5% per 1000 ft. (305 m) above 500 ft. (152 m) above sea level. Derate 1% for every 10°F (5.5°C) above 85°F (30°C).

Compartment Size

When planning compartment size requirements, allow the minimum clearances for cooling of the generator set as shown in Figure 6-5.

NOTE

Since the sets are flexibly mounted, the minimum clearances will assure that the sides of the compartment and the set will not rub while the set is in operation or while the vehicle is in transit.

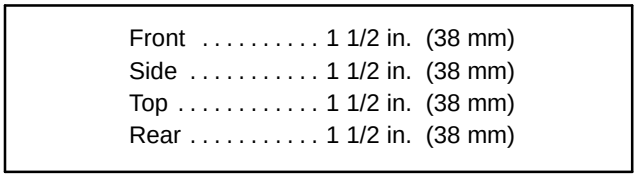


Figure 6-5. Minimum Clearance Requirements

NOTE

Minimum clearances listed for cooling air circulation. Additional clearance is required for routine servicing of the generator set.

Consider the thickness of insulating and sound-deadening material used to line the compartment when planning clearances. If necessary, enlarge the compartment to minimum clearance requirements. Securely fasten the generator set to avoid unwanted movement from vibration and road shock. If the unit is equipped with a mounting tray, the tray is usually supported on the ends by angle iron and has a full door for service access. Use the same number of bolts as mounting holes in the tray to secure the tray to the support structure. Secure units not equipped with a mounting tray by attaching the generator set mounts directly to the vehicle frame. Skid-mounted units can be either affixed to a tray for tray mounting or attached directly to the vehicle frame by the installer. The generator is easily removed from the coach if a carriage with rollers is incorporated into the support structure. See Figure 6-6. Avoid road splash and the possibility of igniting combustible material beneath the coach by enclosing all unnecessary free space beneath the generator compartment.

When designing the compartment, allow sufficient room for the set to be easily removed if major service is required. See Figure 6-6. Also keep in mind that the compartment door must have air-intake openings having a free area equal to or greater than that specified under Air Requirements following.

Make sure the compartment is vapor tight and completely sealed from the inside of the vehicle to prevent exhaust or other fumes from entering the vehicle.

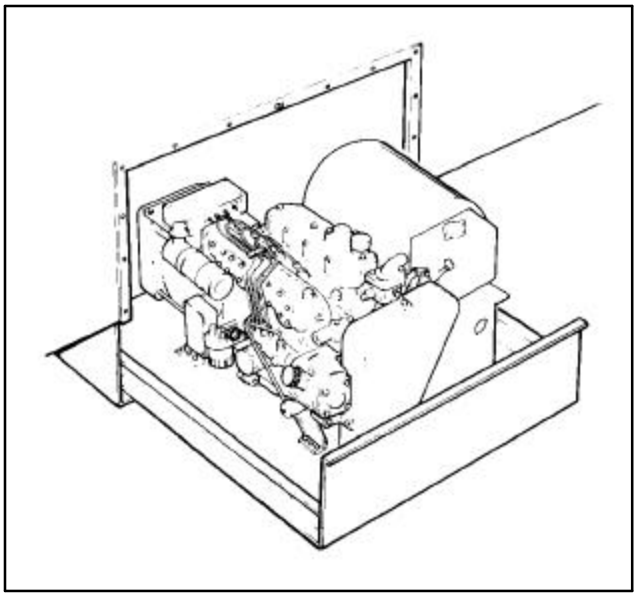


Figure 6-6. Slide Tray Feature for Ease of Service

Line the compartment with a good sound-deadening material. The material selected must be fireproof or highly resistant to fire. An available type of three-layer foam material does a very efficient job of absorbing sound. This type material is easily cut to size with scissors and can be quickly installed using special fire-retardant adhesive which bonds the material to almost any surface that is clean and dry.

NOTE

Be careful not to place combustible insulation near exposed exhaust-system components.

Air Requirements

Each engine is equipped with a high water temperature shutdown switch which will automatically shut down the set if operating temperatures climb too high. To prevent the generator set from shutdown, make sure the compartment openings are large enough to allow adequate circulation of the cooling and combustion air.

The minimum free-air opening in the compartment is shown in Figure 6-7. Remember louvres, screens, and protective grill work definitely restrict effective air flow. Even a simple, relatively open mesh screen as shown in Figure 6-8, will restrict air flow as much as 45%. The intake openings must be increased to compensate for such restrictions. Air inlet and discharge openings for inline radiator-mounted models are shown in Figure 6-9, Figure 6-10, Figure 6-11, Figure 6-12, Figure 6-13, and Figure 6-14.

	AIR INLET	AIR OUTLET
7 kW Remote Radiator	140 (903)	167 (1077)
7 kW Inline Radiator (Suction)	421 (2716)	319 (2058)
7 kW Inline Radiator (Pusher)	239 (1542)	474 (3058)
10 kW Remote Radiator	140 (903)	195 (1258)
10 kW Inline Radiator (Suction)	446 (2877)	309 (1995)
10 kW Inline Radiator (Pusher)	242 (1562)	502 (3241)

Figure 6-7. Min. Air Requirements sq. in. (sq. cm.)

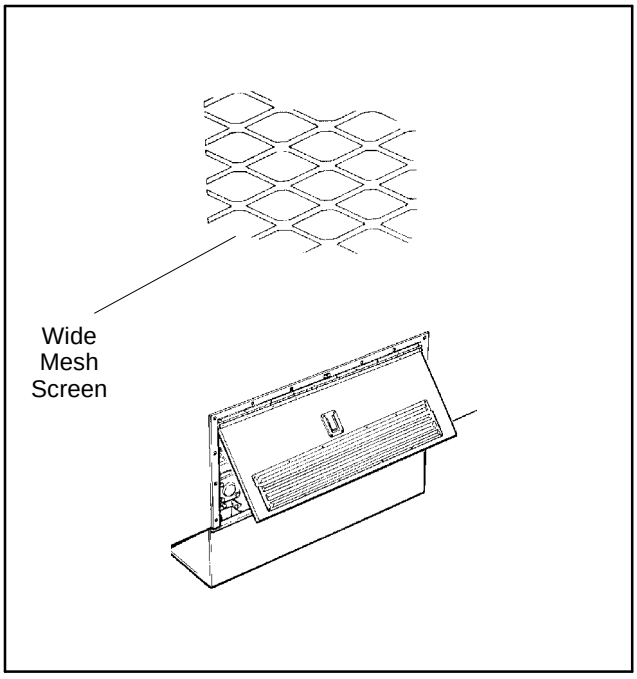


Figure 6-8. Inlet Screen

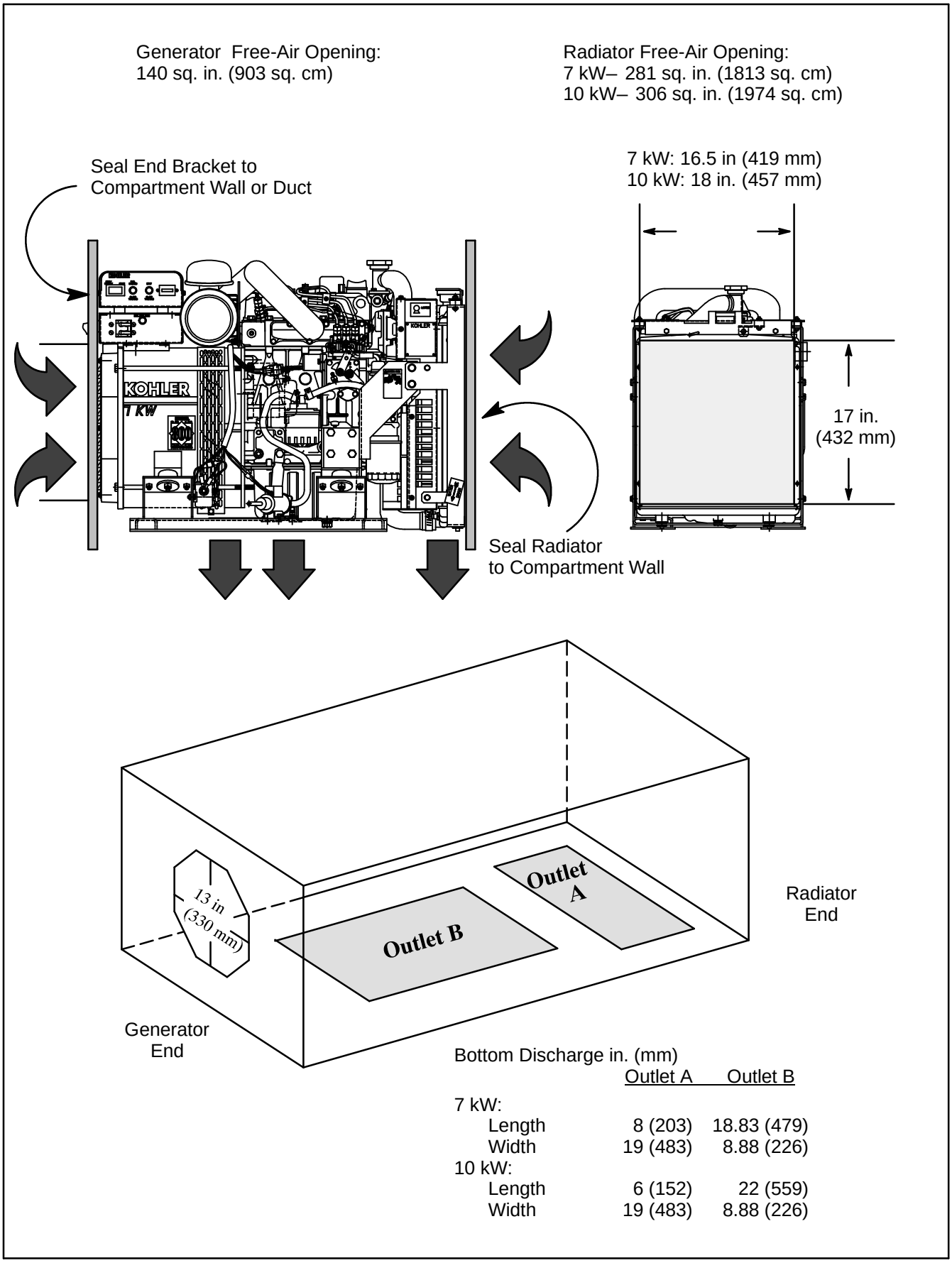
Remote and inline radiator generator sets with suction fans will require an air outlet in the compartment floor, and an air inlet in the generator-end wall. Inline radiator generator sets with pusher fans require an outlet and inlet in the compartment floor, and an air inlet in the generator-end wall. An additional 3 in. (7.62 cm) diameter hole is required in the compartment so combustion air from the outside of the compartment can be brought into the air cleaner using a 2 in. (5 cm) I.D. hose.

NOTE

The air inlet perimeters, at the engine radiator and generator end bracket must be sealed against the compartment wall. This is to make sure that only exterior air is drawn into the generator compartment.

NOTE

Kubota's allowable air intake restriction limit is:
8 in. (200 mm) of water at installation.
25 in. (635 mm) of water after use.



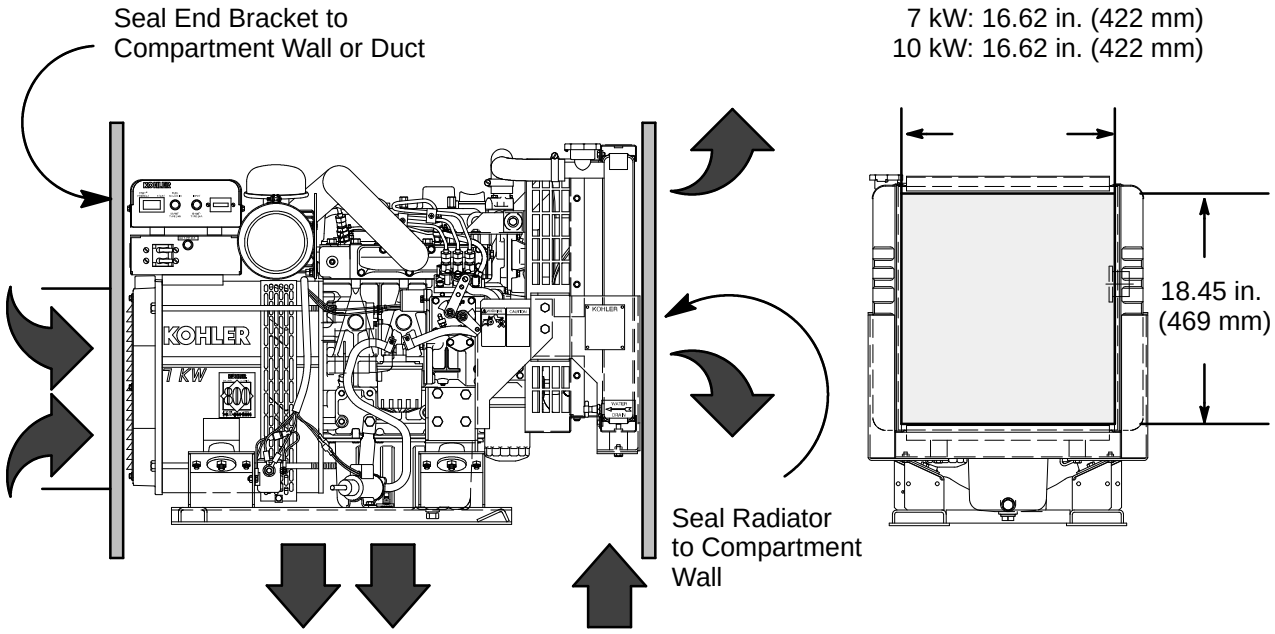
Bottom Discharge in. (mm)

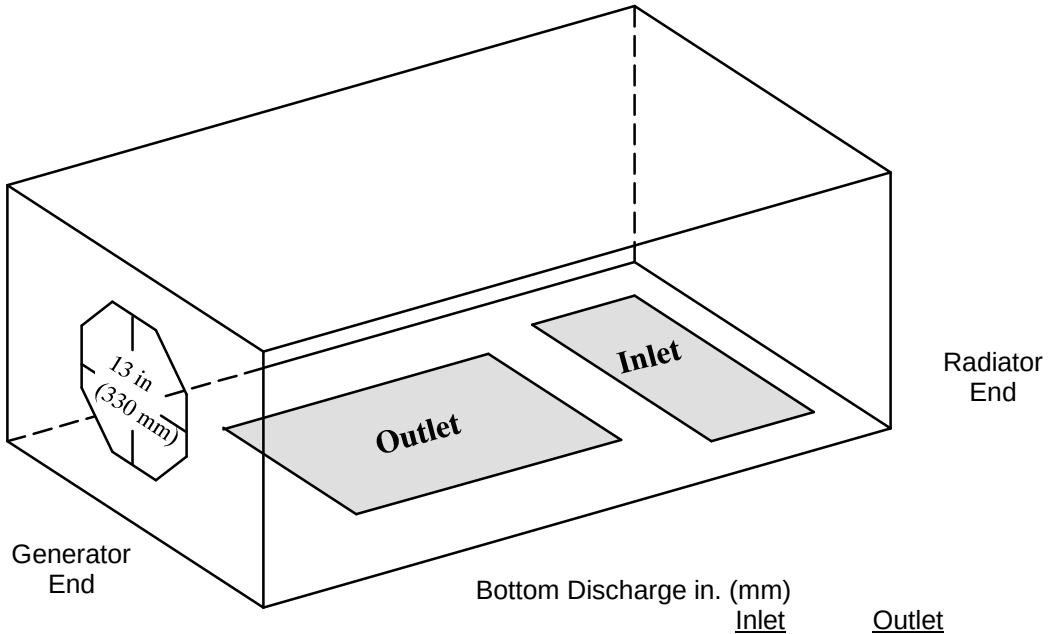
	Outlet A	Outlet B
7 kW:		
Length	8 (203)	18.83 (479)
Width	19 (483)	8.88 (226)
10 kW:		
Length	6 (152)	22 (559)
Width	19 (483)	8.88 (226)

Figure 6-9. Inline-Radiator Model Air-Flow Requirements with Suction Fan

Generator Free-Air Opening:
140 sq. in. (903 sq. cm)

Radiator Free-Air Opening:
7 kW– 307 sq. in. (1981 sq. cm)
10 kW– 307 sq. in. (1981 sq. cm)

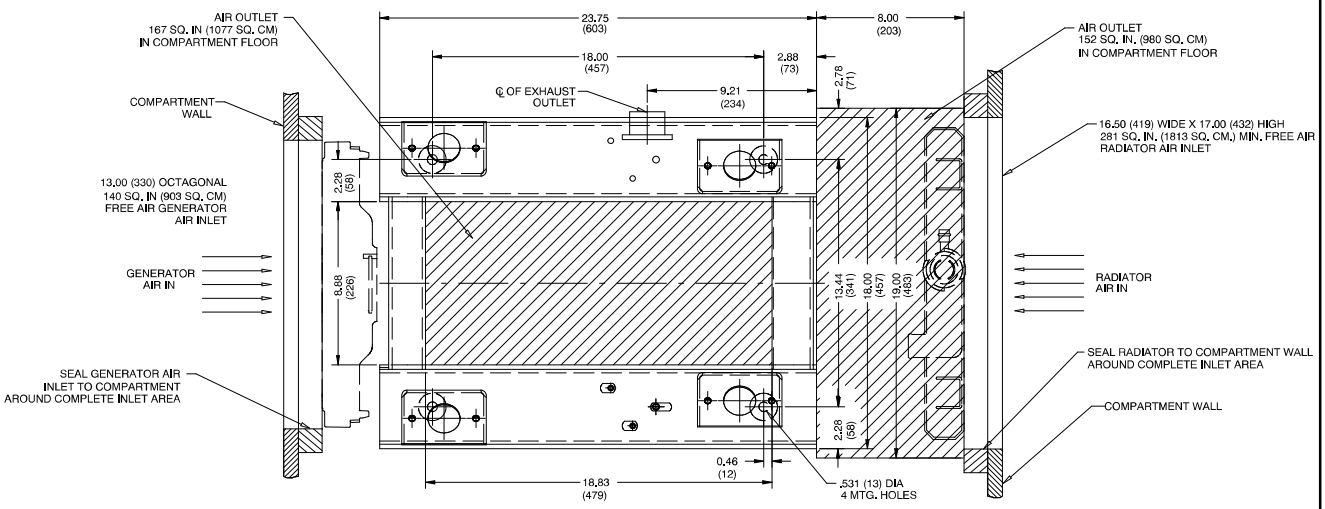




Bottom Discharge in. (mm)

