Kohler RV Generator Sets

Operation and Installation Manual

Models:
9CCO
12.5CCO
14.5CCO

KOHLER®
GENERATORS

TP-5261

TABLE OF CONTENTS

Safety Precautions and Instructions

A Generator Set, like any other electro-mechanical device can pose potential dangers to life and limb if improperly maintained or imprudently operated. The best safeguards against accident are to be ever mindful of the potential dangers and to always use good common sense. In the interest of safety, some general precautions relating to operating of a Generator set follow. Keep these in mind. This manual contains several types of safety precautions which are explained below.

⚠ DANGER

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

⚠ WARNING

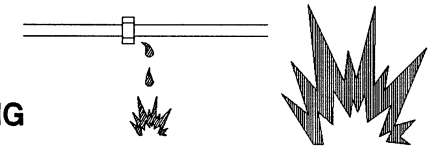
Warning is used to indicate the presence of a hazard which *can* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

⚠ CAUTION

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

NOTE

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



⚠ WARNING

All fuels are highly explosive in a vapor state. Use extreme care when handling, storing, and using fuels Store fuel in a well-ventilated area away from spark producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running since spilled fuel may ignite on contact with hot parts or from ignition spark. Do not smoke or permit flame or spark to occur near potential sources of spilled fuel or fuel vapors. Keep fuel lines and connections tight and in good condition--don't replace flexible fuel lines with rigid lines. Flexible sections are used to avoid breakage due to vibration. Additional precautions must be taken when using the following fuels:

⚠ CAUTION

RV generator fuel system is susceptible to explosion when used in non-RV applications. Use generator sets specified for RV use in RV installations only.

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

⚠ WARNING

Spilled fuel can ignite on contact with hot engine parts. Use a container to catch fuel when draining fuel system. Wipe up all spilled fuel after draining system.

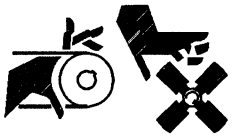
⚠ WARNING

Hazardous voltage can cause death or severe injury. Perform electrical service only as prescribed in equipment manual. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions. Wiring should be inspected at the interval recommended in the service schedule -- replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and wherever electricity is present, there is the hazard of electrocution.

Hazardous "backfeed" voltage can cause death or severe injury.
The generator must not be used to "backfeed" by connecting it to building/campground electrical circuits. Install a transfer switch in RV generator installations to prevent connection of RV and other sources of power. Electrical backfeed into a utility electrical system can cause serious injury or death to utility personnel working on transmission lines.

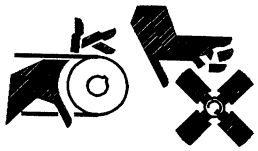
⚠ CAUTION

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.



⚠ WARNING

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

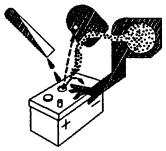


⚠ WARNING

Exposed moving parts can cause severe injury. Keep hands, feet, hair, and clothing away from belts and pulleys when unit is running. Replace guards, covers, and screens before operating generator set. Do not open generator compartment door when unit is running.

⚠ WARNING

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



⚠ WARNING

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

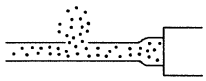
⚠ CAUTION

Hot exhaust system can ignite adjacent combustible materials. Do not locate electrical wiring, fuel lines, or combustible material above the exhaust muffler. Be careful when parking your RV to prevent grass fires started by exhaust system and hot exhaust gases.

Hot generator 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 mounting tray. If sub-flooring is used, cut a corresponding hole in the sub-flooring for drain opening.

⚠ CAUTION

Hazardous noise can cause loss of hearing. Never operate generator without adequate hearing protection or muffler. Never operate generator with faulty exhaust system.



⚠ CAUTION

Diesel fumes can rapidly destroy copper tubing in diesel exhaust systems.
Do not use copper tubing in diesel exhaust systems. Exhaust sulphur will cause rapid deterioration and this could result in exhaust/water leakage.

⚠ WARNING

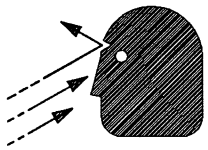
Carbon monoxide can cause death, severe nausea or fainting. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate in any area where exhaust gas could accumulate and seep back inside an occupied building or coach. Be careful when parking your coach to avoid obstructing the exhaust outlet. The exhaust gases must discharge freely, otherwise carbon monoxide may deflect 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 which can cause death if inhaled for even a short period of time. The exhaust system must be leakproof and routinely inspected.

⚠ WARNING

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

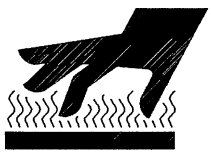
⚠ WARNING

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



⚠ CAUTION

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



⚠ CAUTION

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

⚠ WARNING

A sudden backfire can cause serious burns. Do not operate with air cleaner removed.

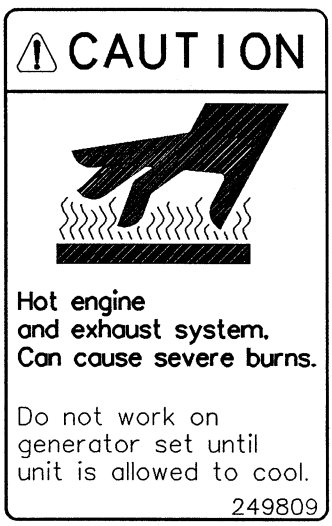
NOTE

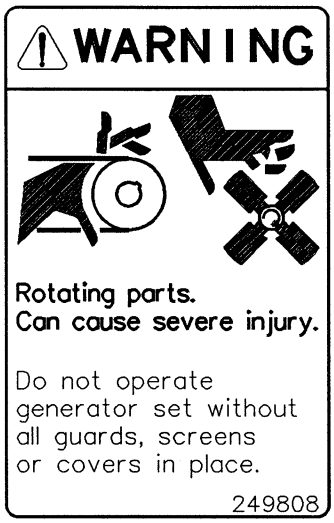
RV generator sets do not comply with United States Coast Guard (U.S.C.G.) requirements and must not be used for marine applications. Use only generator sets specified for marine use in marine installations. U.S.C.G. Regulation 33CFR183 requires a generator set to be "ignition protected" when used in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

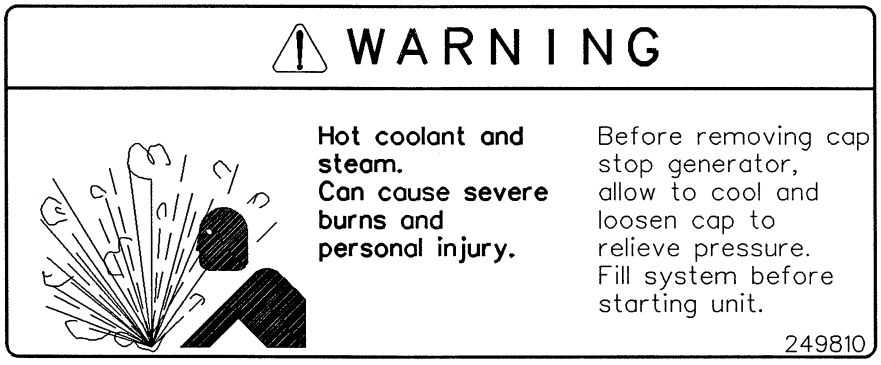
Warning Decals

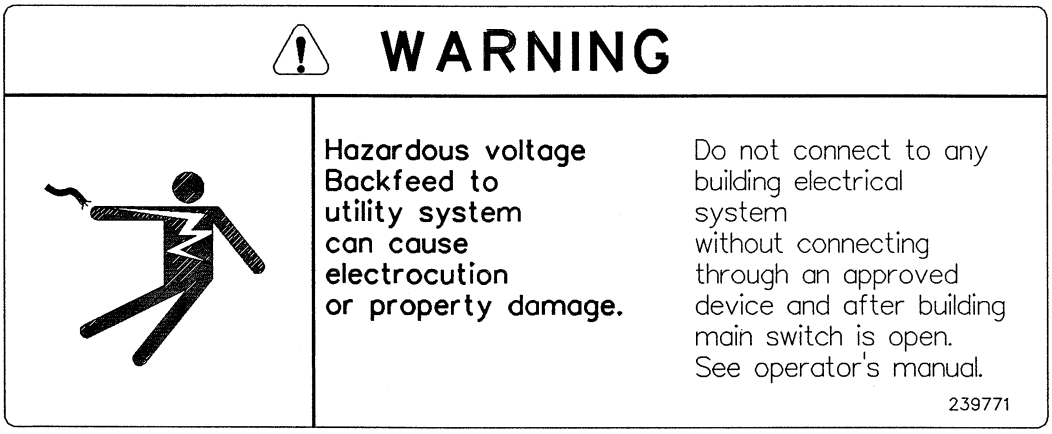
Warning decals are affixed to the generator set in prominent places to advise the operator or service technician of potentially hazardous situations. These decals are reproduced here to improve operator recognition and thereby increase decal effectiveness.

For a further explanation of decal warnings, reference preceding safety precautions. Before operating or servicing the generator set, be sure you understand the message of these decals. Replace decals if missing or damaged.





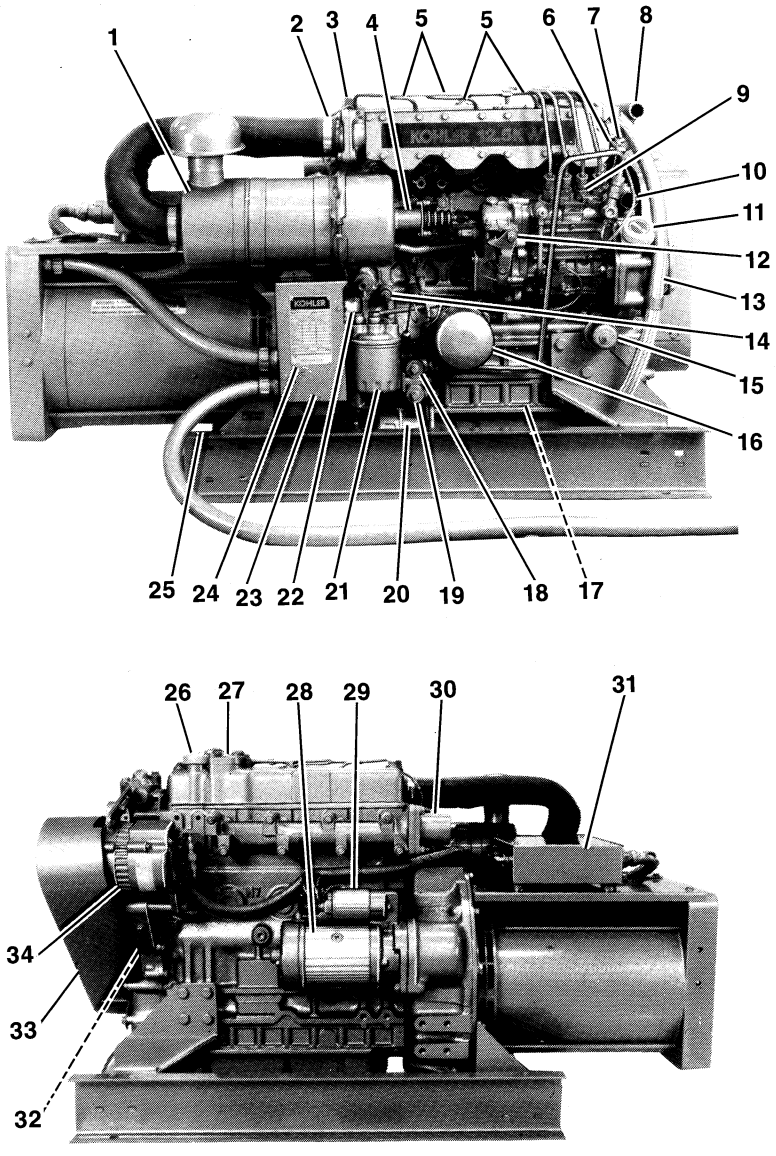




OPERATION

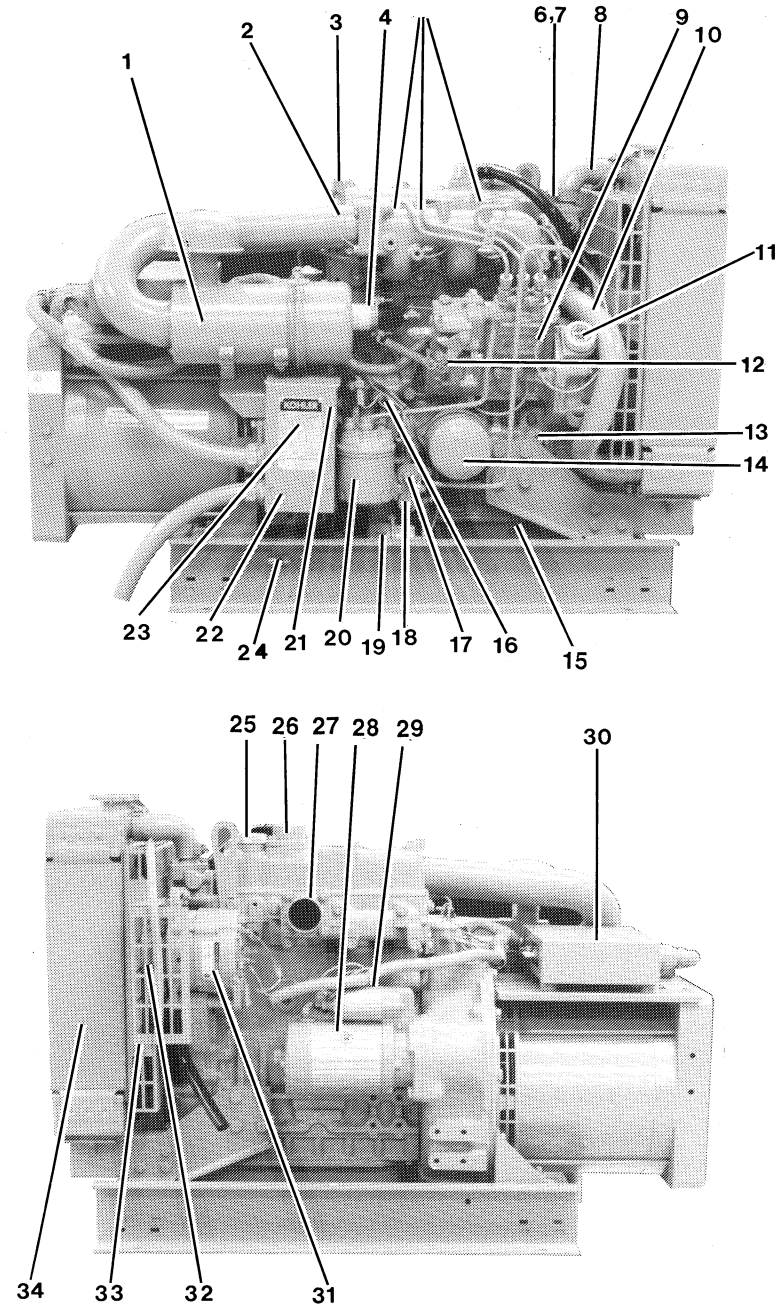
Introduction

Your recreational vehicle is equipped with a dependable Kohler Alternating Current RV Generator Set. Service requirements of the generator set are minimal but it is important that the required services be performed at the prescribed intervals. Please take a few moments to read through this manual, then carefully follow all service recommendations to keep your set in top condition. Record the MODEL, SPECIFICATION, SERIAL, and ENGINE SPECIFICATION numbers as found on the nameplate attached to the frame of the generator or engine block in the space provided. See "Service Ordering Instructions." This information will enable your Kohler Generator Service Dealer to supply the correct part or data for your particular version. Keep this manual in your RV for future reference. The illustrations in this manual are representative of most units. Your generator may differ slightly from that shown.



1. Air Cleaner
2. Air Intake Connection
3. Hoisting Eye
4. Fuel Solenoid
5. Injectors
6. High Water Temperature (HWT) Shutdown Switch
7. Water Temperature Gauge Sender (If Equipped)
8. Water Outlet
9. Fuel Injection Pump
10. Water Inlet
11. Lube Oil Fill
12. Governor
13. Breather Hose
14. Low Oil Pressure (LOP) Shutdown Switch
15. Oil Pressure Gauge Sender (If Equipped)
16. Lube Oil Filter
17. Oil Drain
18. Fuel Return Line Connector
19. Fuel Inlet Connector
20. Fuel Pump
21. Fuel Filter
22. Circuit Breakers
23. Junction Box
24. Nameplate
25. Ground Lug
26. Lube Oil Fill
27. Breather Cap
28. Starter
29. Starter Solenoid
30. Exhaust Outlet
31. Controller
32. V-Belt
33. Belt Guard
34. Battery Charging Alternator
35. Radiator (in-line models)

Figure 1-1. Service Views, 12.5 & 14.5CCO



1. Air Cleaner
2. Air Intake Connection
3. Hoisting Eye
4. Fuel Solenoid
5. Injectors
6. High Water Temperature (HWT) Shutdown Switch
7. Water Temperature Gauge Sender (If Equipped)
8. Water Outlet
9. Fuel Injection Pump
10. Water Inlet
11. Lube Oil Fill
12. Governor
13. Oil Pressure Gauge Sender (If Equipped)
14. Lube Oil Filter
15. Oil Drain (hidden)
16. Low Oil Pressure (LOP) Shutdown Switch
17. Fuel Return Line Connector
18. Fuel Inlet Connector
19. Fuel Pump
20. Fuel Filter
21. Circuit Breakers
22. Junction Box
23. Nameplate
24. Ground Lug
25. Lube Oil Fill
26. Breather Cap
27. Exhaust Outlet
28. Starter
29. Starter Solenoid
30. Controller
31. Battery Charging Alternator (If Equipped)
32. V-Belt
33. Belt Guard
34. Radiator (in-line models)

Figure 1-1a. Service Views, 9CCO

Specifications

Engine

Your Kohler generator set is powered by a Yanmar, three, or four-cylinder model 3TN82-R, 4TN82-U, or 4TN82-R water-cooled diesel engine. General specifications for engines are as follows:

No. of Cylinders	
3TN82R	3
4TN82-U or 4TN82-R	4
Bore x Stroke (in.)	3.228 in. x 3.386 in.
Bore x Stroke (mm)	(82 mm x 86 mm)
Displacement	
3TN82-R	83.11 cu. in. (1362 cc)
4TN82-U or 4TN82-R,	110.8 cu. in. (1817 cc)
Compression Ratio	
3TN82-U	18.06:1
4TN82-U or 4TN82-R	23:1
Horsepower	
3TN82-R	16.5
4TN82-U OR 4TN82-R	22.0

RPM (60 Hz) 1800
Lube Oil Capacity
3TN82–R ..... 5 U.S. qts. (4.7L)
4TN82–U or 4TN82–R .... 6.1 U.S. qts. (5.8L)
Lube Oil Type ..... SAE CC or CD
Cooling System Capacity (Engine Only)
3TN82–R ..... 2.1 qts. (2 L)
4TN82–U or 4TN82–R ..... 2.85 qts. (2.7 L)
Cooling System Capacity
(w/ In–line Kohler Radiator)
3TN82–R ..... 10.6 qts. (10L)
4TN82–U or 4TN82–R ..... 19 qts. (18L)
Remote Radiator Coolant
Capacity (Kohler Model) ..... 4 gal. (15.1 L)
Engine Firing Order (#1 Cyl. nearest flywheel)
3TN82–R 1–3–2–1
4TN82–U or 4TN82–R 1–3–4–2–1
Fuel Injection Timing ..... 12° +/– 1° BTDC
Combustion System
(4TN82–U) ..... Indirect Injection
(3TN82–R or 4TN82–R) ..... Direct Injection
Battery Voltage ..... 12 Volts
Battery Recom, (min.) ..... 500 CCA
100 Amp. Hr.
Direction of Rotation
(from Generator End) ..... Counterclockwise
Cold Weather Starting Aids
(4TN82–UK) ..... Glow Plugs
(3TN82–R or 4TN82–R) ..... Air Intake Heater
Valve Clearance (Cold) .. 0.0079 in. (0.20 mm)
Fuel Recommendation ..... Diesel, ASTM/D975
No. 2–D (Cetane > 45)

Generator

Kohler designed and built rotating field 60 Hz generators are direct connected to the engine for permanent alignment. The 9CCO single–phase generator set produces 9 kW, 120/240 volt, 37.5 Amp. alternating current. The 12.5CCO single–phase generator set produces 12.5 kW, 120/240 Volt, 52 Amp. alternating current. The 14.5CCO single–phase generator produces 14.5 kW, 120/240 Volt, 60 Amp. alternating current.

DERATION: All units are rated at 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).

Controller

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 lengths.) Controller connections are made through the plug connector at the rear of the unit. The relay controller has a toggle type momentary–contact start/stop switch for test operating the set at the controller. See Figure 1–2. Also included is a combination preheat/prime switch, and a 10 Amp fuse. When toggled to the "preheat" position, the preheat/prime switch aids in cold weather starting. When moved to the "prime" position, the switch activates the fuel pump to help bleed air from the fuel system (see "Fuel System Bleeding"). The 10–Amp. fuse protects the controller against damage if a short develops in the engine wiring system or the wiring to the remote start/stop switch. Inside early model controllers (without accessory plug P2) is a terminal strip for connecting remote operating controls; see "Electrical Connections Remote Switch Connections". In some installations, the coach manufacturer may have provided a special wiring harness which permits remote connections without accessing the controller terminal strip. Later model controllers include an accessory plug (P2) for connecting the remote switch, preheat switch, and generator "ON" lamp wiring harness (available separately). If the generator set has automatically stopped due to high water temperature (230 F/110 C) or low oil pressure (7.1 psi/49 kPa or less), the cause must be corrected before the set can be restarted.

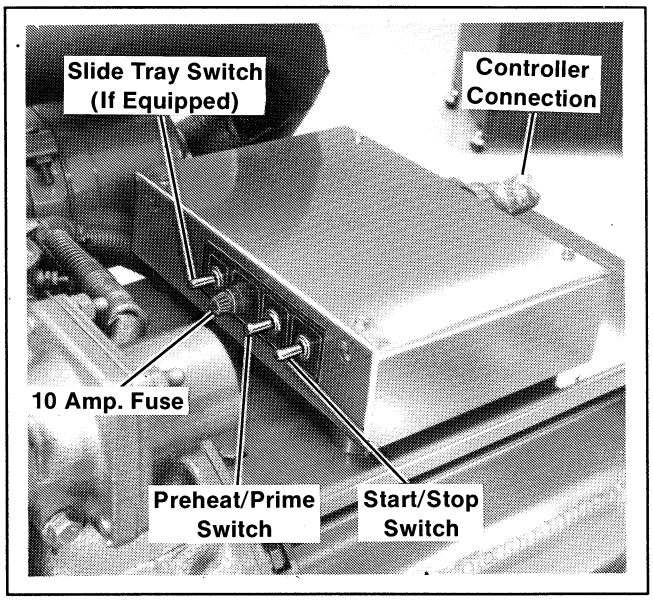


Figure 1–2. Controller

Operating Instructions

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

Prestart Checks

OIL LEVEL: Should be at or near full mark (not over). See "Engine Lubrication."

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 engine. See "Air Cleaner Service."

EXHAUST: Tail pipe must be clear, muffler and piping tight and in good condition.

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. See "Fuel System."

COOLING: If the cooling system is equipped with a coolant recovery tank, check coolant level at tank. Maintain level according to markings on tank. On units without coolant recovery tanks, remove pressure cap to check coolant level. Coolant level should be just below the overflow tube. See "Cooling System."

⚠ WARNING

Hot coolant can cause severe burns.

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

Preheat Feature

The generator is equipped with a preheat feature. The exact temperature where use of the preheater is necessary is subject to many variables. Generally, use of the preheater is necessary at temperatures below 40° F (4°C) when the engine turns over rapidly and exhausts white smoke during an unsuccessful starting attempt. To activate preheater, depress preheat switch for 15 to 20 seconds. Release switch and initiate starting procedure. See Figure 1-3.

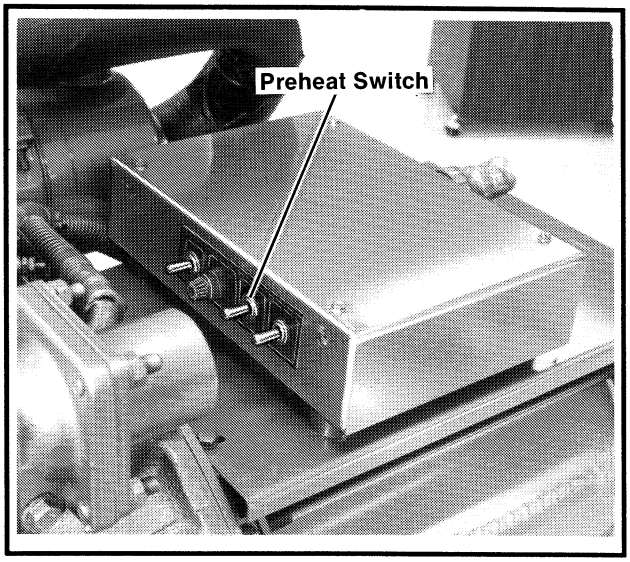


Figure 1-3. Preheat Switch

Starting

Move the START/STOP switch into the START position and hold in this position until the engine is running, then release. Normally, the engine will start within 2 seconds. However, if it fails to start after cranking for 5 seconds, release the switch. Wait 60 seconds before making a restart attempt.

