Operation and Installation

Mobile Generator Sets

Models:

10CCE
10CEZ
12CCE
12CEZ

ISO 9001
KOHLER GENERATORS
INTERNATIONALLY REGISTERED
U.S.A. Plant ISO Registered

KOHLER®
POWER SYSTEMS

TP-5977 7/98a

California Proposition 65

⚠ WARNING

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

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A generator set, like any other electromechanical device, can pose potential dangers to life and limb if improperly maintained or operated. The best way to prevent accidents is to be aware of potential dangers and act safely. Please read and follow the safety precautions and instructions below to prevent harm to yourself and others. This manual contains several types of safety precautions and instructions which are explained below. SAVE THESE INSTRUCTIONS.

DANGER

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

WARNING

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

CAUTION

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

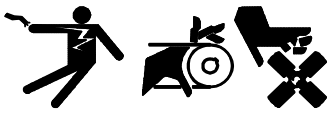
NOTICE

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

Safety decals affixed to the generator set in prominent places advise the operator or service technician of potential hazards and how to act safely. The decals are reproduced in this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

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

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

Battery

WARNING

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

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

Battery acid. Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in battery can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working near the battery. If battery acid is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

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

Engine Backfire/Flash Fire

⚠ WARNING

Fire.
Can cause severe injury or death.

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

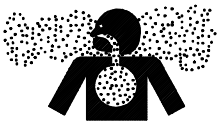
Servicing fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flame or spark to occur near carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuel or fuel vapors. Catch all fuel in a suitable container when removing fuel line or carburetor.

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

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

Exhaust System

⚠ WARNING



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

The exhaust system must be leakproof and routinely inspected.

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

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

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

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

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

Inspecting exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. In addition to routine exhaust system inspection, install a carbon monoxide detector. Consult your coach builder or dealer for approved detector installation. Test the carbon monoxide detector function per the manufacturer's instructions and keep it operational at all times.

Fuel System

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.

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

Fuel system. Explosive fuel vapors can cause severe injury or death. All fuels are highly explosive in a vapor state. Use extreme care when handling and storing fuels. Store fuel in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from spark. Do not smoke or permit flame or spark to occur near sources of spilled fuel or fuel vapors. Keep fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid breakage caused by vibration. Do not operate generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair systems before resuming generator set operation.

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

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

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

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

LP gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check LP vapor gas fuel system for leakage using a soap-water solution with fuel system test pressurized to 6-8 ounces per square inch (10-14 inches water column). Use a soap solution containing neither ammonia nor chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

LP liquid withdrawal fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check LP liquid withdrawal gas fuel system for leakage using a soap-water solution with fuel system test pressurized to at least 90 psi (621 kPa). Use a soap solution containing neither ammonia nor chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

Hazardous Noise

⚠ CAUTION

Hazardous noise.
Can cause loss of hearing.

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

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

Hazardous Voltage/ Electrical Shock

⚠ WARNING

Hazardous voltage. Moving rotor.

Can cause severe injury or death.

Operate generator set only with all guards and electrical enclosures in place.

⚠ WARNING

Hazardous voltage.
Backfeed to utility system can cause severe injury, death, or property damage.

Connect generator set to building electrical system only through an approved device and after building main switch is open.

Grounding generator set. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the generator set and electrical circuits when in use. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution increases under such conditions.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing equipment.

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

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

Electrical backfeed to utility. Hazardous backfeed voltage can cause severe injury or death. Connect generator set to building/campground electrical system only through an approved device and after building/campground main switch is open. Backfeed connections can cause serious injury or death to utility personnel working on power lines and/or personnel in the vicinity of the work area. Unauthorized connection to utility electrical system may be unlawful in some states and/or localities. Install a transfer switch to prevent interconnection of generator set power and other sources of power.

Servicing generator set. Hazardous voltage can cause severe injury or death. Do not touch electrical connections when flashing the generator set. Line voltage is present at the alligator clips when the pushbutton is pressed to flash the generator set.

Heavy Equipment

⚠ WARNING

Unbalanced weight.
Improper lift can cause severe injury or death and/or equipment damage.

Do not use lifting eyes.
Use slings under skid to balance and lift generator set.

Hot Parts

⚠ WARNING

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

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

⚠ WARNING

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

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

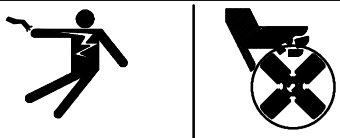
Checking coolant level. Hot coolant can cause severe injury or death. Allow engine to cool. Release pressure from cooling system before opening pressure cap. To release pressure, cover the pressure cap with a thick cloth; then slowly turn it counterclockwise to the first stop. Remove cap after pressure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

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

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

Moving Parts

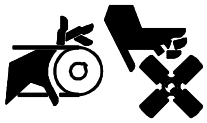
⚠ WARNING



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

Operate generator set only with all guards and electrical enclosures in place.

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

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

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

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

Notice

NOTICE

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

246242

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

NOTICE

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

Notes

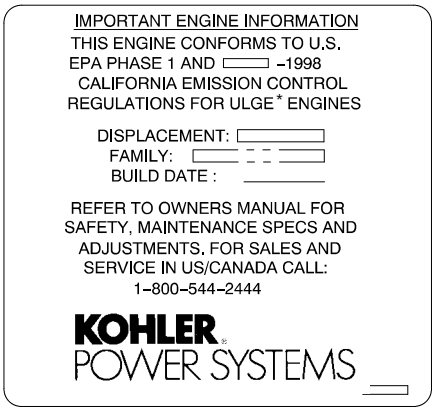
All information in this publication represents data available at time of print. Kohler Co. reserves the right to change this literature and the products represented without incurring obligation.

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

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

California Emission Certification

If your engine/generator has this identification label, it is certified for operation in the state of California.



* Utility Lawn and Garden Equipment

This engine/generator is certified to operate on natural gas or propane fuel.

This engine is certified with engine modifications.

Service Assistance

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

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

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

KOHLER CO., Kohler, Wisconsin 53044 U.S.A.
Phone: 920-565-3381
Fax: 920-459-1646 (U.S.A. Sales)
920-459-1614 (International)

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

GENERATOR SET

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

Model No. _____

Specification No. _____

Serial No. _____

ENGINE

The engine serial number is found on the engine nameplate.

Engine Serial No. _____

Service Parts/Publications

Routine Service Parts

The following table contains a list of recommended spare parts. Contact your Kohler generator distributor/dealer for a complete list of service parts for your generator set.

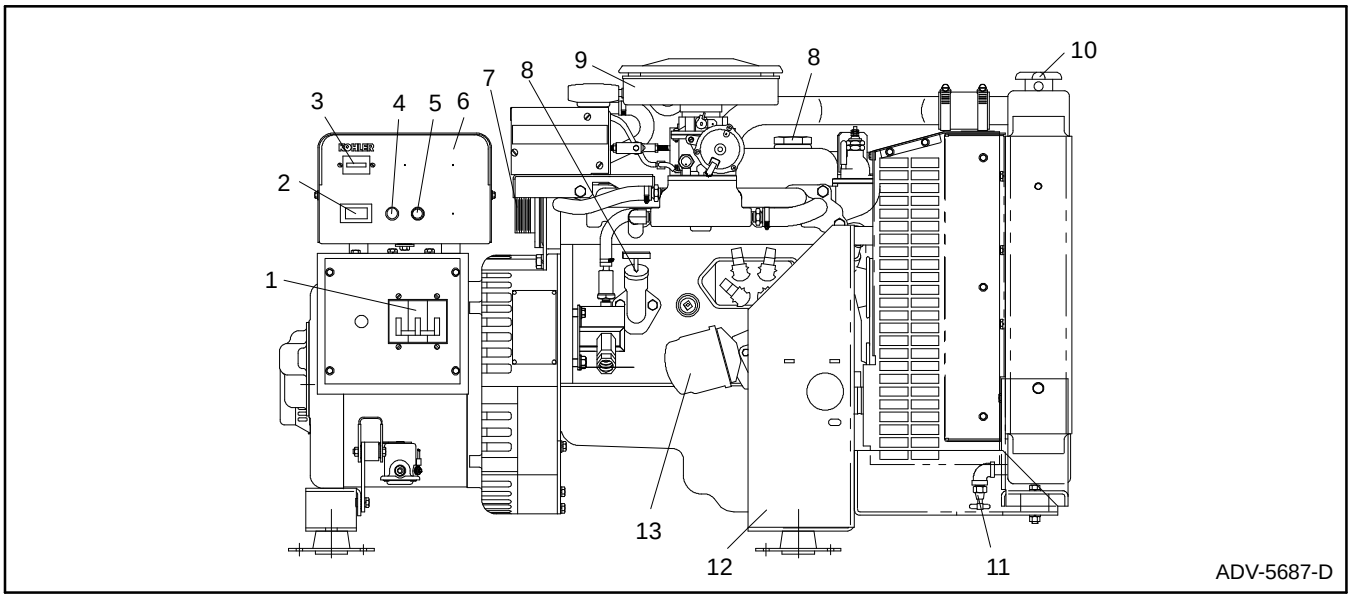
Model 10/12CCE/CEZ	
Part Description	**Kohler Part Number**
Air Cleaner Element	254772
Oil Filter	279218
Fuel Filter	249433
V-Belt (Alternator)	254782
Input Fuse (10 amp)	223316

List of Related Literature

The following table identifies literature available for the generator set(s) covered in this manual. Only qualified persons should install or service the generator set.

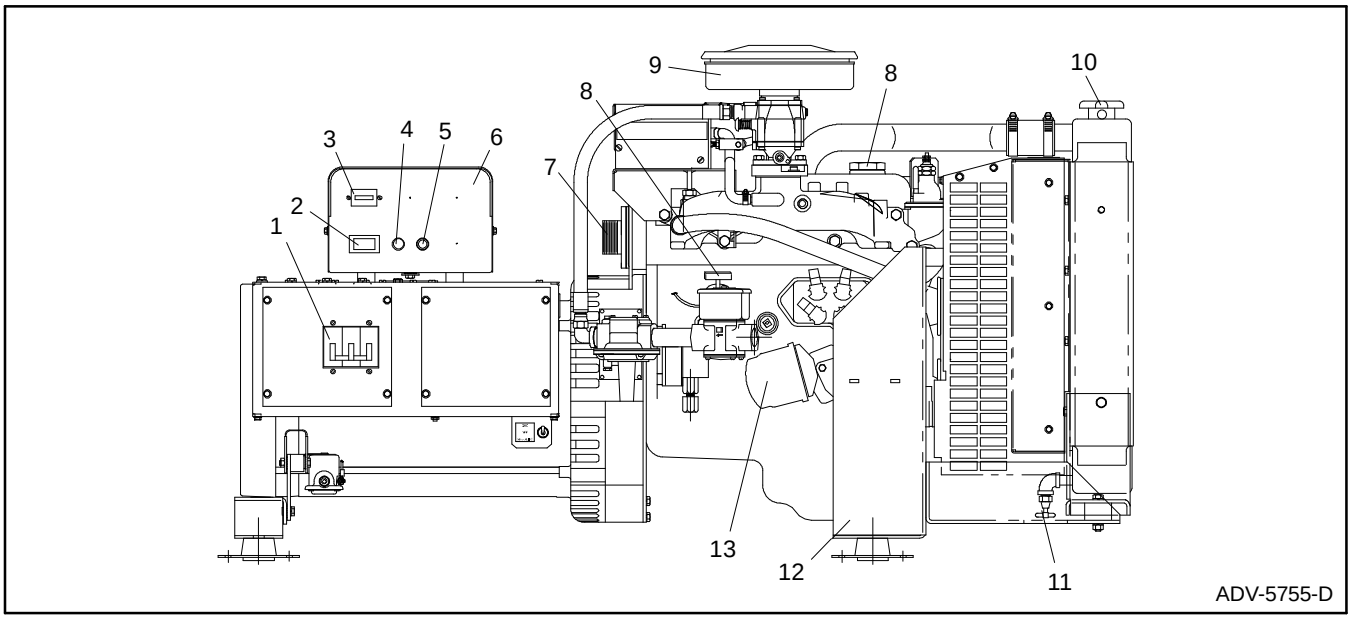
	Model(s)
Literature Type	**10/12CCE/CEZ**
Operation Manual	TP-5977
Parts Catalog*	TP-5411
Service Manual (Generator)	TP-5422
Operation Manual (Engine)	TP-5398
Service Manual (Engine)	TP-5346

* One manual combines Generator and Engine information.



1. Circuit breaker
2. Start/stop switch
3. Hourmeter
4. Fault lamp
5. Controller fuse
6. Controller
7. Exhaust outlet
8. Oil fill
9. Air cleaner
10. Cooling system fill
11. Radiator petcock
12. Oil drain
13. Oil filter

Figure 1-1. Service Views 10/12 kW 1-Phase



1. Circuit breaker
2. Start/stop switch
3. Hourmeter
4. Fault Lamp
5. Controller fuse
6. Controller
7. Exhaust outlet
8. Oil fill
9. Air cleaner
10. Cooling system fill
11. Radiator petcock
12. Oil drain
13. Oil filter

Figure 1-2. Service Views 10/12 kW 3-Phase

Notes

2.1 Prestart Checklist

To ensure continued satisfactory operation, check the following items before each startup and at regular intervals. Refer to the engine service manual for specific service procedures.

Air Cleaner. Keep air cleaner element clean. Install element to keep unfiltered air from entering engine.

Air Inlets. Keep clean and unobstructed.

Battery. Ensure tight battery connections. Maintain full battery electrolyte level.

Coolant Level. For cooling systems equipped with a coolant recovery tank, check coolant level at tank after the engine has cooled.

Maintain coolant level just below the filler neck, approximately 3/4 to 1 1/2 in. (19 to 33 mm).

A coolant solution of 50% ethylene glycol provides freezing protection of −34°F (−37°C) and overheating protection to 265°F (129°C). A coolant solution with less than 50% ethylene glycol may not provide adequate freezing and overheating protection. A coolant solution with more than 50% ethylene glycol can cause engine or component damage. Do not use alcohol or methanol antifreeze or mix them with the specified coolant. Consult the engine manufacturer's operation manual for engine coolant specifications.

Do not add coolant to a hot engine. Wait until engine has cooled. Adding coolant to a hot engine can cause the cylinder block or cylinder head to crack.

Drive Belts. Check belt condition and tension of radiator fan, water pump, and battery charging alternator belt(s).

Exhaust System. Keep exhaust outlet clear. Keep muffler and piping tight and in good condition.

Fuel Level. Keep tank(s) full to ensure adequate fuel supply.

Oil Level. Maintain oil level at or near full but not over. Keep the oil level in the mechanical governor (if equipped) at or near the full level.

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

2.2 Exercising the Generator

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

Operator should perform all prestart checks before starting the exercise procedure. While the generator set is running, listen for a smooth-running engine and visually inspect the generator set to ensure there are no fluid or exhaust leaks.

Start the generator set according to the starting procedure in the controller section of this manual.

2.3 Starting and Stopping Procedure

NOTE

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

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

2.3.1 Controls and Indicators

The following table describes the generator set controller controls and indicators.

Name	Description
Start/Stop Switch	Use switch to start and stop the generator set. Press the switch to the start position to start generator set. Press the switch to the stop position to stop the generator set.
AC Circuit Breaker (optional)	Circuit breaker trips when a fault occurs in the output circuit. During maintenance of vehicle wiring, the circuit breaker disconnects the generator set. Place the circuit breaker(s) in the ON position to close circuit breaker.
Input Fuse	Protects the controller circuitry and the generator DC wiring in the event of a short circuit.
Remote Start Connector	A 6-pin connector on controller back panel allows connection of (optional) remote start kits. Use to operate the generator set at a location remote from the set.
Hourmeter	Meter records total generator set operating hours for reference in maintenance scheduling.
Fault Lamp	Lamp lights to indicate a fault condition. Generator set shuts down on overspeed, high engine temperature, and low oil pressure. Fault lamp does not stay lit after generator set shuts down. Fault lamp lights as fault occurs.

2.3.2 Starting the Generator Set

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

Action
Starting Place the generator set controller start/stop switch or the remote start/stop switch in the start position.

NOTE

Do not crank engine continuously for more than 10 seconds at a time. Allow a 60 second cooldown period between cranking attempts if the engine does not start. If the generator set does not start after three attempts, see Section 4– Troubleshooting for possible causes.

2.3.3 Gauge Operation

If generator set has the optional 3-meter panel kit, observe the gauges upon engine start-up. If gauge readings are not within the ranges specified, contact an authorized service distributor/dealer.