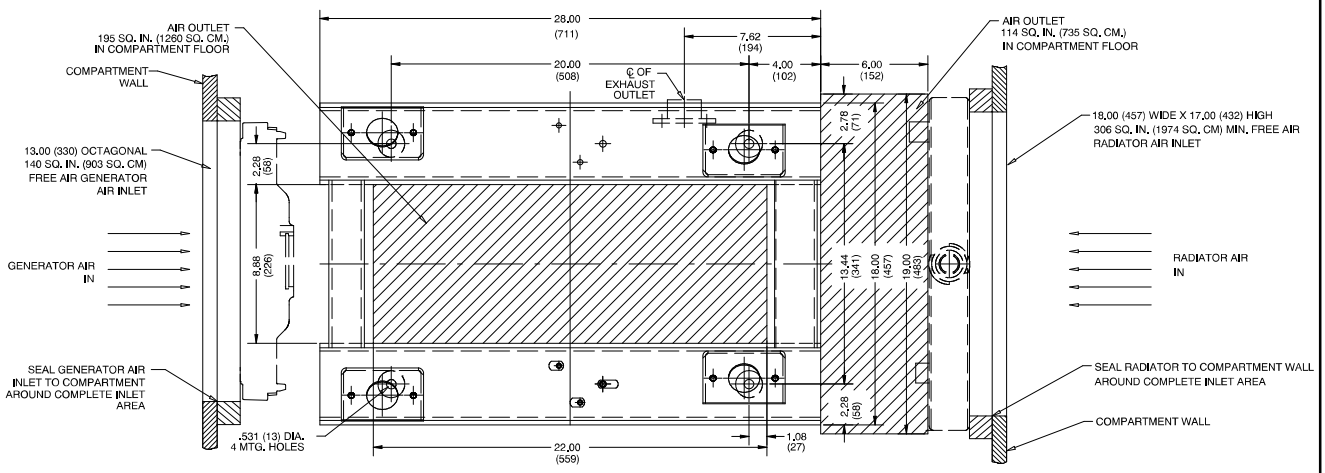
	Inlet	Outlet
7 kW:		
Length	16.62 (422)	18.83 (478)
Width	5.95 (151)	8.88 (225)
10 kW:		
Length	16.62 (422)	22 (559)
Width	6.15 (156)	8.88 (225)

Figure 6-10. Inline-Radiator Model Air-Flow Requirements with Pusher Fan.



7 kW Inline-Radiator Model

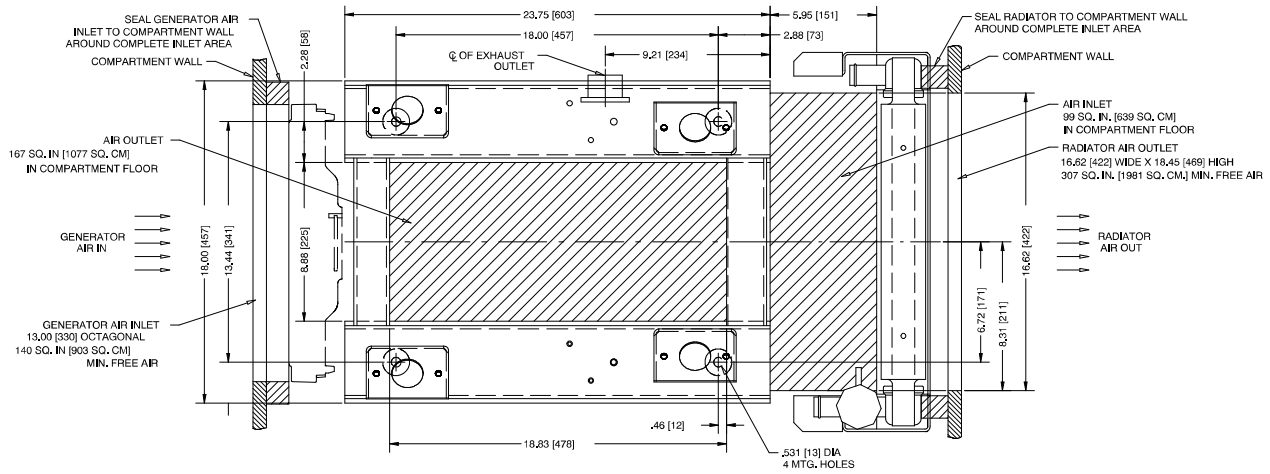
ADV-5831A-D



10 kW Inline-Radiator Model

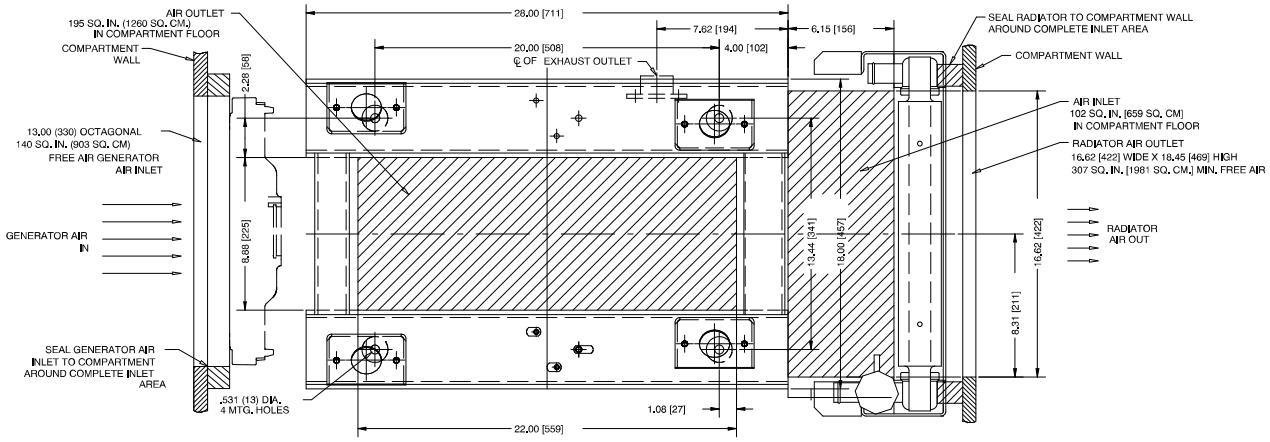
ADV-5832A-C

Figure 6-11. Air Flow Requirements for Inline-Radiator Models (with Suction Fan)



7 kW Inline-Radiator Model

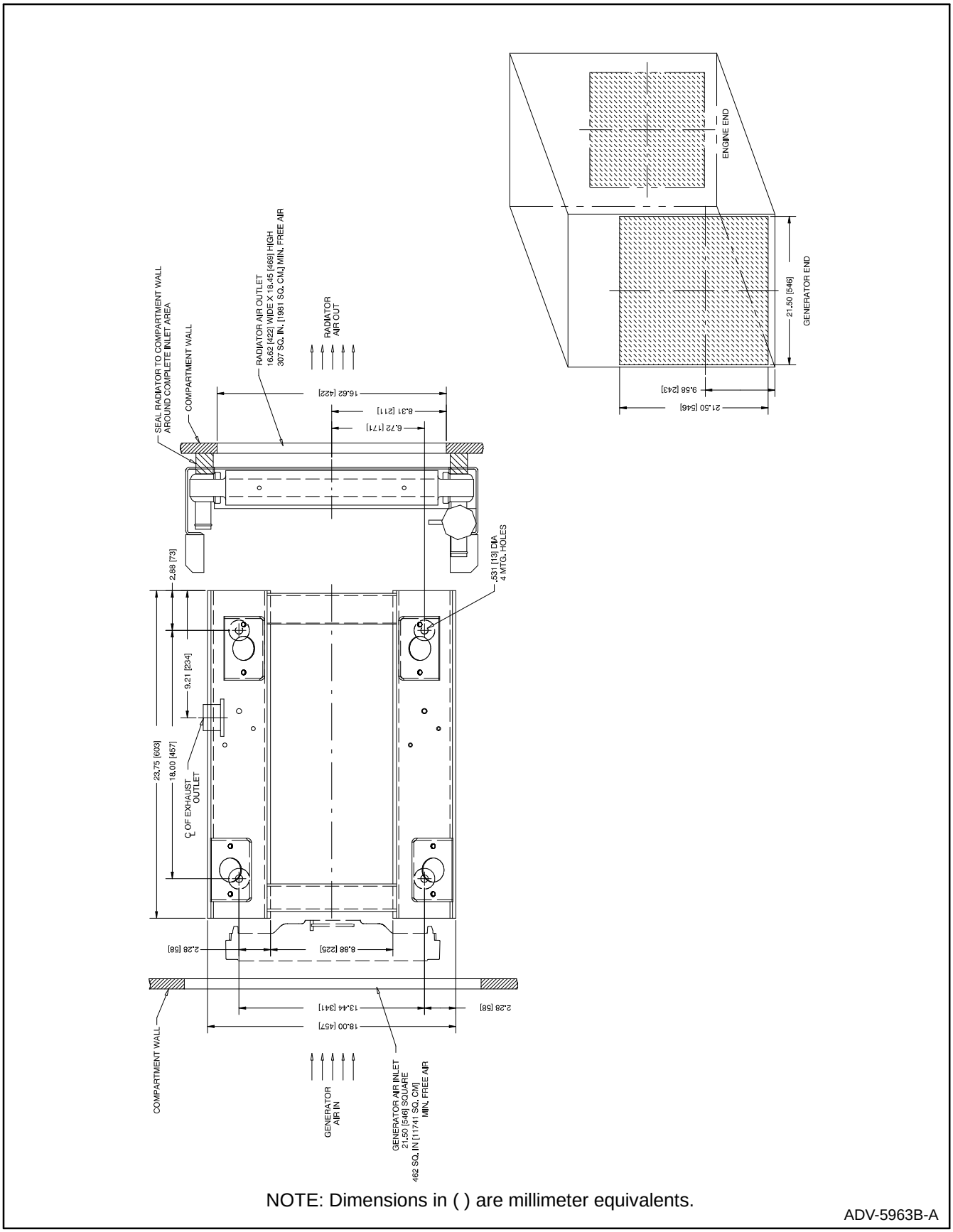
ADV-5963A-A



10 kW Inline-Radiator Model

ADV-5968A-A

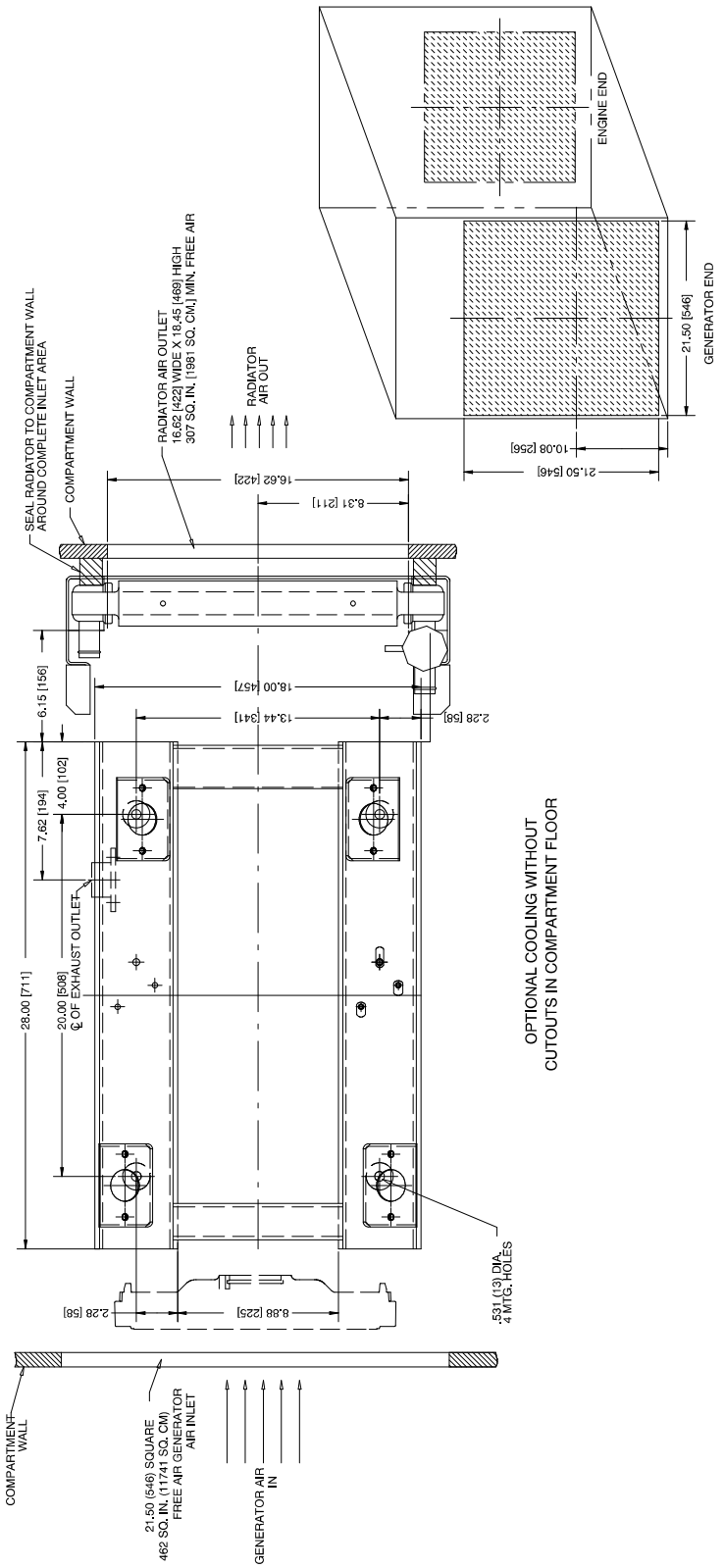
Figure 6-12. Air Flow Requirements for Inline-Radiator Models (with Pusher Fan)



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5963B-A

Figure 6-13. 7CCO/CCOZ Inline Radiator (Pusher Fan) Single- and Three-Phase Models Optional Cooling without Cutouts in Compartment Floor



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5968B-A

Figure 6-14. 10CCO/CCOZ Inline Radiator (Pusher Fan) Single- and Three-Phase Models Optional Cooling without Cutouts in Compartment Floor

Remote Radiator Cooling System

Use the following data in designing and installing the generator set cooling system. To ensure a safe, effective installation, be sure the cooling system selected follows these parameters. Kohler Co. offers radiator assemblies which meet these requirements and adequately cool the generator. Select the radiator assembly appropriate for the generator installation.

Due to the multitude of coach manufacturers and variety of generator installations, only general guidelines are provided. Adapt these recommendations to the installation. In a typical installation, the radiator assembly is installed in the same compartment as the generator. If the blower-fan radiator assembly is used, cooling air is drawn across the generator and engine and then through the radiator. If the suction fan radiator assembly is used, the suction fan pulls cooling air through the radiator and then past the generator set. If the radiator assembly alone is used, the installer must supply an electric blower or suction fan to circulate the cooling air. See Figure 6-15 and Figure 6-16. Depending on space limitations, the radiator can be located in front of, adjacent to, or in a ventilated location remote from the engine (maximum distance from the generator is 10 ft.). To prevent recirculation of heated air, be sure to maintain a tight seal between the radiator and the discharge chute. Generally, the discharge chute opening should be approximately 1 1/2 times the size of the radiator core.

NOTE

If locating the radiator in a compartment separate from the engine, remember the engine combustion air and heat rejection requirements of the alternator and engine block when designing the cooling system. Install two supplemental cooling fans capable of 265 cfm (7.49 m^3/min) to supply air to the generator compartment for these requirements.

NOTE

If installing a non-Kohler radiator assembly, be sure the radiator fan motor rotates in the correct direction and is of the proper voltage.

If sizing a non-Kohler radiator, follow these general guidelines for radiator selection.

Heat Rejection:

7 kW– 638 Btu per min.
10 kW– 942 Btu per min.

Cooling System Water Flow:

Typical: 5-6 gallons per min.*

Max. water temperature allowed:

230° F

Connection Points to Radiator:

Radiator Inlet: 7 kW– 1.25 I.D. Hose
10 kW– 1.12 I.D. Hose
Radiator Outlet: 7 kW– 1.12 I.D. Hose
10 kW– 1.12 I.D. Hose

*If the application requires excessive runs between the generator set and the remote radiator, check the water flow. Be certain the radiator is sized accordingly.

NOTE

The cooling system fill (radiator or expansion tank) must be the highest point in the cooling system. See Figure 6-17. If the cooling system fill is not located as directed, cooling water will not completely fill the engine and result in overheating of the engine and disablement of the high water temperature shutdown switch.

A close relationship exists between the cooling system design and the generator compartment size. Availability of space is often the determining factor in cooling system design. See Compartment Size section of this manual prior to designing and installing the generator cooling system.