NOTE

Do not crank engine continuously for more than 10 seconds at a time. A 60 second cool-down 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 Kohler Service Dealer for repair. Failure to follow these guidelines may result in burn-out of the starter motor from overheating.

NOTE

If the engine starts and then stops, allow the engine to come to a complete halt before making a restart attempt. If 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.

NOTE

If ambient temperature is below 40° F (4° C), see "Preheat Feature."

Stopping

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

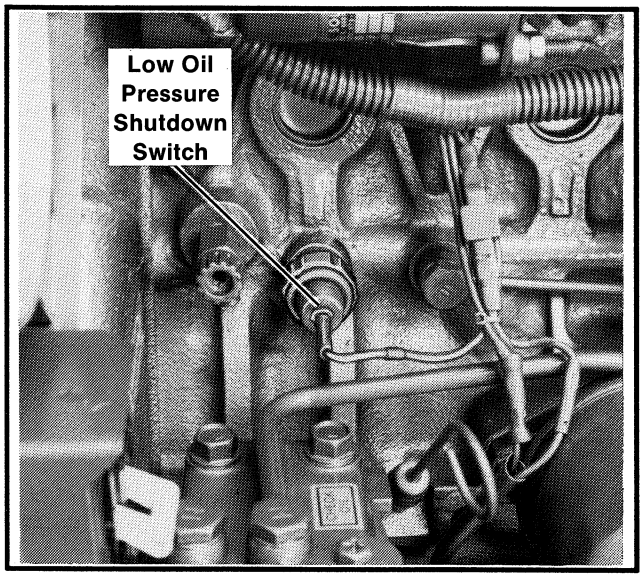


Figure 1-4. Low Oil Pressure Shutdown Switch

Fault Shutdowns

Low Oil Pressure Shutdown Switch

Your generator is equipped with a low oil pressure shutdown switch. See Figure 1-4. If the engine oil pressure drops below 7.1 psi (49 kPa), the engine will automatically stop. Cause of the shutdown must be corrected before the set can be restarted.

NOTE

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

High Water Temperature Shutdown Switch

The generator set is also equipped with a high water temperature shutdown switch. See Figure 1-5. 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.

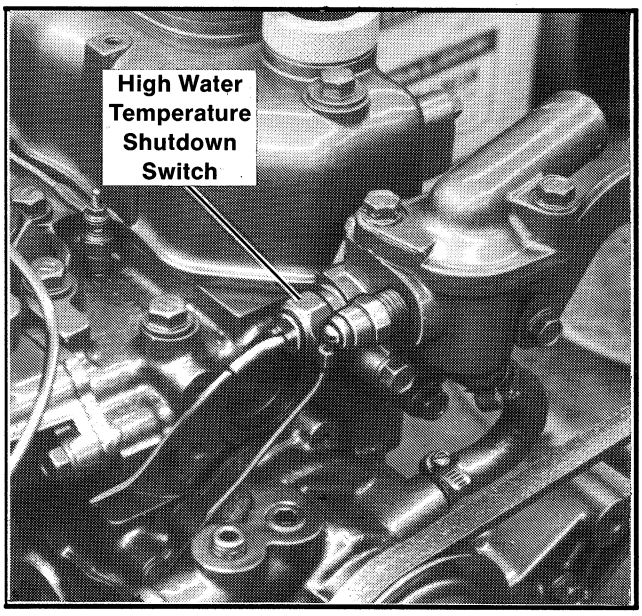


Figure 1-5. High Water Temperature Shutdown Switch

Circuit Protection

9CCO generators are equipped with two 40 Amp. line circuit breakers. 12.5CCO generators are equipped with two 60 Amp. circuit breakers. All 14.5CCO models are equipped with two 65 Amp. breakers in a side-mounted junction box. See Figure 1-6. If the circuit breaker(s) trip, reduce the load and switch the breaker(s) back to the "ON" position. With the circuit breakers in the "OFF" position, the engine will run but there will be no AC output. If circuit breaker(s) continue to trip after reducing load, have the generator examined by an Authorized Service Dealer.

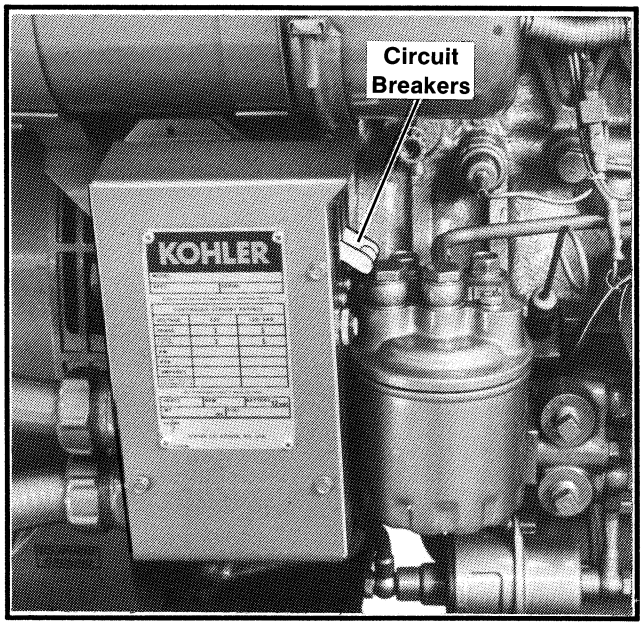
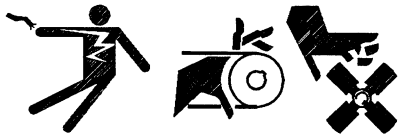


Figure 1-6. Circuit Breakers

Service Schedule

Use the service schedule following and the optional remote panel hourmeter to schedule routine maintenance.

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



⚠ WARNING

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

Service Schedule

	Before Starting	After 50 Hrs./ One Month	Every 150 Hrs./ 3 Months	Every 300 Hrs./ 6 Months	Every 600 Hrs. Yearly
FUEL SYSTEM					
Check the fuel oil level	X				
Fill fuel tank	X				
Remove sediment from fuel tank	X				
Replace the fuel filter element		X (Break-in Period)		X	
Check the injection timing					X
Check governor operation and adjust as necessary					X
Check the injection spray condition					X
LUBRICATION SYSTEM					
Check the oil level crankcase	X				
Replace the oil crankcase		X (Break-in Period)	X		
Replace the lube oil filter element			X	X	
COOLING SYSTEM					
Check coolant level	X				
Adjust the tension of water pump V-belt		X (Break-in Period)	X		
Check the thermostat function					X
Change coolant					X
Clean radiator fins			X		
AIR CLEANER, ETC.					
Replace the air cleaner element				X	
Clean the breather pipe			X		
ELECTRICAL SYSTEM					
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	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	
REMOTE CONTROL SYSTEM, ETC.					
Check the remote control operation		X		X	
Check compartment condition (fuel or oil leaks, exhaust gases, etc.)	X				
GENERATOR					
Blow dust out of generator					X
Clean slip rings and inspect brushes					X

Engine Lubrication

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, it may result in damage and a shorter engine life. Oil must meet the American Petroleum Institute (API) classification of CC or CD. Recommended SAE viscosity designation for given temperature ranges are listed in Table 1-1.

NOTE

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

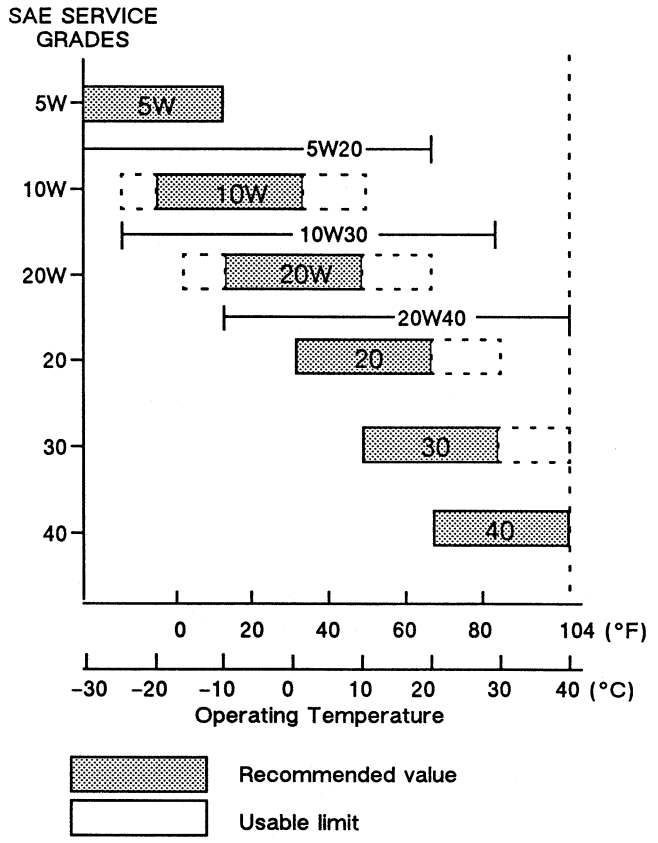


Table 1-1. Engine Oil Selection

Oil Check

Check the oil level in the crankcase daily or before each start-up to insure that the level is in the "safe range." To check oil level, remove dipstick and wipe the end clean, reinsert as far as possible, and remove. Level should be between MIN and MAX marks on the dipstick (see Figure 1-7).

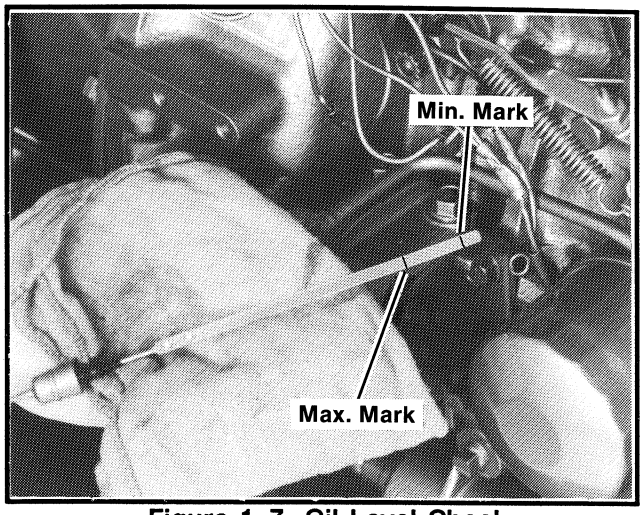


Figure 1-7. Oil Level Check

NOTE

Do not operate the set if the level is below the MIN mark or above the MAX mark.

Oil Change

Change oil for the first time after 50 hours or one month and then every 150 hours or three months. 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.
2. Remove oil fill cap. One is located on the rocker arm cover and one is located near the fuel injection pump. See Figure 1-8.
3. Fill crankcase with proper amount and type of oil, see "Specifications-Engine" and "Oil Selection."
4. If engine oil filter is to be replaced, see "Oil Filter" following.
5. Start generator set and check for oil leaks.
6. Stop generator set. Remove dipstick and wipe clean, reinsert as far as possible, and remove to check oil level. Add oil, as necessary, to bring level up to MAX mark.

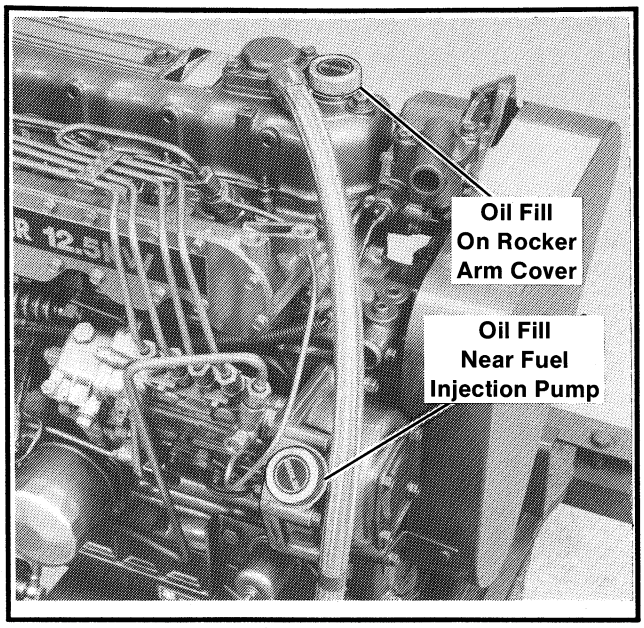


Figure 1-8. Oil Fill Locations

NOTE

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

Oil Filter

Replace the oil filter for the first time after 50 hours or one month and then every 300 hours or six months. Change more frequently if operating in dirty, dusty conditions. See Figure 1-9 and refer to the following procedure.

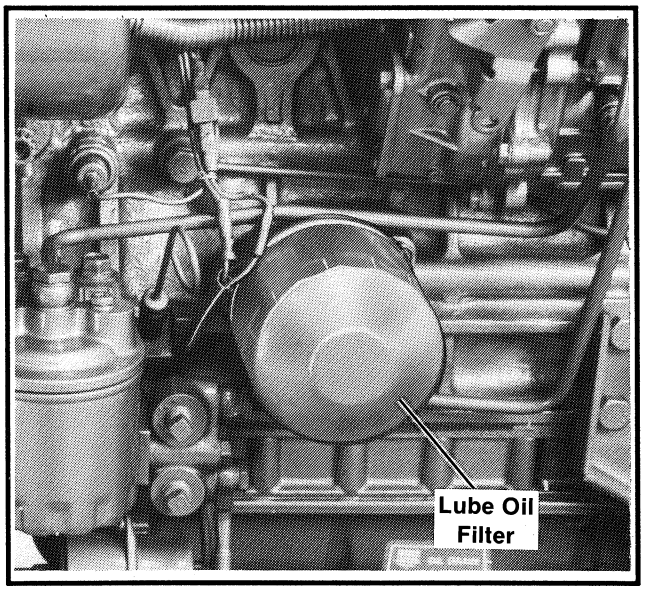


Figure 1-9. Oil Filter Location

1. Loosen oil filter by turning 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 to adapter until gasket makes contact, hand-tighten an additional one-half turn.
4. Start generator set and check for oil leaks.
5. Stop generator set. Remove dipstick and wipe clean, reinsert as far as possible, and remove to check oil level. Add oil, as necessary, to bring level up to MAX level.

Fuel System

Specifications

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 or Class A2**

Other Considerations:

Sulfur Content ..... Less than 0.5%
Sediment and Water Content Not to exceed 0.1%
Cetane Number ..... 40 minimum
Pour Point . At least 10^0 F (5.6^0 C) below the lowest outside air temperature

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 will clog fuel filters and lines.

Fuel Filter

The fuel filter is paper and no attempt should be made to clean it. Its useful life will be determined largely by the quality and condition of the fuel used. Under normal conditions, the fuel filter element should be replaced for the first time after 50 hours or one month and then every 300 hours or six months. See Figure 1–10 for location and use the following procedure to service fuel filter.

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

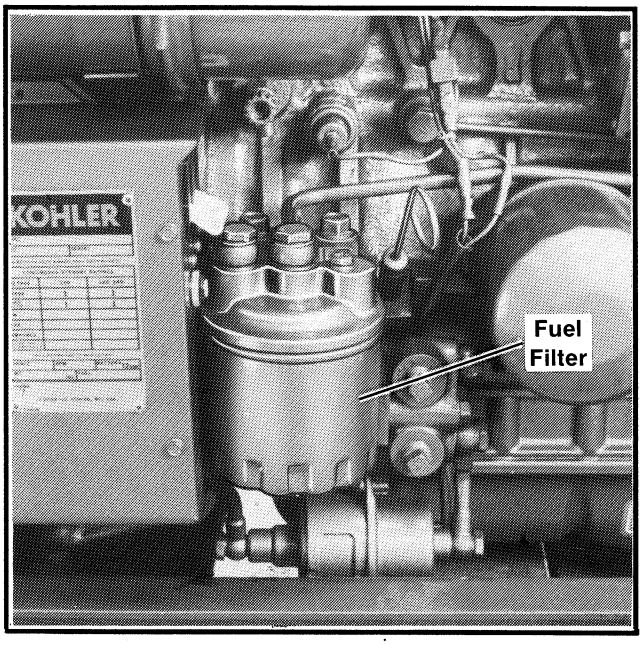


Figure 1–10. Fuel Filter Location

Bleeding

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 1–11 and refer to the following procedure.

1. Loosen line connection at fuel filter.
2. Using priming switch (see Figure 1–2) on controller, operate fuel pump until fuel (free from air bubbles) flows from this point. Tighten line connection.
3. Loosen small vent screw (with Phillips head) on fuel filter.
4. Using priming switch on controller, operate fuel pump until fuel, free from air bubbles, flows from this point. Tighten vent screw.
5. Loosen line connection (bleed point) at fuel injection pump inlet.
6. Using priming switch on controller, operate fuel pump until fuel, free from air bubbles, flows from this point. Tighten line connection.

⚠ WARNING

Spilled fuel can ignite on contact with hot engine parts. Use a container to catch fuel when draining fuel system. Wipe up all spilled fuel after draining system.

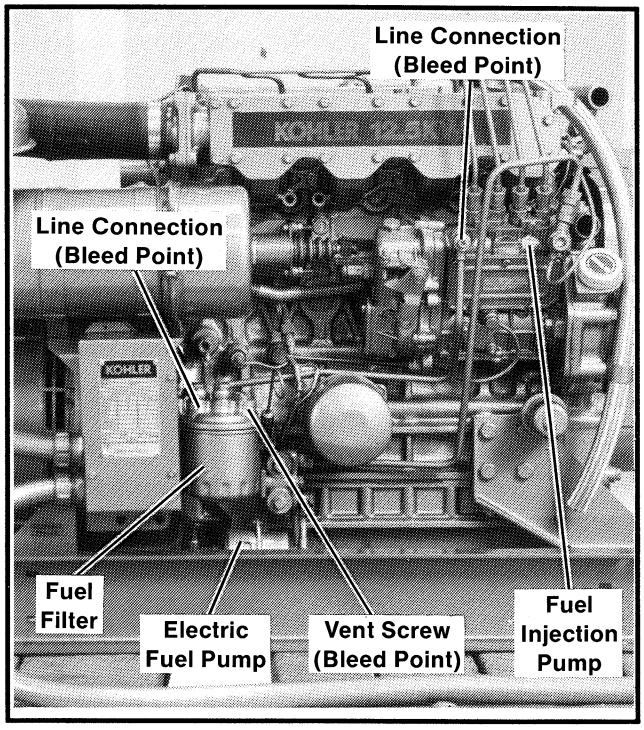


Figure 1–11. Bleeding Fuel System

Air Cleaner Service

The paper element should be replaced at 300–hour/6–month intervals; change more frequently if operating under extremely dirty, dusty conditions. See Figure 1–12 and refer to the following procedure. If the air cleaner on your generator does not resemble that pictured, consult the coach manufacturer for service requirements.

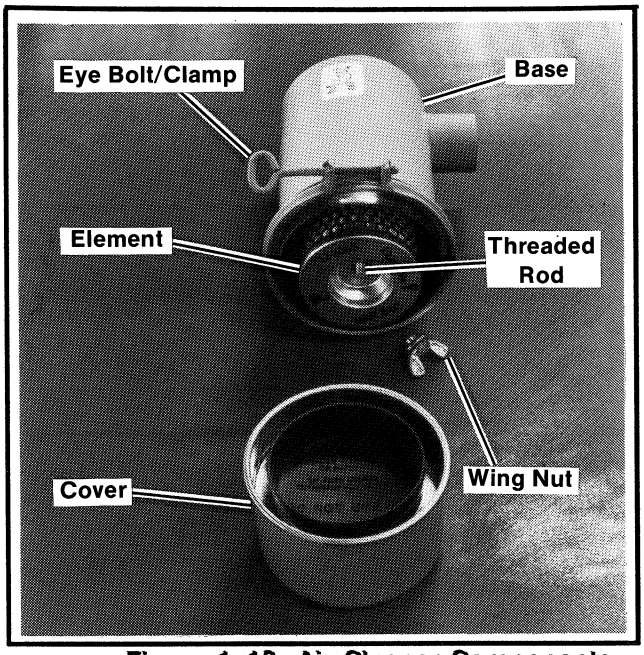


Figure 1-12. Air Cleaner Components

1. Loosen eye bolt and clamp enough to remove air cleaner cover.

2. Remove wing nut and slide air cleaner element from 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 eye bolt.

Governor

The centrifugal, mechanical-type governor serves to keep 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 should not be needed unless greatly varying load conditions are encountered or if poor governor control develops after extended usage.

This set is designed to operate at 60-63 Hz, 1800 rpm under full load and 1890 rpm under no load. To check speed, use hand tachometer or frequency meter. See Figure 1-13. Loosen locking nut on speed adjusting screw and lock screw on governor lever. Turn screw in counterclockwise direction to increase speed (and frequency) or in clockwise direction to decrease speed. Tighten lock nut and lock screw at new setting.

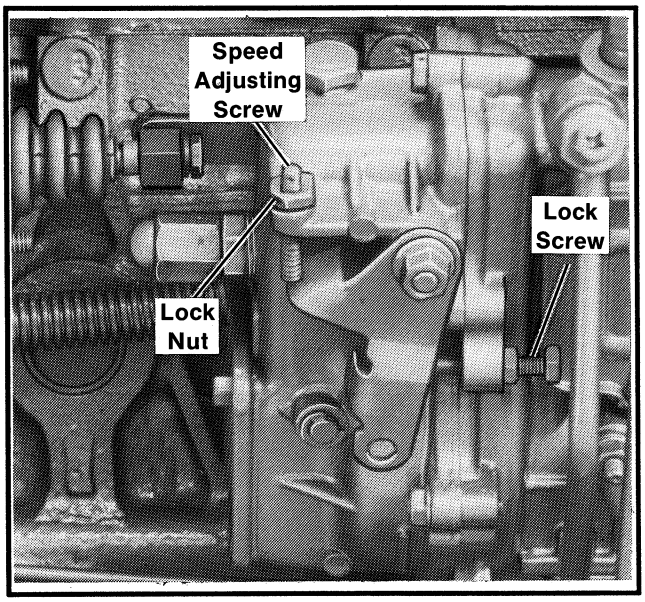


Figure 1-13. Governor

Valve Adjustment

With poppet-type valve mechanism, each valve is spring-held in the closed position until forced open by the action of the rocker arm in contact with the push rod which is moved by the tappet which rides on a lobe of the camshaft. Rocker arms have adjusting screws with lock nuts for adjusting the valve stem-to-rocker arm clearance. Check the intake/exhaust valve clearance every 300 hours or six months. Valve clearance on both intake and exhaust valves is 0.0079 in. (0.2 mm) with the engine cold.

NOTE

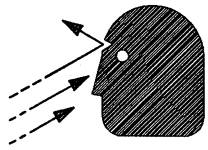
The engine firing order is based on the No. 1 piston being next to the flywheel, not the crankshaft pulley.

1. Remove rocker arm cover screws and breather hose at rocker arm cover connection. Carefully pry rocker arm cover from cylinder head. Wipe excess oil from components using a clean rag.

NOTE

Be careful not to damage gasket or mating surfaces.

2. Locate intake/exhaust valves of No. 1 cylinder. These are the first set of valves nearest the flywheel. Remove belt guard, if used, and place two screws in threaded holes of pulley. Use a bar to rotate until maximum clearance between intake/exhaust valves and rocker arms is achieved. This is the period between the closing of the intake valve and the opening of the exhaust valve. At this point the No. 1 piston is at Top Dead Center (TDC), and both intake and exhaust valves will be closed.



⚠ CAUTION

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

3. Insert feeler gauge between rocker arm and exhaust valve. If necessary, loosen lock nut and move adjusting screw so that very slight drag is felt on the feeler gauge as it is withdrawn. Tighten lock nut on adjusting screw. See Figure 1-14. Repeat step for intake valve.

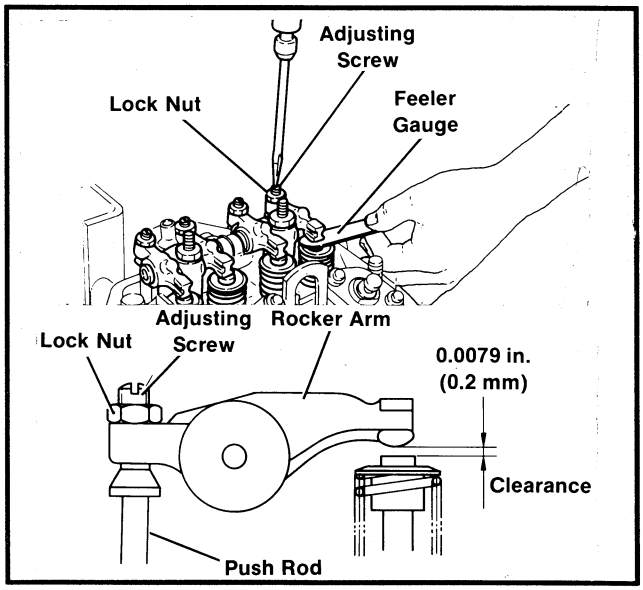


Figure 1-14. Valve Adjustment

4. Repeat procedure for each additional cylinder to be checked and/or adjusted.

5. With mating surfaces clean and gasket properly aligned, install rocker arm cover and screws. Be careful that O-ring is properly seated in recessed hole.

