



Operator Manual

Onan Generator Set for Commercial Mobile

HDKAG (Spec A–K)

California

Proposition 65 Warning

Warning: Natural Gas/Liquid Propane Gas engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.



WARNING



**Do not use this genset on a boat
Such use may violate U. S. Coast Guard
regulations and can result in
severe personal injury or death from
fire, electrocution, or
carbon monoxide poisoning**

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Safety Precautions

Thoroughly read the OPERATOR'S MANUAL before operating the generator set. Safe operation and top performance can only be obtained when equipment is operated and maintained properly.

The following symbols in this manual alert you to potential hazards to the operator, service person and equipment.

⚠ DANGER alerts you to an immediate hazard that will result in severe personal injury or death.

⚠ WARNING alerts you to a hazard or unsafe practice that can result in severe personal injury or death.

⚠ CAUTION Do not operate the engine with the oil level below the ADD mark or above the FULL mark. Overfilling can cause foaming or aeration of the oil, while operation below the ADD mark can cause loss of oil pressure. alerts you to a hazard or unsafe practice that can result in personal injury or equipment damage.

Electricity, fuel, exhaust, moving parts and batteries present hazards which can result in severe personal injury or death.

GENERAL PRECAUTIONS

- Keep children away from the generator set.
- Do not use evaporative starting fluids. They are highly explosive.
- To prevent accidental or remote starting while working on the generator set, disconnect the negative (-) battery cable at the battery.
- Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray out and cause severe burns.
- Keep the generator set and its compartment clean. Excess oil and oily rags can catch fire. Dirt and gear stowed in the compartment can restrict cooling air.
- Make sure all fasteners are secure and torqued properly.

- Do not work on the generator set when mentally or physically fatigued or after consuming alcohol or drugs.
- You must be trained and experienced to make adjustments while the generator set is running—hot, moving or electrically live parts can cause severe personal injury or death.
- Used engine oil has been identified by some U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.
- Ethylene glycol, used as engine antifreeze, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10)
- generator set installation and operation must comply with all applicable local, state and federal codes and regulations.

GENERATOR VOLTAGE IS DEADLY

- Disable the automatic generator set starting feature of an inverter-charger or other automatic starting device before servicing the generator set.
- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.
- The generator set must not be connected to the public utility or any other source of electrical power. Back-feed could lead to electrocution of utility personnel and damage to equipment. An approved switching device must be used to prevent interconnections.
- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

ENGINE EXHAUST IS DEADLY

- Inspect for exhaust leaks at every startup and after every eight hours of running.
- Prior to every startup and after every eight hours of running, all carbon monoxide detectors must be tested and confirmed to be working in accordance with the manufacturer's instructions or owners manual.
- Learn the symptoms of carbon monoxide poisoning in the Operator's Manual.
- Never occupy the vehicle while the generator set is running unless the vehicle is equipped with a working carbon monoxide detector.
- Do not operate the generator set when the vehicle is in a confined space, such as a garage.
- Disable the automatic generator set starting feature of an inverter-charger or other automatic starting device before storing the vehicle or parking it in a garage or other confined space.
- The exhaust system must be installed in accordance with the generator set Installation Manual.
- Engine cooling air must not be used for heating working or living spaces or compartments.

DIESEL FUEL IS COMBUSTIBLE

- Do not smoke or turn electrical switches ON or OFF where fuel fumes are present or in areas sharing ventilation with fuel tanks or equipment. Keep flames, sparks, pilot lights, arc-producing equipment and all other sources of ignition well away.

- Fuel lines must be secured, free of leaks and separated or shielded from electrical wiring.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses.
- Do not smoke.
- To reduce arcing when disconnecting or reconnecting battery cables, always disconnect the negative (-) battery cable first and reconnect it last.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disable the automatic generator set starting feature of an inverter-charger or other automatic starting device before servicing the generator set.
- Do not wear loose clothing or jewelry near moving parts such as PTO shafts, fans, belts and pulleys.
- Keep hands away from moving parts.
- Keep guards in place over fans, belts, pulleys, and other moving parts.

FLAMMABLE VAPOR CAN CAUSE A DIESEL ENGINE TO OVERSPEED

Flammable vapor can cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. ***Do not operate a diesel-powered generator set where a flammable vapor environment can be created by fuel spill, leak, etc.*** The owners and operators of the generator set are solely responsible for operating the generator set safely.

Introduction

ABOUT THIS MANUAL

This manual covers the operation and maintenance of the generator set models listed on the front cover. Study this manual carefully and observe all of its instructions and precautions.

Control Panel, Pre-Start Checks, Starting and Stopping, Wattage Requirements and Operating Recommendations cover basic operation of the generator set.

Maintenance Schedule, Maintenance Procedures, Generator Set Storage and Troubleshooting cover the maintenance and care necessary for top performance. The owner is responsible for maintaining the generator set according to the maintenance schedule (Page 11).

Information for California generator set Users provides important information for California generator set users.

Each operator of the generator set should become thoroughly familiar with the information in this manual. Keep this manual and the generator set Installation Manual with the other vehicle manuals.

⚠ WARNING *This generator set is not a life support system. It can stop without warning. Children, persons with physical or mental limitations, and pets could suffer personal injury or death. A personal attendant, redundant power or a warning system must be used if generator set operation is critical.*

MODEL IDENTIFICATION

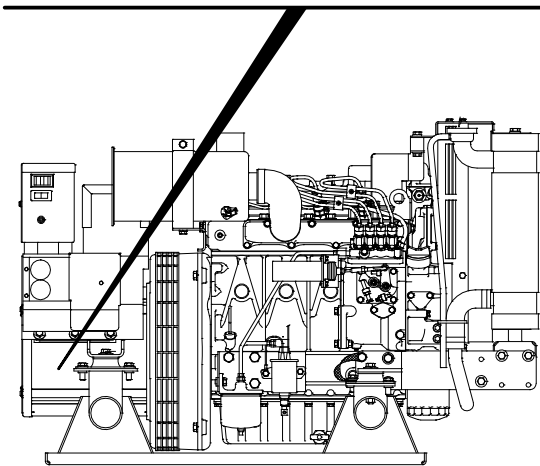
When contacting a Cummins dealer or distributor for parts, service or product information, be ready to provide the model and serial numbers on the generator set nameplate (Figure 1-1). Every character in these numbers is significant. (The last character of the model number is the specification letter, which is important for obtaining the right parts.)