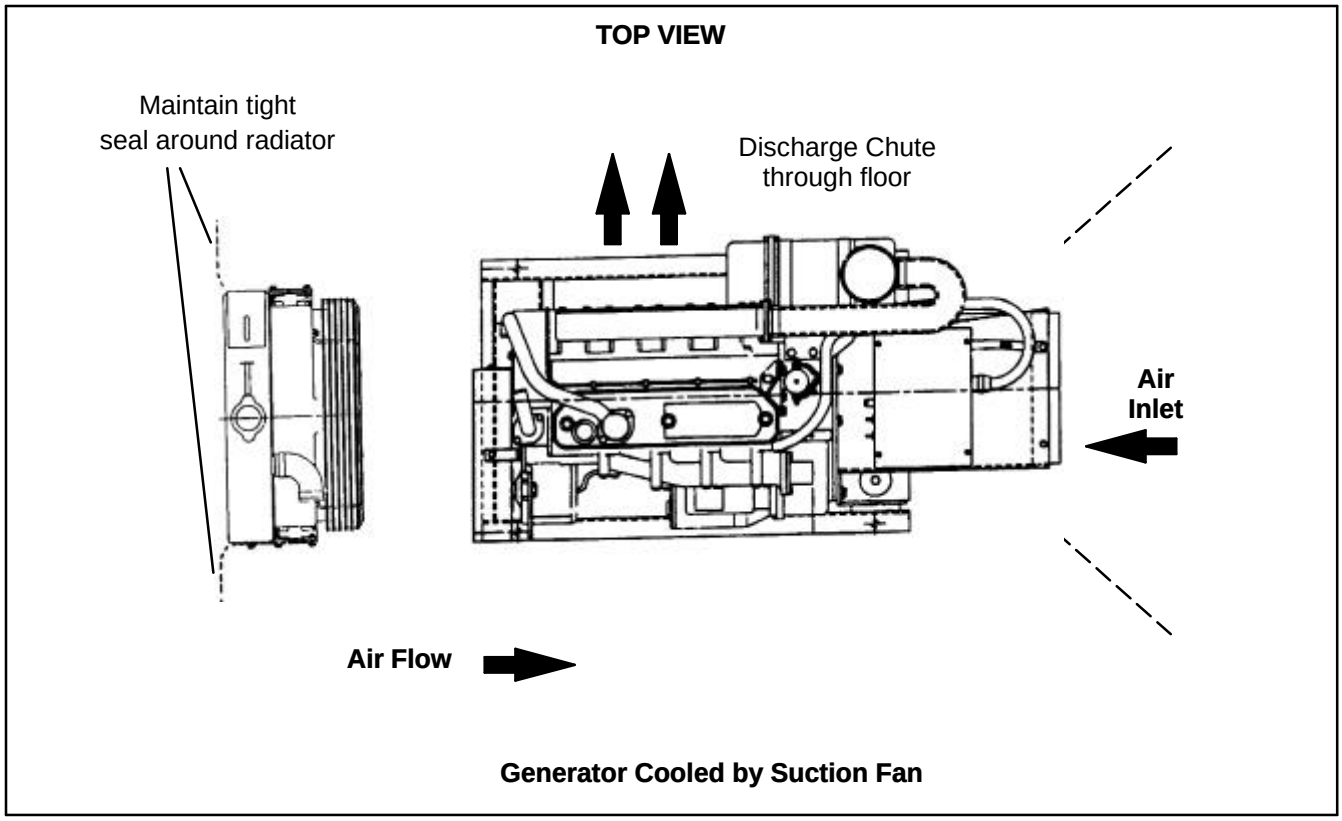


Figure 6-15. Typical Cooling System Installation for Remote Radiator Mounted in the Generator Compartment

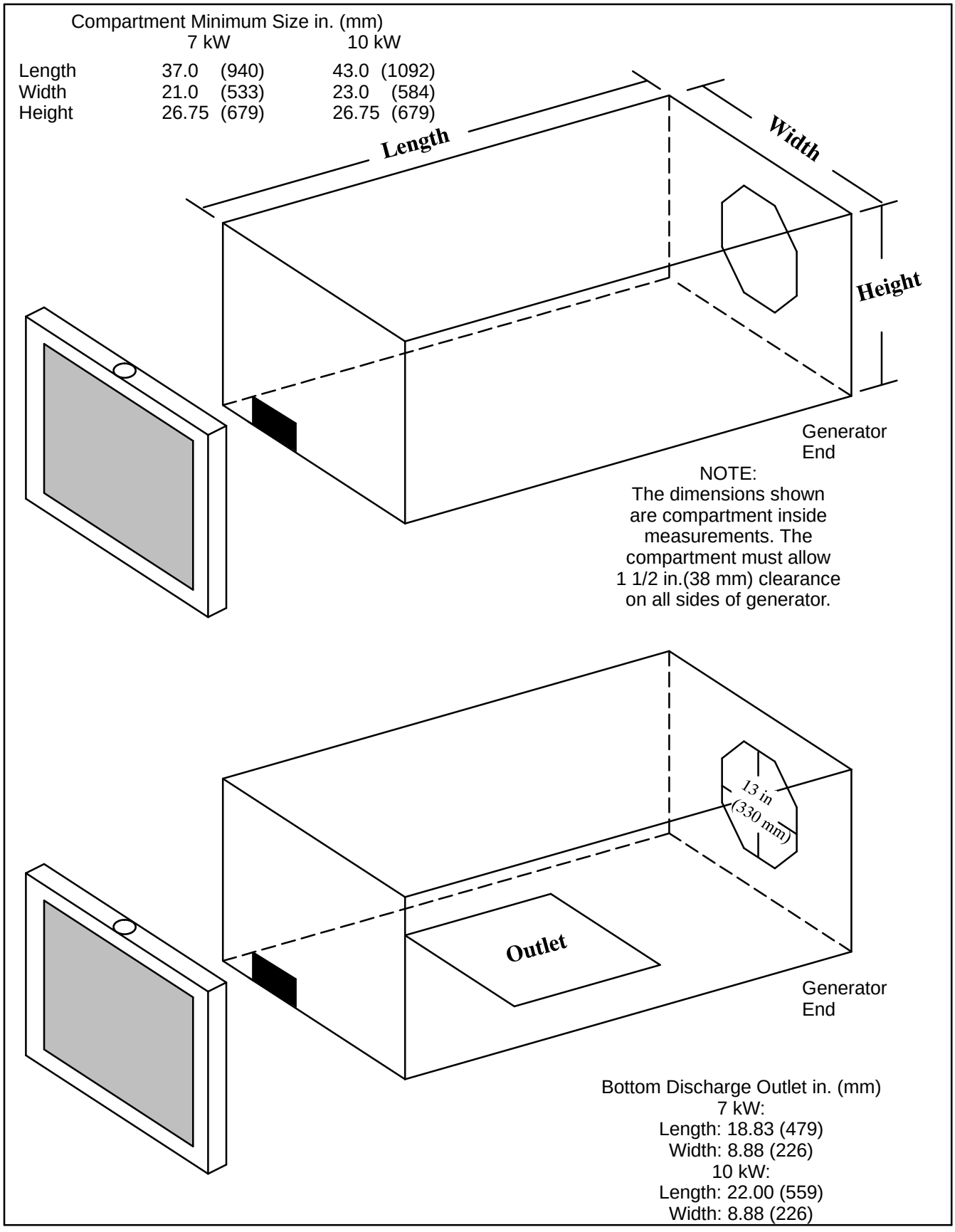
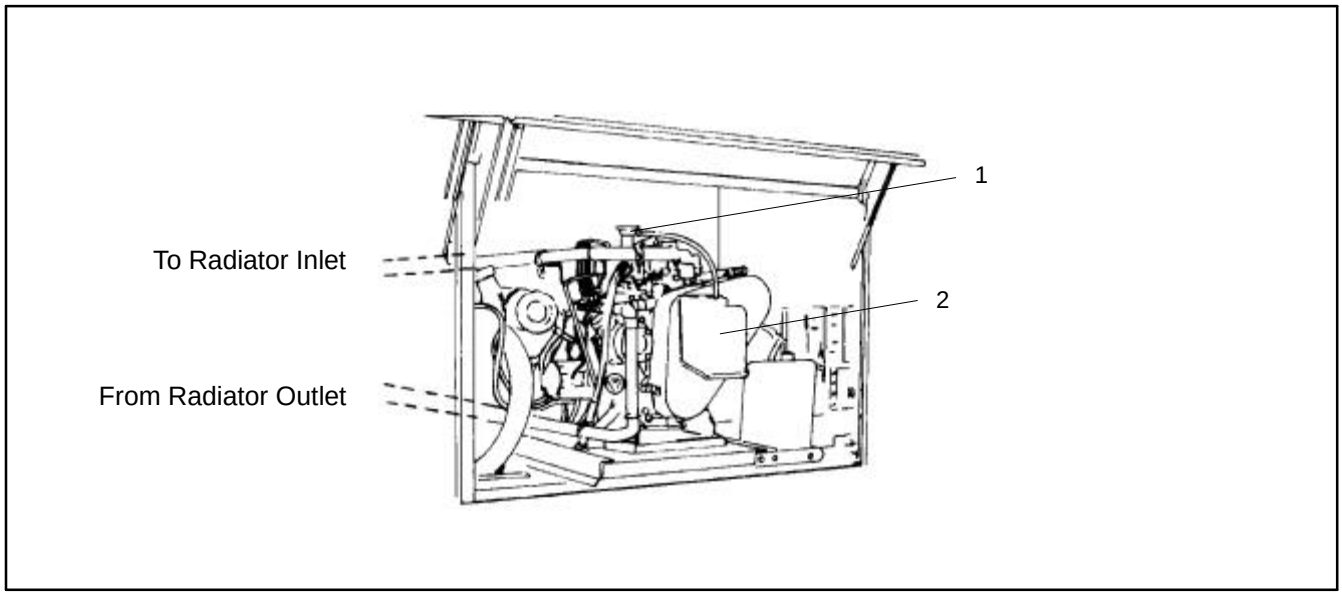


Figure 6-16. Typical Cooling System Installation (Compartment Minimum Sizes) for Remote Radiator Mounted Outside the Generator Compartment



1. Initial Coolant Fill
2. Coolant Fill at Coolant Recovery Tank

Figure 6-17. Cooling System Fill (Coolant Recovery Tank)

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. Spilled fuel can cause an explosion. Use a container to catch fuel when draining fuel system. Wipe up all spilled fuel after draining system.

The diesel fuel system for the generator set must be designed to operate independently of the system for the vehicle engine if both engines are to be operated at the same time. The best way to do this is to have separate fuel tanks; however, this is usually impractical because of space restrictions. In most installations, both engines operate off a common tank with a separate dip tube arrangement as shown in Figure 6-18. This prevents the smaller engine from being starved of fuel by the larger engine. The generator set dip tube is generally shorter than the vehicle dip tube. With this arrangement, fuel may not be available to the generator set when fuel supply is low.

A simple tee fitting is sometimes used to provide fuel for both engines off a common tank; however, this usually prohibits simultaneous operation. There is also the possibility that operation of either engine could completely drain the fuel line of the other engine, thus making starting difficult if not impossible. Do not use the tee arrangement.

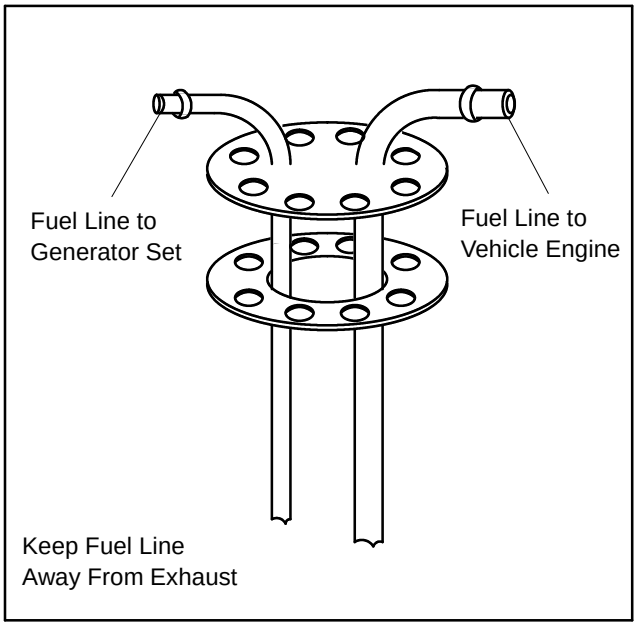


Figure 6-18. Two Dip Tubes in Fuel Tank

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.

Care must be taken when routing the fuel line from the fuel tank to the generator set. Keep fuel lines as short as possible but maintain adequate clearance from the exhaust system. Fuel lines must be run along the frame or undercarriage– never run fuel lines inside the coach. Locate fuel lines below the generator set compartment with entry point near fuel pump (max. lift of the fuel pump is 1 meter or 39 inches). The fuel line must be of adequate size to handle the flow of fuel and withstand road shock and year-round climate conditions. If steel tubing is used, use a 5/16 in. (8 mm) I.D. (minimum) with an 8 in. (230 mm) (minimum) flexible section to allow free movement of the generator set.

Locate the fuel return line as far as practical from the fuel pickup. This will allow returned fuel to be cooled by the tank fuel before delivery back to the fuel injectors. Incoming fuel is used to cool the injectors and maximum engine efficiency will be achieved by supplying cool fuel to the engine. The fuel tank capacity and the amount of fuel will affect cooling capability.

Fuel Line Sizes:

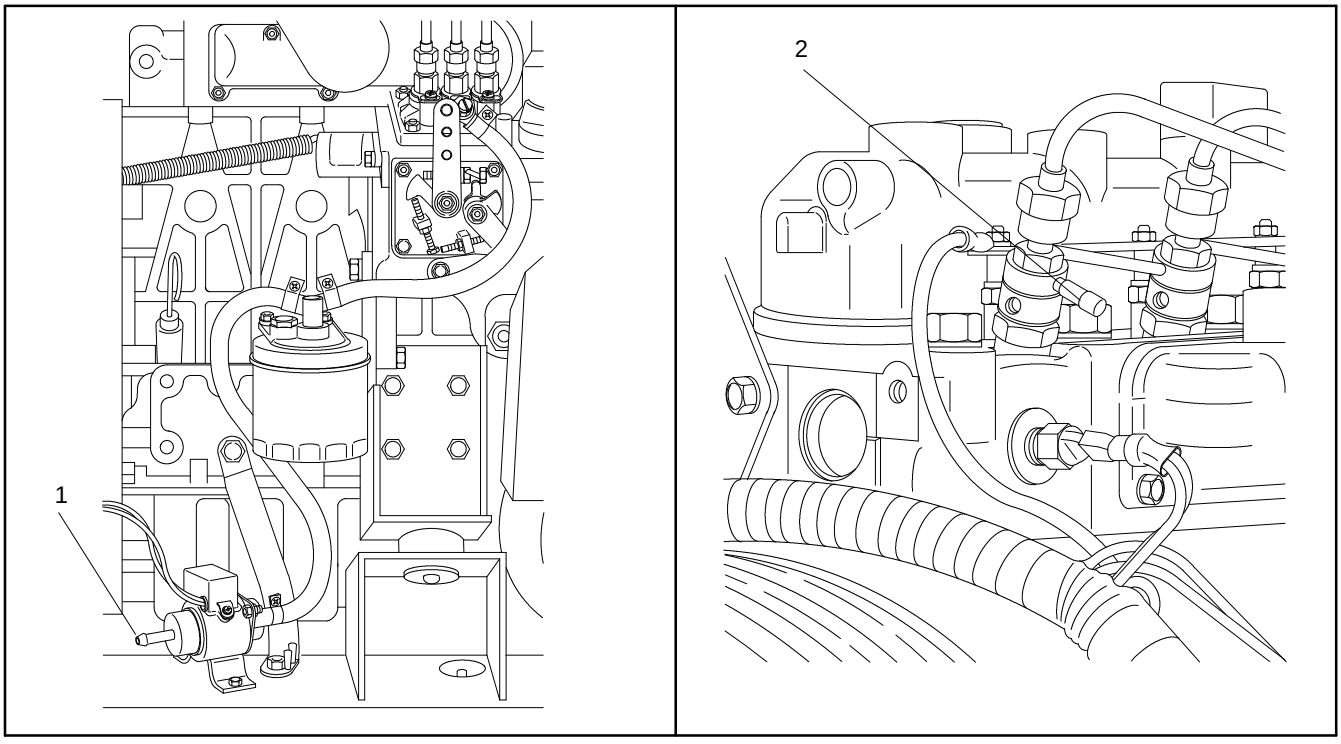
Fuel Inlet	5/16 in. (8 mm)
Fuel Return	3/16 in. (5 mm)

Fuel Lines

If metal lines are used from the fuel tank, use a flexible hose section to connect the metal line to the preliminary fuel filter (supplied loose) and flexible hose section to the engine fuel pump (fuel-inlet connection). Use a flexible hose section to connect the metal line from the fuel tank to the engine fuel-return connection point. The flexible sections are necessary to allow vibrational motion of the generator set during operation. See Figure 6-19 for fuel inlet- and return-line connections.

NOTE

Diesel-fueled engines require SAE 30R6, SAE30R7, or SAE 30R8 type hose.



1. Fuel Inlet Connection
2. Fuel Return Connection

Figure 6-19. Fuel Inlet and Return Connection Points

Exhaust Systems

Carefully plan the generator exhaust system to ensure a safe, quiet installation. Be sure the installation will comply with all state and local requirements and applicable articles of the codes listed at the beginning of this section.

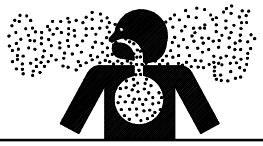
⚠ WARNING

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

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

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.

⚠ 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. 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. 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. Do not use copper tubing in diesel exhaust systems. Diesel fumes can rapidly destroy copper tubing in diesel exhaust systems. Exhaust sulfur causes rapid deterioration of copper tubing resulting in exhaust leakage.

NOTE

Suspend exhaust system components beneath the undercarriage with automotive-type tailpipe hangers (shock mounted) only. Position hangers in vertical position directly above exhaust pipe to reduce vibration. Excessive vibration caused by angular hanger mounting could cause exhaust pipe damage. If the tailpipe extends more than 18 in. (45.7 cm) beyond muffler, attach an additional hanger for support. Use only automotive-type, U-bolt muffler clamps in exhaust system installation.