6. Remove screws from pulley and replace belt guard, if used.

Cooling System

To prevent the inconvenience of having the generator set shut down or become damaged due to overheating, keep the cooling air inlets to the component clean and unobstructed at all times.

Consult the coach manufacturer for remote radiator cooling system capacity. Coolant capacity for12.5 and 14CCO in-line radiator models is 19 qts. (18 L). 9CCO in-line radiator model coolant capacity is 8.5 qts. (8 L). Contact the coach manufacturer for remote radiator coolant capacity. A drain petcock is provided on the underside of the radiator and 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. When operating in climates subject to freezing temperatures, make sure a sufficient amount of antifreeze solution is added to prevent freeze-up of the system. The antifreeze should contain a rust inhibitor and be changed every two years. A coolant solution of 50% clean, softened water is recommended to inhibit corrosion and prevent freezing to -34°F (-37°C). For maximum protection, always use a solution which will remain liquid below the lowest anticipated temperature.

Check coolant level frequently and add water or antifreeze solution as needed to maintain level just below the overflow tube.

NOTE

Special attention should be given when checking for proper coolant level. After a radiator has been drained, it normally requires some time before complete refill of all air cavities takes place.

NOTE

Remote radiators with electric blower fans do not have fill caps. A coolant expansion recovery tank must be used to fill and/or maintain coolant level.

Belt Tension

The belt tension should be adjusted so that it can be depressed about 0.38 (10 mm) with about 22 lbs. (10 kg) of force, see Figure 1-15. Use the following procedure to adjust belt.

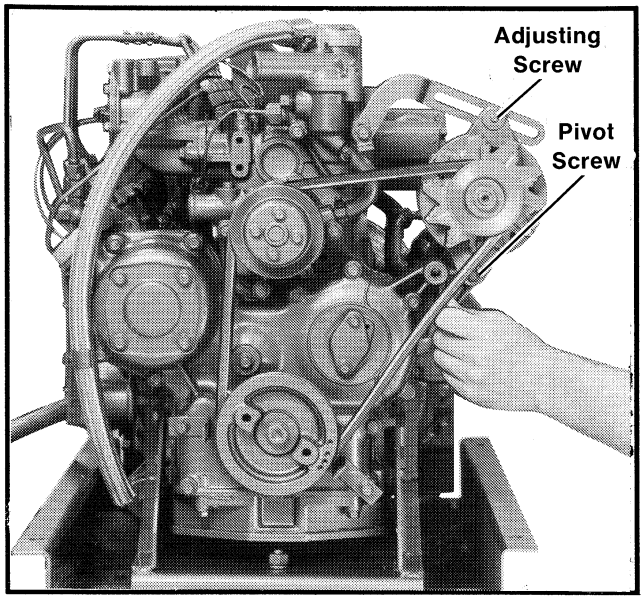
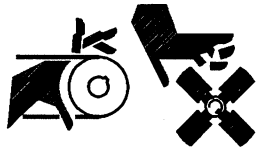


Figure 1-15. Belt Tension

1. Loosen pivot and adjusting screws.
2. While prying idler pulley outward, tighten adjusting screw.
3. Tighten pivot screw.
4. Recheck and adjust as necessary.



⚠ WARNING

Exposed moving parts can cause severe injury. Keep hands, feet, hair, and clothing away from belts and pulleys when unit is running. Replace guards, covers, and screens before operating generator set. Do not open generator compartment door when unit is running.

Battery Charging

Your generator may be equipped with a belt-driven battery charging alternator. See Figure 1-16. 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 battery to the genset. To adjust alternator belt tension, see "Belt Tension".

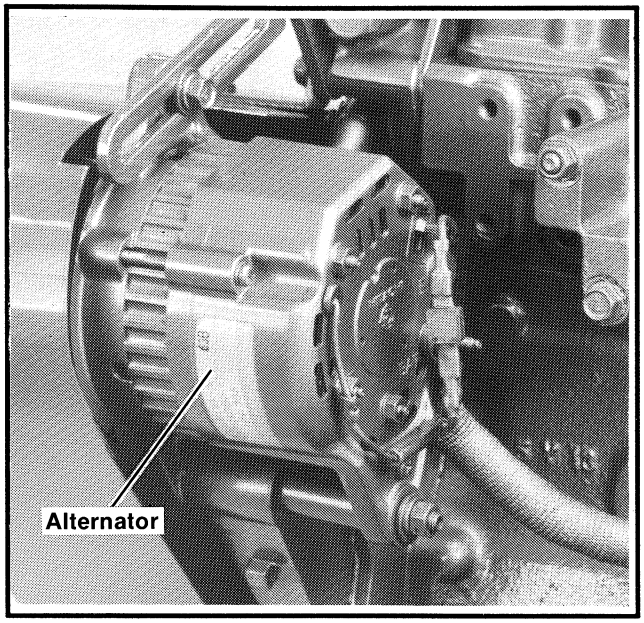


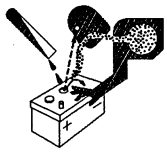
Figure 1-16. Battery Charging Alternator

Battery

Use a 12 Volt battery with a rating of at least 500 Cold Cranking Amps./100 Amp. Hr. When using a "Maintenance Free" battery, it is not necessary to check the specific gravity or electrolyte level. Otherwise these procedures should be done at the intervals specified in the "Service Schedule." A negative ground system is used. Battery connections are shown on the wiring diagram. Make sure battery is properly connected and terminals are tight.

NOTE

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



⚠ WARNING

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

⚠ WARNING

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

Cleaning

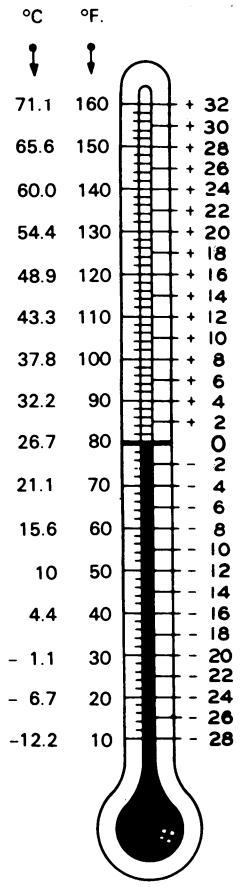
Keep battery clean by wiping it with a damp cloth. Keep all electrical connections dry and tight. If corrosion is present, disconnect cables from battery and remove corrosion with a wire brush. Clean battery and cables with a solution of baking soda and water. Be careful that cleaning solution does not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

Checking Electrolyte Level

Check the level of electrolyte before each start-up. Remove filler caps and check to see that electrolyte level is up to bottoms of filler holes. Refill as necessary with distilled water or clean tap water. DO NOT add fresh electrolyte! Be sure filler caps are tight.

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 1-17. Determine specific gravity and electrolyte temperature of battery cells. Locate temperature in Figure 1-17 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).



EXAMPLE NO. 1 —
Temperature *below* 80° F (26.7° C)

Hydrometer Reading 1.250
Acid Temperature 20° (-6.7° C)
***Subtract* .024 Sp. Gr.**
Corrected Sp. Gr. is 1.226

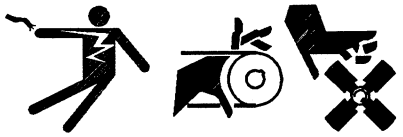
EXAMPLE NO. 2 —
Temperature *above* 80° F (26.7° C)

Hydrometer Reading 1.235
Acid Temperature 100° (37.8° C)
***Add* .008 Sp. Gr.**
Corrected Sp. Gr. is 1.243

The temperature correction amounts to about .004 Specific Gravity, sometimes referred to as 4 "points" of "gravity" for each 10° F (5.5° C) change in temperature.

Figure 1-17. Specific Gravity Temperature Correction

Fuse Replacement



⚠ WARNING

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

There is one 10 Amp. fuse located on the relay controller. This fuse protects the controller against damage in the event a short develops in the engine wiring system or the wiring harness to the remote start/stop switch. See Figure 1–18. If this fuse "blows," the set will stop. An 8 Amp. fuse is located in the end bracket assembly, or junction box. This fuse protects the voltage regulator circuit in the event of an overload in the circuit. If there is no AC output, check the fuse; if blown, replace the fuse, then restart the generator set. If the fuse blows again, contact an Authorized Service Dealer.

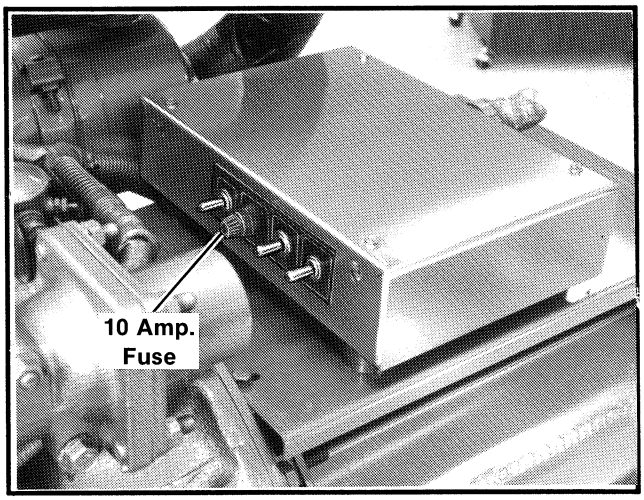


Figure 1–18. Fuse Replacement

NOTE

If the 8 Amp. fuse (in the end bracket, or junction box) is blown, the engine will crank but not start. If the 10 Amp. fuse (on the controller) is blown, the engine will not crank. If either fuse blows while the generator set is running, the set will stop.

Fuel Solenoid

The fuel solenoid (Figure 1–19) serves to stop fuel flow through the fuel injection pump when the start/stop switch is placed in the STOP position. If the fuel solenoid is removed or the setting is believed incorrect, use the following procedure and see Figure 1–19. Do not modify linkage during reconnection.

1. With fuel solenoid mounted to engine block, compress plunger and adjust fuel solenoid linkage so that linkage connects to fuel control lever 1/16 in. (1.6 mm) before lever contacts internal full-open stop.

2. Attach cotter pin to fuel solenoid linkage.

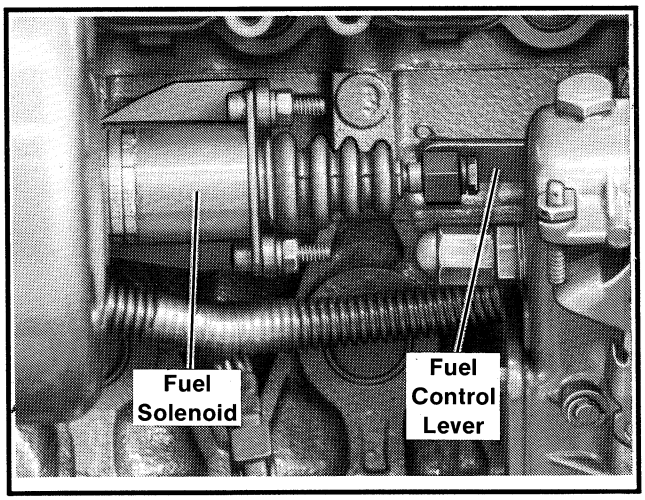
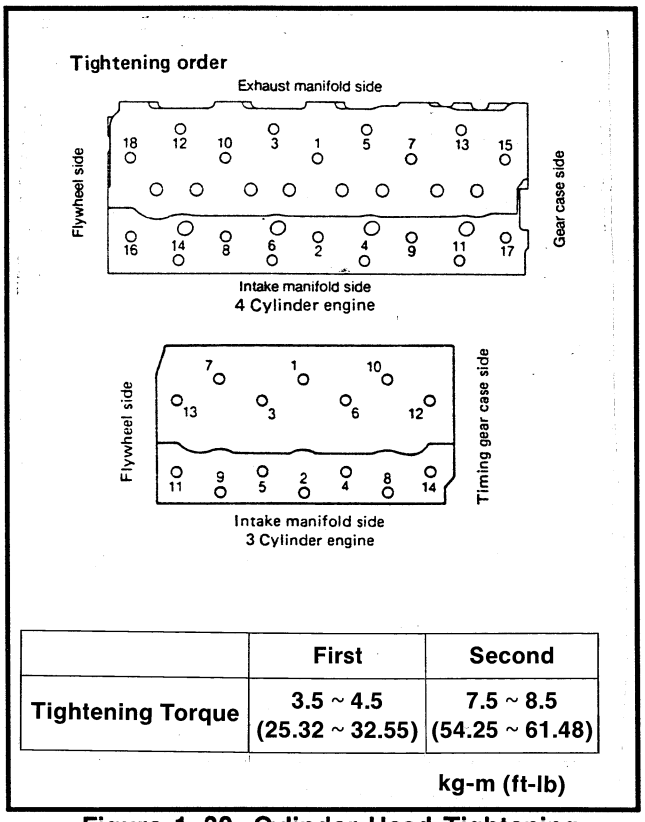


Figure 1–19. Fuel Solenoid

Cylinder Head Retightening

If the cylinder head is removed for servicing, refer to the following procedure and Figure 1-20 for reassembly. Always install a new head gasket and be sure the head bolts are tightened in the proper sequence and to the torque values specified.



	First	Second
Tightening Torque	3.5 ~ 4.5 (25.32 ~ 32.55)	7.5 ~ 8.5 (54.25 ~ 61.48)

kg-m (ft-lb)

Figure 1-20. Cylinder Head Tightening Sequence and Torque Values

1. Remove all foreign matter from cylinder head surface and bolt holes.

2. Coat cylinder head bolt threads and nut seats with lube oil.

3. Position new head gasket on cylinder block.

4. Align cylinder head with head gasket and engine mount. Hand-tighten cylinder head mounting bolts to secure cylinder head.

5. Tighten cylinder head mounting bolts in two stages. Be sure mounting bolts are tightened in the proper sequence and to the torque values specified.

Gauge Connections

Some models are equipped with sending devices for connection to oil pressure and water temperature gauges (not provided). Location of the oil pressure and water temperature senders is shown in Figure 1-21. Follow the recommendations of the gauge manufacturer in selecting a gauge compatible with each sender. The resistance and range of the gauge must match the resistance and range of the sending device (reference the sender ratings on the next page). RV Coach manufacturers have successfully used the following gauges with the oil pressure and water temperature senders on 12.5/14.5CCO generator sets:

Water Temperature Gauge - Teleflex No. 53215
Oil Pressure Gauge - Teleflex No. 53214

NOTE

Generator set operating oil pressure is 21.3 - 56.9 psi (147 - 392 kPa).

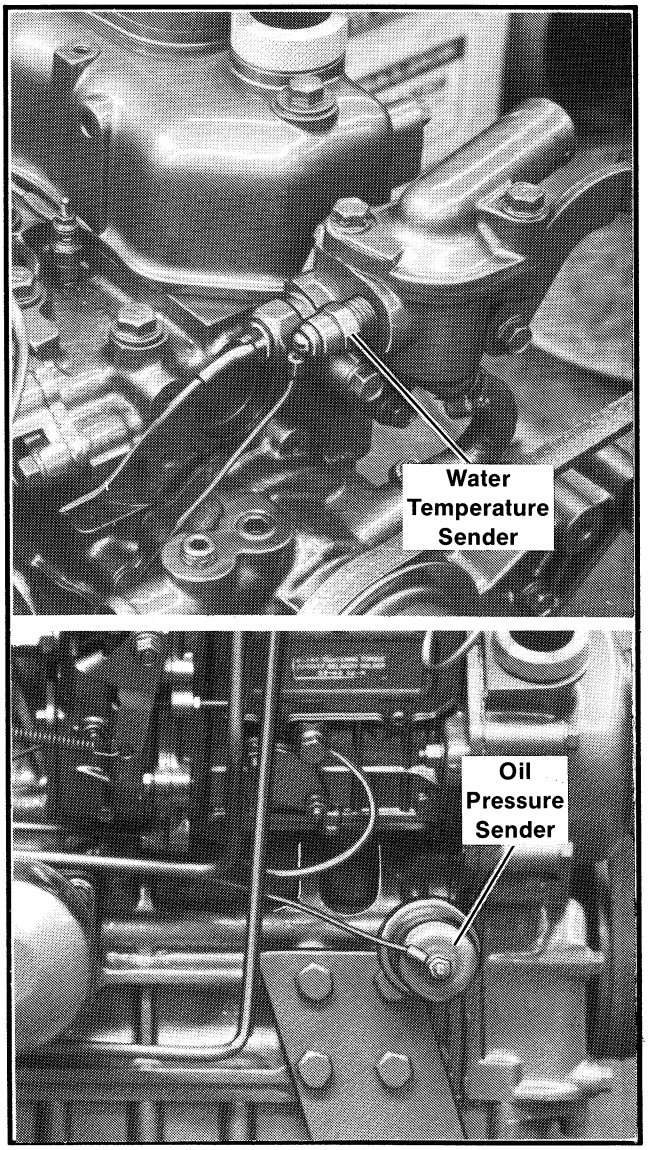


Figure 1-21. Engine Temperature and Oil Pressure Senders

Oil Pressure & Water Temperature Sender Ratings

Description	Kohler Part No.	Range	Resistance (approx.)
Water Temperature Sender	258694	100–360° F	218.5–251.5 Ohms @ 200 F (93° C) (34–182° C)
Oil Pressure Sender	258693	0–125psi (862 kPa)	1 Ohm @ 0 psi (0 kPa) 44 Ohms @ 62.5 psi (431 kPa) 88 Ohms @ 125 psi (862 kPa)

To connect the sending units to the gauges, use spade connectors and 16 or 18 gauge wire. Since lead 10 (from water temperature sender) and lead 11 (from oil pressure sender) may not appear at controller plug J1 or P1, it may be necessary to access 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 gauges. The installer may also elect to run separate leads from each sender directly to the gauges and bypass the harnesses entirely. Each of these options is illustrated in Figure 1-22. Use insulink or similar connectors at all spliced connections to insure reliable operation of the senders and gauges.

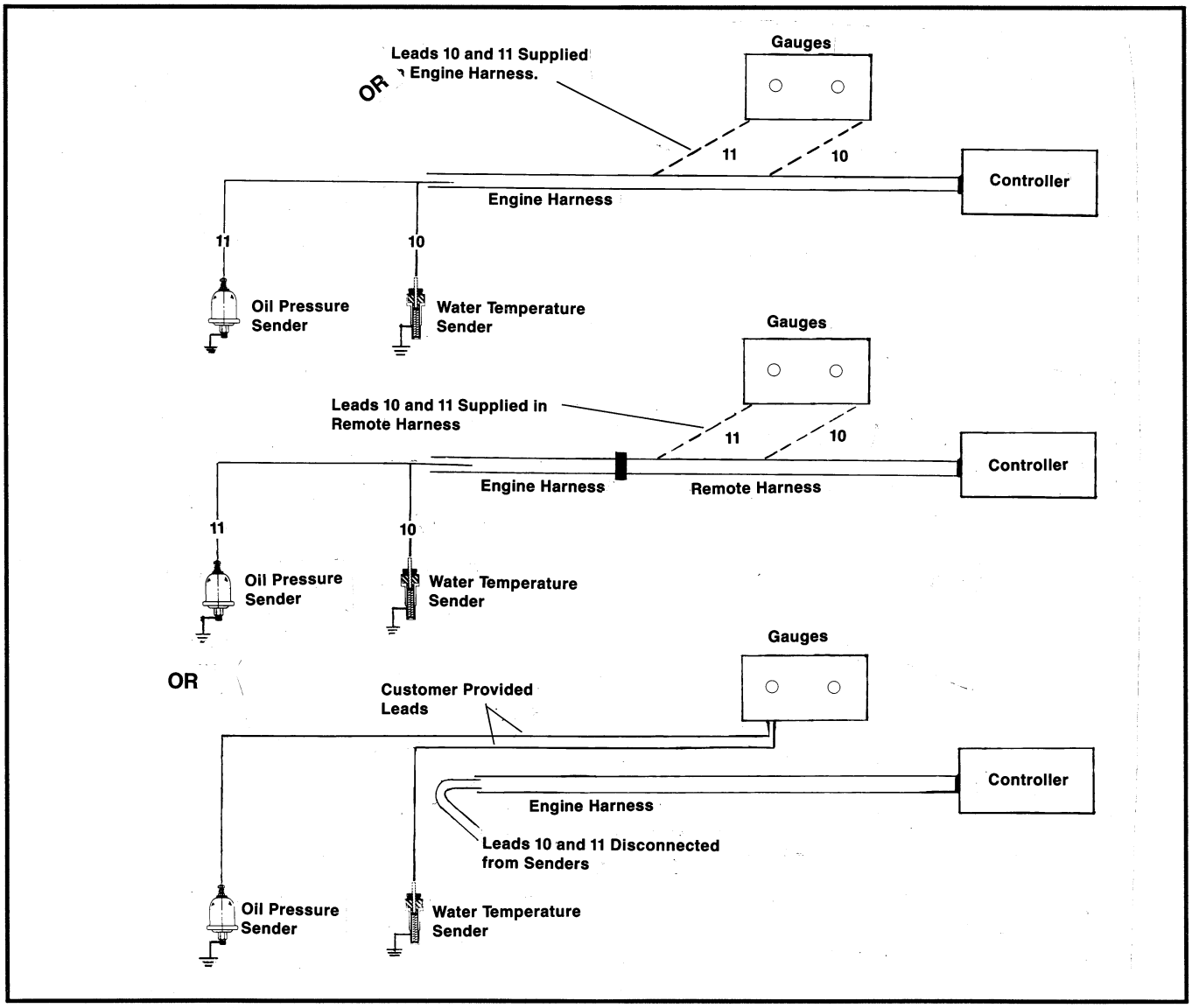


Figure 1-22. Oil Pressure/Water Temperature Sender Connections

Wattage Requirements

Line circuit breakers are used to prevent damage to the generator set should the rated capacity of the generator set be exceeded. This could be caused by a short in the AC circuit in your RV or simply by having too many appliances 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 and lights inside the RV to bring the load down within the rated limits of the set. If this is done and the circuit breaker trips again after being reset, 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 appliances and motor loads are listed in the following chart. Use these figures to calculate the total load on your set to avoid the inconvenience of having the circuit breaker trip due to overload. Your generator set will operate three 13,500 BTu air conditioners. 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 RV 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

Generator Service

Under normal conditions, generator service will not be required on a regular basis. If operating under extremely 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. Because of the design of this Kohler generator, brush service should be practically non–existent. The brushes operate at very low amperage and should last indefinitely. Abrasive dust on the controller rings could, however, shorten the life of the brushes. If brush replacement becomes necessary due to poor or no AC output, return set to a Kohler Generator Service Dealer to have this done.

Storage Procedure

If your generator set is to be out of service for a considerable length of time, the following steps should be taken to preserve it.

1. Drain oil from crankcase while engine is still warm. Refill crankcase with specified weight oil.

2. If generator set has a separate fuel tank, drain fuel completely from tank, otherwise moisture from the fuel system will mix with the fuel.

3. Clean exterior of generator set and spread a light film of oil or silicon spray over any exposed surfaces which may be subject to rust or corrosion.

4. Disconnect and remove battery. Battery should be placed in a warm, dry location for period of storage. Recharge once a month to maintain full charge.