To make the model and serial numbers easy to find when you need them, record them in the boxes provided in Figure 1-1.

FEATURE AND COMPONENT LOCATIONS

The standard control panel and the routine maintenance items are shown in Figure 2.

IMPORTANT ENGINE INFORMATION			
Model No.: 10HDKAG11435C		ONAN CORPORATION 1400 73rd Ave. NE Minneapolis, MN 55432 Made in U.S.A.	
S/N: A953123456	Ph:	kW:	
AC Volts:	Pf:	RPM:	
Amps:	Hz:	Bat: 12V	
Fuel:			
Insulation - NEMA Class	Ambient: 40°C	INI 3461	URC
REFER TO OPERATOR'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS.			
THIS ENGINE MEETS 1995-1998 CALIFORNIA EMISSIONS REGULATIONS FOR ULGE ENGINES.			
SKB1.5U6D2RA		1335 cc	



RECORD NUMBERS HERE

MODEL NUMBER:
SERIAL NUMBER:

FIGURE 1-1. TYPICAL NAMEPLATE

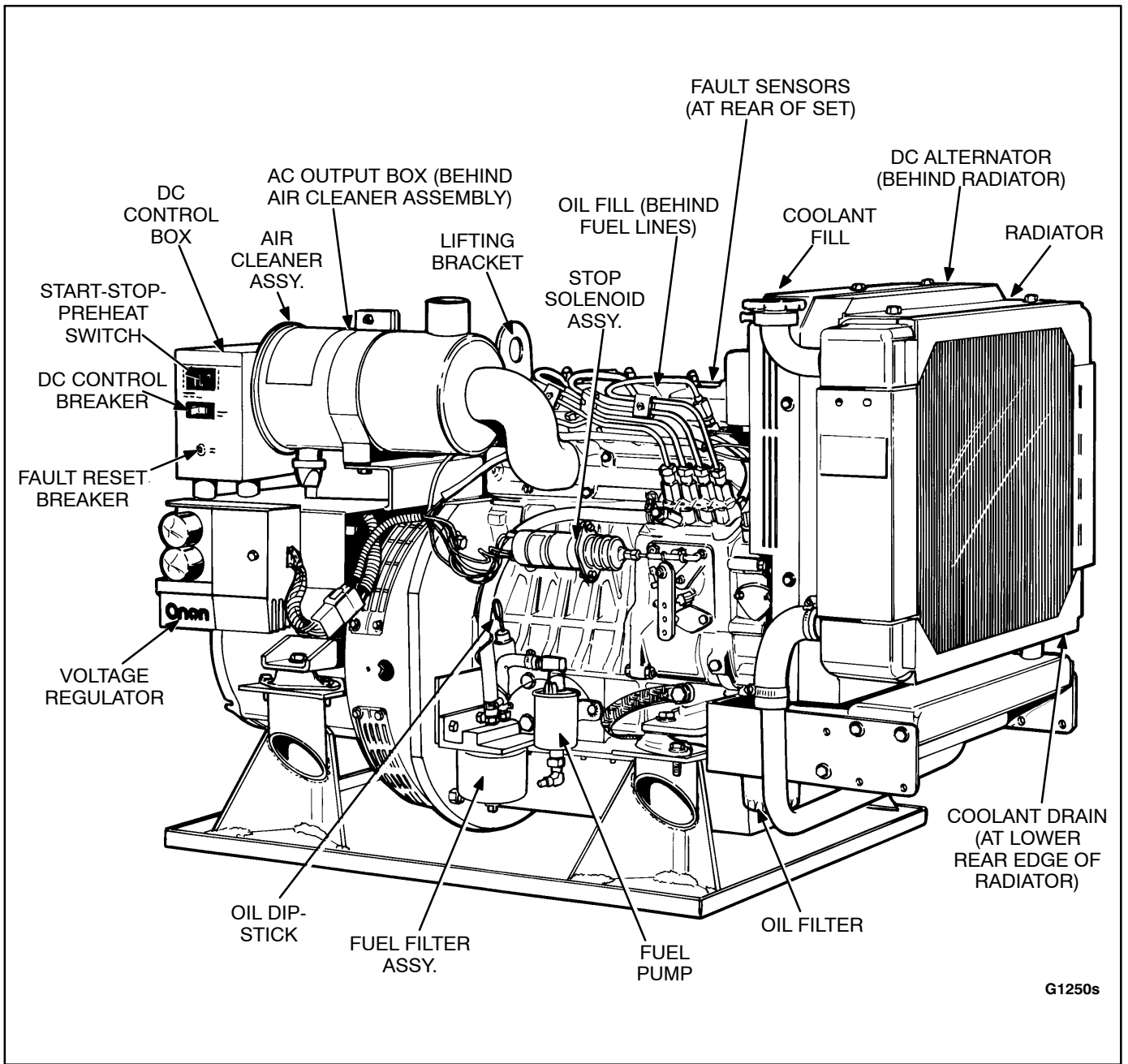


FIGURE 2. TYPICAL GENERATOR SET

MANUFACTURING FACILITIES

Eje 120 No. 201, Zona Industrial, San Luis Potosí,
C.P. 78395, San Luis Potosí, México.

Phone +52 444 870 6700
Fax +52 444 824 0082

Control Panel

This section describes the features of the standard control panel. The set controls and breakers are located on the front of the DC control box. The line circuit breaker is located on the side of the AC control box. See Figure 3.

Controls and Breakers

Start-Stop-Preheat Switch: Starts and stops the generator set. Operates the engine cylinder preheaters.

DC Control Breaker: A 15 ampere DC breaker that protects the control box and remote wiring from

short circuits or overload. Also serves as an emergency stop switch.

Fault Reset Breaker: A manual reset breaker that shuts down the engine for:

- Low oil pressure
- High coolant temperature
- Overspeed

Line Circuit Breaker: A circuit breaker that protects the set from a short circuit or other overload. It is mounted on the side of the AC control box. The single phase generator set uses a dual 45-amp breaker. The three-phase set uses a three-pole 35-amp breaker.

