Operation

Mobile Generator Sets

Models:

10/12CC
10/12CZ
10/12CCF
10/12CFZ

ISO 9001
KOHLER GENERATORS
INTERNATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-5405 4/92b

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.

Table of Contents

Introduction

This manual covers the general operation of the Kohler 10/12 CC/CZ mobile generator sets. Prior to operating the generator, READ THIS MANUAL. Carefully follow the operating procedures and observe all safety precautions to ensure proper generator operation and to avoid serious bodily injury. Information on servicing and troubleshooting the generator is available separately.

Service Assistance

Contact your Kohler Generator Distributor to obtain additional servicing information for particular models. Look in the Yellow Pages listing under Generators–Electric. To obtain complete engine and generator service literature, supply your distributor with the Model, Specification, and Serial numbers from the generator nameplate.

Safety Precautions and Instructions

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

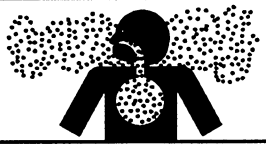
NOTE

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

Safety decals are affixed to the generator set in prominent places to advise the operator or service technician of potentially hazardous situations. The decals are reproduced here to improve operator recognition and thereby increase decal effectiveness. For a further explanation of decal information, reference the accompanying safety precautions. Before operating or servicing the generator set, be sure you understand the message of these decals. Replace decals if missing or damaged.

EXHAUST SYSTEM

⚠ WARNING



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

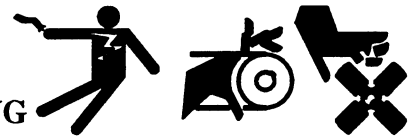
The exhaust system must be leakproof and routinely inspected.

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

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

ACCIDENTAL STARTING

⚠ WARNING



Accidental starting.
Can cause severe injury or death.
Disconnect battery cables before working on generator set (negative lead first and reconnect it last).

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

MOVING PARTS

⚠ WARNING

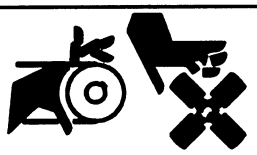
Hazardous voltage.

Moving rotor.

Can cause severe injury or death.

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

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

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

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

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

ENGINE BACKFIRE/FLASH FIRE

⚠ WARNING

Fire.
Can cause severe injury or death.

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

A flash fire can cause severe injury or death. Do not smoke or permit flame or spark to occur near carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuel or fuel vapors. When removing fuel line or carburetor, use a proper container to catch all fuel.

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

HAZARDOUS VOLTAGE/ ELECTRICAL SHOCK

⚠ WARNING

Hazardous voltage. **Moving rotor.**

Can cause severe injury or death.

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

⚠ WARNING

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

Do not connect to any building electrical system without connecting through an approved device and after building main switch is open.

Hazardous voltage can cause severe injury or death. The heat sink of the voltage regulator contains high voltage. Do not touch voltage regulator heat sink when testing or electrical shock will occur.

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

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

Hazardous voltage can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits.

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

FUEL SYSTEM

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.
Use extreme care when handling, storing, and using fuels.

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

Gasoline – Store gasoline only in approved red containers clearly marked GASOLINE. Do not store gasoline in any occupied building.

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

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

Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check LP Vapor gas fuel system for leakage using a soap–water solution with fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use test solutions that contain ammonia or chlorine, since the soap will not bubble for an accurate leakage test.

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

BATTERY

⚠ WARNING

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

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

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

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

HAZARDOUS NOISE

⚠ CAUTION

Hazardous noise.
Can cause loss of hearing.
Never operate generator without a muffler or with faulty exhaust system.

HOT PARTS

⚠ WARNING

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

Before removing pressure cap stop generator, allow to cool and 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 unit is allowed to cool.

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. Be careful when parking your vehicle to prevent grass fires started by exhaust system and hot exhaust gases.

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

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

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

NOTES

NOTICE

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

NOTICE

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

NOTE

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

NOTE

Do not "tee" into fuel injected fuel systems. Use a two dip tube arrangement for fuel supply. Consult an Authorized Kohler Service Dealer for further fuel system installation information.

NOTE

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

NOTE

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

NOTE

HARDWARE DAMAGE! Engine and generator may make use of both American Standard and metric hardware. Be sure to use the correct size tools to prevent rounding of bolt heads and nuts.

SECTION 1. SPECIFICATIONS

General Specifications

	10CC	12CC	10CZ	12CZ
Dimensions – L x W x H —in. (mm)	42.9 x 22 x 26.6 (1089 x 558 x 676)	45 x 22 x 26.6 (1143 x 558 x 676)	51 x 22 x 26.6 (1295 x 558 x 676)	51 x 22 x 26.6 (1295 x 558 x 676)
Weight – lbs. (kg)	532(241)	590(268)	572(259)	640(290)
Air Requirements – 60 Hz				
Combustion – cfm (cmm)	30(0.85)	35(1.0)	30(0.85)	35(1.0)
Cooling – cfm (cmm)	2400(68)	2400(68)	2400(68)	2400(68)
Fuel Consumption		**Gasoline – gph (Lph)**		
Load	25%	50%	75%	100%
10CC/CZ				
60 Hz	0.75(2.8)	1.0(3.8)	1.2(4.5)	1.5(5.6)
50 Hz	0.62(2.3)	0.83(3.1)	1.0(3.8)	1.3(4.9)
12CC/CZ				
60 Hz	1.0(3.8)	1.3(4.9)	1.5(5.7)	1.8(6.8)
50 Hz	0.8(3.1)	1.1(4.1)	1.3(4.9)	1.5(5.7)
Fuel Consumption		**LP Gas – cfh(m^3/hr.)**		
Load	25%	50%	75%	100%
10CC/CZ				
60 Hz	44(1.3)	53(1.5)	60(1.7)	68(1.9)
50 Hz	37(1.0)	44(1.2)	50(1.4)	56(1.6)
12CC/CZ				
60 Hz	36(1)	48(1.4)	60(1.7)	75(2.1)
50 Hz	30(0.8)	40(1.1)	50(1.4)	63(1.8)

Engine

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

	10CC/CZ		12CC/CZ
Manufacturer		Ford	
Model	VSG–411		VSG–413
Cycle		4	
Number Cylinders		4	
Compression Ratio	9.5:1		9.5:1
Displacement – cu.in. (cc)	67(1100)		79(1300)
Rated Horsepower	17		23
RPM		1800 (60 Hz)	
Bore – in. (mm)	2.7(68.68)		2.91(73.96)
Stroke – in. (mm) . 3.126 (79.4)	2.97(75.48)		2.97(75.48)

Valve Material	Forged Steel		
Valve Clearance – in. (mm)			
Intake	0.009(0.22)		0.009(0.22)
Exhaust	0.013(0.32)		0.013(0.32)
Cylinder Block Material	Cast Iron		
Cylinder Head Tightening Torque – ft. lbs (Nm)	Step 1: 22(30) Step 2: Turn 90° More Step 3: Turn 90° More		
Cylinder Head Material	Cast Iron		
Piston Rings	2 Compression/ 1 Oil		
Crankshaft Material	Nodular Cast Iron		
Bearings, Number & Type	3, Replaceable Insert		5, Replaceable Insert
Governor	Electronic		
Lubrication System	Full Pressure		
Oil Capacity (with filter) – qts. (L)	3.5 (3.3)		
Oil Type (API)	SG		
Oil Pressure – psi (kPa) @ 2000 rpm	21.7 (150)		
Fuel Type	Gas/Gasoline*		
Battery Voltage	12		
Battery Ground	Negative		
Battery Recommendation	400 Cold Cranking Amps.		
Battery Charging	Belt–Driven Alternator		
Spark Plug Type	Motorcraft AGSF 22C		
Spark Plug Gap – in. (mm) Gasoline & LP	0.0393 (1)		
Spark Plug Tightening Torque – ft. lbs (Nm)	11–15 (15–20)		
Ignition System	Distributorless		
Coil Type	High Output DIS Coil		
Coil Output	37 KV Minimum		
Primary Resistance at Coil Tower (ohms)	0.5 – 1.0		
Starter Motor	Positive Engagement		
Cooling System	Water–Cooled		
Cooling System Capacity – qts. (L)	12.4 (11.8)		
Engine Firing Order	1–2–4–3		
Timing	Fixed		
Intake Manifold Bolt Torque – ft. lbs. (Nm)	12–15 (16–20)		
Alternator Belt Tension – lbs. (kg)	New: 79–101 (36–46) Used: 56–75 (25–34) **		

* Depends on Fuel System Option Installed on Generator Set (Gasoline, Natural Gas, Gas/Gasoline, LP Vapor or LP Liquid Withdrawal)

** A belt in operation longer than 10 minutes is considered used.

Generator (10 kW Models)

	10CC	10CFC	10CZ	10CFZ
Rated kW	10	8	10	8
Frequency – Hz	60	50	60	50
RPM	1800	1500	1800	1500
Rated Voltage	120/240	120/240 115/230 110/220	Broadrange	110/220 110/190 220/380 240/416 120/208
Rated Amps.	42	*	*	*
Excitation Method	Static Excited	Static Excited	Brushless Exciter	Brushless Exciter
Coupling Type		Flexible Disc		
Overbolt Torque – in. lbs. (Nm)		70(7.9)		
Rotor Resistance (ohms)**	3–5	3–5	2.5–4.5 (Main Field) 0.71 (Exciter Arm.)	2.5–4.5 (Main Field) 0.71 (Exciter Arm.)
Stator Resistance (ohms)**				
Leads:				
1–2, 3–4	0.09	0.09		
33–44	0.09	0.09		
55–33	1.3	1.3		
B1–B2	0.07	0.07		
1–4, 2–5, 3–6 etc.			0.19	0.19
55–66			1.4	1.4
B1–B2			0.05	0.05
Exciter Field			5	5
Voltage Regulator Type	PowerBoost III	PowerBoost III	PowerBoost V	PowerBoost V
Number of Output Leads	4	4	12	12
Insulation (Rotor and Stator)	Class F, Epoxy Varnish, Vacuum Impregnated			
Fungus Resistance	Meets Mil–I–24092 Standard			
Winding Material	Copper			
Bearing, Quantity and Type	1, Replaceable Ball			
Circuit Protection				
Controller	Replaceable 10 Amp. Fuse			
Generator	Optional Line Circuit Breaker (Size Dependent on Voltage)			
Voltage Regulator	Replaceable 10 Amp. Fuse (CC/Single–Phase Models Only)			

* Amperage will vary with voltage selected.

1–Phase Amps. = 1–Phase watts ÷ Volts

3–Phase Amps. = (3–Phase watts ÷ 0.8) ÷ 1.73205080756) ÷ Volts

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

DERATION: The kilowatts of the generator set will decrease 4% for each 1000 feet (305 meters) above sea level and 1% for each 10°F (5.5°C) increase in ambient temperature above 85°F (29°C). Ambient temperature is measured at air cleaner inlet.

Generator (12 kW Models)

	12CC	12CFC	12CZ	12CFZ
Rated kW	12	10	12	10
Frequency – Hz	60	50	60	50
RPM	1800	1500	1800	1500
Rated Voltage	120/240	120/240 115/230 110/220	Broadrange Reconnectible	110/220 110/190 220/380 240/416 120/208
Rated Amps.	50	*	*	*
Excitation Method	Static Excited	Static Excited	Brushless Exciter	Brushless Exciter
Coupling Type		Flexible Disc		
Overbolt Torque – in. lbs. (Nm)		70(7.9)		
Rotor Resistance (ohms)**	2.5–4.5	2.5–4.5	2.5–4.5 (Main Field) 0.71 (Exciter Arm.)	2.5–4.5 (Main Field) 0.71 (Exciter Arm.)
Stator Resistance (ohms)**				
Leads:				
1–2, 3–4	0.06	0.06		
33–44	0.06	0.06		
55–33	1.1	1.1		
B1–B2	0.05	0.05		
1–4, 2–5, 3–6 etc.			0.17	0.17
55–66			1.3	1.3
B1–B2			0.05	0.05
Exciter Field			5	5
Voltage Regulator Type	PowerBoost III	PowerBoost III	PowerBoost V	PowerBoost V
Number of Output Leads	4	4	12	12
Insulation (Rotor and Stator)	Class F, Epoxy Varnish, Vacuum Impregnated			
Fungus Resistance	Meets Mil–I–24092 Standard			
Winding Material	Copper			
Bearing, Quantity and Type	1, Replaceable Ball			
Circuit Protection				
Controller	Replaceable 10 Amp. Fuse			
Generator	Optional Line Circuit Breaker (Size Dependent on Voltage)			
Voltage Regulator	Replaceable 10 Amp. Fuse (CC/Single–Phase Models only)			

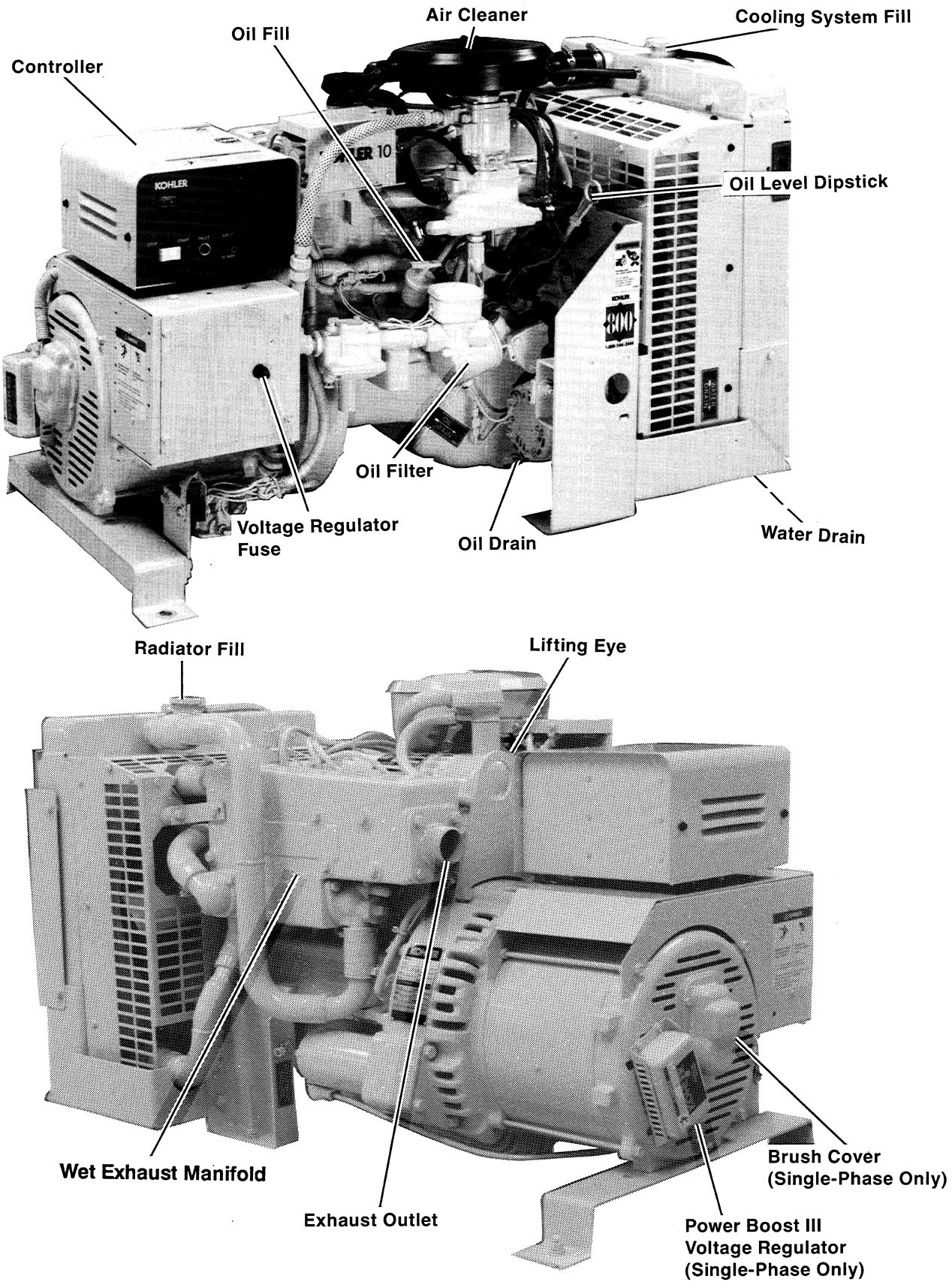
* Amperage will vary with voltage selected.

1–Phase Amps. = $1-\text{Phase watts} \div \text{Volts}$

3–Phase Amps. = $(3-\text{Phase watts} \div 0.8) \div 1.73205080756) \div \text{Volts}$

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

DERATION: The kilowatts of the generator set will decrease 4% for each 1000 feet (305 meters) above sea level and 1% for each 10°F (5.5°C) increase in ambient temperature above 85°F (29°C). Ambient temperature is measured at air cleaner inlet.



NOTE: A single–phase (CC) generator is shown above. Three–phase (CZ) generators will differ in appearance from that shown.

Figure 1–1. Service Views – 10/12 CC/CZ Generator Sets

Vibro Mount Installation on 10/12 CC/CCF/CZ/CFZ Generator Sets

⚠ WARNING

Accidental starting.
Can cause severe injury or death.
Disconnect battery cables before working on generator set (negative lead first and reconnect it last).

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

Attach the vibro mounts to the generator set as shown in Figure 1–2 (using the supplied mounting hardware). Be sure to install the two green–coded vibro mounts (278322) at the generator end of the set and the two brown–coded vibro mounts (254950) at the engine end of the generator set. Disconnect starting battery (remove negative lead first) before working on the generator set.

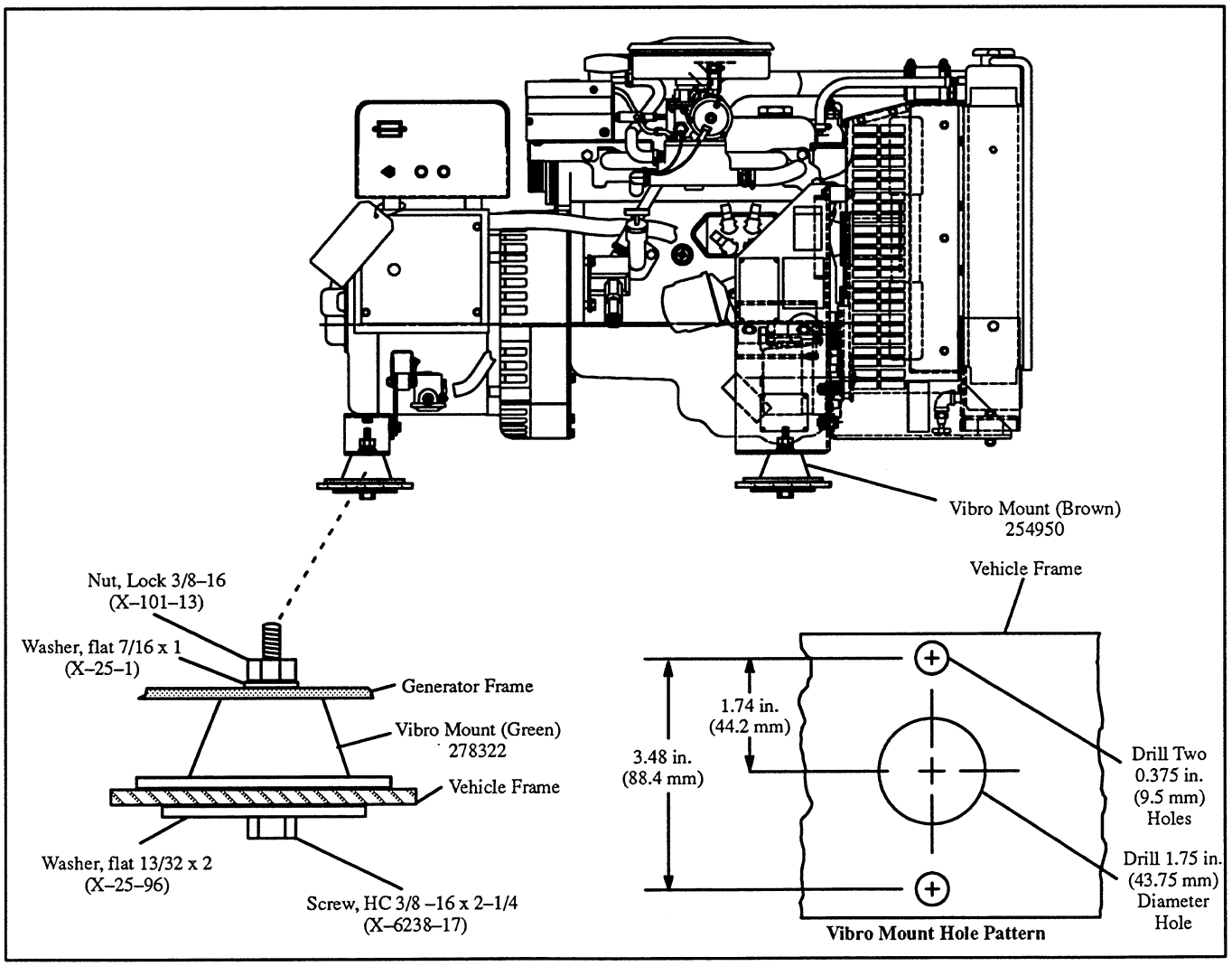


Figure 1–2. Vibro Mount Installation

SECTION 2. OPERATION

Prestart Checklist

The following items should be checked before each start–up of manually controlled generator sets and at regular intervals on sets equipped with automatic transfer switches. See your engine operation/maintenance manual for specific service procedures.