Troubleshooting

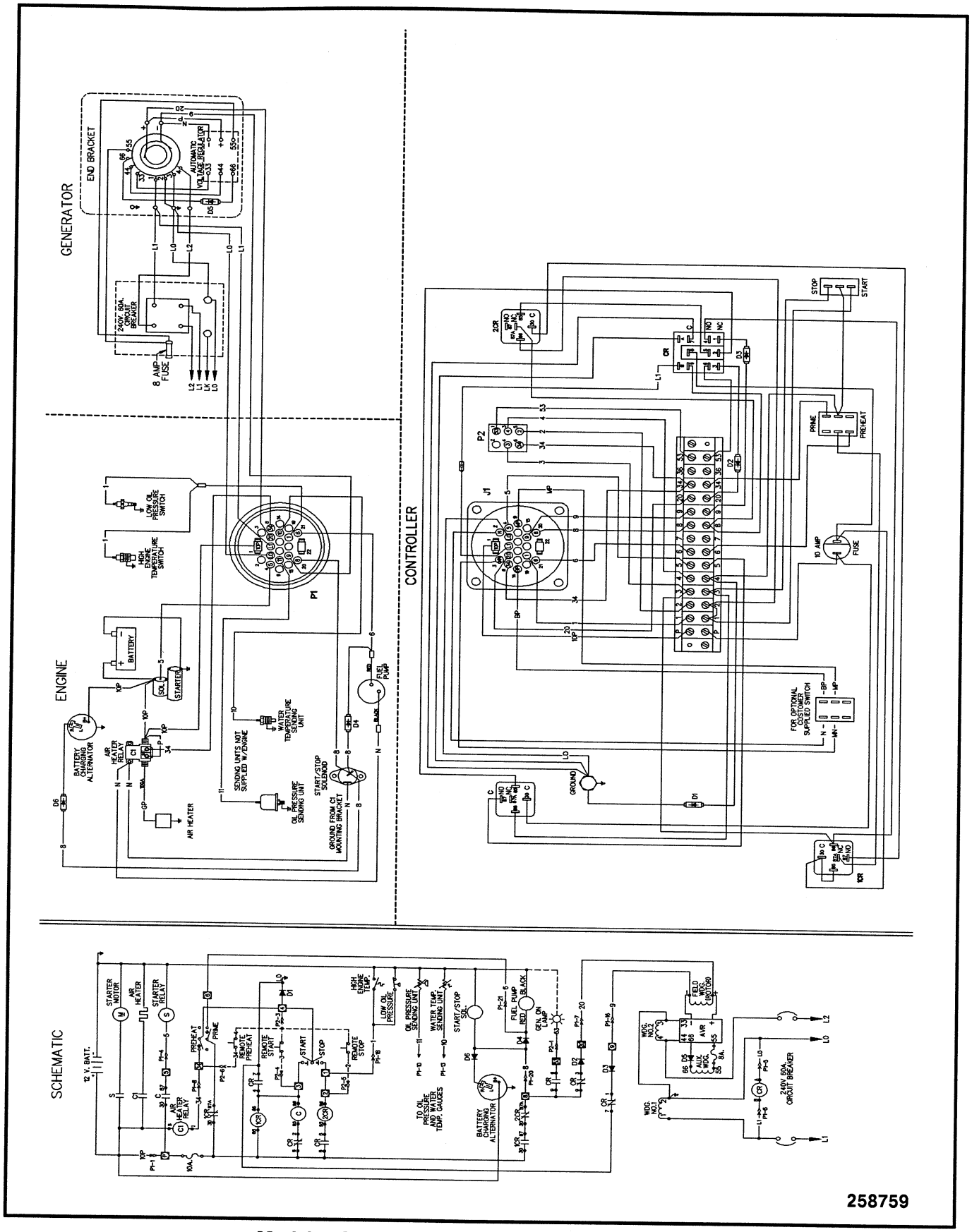
When troubles occur, don't overlook simple causes. A starting problem could be caused, for example, by improper fuel or an empty fuel tank. Make sure all electrical connections are secure. Remember the battery negative must have a good ground. The following charts list some common problems. If procedures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

Troubleshooting Chart

Problem	Possible Cause	Corrective Action
Engine		
Engine hard to start or will not start	Weak or dead battery	Recharge or replace
	Battery connections made in reverse	Check connections
	Faulty ground	Clean and retighten
	Fuse blown	Replace
	Out of fuel	Replenish
	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
	Water, dirt in fuel system	Drain, flush fuel system
	Dirty or faulty injectors	See Authorized Service Dealer
	Improper compression	See Authorized Service Dealer
	Improper type of fuel	Use proper type of fuel; consult fuel supplier
	Improper type of crankcase lube oil	Use proper lube oil
Engine knocks	Faulty injector	Check, replace
	Improper type of fuel	Use proper type of fuel; consult fuel supplier
	Incorrect fuel injection timing	Check injection timing
	Improper cylinder top clearance	See Authorized Service Dealer
	Defective piston or piston ring	See Authorized Service Dealer
	Defective crankshaft bearing or piston pin bearing	See Authorized Service Dealer
	Improper valve clearance	Adjust proper valve clearance
	Air in injectors	Bleed air
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 the system
	Dirty or faulty injectors	See Authorized Service Dealer
	Faulty governor linkage	See Authorized Service Dealer
	Defective fuel feed pump	Replace fuel feed pump
	Improper valve clearance	Adjust proper valve clearance
	Defective valve spring	Replace valve spring
	Improper compression	See Authorized Service Dealer
Lack of engine power	Engine overloaded	Reduce load
	Air intake restriction	Service air cleaner
	Clogged fuel filter	Replace filler element
	Improper type of fuel	Use proper fuel
	Improper valve clearance	Adjust proper valve clearance
	Dirty or faulty injectors	See Authorized Service Dealer
	Incorrect fuel injection timing	Check fuel injection timing
	Improper engine compression	See Authorized Service Dealer
	Vent in fuel tank cover obstructed	Clean cap in solvent; blow dry
	Overfueling (rich)	Adjust injection pump, injectors
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

Problem	Possible Cause	Corrective Action
Engine emits black or gray exhaust smoke	Improper type of fuel	Use proper fuel
	Clogged or dirty air cleaner	Service air cleaner element
	Defective injection pump	See Authorized Service Dealer
	Faulty injectors	See Authorized Service Dealer
	Incorrect fuel injection timing	Check the injection timing
	Improper valve clearance	Adjust valve clearance
	Lube oil level too high	Drain out surplus
	Improper lube oil	Use proper viscosity oil
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
	Defective oil pressure switch	Replace switch
	Worn engine components	Rebuild
High lube oil consumption	Too light viscosity oil	Use proper viscosity oil
	Oil leaks	Check for leaks in lines, around gasket, 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
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	Adjust valve clearance
	Incorrect fuel injection timing	Check injection timing
	Low engine temperature	Check thermostat
	Improper compression	See Authorized Service Dealer
	Fuel leakage	Check for leaks at fuel tank, lines, and engine fuel system
Electrical System		
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		
No AC output	AC circuit breaker(s) in OFF position	Reset to ON position
	No DC power to controller	Check battery connections
	Fuse blown in end bracket or junction box	Replace fuse
	Generator malfunction such as sticking brushes, broken brush leads, or other internal fault	See Authorized Service Dealer
Low output	Engine speed too low	Check governor operation
	Set overloaded	Make sure set capacity is not being exceeded. See ''Wattage Requirements.''
Engine in poor condition.		If routine services are performed and condition persists, see Authorized Service Dealer

Wiring Diagrams



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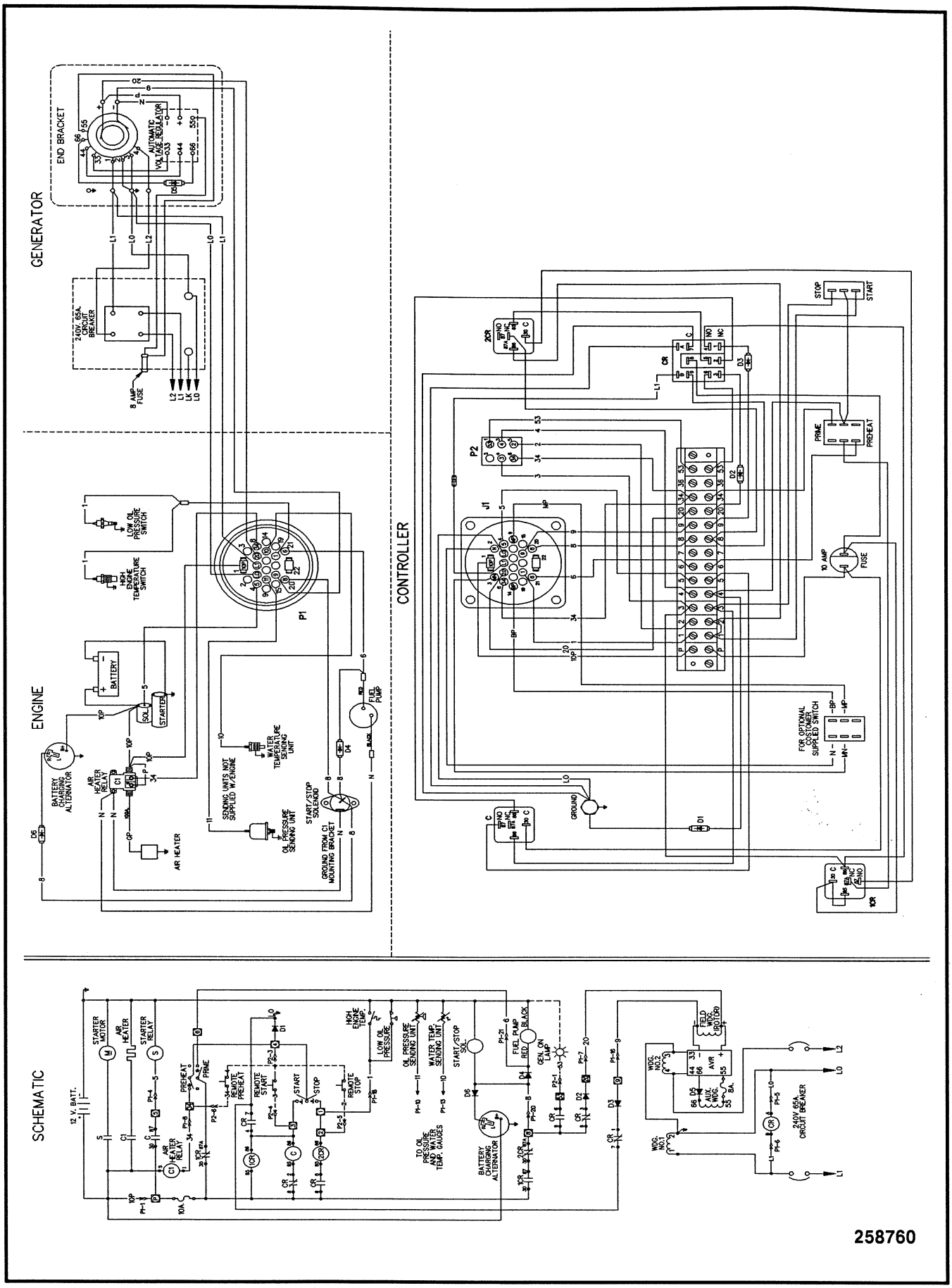
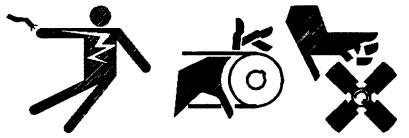
Models 9CCO-RV & 12.5CCO-RV, 120/240 Volt



Model 14.5CCO-RV, 120/240 Volt

Generator Reconnection

The generator may be reconnected to supply a different output voltage than listed on the generator nameplate. Refer to the reconnection procedure that applies to your generator set. Observe the following safety precautions during the reconnection procedure.



⚠ WARNING

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

⚠ WARNING

Hazardous voltage can cause death or severe injury. Perform electrical service only as prescribed in equipment manual. Be sure that generator is properly grounded. Never touch electrical leads or appliances with wet hands, when standing in water, or on wet ground as the chance of electrocution is especially prevalent under such conditions. Wiring should be inspected at the interval recommended in the service schedule -- replace leads that are frayed or in poor condition. The function of a generator set is to produce electricity and that wherever electricity is present, there is the hazard of electrocution.

Four-Lead Reconnectible Generator Sets

Single-phase generators with four-lead stators can be reconnected to 120-Volt or 120/240-Volt systems at 60 Hz. Contact the factory for information on reconnecting the set at 50 Hz voltages.

NOTE

If generator is reconnected to a voltage different than nameplate rating, new voltage should be recorded on generator. Voltage change decals for this purpose are available from your Kohler Service Dealer.

120-Volt Connection

The jumper lead should be placed on the line side of the circuit breaker. See Figure 1-23. Leads L1 and L2 can either be left as separate leads or can be connected depending upon application. Regardless of the number of output leads used in the application, both circuit breakers must have leads attached to the load side. It is recommended that the jumper lead be used for all straight 120-Volt systems to help balance the generator set load.

Leads	Voltage (60Hz)
L0-L1	120
L0-L2	120

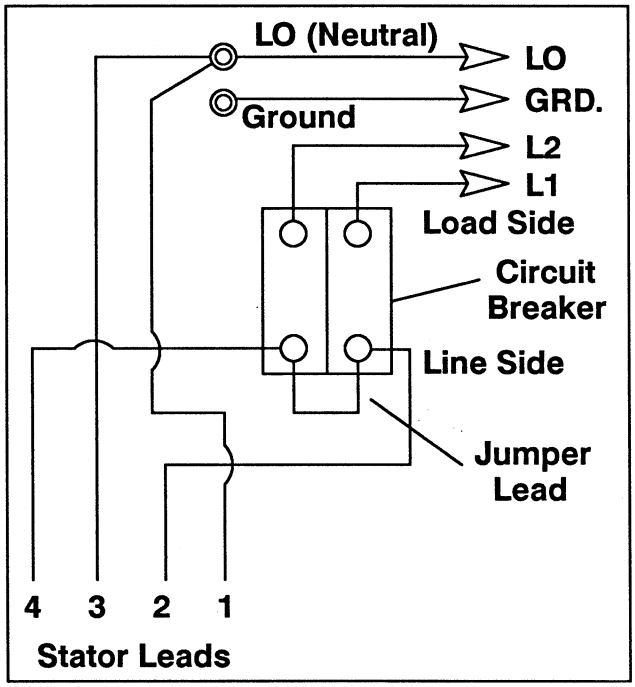


Figure 1-23. 120-Volt Connection

120/240-Volt Connection

In 120/240-Volt systems, the jumper lead is not used. If the unit was originally wired for straight 120-Volt, be sure jumper jumper lead is removed (see Figure 1-23 for location). Leads L1 and L2 are different phases and must never be connected together.120/240 Volt connection is illustrated in Figure 1-24.

Leads	Voltage (60Hz)
L0-L1	120
L0-L2	120
L1-L2	240

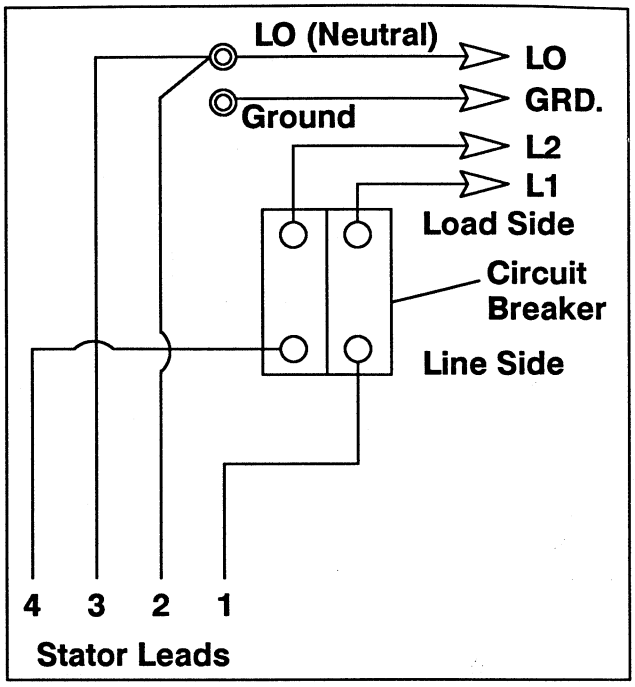


Figure 1-24. 120/240-Volt Connection

INSTALLATION

Introduction

Use this section as a guide when installing a generator set in the recreational vehicle, then refer to the appropriate operation section for specific service instructions. When installing an RV generator set, the installation must comply with CURRENT standards of (1) ANSI/RVIA EGS-1, (2) ANSI A119.2/NFPA 501 C and (3) article 551 of ANSI/NFPA 70, National Electrical Code. Generator set installation must also comply with state and local requirements.

NOTE

RV generator sets do 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.

General Information

This information section covers the Kohler RV generator set models listed below. To determine which model is involved, check the model number found on the nameplate attached to the frame of the generator being installed. Follow all instructions to ensure proper installation.

Model No.	Engine No.	Volts	Hz	kW	Phase
9CCO	3TN82-RK	120/240	60	9	1
12.5CCO	Yanmar 4TN82-U (early models) 4TN82-R (later models)	120/240	60	12.5	1
14.5CCO	4TN82-U (early models) 4TN82-R K (later models)	120/240	60	14.5	1

Features

These generator sets feature Yanmar 4TN82-U, 3TN82-RK, or 4TN82-RK 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 switch for test operating the set at the controller. Also included is a Preheat/Prime switch to aid in cold weather starting or assist in bleeding air from the fuel system. The controller may be equipped with a switch to operate the mechanism used to move the generator out of the coach for servicing (supplied by coach manufacturer). Early model controllers (without accessory plug P2) require that remote operating controls be connected to the terminal strip inside the controller. In some cases, the coach manufacturer may provide a specialized wiring harness which permits remote connection without assessing controller terminal strip. Later model controllers include an accessory plug (P2) for connecting the remote switch, preheat switch, and generator "ON" lamp wiring harness. 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.
- Add oil to crankcase until dipstick reads FULL.
- Connect fuel line, remote switch, load leads, and battery terminals.

Consult the specification chart following to aid in the installation.

NOTE

When selecting and installing radiator, consult Kohler Co., Generator Division, Product Applications Dept., Kohler, WI 53044, Telephone (414) 565-3381 for recommendations and instructions.

Specifications	9CCO Skid Mount	12.5CCO67 Skid Mount	12.5CCO67 Pedestal Mnt. (Blue Bird)	14.5CCO67 Skid Mount
Weight (Dry)	620 lbs. (281 kg)	701 lbs. (315 kg)	660 lbs. (279 kg)	715 lbs. (322 kg)
Length Overall	39.9 In. (1013 mm)	42.5 In. (1080 mm)	45.3 In. (1151 mm)	44.3 In. (1125 mm)
Width Overall	21.2 in. (539 mm)	22.0 In. (559 mm)	18.9 In. (480 mm)	22.0 In. (559 mm)
Height Overall	26.6 In. (675 mm)	24.0 In. (610 mm)	24.75 In. (629 mm)	24.2 In. (615 mm)
Radiator Type	In-line	In-line or Remote	Remote	In-line or Remote
Radiator Capacity (with Kohler Radiator)	8.5 qts. (8L)	16 qts. (15.1 L)	16 qts. (15.1 L)	16 qts. (15.1 L)
Engine Coolant Capacity	2.1 qts. (2L)	2.85 qts. (2.7L)	2.85 qts. (2.7L)	2.85 qts. (2.7L)
Cooling Sys. Cap. (w/In-line Radiator)	10.6 qts. (10L)	19 qts.(15.1L)	-	19 qts. (15.1L)
Total Air Require.	1400 CFM (39600L/Min.)		2000 CFM (56628 L/min.)	
Fuel Inlet Connection	1/4 NPT		1/4 In. (6.4 mm)	
Battery Voltage			12 Volts	
Battery Recommend.			Minimum 500 Cold Cranking Amps., 100 Amp. Hr.	
Battery Cranking Current			170 Amps.	
Battery Ground			Negative	
Fuel Recommendation			No. 2-D Diesel Oil (Cetane > 45); ASTM D975	
Fuel Consumption (% Load)				
25%	0.43 gph (1.6 Lph)	0.52 gph (1.9 Lph)	0.52 gph (1.9 Lph)	0.58 gph (2.2 Lph)
50%	0.48 gph (1.8 Lph)	0.69 gph (2.6 Lph)	0.69 gph (2.6 Lph)	0.74 gph (2.8 Lph)
75%	0.66 gph (2.5 Lph)	0.88 gph (3.3 Lph)	0.88 gph (3.3 Lph)	0.94 gph (3.5 Lph)
100%	0.86 gph (3.3 Lph)	1.13 gph (4.2 Lph)	1.13 gph (4.2 Lph)	1.2 gph (4.5 Lph)

Installation Factors

Each generator set is received 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. ELECTRICAILCONNECTIONS: Will all systems, (battery, load, and remote switch) when connected, be compatible with vehicle system?

Each of these installation considerations are 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 start up.

Motor Loads

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

Air conditioning units are perhaps the most common type of motor loads for generator sets in recreational vehicles. The starting characteristics of the different makes of air conditioners vary greatly one particular 12,000 Btu unit has, for example, lower starting requirements than a 10,000 Btu unit of another make. When only one unit is involved, there is usually no starting problem provided, 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. Delayed starting or use of ''easy starting'' devices on air conditioner units should be considered whenever simultaneous starting of more than one motor is involved. The starting and running requirements of some motor loads common to mobile applications are listed in Table 2–1. Use this as a guide when selecting generator set capacity requirements involving motor loads. See Table 2–2 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 Kohler Co., Generator Division, Product Applications Dept., Kohler, WI 53044, Telephone (414) 565–3381.

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

Table 2–1. Motor Requirements

Generator Model	Wattage	Will Operate Air Conditioner of Size Indicated	''Power to Spare'' for Lighting Appliances, Tools
9CCO	9,000	Two, 13,500 Btu	6400 Watts
12.5CCO	12,500	Three 13,500 Btu	6000 Watts
14.5CCO	14,500	Three 13,500 Btu	8000 Watts

Table 2–2. Generator Capacity/Air Conditioner Ratings

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 common electrical appliances are listed in Table 2-3.

Electrical Appliance	Rating (Watts)
Blanket	50-250
Blender	600
Hair Dryer	5 00-1200
Air Circulating Fan	25-100
Furnace Fan	270
Space Heater	750-1500
Water Heater	1500
Pan, Frying	1200
Coffee Percolator	650
Radio	50-100
Television	300-750
Toaster	750-1200

Table 2-3. Appliance Ratings

Kilowatt Derating

All units are rated at 1.0 power factor. The kilowatts of the generator set will decrease 3.5% per 1,000 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 Table 2-4.

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.

Front	1-1/2	(38 mm)
Side	1-1/2	(38 mm)
Top	1-1/2	(38 mm)
Rear	1-1/2	(38 mm)

Table 2-4. Minimum Clearance Requirements

The thickness of insulating and sound deadening material used to line the compartment must be taken into consideration when planning clearances. If necessary, enlarge the compartment so minimum clearance requirements are maintained. The generator set must be securely fastened 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. The same number of bolts as mounting holes in the tray must be used to secure the tray to the support structure. Units not equipped with mounting tray are secured by attaching genset mounts (one in front, two in rear) directly to the vehicle frame. Skid-mounted units can either be affixed to a tray for tray mounting or attached directly to the vehicle frame by the customer. The generator is easily removed from the coach if a carriage with rollers is incorporated into the support structure. See Figure 2-1. 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 when major service is required. See Figure 2-1. Also keep in mind that the compartment door must have air intake openings having a free area of equal to or greater than that specified under "Air Requirements" following.

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

Line the compartment with a good sound deadening material. The material selected must be fireproof or highly resistant to fire. An available type of 3-layer foam material does a very efficient job of absorbing sound. This type of 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. Other materials, such as fiberglass insulation with heat barrier, have also been used successfully in mobile installations.

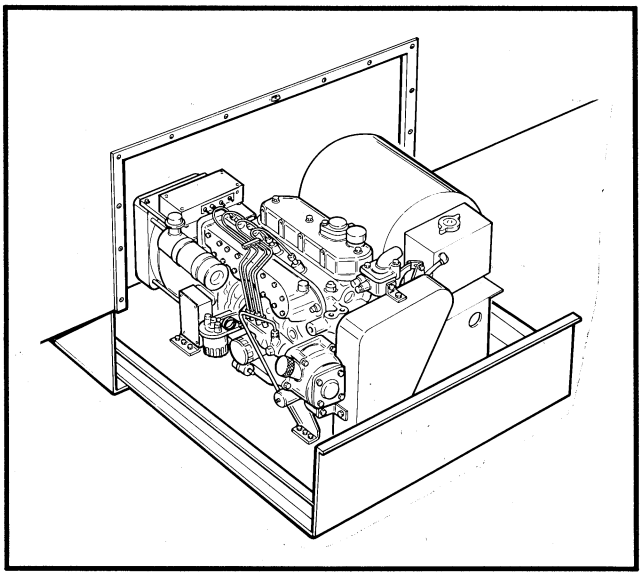


Figure 2-1. Slide Tray Mounting for Ease of Service

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 cooling air. The minimum **free air** opening in the compartment door,for remote radiator models, is shown in Table 2-5. Remember, louvers, screens, and protective decorative grill work definitely restrict the effective air flow. Even a simple, relatively open mesh screen, as shown in Figure 2-2 will restrict air flow as much as 45%. The intake opening must be increased to compensate for such restrictions.

Minimum Air Openings, sq.in. (sq.cm)		
Model	**Inlet**	**Outlet**
12.5/14.5CC0 Remote Radiator	350 (2258)	700 (4517)

Table 2-5. Remote Radiator, Compartment Door Air Opening

Air inlet and discharge openings for in-line radiator mounted models are shown in Figures 2-3 and 2-4. Also shown are required dimensions and positions for engine inlet, generator inlet and bottom discharge openings.

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.