Due to the different locations of mufflers and piping to these mufflers, clearance requirements must be followed to protect generator set components and to avoid igniting adjacent combustible materials. A clearance of 1.5 in. (38 mm) is recommended between exhaust system parts and fuel system, electrical system, and all combustible components.

The exhaust piping can be routed through the compartment floor or walls provided minimum clearances are maintained and exhaust piping bends are minimized. Use a tail pipe as short as possible with as few gradual bends as possible to reduce back pressure; maximum back pressure allowed is 28 in. (700 mm) water column. The exhaust piping must include an exhaust sleeve or thimble when routed through a combustible wall. Extend tail pipe a minimum of 1 in. (25 mm) past perimeter of vehicle. If the generator tail pipe is located on the same side as the compartment air intake, position tail pipe so exhaust gases will not be recirculated. Installation of 1.61 in. I.D. flexible tubing must be made between the exhaust manifold flange and the silencer.

NOTE

The muffler material must be aluminized steel or other corrosion-resistant material of welded or crimped construction. Use a USDA-approved type muffler or muffler fitted with a USDA-approved spark arrestor.

Battery, load lead, and remote switch panel connections are needed to complete the installation. Make final connections to the battery only after all other connections have been made as this will prevent unintentional starting. Some specific details on each connection are stated in the following paragraphs. Refer to the wiring diagram for specific details. Connections should be made only by qualified electricians. All wiring to the generator set shall be securely supported or harnessed to prevent abrasion. Additional support is required to prevent exposure to the exhaust system and drippage of fuel, oil, or grease– at least 2 in. (51 mm) clearance must be provided between electrical wiring and hot exhaust parts. Also, wiring must not be located directly below or in close proximity to fuel system parts or oil fill tube. Some other points to consider when making AC load connections are covered in the following paragraphs.

NOTE

Wiring connections made at the time of installation should be accessible for inspection and servicing.

Battery And Connections

A separate 12-volt battery is recommended for the generator set. With a separate battery, cables can be kept short which eliminates the problem of excessive voltage drop through long cables. See Figure 6-20 for length and sizes. Refer to Figure 6-21 (View A) for cable connections (note that a ground strap must be connected between the ground lug on the generator set and frame of the vehicle with this arrangement).

If the starting battery for the vehicle engine must also be used for starting the generator engine, the negative battery terminal must be grounded to the vehicle frame and heavy gauge (#4) ground strap must connect the ground lug on the generator set to the vehicle frame as illustrated in Figure 6-21 (View B).

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

Figure 6-20. Battery Cable Size

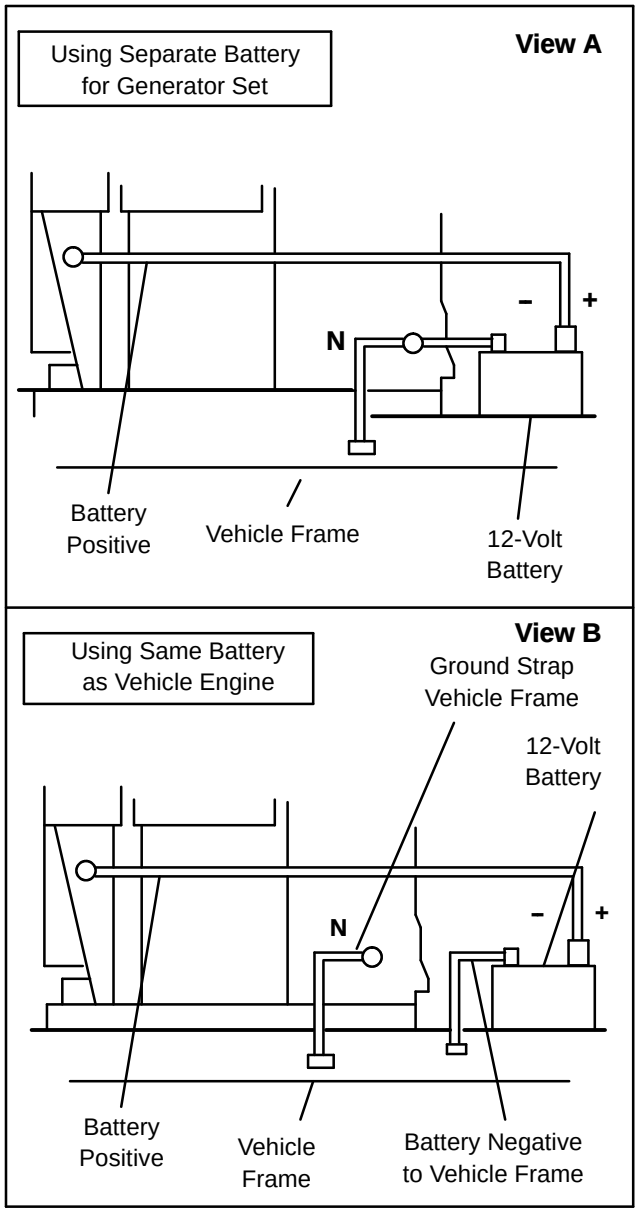


Figure 6-21. Battery Connection Details

⚠ 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.

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 changed. Always turn battery charger off before disconnecting battery connections. Remove negative lead first and reconnect it last when disconnecting battery.

NOTE

A ground connection is required between the generator and the vehicle frame even if the battery used to start the generator is not the same as the vehicle.

AC Load Lead Connections

Each set has four color-coded load leads. The black leads (L1 and L2) are hot, the white lead (L0) is neutral and the green lead is the hazard ground. The load leads can be routed directly from the junction box to the vehicle AC circuit or transfer-switch connection. All installations require that the load leads be routed through flexible conduit from the generator end bracket to the junction box location. The load lead junction box must be accessible for servicing and inspection.

NOTE

Keep load lead circuit away from the generator, specifically fuel and exhaust system components.

NOTE

All field-supplied wiring must be capable of withstanding temperatures of 167°F (75°C).

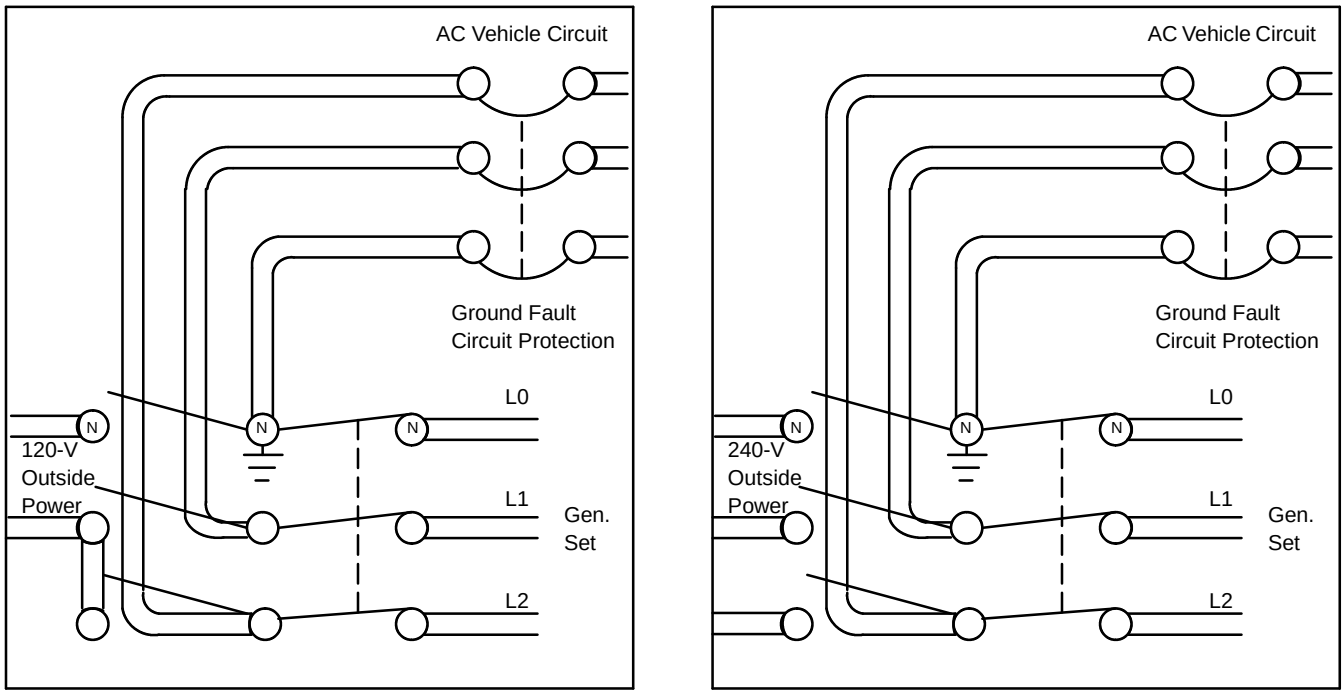
AC load lead L0 (white or gray) is always the neutral lead on Kohler generator sets. Make sure the neutral of the AC circuit in the vehicle is connected to the lead L0 (white or gray). If equipment ground-type plugs and receptacles (3-pronged) are used in the vehicle, the green wire must be connected to the U-shaped pin. On vehicles which also have provisions for using an outside AC power source, the neutral as well as the hot (or black) leads must be completely isolated from the generator set when power is switched to the outside source. See Figure 6-22.

NOTE

A triple-pole, double-throw transfer switch rated for the calculated load of the RV must be used to transfer the load from one source to the other. Install a ground-fault circuit interrupter in the wiring system to protect all branch circuits.

NOTE

The AC load circuit of the generator set must be protected by a circuit breaker(s) against overload or short circuit.



120 Volt 120/240 Volt

Figure 6-22. Transfer Switch Connections, 3-Wire AC Circuit

⚠ 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.

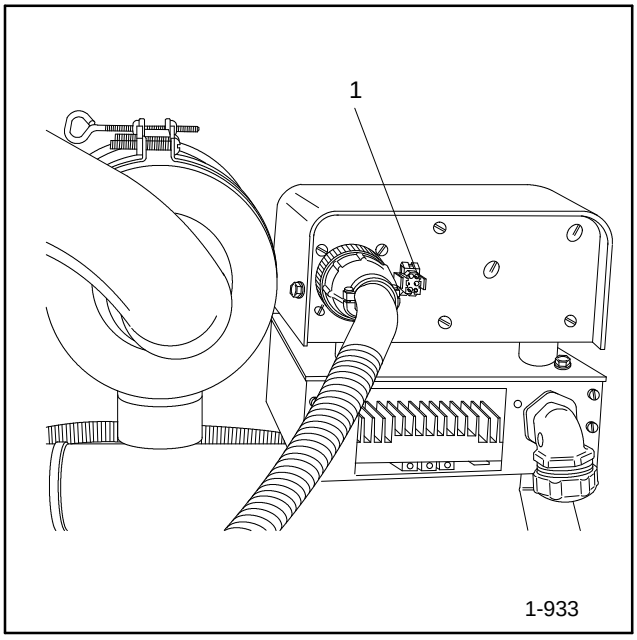
Hazardous backfeed voltage can cause severe injury or death. Do not connect generator set to any building/campground electrical system without connecting through an approved device and after building/campground main switch is open. Backfeed connections can cause serious injury or death to utility personnel 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.

NOTE

For standby service connect output of generator to suitably rated transfer switch in accordance with Canadian Electrical Code, Part 1.

Remote Switch Connection (Single-Phase Models Only)

Controllers include an accessory plug (P3) for easy connection of the remote switch to the start/stop switch, preheat switch, oil pressure gauge (if equipped), water temperature gauge (if equipped) and generator ON lamp wiring harness (available separately). One end of the 15 in. (38.1 cm) P3 wiring harness plugs directly into the controller. The pigtail leads on the remaining end of the harness are connected to the appropriate remote panel terminals via customer-supplied wiring. Be sure to connect the remote operating controls to the correct P3 wire harness lead. See Figure 6-23 and Figure 6-24 for identification of P3 harness leads.



1. Remote Connection

Figure 6-23. Controller Remote Connection

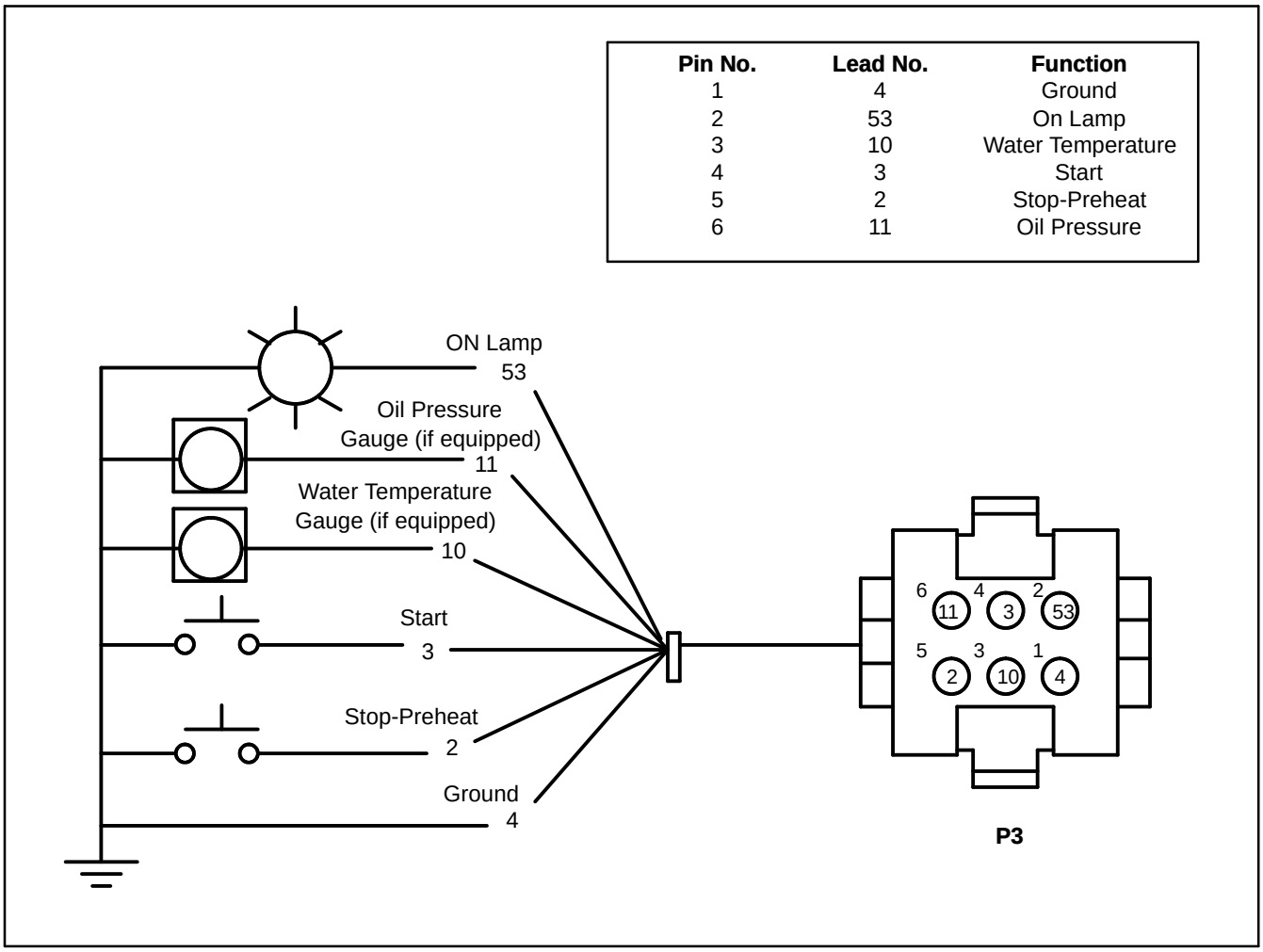
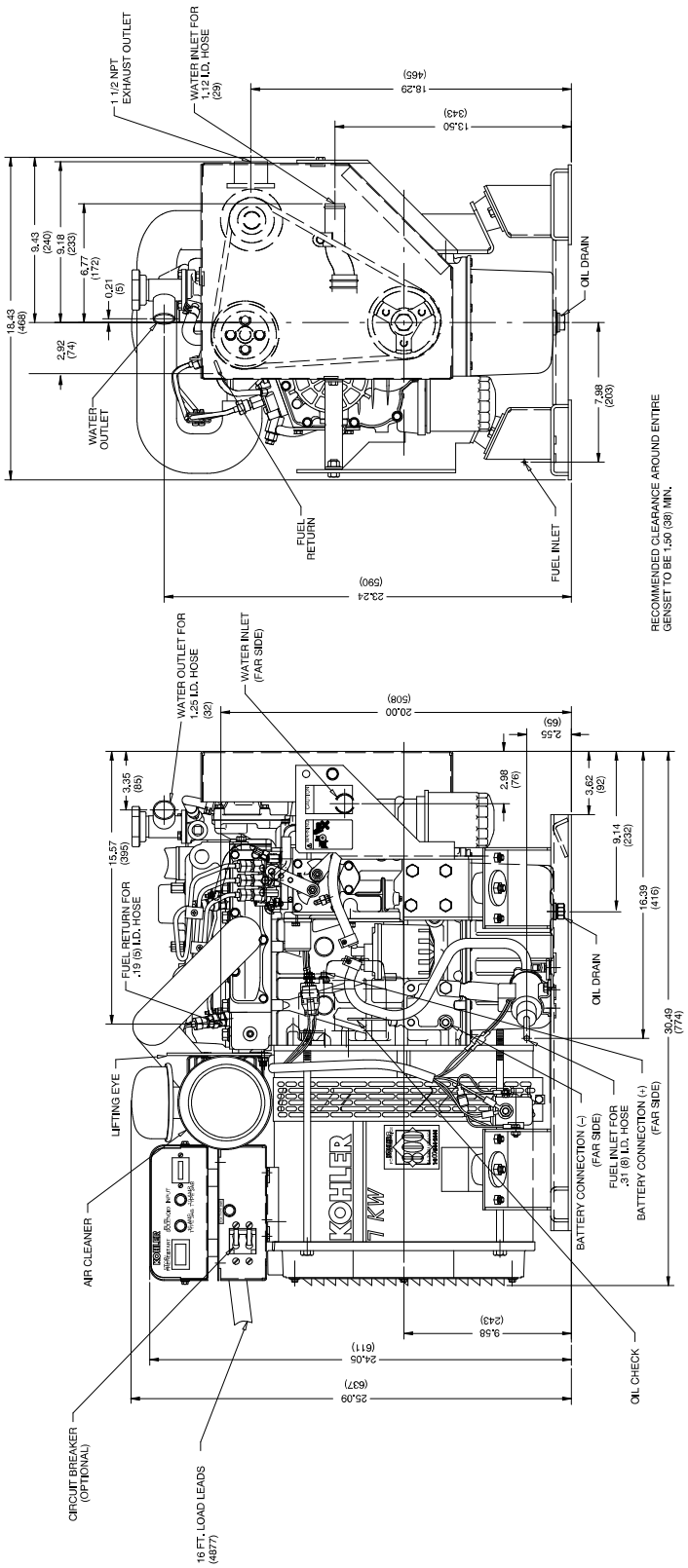