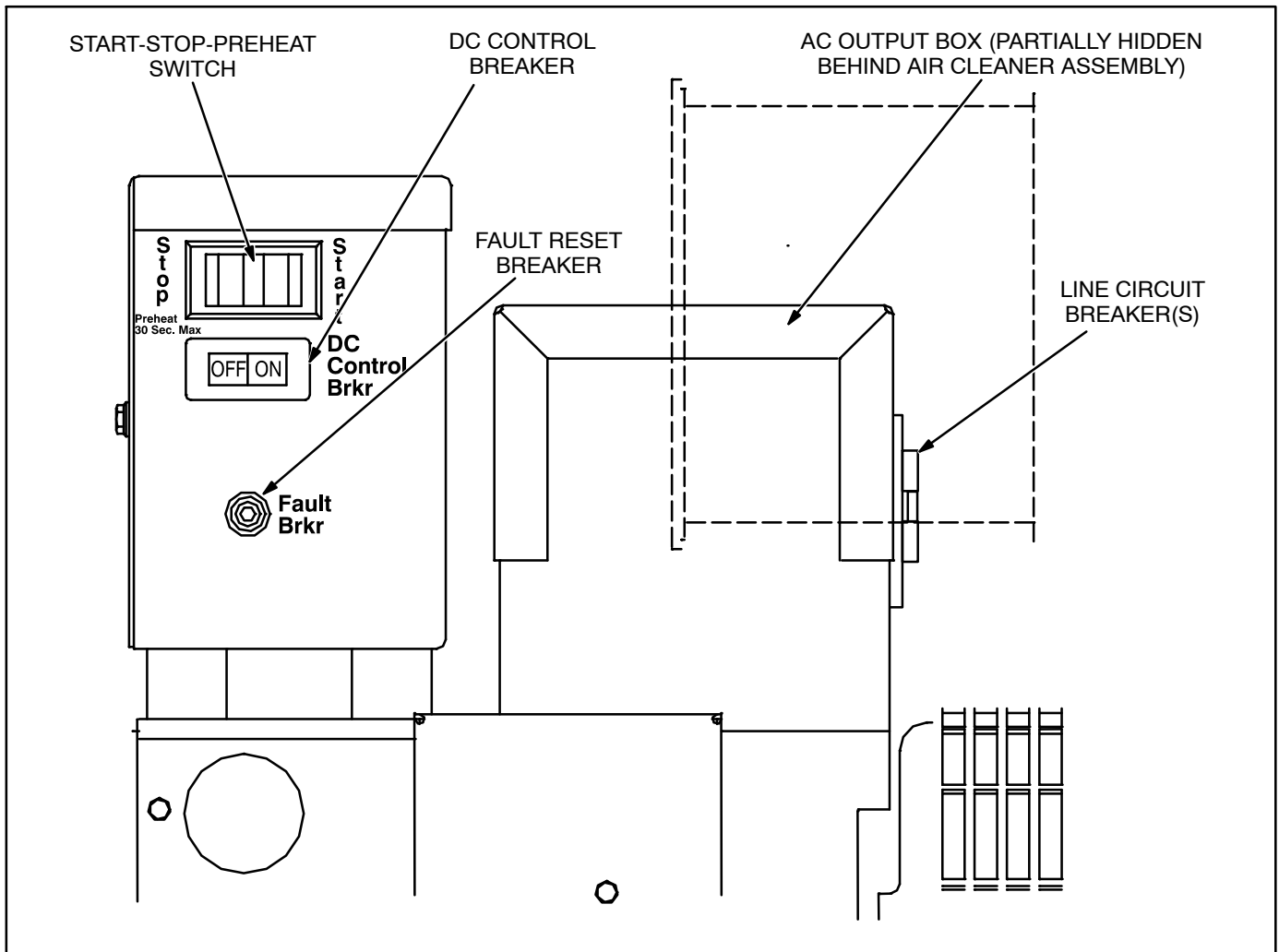


FIGURE 3. GENERATOR SET CONTROLS AND BREAKERS

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EXHAUST CHECK

Thoroughly inspect the exhaust system for leaks or corrosion. Have any problems repaired before operating the generator set.

⚠️WARNING *Exhaust gas presents the hazard of severe personal injury or death. Make certain that all exhaust components are operational and that there are no exhaust leaks.*

Do not start the set if exhaust gases will not effectively expel away from the vehicle. Be aware that any vent, window or opening that is not permanently sealed from the vehicle living space can be an avenue for carbon monoxide.

⚠️WARNING *Exhaust gases can cause severe personal injury or death. Never operate the generator set unless the exhaust outlet is clear of walls, snow banks, or any obstructions that can prevent exhaust gases from dissipating. Never operate any exhaust fan in the vehicle when the generator set is running: an exhaust fan can draw exhaust gas into the vehicle.*

FUEL CHECK

Carefully inspect the fuel system for leaks or corrosion. Have any problems repaired immediately.

⚠️WARNING *Fuel presents the hazard of fire or explosion which can cause severe personal injury or death. Do not permit any flame, spark, pilot light, cigarette, or other ignition source near the fuel system.*

Use the best fuel available. Fuel quality is important for dependable performance and satisfactory engine life.

⚠️WARNING *Ignition of fuel can cause serious personal injury or death by fire or explosion. Do not permit any flame, cigarette, pilot light, spark or other igniter near the fuel system.*

Fuel Recommendation

⚠️WARNING *Diesel fuel is combustible and can cause severe personal injury or death. Do not smoke near fuel tanks or fuel-burning equipment or in areas sharing ventilation with such equipment. Keep flames, sparks, pilot flames, electrical arcs and switches and all other sources of ignition well away. Keep a type ABC fire extinguisher handy.*

Use clean, fresh No. 2 diesel fuel (ASTM 2-D) when the outdoor ambient temperature is above freezing, and No. 1 diesel fuel (ASTM 1-D) when below freezing. The fuel should have a Cetane number of at least 45 for reliable starting.