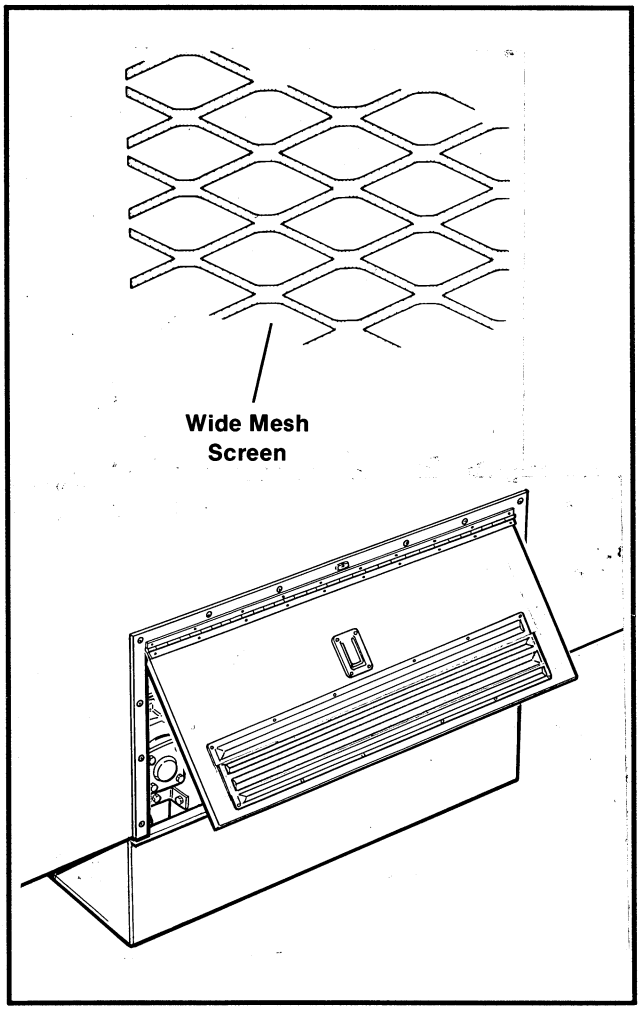


Figure 2-2. Inlet Louvers & Screen

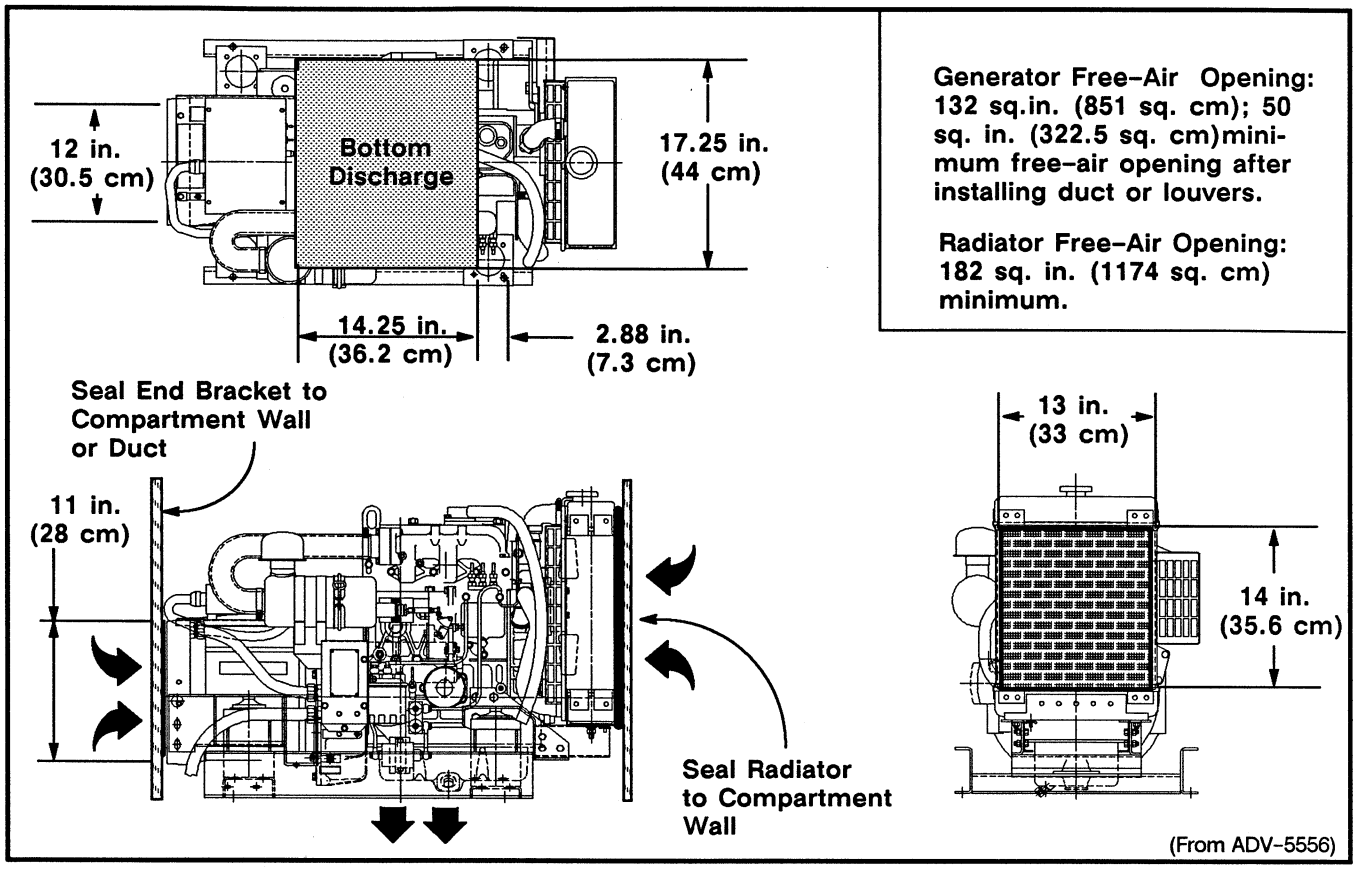


Figure 2-3a. 9CCO Air Flow Requirements - Suction Fan Models

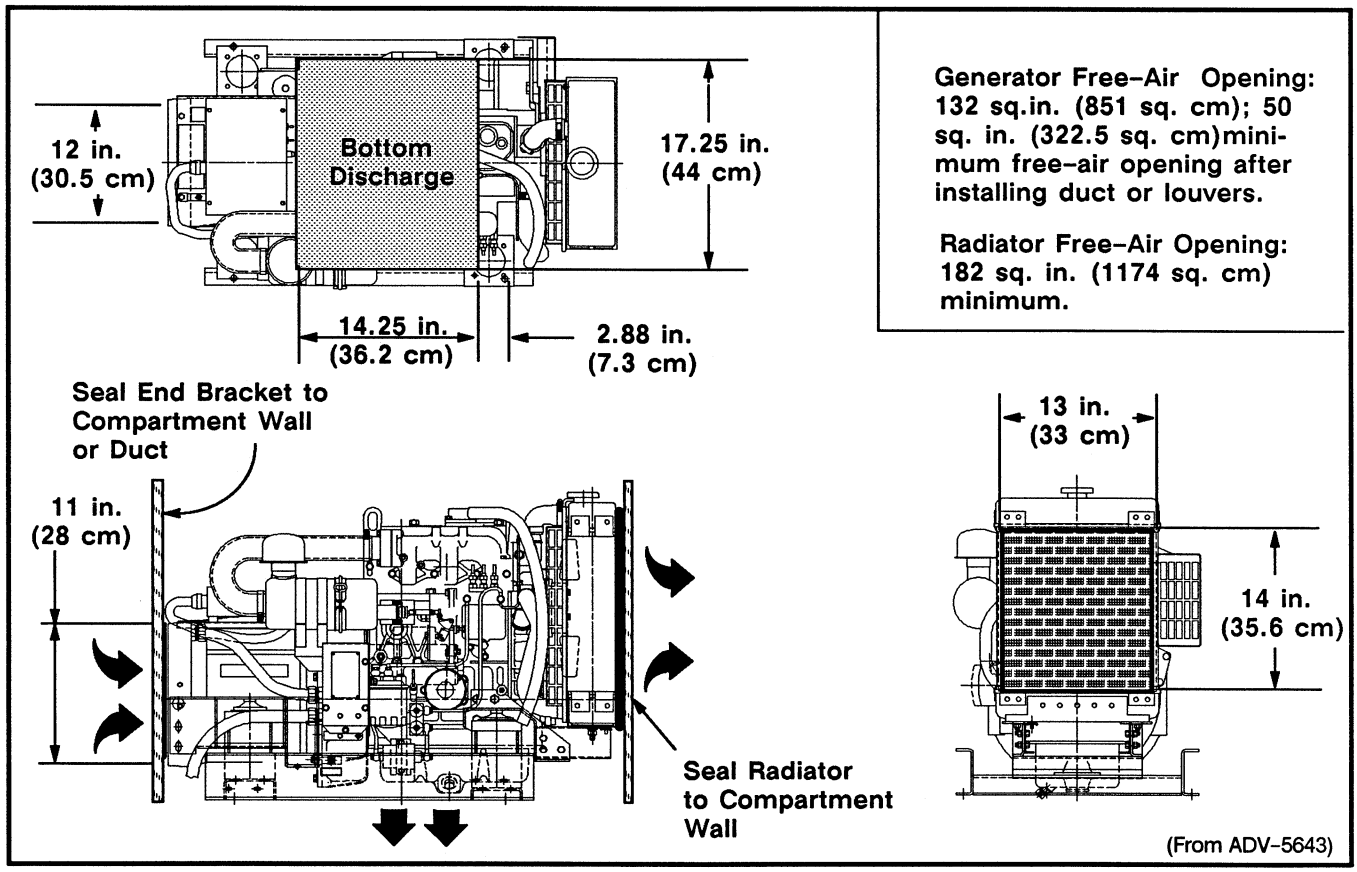


Figure 2-3b. 9CCO Air Flow Requirements - Blower Fan Models

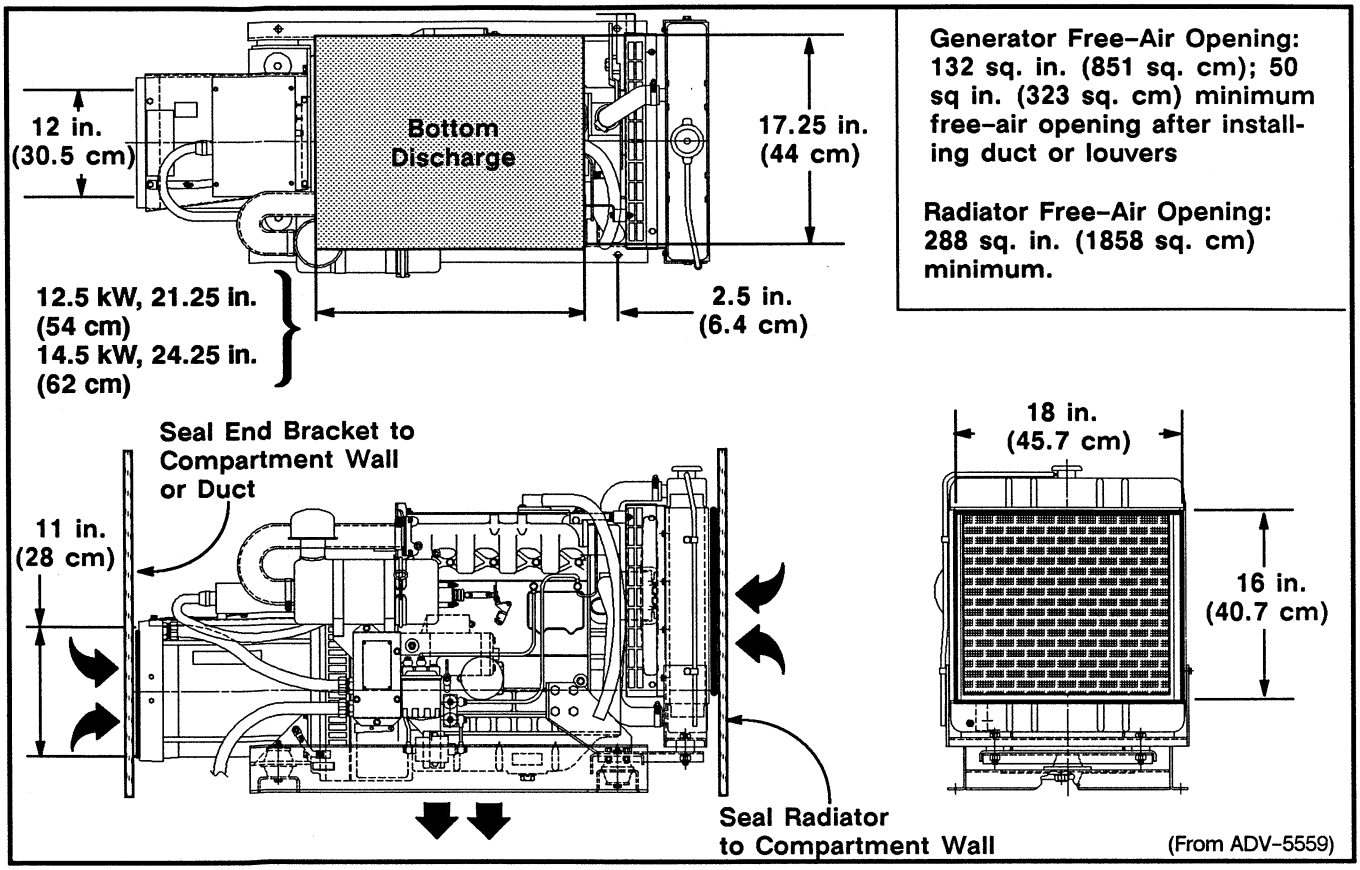


Figure 2-4a. 12.5CCO & 14.5CCO Air Flow Requirements - Suction Fan Models

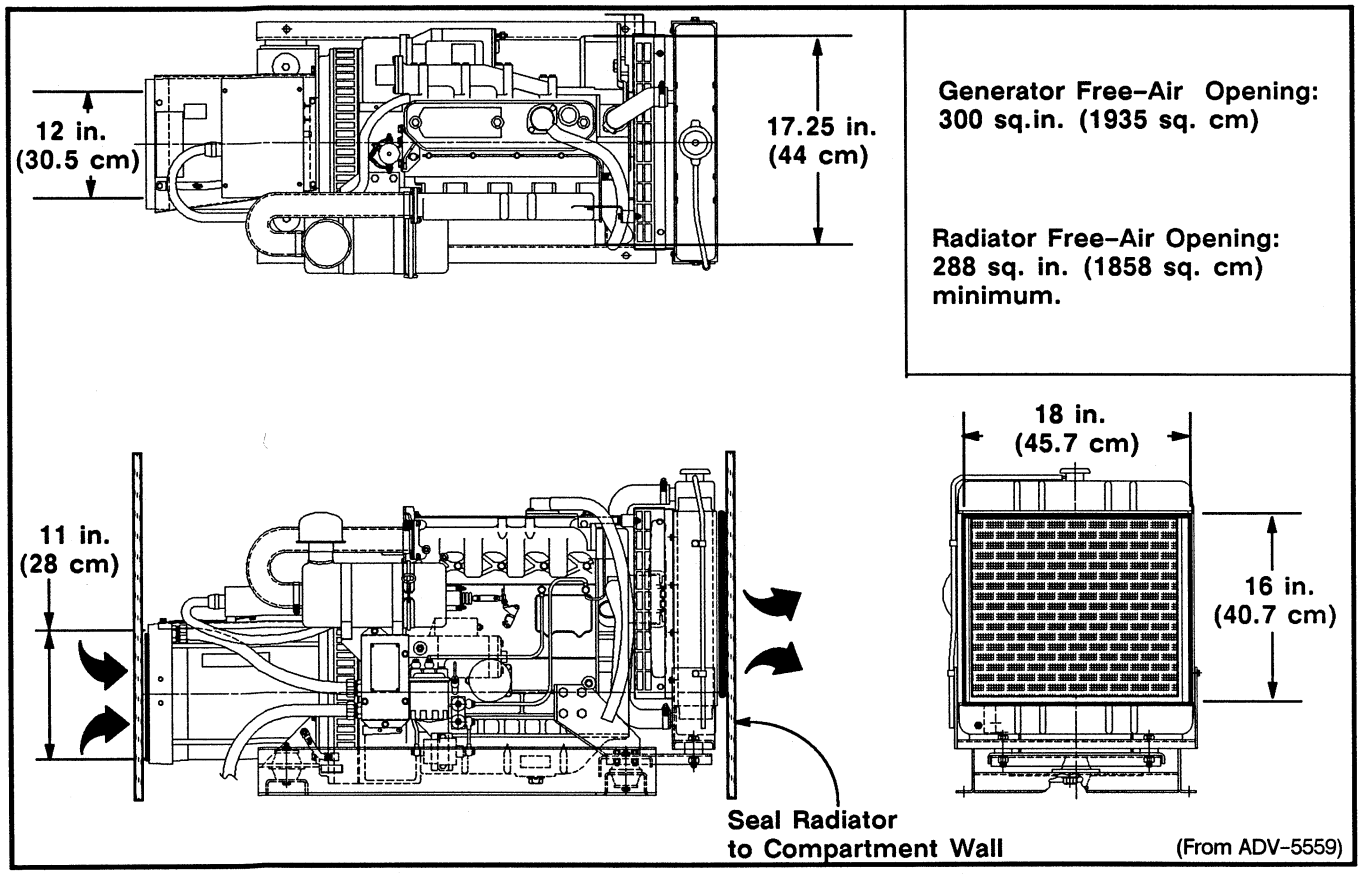


Figure 2-4b. 12.5CCO & 14.5CCO Air Flow Requirements - Blower Fan Models

Remote Radiator Cooling System

Use the following data in designing and installing the generator set cooling system. To insure a safe, effective installation, be sure the cooling system selected follows these parameters. Kohler Generator offers three 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 2–5. 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 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 one and one–half times the size of the radiator core.

NOTE

If the radiator is to be located 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. A supplemental cooling fan capable of 200 cfm (5.66 m3/min) should be installed to supply air to the generator compartment for these requirements.

Connect radiator fan motor to generator output leads L1 and L2 as shown in Figure 2–6. If a non–Kohler radiator assembly is installed, be sure the radiator fan motor rotates in the correct direction and is of the proper voltage. To protect against overload and short circuits, it is recommended that fuses (adequate for the motor used) be installed between the fan motor and the L1/L2 connections.

NOTE

The cooling system fill (radiator or expansion tank) must be the highest point in the cooling system. (See Figure 2-7.) 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 cooling system design and 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 generator cooling system.

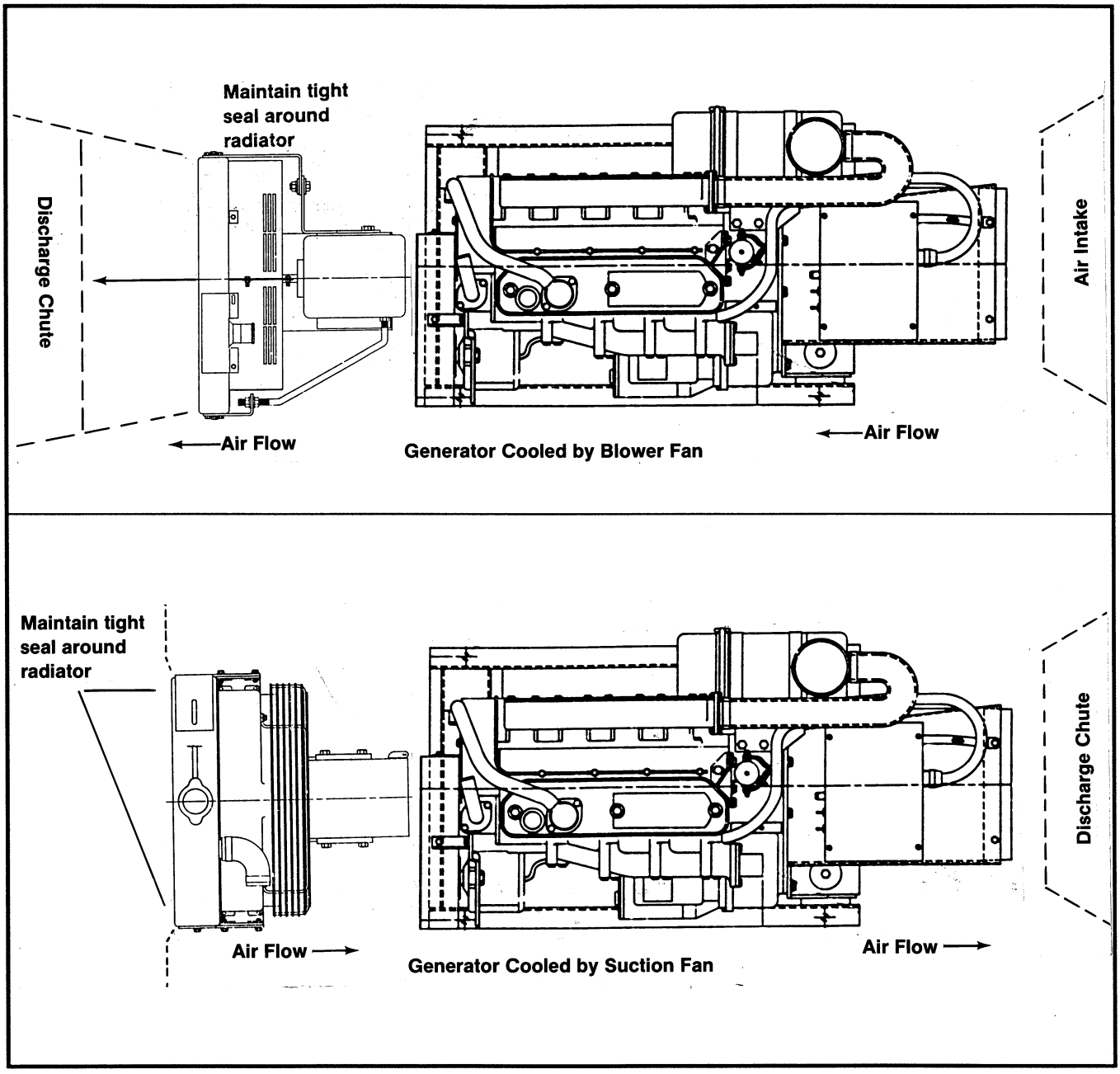


Figure 2-5a. Typical Cooling System Installations - Remote Radiator in Generator Compartment

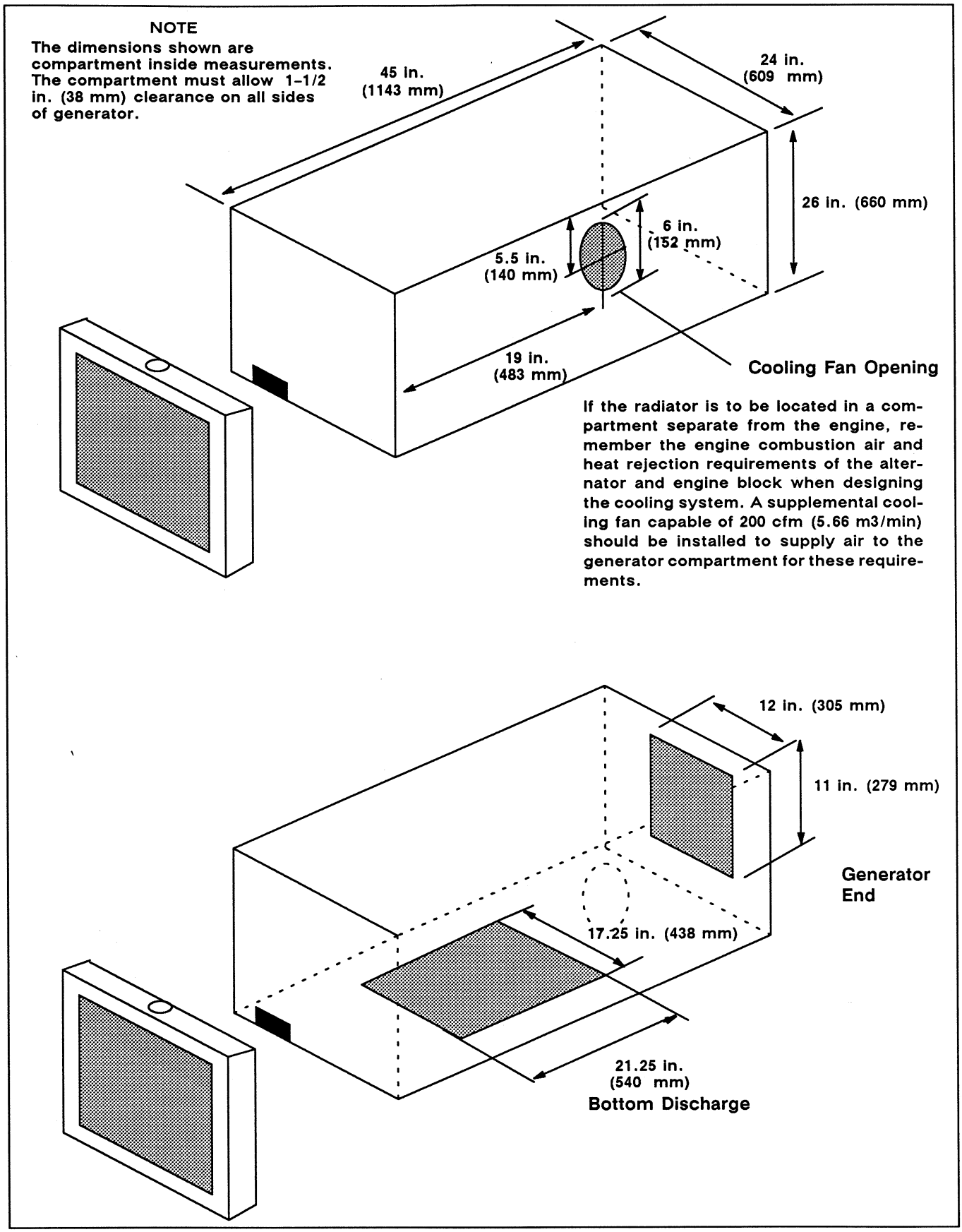


Figure 2-5b. Typical Cooling System Installation - Remote Radiator Mounted Outside Generator Compartment