OIL LEVEL: Should be at or near FULL mark on dipstick — not over.

FUEL LEVEL: Make sure there is adequate supply; keep tanks full to allow operation for extended periods.

BATTERY: Check connections and level of battery electrolyte.

COOLANT LEVEL: Maintain coolant level at approximately 3/4 to 1–1/2 in. (19 – 38 mm) below the radiator filler neck seat when the engine is cold. If the unit is equipped with a coolant recovery tank, level in tank should be between 1/3 full (cold) and 2/3 full (hot). See "Safety Precautions" before filling radiator. A coolant solution of 50% ethylene glycol and 50% clean, softened water is recommended to inhibit corrosion and prevent freezing to –34°F (–37°C). Do not use alcohol or methanol antifreeze or mix them with the specified coolant. Do not add coolant to an engine that has overheated until engine has cooled. Adding coolant to an extremely hot engine can cause a cracked block or cylinder head.

NOTE

Do not turn on block heater (if equipped) before filling cooling system. Run engine until warm and refill radiator to purge air from the system. Block heater may be damaged if not immersed in water.

AIR CLEANER: Must be clean and properly installed to prevent unfiltered air from entering the engine.

DRIVE BELTS: Make a visual check of radiator fan, water pump and battery charging belts to make sure they are properly tensioned and in good condition.

OPERATING AREA: Make sure there are no obstructions that could block the flow of cooling air. Make sure the area is clean. Rags, tools, or debris must not be left on or near the generator set.

EXHAUST SYSTEM: Exhaust outlet must be clear; silencer and piping must be tight and in good condition. Exhaust gas must be vented safely outside. See "Safety Precautions" Section.

Controller Features

To identify components of the relay controller, refer to Figure 2–1 and the following descriptions.

Fault Lamp – lights to indicate a fault condition. Generator will shut down on Overspeed, High Engine Temperature, and Low Oil Pressure faults. See "Fault Shutdowns" section following.

Hourmeter – records total generator set operating hours for reference in maintenance scheduling.

Generator Stop/Start Switch – used to start and stop generator set. Refer to Start/Stop procedure following.

Controller Fuse – 10 Amp. fuse protects controller circuitry.

Remote Switch Connection – connect remote start/stop switch (includes 15 ft. harness) to operate the generator at a location remote from the set. Request Remote Start Panel PA–254999.

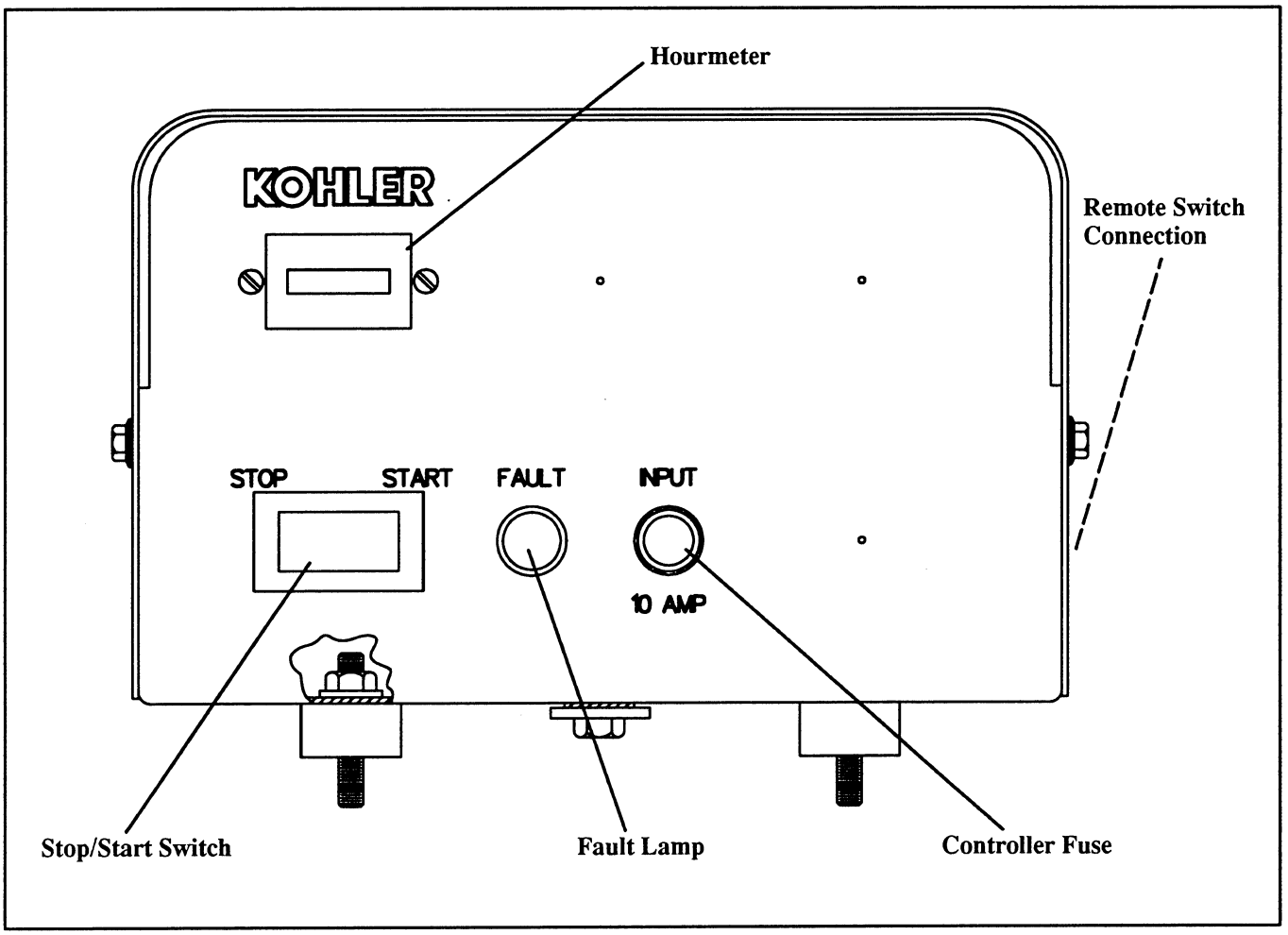


Figure 2–1. Controller Features.

Start/Stop Procedure

Starting

Hold controller or remote Start/Stop switch in "Start" position until the engine starts. Normally the engine will start within 2 seconds. However, if the engine fails to start after cranking for 5 seconds, release the switch. Wait for the engine to come to a complete stop before attempting restart.

NOTE

Do not crank engine continuously for more than 10 seconds at a time. A 60 second cool–down period must be allowed between cranking attempts if the engine does not start. If the unit does not start after three attempts, contact an Authorized Service Dealer for repair.

Stopping

1. Run generator set at no load for 5 minutes to allow engine cool–down.
2. Hold controller or remote Start/Stop switch in "Stop" position until generator completely stops.

Fault Shutdowns

The generator will shut down automatically under the following fault conditions. The generator cannot be restarted until the fault condition has been corrected. The shutdown switches will automatically reset when the problem is corrected or the generator set cools (if overheating was the problem).

OVERSPEED – Generator will shut down immediately if governed frequency exceeds 70 Hz (2100 rpm) on 50 and 60 hz models.

HIGH ENGINE TEMPERATURE – Shutdown occurs 10–20 seconds after fault. Fault occurs when engine coolant temperature reaches 218°F (103°C).

LOW OIL PRESSURE – Shutdown occurs 10–20 seconds after fault. Fault occurs when engine oil pressure drops to 15 psi (103 kPa).

Circuit Protection

An optional line circuit breaker (sized for generator output) is available to protect the generator from damage due to overload or short circuits. If the circuit breaker trips, reduce the load and switch the breakers back to the "ON" position. With the breaker in the "OFF" position, the generator will run but there will be no output voltage.

NOTE

If the generator circuit breaker trips repeatedly, have the generator set examined by an Authorized Kohler Service Dealer.

The controller circuitry is protected by a replaceable 10 Amp. fuse. If the generator will not crank and the battery and/or connections appear okay, the controller fuse may be "blown".

A replaceable 10 Amp. fuse protects the voltage regulator circuitry **on single–phase (CC) generator sets**. If this fuse is "blown", the generator set will shut down. The set will not start until the voltage regulator fuse is replaced. Have the generator set examined by an Authorized Kohler Service Dealer if there is no AC output.

NOTE

When a fuse replacement is required, be sure fuse has the same ampere rating and is the same type (glass or ceramic). Do not use "clear" glass–type fuses in place of ceramic fuses. If ampere rating is unknown or questionable, see Wiring Diagram Section.

Exercising the Generator

If the generator set is not equipped with an automatic transfer switch, or the transfer switch does not have the automatic exercise option, run the generator set once a week for one hour (under load). The operator should be in attendance during this period. Be sure to make all "Prestart Checks" before starting the exercise procedure. Hold controller START/STOP switch in the "Start" position or press the TEST button on the automatic transfer switch (if equipped) to exercise the unit.

SECTION 3. SCHEDULED MAINTENANCE

General

Schedule routine maintenance using the "Maintenance Schedule" following and the hourmeter located on the generator controller. If the generator will be subject to extreme operating conditions, service the unit more frequently. Instructions to perform most of the scheduled services are provided in the following pages. Refer to the engine service manual for engine maintenance procedures not provided in this manual. Items in the maintenance schedule marked with an asterisk (*) should be performed more often if the generator set is operated in dirty, dusty conditions. Items identified with asterisks (**) should only be performed by an Authorized Kohler Service Dealer.

NOTE

The items listed in the service schedule must be performed at the designated intervals for the life of the generator. For example, an item to be serviced "Every 100 Hours or 3 Months" must also be serviced after 200 hours or 6 months, 300 hours or 9 months, etc. The generator will eventually accumulate enough hours to warrant a complete overhaul. The exact time at which extensive service will be necessary cannot be predicted. However, rough operation, lack of power, and excessive oil use indicate serious generator problems. As part of a preventative maintenance program, service the engine (clean cylinder head, inspect valves, check compression, etc.,) and generator (replace bearing, inspect wiring, remove debris, etc.) at the earliest indication that a serious problem exists.

Maintenance Schedule

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 proper 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 exterior of radiator)			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 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.

** Should be performed by Authorized Kohler Service Dealer.

Lubrication System

Oil Check

Check the oil level in the crankcase daily or before each start–up to insure that the level is in the safe range on the dipstick. See Figure 3–1. Allow several minutes for engine oil to drain after shut–down to ensure an accurate oil reading. Add oil as needed to maintain oil in the safe range. Do not operate the set if the oil level is below the "SAFE" range on dipstick.

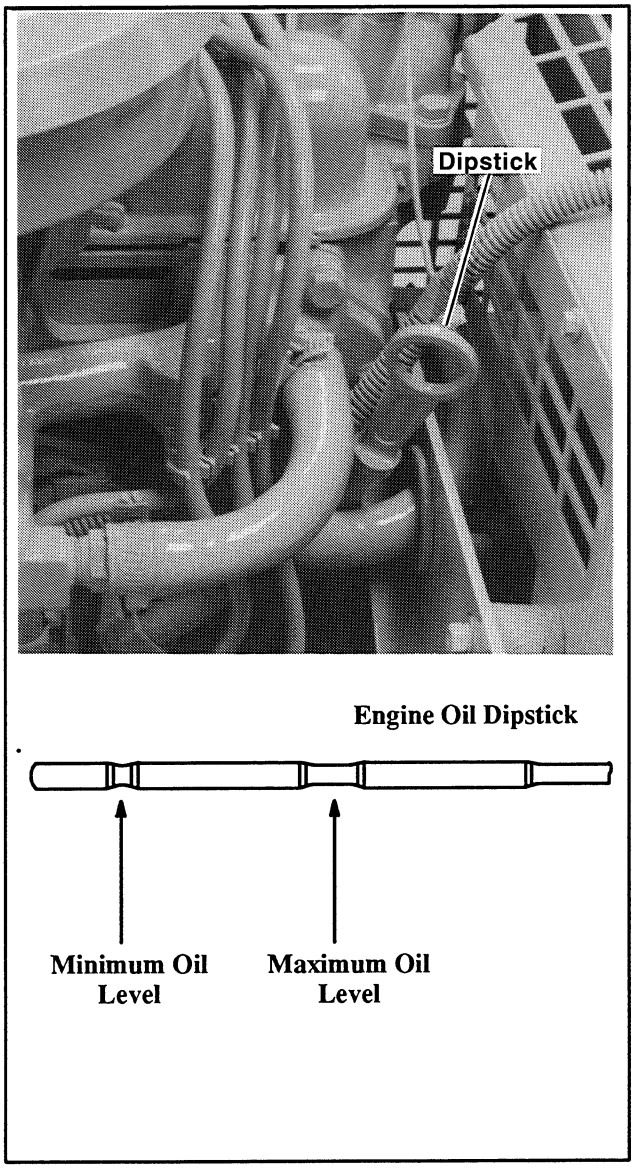


Figure 3–1. Engine Oil Dipstick/Safe Range

Oil Type

Oils labeled API SG or in combination with other classifications (SG/CC, SG/CD) are preferred as 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. Consult the chart in Figure 3–2. to select proper weight oil.

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 (10°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 (–7°C)	20W–40 or 20W–50

* Not recommended for severe service

Figure 3–2. Oil Selection Guide

Oil Change

Change the engine lube oil and filter every 100 hours or 3 months of operation. Change oil more frequently if the set is operated under continued light load or in dirty, dusty conditions. Drain engine oil while engine is warm to ensure good drainage. Drain engine lube oil, according to the following procedure.

1. Place a suitable container beneath engine oil drain plug. See Figure 3–3.

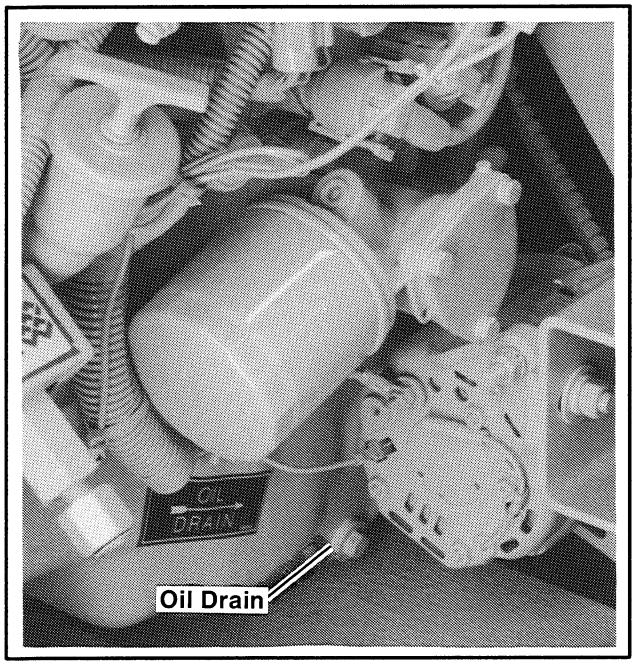


Figure 3–3. Engine Oil Drain

2. Loosen drain plug. Allow adequate time for oil to drain completely.
3. Replace drain plug and tighten securely. Add proper weight/type oil to crankcase until oil reads in "safe" range on dipstick (Figure 3–4).

Crankcase Capacity – 2.9 qts. (2.8 L)
with Filter – 3.5 qts. (3.3 L)

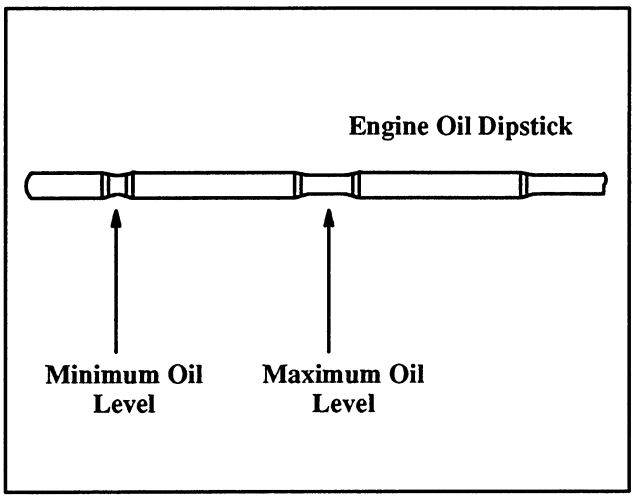


Figure 3–4. Lube Oil Safe Range

Oil Filter

Change the oil filter every 100 hours of operation at time of oil change. See Figure 3–5 and refer to the following procedure.

1. Remove old filter from engine adapter by rotating filter counterclockwise.
2. Apply a thin coat of engine oil to rubber gasket on new oil filter. Hand–tighten filter clockwise onto adapter until the filter gasket contacts adapter face; then rotate filter an additional one–half turn.
3. Refill engine crankcase with oil as specified in "Oil Change" section preceding.

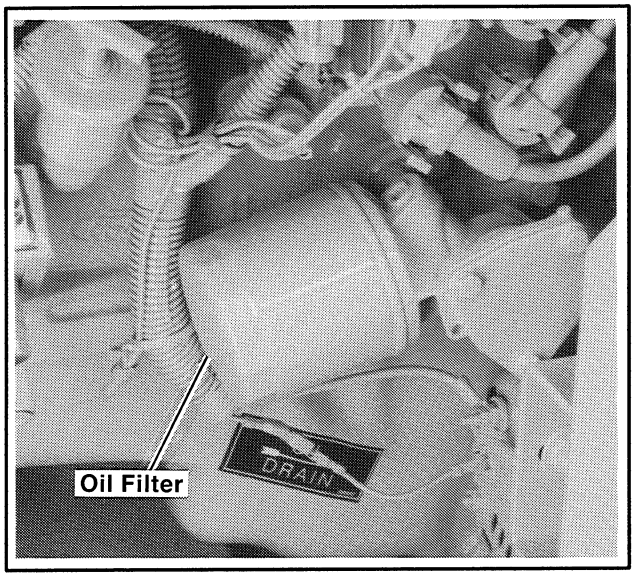


Figure 3–5. Engine Oil Filter

4. Start generator set and check for leaks at oil filter and drain plug. Tighten filter and/or drain plug if leaks occur.