Gauge	Operating Range
Oil pressure	0-100 psi (0-690 kPa)
Water temperature	100-240 °F (38-116 °C) or 100-250 °F (38-120 °C)
DC voltmeter	10-16 volts

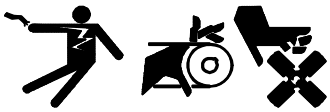
Figure 2-1. Engine Gauge Specifications

2.3.4 Stopping the Generator Set

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

Step	Action
1	**Cooldown** Run generator set at no load for 5 minutes to ensure adequate engine cooldown.
2	**Stopping** Place controller start/stop switch or remote start/stop switch in the stop position and wait until generator set comes to a complete stop.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

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

Disabling generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: 1) Turn the generator set master switch to OFF position. 2) Disconnect power to battery charger. 3) Remove battery cables (remove negative (−) lead first). Reconnect negative (−) lead last when reconnecting battery. Follow these precautions to prevent starting of generator set by an automatic transfer switch or remote start/stop switch.

⚠ WARNING

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

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

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

⚠ WARNING

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

Operate generator set only with all guards and electrical enclosures in place.

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

Alternator service. Under normal operating conditions the generator set alternator does not require scheduled service. Refer to the service schedule for items that require maintenance.

Engine service. Perform generator set engine service at the intervals specified by the engine service literature. Contact an authorized Kohler service distributor/dealer to obtain engine service literature.

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

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

Routine maintenance. Refer to the service schedule following and the hourmeter located on the generator set controller to schedule routine maintenance. Service units subject to extreme weather, long operating hours, or dusty or dirty conditions more frequently.

Service schedule. Perform maintenance on each item in the service schedule at the designated interval for the life of the generator set.

Tools. Tools and instruments to perform some maintenance items are not generally available to the generator set owner. Therefore, have service performed by an authorized distributor/dealer.

Tune-ups. Have the generator set tuned-up by an authorized distributor/dealer. Tune-ups improve performance and ensure continuous satisfactory operation during a long, trouble-free service life.

All generator sets are equipped with an emission certified engine. Emission certified engines are fitted with carburetors that have no possible adjustments.

3.1 Service Schedule

Perform the items listed in the service schedule at the designated intervals for the life of the generator set. Service items at every multiple of the service interval. For example, service items with service interval of every 100 hrs or 3 months again at 200 hrs or 6 months, 300 hrs or 9 months, etc.

The generator set eventually accumulates enough hours to warrant a complete overhaul. Rough operation, lack of power, and excessive oil use indicate serious generator set problems and need for overhaul. As part of a preventive maintenance program, service the engine (clean cylinder heads, inspect valves, check compression, etc.) and generator (replace bearing, inspect wiring remove debris, etc.) as soon as symptoms arise.

Perform Service at Intervals Indicated (X)	Before Each Start-up	Every 100 Hours or 3 Months	Every 400 Hours or 6 Months	Every 800 Hours or Yearly
Check engine oil level	X			
Check coolant level	X			
Check fuel supply	X			
Verify correct operation of gauges, if equipped	X			
Clean air intake screen, if equipped	X			
Check electrolyte level in battery	X			
Change engine oil and filter*		X		
Inspect air cleaner element		X		
Clean crankcase vent system breather cap		X		
Inspect/adjust engine belts		X		
Lubricate throttle, governor, and choke linkage		X		
Replace gasoline fuel filter			X	
Change air cleaner element*			X	
Inspect cooling system (inspect hoses, clean radiator exterior)			X	
Inspect/replace spark plugs*			X	
Retighten electrical connections			X	
Clean slip rings and inspect brushes (1-phase/CC models only)**			X	
Blow dust out of generator			X	
Check and adjust engine valve clearance**			X	
Replace crankcase vent system breather cap**			X	
Torque intake manifold bolts**				X
Check throttle and governor operation and adjust as necessary**				X
Check nuts and bolts for tightness				X

* Service more frequently if operated in dusty areas.

** Have an authorized Kohler Service Distributor/Dealer perform.

3.2 Lubrication System

The following paragraphs describe the engine lubrication system.

3.2.1 Oil Specifications

Use oils labeled API SG alone or in combination with other classifications (SG/CC, SG/CD) because they offer improved wear protection. Avoid mixing different brands of oils and lubricants. Oils of different manufacturers may be incompatible and deteriorate when mixed. Base oil weight selection on temperature at time of start-up. See Figure 3-1 for oil weight selection.

Single Viscosity Oils

When Outside Temperature is Consistently	Use SAE Viscosity Number
−10°F to +60°F (−23°C to 16°C)	* 10W
+10°F to +90°F (−12°C to 32°C)	20W-20
Above +32°F (0°C)	30
Above +50°F (10°C)	40

Multi Viscosity Oils

When Outside Temperature is Consistently	Use SAE Viscosity Number
Below +10°F (−12°C)	*5W-20
Below +60°F (−16°C)	5W-30
10°F to 90°F (−23°C to 32°C)	10W-30
Above −10°F (−23°C)	10W-40 or 10W-50
Above +20°F (−23°C)	20W-40 or 20W-50

*Not recommended for severe service

TP-5402-3

Figure 3-1. Oil Selection Guide

3.2.2 Oil Check

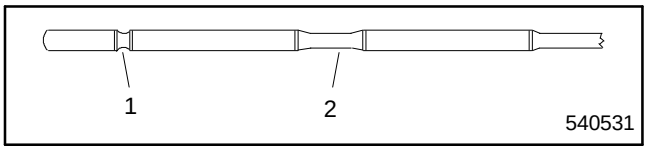
Check the oil in the crankcase daily or before each start-up whichever occur first to ensure that the oil level is in the safe range. To check the oil level, remove dipstick and wipe the end clean. Reinsert the dipstick as far as possible into the tube, and remove. Maintain the oil level between the Min and Max marks on the dipstick. See Figure 3-2.

NOTE

Do not operate the generator set with the oil level below the minimum mark or above the maximum mark on the dipstick.

NOTE

Do not check oil level when the generator set is operating.



1. Minimum oil level
2. Maximum oil level

Figure 3-2. Engine Oil Dipstick/Safe Range

3.2.3 Oil Change

Change oil at the interval specified in the service schedule. Change oil more frequently under dirty, dusty conditions. Refer to the following oil change procedure. See Section 1– Service Views for oil fill, oil check, and oil filter locations.

Model	Qts. (L)
10/12 CCE/CEZ	3.5 (3.3)

Figure 3-3. Oil Capacity with Filter

Oil Change Procedure

1. Place the generator set master switch in the STOP position.
2. Disconnect generator set engine starting battery, negative (−) lead first.
3. Place a container below the oil drain and remove the oil-drain plug. See Section 1– Service Views for oil drain location.
4. Allow ample time for all oil to drain.
5. Replace oil drain plug.
6. Replace engine oil filter according to service schedule and procedure following.
7. Remove oil-fill cap. One is located on the rocker-arm cover and one is located near the oil filter.
8. Fill crankcase with specified amount of oil. Section 1 shows typical oil fill locations. See Figure 3-1 for oil selection and Figure 3-3 for oil capacity. Replace oil-fill cap(s).
9. Reconnect generator set engine starting battery, negative (−) lead last.

10. Start generator set and check for oil leaks.
11. Stop generator set. Check oil level. Add oil as necessary to bring oil level up to MAX mark.

NOTE

Too high an oil level causes high oil consumption and engine carbonizing. Too low a level damages the engine.

NOTE

Do not pollute the environment. Dispose of used engine oil and other contaminants in a safe, approved manner.

3.2.4 Oil Filter Change

Replace the oil filter at the interval specified in the service schedule. Change the oil filter more frequently under dirty, dusty conditions. Refer to the following procedure. See Section 1– Service Views for oil filter location.

Oil Filter Change Procedure

1. Loosen the oil filter by turning it counterclockwise. Remove the oil filter and use rags to clean up spilled oil. Dispose of the oil filter in an approved manner.
2. Clean contact surface of the oil filter adapter.
3. Lightly lubricate the gasket surface of the new filter with fresh engine oil. Thread filter onto adapter until gasket makes contact; hand-tighten an additional one-half turn. Wash hands after any contact with engine oil.

   If also performing an oil change, skip steps 4-5 and return to oil change procedure.
4. Start generator set and check for oil leaks.
5. Stop generator set. Check oil level. Add oil as necessary to bring oil level up to MAX mark.

3.3 Gasoline Fuel System

The generator set can be equipped with one of four different fuel systems: gasoline, straight gas (LP/natural gas), gas/gasoline, and liquid withdrawal. The following sections discuss each of the fuel systems.

3.3.1 Fuel Specifications– Gasoline

For best results, use only clean, fresh regular grade unleaded gasoline with a pump sticker rating of 87 octane or higher in the U.S.A. In countries using the research rating method use 90 octane minimum.

Use unleaded gasoline because it leaves fewer combustion chamber deposits. Regular grade leaded gasoline may be used; however, be aware the combustion chamber and cylinder head will require more frequent service. Use gasohol containing no more than 10% ethanol if unleaded gasoline is unavailable. Never use gasohol containing more than 10% ethanol or gasoline containing Methanol. Do not mix oil with fuel.

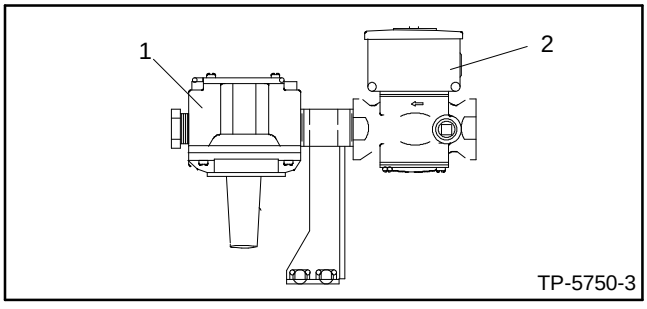
Use fresh, clean gasoline to ensure that it is blended for the season and to reduce the possibility of gum deposits forming which could clog the fuel system. Do not use gasoline left over from the previous season.

3.3.2 Fuel Filter (Gasoline)

Clean/replace the gasoline fuel filter at the interval specified in the service schedule. Service more frequently if rough operation suggests a clogged fuel filter. Some models use an in-line fuel filter which cannot be cleaned and requires replacement. Other models have a fuel pump with an integral fuel filter which requires cleaning at the specified interval.

3.4 Gaseous Fuel System

The gaseous fuel system utilizes a fuel valve (with solenoid) to control the fuel flow to the fuel regulator. The generator-mounted regulator reduces fuel pressure as fuel passes to the carburetor. See Figure 3-4. The carburetor (mixer) controls the ratio of fuel to air under varying loads and speed conditions. Because the carburetor receives fuel in a gaseous state, it does not have to provide vaporization of the fuel. When switching from natural gas to LP gas or LP gas to natural gas, verify that engine speed meets specifications. If the engine speed is incorrect, refer to the Generator Set Service Manual.



1. Gas fuel regulator
2. Gas fuel valve

Figure 3-4. Fuel Regulator and Valve

3.4.1 Fuel Regulators

Fuel regulators are compatible with both natural gas and LP gas. Install the spring and retainer when using natural gas.

Some models require removal of the spring and retaine, while other models maintain the spring and retainer when using LP gas. Read and follow the instructions found on the hang tag attached to the generator set.

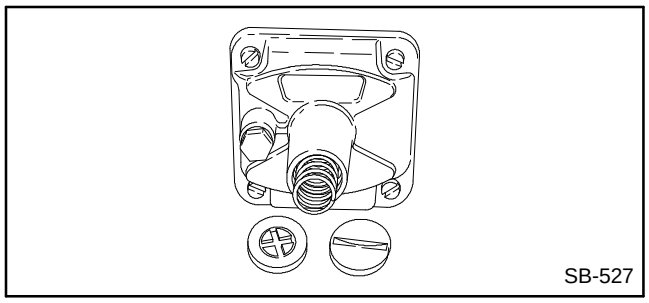


Figure 3-5. LP Vapor Gas Fuel Regulator

3.5 LP Liquid Withdrawal Fuel System

With the LP liquid withdrawal system, LP fuel in liquid form is directed under pressure from the tank to a vaporizer. The vaporizer converts the fuel from a liquid to a gaseous state and then LP is drawn off to the carburetor. The system also includes a fuel valve which shuts off the fuel flow when the engine is stopped. Contact an authorized service distributor/dealer for LP liquid withdrawal availability.

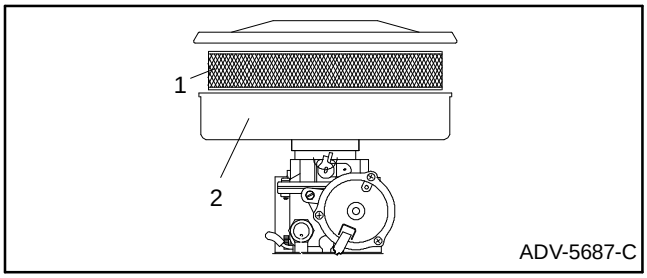
3.6 Combination Gas/Gasoline Fuel System

The gas/gasoline fuel system operates on gas (LP, natural gas) or gasoline without modification or extensive mechanical changeover. The combination system utilizes gas as the primary fuel and gasoline in emergency situations. The dual fuel allows for continued generator set operation in absense of a gas fuel supply. Contact an authorized service distributor/dealer for the combination gas/gasoline fuel system availability.

3.7 Air Cleaner

The engine has a dry-type air cleaner. Replace the air cleaner element at the interval specified in the service schedule. Replace the element more often if operating the generator set under dirty or dusty conditions. Operating the generator set with a dirty air cleaner element may cause engine damage and increase fuel consumption. At the time of service remove all foreign matter from the air cleaner housing.

Every 50 hours (more often if operating under dusty or dirty conditions) remove and service element by tapping element lightly against flat surface to dislodge loose surface dirt. Do not clean filter using any liquid or attempt to blow out foreign matter with compressed air which ruins filter element. Replace element if it is dirty, bent, or damaged.



1. Air cleaner element
2. Air cleaner housing

Figure 3-6. Air Cleaner Assembly

3.8 Cooling System

Circulating coolant through passages in the engine cools the engine. When the engine starts, coolant in the engine block and head adsorbs heat diffused by the engine during combustion. When the engine coolant temperature reaches approximately 195°F (90°C) the cooling system thermostat opens and allows heated coolant to flow through the radiator. A fan on the water pump pushes or pulls air through the radiator to reduce the temperature of the coolant. The water pump recirculates the coolant through the engine to cool the engine.

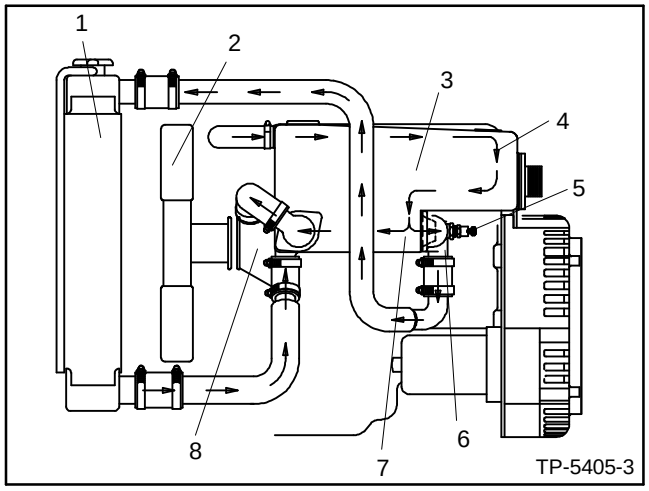
To prevent generator set shutdown and/or damage from overheating, service the cooling system every 400 hours or 6 months of generator set operation. Inspect the exterior of the radiator for obstructions; remove all foreign material with a soft brush or cloth to avoid damaging radiator fins. Clean radiator with compressed air or a stream of water, if available, in the direction of normal air flow.

Check all hoses and connections for leaks and replace any cracked, frayed, or spongy hoses. Check condition of radiator cap rubber seal when checking coolant level. Replace radiator cap seal if it is cracked or deteriorated. Remove all dirt and other debris from radiator cap filler neck.

Use only a permanent-type coolant that meets specifications. Use a coolant solution of 50% ethylene glycol and 50% clean, softened water to inhibit corrosion and prevent freezing to −34°F (−37°C). Do not use alcohol or methanol antifreeze or mix them with the coolant. The coolant system is equipped with an air bleed feature. Do not remove the air bleed orifice from the system or engine overcooling results.

3.8.1 Wet Manifold

Some generator sets may be equipped with a wet manifold in which the coolant solution circulates through the exhaust manifold to reduce the exhaust temperature. Figure 3-7 illustrates the direction of coolant flow on a generator set equipped with a wet manifold. Coolant flow in an engine with a dry exhaust is based upon the same principal; however, coolant flows only through the engine and then back to the radiator.



1. Radiator
2. Fan
3. Exhaust manifold
4. Arrows indicate direction of water flow
5. Water temperature sender
6. Thermostat
7. Bypass
8. Water pump

Figure 3-7. Cooling Water Circulation (Wet Manifold)

3.8.2 Draining and Refilling the Cooling System

Perform the following procedure to drain and refill the cooling system.