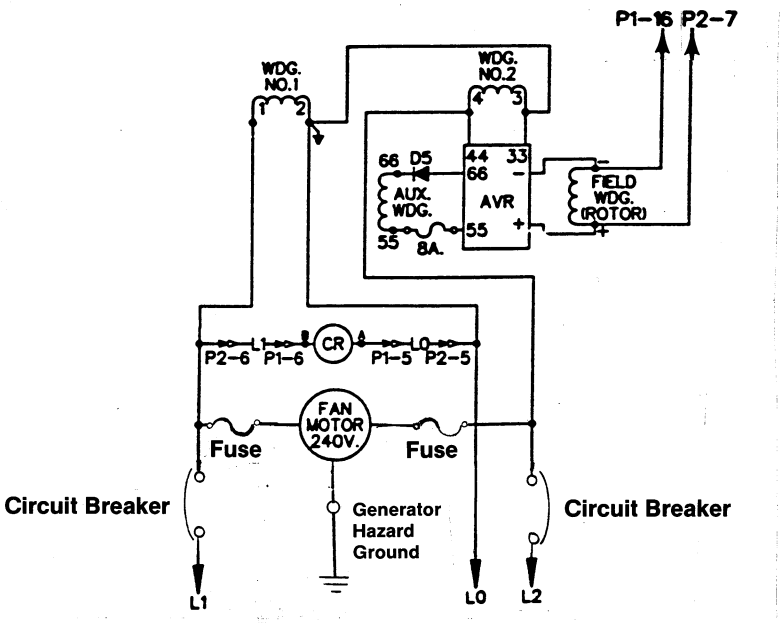


Figure 2-6. Radiator Fan Electrical Connections

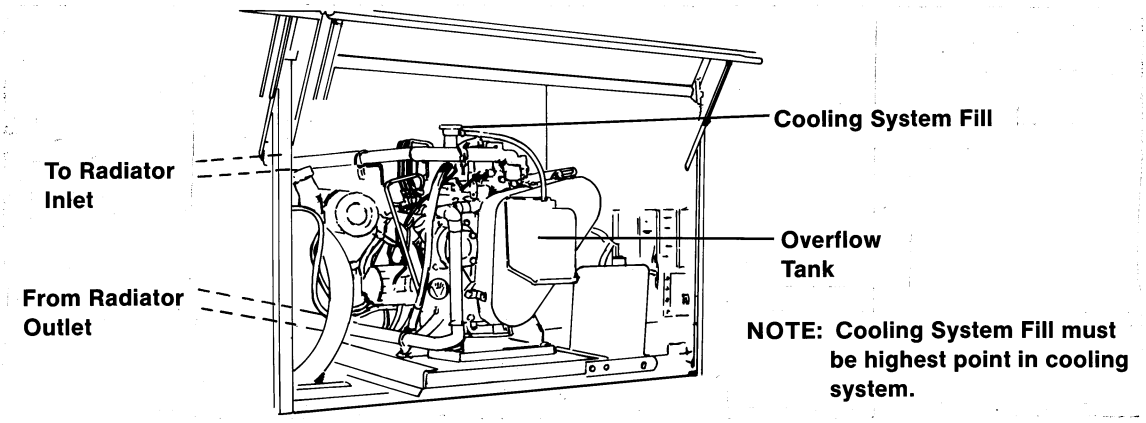


Figure 2-7. Cooling System Fill

12.5 and 14.5CCO Cooling System

Cooling System Components

Radiator with Motor–Driven Blower Fan ..... Kohler Part No. PAA–258570
(Does not include radiator fill cap;
installer to provide fill/expansion tank.
Includes mounting brackets).

Radiator with Motor–Driven Suction Fan ..... Kohler Part No. PAB–258598
(Includes mounting brackets)

Radiator Assembly (alone) ..... Kohler Part No. A–258591

Radiator Hose Adapter*, ... Kohler Part No. 259491
1.25 in. hose (I.D.) to 1.5 in. hose (I.D.)

Radiator Hose Adapter*, ... Kohler Part No. 259492
1.25 in. hose (I.D.) to 1.75 in. hose (I.D.)
*One required for installation of listed radiator assemblies

Radiator Specifications
(radiators designed to meet these criteria)

Water Flow ..... 12 gpm (46 Lpm)
Heat Rejection ..... 1150 Btu/min.
Air Flow ..... 3000 cfm (85 m 3/min.)
Radiator Pressure Drop ..... 0.04 psi (.275 kPa)
Air to Boil (ATB) ..... 125° F (51.6° C)
Radiator Cap Pressure ..... 7 psi (48.2 kPa)
Coolant Capacity ..... 16 qts. (15.1 L)**
Dimensions ..... See Installation Drawings
**Radiator capacity only. Total cooling system capacity affected by radiator hose length.

Cooling System Specifications
(Design cooling system and compartment so generator set meets these specifications)

Engine Inlet Water Temperature (maximum) ..... 186° F (85.5° C)
Engine Outlet Water Temperature (maximum) ..... 196° F (91.1° C)
Engine Oil Temperature (maximum) ..... 250° F (121.1° C)
Combustion Air Temperature ..... 120° F (48.8°C) or 15° F (–9.4° C) Over Ambient

NOTE

Ambient temperature is defined as the temperature of the generator operating environment. In RV applications, ambient temperature is the temperature inside the generator compartment.

Other Pertinent Information

Thermostat Rating (Yanmar Engine)
Start to Open ..... 157° F (69.5° C)
High Water Temperature Switch Rating (Yanmar Engine) ..... 230° F (110° C)
Maximum Distance Radiator to Generator Set (4–Cyl.) ..... 10 ft. (9 m)
Generator Set Dimensions ..... See Installation Drawings

Fuel System

The diesel fuel system for the generator set must be designed to operate independently of the system for 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 2-8. 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.

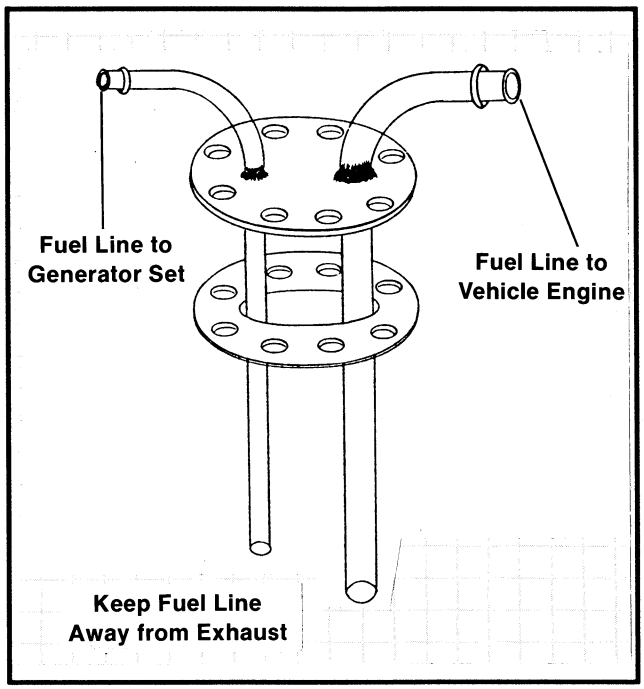


Figure 2-8. Two Dip Tubes in Fuel Tank

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. The tee arrangement should be avoided or used only as a last resort.

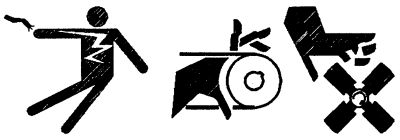
Care must be taken when routing the fuel line from the main tank to the generator set. Keep fuel lines as short as possible but maintain adequate clearance from exhaust system. Fuel lines must be run along the frame or under carriage never run fuel lines inside the coach. Locate fuel lines below the generator set compartment with entry point near fuel pump. 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, it should be 1/8 in. (3.2 mm) I.P. (minimum) with an 8 in. (203 mm) (minimum) flexible section to allow free movement of the generator set.

⚠ CAUTION

Hot generator 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 mounting tray. If sub-flooring is used, cut a corresponding hole in the sub-flooring for drain opening.

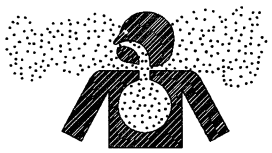
Exhaust System

Carefully plan the generator exhaust system to insure 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

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



⚠ WARNING

Carbon monoxide can cause death, severe nausea or fainting. Do not operate generator set with a faulty exhaust system or obstructed exhaust outlet. Never operate generator where exhaust gas could deflect into your vehicle or adjacent vehicles and buildings. Avoid breathing exhaust fumes when working on or near the generator set. The exhaust system must be installed as prescribed in equipment manual.

Carbon monoxide can cause death, severe nausea or fainting. Install exhaust system tail pipe so discharged exhaust cannot be drawn into vehicle through doors, windows, air conditioners, etc. Do not use flexible tail piping since flexible piping may break and allow exhaust gas to enter the vehicle.

NOTE

Suspend exhaust system components beneath 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. (46 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 genset 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 kept to a minimum. Use a tail pipe with as few gradual bends as possible to reduce back pressure; maximum back pressure allowed is 16 in. 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.

Electrical Connections

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 locations. If the coach is equipped with a mechanism for removing the generator from the compartment for servicing, be sure all wiring is long enough to allow free movement of the set. Some other points to consider when making AC load connections are covered in the following.

NOTE

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

Battery and Connections

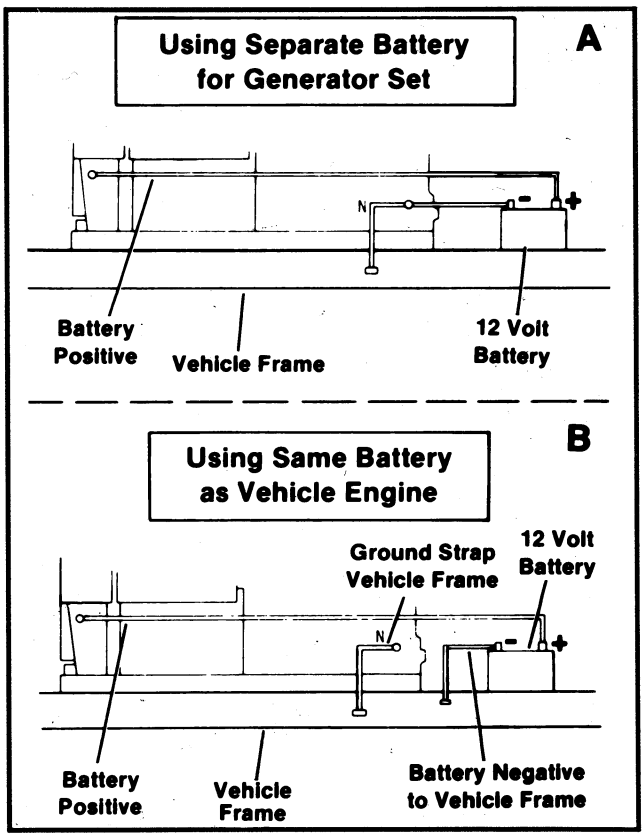


Figure 2-9. Battery Connection Details

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 Table 2-6 for lengths and sizes. Refer to Figure 2-9 (View A) for cable connections note that a grounding 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 2-9.

Distance Between Generator Set & Battery	Cable Size (AWG) At 0° F (-18° C)	At 32° F (0° C)	At 75° F (24° C)
40 Feet (12.2 m)	00	0	1
30 Feet (9.2 m)	0	1	2
25 Feet (7.6 m)	1	2	4
20 Feet (6.1 m)	2	2	6
15 Feet (4.6 m)	2	4	6
10 Feet (3.0 m)	4	6	8
5 Feet (1.5 m)	6	6	8
2.5 Feet (0.8 m)	8	8	8

Table 2-6. Battery Cable Size

⚠ WARNING

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

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" leads (or black) must be completely isolated from the generator set when power is switched to the outside source. See Figure 2-10.

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. A ground-fault circuit interrupter should be installed 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.

Remote Switch Connections

Early Controllers (without accessory plug P2)

Connection of customer supplied accessories (Start/Stop switch, preheat switch, hourmeter, generator "ON" lamp) is accomplished by connecting the remote wiring to the controller terminal strip. Route remote harness leads through grommet in controller and connect to the terminal strip using spade or eyelet terminals. If an hourmeter is to be connected, use the same terminal as the generator "ON" lamp. Remote wiring harnesses in various lengths are available. Refer to the wiring diagram for proper connections.

In some applications, accessory wiring is connected to the junction box mounted in the generator or baggage compartment. The coach manufacturer will provide a special accessory wiring harness for connection at this location. Access to the controller terminal strip is unnecessary if this method is used.

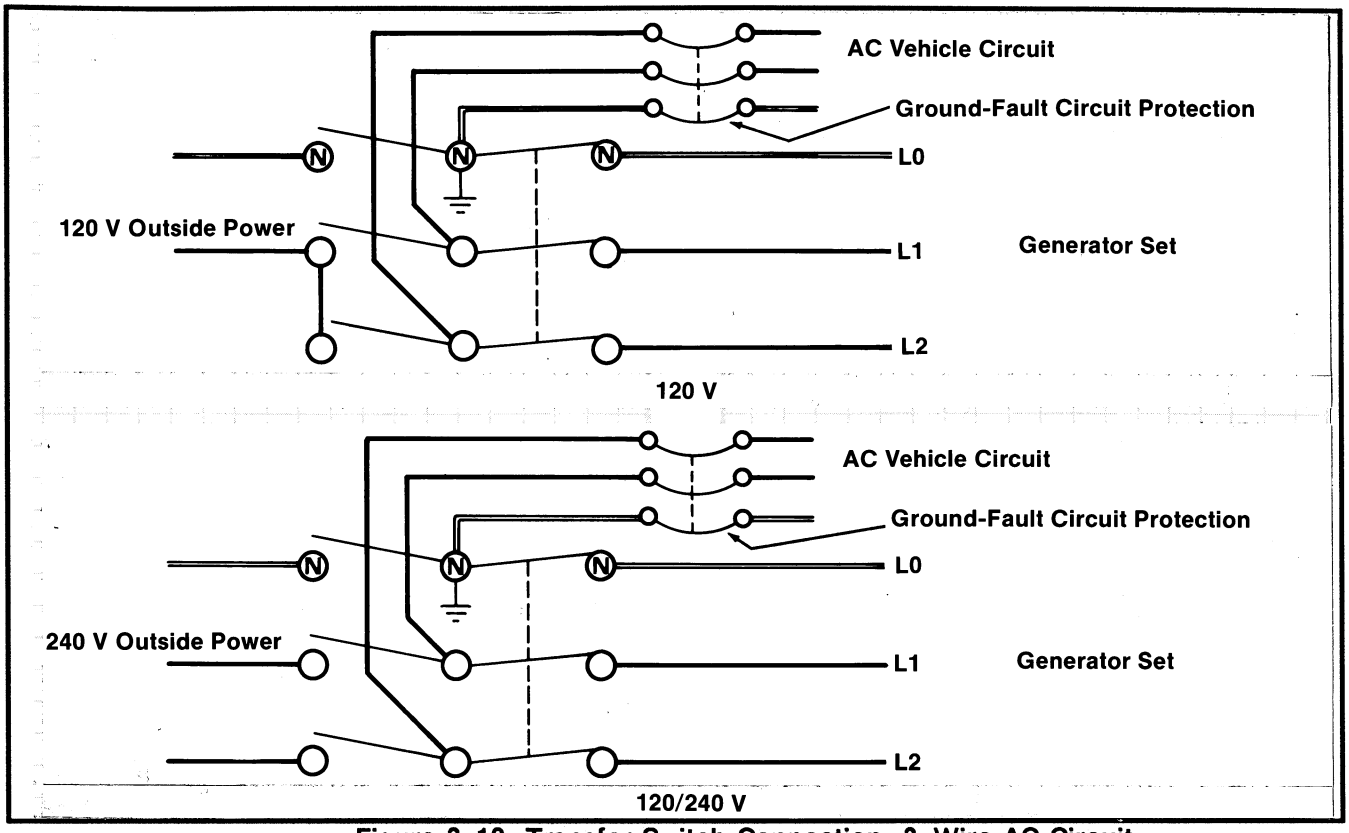
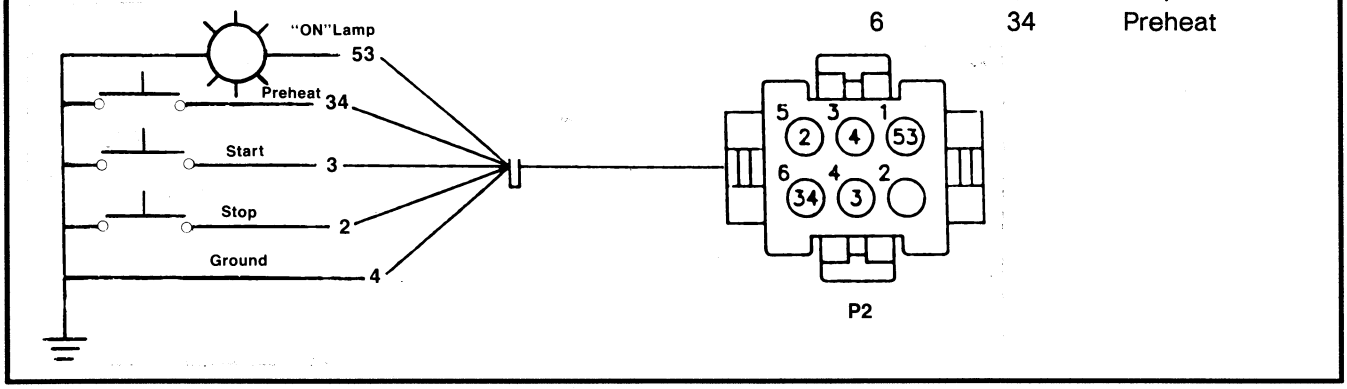


Figure 2-10. Transfer Switch Connection, 3-Wire AC Circuit

Later Controllers (with accessory plug P2)

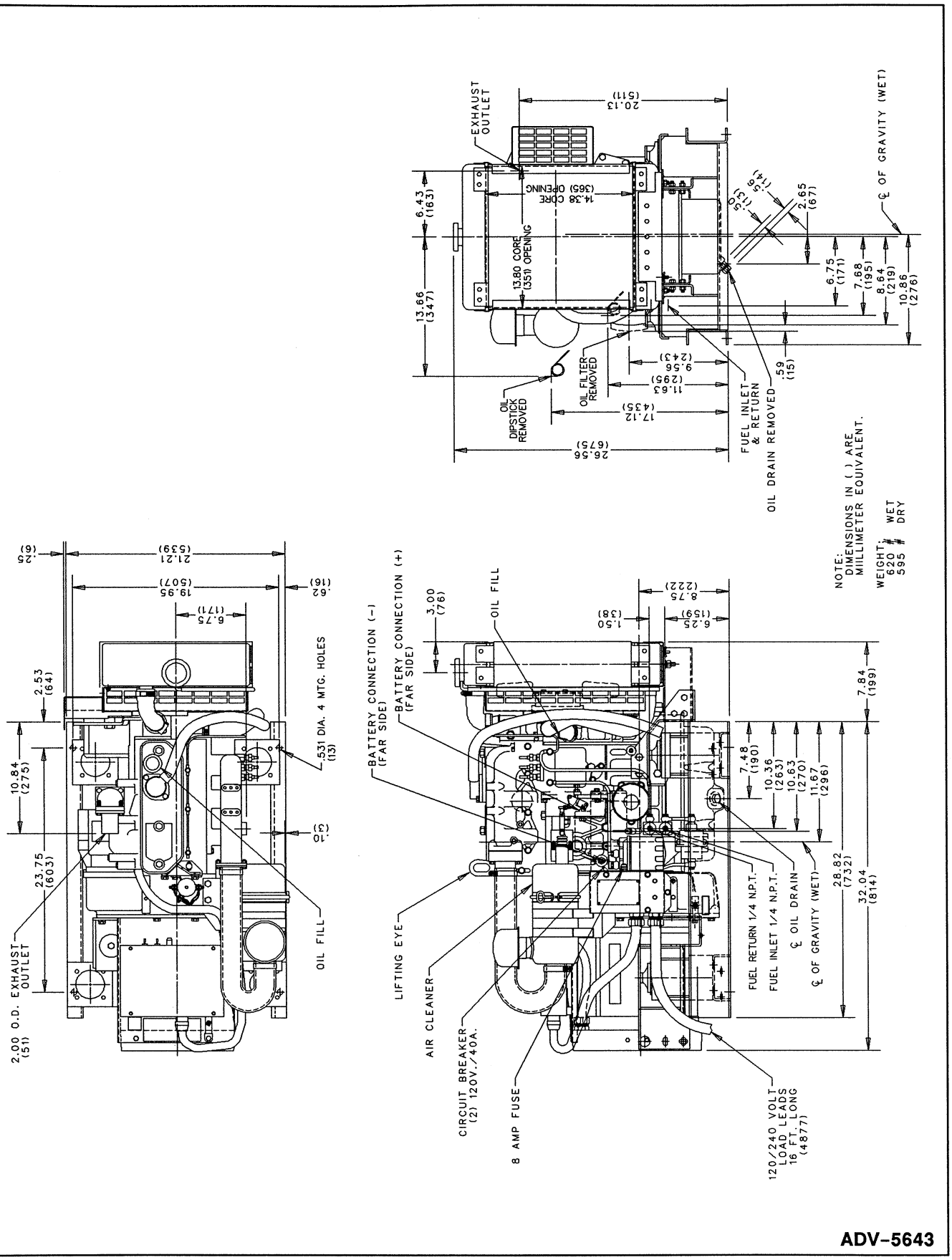
Later model controllers include an accessory plug (P2) for easy connection of the remote switch, preheat switch, and generator ''ON'' lamp wiring harness (available separately). One end of the 12 in. (30.5 cm) P2 wiring harness plugs directly into the controller. The ''pigtail'' leads on the remaining 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 P2 wire harness lead. See figure 2-11 for identification of P2 harness leads.