Note: Low sulfur diesel and Ultra Low Sulfur Diesel (ULSD) fuel that meets the ASTM D975 or EN 590 standard for lubricity must be used with this engine. The 1 to 2 percent less energy content of the fuel can have a slight effect on maximum engine power.

Note: B5 Bio-Diesel fuel that meets industry specifications and quality is suitable for use with this engine.

GENERAL INSPECTION

Check the generator set for damaged or loose parts. Make sure the air inlet and outlet areas are not blocked. Investigate any abnormal operating noises. Make sure that the generator set is securely mounted in its compartment or under-floor housing.

Check to see that the vehicle is not parked in high grass or brush.

⚠️WARNING *Do not operate the generator set when the vehicle is parked in high grass or brush. Engine exhaust could ignite the grass, and the resulting fire could cause severe personal injury or death, and/or property damage.*

Starting and Stopping

⚠️WARNING EXHAUST GAS IS DEADLY!

All engine exhaust contains carbon monoxide, an odorless, colorless, poisonous gas that can cause unconsciousness and death. Symptoms of carbon monoxide poisoning include:

- Dizziness
- Headache
- Weakness and Sleepiness
- Nausea
- Vomiting
- Inability to Think Coherently

IF YOU EXPERIENCE ANY OF THESE SYMPTOMS, GET INTO FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the generator set and do not operate it until it has been inspected and repaired.

Never sleep in the vehicle while the generator set is running unless the vehicle has a working carbon monoxide detector. The exhaust system must be installed in accordance with the generator set Installation Manual. Make sure there is ample fresh air when operating the generator set in a confined area.

STARTING

Starting at Set

1. Press the Start/Stop/Preheat switch to **Stop/Preheat**. Hold for 10 to 30 seconds, depending on the temperature (see Table 2).

⚠️CAUTION Preheat time longer than 30 seconds may damage glow plugs.

TABLE 2. PREHEAT TIME VS. TEMPERATURE

Ambient Temperature	Preheat Time
Above 86° F (30° C)	10 seconds
BETWEEN 50° TO 86° F (10° TO 30° C)	15 seconds
BETWEEN 32° TO 50° F (0° TO 10° C)	20 seconds
Below 32° F (0° C)	30 seconds

2. Press the Start/Stop/Preheat switch to **Start**. Release the switch when the engine starts.
3. If the engine does not start after cranking 30 seconds, release the switch. Wait two minutes, then repeat Step 1 (preheat).

⚠️CAUTION Excessive cranking can overheat the starter, damaging it. Do not engage the starter longer than 30 seconds without allowing two minutes for cooling.

4. If the engine does not start on the second try:

- Check the fuel supply.
- Make sure the fuel system has been primed.

With an empty tank, the fuel system may need priming before the set can start. See *Fuel System* in the *Maintenance* Section.

Starting at Remote Panel

The same procedures and cautions for normal starting apply to remote starting.

Start-up Checks (Remote Panel)

Check the gauges on the control box after the engine starts. Check the oil pressure gauge immediately.

Oil Pressure Gauge: Oil pressure should be 40 to 60 psi (276 to 414 kPa) when the engine is at operating temperature.

DC Voltmeter: Battery voltage during operation should be 14 to 15 volts, depending on the state of battery charge.

Water Temperature Gauge: Water temperature should be 165° to 195° F (74° to 91° C) depending on load and ambient temperature.

STOPPING

Before Stopping

Run the generator set at no load three to five minutes before stopping. This lets the lubricating oil and engine coolant carry heat away from the combustion chamber and bearings.

⚠ CAUTION *Failure to allow running time for engine cooling without load can cause engine damage. Make sure the generator set runs unloaded at least three minutes.*

To Stop: Press the Start/Stop/Preheat switch to **Stop**. Failure to hold the stop button down long

enough may allow the generator set to slow, but begin running again, if AC voltage to the control does not fall below the minimum operating level.

Wattage Requirements

AC WATTAGE CAPACITY

The AC power output from the generator will power appliances and other equipment. (The wattage requirement of appliances and electrical equipment may be referred to as “electrical load”.)

On the single-phase set, a 45-amp dual circuit breaker (two 45-amp circuits) mounted on the set protects the generator from an overloaded output, which occurs when too much load is applied at once. On the three-phase set, a three-pole 35-amp breaker is used.

Connecting a Load

To determine the maximum amount of electrical load that can be applied, follow these steps:

1. Determine the maximum load (wattage) supplied by the generator set/vehicle circuit, by multiplying the circuit breaker size by the AC output voltage:

$$2 \times 45 \text{ (amps)} \times 120 \text{ (volts)} = 10800 \text{ watts}$$

$$\text{or}$$

$$2 \times 22.5 \text{ (amps)} \times 240 \text{ (volts)} = 10800 \text{ watts}$$

2. Check the wattage requirement of each device to be connected (see Table 3). The appliance nameplate should list the wattage of each item.
3. Add the wattages of all the items to be powered at the same time. Make sure that the total wattage does not exceed the limit of the circuit breaker.

Example:

Air Conditioner	1800 watts
Converter	500 watts
Coffee Percolator	600 watts
Television	300 watts
Total	3200 watts

4. Start the generator set and let it warm up a few minutes before applying electrical load.

Make sure that each appliance and tool is properly grounded and in good working condition before using it.

⚠️WARNING *Electrical shock can cause severe personal injury or death. Appliances should be in good working condition and be properly grounded to provide additional protection from electrical shock.*

TABLE 3. APPROXIMATE POWER DRAW OF COMMON APPLIANCES

Appliance or Tool	Approximate Running Wattage
Air Conditioner	1400-2000
Battery Charger	Up to 800
Coffee Percolator	550-750
Converter	300-500
Electric Blanket	50-200
Electric Broom	200-500
Electric Drill	250-750
Electric Frying Pan or Wok	1000-1500
Electric Iron	500-1200
Electric Stove (Per Element)	350-1000
Electric Water Heater	1000-1500
Hair Dryer	800-1500
Microwave Oven	1000-1500
Radio	50-200
Refrigerator	600-1000
Space Heater	1000-1500
Television	200-600

Motorized Devices

Motorized devices consume more power during startup than they do when running at normal speed. (Some motors draw as much as three times their operating power during startup.) If you plan to use a motorized device, turn it on **before** starting other appliances. When the motor is running at normal speed, more devices may be added.