Figure 6-24. Panel Wiring (P3 Wiring Harness)

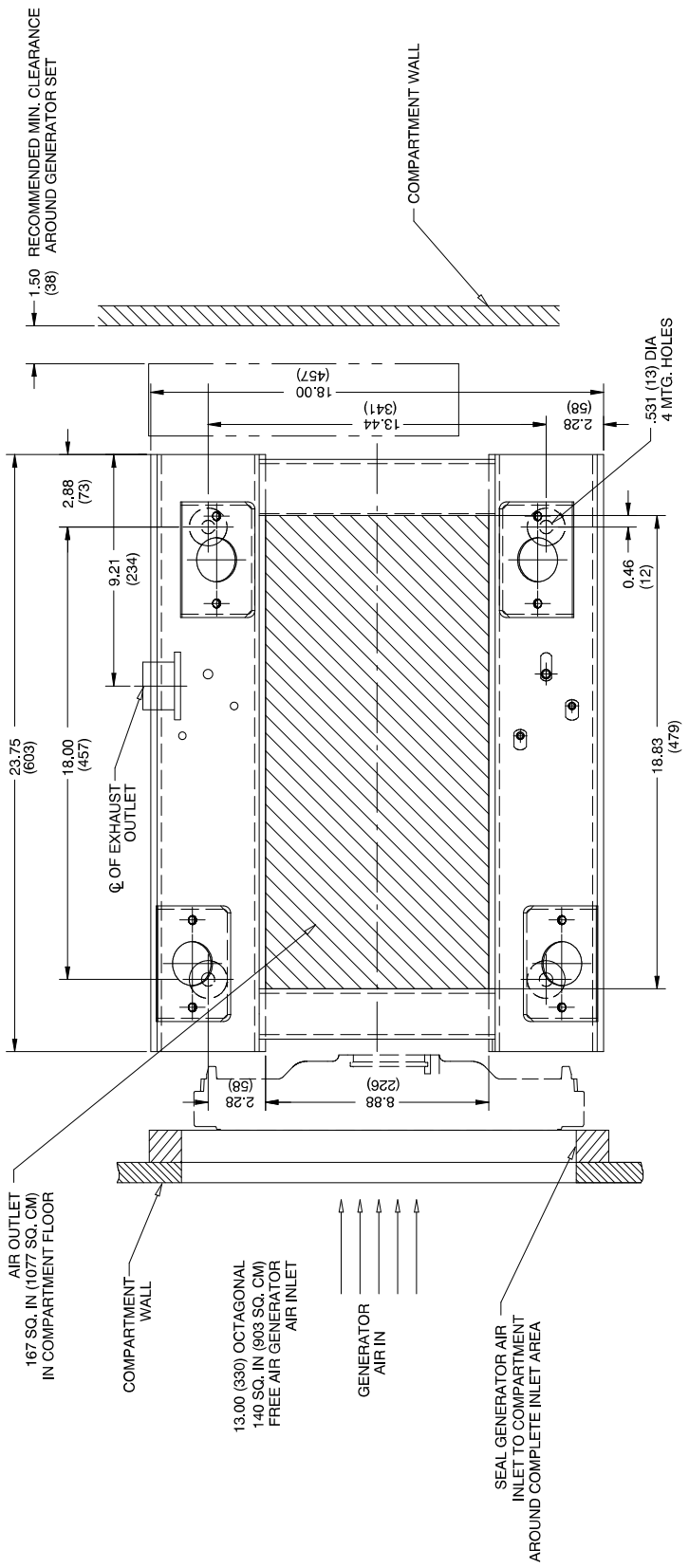
Section 7. Installation Drawings



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5831C-B

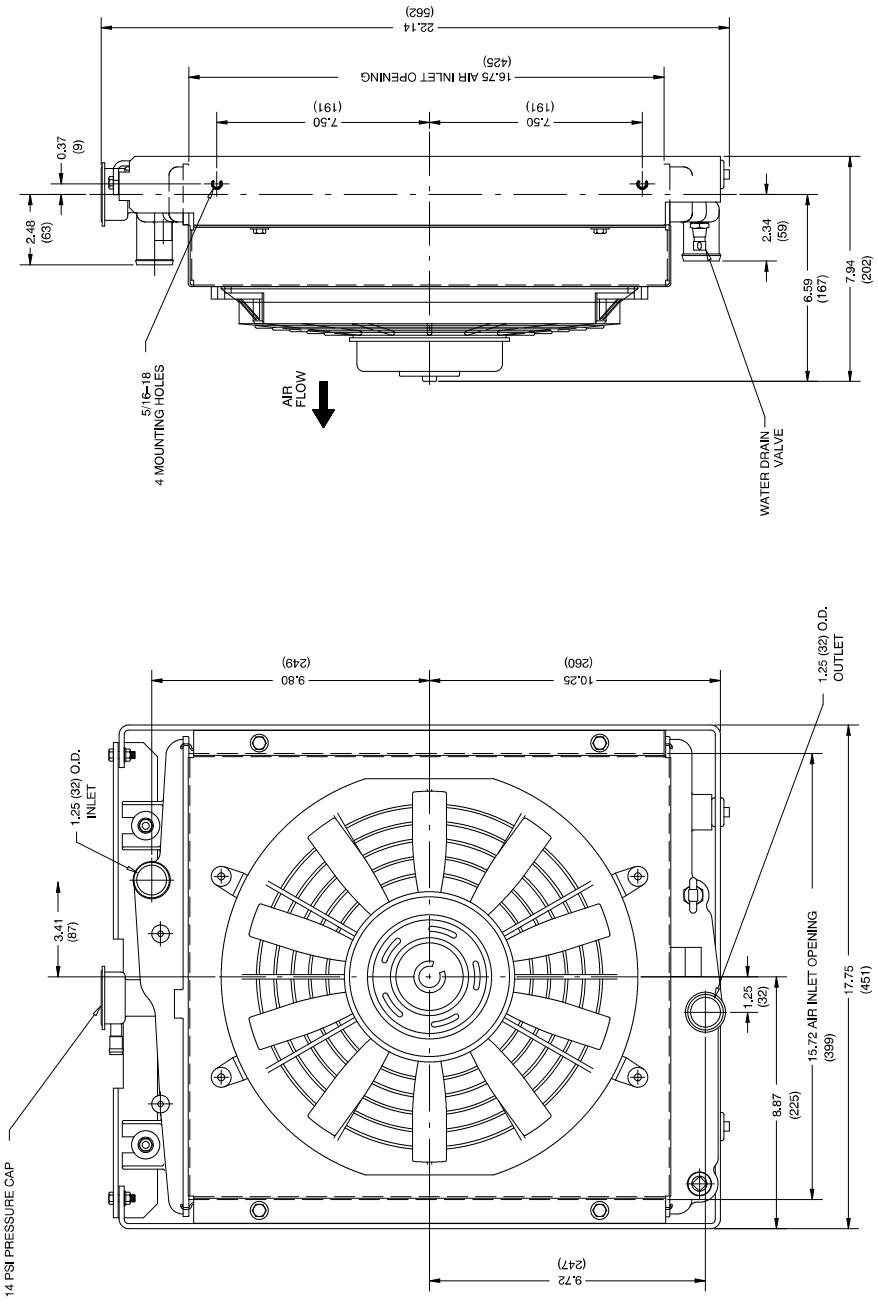
7CCO-RV Remote-Radiator Single-Phase Model



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5831C-B

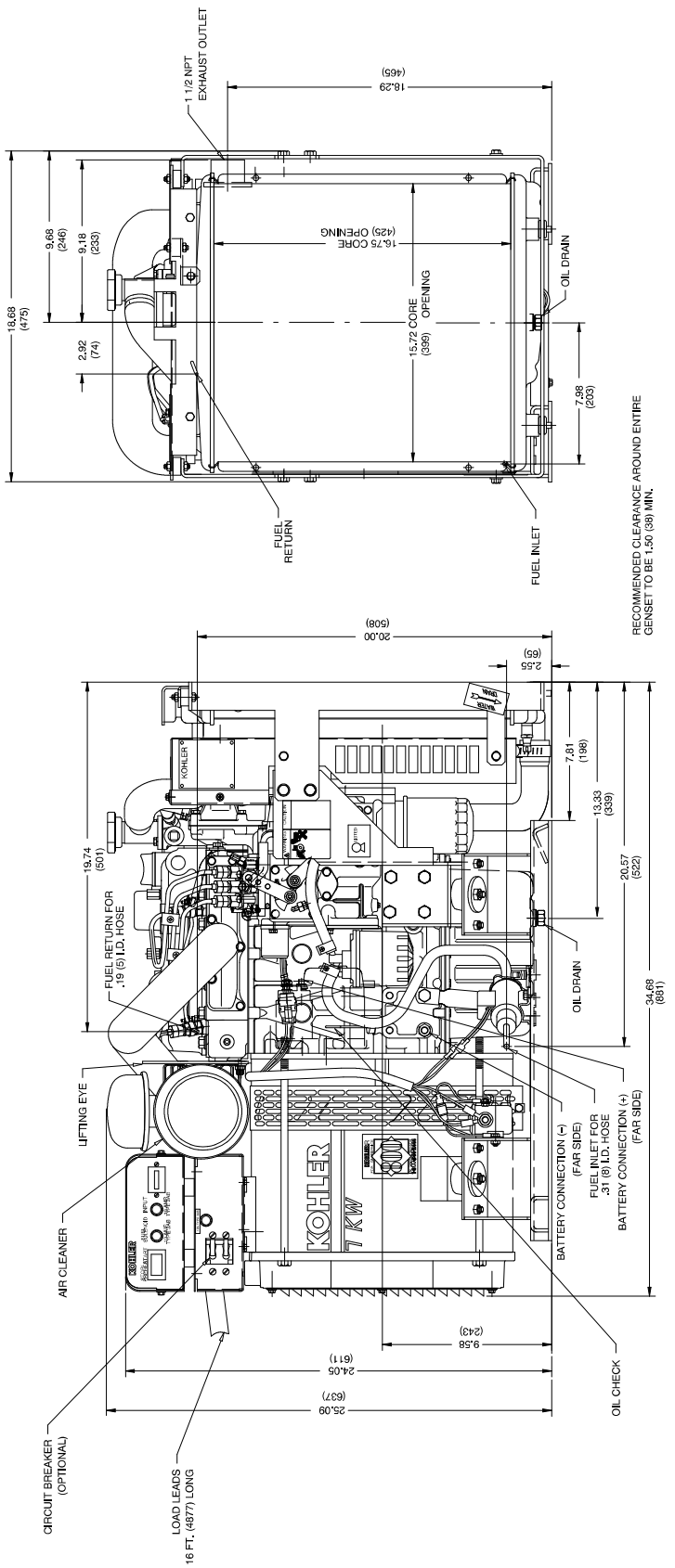
7CCO-RV Remote-Radiator Single-Phase Mounting Pattern



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5831B-A

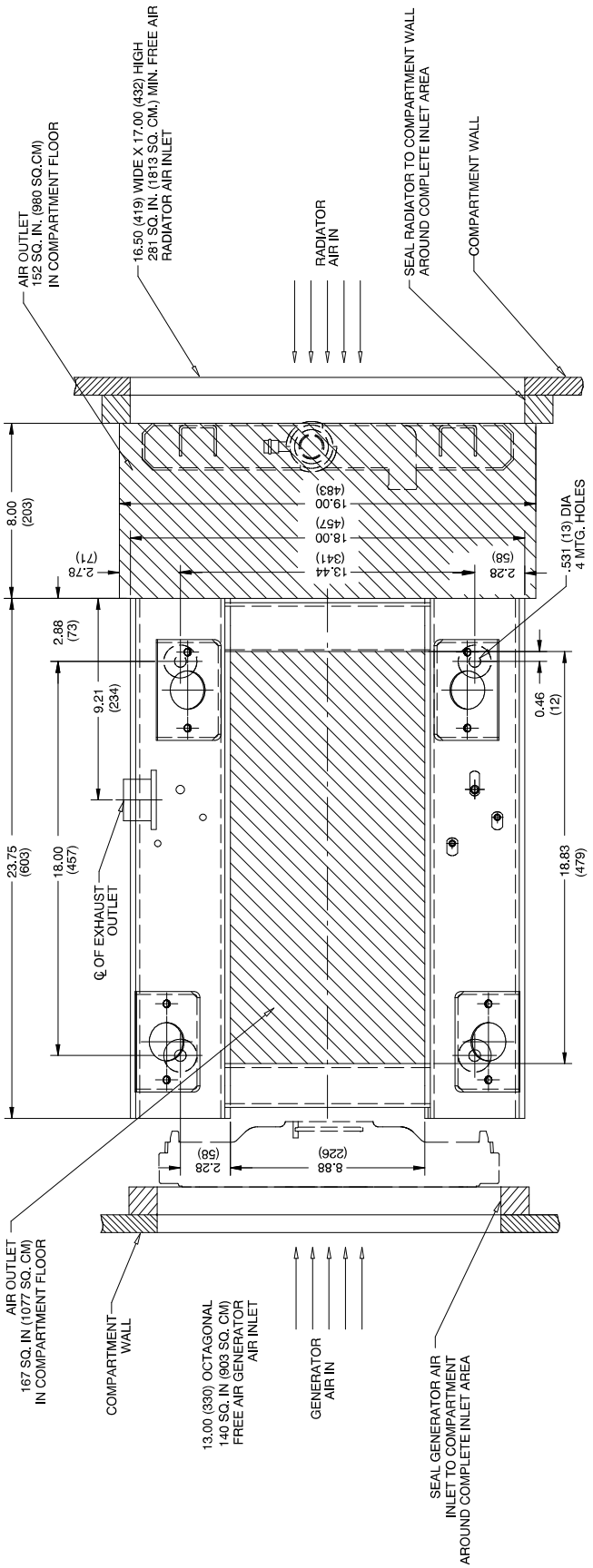
7CCO-RV Remote Radiator



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5831A-D

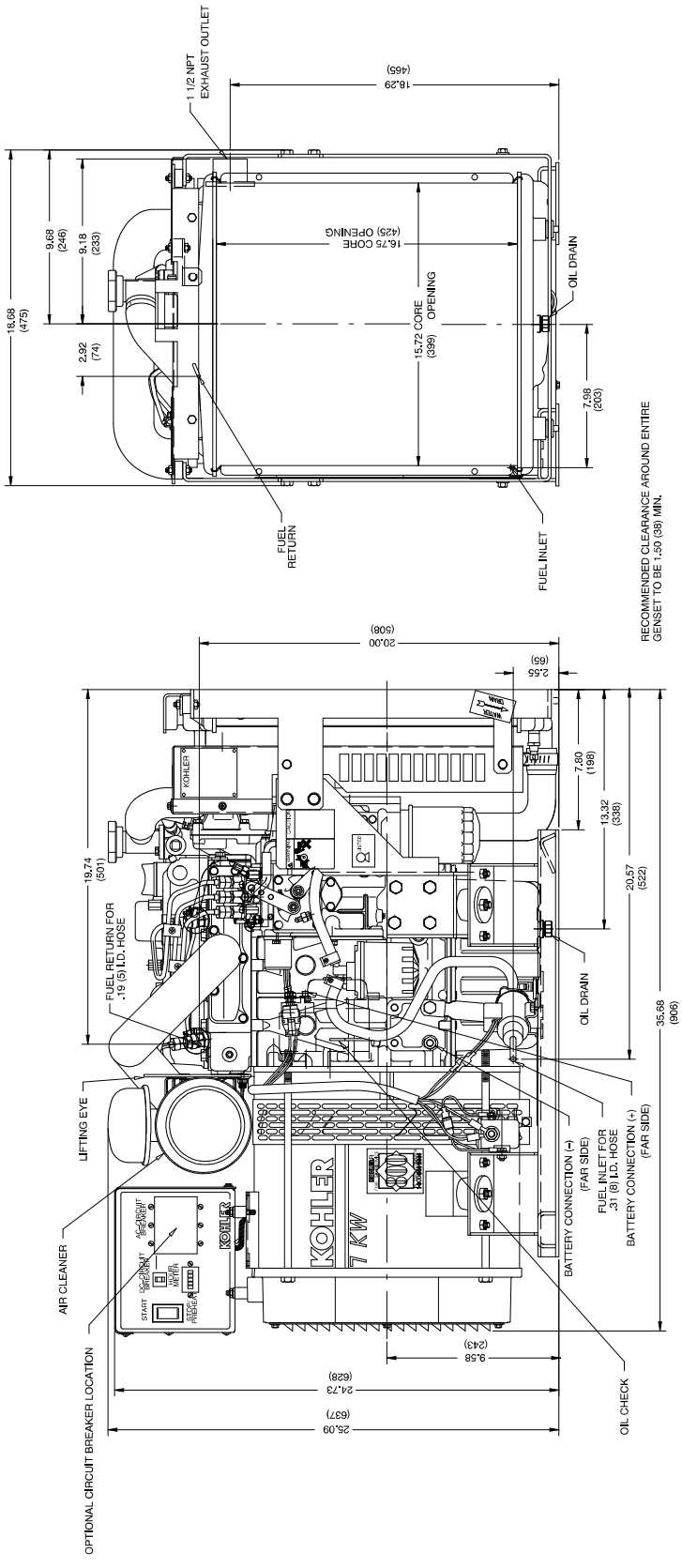
7CCO-RV Inline-Radiator (Suction Fan) Single-Phase Model



ADV-5831A-D

NOTE: Dimensions in ( ) are millimeter equivalents.