Pin No.	Lead No.	Function
1	53	Gen ''ON'' lamp
2		Not Used
3	4	Ground
4	3	Start
5	2	Stop
6	34	Preheat

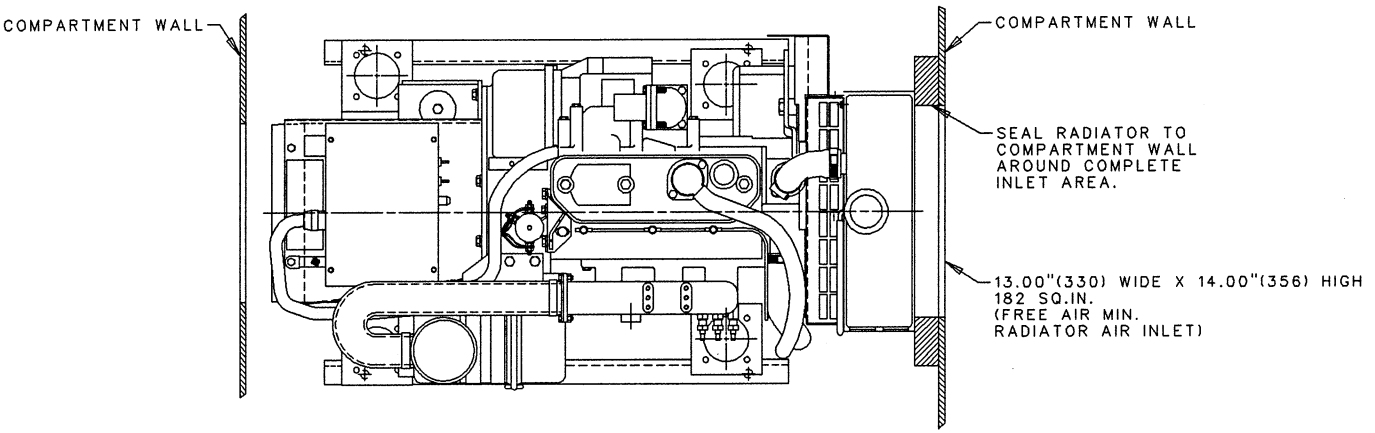
Figure 2-11. Remote Panel Wiring (P2 Wiring Harness)

Dimension Drawings

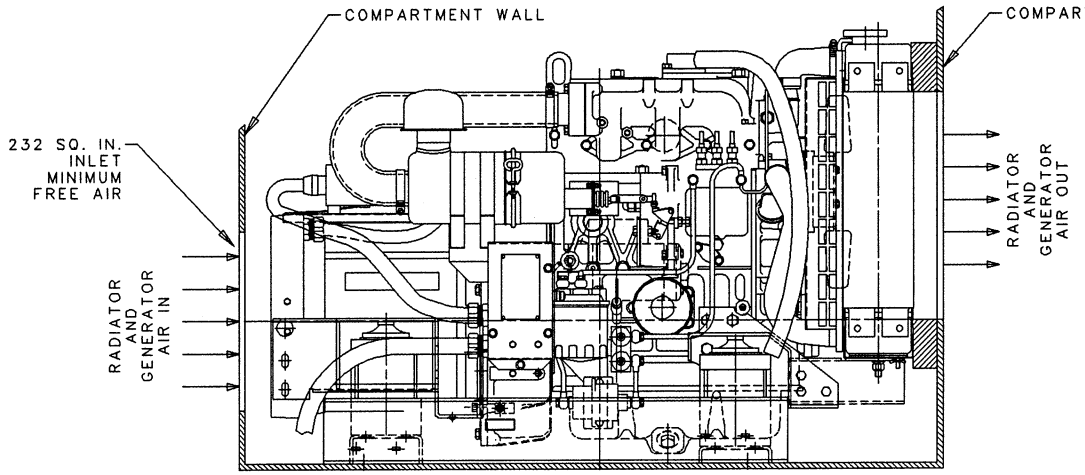


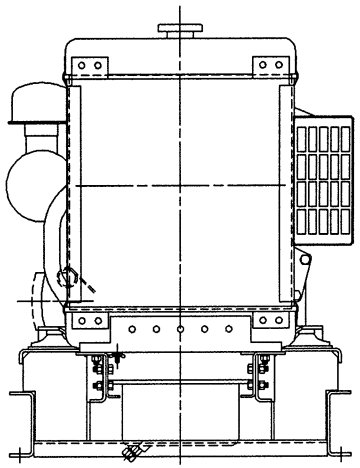
ADV-5643

9CCO – Skid Mounted Radiator w/ Blower Fan



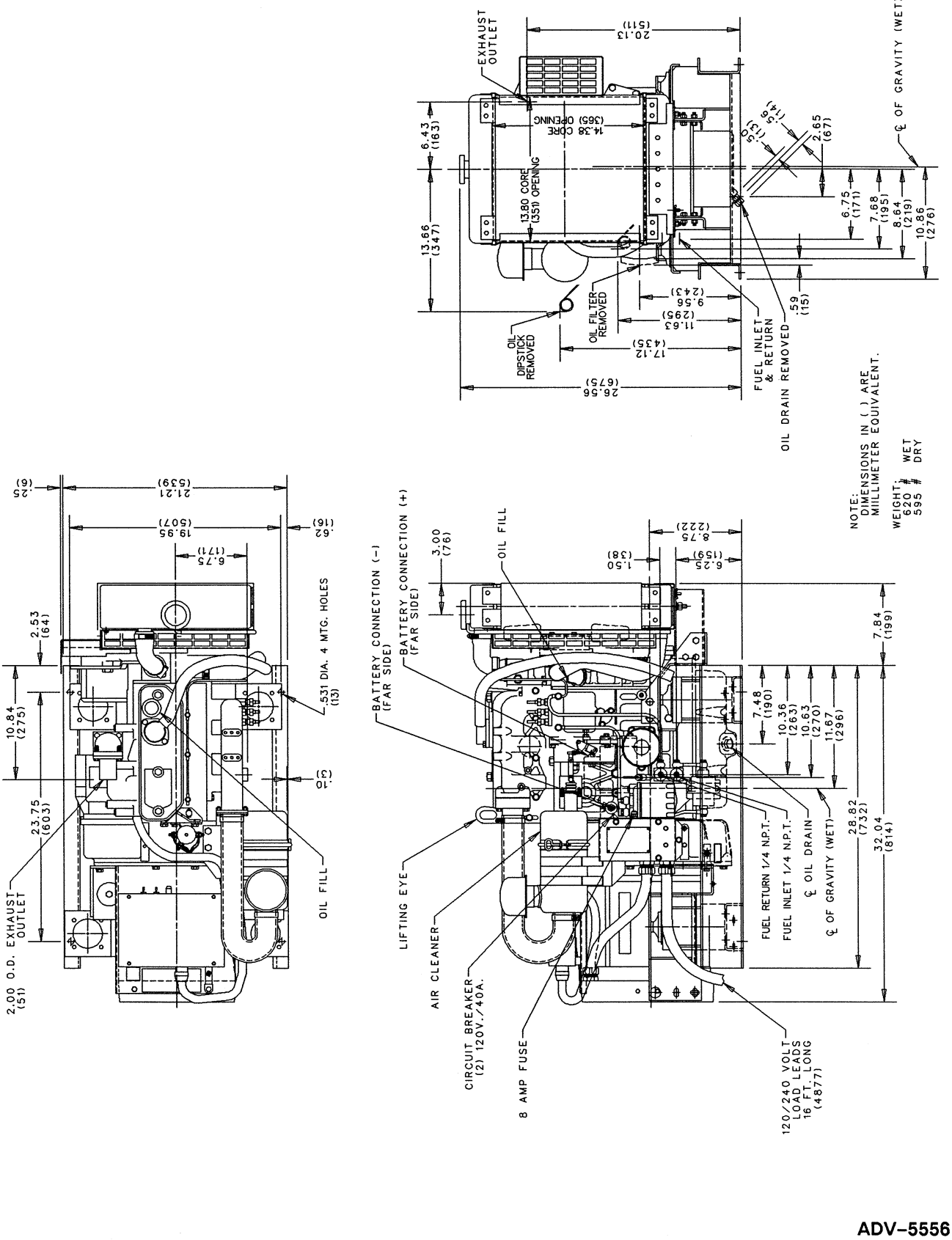
NOTE:
IDEAL COMPARTMENT SIZE IS GENSET DIMENSIONS PLUS 1.5"(38) CLEARANCE ON ALL SIDES. THIS GIVES THE GREATEST EXCHANGE OF AIR AND BETTER COOLING.



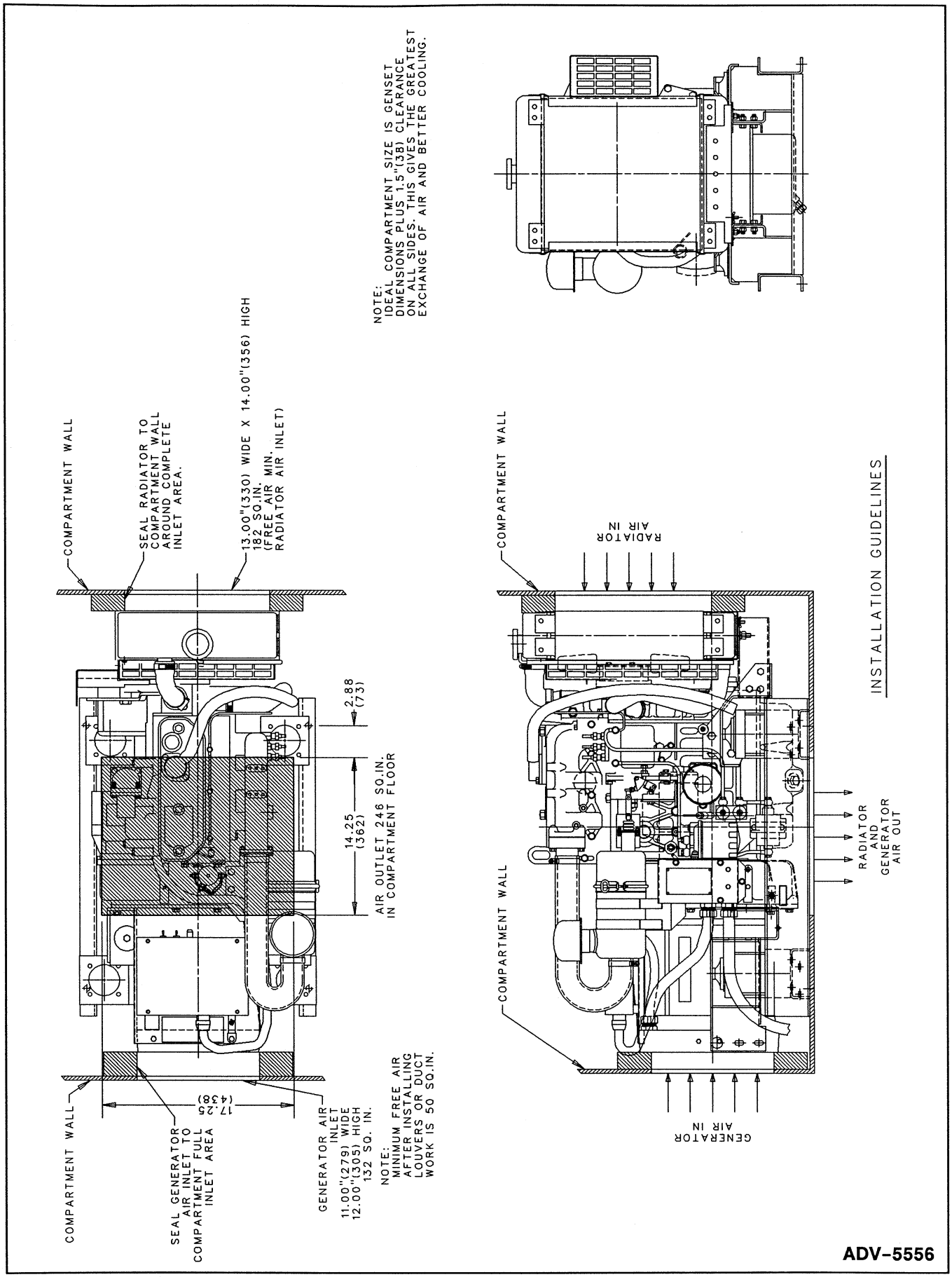


INSTALLATION GUIDELINES

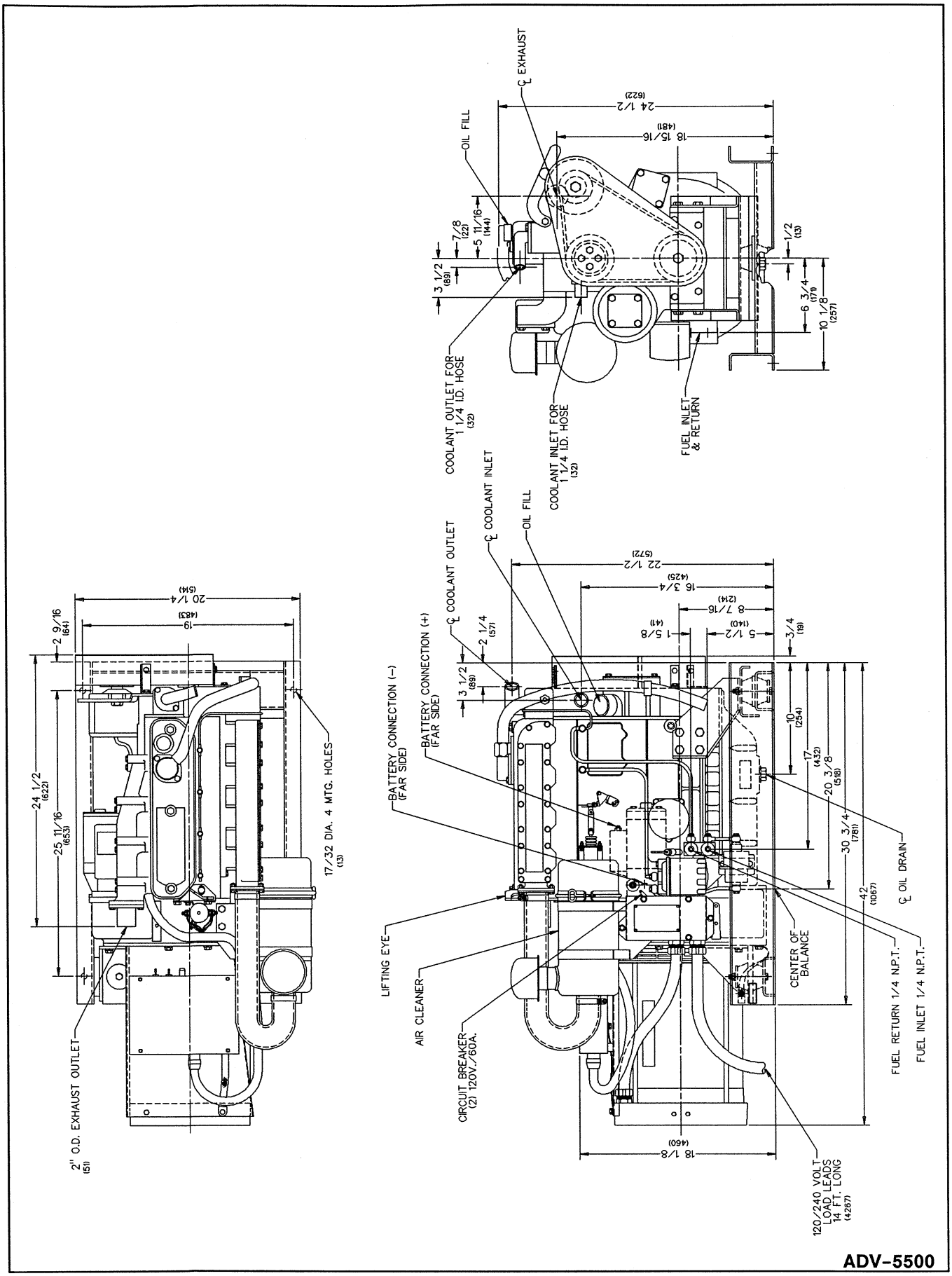
ADV-5643



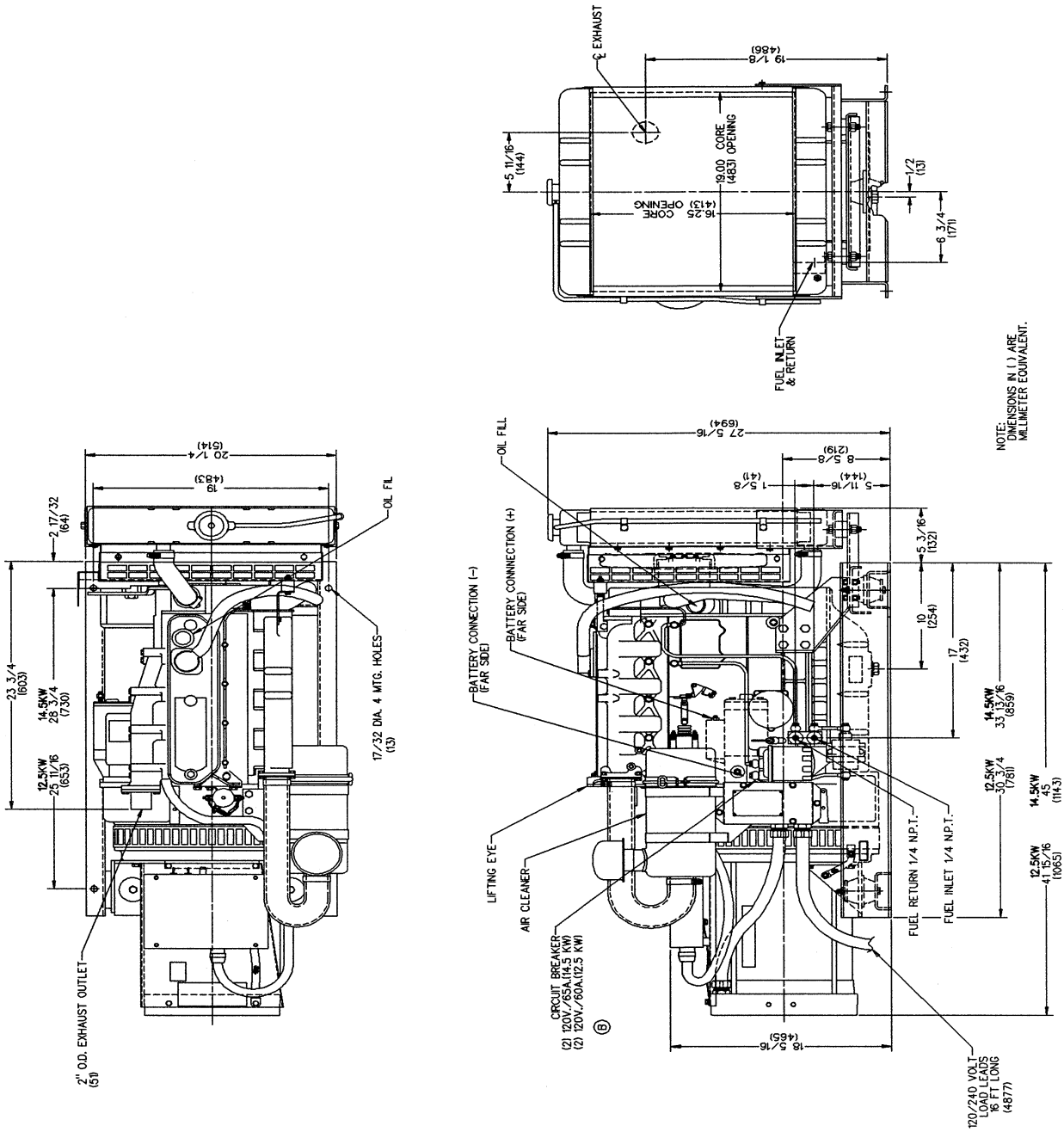
9CCO - Skid-Mounted Radiator w/Suction Fan



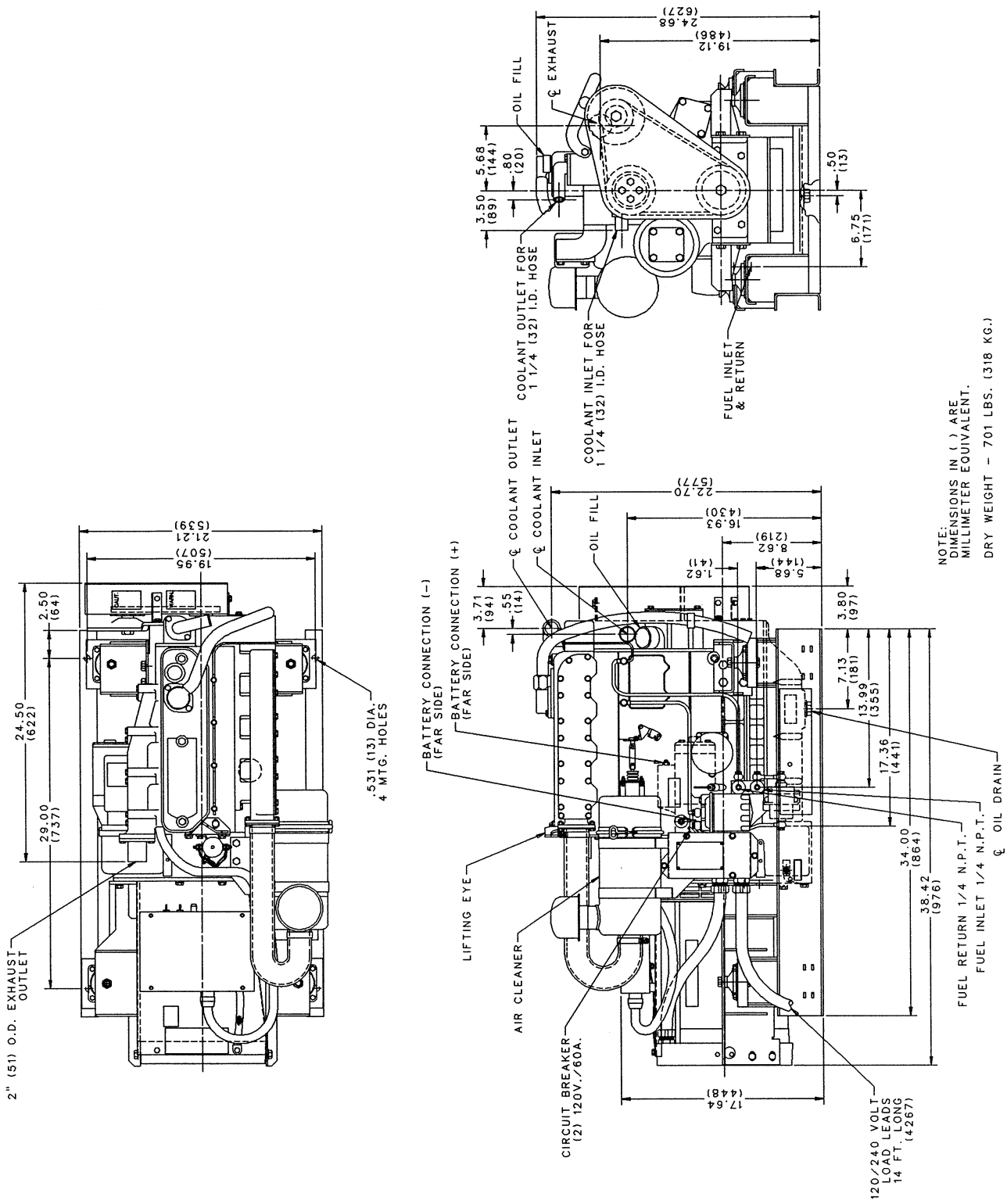
9CCO Skid Mounted Radiator w/Suction Fan - Installation Guidelines