Circuit Breakers

Circuit breakers on the electrical distribution panel or on the generator set will open if their current ratings are exceeded. This may be caused either by running too many appliances at once, or by a short circuit.

The generator set will continue to run after a breaker trips. Turn off all loads, then reset the breaker. If it trips again, a short circuit is indicated. Turn off the set and contact a qualified technician for assistance.

If the breaker does not trip, turn on only as many devices as the breaker size allows (see Connecting A Load in this section). If the breaker trips again, a defective load or circuit breaker is indicated.

Connection to Utility Power

Connect the RV or commercial vehicle to utility power (power from an outside source such as a plug-in outlet) **only** through an approved device, to protect against the possibility of generator power and utility power being connected. Consult the Installation Manual for information on isolating the generator set from utility-supplied power.

⚠WARNING *Connecting the generator set directly to the public utility or any other power system can cause electrocution, damage to equipment, or fire. Hazardous voltages can flow from the generator set into the utility line. An approved switching device must be used to prevent interconnections.*

DC POWER

A 30-amp belt-driven alternator on the engine supplies DC power to recharge the starting battery for the set.

Operating Recommendations

BREAK-IN PROCEDURE

Drain the crankcase oil after the first 35 hours of operation. See the *Maintenance* section of this manual for the procedure.

NO-LOAD OPERATION

Hold no-load operation to a minimum. With no load, combustion chamber temperatures drop so low that fuel does not burn completely. This creates carbon deposits which clog injectors, glaze cylinders and cause piston rings and valves to stick. If it is necessary to run the engine for long periods, **connect an electrical load to the generator output.**

EXERCISE PERIOD

Infrequent use can result in difficult starting and moisture condensation problems. This moisture is a result of the engine not being run long enough to reach normal operating temperature. In extreme cases, water may be deposited in the oil. If this happens, severe engine damage can result. To prevent this possibility, run the generator set under load at least one hour per week.

Exercising for one long period each week is better than several shorter periods of operation. Do NOT operate the set for long periods at no load.

LOW TEMPERATURE/HIGH ALTITUDE OPERATION

1. Use the correct SAE oil rating for the current temperature conditions. Change the oil only when it is warm. See Table 1.
2. Use No. 1 diesel fuel for temperatures lower than 32° F (0° C) or for all temperatures if altitude is above 5000 feet (1500 m). The fuel should have a cetane rating of at least 45. Shorten the oil change interval by half if the sulfur content of the fuel is higher than 0.5%.

EXTREMELY DUSTY OR DIRTY CONDITIONS

If running the generator set in extremely dusty or dirty environments, do the following:

- Keep generator set and radiator cooling surfaces clean.
- Service the air cleaner more frequently (as necessary).
- Change crankcase oil every 50 operating hours.
- Clean the generator as necessary. See *Maintenance Procedures*.

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Maintenance Schedule

Following the maintenance schedule and using the generator set properly will result in longer generator set life, better performance, and safer operation. Perform each maintenance procedure at the time period indicated or after the number of operating hours indicated, whichever comes first. Refer to *Maintenance Procedures* for instructions.

NOTE: Many of these procedures are best performed by an authorized Cummins service center. If you are at all in doubt about your ability to perform generator set maintenance, have the Cummins service center

nearest you perform these tasks.

Consult a Cummins service center if the generator set will be subjected to extremely hot or dusty conditions; a more frequent maintenance schedule may be necessary. Log all service and maintenance for warranty support (see *Maintenance Record*).

⚠️WARNING *Accidental starting of the generator set during maintenance can cause severe personal injury or death. Disconnect both generator set starting battery cables, before performing maintenance. Remove the negative (-) cable first to reduce the risk of arcing.*

TABLE 4. PERIODIC MAINTENANCE SCHEDULE

SERVICE THESE ITEMS	SERVICE TIME				
	Daily or after 8 hours	Weekly or after 50 hours	Monthly or after 100 hours	6 Months or after 250 hours	Yearly or after 500 hours
Inspect set	x ¹				
Check oil level	x				
Check coolant level	x				
Check fuel level	x				
Check air cleaner dust cap (clean if required)		x ³	x		
Check battery charging system			x		
Check drive belt tension			x ⁴		
Check battery specific gravity			x		
Change crankcase oil and filter			x ²		
Drain water/sediment from fuel filter			x		
Check anti-freeze				x	
Clean generator assembly				x	
Drain sediment from fuel tank				x ⁵	
Clean crankcase breather				x ³	
Check fuel shut-off linkage				x	
Change fuel filter element				x ⁷	
Check generator set brushes				x ⁶	
Change air cleaner element					x ³
Clean cooling system					x

- 1 - Check for oil, fuel, cooling and exhaust system leaks. Check exhaust system audibly and visually with generator set running and repair any leaks immediately.
- 2 - Perform after first 35 hours of operation on new generator set.
- 3 - Perform more often in extremely dusty conditions.
- 4 - Visually check belts for evidence of slippage.
- 5 - Drain one cup of fuel to remove water and sediment.
- 6 - To be performed by authorized service technician.
- 7 - Perform every 250 hours when using B20 Bio-diesel fuel.

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Maintenance Procedures

GENERATOR SET INSPECTION

Inspect the generator set daily or after every eight hours of operation, whichever comes first. Check the exhaust, fuel, and DC electrical systems as described below. Also check the mechanical condition of the set.

Engine Gauges (Remote Installation)

Check these gauges while the set is running.

Oil Pressure Gauge: Oil pressure should be 40 to 60 psi (276 to 414 kPa) when the engine is at operating temperature.

Coolant Temperature Gauge: Coolant temperature should be 165° to 195° F (74° to 91° C), depending on load and ambient temperature.

DC Voltmeter: Battery voltage during operation should be 14 to 15 volts.

Exhaust System

With the set running, inspect the entire exhaust system including the exhaust manifold, exhaust elbow, muffler and exhaust pipe. Visually and audibly check for leaks at all connections, welds, gaskets, and joints. If any leaks are detected, **shut down the generator set and do not operate until corrected.** Replace corroded exhaust components before leaks occur.