1. Place the generator set master switch in the STOP position.
2. Disconnect the generator set engine starting battery, negative (−) lead first.
3. With the engine cool remove the radiator cap.
4. Place a container under the generator set radiator petcock and engine block drain plug.
5. Open the petcock on the bottom of the radiator and remove the drain plug from the engine block.
6. When all the coolant has been drained reinstall the drain plug in the engine block and close the petcock on the bottom of the radiator.
7. Fill the radiator to the correct level with the recommended coolant mixture.
8. Reinstall the radiator cap.
9. Reconnect the generator set engine starting battery, negative (−) lead last.
10. Start the generator set and operate until the thermostat opens and the upper radiator hose becomes warm.
11. Stop the generator set and allow to cool.
12. Remove radiator cap and add coolant to the radiator until the level is just below the overflow tube on the filler neck.
13. Reinstall the radiator cap.

Maintain coolant recovery tank coolant level between 1/3 full (cold) and 2/3 full (hot) if the engine is equipped with a coolant recovery tank.

NOTE

Periodically check the coolant level on closed systems by removing the radiator's pressure cap. Do not rely solely on the level in coolant recovery tank. Add fresh coolant until level is just below the overflow tube opening.

NOTE

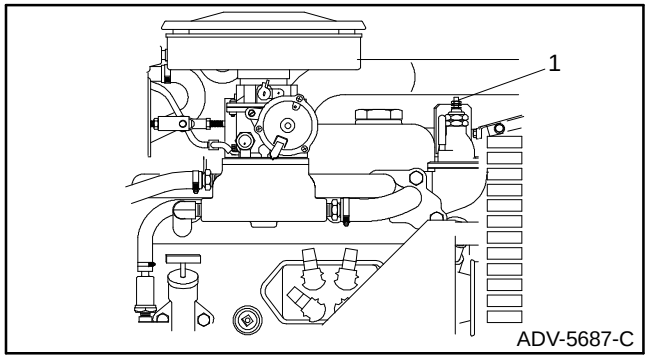
Pay special attention to the coolant level. After draining the coolant, when filling cooling system, allow time for complete refill of the engine water jacket. Check coolant level as prescribed in the Prestart Checklist of the Operation Manual.

3.8.3 High Engine Temperature Shutdown

The engine automatically shuts down 10-20 seconds after the engine temperature reaches 218°F (103°C). Correct the cause of the shutdown or wait until the engine has cooled and the controller reset before restarting the generator set.

NOTE

The high engine temperature (HET) shutdown is not a low coolant level switch. Maintain engine coolant level for the HET shutdown switch to function.



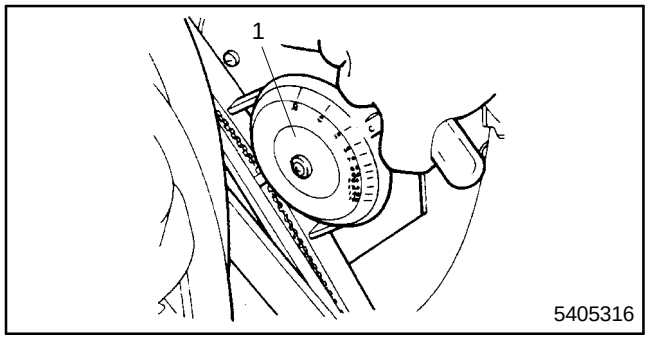
1. High engine temperature sender

Figure 3-8. High Engine Temperature Shutdown

3.9 Belt Tension

Check the belt tension at the interval specified in the service schedule. If tension is not within specification given in the engine operation manual, adjust as necessary using the following procedure.

1. Place the generator master switch in the STOP position.
2. Disconnect the generator set engine starting battery, negative (−) lead first.
3. Position the belt tension tool on the drive belt and check the tension according to the instructions of the tool manufacturer. See Figure 3-9.



1. Belt tension tool

Figure 3-9. Adjusting Belt Tension

4. Loosen the alternator mounting hardware if the tension is not set to specifications.
5. While prying the alternator outward, tighten alternator adjusting hardware.
6. Recheck and adjust as necessary.
7. Reconnect the generator set engine starting battery, negative (−) lead last.

3.10 Battery

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

⚠ WARNING

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

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

Battery acid. Sulfuric acid in batteries can cause severe injury or death. Sulfuric acid in battery can cause permanent damage to eyes, burn skin, and eat holes in clothing. Always wear splash-proof safety goggles when working near the battery. If battery acid is splashed in the eyes or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

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

3.11 Generator Storage Procedure

Follow the procedure below when storing the generator set for a period of 2 months or more.

Engine Oil

1. Start and run generator set until it reaches operating temperature or about 15 minutes.
2. Stop generator set. Drain oil from crankcase while engine is still warm. Refill crankcase with specified weight oil. Replace oil filter.

Gasoline-Fueled Generator Sets

3. Drain the fuel from the fuel tank to prevent accumulated moisture from mixing with the fuel.

Gaseous-Fueled Generator Sets

With the generator set running, shut off the gas supply. Operate the generator set until the engine stops from lack of fuel.

Coolant

4. Check the engine coolant protection as described earlier in the section.

NOTE

Use antifreeze capable of withstanding the lowest possible temperatures.

Exterior Preparation

5. 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.
6. Seal all engine openings with non-absorbent adhesive tape. Mask off all areas used for electrical contact.

Battery

7. Disconnect and remove battery. Place battery in a warm, dry location for storage period. Recharge once a month to maintain full charge.

Storage

8. Select a well-ventilated (not humid or dusty) location to store generator.
9. Cover entire unit with a dust cover.

Section 4. Troubleshooting

When troubles occur, do not overlook simple causes which might seem too obvious to be considered. A starting problem, for example, could be attributed to an empty fuel tank. As a general aid to diagnosing common problems, refer to the Troubleshooting Table below. If the trouble cannot be corrected through routine servicing, contact an authorized service distributor/dealer for assistance.

Engine			
Problem	**Possible Cause**	**Corrective Action**	**Reference**
Generator set does not crank	Weak or dead battery	Recharge or replace battery	Section 3. Battery
	Reversed or poor battery connections. Poor ground.	Check and correct connections	Section 5. Wiring Diagrams
	Circuit breaker tripped in controller	Reset circuit breaker	Section 2. Operation
	Defective start/stop switch	Check switch; replace as necessary.	Service Manual
	Defective starter solenoid	Check starter solenoid and wiring. Replace as necessary.	Engine Service Manual
	Defective starter	Replace/repair as necessary	Engine Service Manual
Generator set cranks but does not start	Out of fuel	Replenish fuel	
	Defective fuel solenoid/pump	Replace fuel solenoid/pump	
	Clogged fuel filter	Replace fuel filter	
	Water, dirt in fuel system	Drain, flush fuel system	
	Incorrect compression	See authorized Kohler service distributor/dealer	
	Incorrect type of fuel	Use correct type of fuel	
	Incorrect type of crankcase lube oil for ambient temperature	Use correct lube oil	Engine Operation Manual
	Air cleaner clogged	Clean or replace element	Section 3. Air Cleaner
	Faulty ground (–) connection	Clean and retighten	Section 5. Wiring Diagrams
	Weak or dead battery	Recharge or replace battery	Section 3. Battery
	Engine malfunction	See authorized Kohler service distributor/dealer	
Engine starts, but does not continue to run after start switch is released	Fault shutdown	Check shutdown switches	Service Manual
	No generator output voltage	Check AC voltage	Service Manual
	No/low oil pressure	Check oil. See authorized Kohler service distributor/dealer	
	Defective low oil pressure (LOP) safety shutdown switch	Replace LOP shutdown switch	Service Manual
	High temperature shutdown	Check cooling system for coolant level	Section 3. Cooling System
	Defective high water temp. (HWT) safety shutdown switch	Replace HWT shutdown switch	Service Manual

Problem	Possible Cause	Corrective Action	Reference
Stops suddenly	Out of fuel	Replenish fuel	
	Air intake clogged	Service air cleaner	Section 3. Air Cleaner
	Fuel line restriction	Check fuel lines and tank	Section 6. Installation
	Dirty fuel filter	Replace fuel filter	Section 3. Fuel Filter
	No/low oil pressure	See authorized Kohler service distributor/dealer	
	Fuse blown in controller	Replace fuse. If fuse blows again, see authorized Kohler service distributor/dealer	Section 2. Operation

Engine– continued			
Problem	**Possible Cause**	**Corrective Action**	**Reference**
Stops suddenly (continued)	Defective low oil pressure (LOP) safety shutdown switch	Replace LOP shutdown switch	Service Manual
	High temperature shutdown	Check engine coolant system for coolant level	Section 3. Cooling System
	Defective high water temp. (HWT) safety shutdown switch	Replace HWT shutdown switch	Service Manual
	Loss of AC output	See authorized Kohler service distributor/dealer	Service Manual
Operates erratically or lacks power	Air intake clogged	Service air cleaner	Section 3. Air Cleaner
	Stale or bad fuel	Replace fuel	
	Dirty fuel filter	Replace fuel filter	Section 3. Fuel Filter
	Vent in fuel tank cap obstructed	Clean cap in solvent; blow dry	
	Water, dirt, or air in fuel system	Drain, flush, fill, and bleed air in the system	
	Inadequate cooling	Inspect cooling system	Section 3. Cooling System
	Fuel line restricted	Check fuel lines	Section 6. Installation
	Engine overloaded	Reduce load	
Engine overheats	Inadequate cooling	Check engine coolant level	Section 3. Cooling System
	Thermostat defective	Replace thermostat	Engine Service Manual
	Air intake clogged	Service air cleaner	Section 3. Air Cleaner
	Engine overloaded	Reduce load	Section 2. Operation
	Loose or defective water pump belt	Adjust belt tension or replace belt	Section 3. Belt Tension
	Defective temperature switch	Replace shutdown switch	Service Manual
Low lube oil pressure	Low lube oil level	Add lube oil	Section 3. Oil Check
Generator set is noisy or abnormal noise	Exhaust system leak	Inspect exhaust system for leaks and repair them	
	Exhaust system not securely installed	Check for loose parts and tighten them	
	Worn or defective bearing or gear	See authorized Kohler service distributor/dealer	
	Loose bolt or screw	Tighten hardware	
	Low lube oil level	Add lube oil	Section 3. Oil Check

Electrical System			
Problem	**Possible Cause**	**Corrective Action**	**Reference**
Battery does not charge	Loose or corroded connections	Clean and tighten connections	Section 3. Battery
	Sulfated or worn-out battery	Check electrolyte level and specific gravity (batteries with filler caps only)	Section 3. Battery
	Defective battery charging system	Check charging system	Engine Service Manual
	Battery charging fuse blown	Replace fuse. If fuse blows again, see authorized Kohler service distributor/dealer	
Starter failure	Loose or corroded connections	Clean and tighten loose connections	Engine Service Manual
	Low battery output	Check electrolyte level and specific gravity (batteries with filler caps only). Check battery voltage.	Section 3. Battery
	Defective starter solenoid	Replace starter solenoid	Engine Service Manual
	Defective start/stop switch	Replace switch	Service Manual
	Defective wiring	Check wiring	Seciton 5. Wiring Diagrams
Starter cranks slowly	Low battery output	Check electrolyte level and specific gravity (batteries with filler caps only)	Section 3. Battery
	Too heavy viscosity lube oil	Use correct viscosity oil	Section 3. Oil Specifications
	Loose or corroded wiring	Clean and tighten loose connections	Engine Service Manual
	High starter current draw	Rebuild or replace starter	Engine Service Manual

Generator			
Problem	**Possible Cause**	**Corrective Action**	**Reference**
Abnormal voltage output. **Lights in vehicle dim; appliances fail**	Circuit breaker in OFF position	Reset breaker to ON position	Section 2. Operation
	Circuit breaker tripped because of overload on generator set	Reduce load. Requirements. Reset breaker to ON position.	Section 2. Operation
	Circuit breaker tripped in controller	Reset circuit breaker	Section 2. Operation
	Generator malfunction such as defective rotor, faulty voltage regulator, or other internal fault	See authorized Kohler service distributor/dealer	

Notes

5.1 Voltage Reconnection Procedure

The reconnection procedure explains voltage reconnections only. If frequency changes are required, the governor and voltage regulator need adjustment. See the generator set service manual for information regarding frequency adjustment.

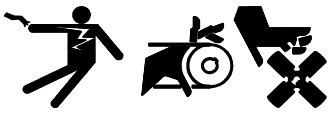
The following pages provide information and illustrations for reconnection of 4-lead and 12-lead generator sets. In all cases, follow the National Electrical Code (NEC) guidelines.

Reconnect the stator leads of the generator set if a different output phase (12-lead models only) or voltage is desired. Refer to the following procedure and the connection schematics. Follow all safety precautions at the front of this manual and in the text while performing this procedure.

NOTE

Order voltage reconnection decal 246242 from an authorized service distributor/dealer and affix decal to generator set after reconnecting to a voltage different than the nameplate.

⚠ WARNING

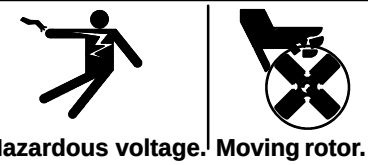


Accidental starting.
Can cause severe injury or death.

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

Disabling generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: 1) Turn the generator set master switch to OFF position. 2) Disconnect power to battery charger. 3) Remove battery cables (remove negative (–) lead first). Reconnect negative (–) lead last when reconnecting battery. Follow these precautions to prevent starting of generator set by an automatic transfer switch or remote start/stop switch.

⚠ WARNING



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

Operate generator set only with all guards and electrical enclosures in place.

Grounding generator set. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the generator set and electrical circuits when in use. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution increases under such conditions.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing equipment.

5.1.1 Four-Lead (1-Phase) Generator Sets

NOTE

Generator sets equipped with controllers with meters have current transformers (CTs).

NOTE

Position current transformers CT1, CT2, and CT3 with dot or HI side toward generator set.

See Figure 5-1 for four-lead reconnectable (single-phase) generator set options.

	60 Hz	50 Hz
120 volt	X	
120/240 volt	X	X
115/230 volt		X
110/220 volt		X

Figure 5-1. Four-Lead, 1-Phase Generator Set Voltage Connection Options

120 Volt (60 Hz) or 110 Volt (50 Hz) Voltage Connection

Place the jumper lead on the line side of the circuit breaker. See Figure 5-2. Leave leads L1 and L2 as separate leads. Regardless of the number of output leads used in the application, both circuit breakers must have leads attached to the load side. Use the jumper lead for all straight 120 volt systems to help balance the generator set load.

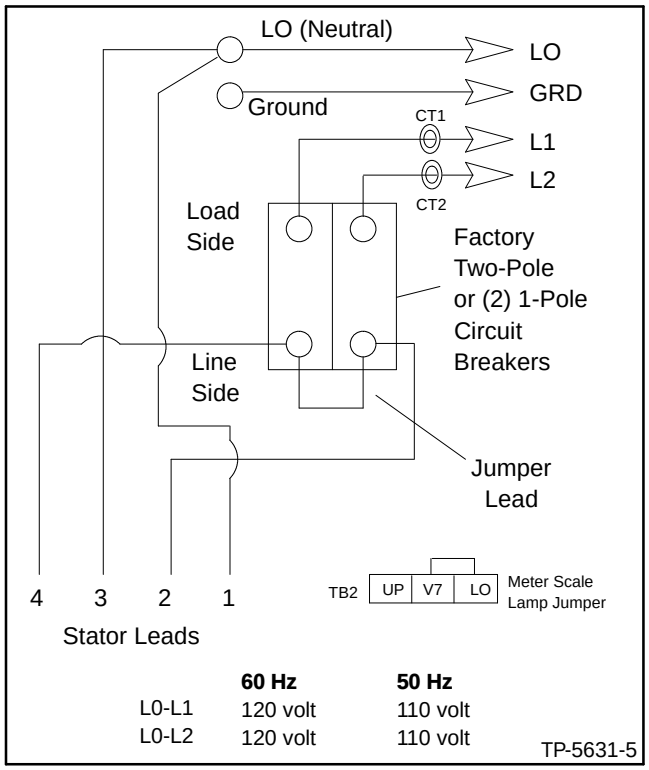


Figure 5-2. 4-Lead 120 Volt (60 Hz) or 110 Volt (50 Hz) Connection

120/240 Volt (60 Hz), 110/220 Volt (50 Hz), 120/240 Volt (50 Hz), 115/230 Volt (50 Hz) Voltage Connection

Do not use the jumper lead in these systems. If the generator set was originally wired for straight 120 volt (60 Hz) or 110 volt (50 Hz), be sure to remove jumper lead. See Figure 5-3 for location of jumper lead. Leads L1 and L2 are of different phases. Never connect Leads L1 and L2 together.

NOTE

Use a circuit breaker manufacturer's two-pole circuit breaker. Do not substitute two single-pole circuit breakers, as they do not conform to NEC requirements when supplying a 200-240 volt load even if they are mechanically attached together.