Low Oil Pressure (LOP) Shutdown

The low oil pressure (LOP) shutdown feature protects the engine against internal damage if the oil pressure drops below 15 psi (103 kPa) due to oil pump fault or other engine malfunction. The LOP shutdown does not protect the set from damage due to operating with the oil level below the safe range — IT IS NOT A LOW OIL LEVEL SHUTDOWN. The only protection against running out of oil is to check the oil level regularly and add oil as needed. Location of the LOP shutdown is shown in Figure 3–6.

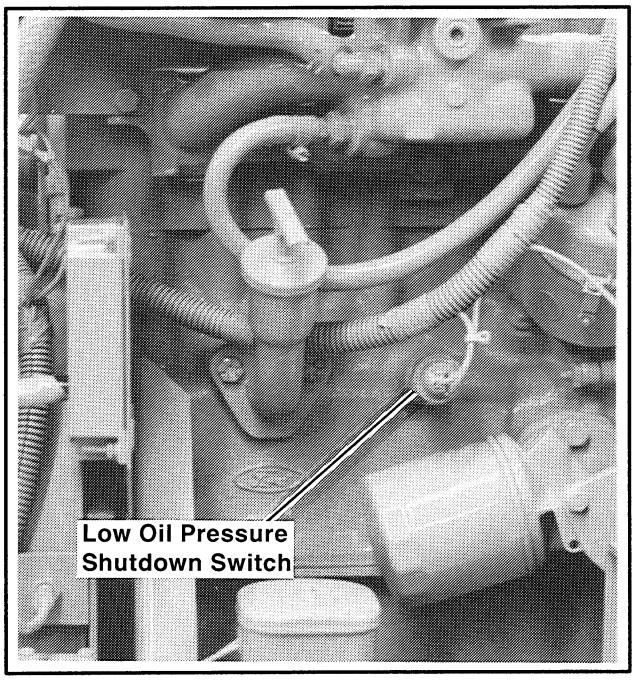
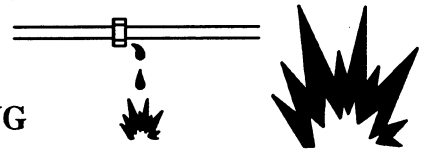


Figure 3–6. Low Oil Pressure Shutdown

Fuel System

The generator set can be equipped with four different fuel systems: gasoline, straight gas (LP/natural gas), gas/gasoline, and LP liquid withdrawal. Each of these systems is discussed in the following paragraphs. Observe the following safety precautions when operating the generator set.



⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.
Use extreme care when handling, storing, and using fuels.

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

Gasoline – Store gasoline only in approved red containers clearly marked GASOLINE. Do not store gasoline in any occupied building.

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

Gasoline Fuel System

Fuel Specifications

Use only clean, fresh, regular grade unleaded gasoline with a pump sticker octane rating of 87 or higher in the U.S.A. Ford engines should operate satisfactorily on gasohol blends containing no more than 10% ethanol by volume and having an antiknock index of 87 or higher. (Gasohol, a mixture of gasoline and ethanol (grain alcohol), is available in some areas.) Use fresh gasoline to ensure it is blended for the season and to reduce the formation of gum deposits which could clog the fuel system. If the generator set is to be stored longer than two months, refer to Section 7. Storage Procedures.

NOTE

In some cases, methanol (wood alcohol) or other alcohols may be added to gasoline. Ford engines should operate satisfactorily on blends containing up to 5% methanol by volume when cosolvents and other necessary additives are used. If not properly formulated with appropriate cosolvents and corrosion inhibitors, such blends may cause engine performance problems or damage fuel system materials. Insufficient data is available to insure the suitability of all methanol/gasoline blends at this time. To avoid jeopardizing your engine warranty or incurring unnecessary repair costs, DO NOT USE blends than contain more than 5% methanol by volume, or blends that do not contain cosolvents and corrosion inhibitors.

If you are uncertain as to the presence of alcohols in the gasoline you are purchasing, check the label on the pump or ask the fuel station attendant.

NOTE

Discontinue use of any gasohol or alcohol/gasoline blend if fuel system problems occur. Do not use such fuels unless they are unleaded.

Fuel Filter Service

The generator set utilizes an in–line fuel filter connected to the outlet side of the electric fuel pump. Replace the filter every 6 months/400 hours of operation or when rough operation indicates an engine tune–up may be necessary. Location of the gasoline fuel filter is shown in Figure 3–7.

⚠ WARNING

Fire.
Can cause severe injury or death.

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

A flash fire can cause severe injury or death. Do not smoke or permit flame or spark to occur near carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuel or fuel vapors. When removing fuel line or carburetor, use a proper container to catch all fuel.

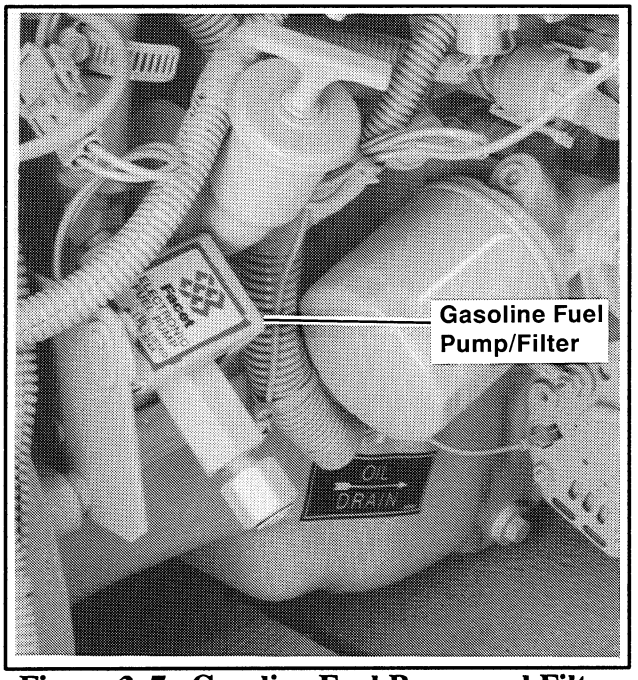


Figure 3–7. Gasoline Fuel Pump and Filter

Gasoline Carburetor Adjustments

Correct carburetor adjustment cannot be obtained unless engine compression and ignition meet specifications. Do not adjust the carburetor to compensate for other engine disorders.

Always check the condition of the air cleaner before adjusting the carburetor. A dirty air cleaner will adversely affect engine performance and carburetor adjustment

The engine uses a fixed–jet Nikki carburetor with an electric choke and anti–dieseling solenoid. The only adjustment necessary is the idle speed mixture. The idle system functions only as the engine comes up through idle range to governed speed. For this reason, idle system has only a momentary effect. Under normal circumstances, carburetor adjustment will not be necessary. However, if the carburetor is removed or tampered with, carburetor adjustment may be required to obtain optimum engine performance. Minor carburetor adjustment may also be necessary to compensate for differences in altitude, fuel, and temperature.

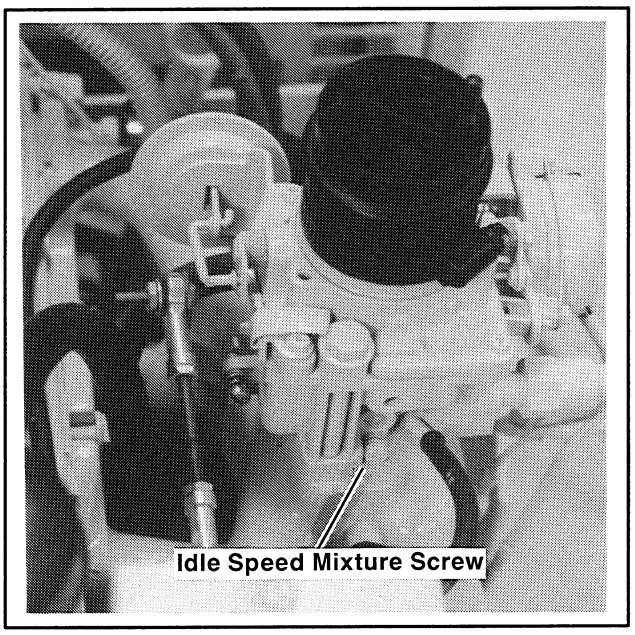


Figure 3–8. Idle Speed Mixture Adjustment

1. With ENGINE STOPPED, turn idle speed mixture screw in (clockwise) until it seats lightly. DO NOT FORCE! Turn idle speed mixture screw out 1–3/4 turns. See Figure 3–8.

   NOTE

   Throttle stop adjustment screw should be turned out to prevent interference with governor/carburetor throttle rod. The throttle rod must be allowed to travel through full range of motion to avoid interfering with governor action. The throttle stop screw should have no effect on engine speed during adjustments and operation.

2. Start engine and let it run at no load for about 5 minutes. Before making adjustments, engine should be thoroughly warmed up.

⚠ WARNING

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

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

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

3. Adjust carburetor idle speed mixture screw +/– 3/8 turn to achieve best stability results at no load.

4. STOP generator set.

5. Contact an Authorized Service Dealer if engine governed speed is incorrect.

Gasoline Choke Adjustment

The automatic choke on the gasoline carburetor enriches the fuel mixture to improve starting at cooler temperatures. As the ambient air or engine temperature decreases, the choke automatically closes. As the engine or ambient air temperature increases, the choke plate automatically opens. If readjustment is needed, loosen the screws securing the choke bracket and shift the position of the choke assembly. See Figure 3–9. When properly set, the choke plate should be within 10 degrees of full–closed at an ambient temperature of approximately 70°F (21°C).

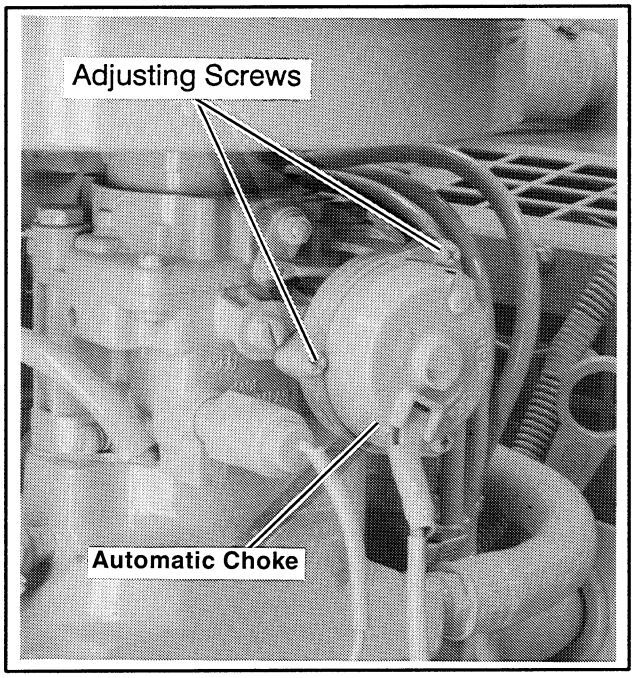


Figure 3–9. Choke Adjustment

Straight Gas Fuel System

The straight gas fuel system utilizes a fuel valve (with solenoid) to control fuel flow to the fuel regulator. The generator–mounted regulator reduces fuel pressure as fuel passes to the carburetor. See Figure 3–10. The carburetor controls the ratio of fuel to air under varying load and speed conditions. Since 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 and vise–versa, verify that engine speed is adjusted by the electronic governor to meet specifications.

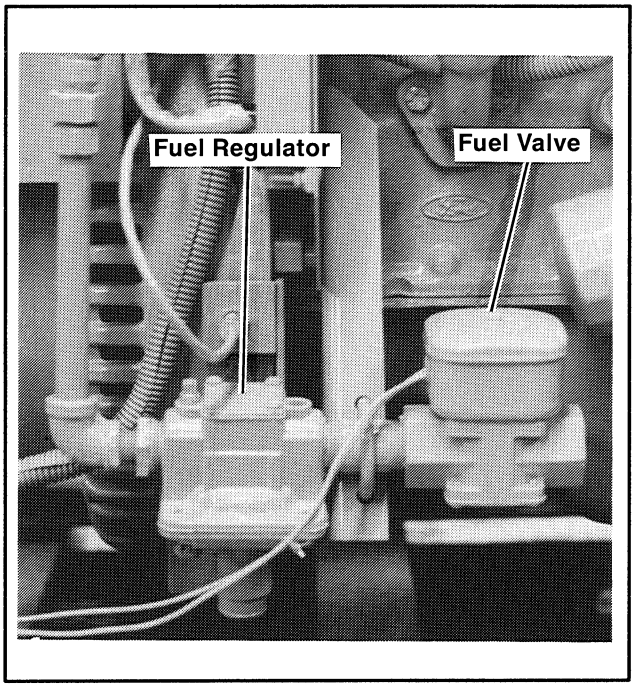


Figure 3–10. Fuel Regulator and Valve

LP Gas/Natural Gas Conversion

The generator set can be operated on LP gas or natural gas fuel. If the set is to be operated on LP gas, remove the internal spring from the gas regulator. The spring must be in place if the generator is to be operated on natural gas. (The generator sets leave the factory prepared for operation on natural gas.)

To remove the internal spring from the gas regulator, remove the retaining screw from the underside of the regulator. See Figure 3–11. Remove retainer and spring then reinstall retaining screw. The regulator spring and retainer should be saved for conversion back to natural gas (if necessary). If the generator is converted back to natural gas (by replacing spring and retainer), a manometer check must be made on the carburetor side of the regulator. Rotate spring retainer on regulator to obtain a constant 5 in. water column measurement on manometer.

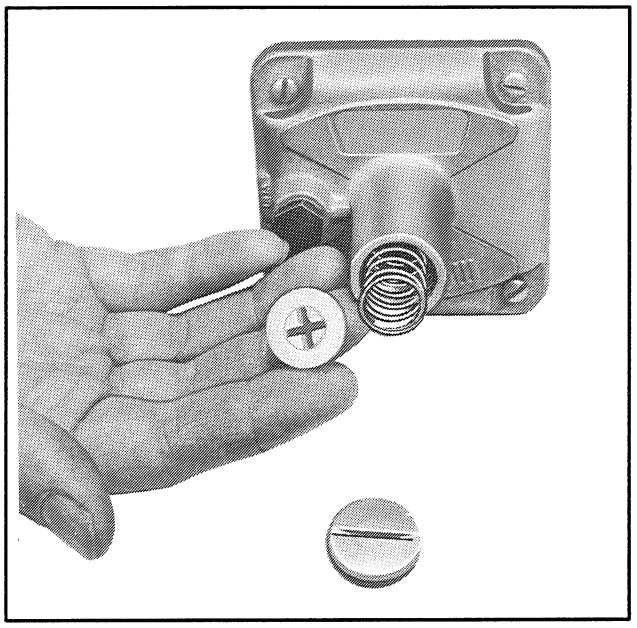


Figure 3–11. Regulator Spring and Retainer

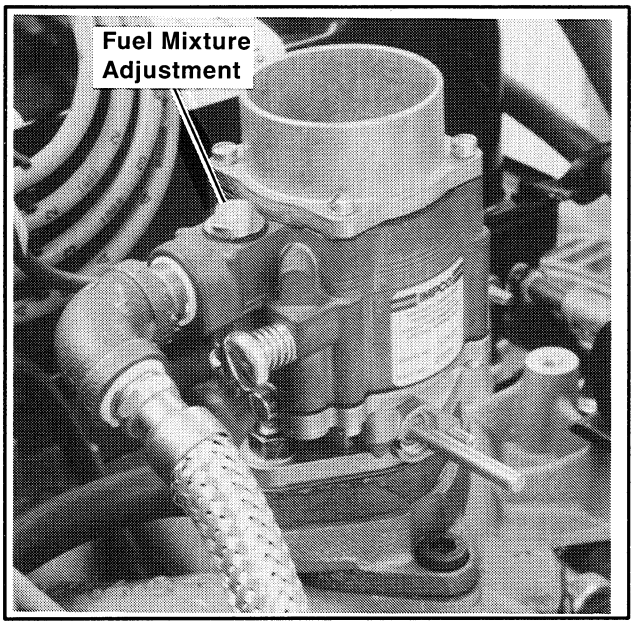


Figure 3–12. Fuel Mixture Adjustment

Carburetor Adjustments (LP/Natural Gas)

Correct carburetor adjustment cannot be obtained unless engine compression and ignition meet specifications. Do not adjust the carburetor in an attempt to compensate for other engine disorders. If engine speed is incorrect, adjust electronic governor to obtain 1800 rpm (60 Hz) or 1500 rpm (50 Hz). If desired engine speed cannot be obtained through governor adjustment carburetor adjustment may be necessary.

The only carburetor adjustment necessary or possible is the engine fuel mixture. Under normal circumstances, carburetor adjustment will not be necessary. However, if the carburetor is removed or tampered with, carburetor adjustment may be required to obtain optimum engine performance

The engine fuel mixture screw (figure 3–12) should be rotated clockwise or counterclockwise to obtain a maximum adjustment at full load.

LP Liquid Withdrawal Fuel System

With the LP liquid withdrawal fuel 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 gaseous state. After vaporization, the LP fuel is drawn off to the carburetor. The system also includes a fuel valve which shuts off the fuel flow when the engine is stopped. The LP liquid withdrawal fuel system is available as an accessory from your dealer or distributor..

Combination Gas/Gasoline Fuel System

The gas/gasoline fuel system will operate 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. This allows continued generator operation when a gas fuel supply is unavailable. The combination gas/gasoline fuel system is available as an accessory from your dealer or distributor.

Ignition System

Spark Plugs

⚠ WARNING

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

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

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

Recommended Spark Plug: **Motorcraft AGSF–22C**

Every 400 hours of operation remove the spark plugs and check their condition. Proper generator operation is indicated by a light deposit of gray or tan material on plug electrodes. A dead–white, blistered coating could indicate overheating. A black (carbon) coating may indicate an overrich fuel mixture caused by clogged air cleaner or improperly adjusted carburetor. Do not sandblast, wire brush, or use similar methods to service a plug in poor condition. Best results are obtained with a new plug. Service spark plugs as described in the following steps.

1. Clean the area around the spark plug with compressed air. Remove spark plug cap(s) and use a wrench to remove spark plugs.

2. Visually inspect the spark plugs. Replace plug(s) if the insulation is cracked or damaged.

3. Measure the plug gap with a feeler gauge. See Figure 3–13. Adjust plug gap to 0.0393 in. (1 mm) as shown in Figure 3–14.

4. To prevent cross–threading, thread spark plug(s) into engine by hand until snug.

5. Use a plug wrench to final tighten spark plug(s) to 11–15 ft. lbs. (15–20 Nm). Replace spark plug cap(s).

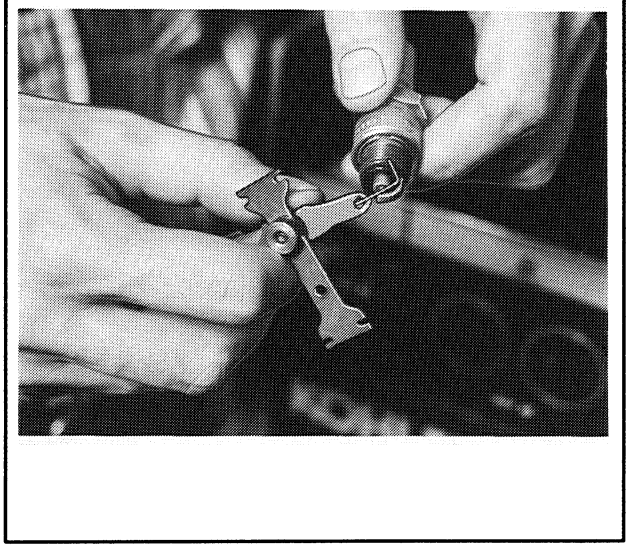


Figure 3–13. Measuring Plug Gap

Figure 3–14. Spark Plug Gap Adjustment

NOTE

Do not overtighten spark plugs. Overtightening may distort spark plug outer shell and change spark plug gap.