⚠️WARNING *Inhalation of exhaust gases can result in severe personal injury or death. Inspect exhaust system audibly and visually for leaks daily. Repair all leaks immediately.*

Fuel System

With the set running, inspect the fuel supply lines, return lines, filters, and fittings for leaks. Check flexible sections for cuts, cracks and abrasions. See that the fuel lines do not rub against anything that could break them. Replace worn fuel line components before leaks occur.

⚠️WARNING *Fuel leakage will create a fire hazard which can result in severe personal injury or death if ignited. While checking for leaks, do not smoke or allow any spark, flame, pilot light or other ignition source in the area. If any leaks are detected, have them corrected immediately.*

DC Electrical System

With the generator set off, check the battery terminals for clean and tight connections. Loose or corroded connections create resistance which can impede starting. Clean and reconnect loose battery cables. Always disconnect the negative (-) battery cable first and connect it last, to reduce the possibility of arcing.

⚠️WARNING *Ignition of explosive battery gases can cause severe personal injury. Do not smoke. Wear goggles, protective rubber gloves and apron when servicing batteries.*

Mechanical

Check for any signs of mechanical damage. Start the set and listen for any unusual noises that may indicate mechanical problems. Have any problems corrected immediately.

Check the mounting fasteners to make sure the set is secure in its compartment. If an under-floor housing is used, make sure that the set is secured to the housing. Check the condition of the housing components and make sure they are secure to the vehicle.

Make sure that the generator set air inlet and outlet areas are not blocked with debris.

Clean the generator set whenever dust and dirt begin to accumulate. Dust and dirt can usually be removed with a damp cloth. Steam cleaning may be needed to remove road contaminants. Do not clean the generator set while the engine is running. Protect the generator, air cleaner, control panel, and electrical connections from cleaning solvents. Cleaning solvents can damage electrical connectors.

OIL AND FILTER CHANGE

The engine oil was drained from the crankcase before shipment. **Before the initial start, fill the lubrication system with the recommended oil.** See *Specifications* for oil capacity.

Change the oil and filter at the intervals listed in Table 4. Use oil that meets the API classification and

SAE viscosity grade indicated in the previous section.

Engine Oil Change

Run the engine until thoroughly warm. Stop the engine, open the drain valve (Figure 5) and drain the oil into a container. When completely drained, close the valve and refill the crankcase with new oil.

⚠WARNING *Hot crankcase oil can cause burns if it is spilled or splashed on skin. Keep fingers and hands clear when removing the oil drain plug and wear protective clothing.*

⚠WARNING *State and federal agencies have determined that prolonged contact with used engine oil can cause cancer or reproductive toxicity. When adding, changing or working with used oil, take care not to breathe, ingest or come into excessive contact with these substances. Wash hands after use. Wear protective clothing and equipment. Provide adequate ventilation.*

Oil Filter Change

Spin off the oil filter and discard it. Thoroughly clean

the filter mounting surface. Apply a thin film of oil to the filter gasket, and spin the filter on until the gasket just touches the mounting pad. Then turn an additional 3/4 turn. Do not over-tighten the filter.

With oil in the crankcase, start the set and check for leakage around the filter gasket. Tighten the filter only enough to eliminate leaks.