12.5CCO Skid Mounted Model, Remote Radiator - Specification 135014



12.5CCO, 14.5CCO Skid Mounted Radiator - Specifications 135021, 135022



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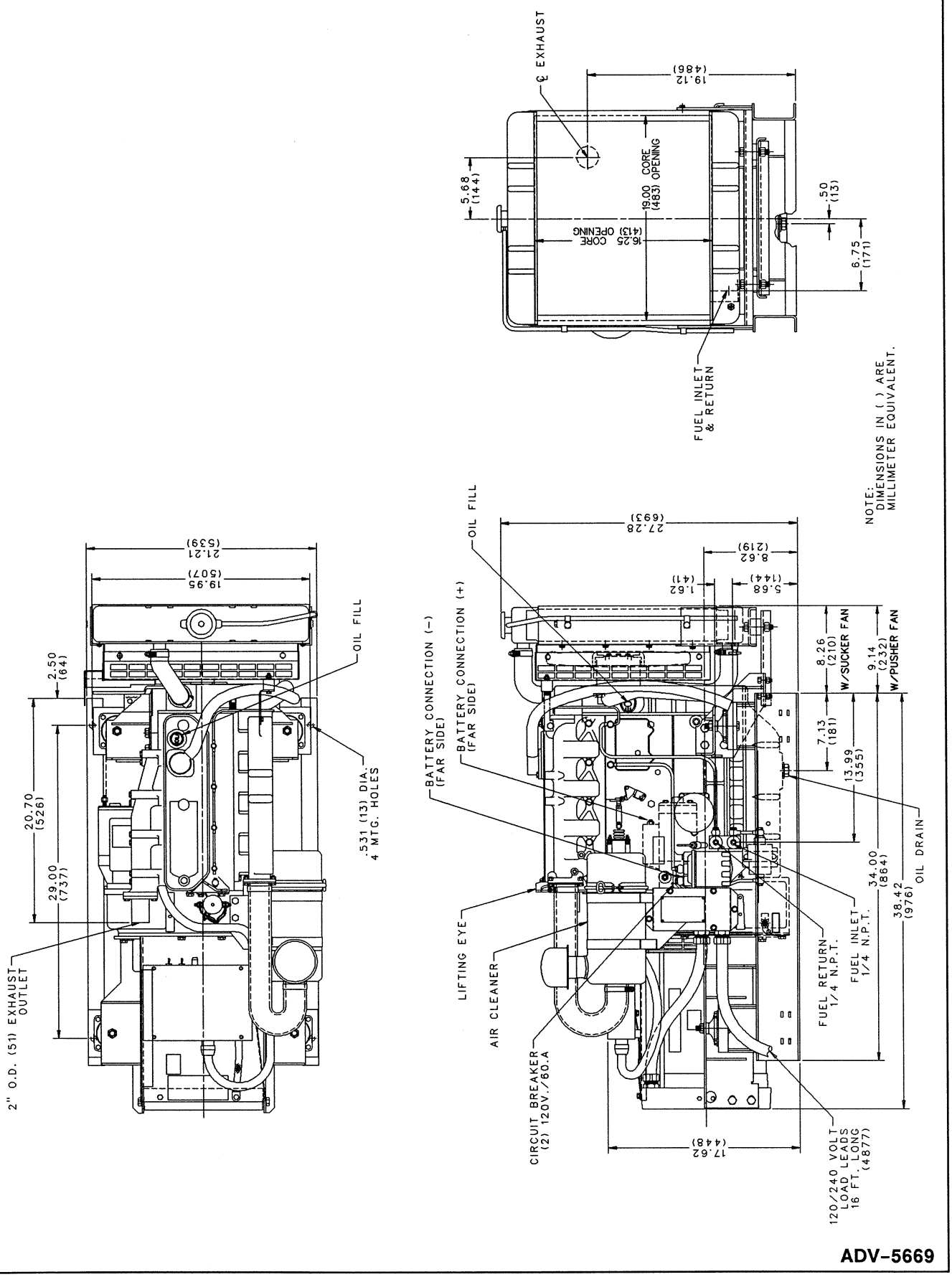
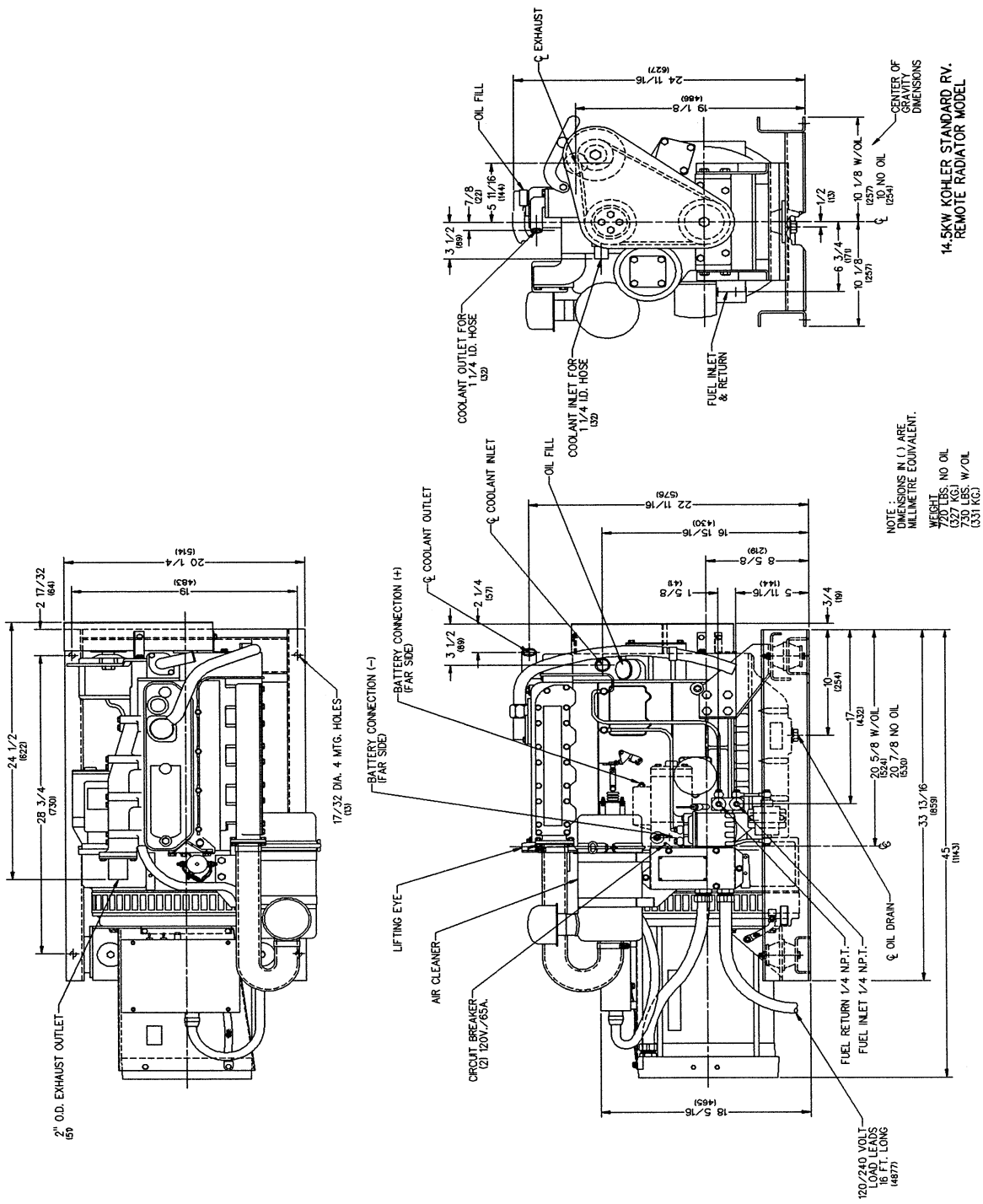
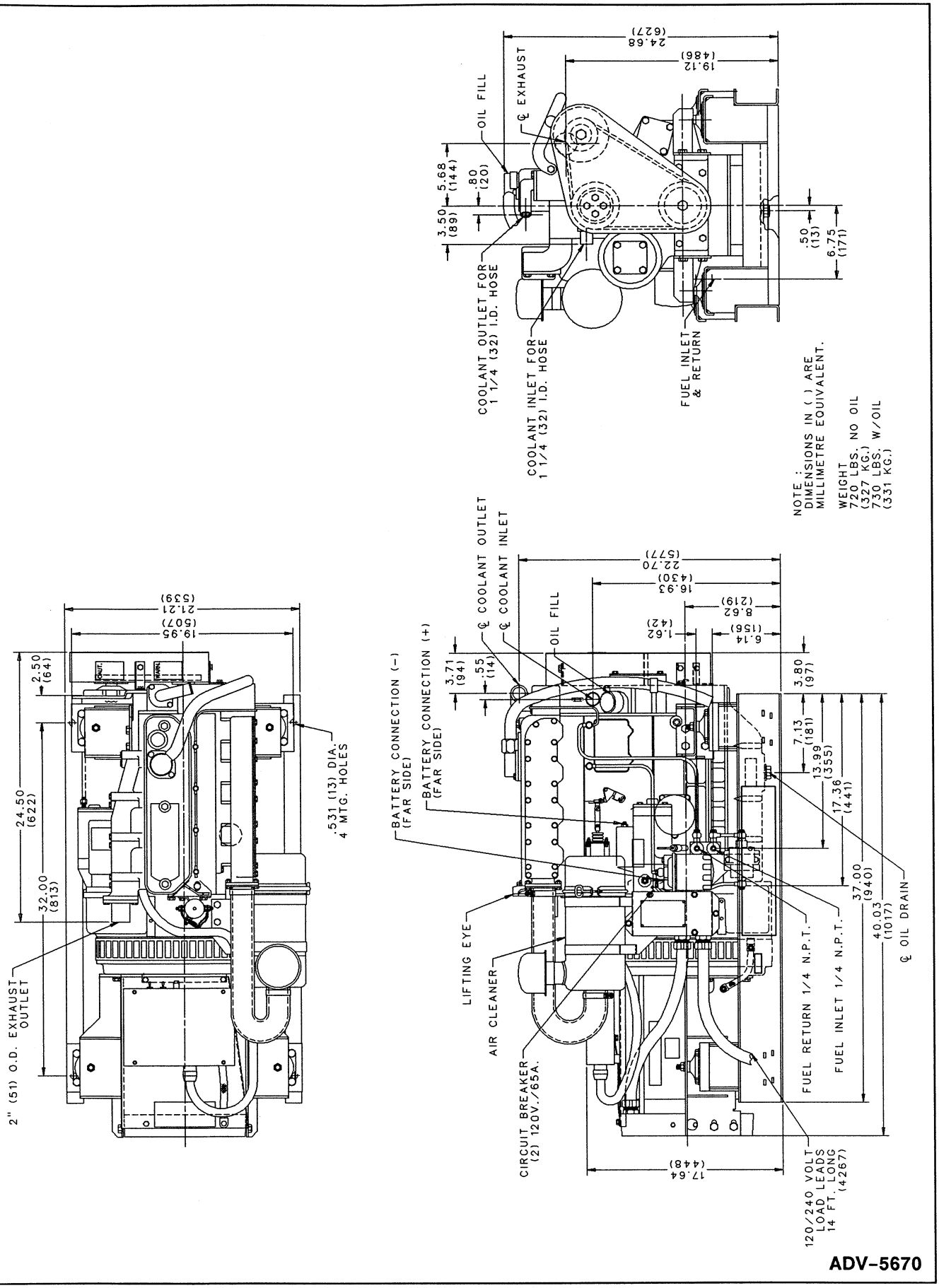
12.5CCO Skid Mount w/ Remote Radiator (Centerline Mtg.) – Specification 135024



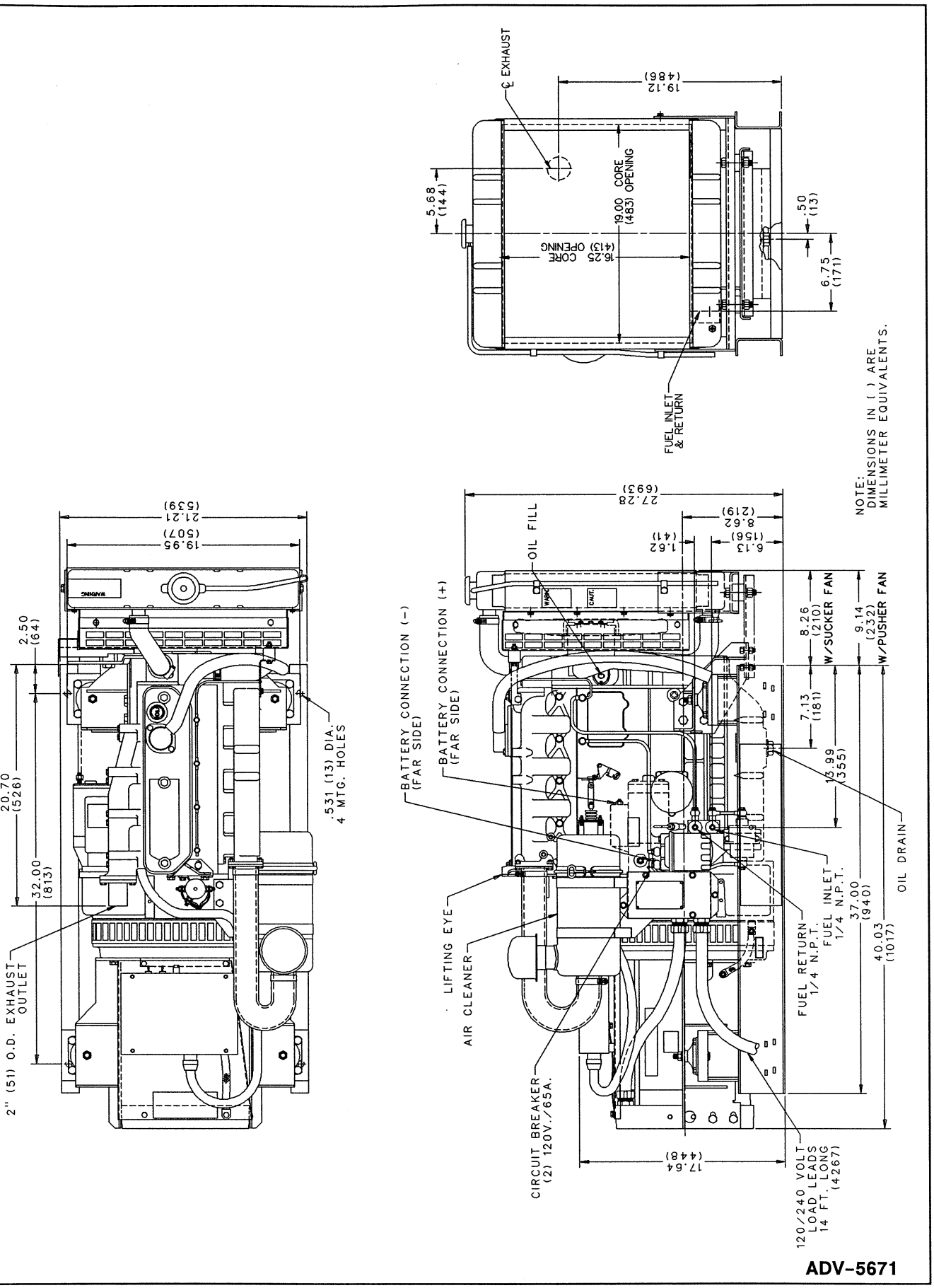
12.5CCO Skid Mount w/Remote Radiator (Centerline Mtg.), Specifications 135025, 135026



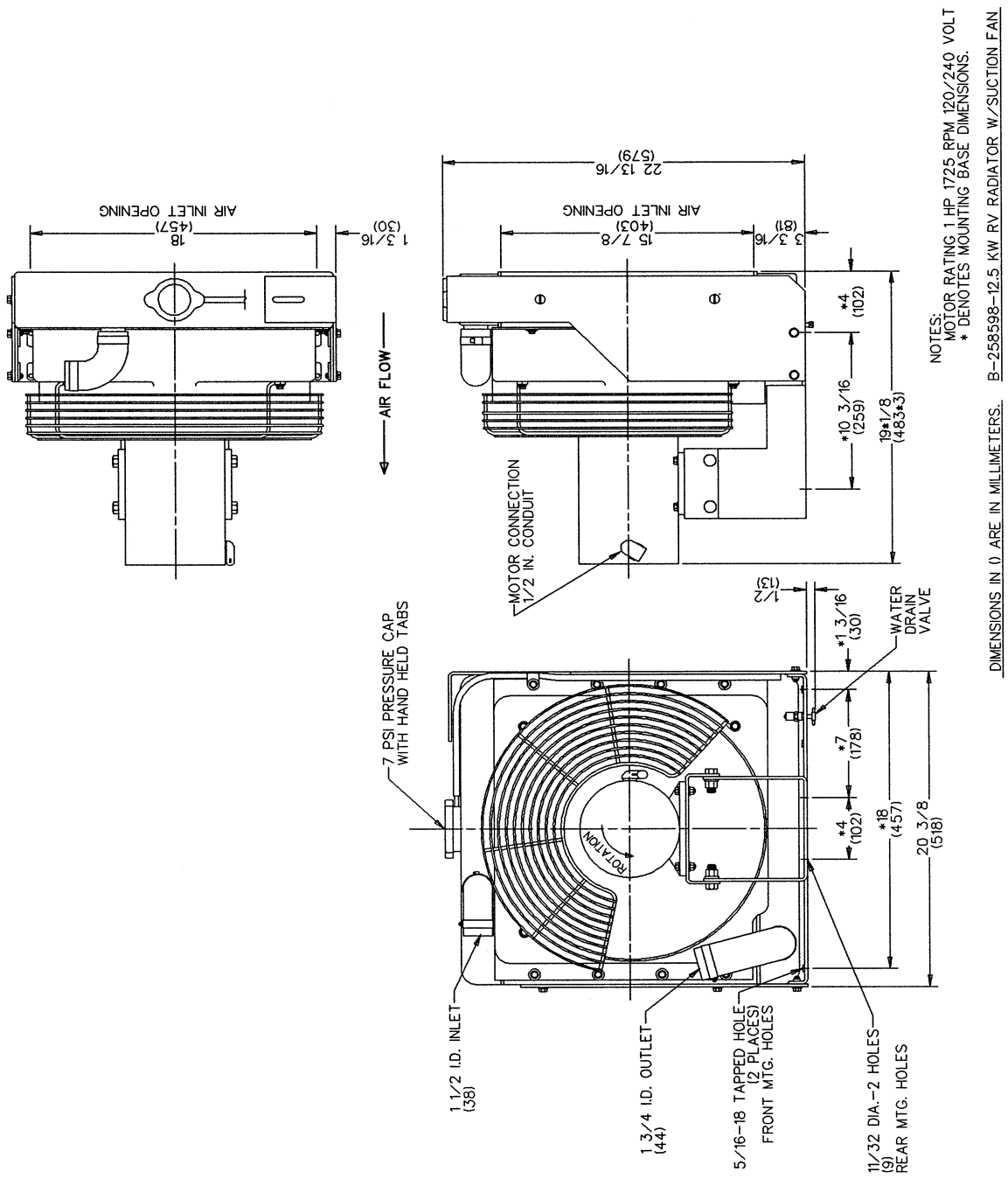
14.5CCO Skid Mounted Model w/Remote Radiator - Specification 135017



14.5CCO Skid Mounting w/Remote Radiator (Centerline Mounting) - Specification 135027

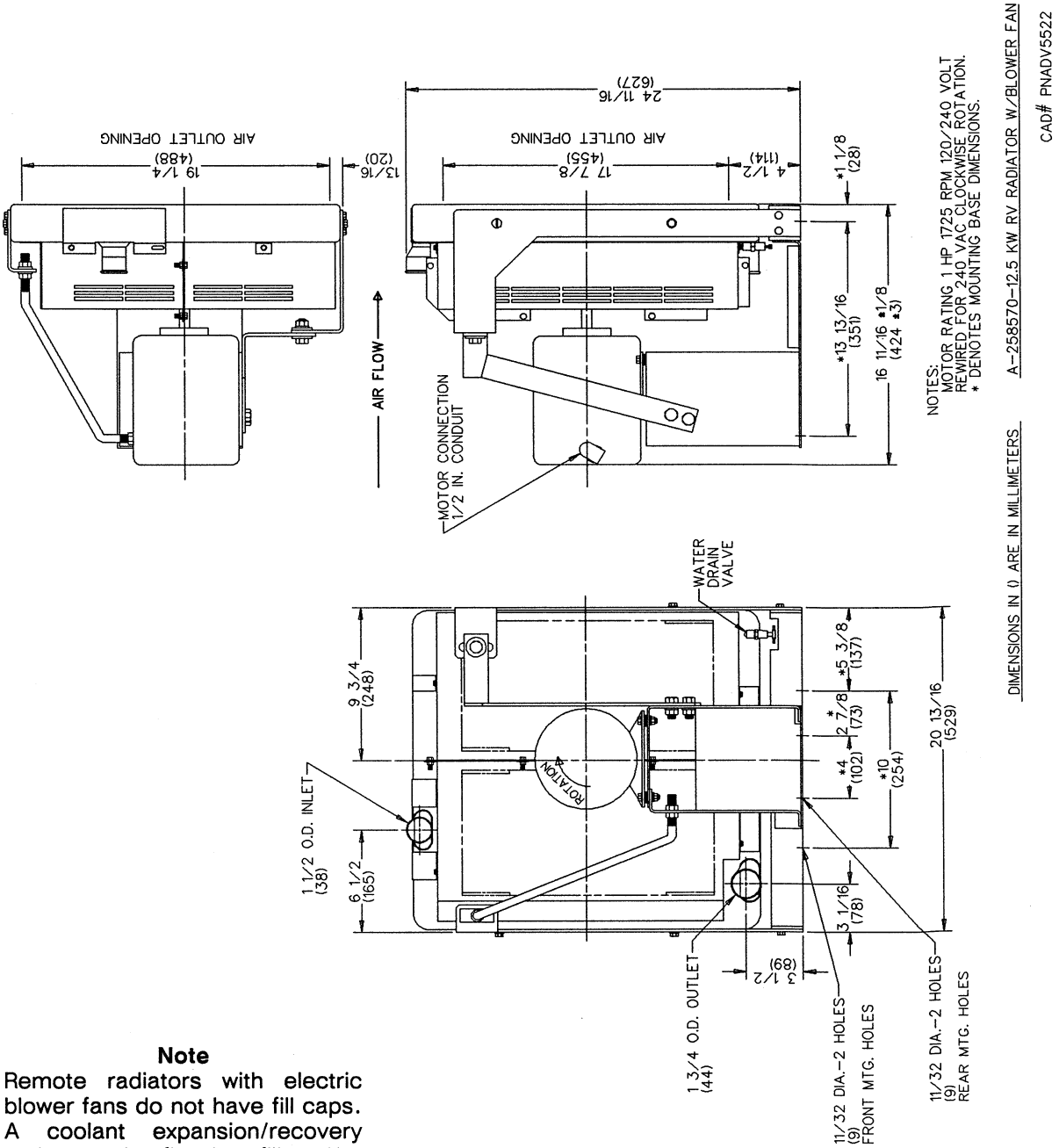


14.5CCO Skid Mount Radiator w/Pusher/Sucker Fan (Centerline Mtg.) - Specifications135028,135029



ADV-5519

12.5/14.5CCO Radiator w/ Motor-Driven Suction Fan

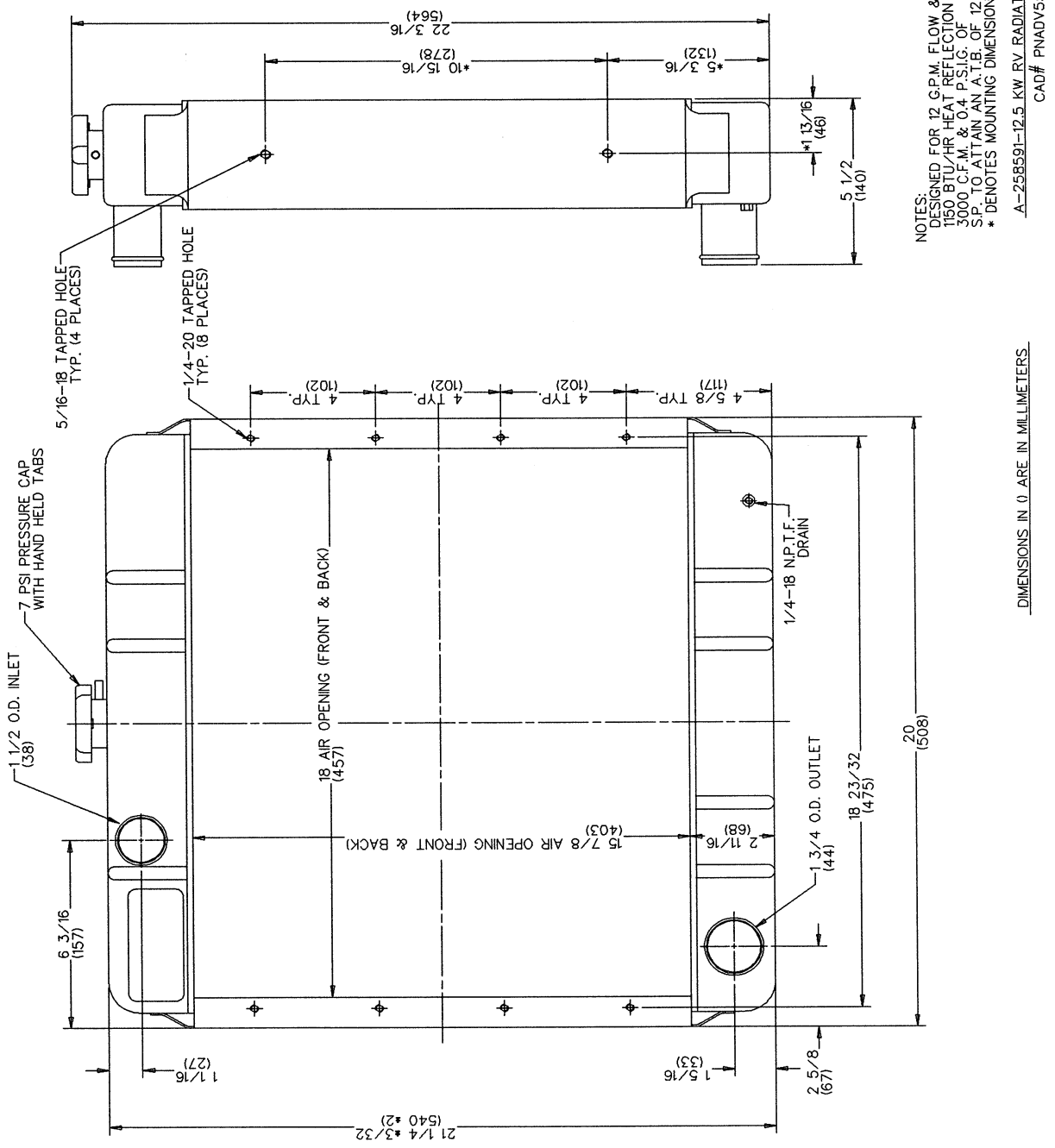


Note

Remote radiators with electric blower fans do not have fill caps. A coolant expansion/recovery tank must be fitted to fill and/or maintain coolant level.

ADV-5522

12.5/14.5CCO Radiator w/ Motor-Driven Blower Fan



12.5/14.5CCO Radiator Assembly

SERVICING ORDERING INSTRUCTIONS

In any communications regarding your generator set, please include the MODEL, SPECIFICATION, SERIAL, and ENGINE SPEC numbers as found on the nameplate attached to the frame of the generator or engine block. Your Authorized Service Dealer will need these numbers to provide the correct parts and information for your generator set. Do not attempt to replace major items or any item that calls for special tools or procedures have this done only by qualified Kohler Generator Specialists. Check the yellow pages of your telephone directory under the heading GENERATORS–ELECTRIC for Kohler Generator Service Dealers in your area.

Routine Service Parts

Your Kohler Generator Dealer has a complete listing of parts for your generator set. Contact them for service.

Part Description	Kohler Part No.
(Engine)	
Element, Air Cleaner	258646*
Filter, Lube Oil	252834
Filter, Fuel	252765
V–Belt	252758
(Generator)	
Brush	239282
Holder, Brush	239247
Spring, Brush	238150
Fuse, 8–A	258405
(Controller)	
Fuse, 10–A	223316

* Coach manufacturers may use different air filter.

Service Manual Procurement

A service manual or parts catalog for your generator set may be obtained through your RV dealer or Kohler Generator Distributor. Record Model, Spec, Serial, and Engine Specification numbers (from generator set nameplate) in the spaces below.

Model No._____

Spec. No. _____

Serial No._____

Engine Spec No. _____

OPERATING HOUR SERVICE LOG

The following is provided to help you keep an accumulative record of operation hours on your generator set and the dates required services were performed. Enter hours to the nearest hour.

Date Run	Operating Hours		Service Record	
	Hours Run	Cumulative	Date	Service

Date Run	Operating Hours		Service Record	
	Hours Run	Cumulative	Date	Service

KOHLER®
GENERATORS

KOHLER CO. KOHLER, WI 53044

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