Distributorless Ignition Timing

With the distributorless ignition system, the electronic control module monitors the engine load, speed and operating temperature and determines what degree of spark advance is correct for all operating conditions. Because the engine timing is fixed and there are no moving parts in this system, no maintenance is required except for periodic spark plug checks. However, if the spark plugs or leads are removed for servicing, be sure the spark plug lead from each cylinder is inserted in the correct location on the ignition coil. See Figure 3–15.

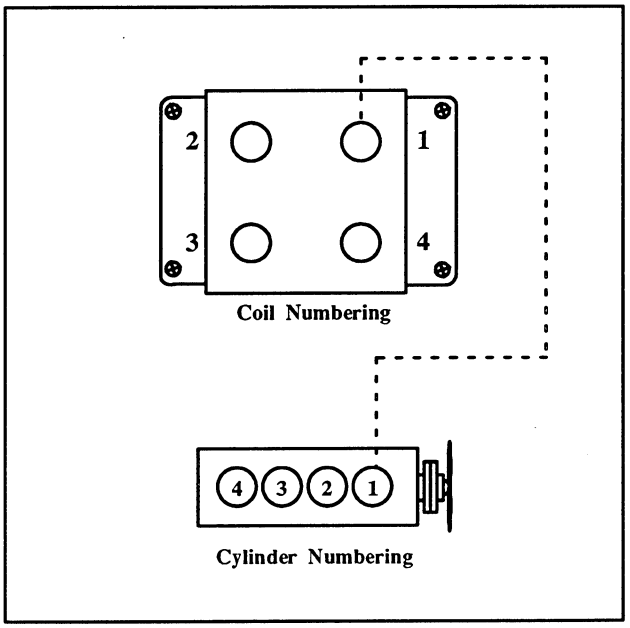


Figure 3–15. Ignition Coil Terminal Identification

Air Cleaner Service

The engine is equipped with a dry type air cleaner. Every 400 hours or 6 months of operation, replace the air cleaner element. Replace the element more frequently if the generator is operated under dirty, dusty conditions. Operating the set with a dirty air cleaner element may cause engine damage and also increase fuel consumption. At time of service, remove all dust and foreign matter from the air cleaner housing. See Figure 3–16.

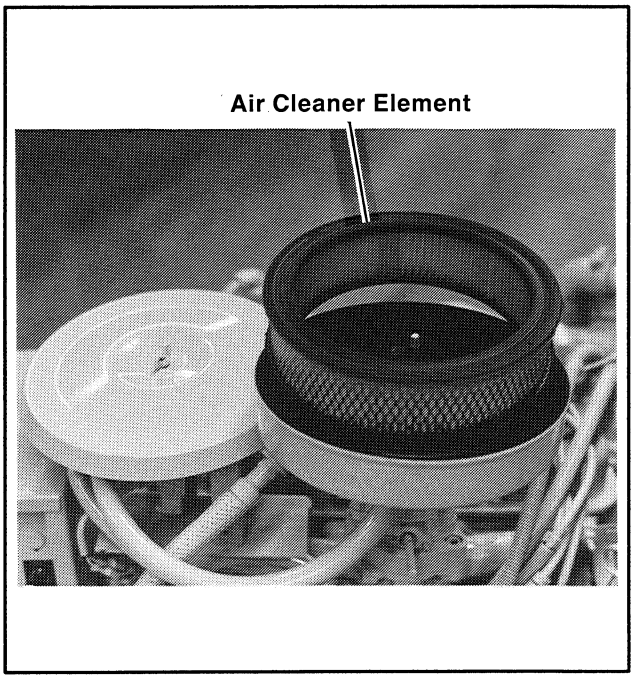


Figure 3–16. Air Cleaner Assembly

Crankcase Ventilation System

The generator engine is equipped with a positive crankcase ventilation system. Clean air is supplied to the breather cap on the engine rocker cover by a tube from the air cleaner. A calibrated port in the cap regulates the flow of fumes into the intake manifold for combustion. See Figure 3–17. The breather cap should be cleaned in a petroleum solvent every three months or 100 hours of operation and replaced yearly or every 800 hours of operation.

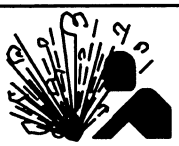
Figure 3–17. Crankcase Vent System Breather Cap

Cooling System

General

The cooling system may be drained by opening the petcock on the bottom of the radiator and the drain plug on the engine block. To refill the cooling system, close drain plug and petcock and fill radiator to the proper level with the recommended coolant mixture. Operate the engine until the thermostat opens and the radiator upper hose becomes hot. Stop the engine and add coolant to the radiator to 3/4 to 1–1/2 in. (19–38 mm) below radiator filler neck. See figure 3–18. The coolant system is equipped with an air bleed feature. Do not remove the air bleed orifice from the system or engine overcooling will result.

⚠ WARNING



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

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

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

NOTE

Block heater will fail if not immersed in wat Always unplug block heater(s) before draini coolant and fill engine block with coolant prior .. plugging in block heater(s). Block heater element MUST be immersed in engine coolant before being energized.

To prevent generator shutdown and/or damage due to overheating, service the cooling system every 400 hours (or 6 months) of generator operation. Inspect the exterior of the radiator for obstructions; remove all dirt and foreign material with a soft brush or cloth (to avoid damaging radiator fins). If available, clean radiator with compressed air or a stream of water in direction opposite normal air flow. Check all hoses and connections for leaks and replace any hoses that are cracked, frayed, or feel spongy. When coolant level checks are made, check condition of radiator cap rubber seal; replace if cracked or deteriorating. Remove dirt and other debris from radiator cap and filler neck.

Maintain coolant level at 3/4 to 1–1/2 in. (19–38 mm) below the radiator filler neck when the engine is cold. If the unit is equipped with a coolant recovery tank, the level in the tank should be between 1/3 full (cold) and 2/3 full (hot). Cooling system capacity is 12.4 qts. (11.8 L). Use only a permanent–type coolant that meets specifications. A coolant solution of 50% etheylene glycol and 50% clean, softened water is recommended to inhibit corrosion and prevent freezing to –34°F (–37°C). Do not use alcohol or methanol antifreeze or mix them with the coolant.

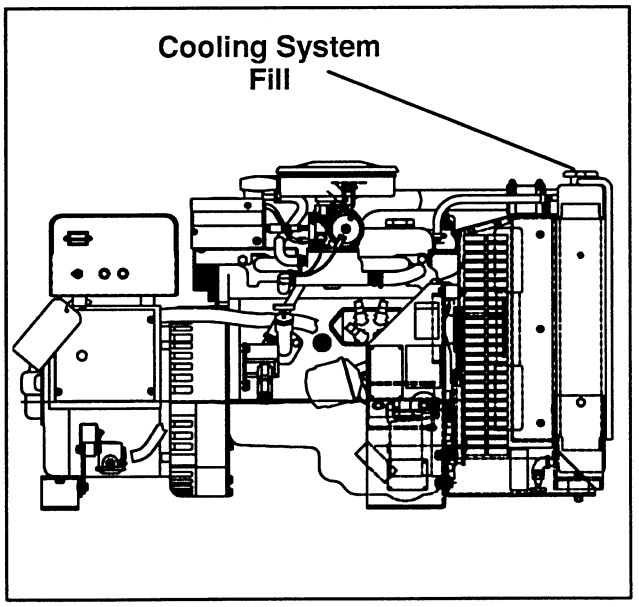


Figure 3–18. Cooling System Fill

High Engine Temperature (HET) Shutdown

The engine will automatically shut down 10–20 seconds after the engine temperature reaches 218°F (103°C). The engine cannot be restarted until the cause of the shutdown has been corrected or the engine has cooled. Location of the shutdown switch is shown in Figure 3–19.

NOTE

The High Engine Temperature (HET) shutdown is not a low coolant level switch. Engine coolant level must be maintained for the HET shutdown switch to function.

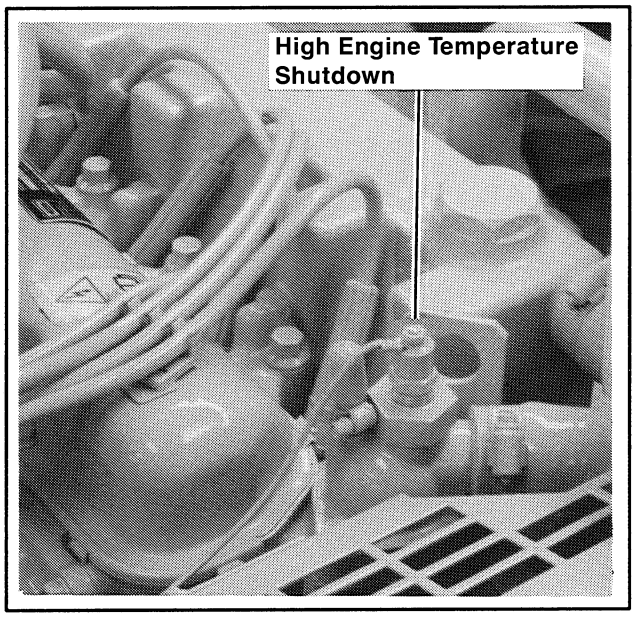


Figure 3–19. High Engine Temperature Shutdown

Drive Belts

The alternator, fan, and water pump are belt driven. The drive belts must be properly adjusted at all times since a loose drive belt causes the belt to overheat and also results in improper operation of belt–driven components. Overtightening the belt may cause excessive wear on the alternator and water pump bearings, as well as premature belt wear. It is recommended that a belt tension gauge be used to check and adjust the belt tension. See "Belt Tension" following. Any belt that has operated for a minimum of 10 minutes is considered a used belt.. Adjust belt to the tension shown in the specifications.

Belt Tension

Position the belt tension tool on the drive belt and check the tension according to the instructions of the tool manufacturer. See Figure 3–20. If the tension is not set to specifications, loosen the alternator and/or governor mounting and adjusting bolts. Move the component away from the engine until the correct tension is obtained. The belt tension should be 79–101 lbs. (36–46 kg) on a new belt and 56–75 lbs. (25–34 kg) on a used belt. (A belt in operation longer than 10 minutes is considered a used belt.) Retighten component mounting bolts.

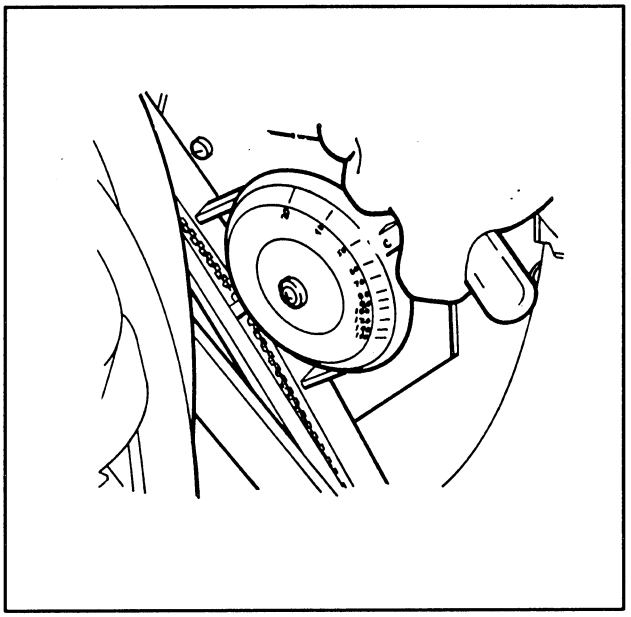


Figure 3–20. Adjusting Belt Tension

Battery

Use a 12 Volt battery with a rating of at least 400 Cold Cranking Amps (CCA). When using a "maintenance free" battery, it is not necessary to check the specific gravity or electrolyte level. Otherwise, these procedures should be done at the intervals specified in the service schedule. Battery connections are shown on the wiring diagram. Note that a negative (–) ground system is used. Make sure battery is properly connected and terminals are tight.

NOTE

The generator set will not start and possible circuit board damage may result if the battery connections are made in reverse.

⚠ WARNING

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

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

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

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

Cleaning

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

Checking Electrolyte Level

Check the level of electrolyte before each start–up. Remove filler caps and check that electrolyte level is up to bottoms of filler holes. See Figure 3–21. Refill as necessary with distilled water or clean tap water. DO NOT add fresh electrolyte. Be sure filler caps are tight.

⚠ WARNING

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

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

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

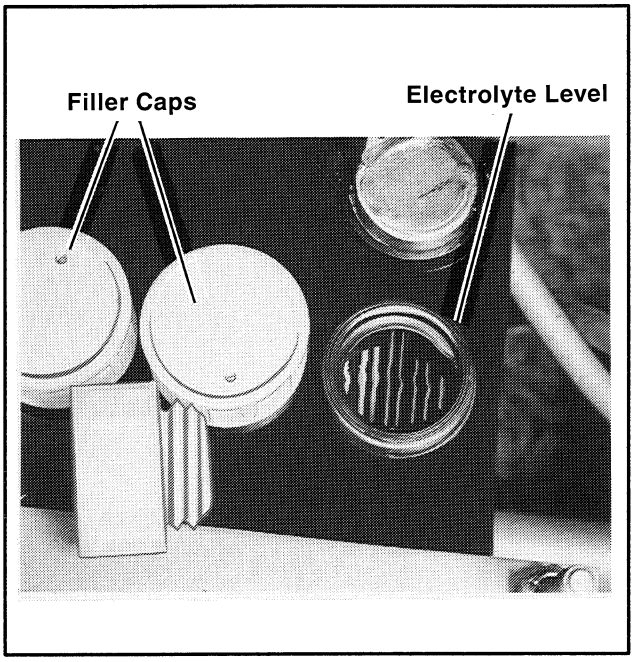


Figure 3–21. Battery Electrolyte Level

Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell. While holding the hydrometer vertically, read the number on the glass bulb at the top of the electrolyte level. The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 80°F (26.7°C). The difference between specific gravities of each cell should not exceed 0.01. The battery should be charged if the specific gravity is below 1.215 at an electrolyte temperature of 80°F (26.7°C). **The temperature of the battery electrolyte will affect the specific gravity reading and must be taken into consideration when checking battery specific gravity. If the hydrometer used does not have a temperature correction table, use the one shown in Figure 3–22.**

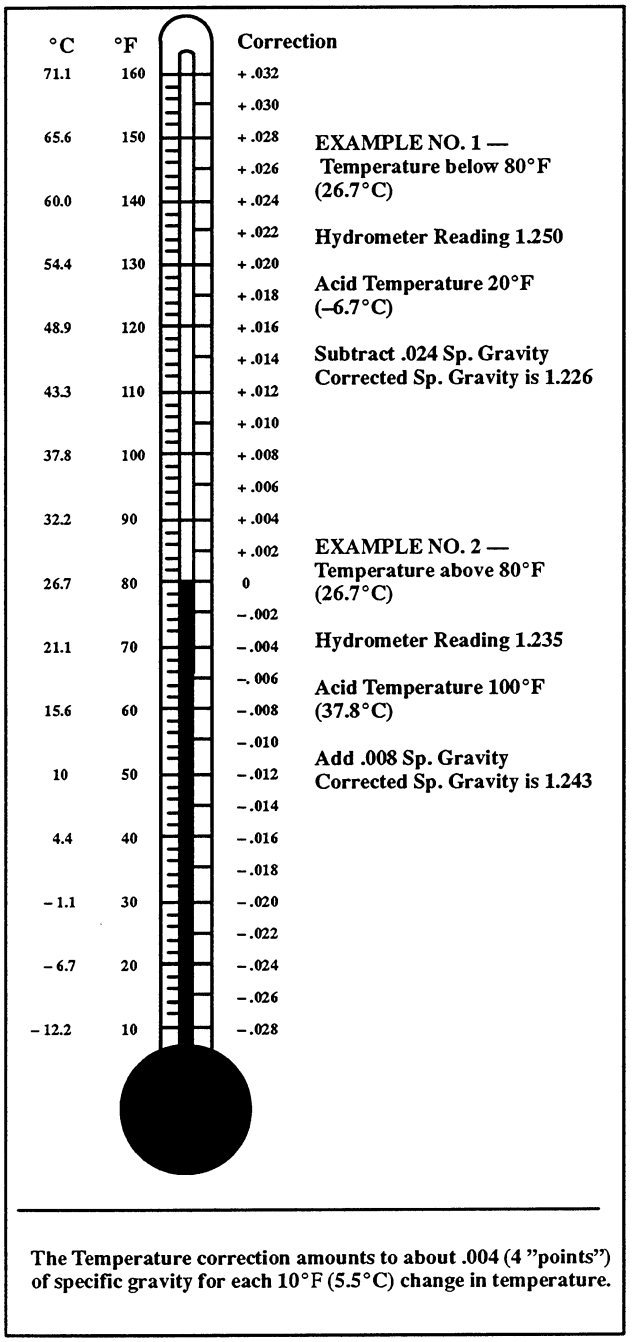


Figure 3–22. Specific Gravity Temperature Correction

Battery Charging

The generator is equipped with a belt–driven battery charging alternator to keep the starting battery fully charged. See Figure 3–23. The alternator requires no maintenance other than maintaining belt tension. To adjust alternator belt tension, see "Drive Belts" earlier in this section. Be sure to observe battery polarity when connecting battery to the generator set.

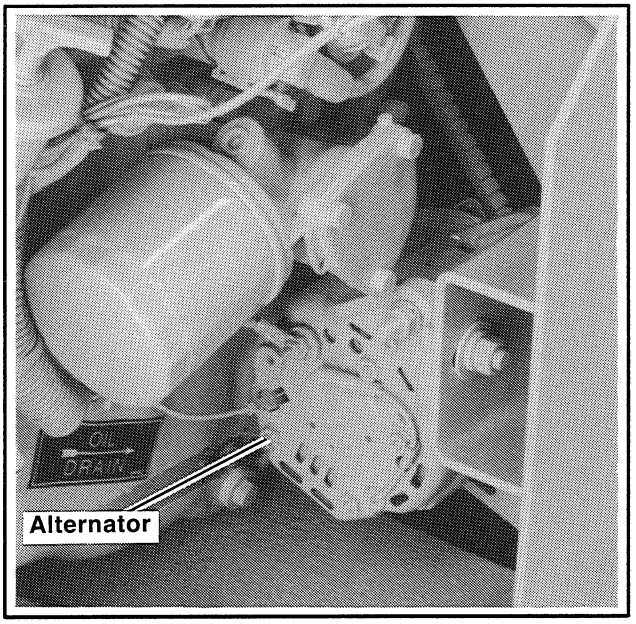


Figure 3–23. Battery Charging Alternator

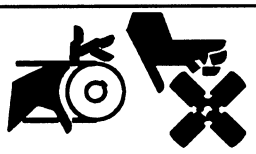
Intake Manifold Bolt Torque

The intake manifold bolts should be torqued to specifications every 800 hours of operation or yearly. Use a torque wrench to tighten the intake manifold bolts to 12–15 ft. lbs. (16–20 Nm).

Valve Adjustment

Every 400 hours or six months of operation the engine valve clearance may require adjustment. With poppet–type valve mechanisms, each valve is spring–held in the closed position until forced open by the action of the rocker arm. The rocker arm is in contact with the push rod which is moved by the tappet. The tappet rides on a lobe of the camshaft. Rocker arms have self–locking adjusting screws for adjusting valve stem–to–rocker arm clearance. Check clearance with the engine cold. See "Specifications – Engine" for intake and exhaust valve clearances. Use the following procedure and see Figure 3–24.