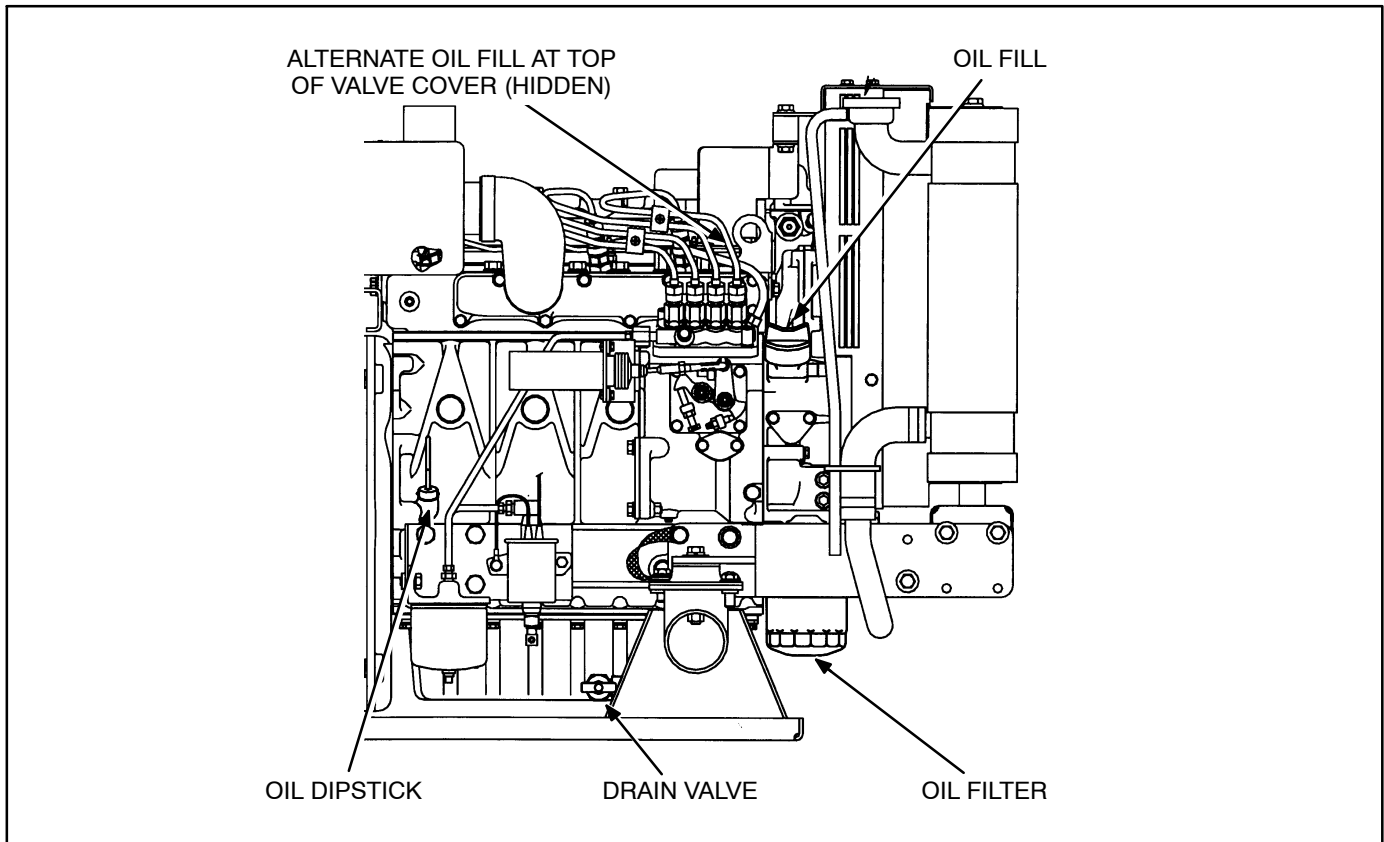


FIGURE 5. ENGINE OIL

COOLING SYSTEM

The cooling system is drained before the set is shipped. **It must be refilled before the generator**

set is operated. Cooling system capacity is listed in *Specifications*.

Coolant Requirements

Engine coolant must inhibit corrosion and protect against freezing. A 50/50 mixture of ethylene glycol anti-freeze and water is recommended for normal operation and storage. Use only a reliable brand of anti-freeze that contains a rust and corrosion inhibitor. **The anti-freeze should not contain a stop-leak additive.**

Do not exceed a 50/50 mixture of ethylene glycol and water. A higher proportion of ethylene glycol will alter the heat transfer properties of the coolant. A 50/50 mixture will provide freeze protection to -34° F (-37° C).

Water used for engine coolant should be clean, low in minerals, and free of corrosive chemicals. Use distilled or soft water if available. Avoid the use of well water, which may contain minerals that can clog the heat exchanger core and reduce cooling efficiency.

Filling the Cooling System

Verify that all drain cocks are closed and all hose clamps are secure. Remove the cooling system pressure cap and slowly fill the cooling system with the coolant mixture.

⚠ CAUTION *Exceeding the recommended fill rate can cause incomplete filling of the engine block, leading to engine damage during warm-up. Always follow the recommended fill procedure.*

Add coolant to the recovery tank (or separate expansion tank if equipped) to the full-cold level.

Start the engine, then remove the pressure cap and monitor the coolant level. As trapped air is expelled from the system, the coolant level will drop. Add coolant to replace it. Replace the pressure cap when the coolant level is stable.

Coolant Level

Check the coolant level at the intervals specified in the Periodic Maintenance Schedule. Check by observing the coolant level in the recovery tank (or separate expansion tank if equipped) when the system is cold. See Figure 6 for a typical cooling system. Engine coolant is at the proper level when the recovery tank level is between FULL and LOW marks.

⚠ WARNING *Coolant in a warm engine is under pressure and can flash to steam causing severe burns if the radiator cap or drain cock are opened. Let the engine cool down before opening the radiator cap or drain cock.*

⚠ CAUTION *The high engine temperature cutoff will shut down the engine in an overheat condition only if the coolant level is sufficiently high to physically contact the shutdown switch. Loss of coolant will allow engine to overheat without protection of shutdown device, thereby causing severe damage to the engine. It is therefore imperative that adequate engine coolant levels be maintained for operational integrity of the cooling system and engine coolant overheat shutdown protection.*

Flushing and Cleaning

Once a year, drain, flush and refill the cooling system with new coolant. To drain the system, open the radiator coolant drain and the cylinder block drain on the the rear (non-service access) side of engine. See Figure 6.

⚠ WARNING *Contact with hot coolant can cause severe burns. Do not bleed hot, pressurized coolant from a closed cooling system.*

Chemical Cleaning: Rust and scale slow heat absorption and can block coolant flow. Clean the cooling system if rust and scale have collected on the engine water jacket or in the heat exchanger. Use a good cleaning compound and follow its instructions.

Flushing: After cleaning, or before filling the system with new coolant, drain the system and fill with clean water. Run the generator set for 10 minutes, then drain the system completely. Refill with the coolant mixture.

⚠ CAUTION *Never pour hot water into a cold engine or cold water into a hot engine. Doing so can crack the head or the cylinder block. Do not operate the unit without water for even a few minutes.*

Thermostat

If the engine overheats or does not reach and maintain a minimum operating temperature, have the thermostat removed and tested. Replace the thermostat with the gasket if necessary. See the Service Manual for instructions.

Pressure Cap

Closed cooling systems use a pressure cap to increase the boiling point of the coolant and allow

higher operating temperatures. Replace the pressure cap every two years, or sooner if it malfunc-

tions.