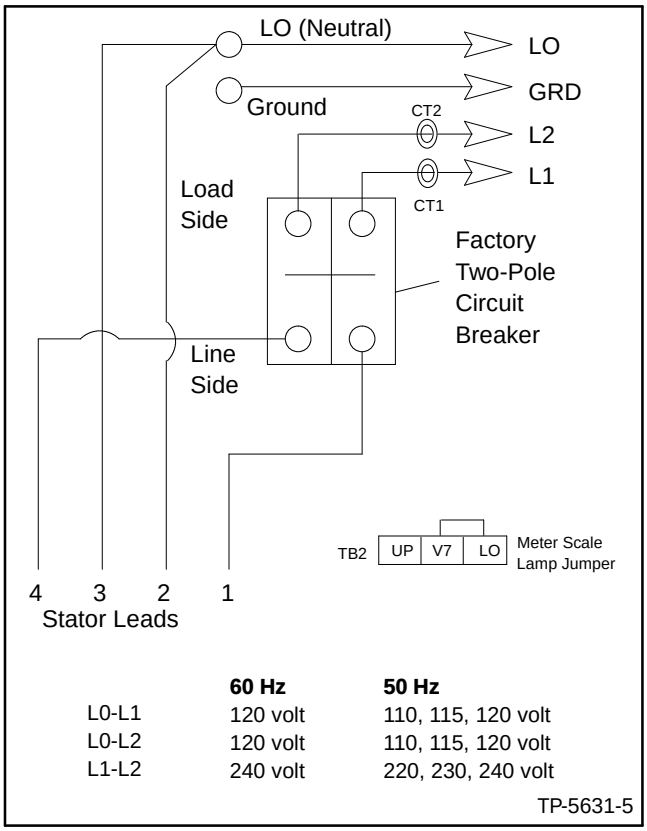


Figure 5-3. Dual Voltage Connection

5.1.2 12-Lead (3-Phase) Generator Sets

NOTE

Generator sets equipped with controllers with meters have current transformers (CTs).

NOTE

Position current transformers CT1, CT2, and CT3 with dot or HI side toward generator set.

Three-phase, 12-lead generator sets are reconnectable to the voltages and phases shown in Figure 5-4. If the generator set is reconnected to obtain a different output voltage, voltage regulator adjustments may be necessary to obtain desired voltage.

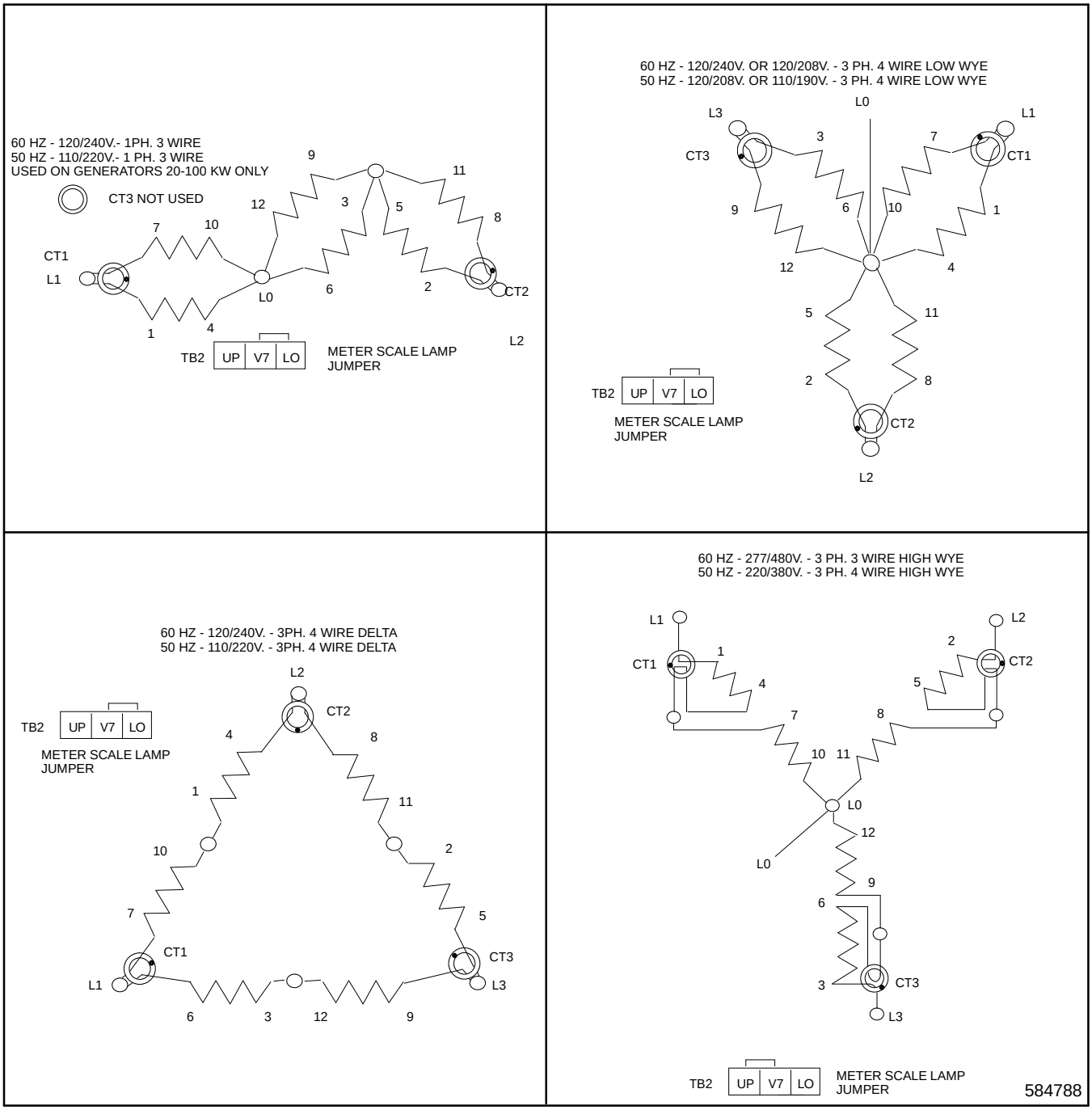


Figure 5-4. 12-Lead Generator Reconnection

5.2 Wiring Diagrams

10/12CCE/CEZ	Drawing	Page
Schematic Diagram		
1-phase	ADV-5719-F	21
3-phase	ADV-5720-F	22
Point-to-Point Wiring Diagram		
1-phase	226543-C	23
1-phase remote mounted	226546-C	24
3-phase	226539-C	25
3-phase remote mounted	226547-B	26