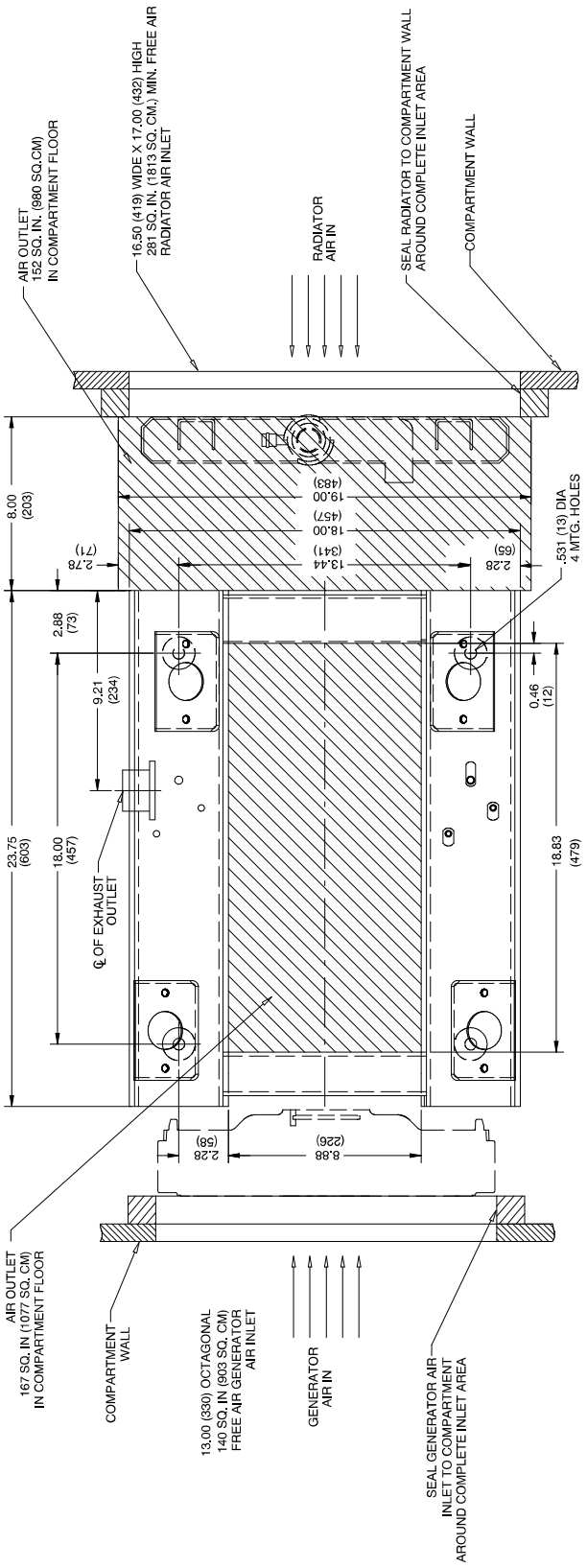
7CCO-RV Inline-Radiator (Suction Fan) Single-Phase Mounting Pattern



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5877-B

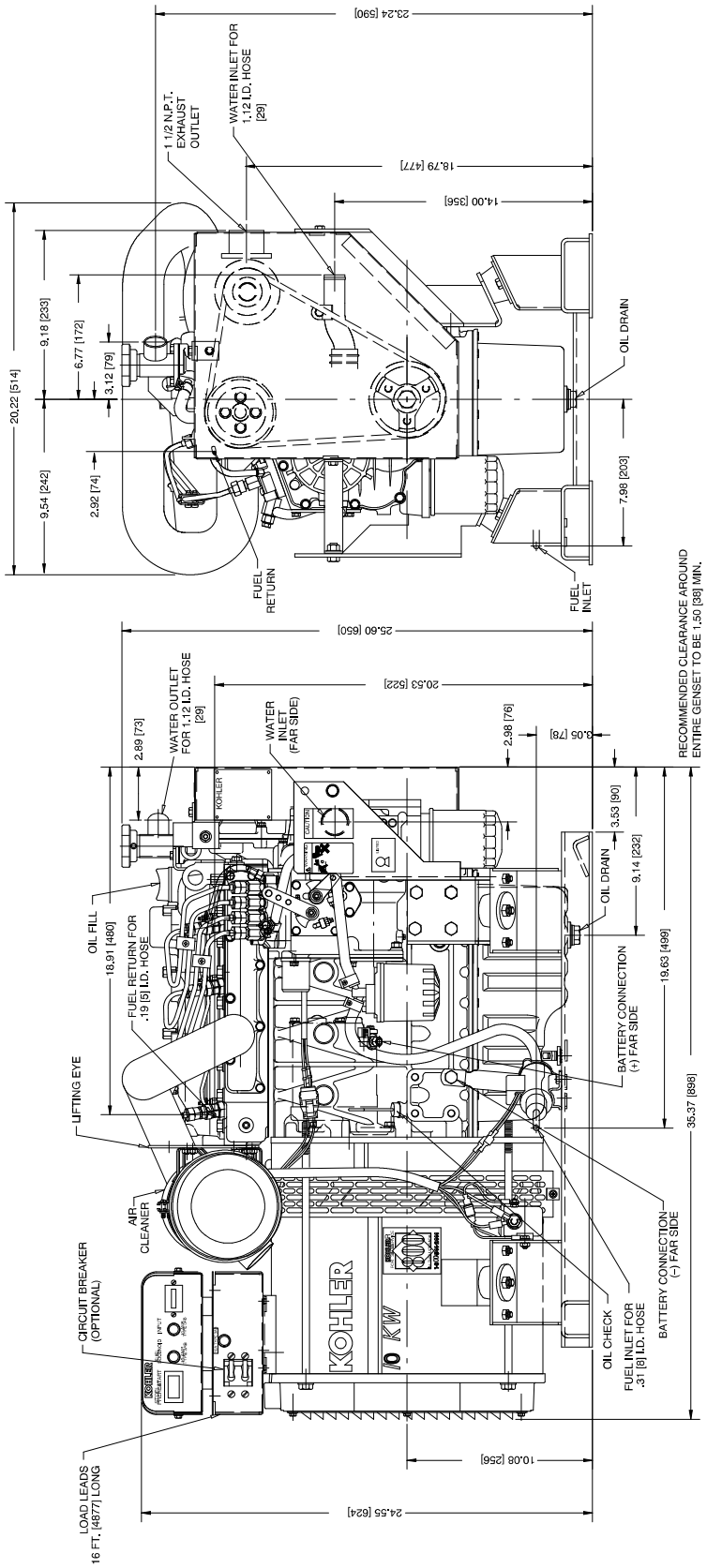
7CCOZ-MOBILE Inline-Radiator (Suction Fan) Three-Phase Model



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5877-B

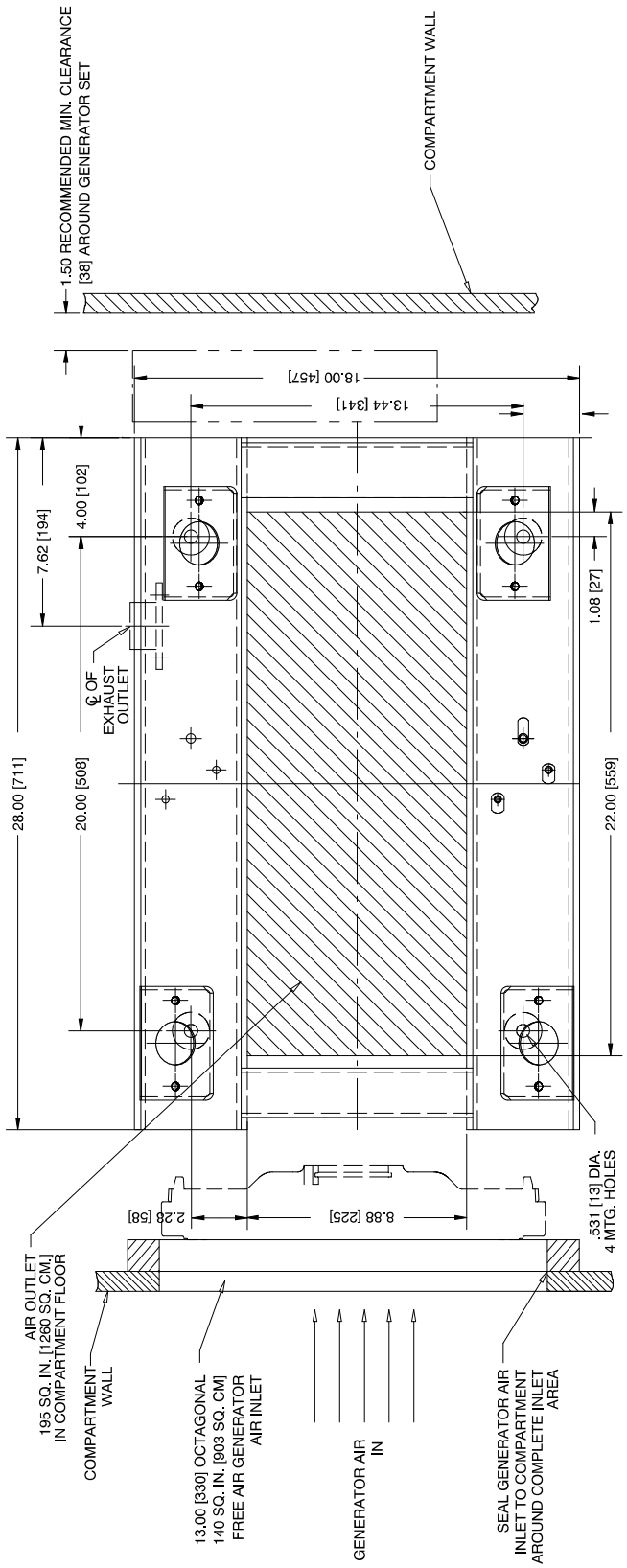
7CCOZ-MOBILE Inline-Radiator (Suction Fan) Three-Phase Mounting Pattern



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5832C-A

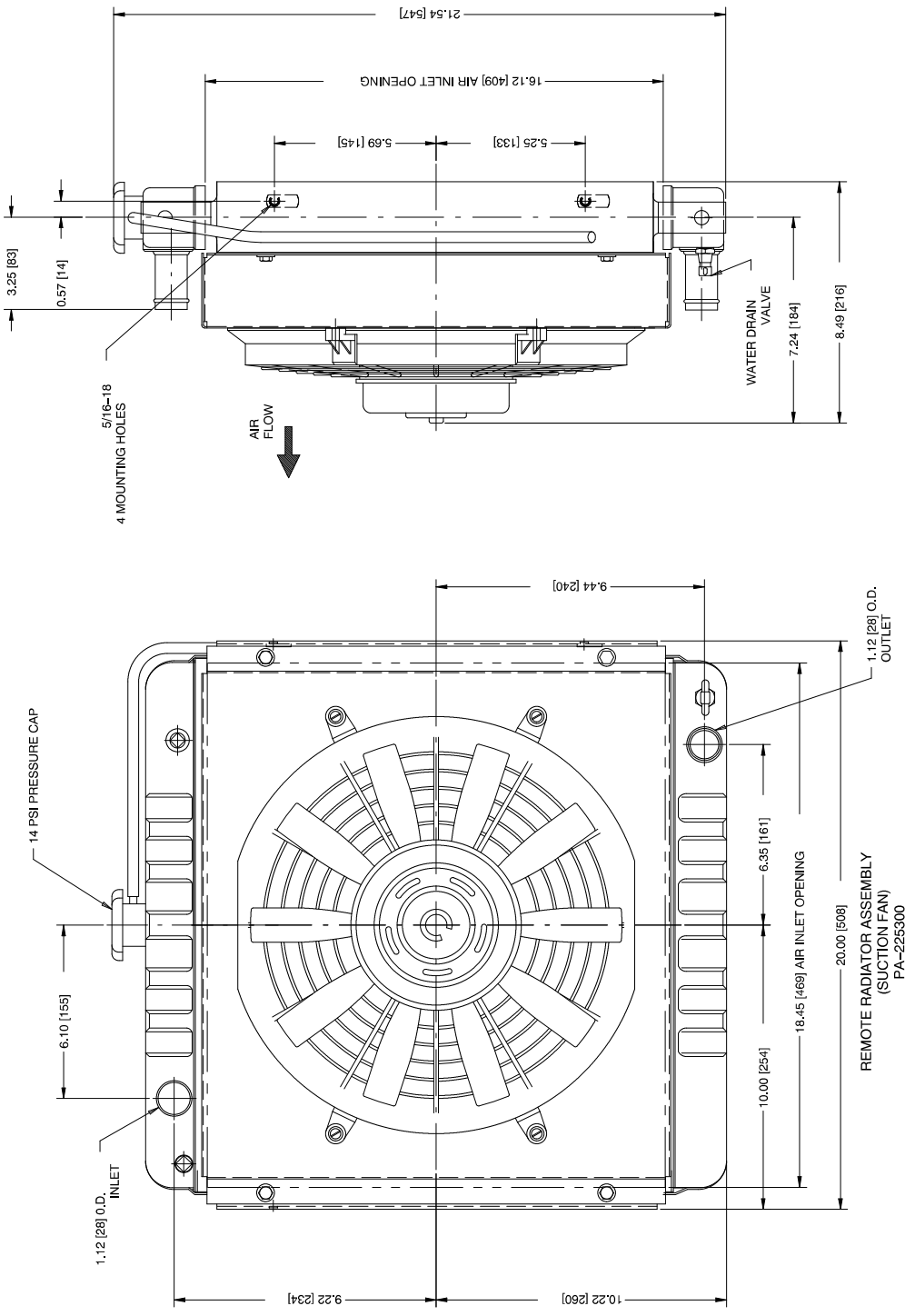
10CCO-RV Remote-Radiator Single-Phase Model



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5832C-A

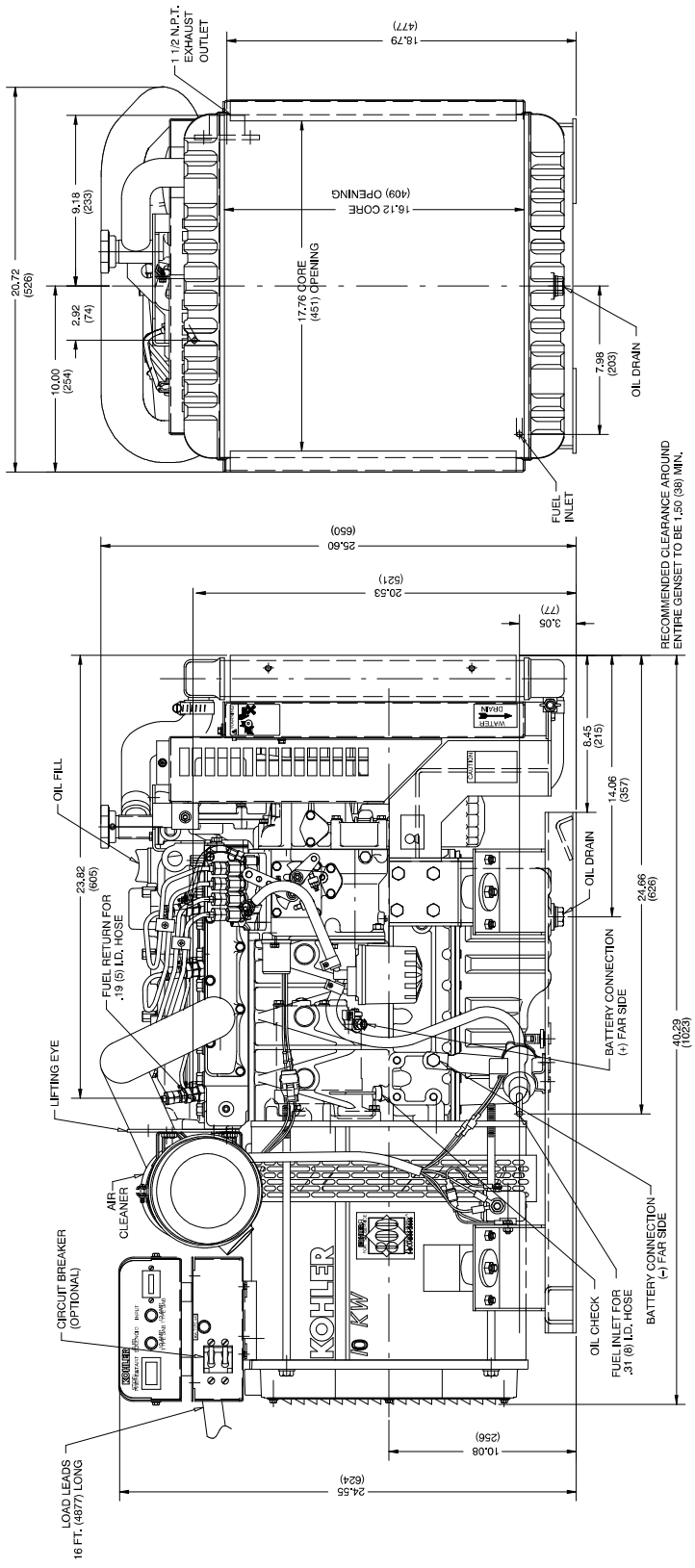
10CCO-RV Remote-Radiator Single-Phase Mounting Pattern