⚠ WARNING



Rotating parts.
Can cause severe injury or death.

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

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

1. Remove rocker arm cover screws using 10 mm socket wrench. Remove oil breather cap. Carefully pry rocker arm cover from cylinder head. Wipe excess oil from components using a clean rag.

2. Rotate the crankshaft clockwise (as viewed from engine end) using ratchet wrench on crankshaft pulley bolt until No. 1 cylinder is at top of compression stroke. At this point the timing marks should read TDC. This is the period between the closing of the intake valve and the opening of the exhaust valve. At this point the No. 1 piston is at TDC (top dead center), and both intake and exhaust valves will be closed.

   NOTE

   To reduce force needed to rotate crankshaft, remove spark plugs to eliminate compression stroke.

3. Insert feeler gauge between rocker arm and exhaust valve. If necessary, adjust screw so that very slight drag is felt on the feeler gauge as it is withdrawn. Repeat step for intake valve.

Valve Clearance Specifications in. (mm)	
Intake	0.009 (0.22)
Exhaust	0.013 (0.32)

4. Rotate crankshaft 180 degrees clockwise and set valve clearance on No. 2 cylinder.

5. Rotate crankshaft 180 degrees clockwise and set valve clearance on No. 4 cylinder.

   NOTE

   Sequence of adjustment is based on engine firing order of 1–2–4–3.

6. Rotate crankshaft 180 degrees clockwise and set valve clearance on No. 3 cylinder.

7. With mating surfaces clean and gasket properly aligned, install rocker arm cover and torque screws to 3–4 ft. lbs. (4–5 Nm). Replace oil breather cap. Remove ratchet wrench from crankshaft pulley

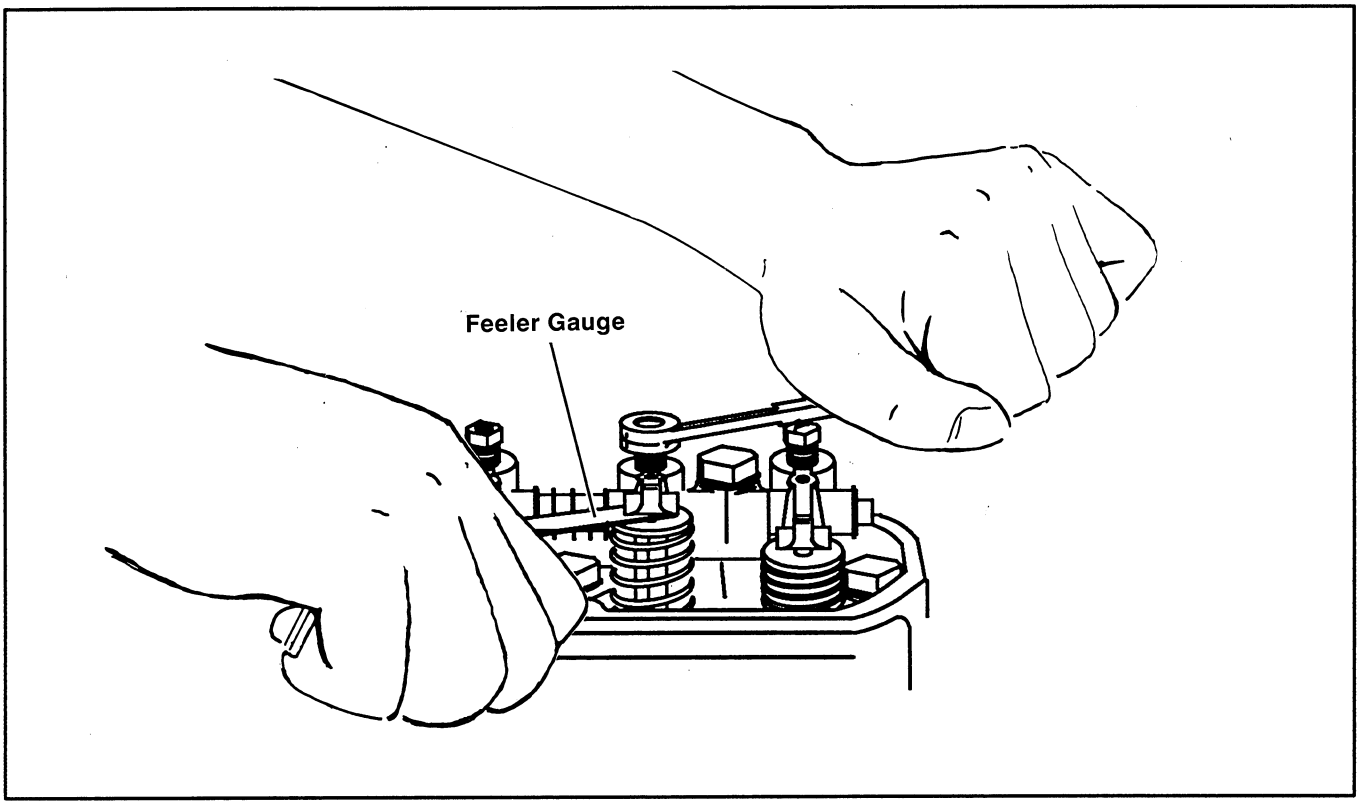


Figure 3–24. Valve Adjustment

SECTION 4. GENERATOR SERVICE

Under normal conditions, generator service will not be required on a regular basis. If operating under extremely dusty and dirty conditions, use DRY compressed air to blow dust out of the generator. Do this with the generator running and direct the stream of air through openings in the generator end bracket. This service is generally required every 400 hours or six months of operation. The generator brushes (on single–phase models) operate at a very low amperage and should last indefinitely. However, abrasive dust on the slip rings could shorten the life of the brushes. Every 400 hours or six months of operation have the brushes and slip rings inspected for damage or wear.

The end bracket bearing should be replaced every 10,000 hours of operation in standby and prime power applications. Service more frequently if bearing inspection indicates excessive rotor end play or bearing damage from corrosion or heat build–up. The end bracket bearing is sealed and requires no additional lubrication. All generator service must be performed by an authorized service dealer.

Generator engine service should be performed at the intervals specified by the engine manufacturer in the engine service literature. Contact your Kohler Generator Distributor to obtain service literature for specific models.

SECTION 5. TROUBLESHOOTING

When troubles occur, do not overlook simple causes. A starting problem, for example, could be caused by improper fuel or an empty fuel tank. The following charts list some common problems. If procedures in this manual do not explain how to correct the problem, take the generator set to an Authorized Service Dealer. Tell the dealer exactly what happened when the problem occurred and of any adjustments made to the set.

Engine

Problem	Possible Cause	Corrective Action
Unit will not crank	Weak or dead battery	Recharge or replace battery
	Reversed or poor battery connections	Check connections
	Defective starter/starter solenoid	Contact Authorized Service Dealer
	Defective start/stop switch	Test function; replace if defective
	Fuse blown in controller	Replace fuse

* See Section 2. "Fault Shutdowns"

** Gasoline–Fueled Sets Only

Engine – cont'd.

Problem	Possible Cause	Corrective Action
Cranks but will not start	Out of fuel	Replenish
	Air cleaner clogged	Clean or replace
	Defective fuel solenoid	Contact Authorized Service Dealer
	Defective ignition system	Contact Authorized Service Dealer
	Defective/misadjusted choke **	Replace/readjust choke
	Defective fuel pump **	Check pump operation
	Clogged fuel filter **	Replace fuel filter
	Defective fuel regulator/valve (on LP/natural gas systems)	Contact Authorized Service Dealer
	Faulty spark plugs	Replace (and regap) spark plugs
	Faulty ground (–) connection	Clean and retighten
	Loose spark plug connection	Reconnect
	Weak or dead battery	Recharge or replace
	Low oil pressure (LOP) shutdown*	Correct cause of shutdown
	High engine temperature (HET) shutdown*	Correct cause of shutdown
	Overspeed shutdown*	Contact Authorized Service Dealer
	Bad fuel mixture	Replace fuel; clean carburetor
	Blown voltage regulator fuse (CC/single–phase models only)	Replace fuse. If fuse blows again, contact an Authorized Service Dealer

* See Section 2. "Fault Shutdowns"

** Gasoline–Fueled Sets Only

Engine – cont'd.

Problem	Possible Cause	Corrective Action
Hard starting	Stale or bad fuel	Replace fuel
	Air cleaner clogged	Clean or replace element
	Carburetor adjustment incorrect	Readjust carburetor
	Faulty spark plug(s)	Replace (and regap) plug(s)
	Weak ignition coil	Replace coil
	Improper cooling	Inspect cooling system
	Choke misadjusted **	Readjust
Stops suddenly	Out of fuel	Replenish
	Air cleaner clogged	Replace element
	Fuse blown in controller	Replace fuse
	Faulty spark plug(s)	Replace (and regap) plug(s)
	High engine temperature (HET) shutdown *	Check engine coolant level
	Low oil pressure (LOP) shutdown*	Check oil level
	Overspeed shutdown *	Contact Authorized Service Dealer
	Defective fuel valve/fuel regulator (on LP/natural gas systems only)	Contact Authorized Service Dealer
	Defective fuel pump **	Check fuel pump operation
	Vapor lock **	Check fuel line routing
	Clogged fuel filter **	Replace filter
	Defective fuel solenoid **	Contact Authorized Service Dealer
	Blown voltage regulator fuse (CC/single–phase models only)	Replace fuse. If fuse blows again contact an Authorized Service Dealer

* See Section 2. "Fault Shutdowns"

** Gasoline–Fueled Sets Only

Engine – cont'd.

Problem	Possible Cause	Corrective Action
Lacks power	Air cleaner clogged	Replace element
	Generator overloaded	Reduce load
	Bad or stale fuel	Replace fuel
	Faulty spark plug(s)	Replace (and regap) plug(s)
	Carburetor adjustment incorrect	Readjust carburetor
	Engine not running at rated rpm	Contact Authorized Service Dealer
	Governor defective or misadjusted	Contact Authorized Service Dealer
	Improper cooling	Inspect cooling system
	Choke misadjusted **	Readjust choke
	Fuel line restriction	Inspect fuel lines
	Dirty fuel filter **	Replace fuel filter
	Defective ignition coil	Contact Authorized Service Dealer
Operates erratically	Air cleaner clogged	Replace element
	Stale or bad fuel	Replace fuel
	Faulty spark plugs	Replace plugs
	Carburetor adjustment incorrect	Readjust carburetor
	Governor adjustment incorrect	Contact Authorized Service Dealer
Overheats	Improper cooling	Check engine coolant level
	Air cleaner clogged	Clean or replace element
	Carburetor adjustment incorrect	Readjust carburetor

** Gasoline–Fueled Sets Only

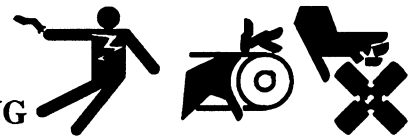
Generator

Problem	Possible Cause	Corrective Action
No AC output	Circuit breaker in OFF position	Reset breaker to ON position
	Circuit breaker tripping due to overload on generator set	Reduce load
	Generator malfunction such as faulty rotor or other internal fault	Contact Authorized Service Dealer
Low output or excessive drop in Voltage	Engine speed too low	Contact Authorized Service Dealer
	Generator overloaded	Reduce load
	Faulty voltage regulator	Contact Authorized Service Dealer
No battery charging output	Defective battery charging alternator	Contact Authorized Service Dealer
	Alternator belt loose	Retighten belt
High generator Output voltage	Defective/misadjusted voltage regulator	Contact Authorized Service Dealer
	Loose voltage regulator connections	Contact an Authorized Service Dealer

SECTION 6. GENERATOR RECONNECTION

The generator may be reconnected to supply a different output voltage (or phase on 12–lead generators) than listed on the generator nameplate. Refer to the reconnection procedure that applies to your generator set. (Refer to ADV–5720 in Section 8 for connection diagram for 600 Volt generator sets.) Observe the following safety precautions during the reconnection procedure.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.
Disconnect battery cables before working on generator set (negative lead first and reconnect it last).

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

⚠ WARNING

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

Do not connect to any building electrical system without connecting through an approved device and after building main switch is open.

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

Four–Lead Reconnectible (CC – Single Phase) Generator Sets

10/12CC (60Hz) generators with four–lead stators can be reconnected to 120–Volt or 120/240–volt systems. 10/12CFC (50Hz) generators can be reconnected to 120/240, 115/230 or 110/220–Volt systems. Contact the factory before attempting to convert the set from 60 to 50 Hz voltages and vise–versa. (Not all 4–lead alternators can be reconnected to 50/60 Hz voltages.

NOTE

Voltage regulator adjustment may be required to achieve the 50 Hz voltages listed.

NOTE

If generator is reconnected to a voltage different than nameplate rating, new voltage should be recorded on generator. A voltage change decal for this purpose is available from Kohler Service Parts.

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

The jumper lead should be placed on the line side of the circuit breaker. See Figure 6–1. Leads L1 and L2 should be left 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. It is recommended that the jumper lead be used for all straight 120–Volt systems to help balance the generator set load.

Leads	60Hz	50Hz
L0–L1	120–Volt	110–Volt
L0–L2	120–Volt	110–Volt

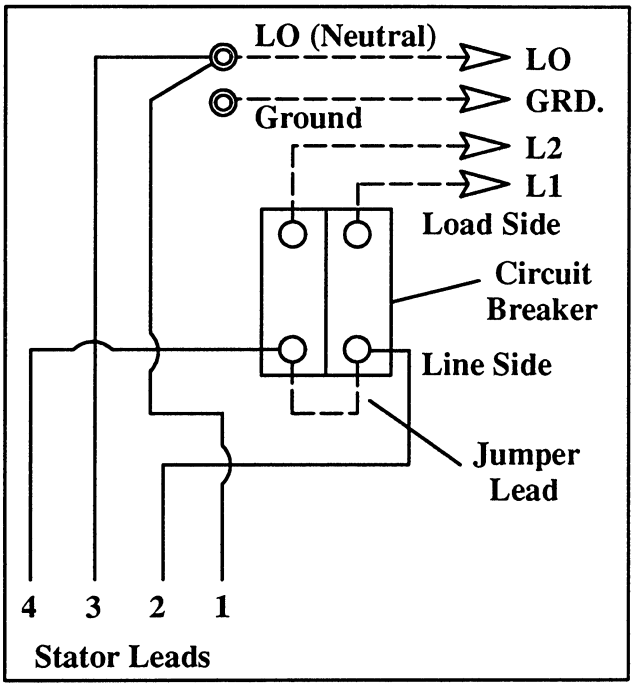


Figure 6–1. 4–Lead 120–Volt (60 Hz) or 110–volt (50 Hz) Connection

Dual Voltage Connections 120/240–Volt (60 Hz) 110/220, 120/240, 115/230–Volt (50 Hz)

In these systems, the jumper lead is not used. If the unit was originally wired for straight 120–Volt (60 Hz) or 110–Volt (50 Hz), be sure jumper lead is removed from circuit breaker line side. Leads L1 and L2 are different phases and must never be connected together. See Figure 6–2 for dual voltage connection.

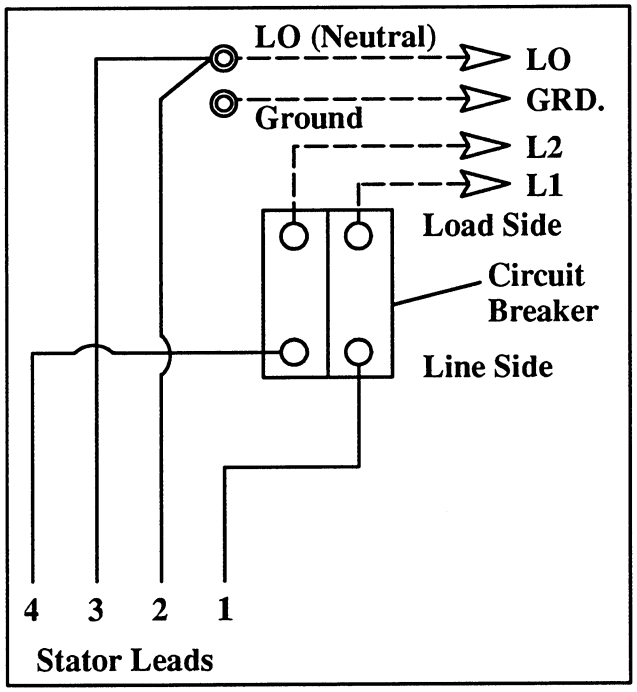


Figure 6–2. Dual Voltage Connection

Leads	Voltage at 60Hz
L0–L1	120–Volt
L0–L2	120–Volt
L1–L2	240–Volt

Leads	Voltage at 50Hz*
L0–L1	110, 115, or 120–Volt
L0–L2	110, 115, 120–Volt
L1–L2	220, 230, 240–Volt

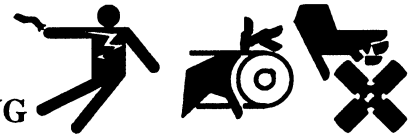
* Voltage regulator adjustment may be required to achieve 50 Hz voltages listed.

12–Lead Reconnectible (CZ) Generator Sets

Three–phase generators can be reconnected to the voltages and phases shown in Figure 6–3. Observe the following safety precautions when performing this procedure.

NOTE

If generator is reconnected to a voltage different than nameplate rating, new voltage should be recorded on generator. A voltage change decal for this purpose is available from Kohler Service Parts.



⚠ WARNING

Accidental starting.
Can cause severe injury or death.
Disconnect battery cables before working on generator set (negative lead first and reconnect it last).

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

⚠ WARNING

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

Do not connect to any building electrical system without connecting through an approved device and after building main switch is open.

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

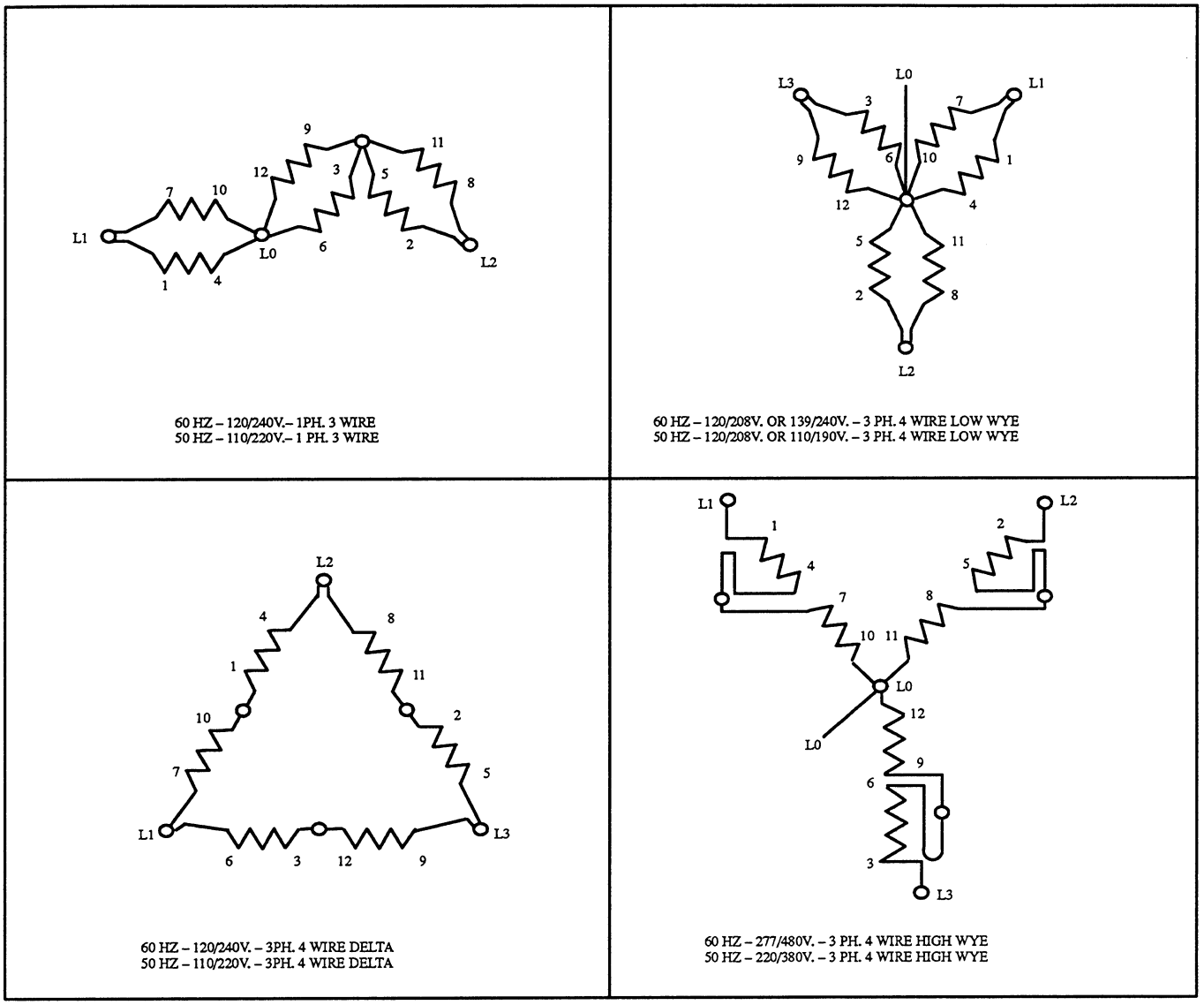


Figure 6–3. 12–Lead (CZ) Generator Reconnection

12–Lead Reconnection Procedure

NOTE

All three–phase generator sets will derate substantially (approximately 33%) if reconnected for single–phase voltages. Contact the factory for specific derate information.