Figure 5-5. Wiring Diagrams

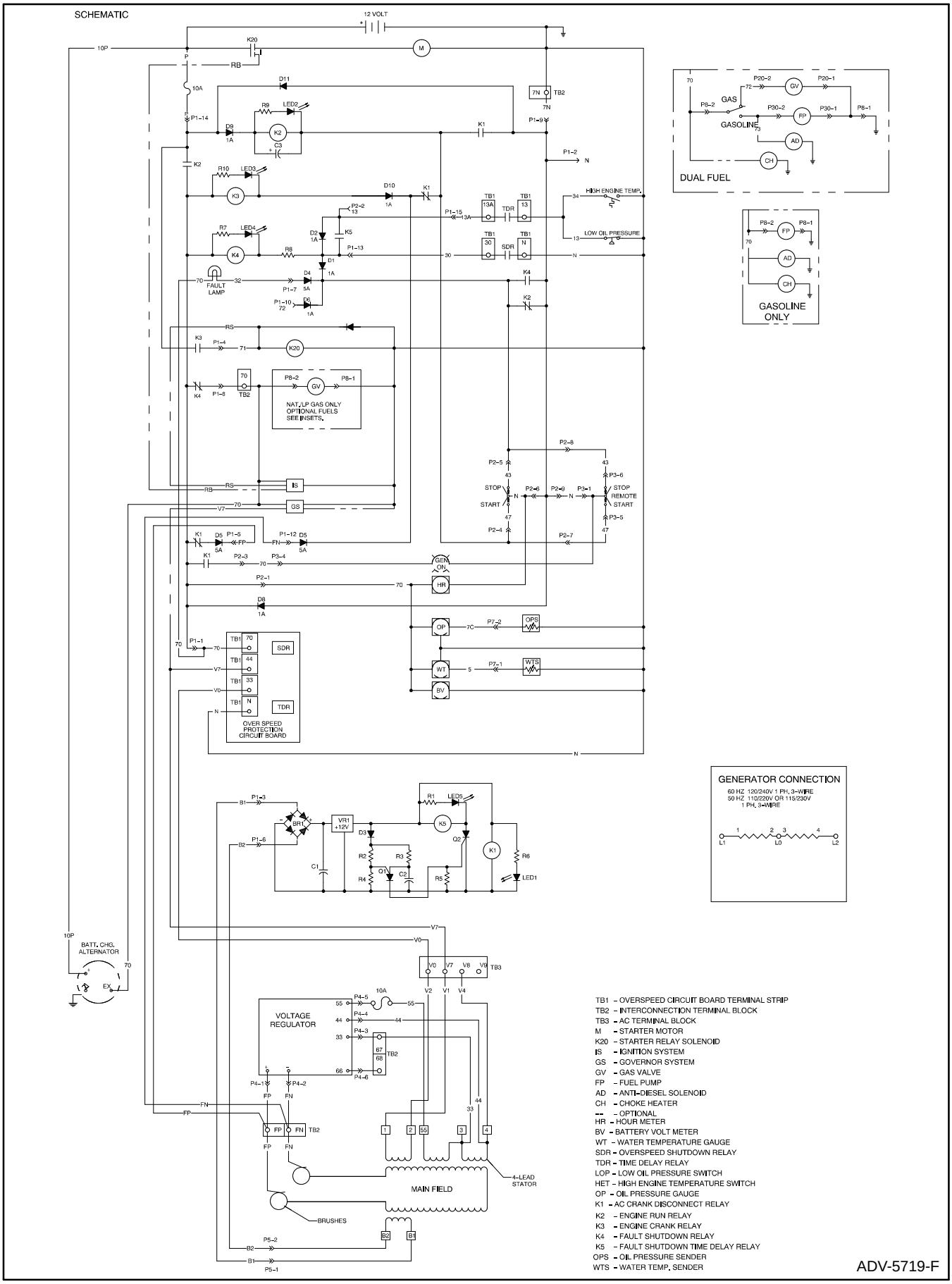


Figure 5-6. Schematic Diagram, 1-Phase

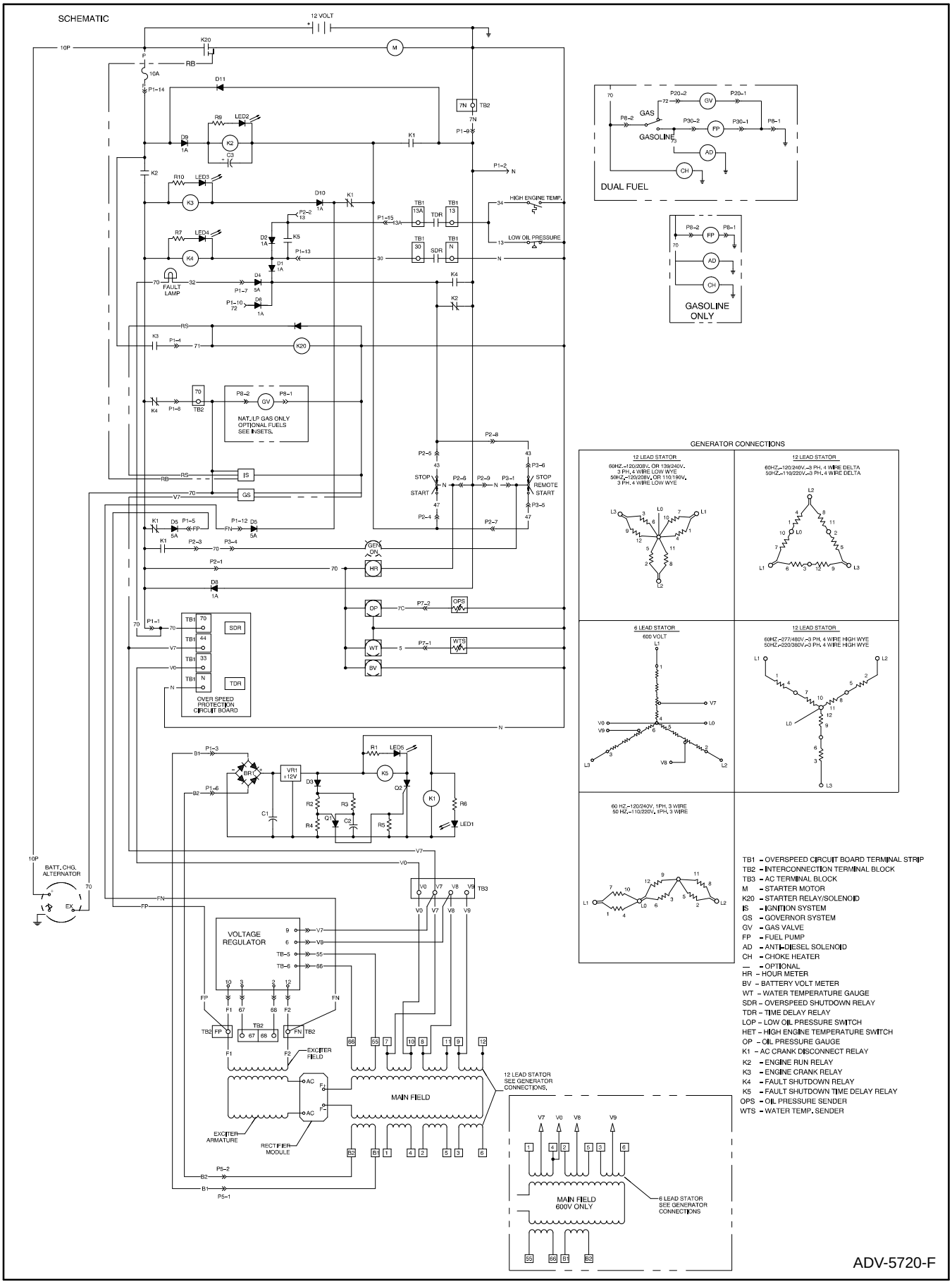


Figure 5-7. Schematic Diagram, 3-Phase

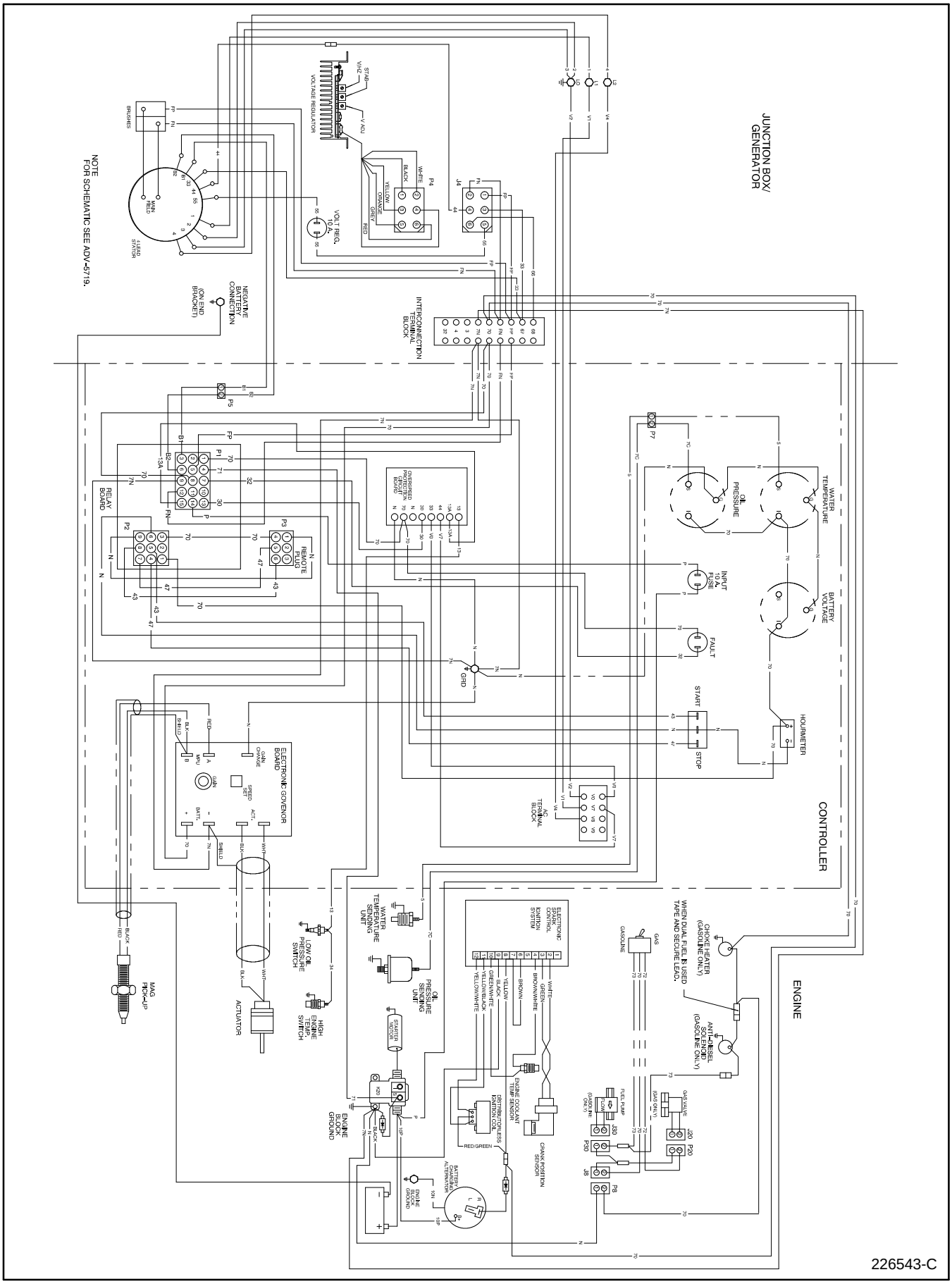


Figure 5-8. Point-to-Point Wiring Diagram, 1-Phase

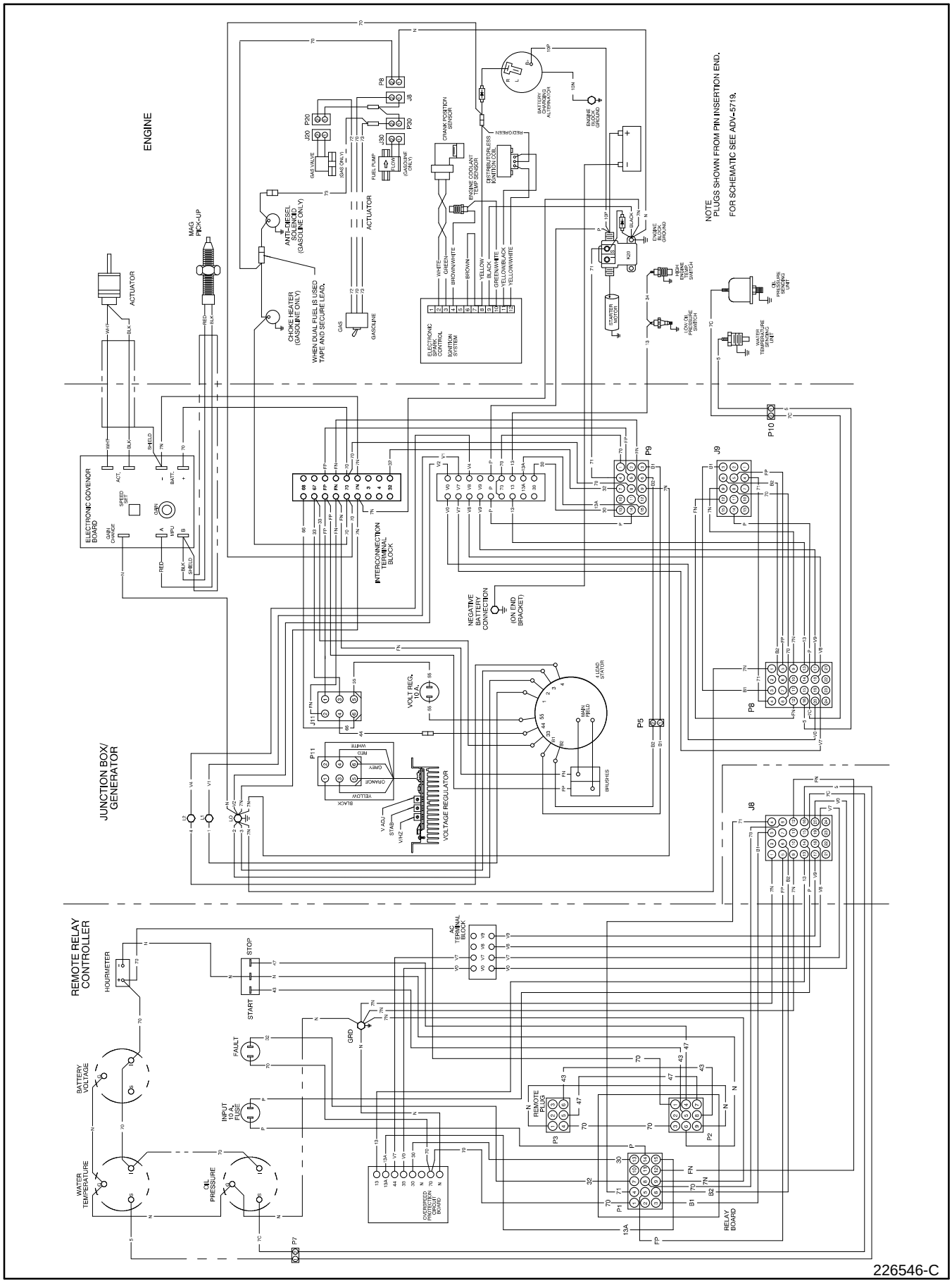


Figure 5-9. Point-to-Point Wiring Diagram, 1-Phase Remote Mounted

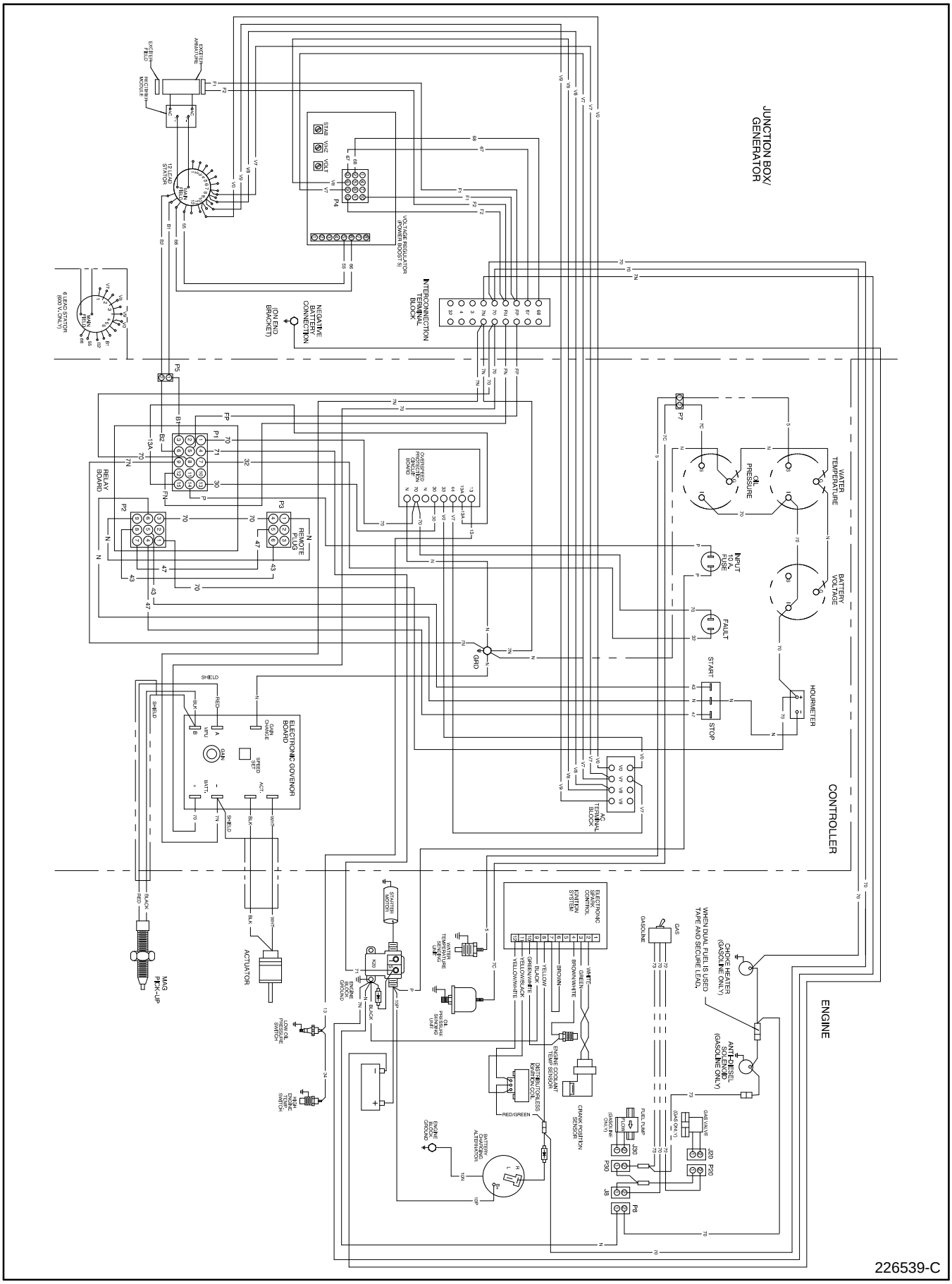


Figure 5-10. Point-to-Point Wiring Diagram, 3-Phase

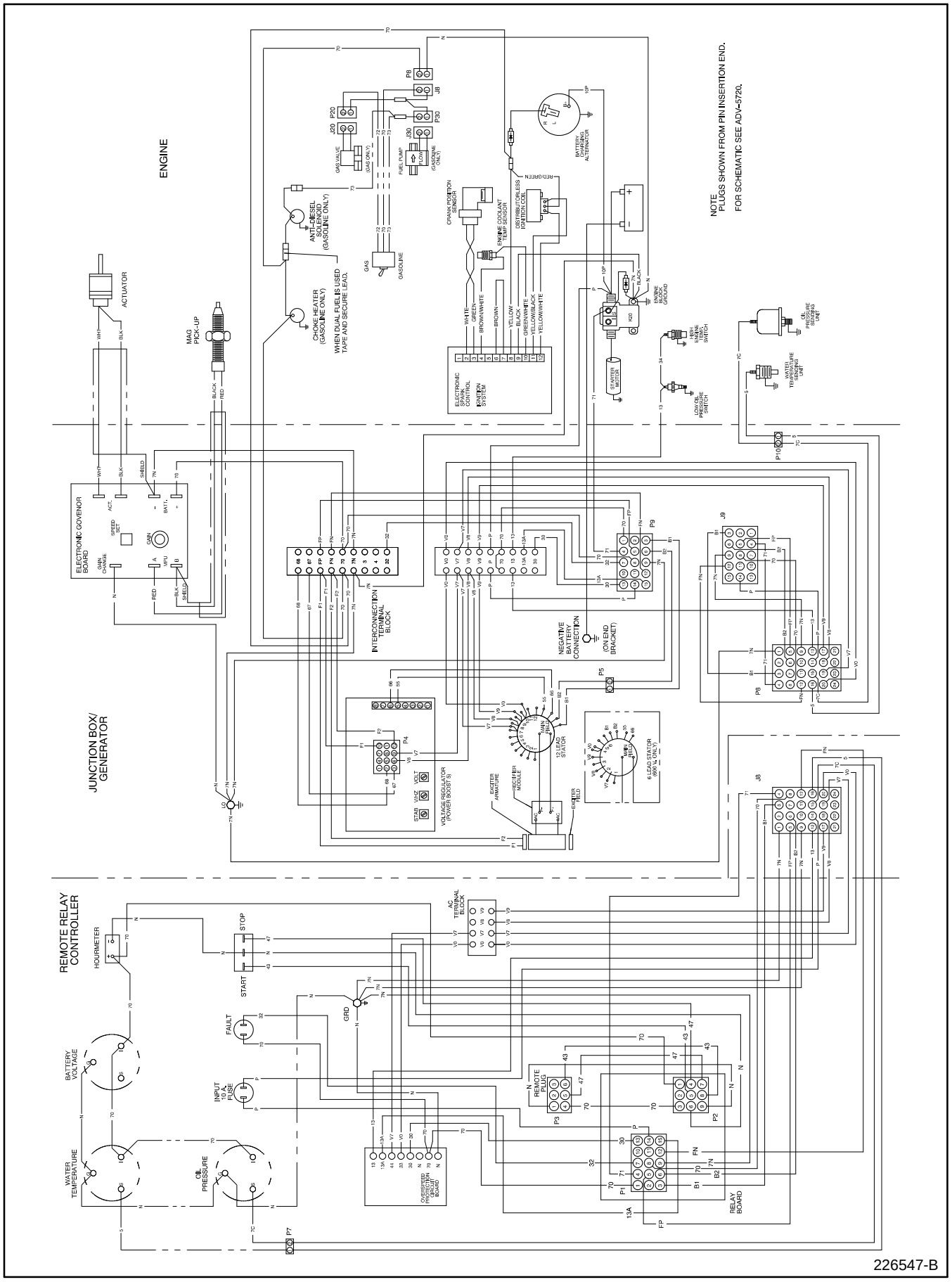


Figure 5-11. Point-to-Point Wiring Diagram, 3-Phase Remote Mounted

The safe and successful operation of a mobile power system depends primarily on the installation. Use this section as a guide to install the mobile generator set; then refer to the operation section preceding for generator set operating instructions.

RV/Mobile generator set installations must comply with the Kohler-detailed installation instructions following. Find additional installation requirements in the following sources:

- ANSI A 119.2/NFPA 501C
- Article 551 of ANSI/NFPA 70, National Electrical Code
- Canadian Standards Association (CSA) standard C22.2#100
- Canadian Electrical Code (CEC) C22.1

Generator set installation must also comply with state and local requirements.

Refer to the model's specification sheet for details– use the spec sheet as a guide for planning your installation. Use current dimension drawings and wiring diagrams.

6.1 Location

Locate the generator set to allow for easy access to the generator set's engine, controller, cooling system, and fuel system components for routine service.

Before making final plans for locating the generator set, consider the following concerning the set and the proposed location.

1. Ensure that the location allows sufficient room to maintain required minimum clearances.
2. Ensure that the location provides enough air flow to allow required cooling.
3. Ensure that the location is strong enough to support the generator set weight.
4. Ensure that the location provides ample room for routine maintenance.

See current generator set specification sheet or dimension drawings following for generator set dimensions.

Allow clearance for vibration and cooling during operation. Minimum clearance for vibration and cooling (top, front, rear, and sides) is 1 1/2 in. (38 mm).

Generator Set Compartment

The most popular way of installing a generator set is in a compartment. Consider the following factors when installing a generator set in a compartment.

Minimum clearance. Allow clearance for vibration and cooling during operation. Minimum clearance for vibration and cooling (top, front, rear, and sides) is 1 1/2 in. (38 mm). Observe the minimum clearances to ensure that the sides of the compartment and the generator set do not rub while operating the generator set or driving the vehicle.

Additional clearance. Routine generator set service requires additional clearance from those listed above. Design the compartment to allow for sufficient room to easily remove the generator set to perform major service.

Sound-deadening material. Line the compartment with a good sound-deadening material. Select a fireproof, or fire resistant material with a fire-retardant adhesive. A 3-layer foam material does an efficient job of absorbing sound. Cut to size this material and bond to a clean, dry surface.

NOTE

Do not install combustible insulation near exposed exhaust-system components.

Compartment size. Consider the thickness of the sound-deadening or insulating material used to line the compartment when planning compartment size. If necessary, enlarge the compartment to maintain minimum clearance requirements.

Compartment door. Also keep in mind that the compartment door must have air-intake openings having a free area equal to or greater than that specified under Air Requirements in the Specification Sheet.

Vapor-tight compartment. Ensure a vapor-tight compartment by completely sealing all crevices to prevent exhaust or other fumes from entering the vehicle.

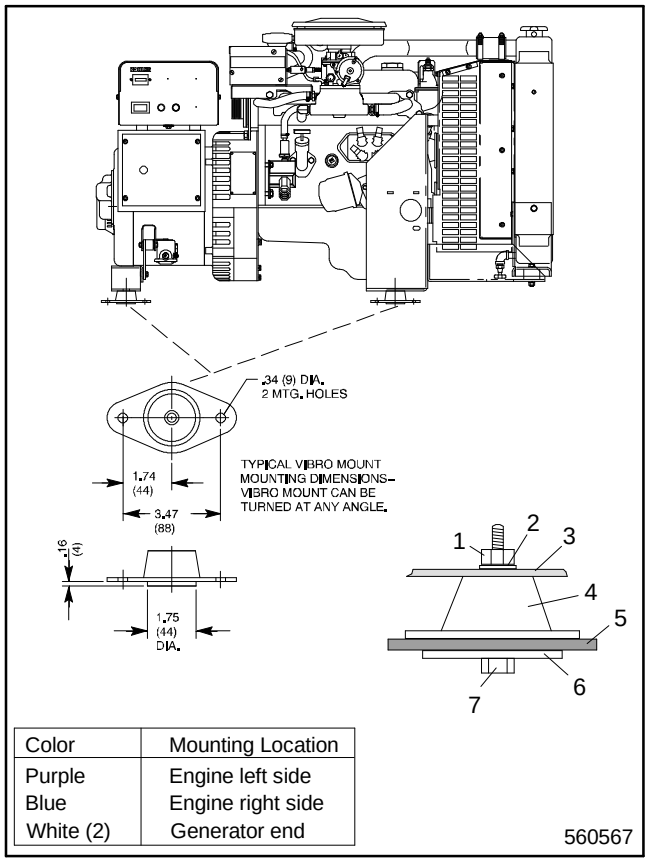
Road splash. Avoid road splash and the possibility of igniting combustible material beneath the vehicle by enclosing all unnecessary free space beneath the generator set compartment.