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5832B-A

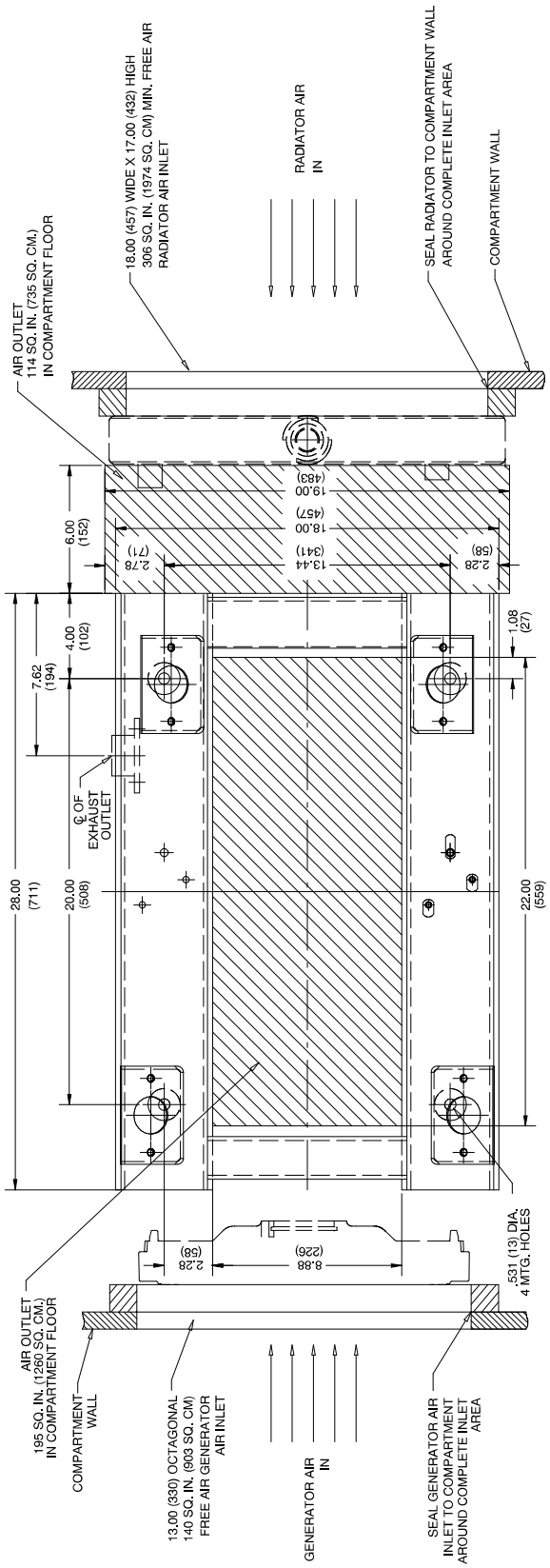
10CCO-RV Remote Radiator



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5832A-C

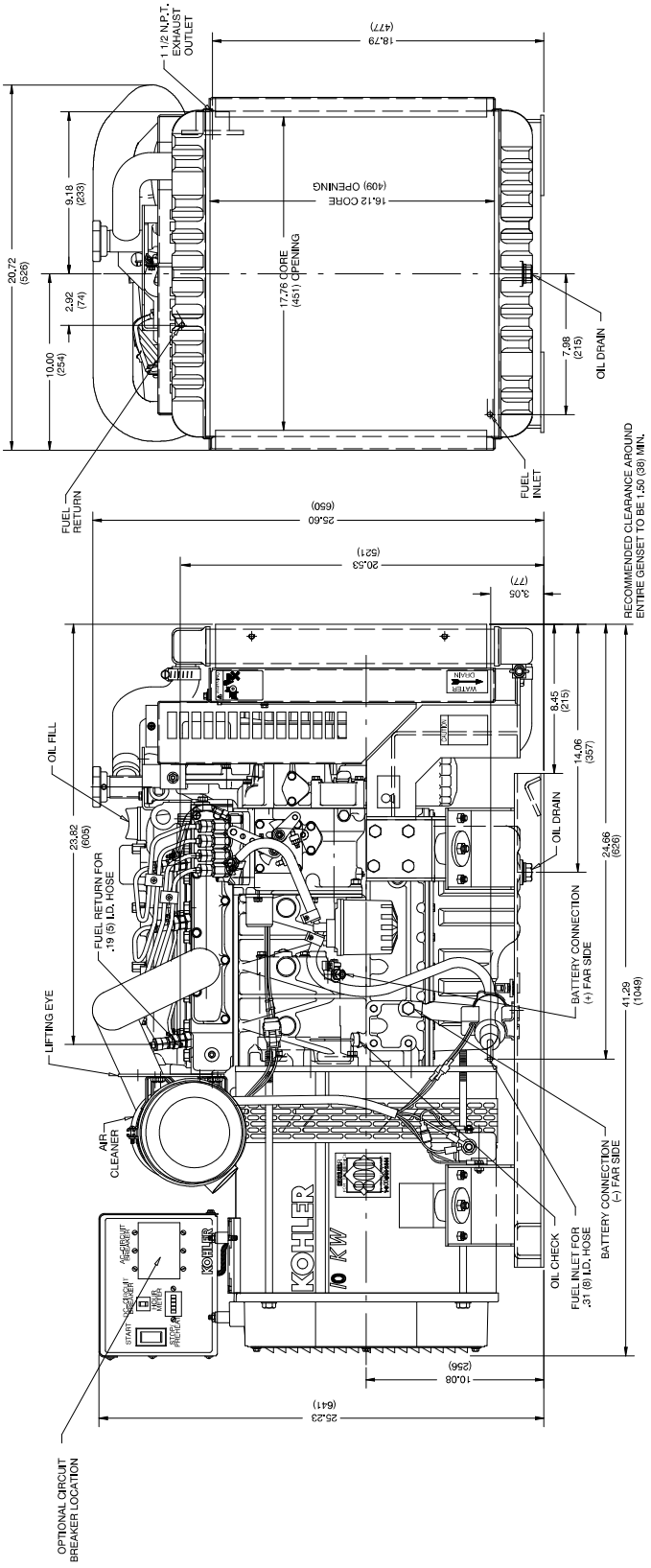
10CCO-RV Inline-Radiator (Suction Fan) Single-Phase Model



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5832A-C

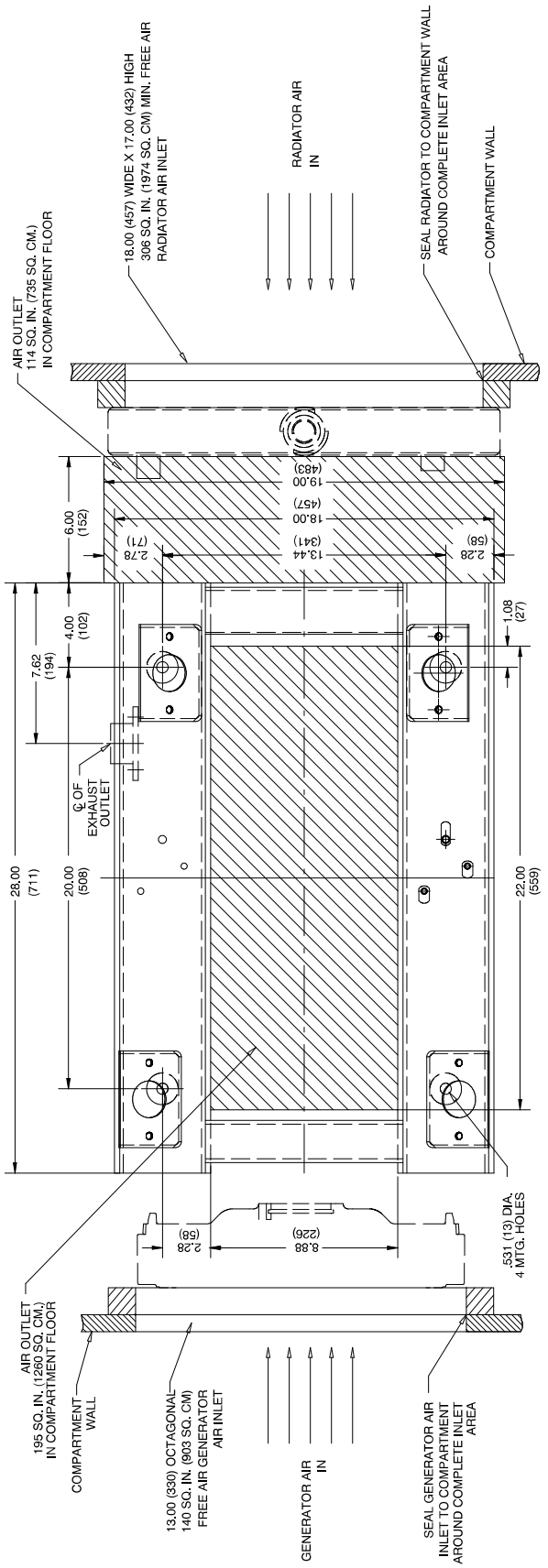
10CCO-RV Inline-Radiator (Suction Fan) Single-Phase Mounting Pattern



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5878-A

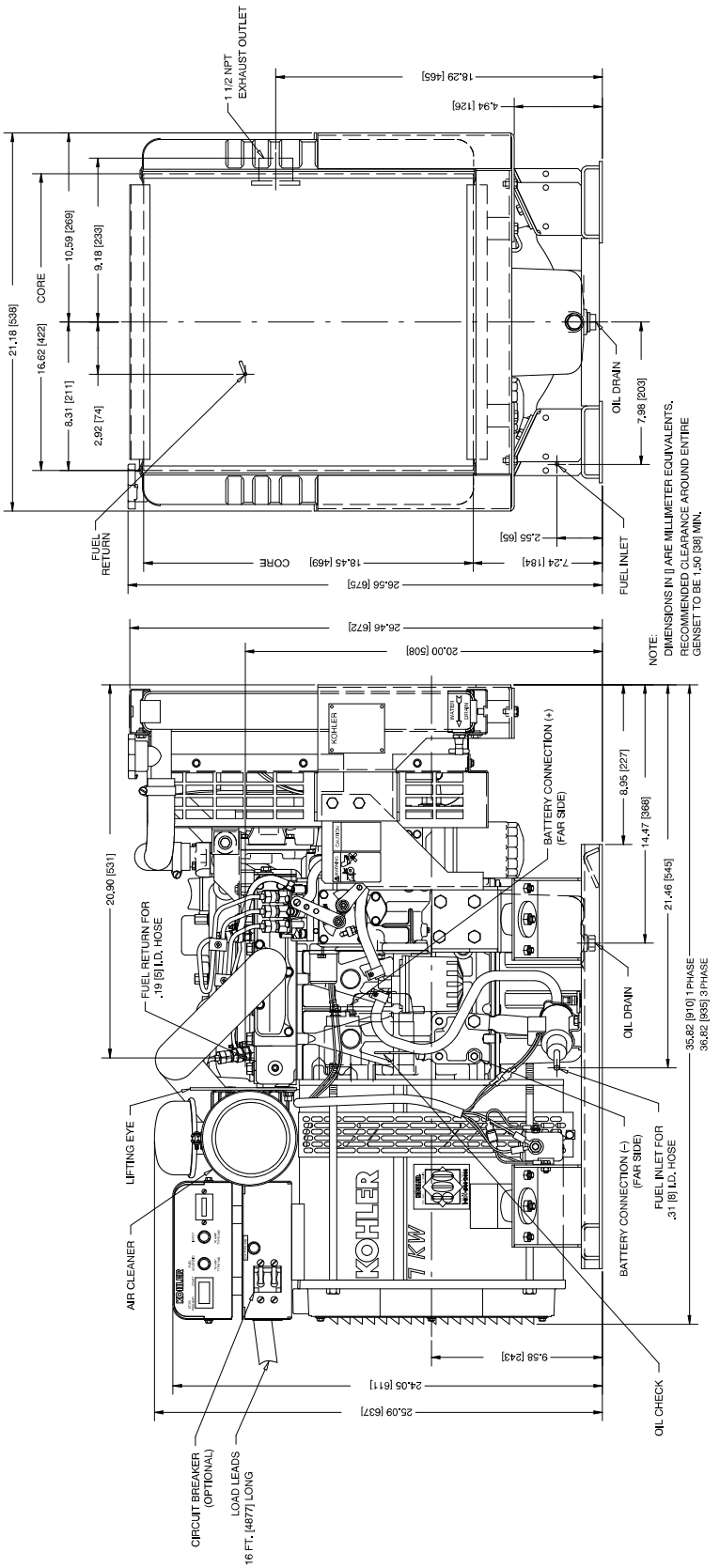
10CCOZ-MOBILE Inline-Radiator (Suction Fan) Three-Phase Model



ADV-5878-A

NOTE: Dimensions in ( ) are millimeter equivalents.

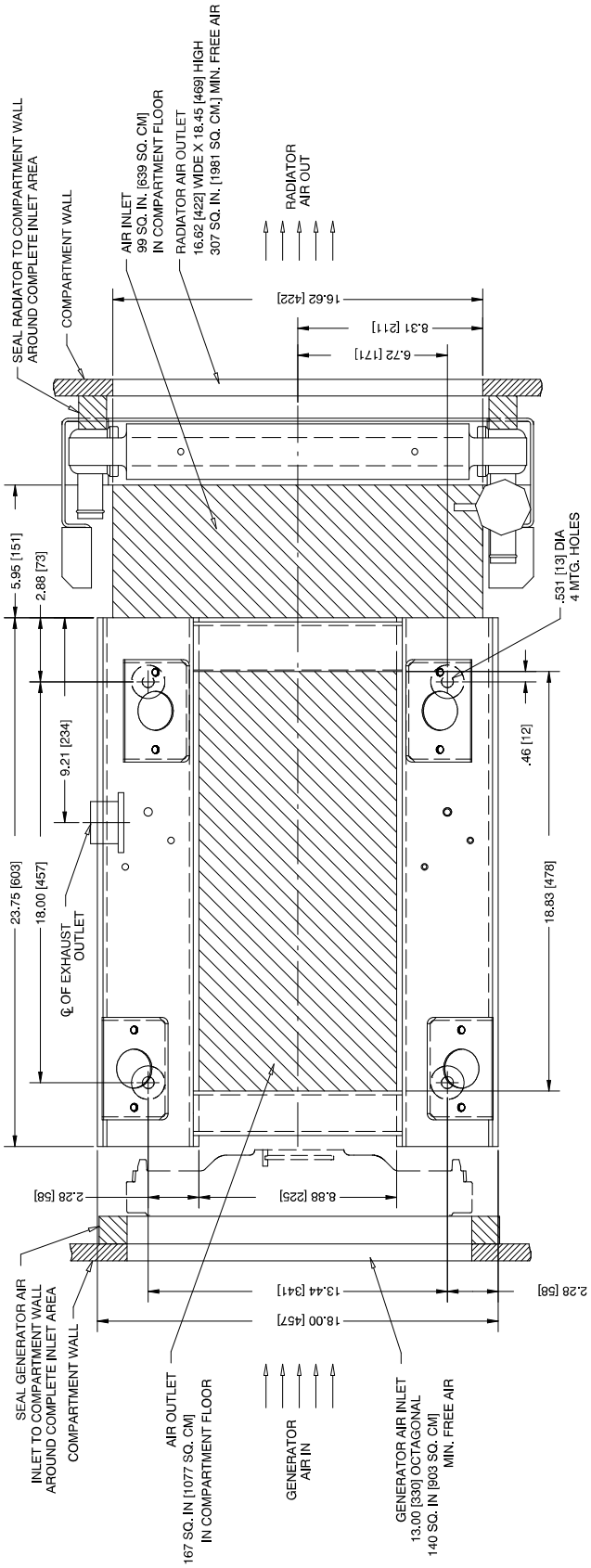
10CCOZ-MOBILE Inline-Radiator (Suction Fan) Three-Phase Mounting Pattern



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5963A-A

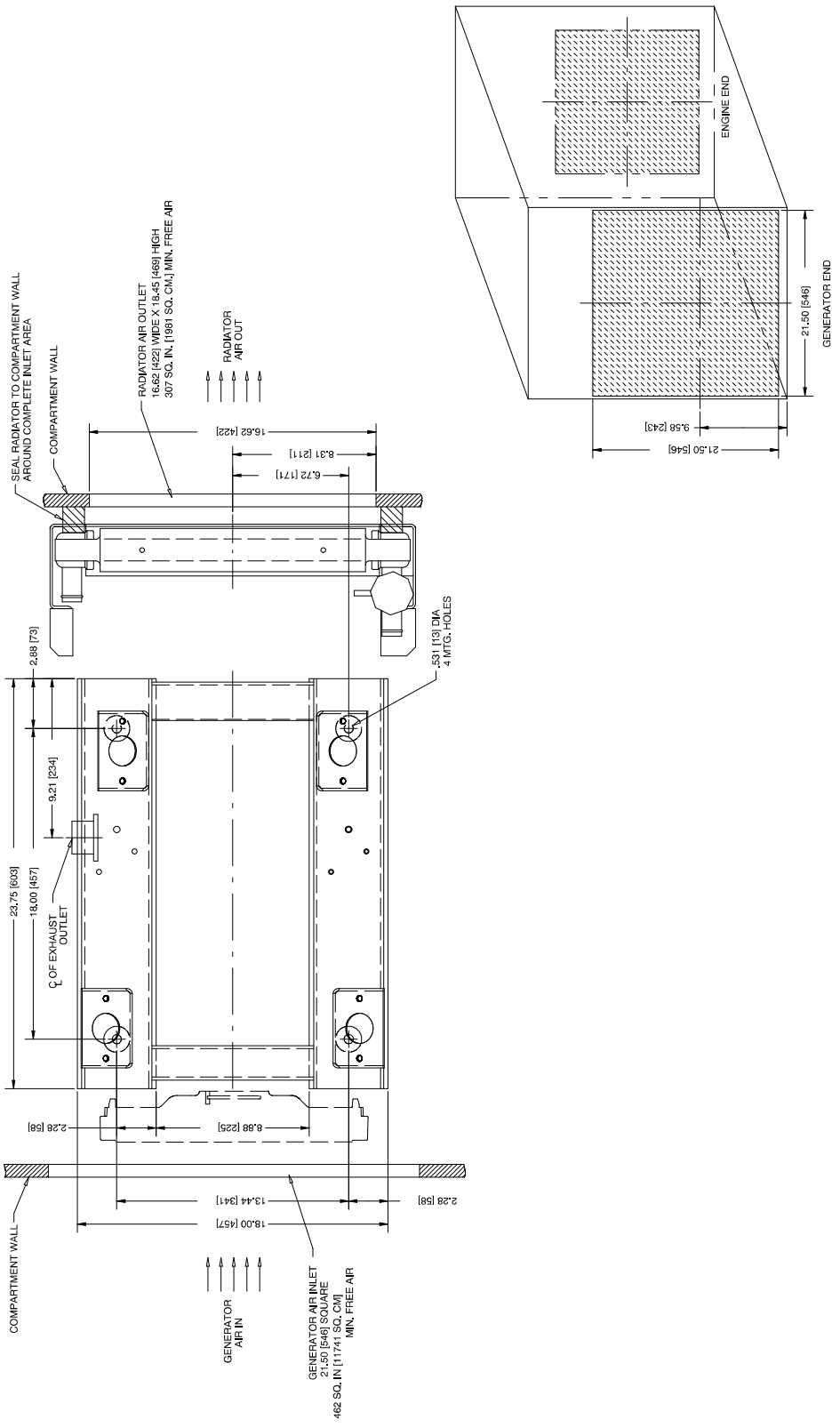
7CCO/CCOZ Inline-Radiator (Pusher Fan) Single- and Three-Phase Model