1. Stop generator set by depressing "Stop" switch on controller/remote Start/Stop switch.

2. Disconnect engine starting battery, negative (–) lead first. Disconnect power to battery charger (if equipped).

3. Select desired voltage connection from Figure 6–3. Connect output leads according to the diagram for desired phase and voltage.

NOTE

Line circuit breakers, transfer switch, and all other accessories must be properly sized for the voltage selected.

4. Reconnect starting battery, negative lead last. Move controller master switch to the RUN position to start the generator set. Check voltmeter (customer supplied) for proper voltage. Adjust voltage, if necessary, with the voltage adjustment on the voltage regulator.

Adjustment – Generator Output Voltage (3–Phase Sets Only – CZ)

The PowerBoost V voltage regulator maintains generator output at selected voltage under load until the generator engine speed drops to a pre–set level (factory setting 57.5 Hz). At this point the regulator allows generator voltage and current to drop to a level sufficient to handle load. When the generator speed returns to normal (60Hz) as load is accepted, the generator output also returns to normal. If the generator has been reconnected to obtain a different output voltage (3–phase/CZ sets only), it may be necessary to adjust the regulator voltage adjustment pot. to reach desired voltage. **Do not tamper with regulator Volts/Hz and Stabilizer pots. during output voltage adjustment.** Location of the PowerBoost V voltage regulator is shown in Figure 6–4. Adjust voltage regulator according to the following procedure.

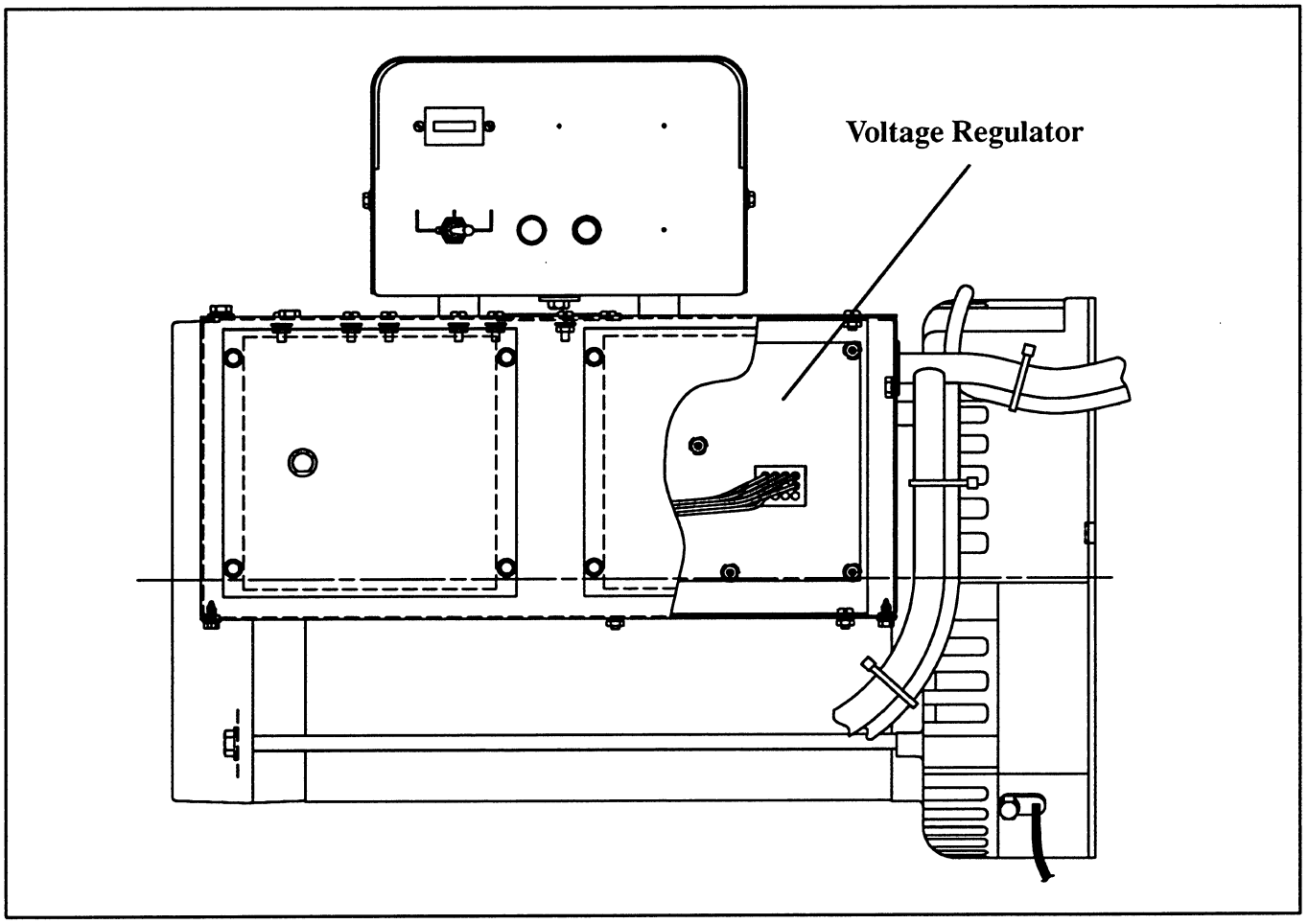


Figure 6–4. PowerBoost V Voltage Regulator Location

⚠ WARNING

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

Do not connect to any building electrical system without connecting through an approved device and after building main switch is open.

Hazardous voltage can cause severe injury or death. The heat sink of the voltage regulator contains high voltage. Do not touch voltage regulator heat sink when testing or electrical shock will occur.

Hazardous voltage can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while adjustments are made. Remove wristwatch, rings, and jewelry that can cause short circuits

1. With generator set off, remove voltage regulator cover. Set remote rheostat (if equipped and voltage adjustment pot. to mid–point. Connect voltmeter to generator AC circuit.
2. Start generator set. Rotate voltage adjustment pot. clockwise (increase voltage) or counterclockwise (decrease voltage) until desired voltage is obtained. See Figure 6–5.
3. Use remote rheostat (if equipped) to make final adjustments.

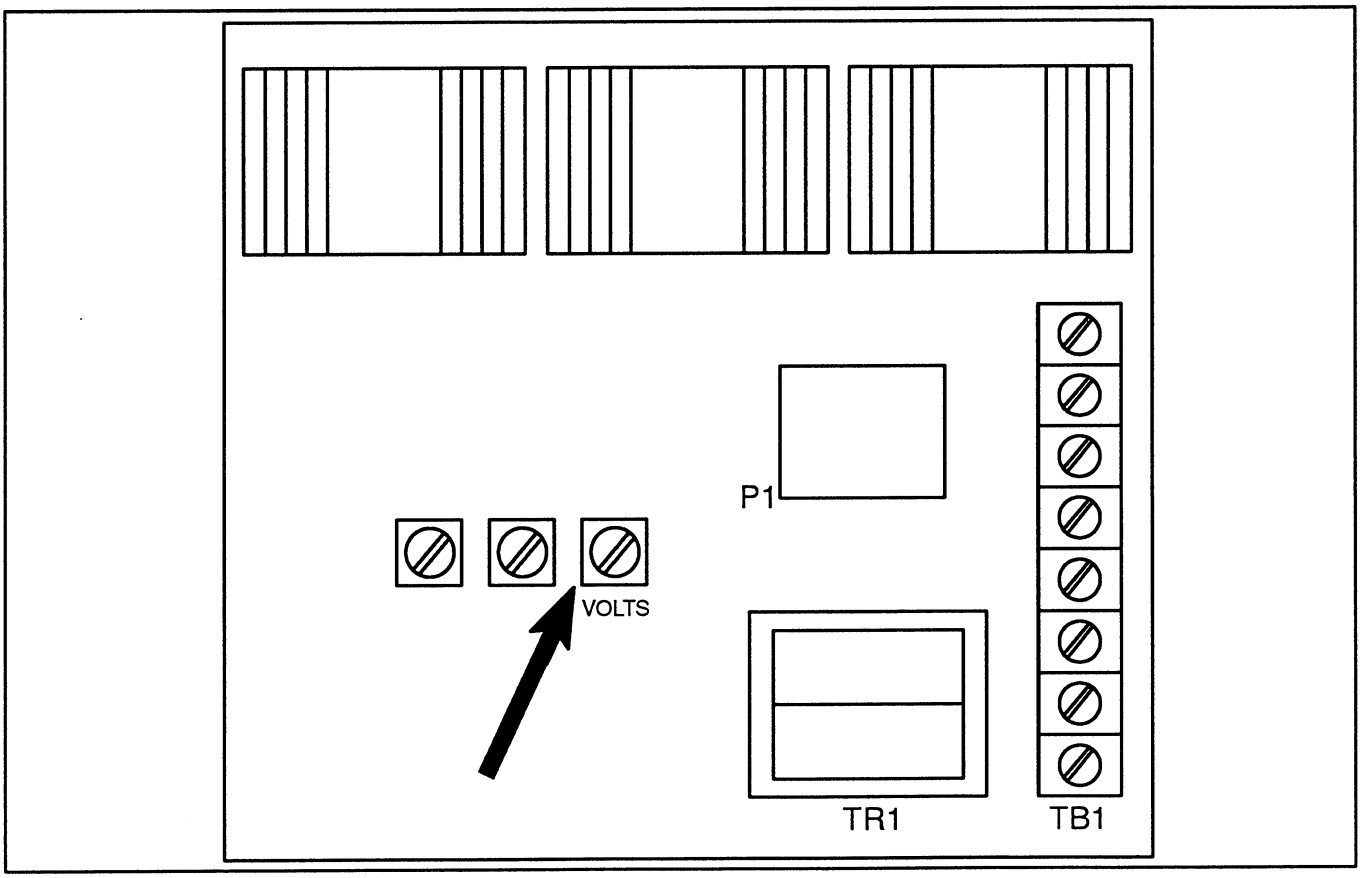


Figure 6–5. Regulator Voltage Adjustment Pot.

SECTION 7. STORAGE & SERVICE

Storage Procedure

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

1. Drain the oil (while hot) from the crankcase then refill with regular grade oil. See Section 3. "Oil Type" in this manual.

2. With the generator running (with no loads connected), treat upper cylinders by spraying recommended engine oil into the air intake for 10 to 15 seconds. Open throttle for a short burst of speed; shut off set and allow it to come to a stop while continuing to spray recommended oil into air intake.

3. Check engine coolant protection. See Section 3. "Cooling System" for additional information.

4. Disconnect battery (negative lead first) and place in storage.

5. Seal all openings in engine with nonhydroscopic adhesive tape. Mask off all areas to be used for electrical contact.

6. Clean exterior surface of the generator. Spread a light film of oil over unpainted metallic surfaces which could rust or corrode.

Service Ordering Instructions

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

Service Manual Procurement

A service manual or parts catalog for your generator set may be obtained through an Authorized Service Dealer or Distributor. Record Model, Spec. and Serial numbers (from generator nameplate) in the spaces below. The dealer or distributor requires these numbers to obtain the proper literature for the generator.

Model No._____

Specification No._____

Serial No._____

Engine Specification No._____

SECTION 8. WIRING DIAGRAMS

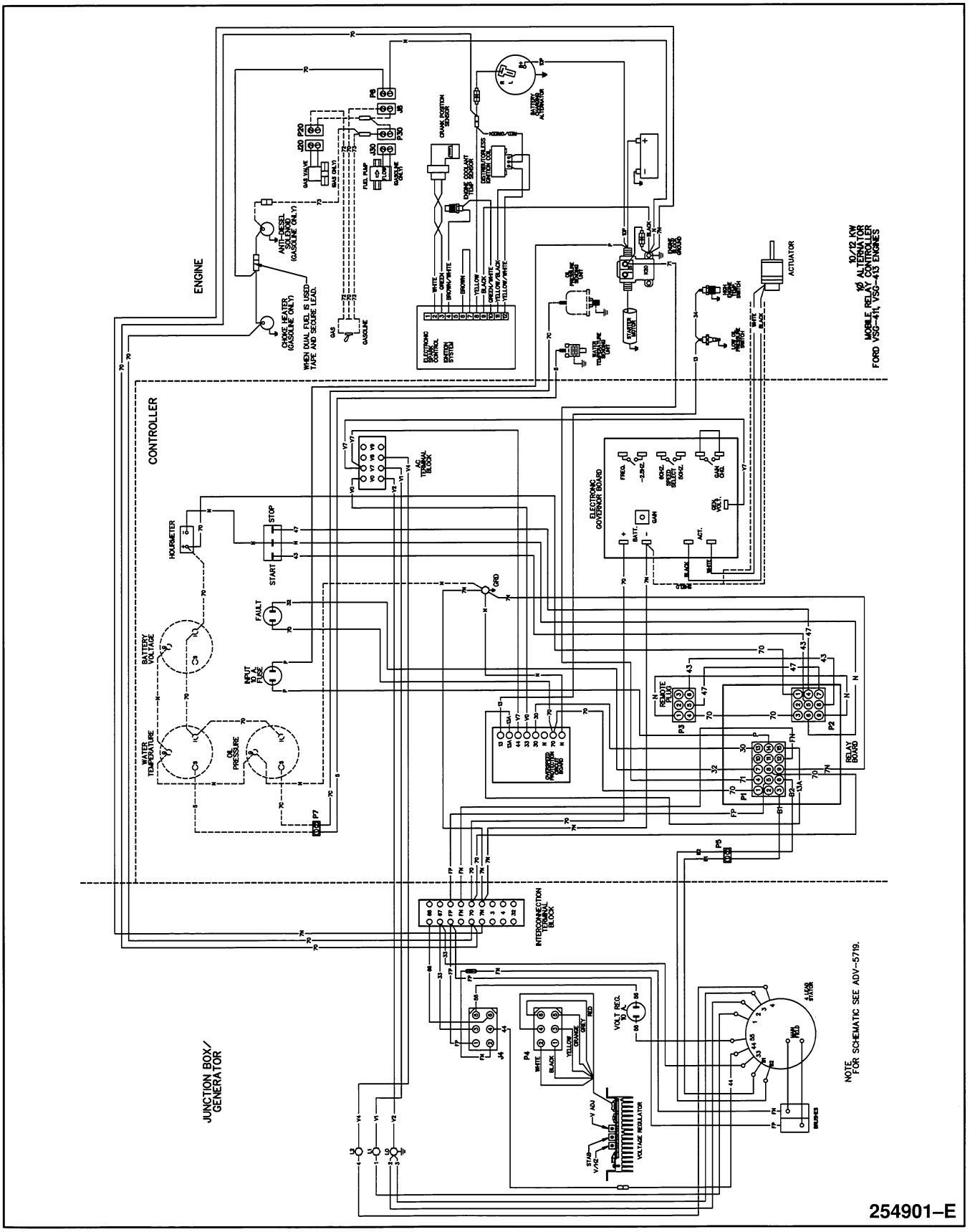


Figure 8–1. Wiring Diagram – 10CC, 12CC (Single Phase) Mobile Generator Set

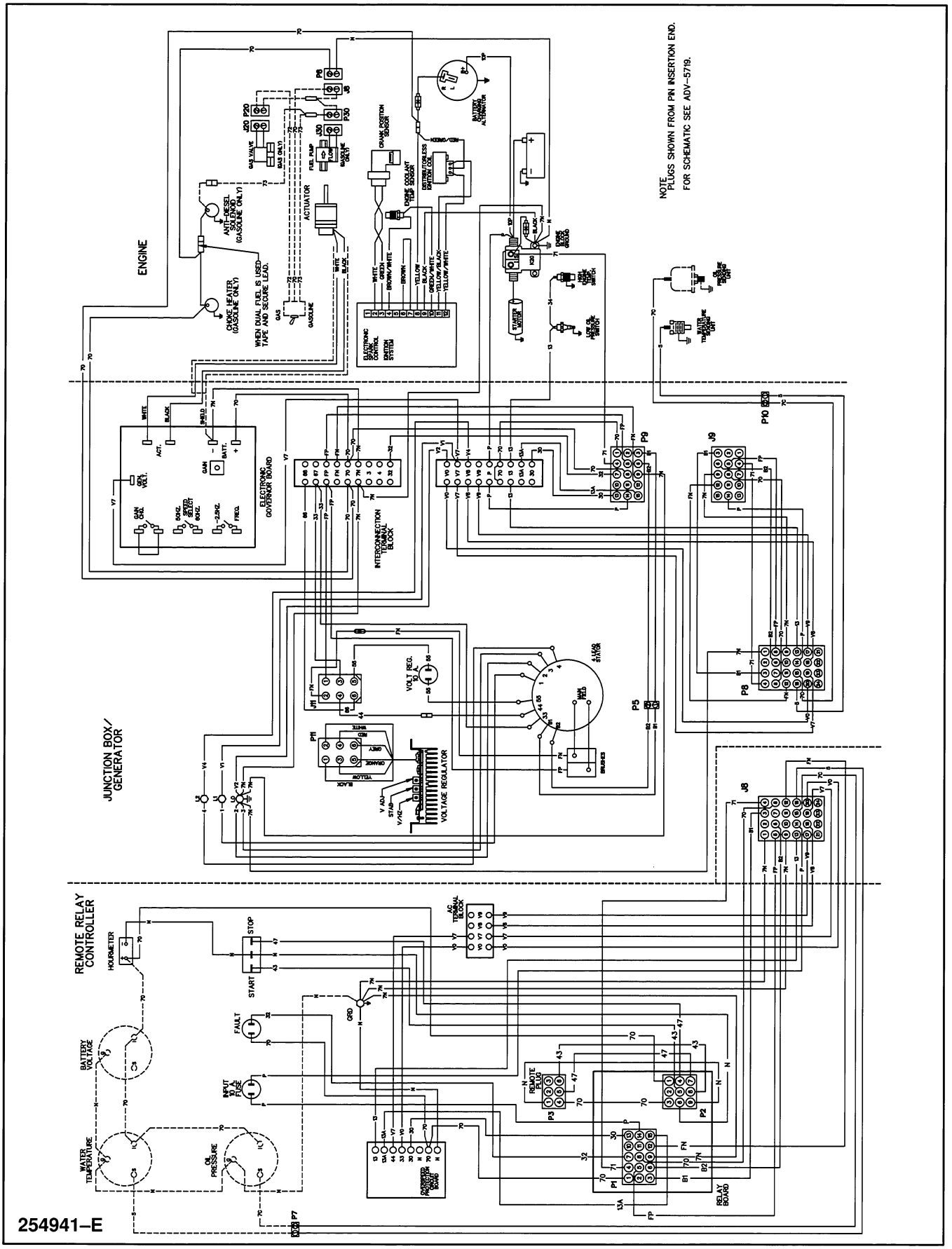


Figure 8–2. Wiring Diagram – 10/12CC (Single Phase) Mobile Generator w/Remote Controller