6.2 Mounting

Securely fasten the generator set to avoid unwanted movement from vibration and road shock. Attach the generator set vibromounts directly to the vehicle's frame. See Figure 6-1 for vibromount installation.

Vibromounts

Attach the vibromounts to the generator set as shown in Figure 6-1 using the supplied hardware.



Color	Mounting Location
Purple	Engine left side
Blue	Engine right side
White (2)	Generator end

1. Lock nut
2. Flat washer 7/16 x 1
3. Generator set frame
4. Vibromount
5. Vehicle frame
6. Flat washer 13/32 x 2
7. Screw 3/8-16 x 2-1/4

Figure 6-1. Vibromount Installation

6.3 Cooling System

See Section 3– Cooling System for a description of the generator sets cooling system.

Air Requirements

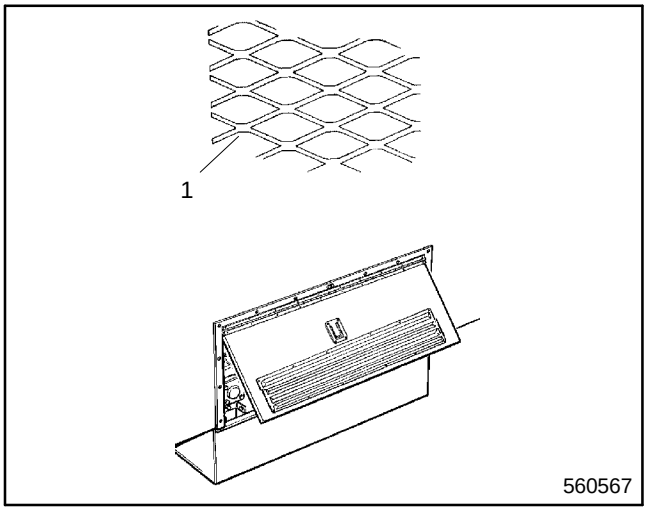
High water temperature shutdown switch. Each generator set includes a high water temperature shutdown switch which automatically shuts down the generator set if operating temperatures climb too high. To prevent generator set shutdown, ensure adequately-sized compartment openings to allow circulation of the cooling and combustion air.

Free-air opening. Figure 6-2 shows the generator set cooling requirements. Louvers, screens, and protective grill work restrict air flow. Even a simple, open mesh screen, as shown in Figure 6-3, restricts air flow as much as 45%. Increase the intake openings to compensate for restrictions.

Seal the air-inlet openings, at the engine radiator and/or generator end bracket, against the compartment wall to ensure that only exterior air is drawn into the generator compartment.

Model	Air Requirements
10/12CCE/CEZ (60 Hz)	2400 (68)
10/12CCE/CEZ (50 Hz)	2000 (57)

Figure 6-2. Engine/Generator Cooling Requirements– cfm (m#/min.)

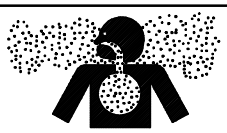


1. Wide mesh screen

Figure 6-3. Inlet Screen

6.4 Exhaust System

⚠ WARNING



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

The exhaust system must be leakproof and routinely inspected.

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

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

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

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

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

Inspecting exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. In addition to routine exhaust system inspection, install a carbon monoxide detector. Consult your coach builder or dealer for approved detector installation. Test the carbon monoxide detector function per the manufacturer's instructions and keep it operational at all times.

Planning. Carefully plan the generator set exhaust system to ensure a safe, quiet installation. Make certain that the exhaust system and installation complies with all state and local requirements and applicable article of the codes listed at the beginning of this section.

Clearance requirements. Because of the different location of mufflers and piping to the muffler, follow clearance requirements to protect generator set components and to avoid igniting adjacent combustible materials. Kohler Co. recommends a clearance of 1.5 in. (38 mm) between exhaust system components and fuel system, electrical system, and all combustible components.

Routing. Route the exhaust piping through the compartment floor or walls maintaining minimum clearances and minimizing exhaust pipe bends.

Exhaust sleeve. Use an exhaust sleeve or thimble when routing exhaust piping through a combustible wall.

Muffler clamps. Use automotive-type, U-bolt muffler clamps in exhaust system installation.

Muffler. Install a muffler made of aluminized steel or other corrosion-resistant material of welded or crimped construction. The muffler must meet USDA-Forest Service approval and have a USDA-Forest Service approved spark arrestor.

Hangers. Suspend exhaust system components beneath the undercarriage with automotive-type tailpipe hangers (shock mounted) only. Position hangers vertically 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. (457 mm) beyond the muffler, attach an additional hanger for support.

Tail pipe. Use a tail pipe as short as possible with as few gradual bends as possible to reduce back pressure.

Extend tail pipe horizontally a minimum of 1 in. (25 mm) past the perimeter of the vehicle. If the tail pipe is located on the same side as the compartment air intake, position tail pipe as not to recirculate exhaust gases.

6.5 Fuel System

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.

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

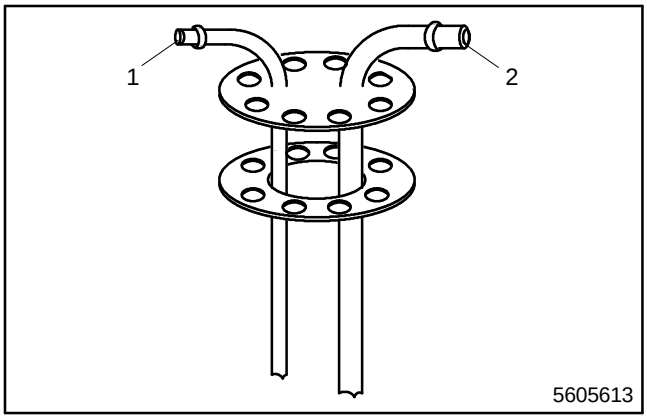
Fuel system. Explosive fuel vapors can cause severe injury or death. All fuels are highly explosive in a vapor state. Use extreme care when handling and storing fuels. Store fuel in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from spark. Do not smoke or permit flame or spark to occur near sources of spilled fuel or fuel vapors. Keep fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid breakage caused by vibration. Do not operate generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair systems before resuming generator set operation.

The following paragraphs describe the installation of gasoline and LP gas fuel systems. Contact an authorized Kohler service distributor/dealer for further fuel system installation information.

6.5.1 Gasoline

Design the gasoline fuel system to operate independently of the vehicle fuel system if operating both the vehicle and the generator set simultaneously. The best way to do this is to have separate fuel tanks; however this is usually impractical because of space restrictions.

Dip tube design. In most installations, both engines operate from a common tank with a separate dip tube arrangement as shown in Figure 6-4. A dip tube arrangement prevents the generator set from being starved of fuel by the vehicle 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 the fuel supply is low.



1. Fuel line to generator set
2. Fuel line to vehicle engine

Figure 6-4. Two Dip Tubes in Fuel Tank

Tee fitting design. Use the tee arrangement only as a last resort. A simple tee fitting is sometimes used to provide fuel for both the generator set and the vehicle engine off a common tank; however, this usually prohibits simultaneous operation. There is also the probability that operation of either engine could completely drain the fuel line and even the carburetor fuel bowl of the other engine making starting difficult if not impossible.

Do not tee into fuel injected fuel systems. Use a two dip tube arrangement for fuel supply.

Gasoline fuel lines. Care must be taken when routing the fuel lines from the main tank to the generator set. Keep fuel lines as short as possible but maintain adequate clearance from exhaust system. Route the fuel lines along the vehicles frame or undercarriage– never run fuel lines inside the vehicle. Locate fuel lines below the generator set compartment with entry point near the fuel pump. Size the fuel line to handle the flow of fuel, to withstand road shock and year-round climate conditions. If using steel tubing, use 1/8 in. (3.2 mm) I.D. minimum with an 8 in. (230 mm) minimum flexible section to allow free movement of the generator set.

6.5.2 LP Gas

LP fuel hose. Use a flexible fuel hose designated for use with LP fuels between the generator set and the main fuel tank. Care must be taken when routing the fuel line. Maintain a 2 in. (51 mm) clearance between the fuel line and any bare exhaust component. Do not tie any electrical wiring to the fuel line. If the flexible fuel line passes through sheet metal, install grommets or clamps to prevent hose abrasion. The LP fuel system shall conform to section 3-6.4 of NFPA58, Storage and Handling of Liquified Petroleum Gases.

For LP gas system, use UL classified pipe joint sealing compound to prevent dangerous fuel leaks. Use a sealing compound approved for use with LP gas. Apply UL classified sealing compound at all fuel line pipe joints.

Use flexible fuel lines in areas where vibration and/or movement of connected components is likely, such as the main fuel line to the generator set. Use seamless steel tubing wherever long main fuel lines are required.

Testing fuel system. After all the LP connections have been completed, pressure test the entire system to 6-8 ounces (10-14 inches water column). Test the connections for leakage with soapy water or bubble solution. Do not use solutions that contain ammonia or chlorine, since the solution will not bubble for an accurate leakage test.

The gas supply pressure should not exceed six ounces. To check inlet pressure, remove plug on fuel inlet for gas regulator. Insert ounce pressure gauge or manometer. Adjust operating pressure to 4-6 ounces or 7-11 inches water column; adjust inlet pressure on the primary regulator.

NOTE

Fuel leakage could cause an explosion. After making all LP gas connections pressure test the entire system to 6-8 ounces (10-14 inches water column).

NOTE

Gas pressure above 10 ounces can result in non-operation of the gas valve.

6.6 Electrical System

Connection of the load leads, battery, and if required remote switch panel complete the generator set installation. The following paragraphs give some details on each connection. Refer to the wiring diagrams in Section 5– Wiring Diagrams for specific details. Have a qualified electrician make connections.

Wiring. Securely support or harness all wiring to the generator set to prevent abrasion. Provide additional support for wiring to prevent exposure to exhaust system components. Maintain at least a 2 in. (51 mm) clearance between electrical wiring and hot exhaust components. Do not locate wiring directly below or in close proximity to fuel system parts or oil-fill.

6.6.1 AC Load Lead Connections

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

NOTE

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

NOTE

Use field-supplied wiring capable of withstanding temperatures of 167°F (75°C)

AC load lead L0 (white or gray) indicates the neutral lead on Kohler generator sets. Make sure to connect the neutral of the AC circuit in the vehicle to the lead L0 (white or gray). If the vehicle uses equipment ground-type plugs and receptacles (3-pronged), connect the green wire to the U-shaped pin. On vehicles which also have provisions for using an outside AC power source, completely isolate the neutral as well as the hot (or black) leads from the generator set when switching power to the outside source. See Figure 6-5.

NOTE

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

NOTE

Protect the AC load circuit of the generator set against overload or short circuit with a circuit breaker(s) .

NOTE

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

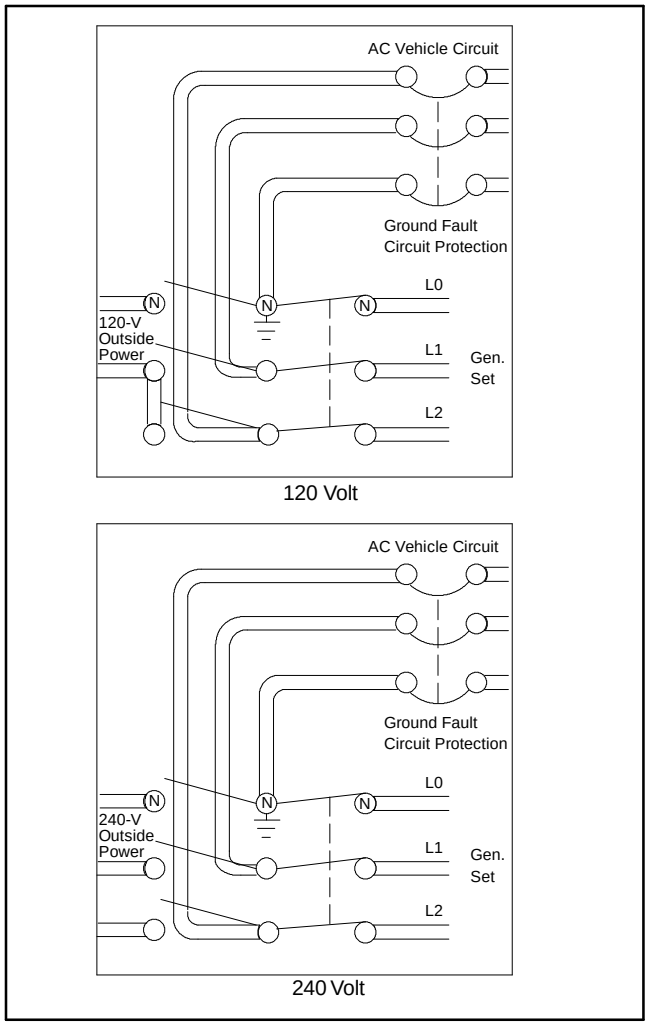


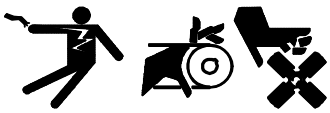
Figure 6-5. Transfer Switch Connections, 3-Wire AC Circuit

6.6.2 Circuit Protection

The AC circuit breaker interrupts generator output in the event of an overload or short circuit in the wiring between the alternator and generator set components.

After correcting the fault, reset the AC circuit breaker by placing it in the ON position.

⚠ WARNING

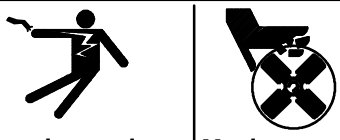


Accidental starting.
Can cause severe injury or death.

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

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

⚠ WARNING



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

Operate generator set only with all guards and electrical enclosures in place.

Grounding generator set. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Open main circuit breakers of all power sources before servicing equipment. Configure the installation to electrically ground the generator set and electrical circuits when in use. Never contact electrical leads or appliances when standing in water or on wet ground, as the chance of electrocution increases under such conditions.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove wristwatch, rings, and jewelry before servicing equipment.

Electrical backfeed to utility. Hazardous backfeed voltage can cause severe injury or death. Connect generator set to building/campground electrical system only through an approved device and after building/campground main switch is open. Backfeed connections can cause serious injury or death to utility personnel working on power lines and/or personnel in the vicinity of the work area. Unauthorized connection to utility electrical system may be unlawful in some states and/or localities. Install a transfer switch to prevent interconnection of generator set power and other sources of power.