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5963A-A

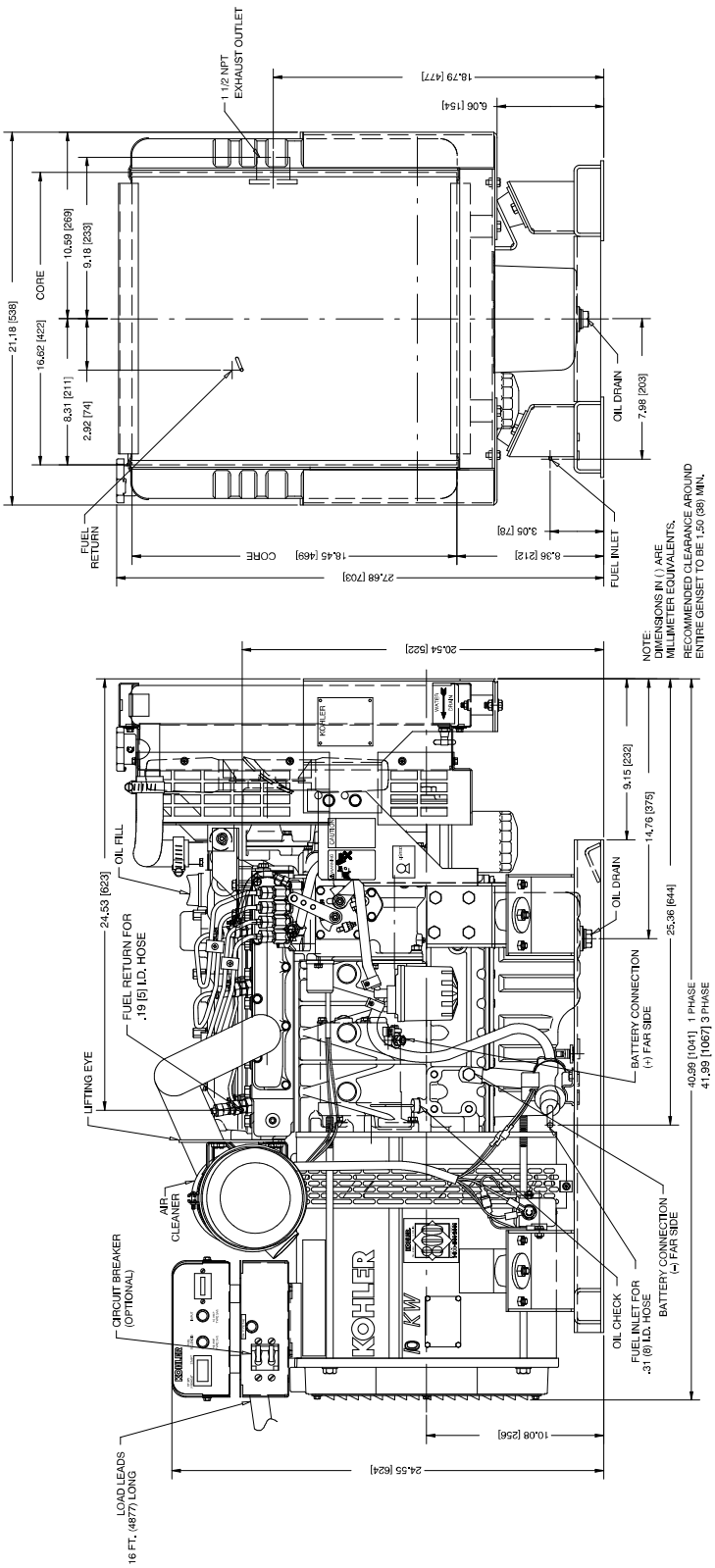
7CCO/CCOZ Inline-Radiator (Pusher Fan) Single- and Three-Phase Mounting Pattern



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5963B-A

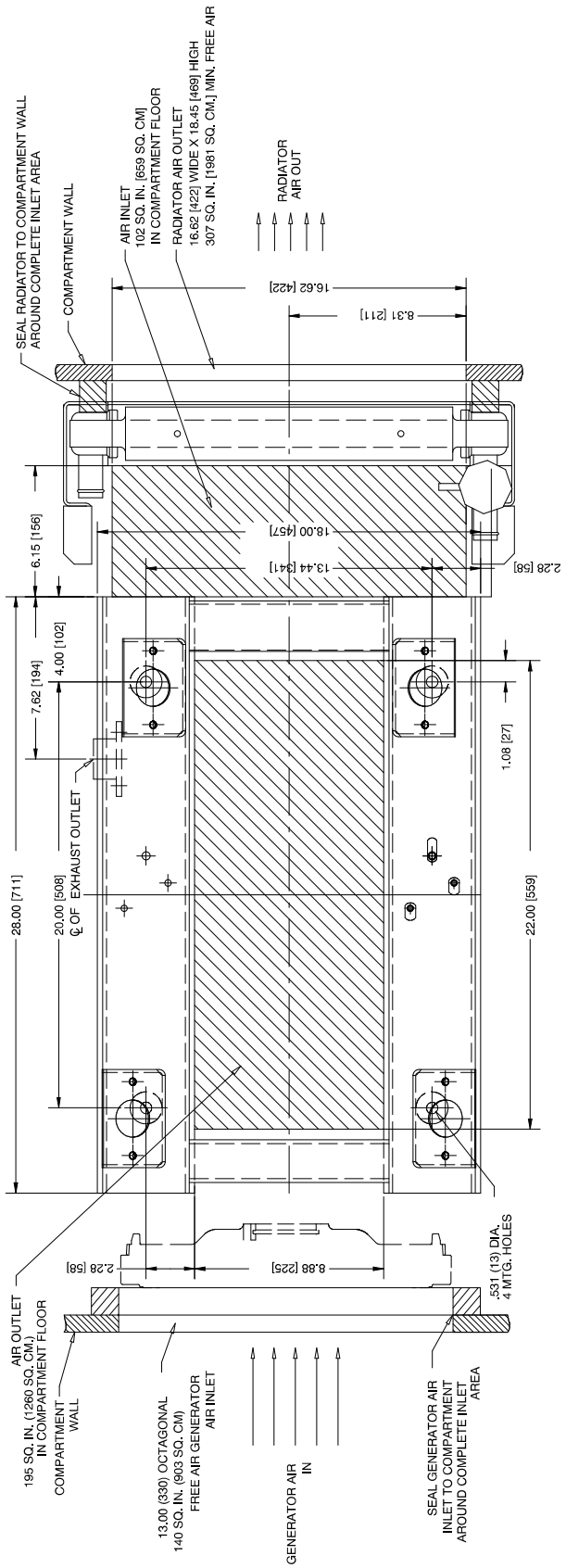
7CCO/CCOZ Inline-Radiator (Pusher Fan) Single- and Three-Phase Models
Optional Cooling without Cutouts in Compartment Floor



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5968A-A

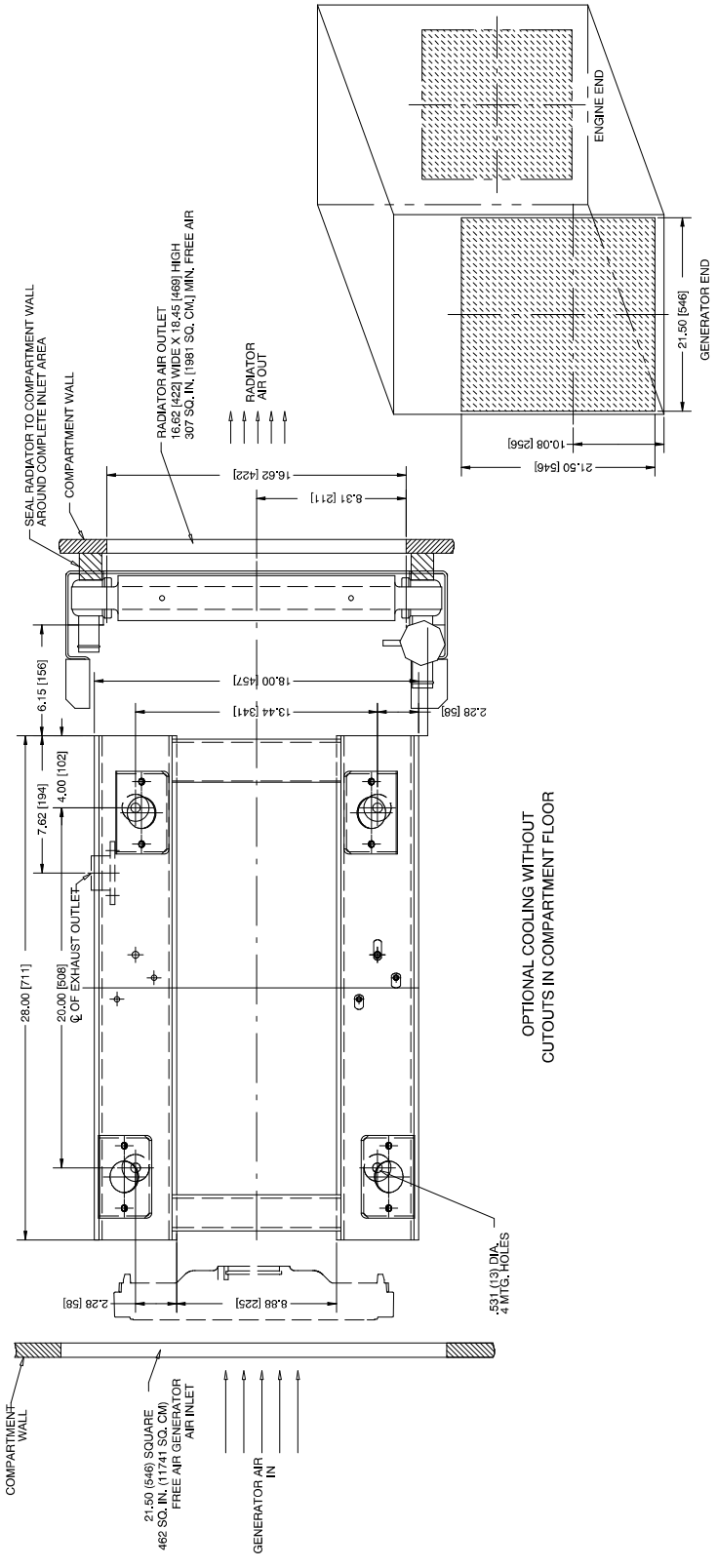
10CCO/CCOZ Inline-Radiator (Pusher Fan) Single- and Three-Phase Models



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5968A-A

10CCO/CCOZ Inline-Radiator (Pusher Fan) Single- and Three-Phase Mounting Pattern



NOTE: Dimensions in ( ) are millimeter equivalents.

ADV-5968B-A

10CCO/CCOZ Inline-Radiator (Pusher Fan) Single- and Three-Phase Models
Optional Cooling without Cutouts in Compartment Floor

Appendix A. Glossary of Abbreviations

Abbreviations are used throughout this manual. Normally they will appear in the text in complete form with the abbreviation following in parentheses the first time they are used. After that they will appear in the abbreviated form. The commonly used abbreviations are shown below. Some items may not apply to this application.

Abbreviation	Description
ABDC	after bottom dead center
AC	alternating current
AISI	American Iron and Steel Institute
AHWT	anticipatory high water temp.
ALOP	anticipatory low oil pressure
AM	amplitude modulation
amp	ampere
amps	amperes
ANSI	American National Standard Institute
API	American Petroleum Institute
approx.	approximate, approximately
A/R	as required, as requested
A/S	as supplied, as stated, as suggested
ASA	American Standards Association (former name of ANSI)
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after dead top center
aux.	auxiliary
A/V	audio–visual
AWG	American Wire Gage
AWM	appliance wiring material
BBDC	before bottom dead center
BDC	before dead center
BHP	brake horsepower
bmep	brake mean effective power
BTDC	before top dead center
Btu	British thermal unit
°C	Celsius degree
cc	cubic centimeter
CCA	cold cranking amps
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CID	cubic inch displacement
cm	centimeter, centimeters
cmm	cubic meters per minute
co.	company
cont'd.	continued
CPVC	chloropoly vinyl chloride
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
cu. in.	cubic inch (es)
CWC	city-water cooled
cyl.	cylinder
dB	decibel
dBA	decibels (A weighted)
DC	direct current
DCR	direct current resistance
deg.	degree
dept.	department
dia.	diameter
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
e.g.	example given
EIA	Electronic Industries Association
EMI	electromagnetic interference
EPA	Environmental Protection Agency
etc.	etcetera, (and so forth)
ext.	external
°F	Fahrenheit degree
fl. oz.	fluid ounce(s)
FM	frequency modulation
ft.	foot, feet
ft. lbs.	foot pound(s)
fs	full scale
ga.	gauge (meters wire size)
gal./gals.	gallon, gallons
gph	gallons per hour
gpm	gallons per minute
gr.	grade
grd.	ground
HCHT	high cylinder head temperature
HET	high exhaust temperature
Hg.	mercury (element)
H_2O	water
HP	horsepower
hr, hrs	hour, hours
HWT	high water temperature
Hz	hertz (cycles per second)
ID	inside diameter
IEEE	Institute of Electrical and Electronic Engineers
in.	inch, inches
inc.	incorporated
in. lbs.	inch pounds
int.	internal
int.-ext.	internal–external

Abbreviation	Description
ISO	International Standards Organization
J	joule, joules
JIS	Japanese Industry Standard
kg	kilogram, kilograms
kg/cm^2	kilograms per square centimeter
kgm	kilogram meter(s)
kJ	kilojoules (btu cal)
km	kilometer, kilometers
kPa	kiloPascal, kiloPascals
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt amperes
kW	kilowatt, kilowatts
kWH	kilowatt hour
L	liter, liters
LxWxH	length x width x height
LED(s)	light emitting diode(s)
lb., lbs.	pound, pounds
L/hr.	liter per hour, liters per hour
L/min.	liter(s) per minute
LOP	low oil pressure
LP	liquified petroleum
LWT	low water temperature
m	meter, meters
m^3	cubic meter, cubic meters
max.	maximum
MCM	one thousand circular mils.
meggar	megohmmeter
MHz	megahertz
mi.	mile, miles
mil	one one−thousandth of an inch
min.	minimum
misc.	miscellaneous
mJ	milli joule(s)
MJ	mega joule(s)
mm	millimeter
m^3/min	cubic meters per minute
MPa	megaPascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
mW	milliwatt(s)
MW	megawatt(s)
N/A	not available
NBS	National Bureau of Standards
N.C.	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	Newton meter(s)
N.O.	normally open
no., nos.	number, numbers
NPT	National Standard taper pipe thread per general use
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed
O/S	oversize
OSHA	Occupational Safety and Health Act
OV	overvoltage
oz.	ounce, ounces
PF	power factor
PMG	permanent magnet generator
pot	potentiometer
ppm	parts per million
psi	pounds per square inch
pt., pts.	pint, pints
PVC	polyvinyl chloride
qt., qts.	quart, quarts
qty.	quantity
ref.	reference
RFI	radio frequency interference
r.h.m.	round−head machine (screw)
rms	root means square
RPM	revolutions per minute
RTV	room temperature vulcanization
SAE	Society of Automotive Engineers
SCR	silicon controlled rectifier
sec.	second, seconds
spec, specs	specification
sq.	square
sq. cm.	square centimeters
sq. in.	square inch(es)
tach	tachometer
TDC	top dead center
tech. pub.	technical publications
temp.	temperature
TIF	telephone influence factor
TP, TPs	technical publications
turbo	turbocharger
UHF	ultrahigh frequency
UNC	Unified coarse thread (was NC)
UNF	Unified fine thread (was NF)
UL	Underwriter ъ Laboratories, Inc.
U/S	undersize
U.S.A.	United States of America
V	volt, volts
vac	volts alternating current
vdc	volts direct current
VHF	very high frequency
W	watt, watts

Appendix B. Operating Hour Service Log

The following is provided to help you 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.

DATE	OPERATING HOURS		SERVICE RECORD	
	HOURS RUN	CUMULATIVE	DATE	SERVICE

KOHLER®
POWER SYSTEMS

TP-5594 5/95

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