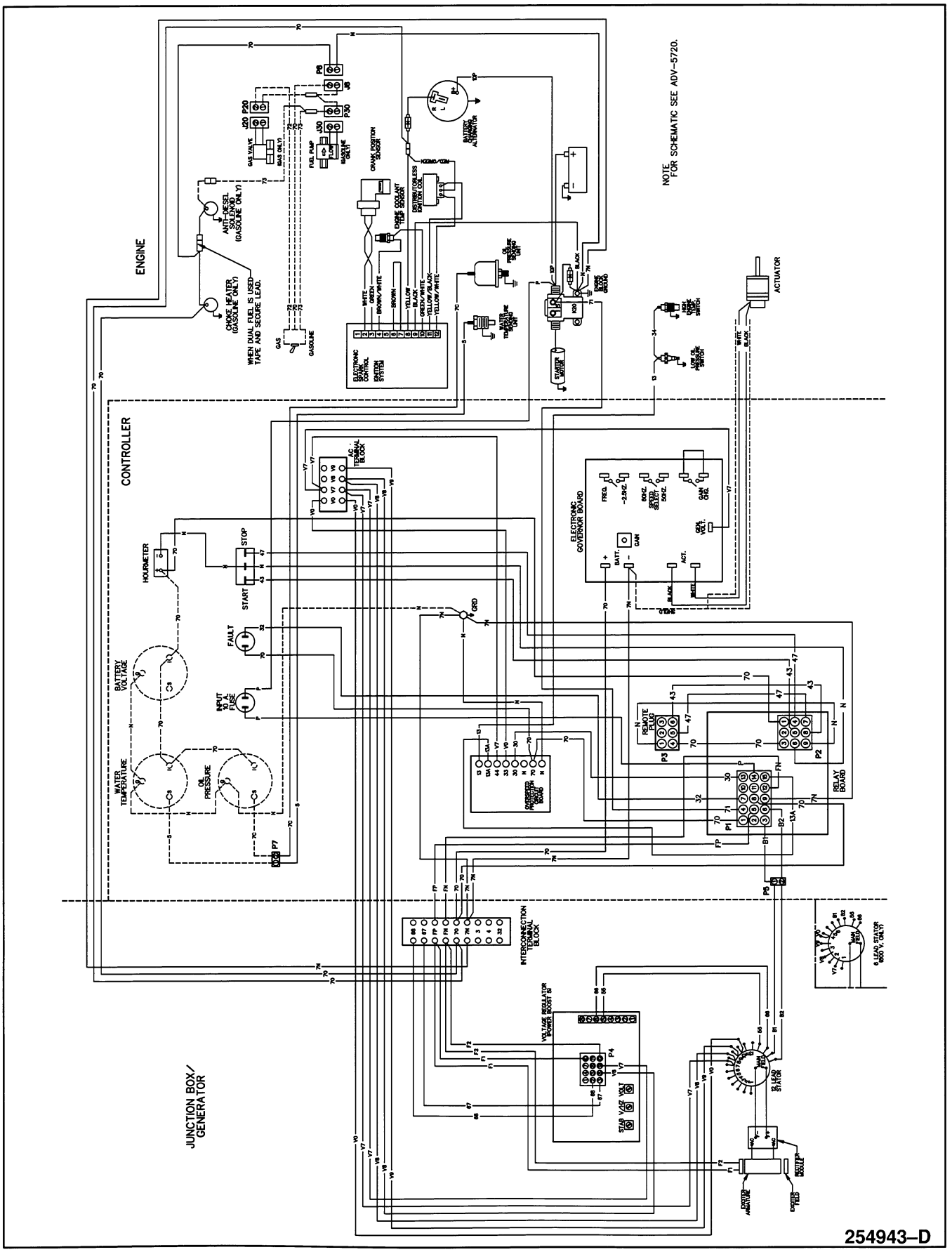


Figure 8–3. Wiring Diagram – 10CZ, 12CZ (3 Phase) Mobile Generator Set

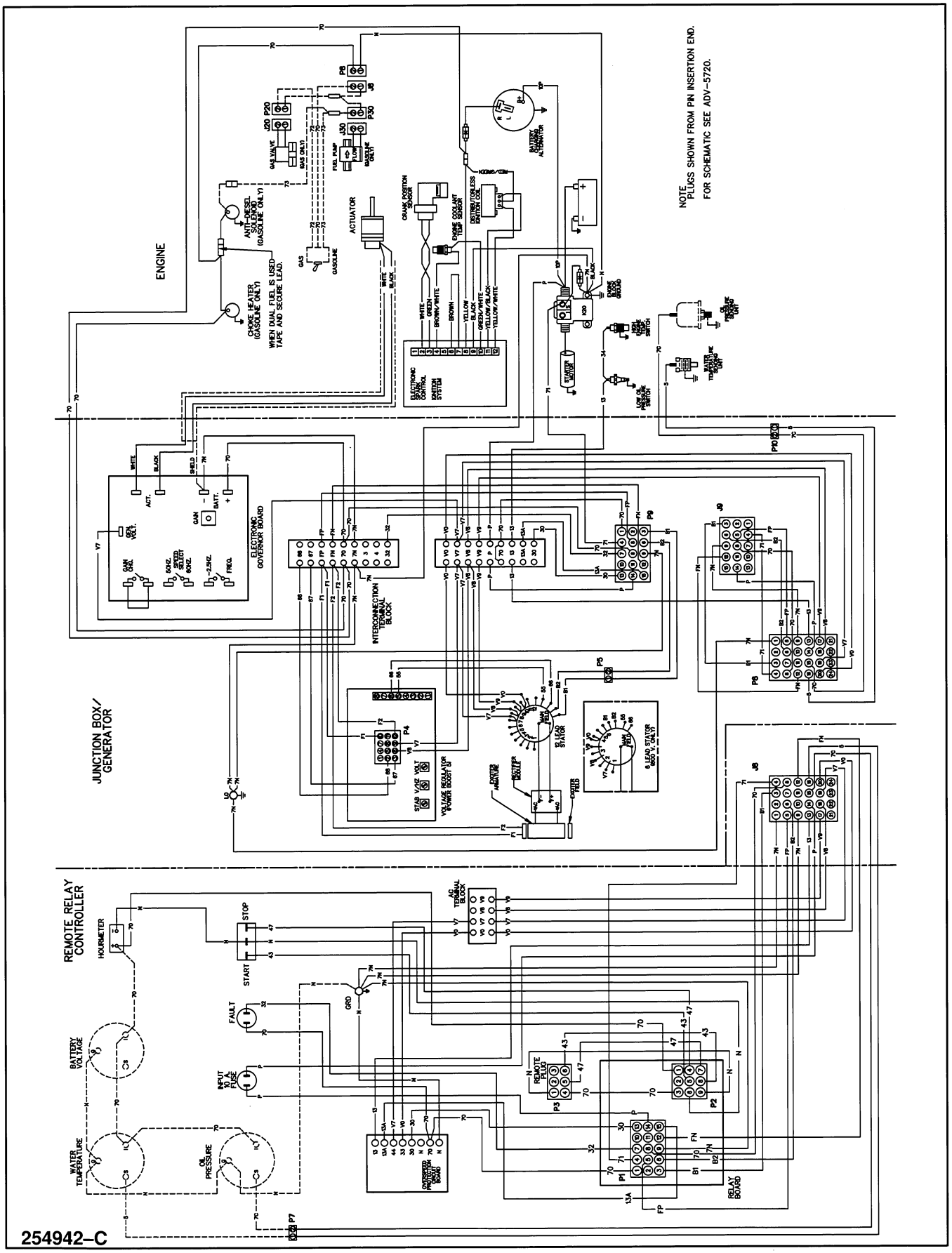


Figure 8–4. Wiring Diagram – 10/12CZ (3 Phase) Mobile Generator w/ Remote Controller

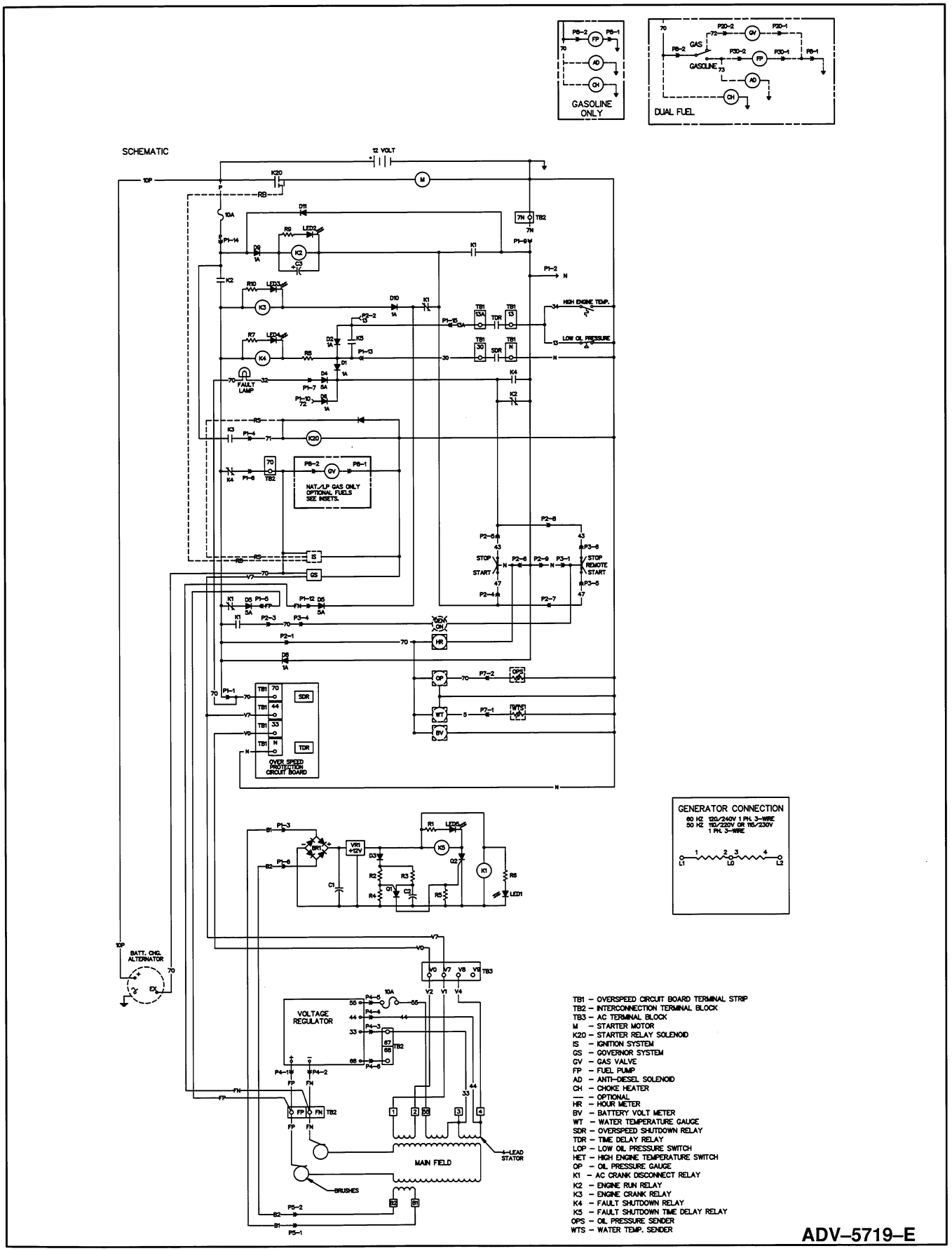


Figure 8–5. Wiring Diagram for Mobile Relay Controller w/PB–3, Single Phase

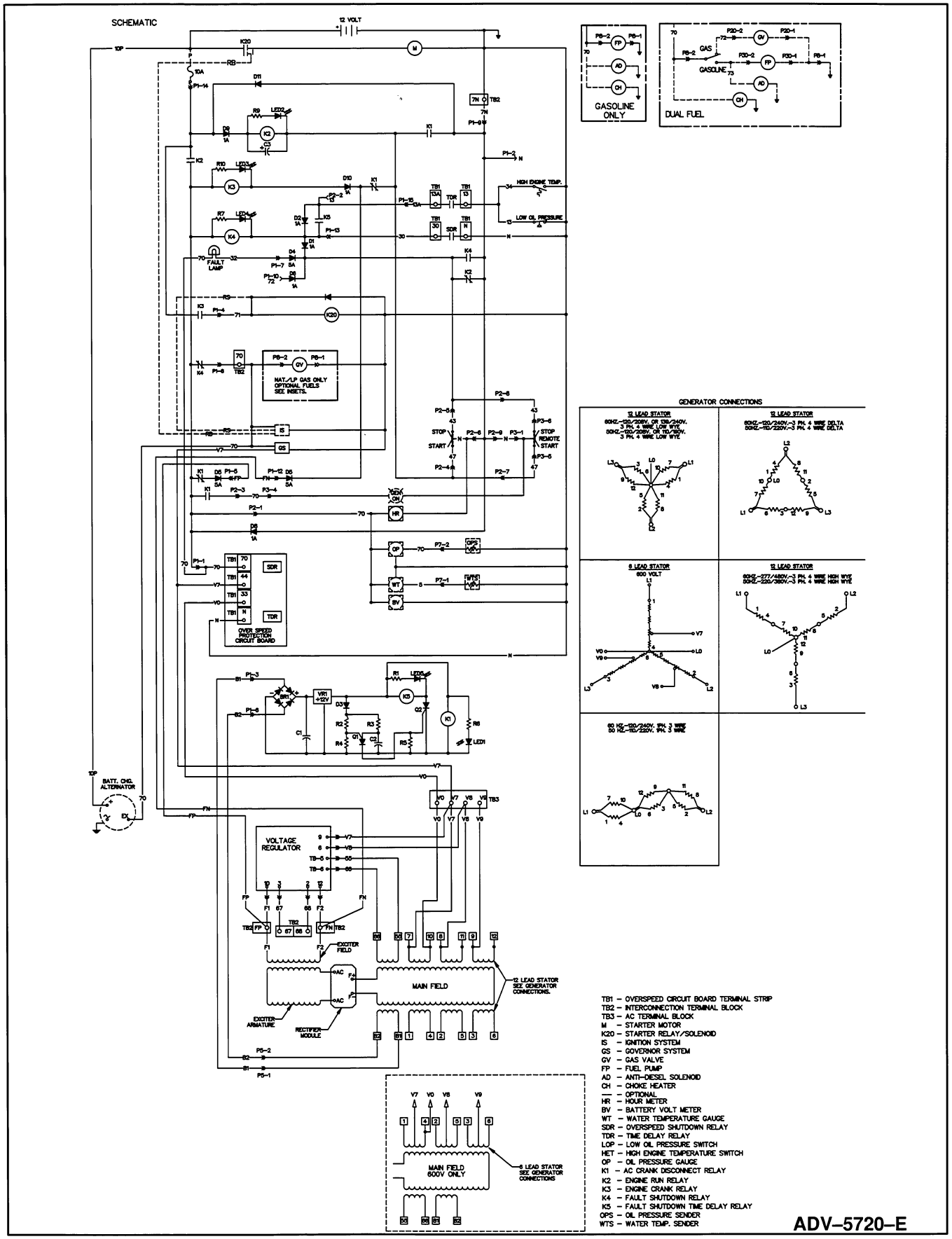
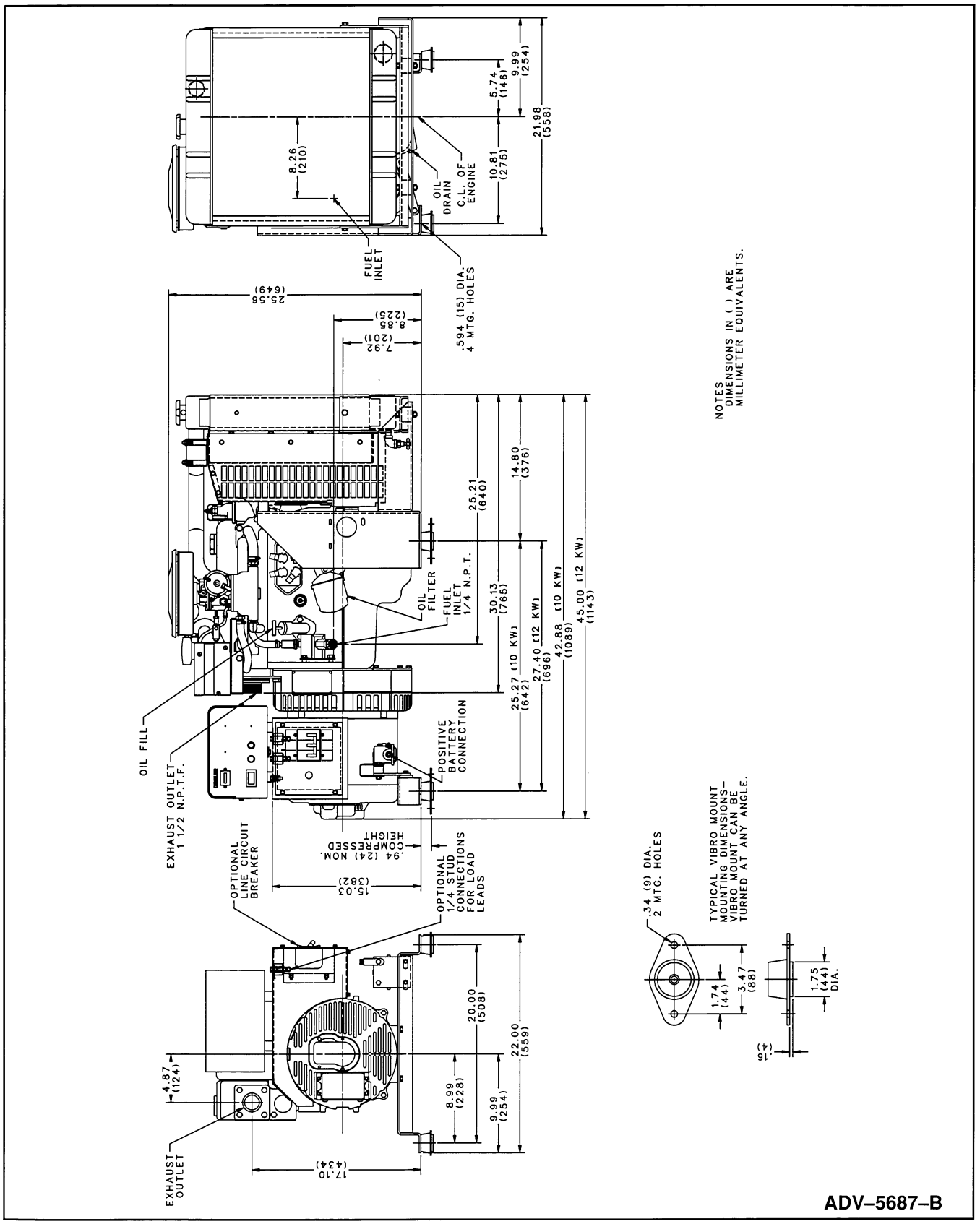
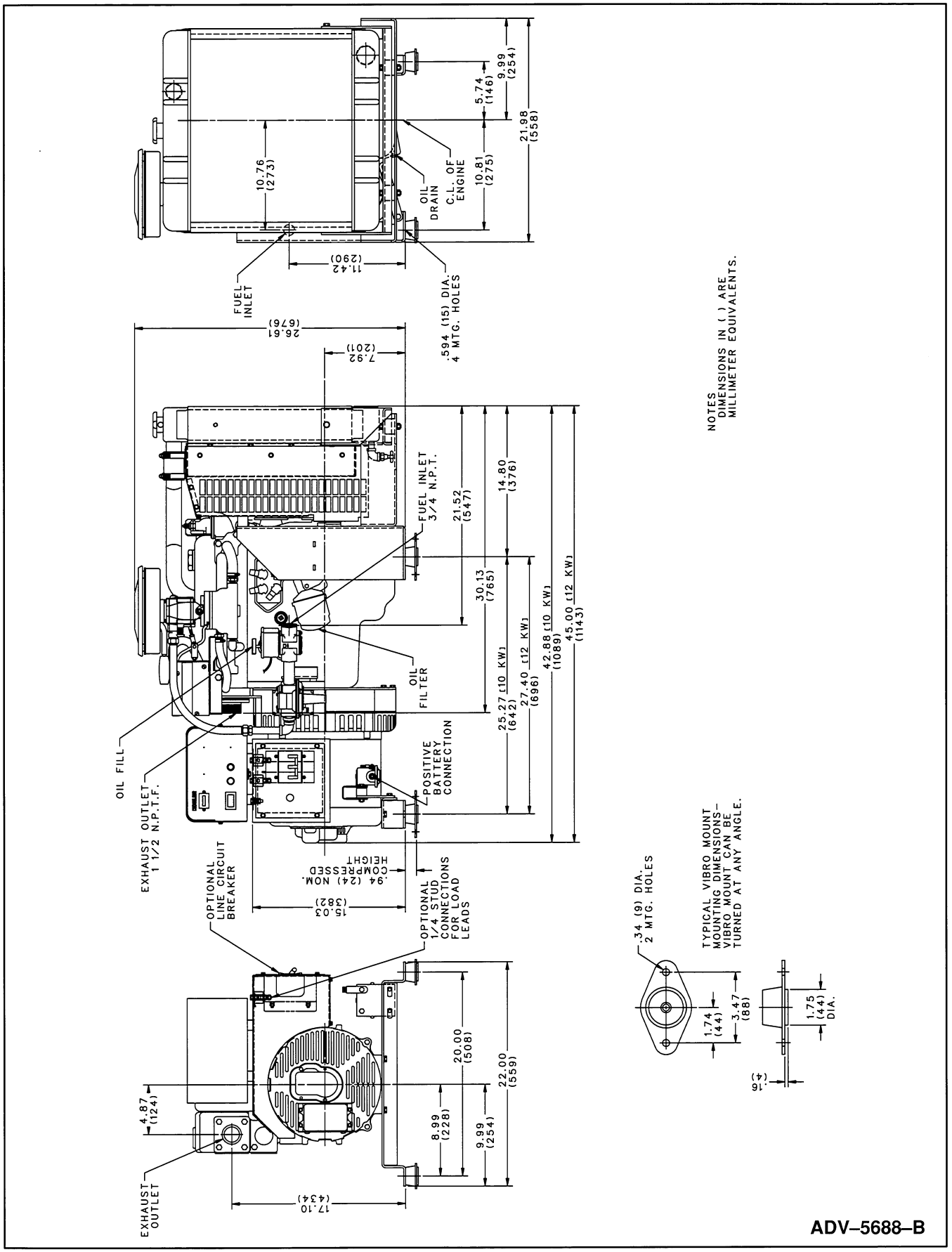