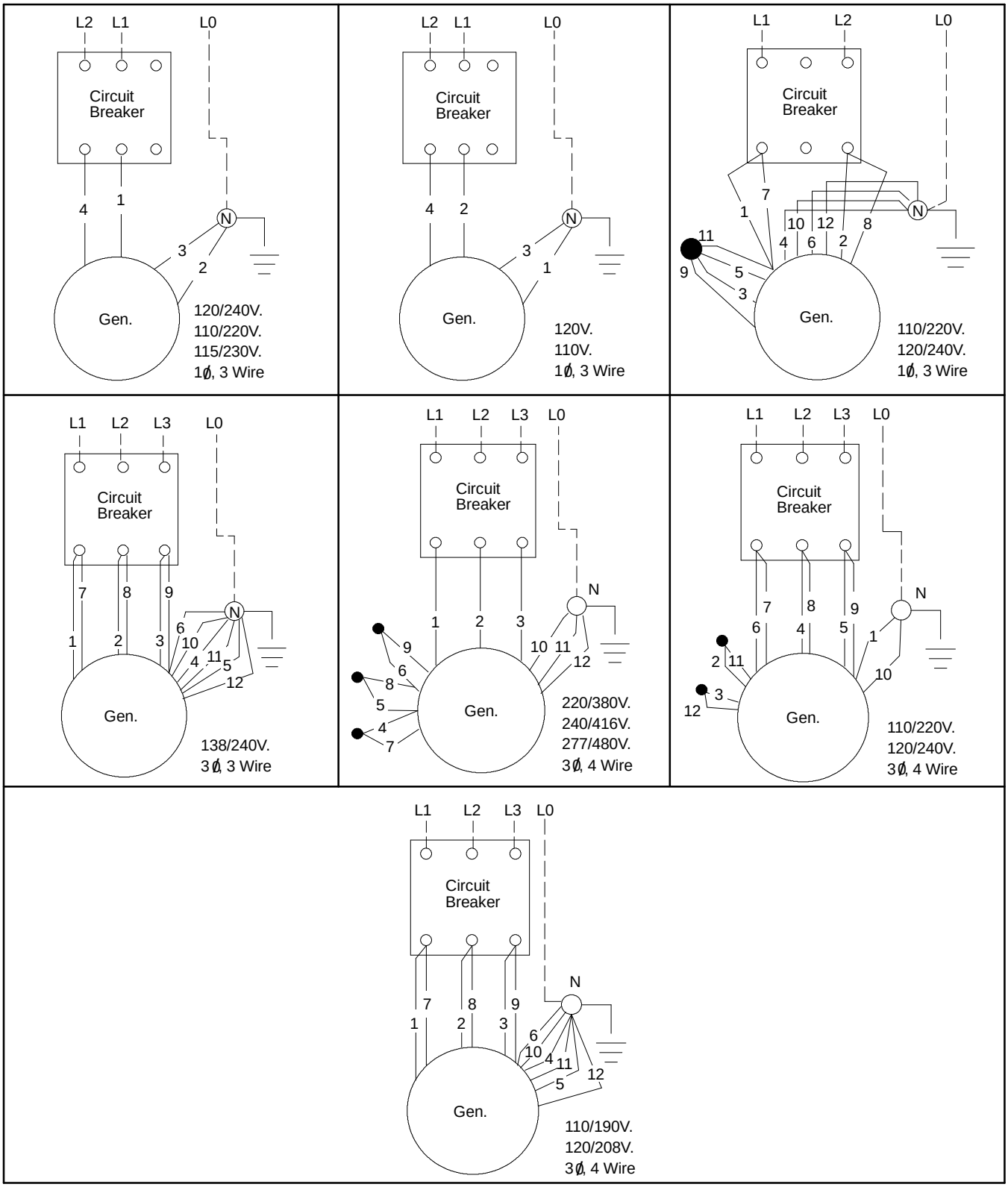


Figure 6-6. Circuit Breaker Connections

6.6.3 Remote Switch Connection

Controllers include an accessory plug (P3) for easy connection of the remote switch. One end of the 15 in. (381 mm) P3 wiring harness plugs directly into the controller. The pigtail leads on the remaining end of the harness connect to the appropriate remote panel terminals via customer-supplied wiring. Connect the remote operating controls to the correct P3 wire harness lead. See the wiring diagrams in the Section 5– Wiring Diagrams for identification of P3 harness leads.

6.6.4 Battery and Connections

⚠ WARNING

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

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

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

Starting battery. Kohler Co. recommends a separate 12-volt battery for the generator set. With a separate battery, cables can be kept short, eliminating the problem of voltage drop through long cables.

Lengths and sizes. See Figure 6-7 for length and sizes.

Cable connections. Refer to Figure 6-8 (View A) for cable connections. Connect a ground strap between the ground lug on the generator set and vehicle frame with this type of battery connection.

If the starting battery for the vehicle engine must also be used for starting the generator engine, ground the negative battery terminal to the vehicle frame and connect heavy gauge (#4) ground strap to the ground lug on the generator set to the vehicle frame as illustrated in Figure 6-8 (View B).

NOTE

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

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

Figure 6-7. Battery Cable Size

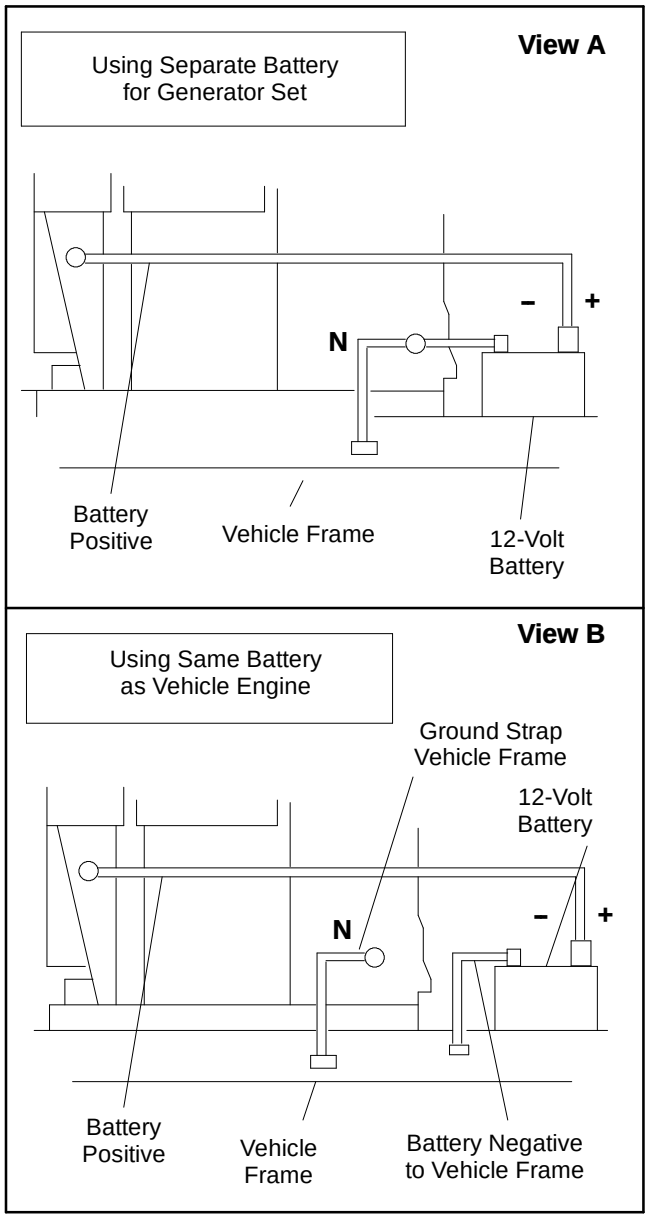


Figure 6-8. Battery Connection

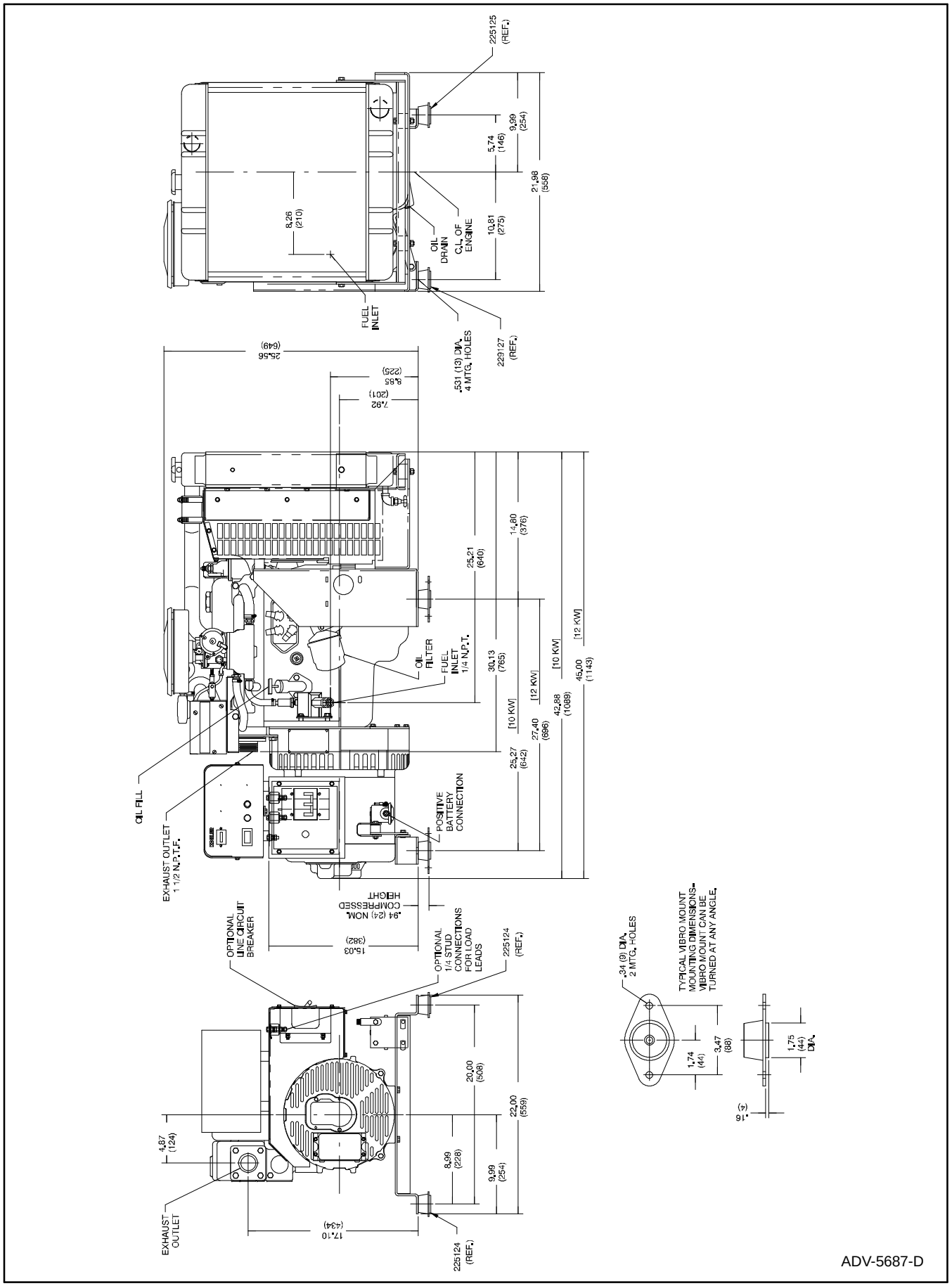


Figure 6-9. 10/12CCE/CEZ, Gasoline, 1-Phase Dimension Drawing

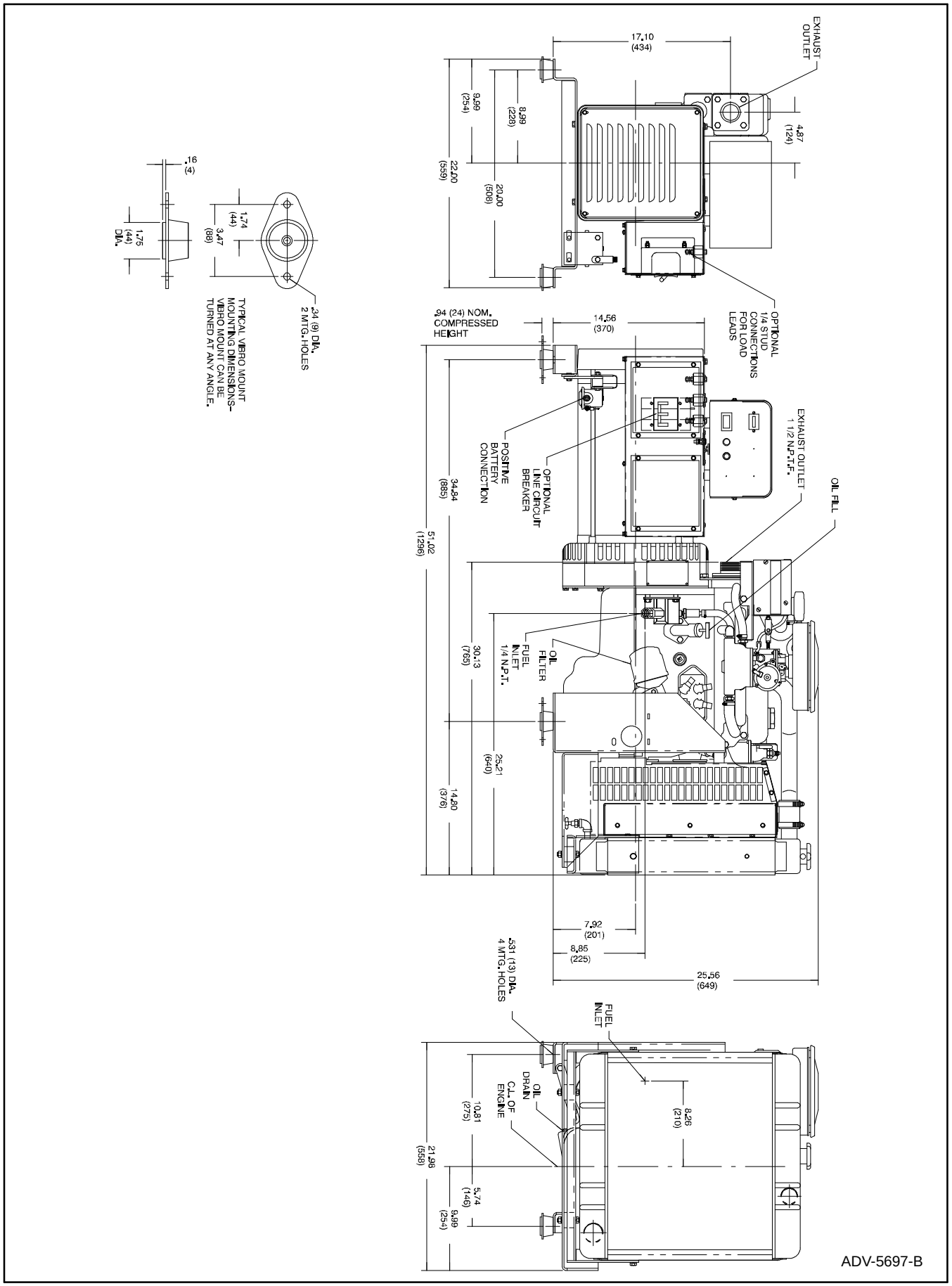


Figure 6-10. 10/12CCE/CEZ, Gasoline, 3-Phase Dimension Drawing

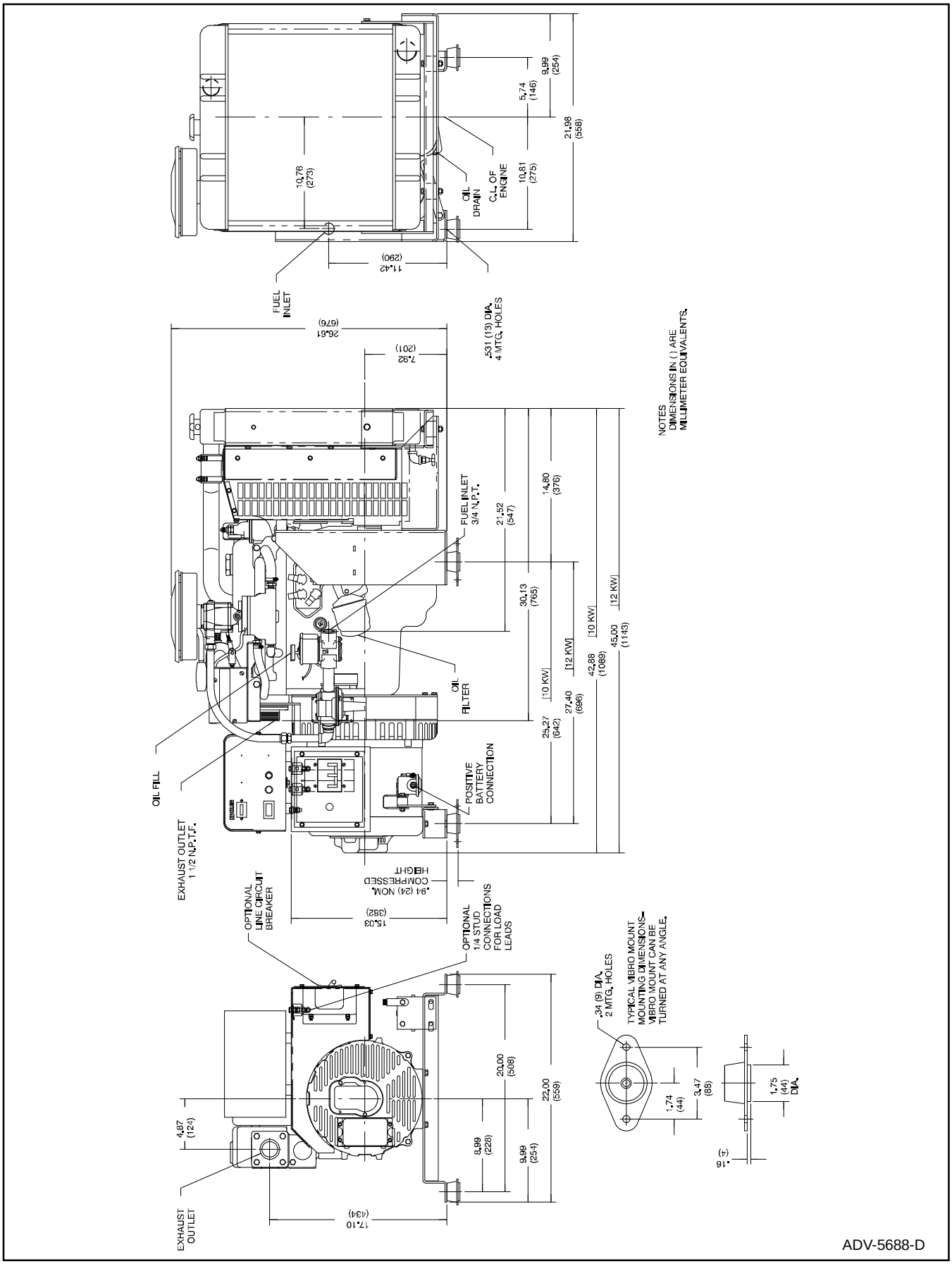


Figure 6-11. 10CCE/CEZ, Straight Gas, 1-Phase Dimension Drawing

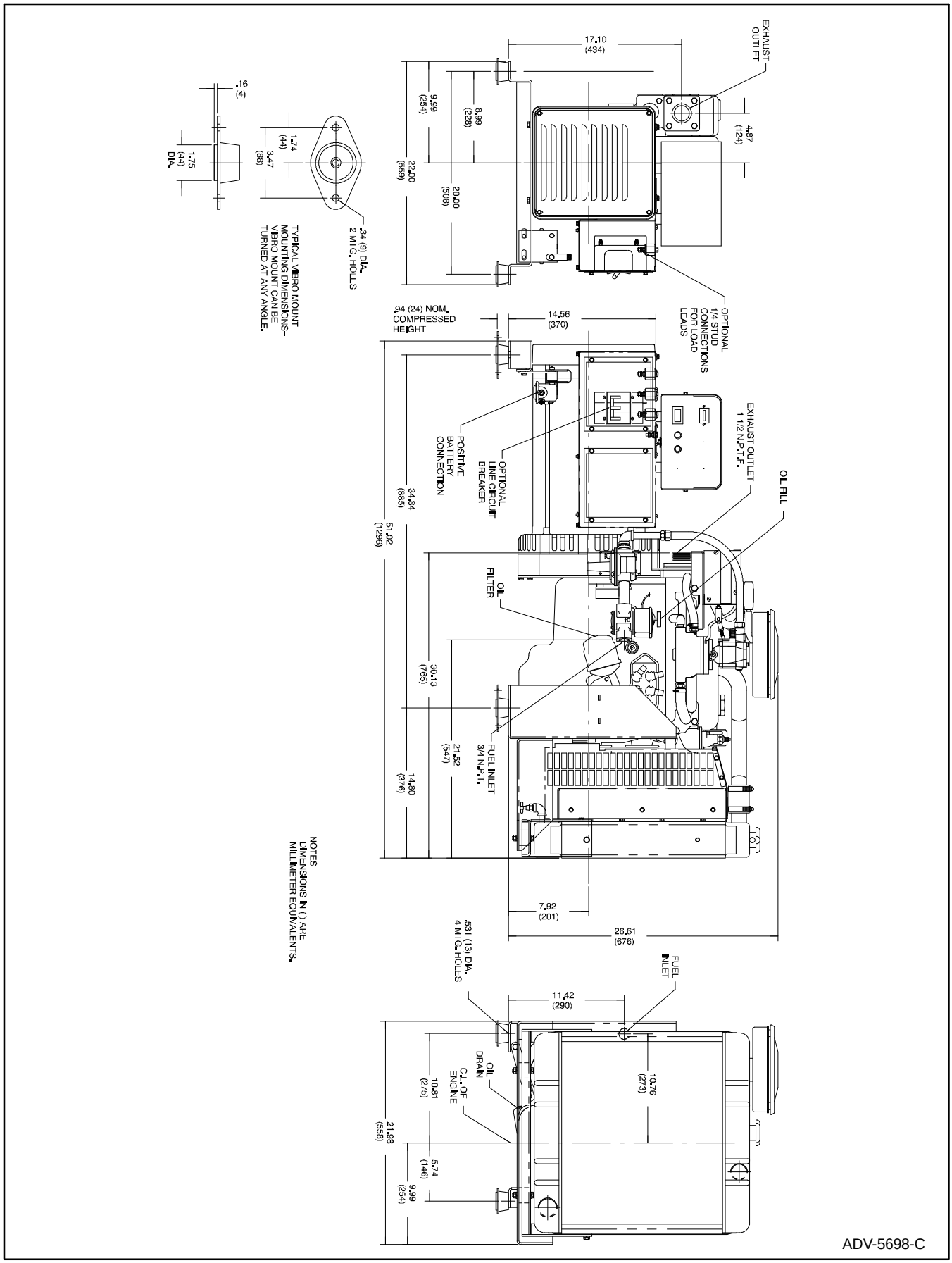


Figure 6-12. 10CCE/CEZ, Straight Gas, 3-Phase Dimension Drawing

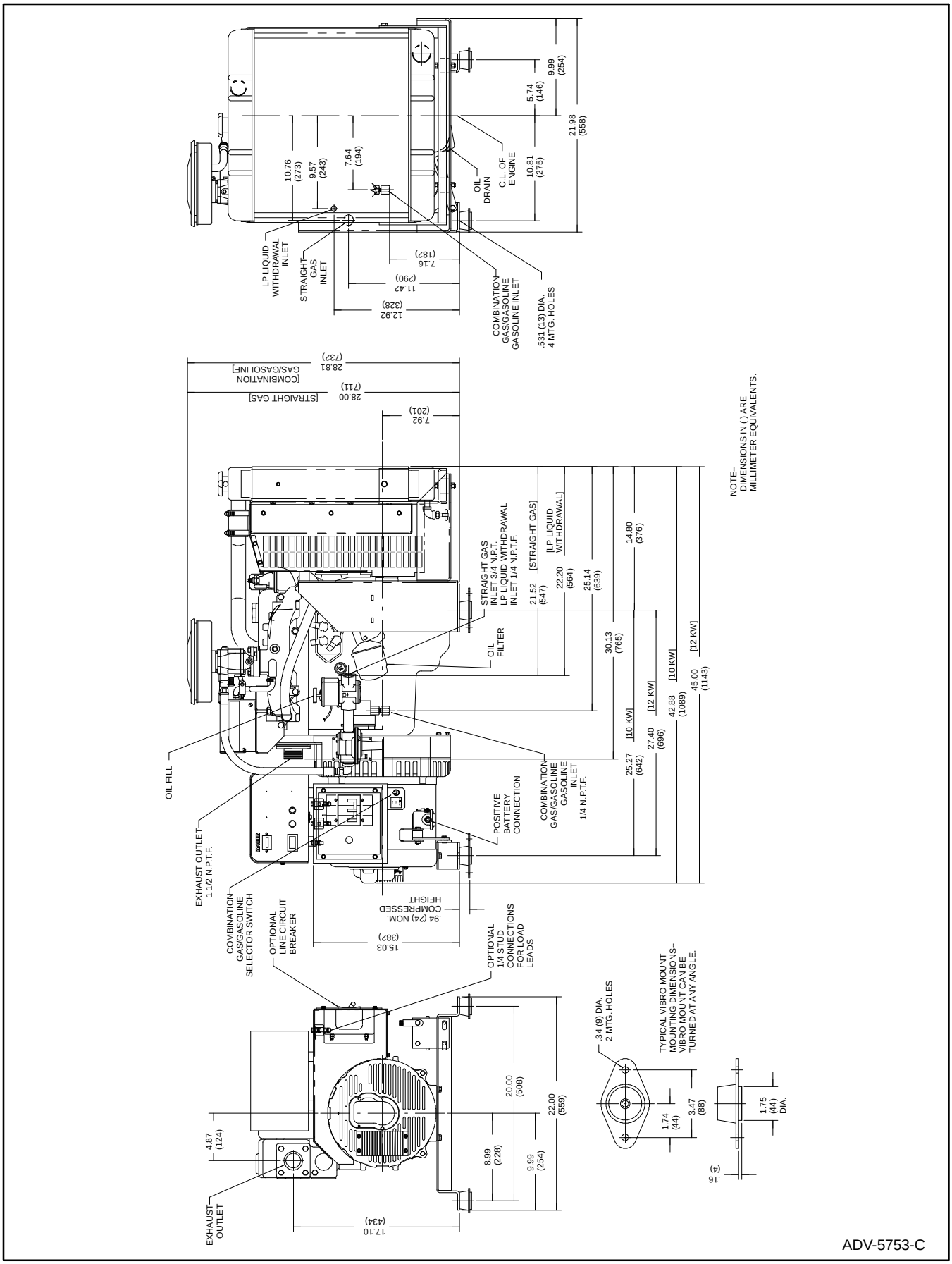


Figure 6-13. 10CCE/CEZ, Straight Gas, LP Liquid, Combination Gas/Gasoline, 3-Phase Dimension Drawing

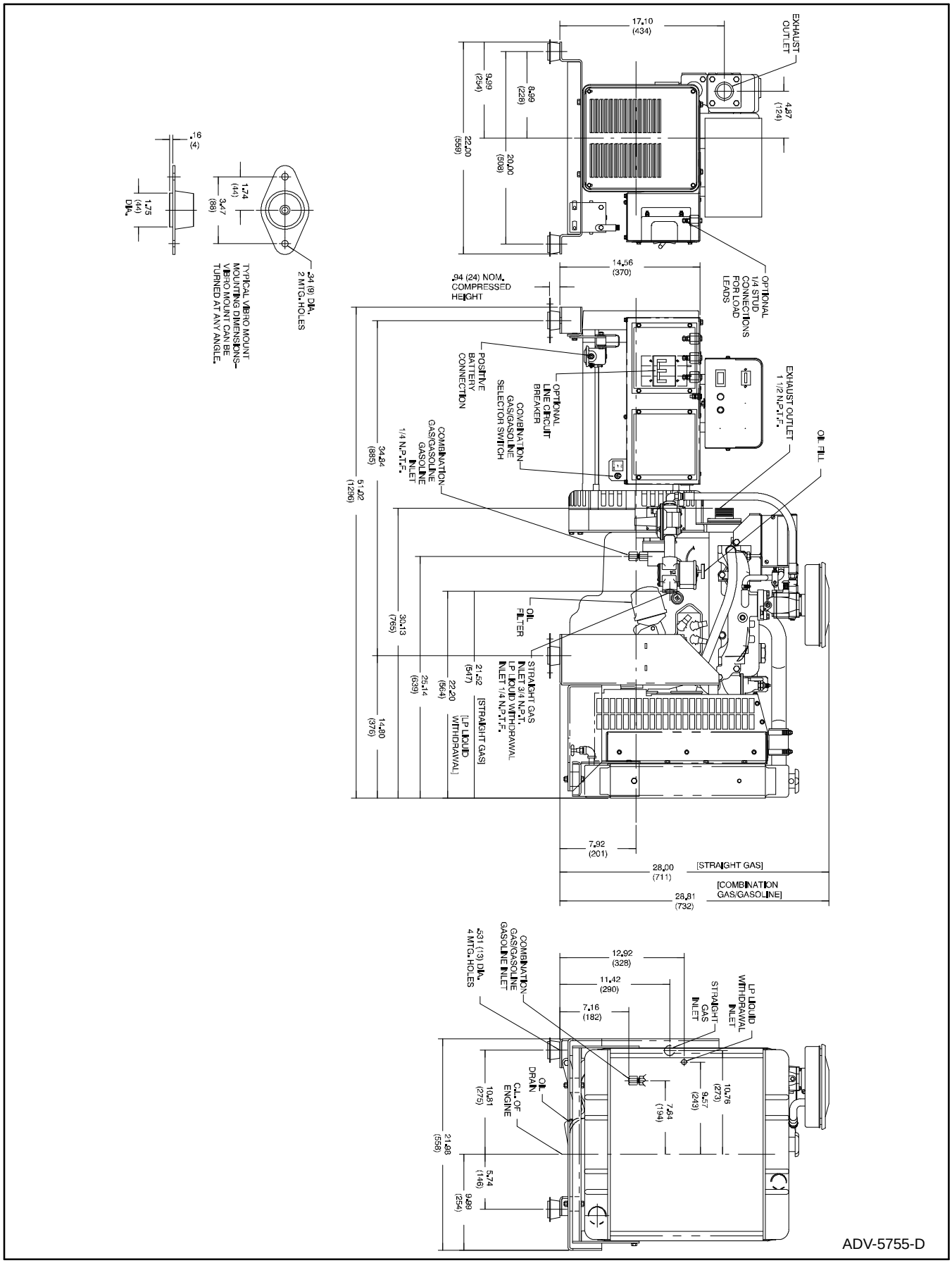


Figure 6-14. 10CCE/CEZ, Straight Gas, LP Liquid, Combination Gas/Gasoline, 3-Phase Dimension Drawing

Appendix A. Glossary of Abbreviations

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

AC	alternating current
AISI	American Iron and Steel Institute
Amp	ampere
Amps	amperes
ANSI	American National Standard Institute
API	American Petroleum Institute
approx.	approximate, approximately
A/R	as required, as requested
A/S	as supplied, as stated, as suggested
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
aux.	auxiliary
AWG	American Wire Gauge
AWM	appliance wiring material
BBDC	before bottom dead center
BDC	before dead center
BHP	brake horsepower
bmep	brake mean effective pressure
Btu	British thermal unit
℃	Celsius degree
cc	cubic centimeter
CCA	cold cranking Amps.
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CID	cubic inch displacement
cm	centimeter, centimeters
cmm	cubic meters per minute
co.	company
cont'd.	continued
CSA	Canadian Standards Association
CT	current transformer
cu. in.	cubic inch, cubic inches
cyl.	cylinder
dB	decibel
dBA	decibels (A weighted)
DC	direct current
DCR	direct current resistance
deg.	degree
dept.	department
dia.	diameter
e.g.	example given
EIA	Electronic Industries Association
EMI	electromagnetic interference
EPA	Environmental Protection Agency
etc.	et cetera (and so forth)
ext.	external
℉	Fahrenheit degree
fl. oz.	fluid ounce, fluid ounces
FM	frequency modulation
ft.	foot, feet
ft. lbs.	foot pound, foot pounds
ga.	gauge (meters, wire size)
gal./ gals.	gallon, gallons
gph	gallons per hour
gpm	gallons per minute
gr.	grade
grd.	ground
HCHT	high cylinder head temperature
HET	high exhaust (or engine) temperature
Hg	mercury (element)
H_2O	water
HP	horsepower
hr, hrs	hour
Hz	hertz (cycles per second)
ID	inside diameter
IEEE	Institute of Electrical and Electronic Engineers
in.	inch(es)
inc.	incorporated
in. lbs.	inch pounds
int.	internal
int.-ext.	internal-external
ISO	International Standards Organization
J	joule, joules
JIS	Japanese Industry Standard
kg	kilogram, kilograms
kg/cm^2	kilograms per square centimeter
kgm	kilogram meter(s)
kJ	kilojoules (btu cal)
km	kilometer, kilometers
kPa	kiloPascal, kiloPascals
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt amperes
kW	kilowatt, kilowatts
kWH	kilowatt hour
L	liter, liters
LxWxH	length x width x height
LED(s)	light emitting diode
lb., lbs.	pound, pounds
L/hr.	liter per hour, liters per hour
L/min.	liter(s) per minutes
LOP	low oil pressure
LP	liquefied petroleum
m	meter, meters
m^3	cubic meter, cubic meters
max.	maximum
MCM	one thousand circular mils.
megger	megohmmeter
MHz	megahertz
mi.	mile, miles
mil	one one-thousandth of an inch
min.	minimum
mJ	millijoule, millijoules
MJ	mega joule, mega joules
mm	millimeter, millimeters
m^3/min	cubic meters per minute
MPa	megaPascal
mW	milliwatt, milliwatts
MW	megawatt, megawatts
N/A	not available or not applicable
NBS	National Bureau of Standards
N.C.	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	Newton meter, Newton meters
no., nos	number, numbers
NPT	National Standard taper pipe thread per general use
N/R	not required
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OS	overspeed, oversize
O/S	oversize
OSHA	Occupational Safety and Health Act
OV	overvoltage
oz.	ounce, ounces
PF	power factor
PMG	permanent magnet generator
pot.	potentiometer
ppm	parts per million
psi	pounds per square inch
pt., pts.	pint, pints
PVC	polyvinyl chloride
qt., qts.	quart, quarts
qty.	quantity
ref.	reference
RFI	radio frequency interference
r.h.m.	round-head machine (screw)
rms	root mean square
RPM	revolutions per minute
RTV	room temperature vulcanization
SAE	Society of Automotive Engineers
SCR	silicon-controlled rectifier
sec.	second, seconds
spec.	specs, specification
sq.	square
sq. cm	square centimeters
sq. in.	square inch, square inches
tach	tachometer
TDC	top dead center
tech. pub.	technical publications
temp.	temperature
TIF	telephone influence factor
TP, TPs	technical publications
turbo	turbocharger
UHF	ultrahigh frequency
UNC	Unified coarse thread (was NC)
UNF	Unified fine thread (was NF)
UL	Underwriter's Laboratories, Inc.
U/S	undersize
U.S.A.	United States of America
V	volt, volts
vac	volts alternating current
vdc	volts direct current
VHF	very high frequency
W	watt, watts

Notes

Appendix B. Operating Hour Service Log

The following is provided to help you keep a cumulative record of operating hours on your generator set and the dates required services were performed. Enter hours to the nearest quarter hour.

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

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