Figure 8–6. Wiring Diagram for Mobile Relay Controller w/PB–5 Single – Three Phase and 600Volt.

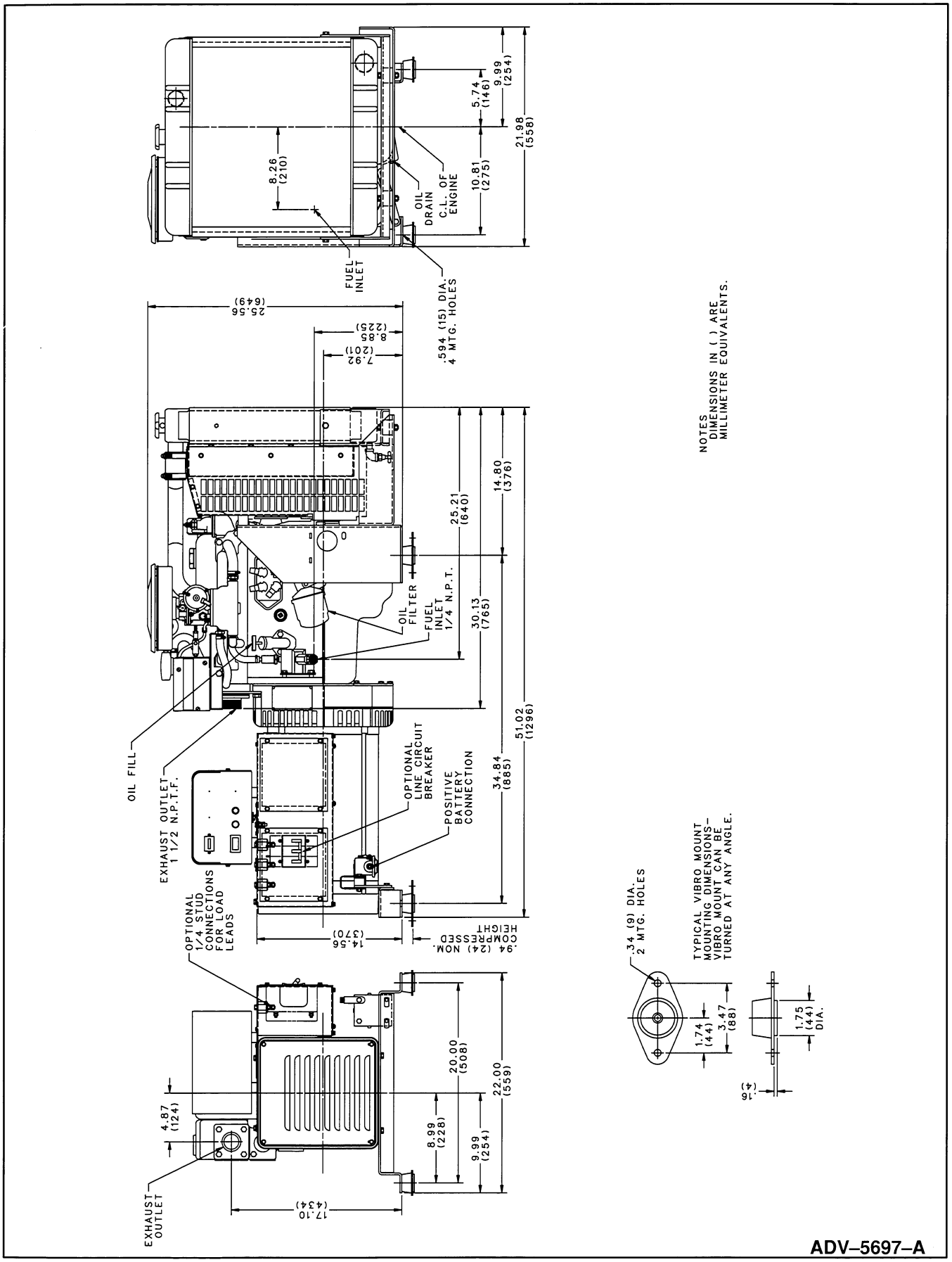
SECTION 9. DIMENSION DRAWINGS



10CC/12CC (Single Phase) Mobile Generators (Gasoline Fuel System)



10CC/12CC (Single Phase) Mobile Generators (Straight Gas Fuel System)



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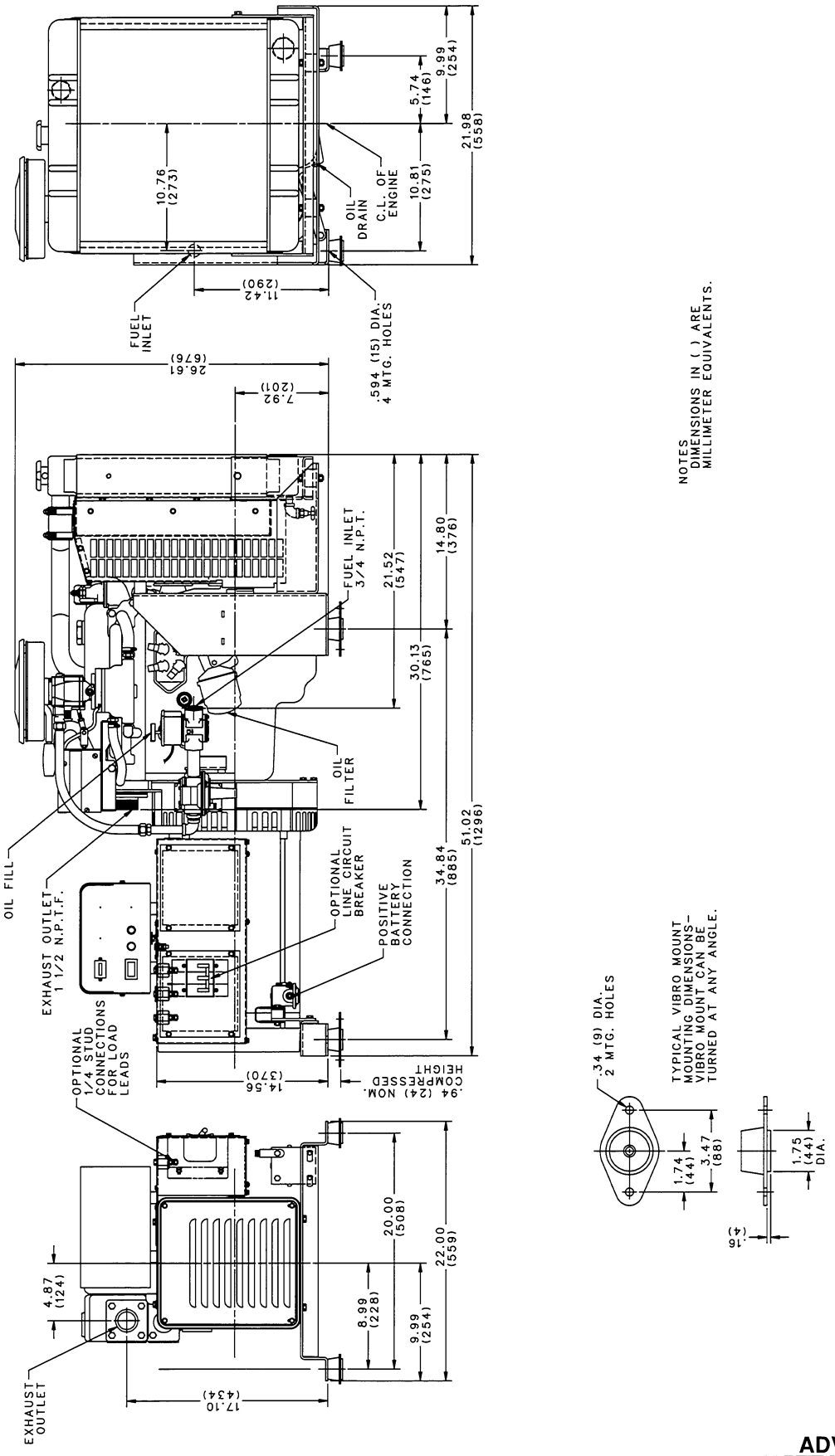
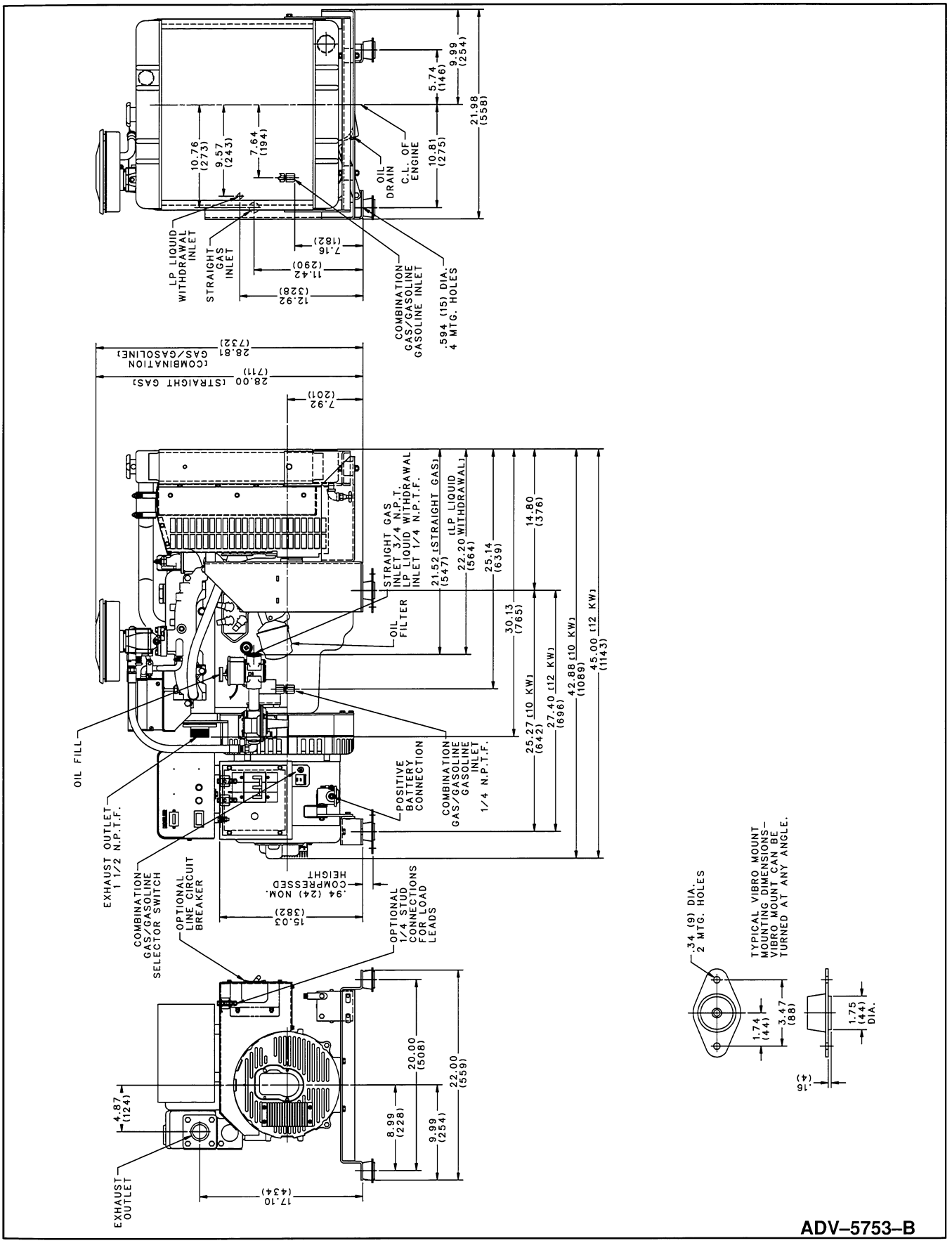
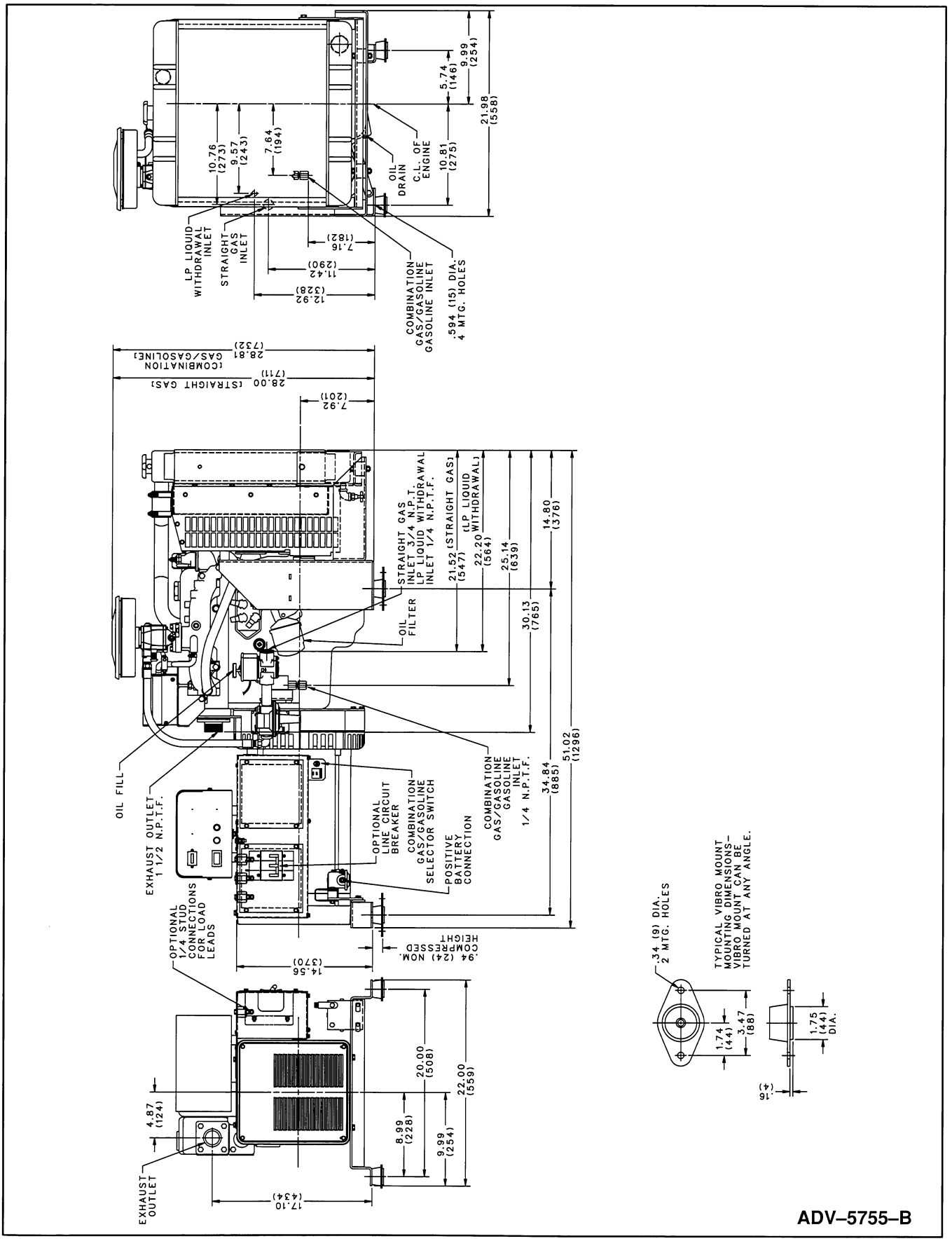
10CZ/12CZ (3 Phase) Mobile Generators (Gasoline Fuel System)



10CZ/12CZ (3 Phase) Mobile Generators (Straight Gas Fuel System)



10CC/12CC (Single Phase) Mobile Generators
(Straight Gas, LP liquid, Combination Gas/Gasoline Fuel System)



10CZ/12CZ (3 Phase) Mobile Generators (Straight Gas, LP Liquid, Combination Gas/Gasoline Fuel System)

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