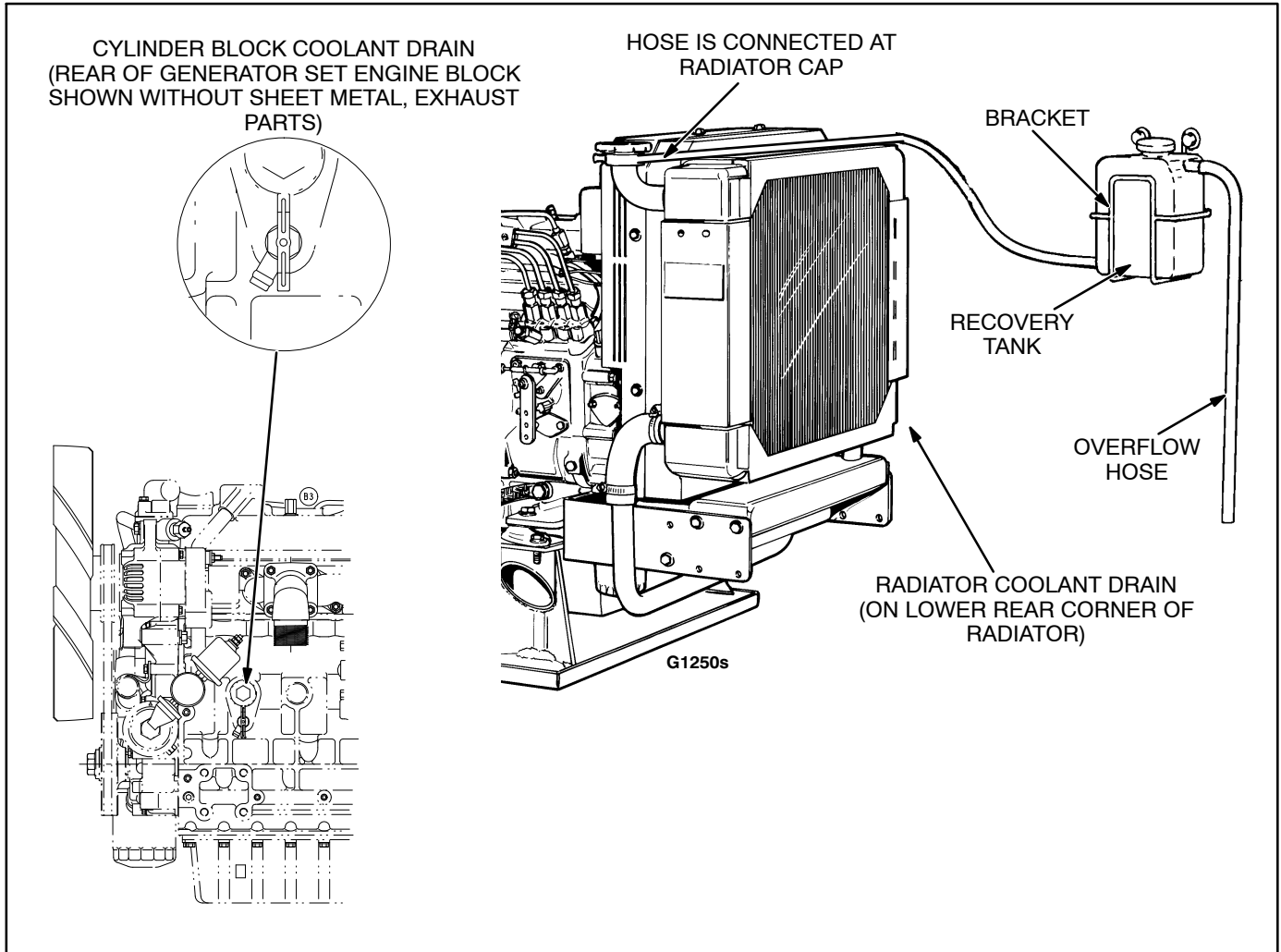


FIGURE 6. COOLING SYSTEM COMPONENTS

FAN BELT

A loose fan belt can cause the engine to overheat. The belt tension must be correct for the set to run well.

First, remove the generator set's starting battery cables (negative [-] cable first).

⚠️ WARNING *Accidental starting of the set can cause severe personal injury or death. Stop the generator set and disable it by disconnecting the starting battery cables (negative [-] cable first) when maintaining or repairing the engine, controls, or generator.*

To reach the fan belt, remove the belt guard from the front of the set. **Do not operate the generator set without the belt guard in place.**

To adjust the belt, loosen the bolt that passes through the long slot in the alternator mounting bracket and slide the alternator until the tension is right. See Figure 7.

Belt tension is correct when a finger pressure of 22 pounds (10 kg) at the middle of the belt deflects it about 0.4 inch (10 mm).

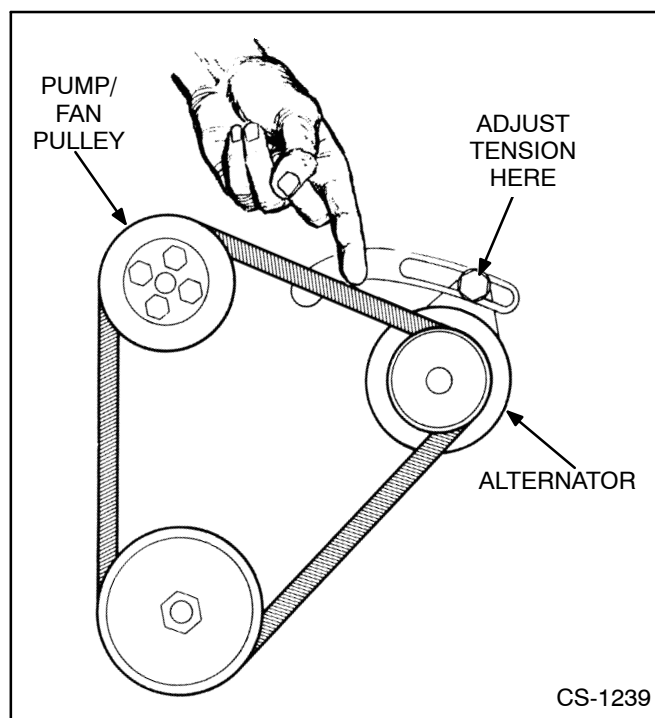


FIGURE 7. FAN BELT ADJUSTMENT

FUEL SYSTEM

⚠ WARNING *Ignition of fuel can cause serious personal injury or death by fire or explosion. Do not permit any flame, cigarette, pilot light, spark or other igniter near the fuel system.*

Fuel Recommendation

Use ASTM 2-D (No. 2 Diesel) or ASTM 1-D (No. 1 Diesel) fuel with a minimum Cetane number of 45. Number 2 diesel fuel gives the best economy and performance under most conditions. Use number 1 diesel fuel when ambient temperatures are below 32° F (0° C), and during long periods of light engine load.

Use low sulfur content fuel which has a cloud point at least 10 degrees below the lowest expected fuel temperature. (Cloud point is the temperature at which wax crystals begin to form in diesel fuel.)

Fuel Handling Precautions

Prevent dirt, water or other contaminants from entering the fuel system. Filter or strain the fuel as the tank is filled.

⚠ CAUTION *Due to the precise tolerances of diesel injection systems, dirt or water in the system will cause severe damage to both the injection pump and the injection nozzles. It is extremely important the fuel be kept clean and water free.*

Condensation (water) can cause clogging of fuel filters as well as freezing problems. Water mixing with the sulfur in the fuel forms acid which can corrode and damage engine parts.

Low fuel in the tank promotes condensation. In warm weather, the fuel tank cools at night quicker than the fuel. If the fuel level is low, the upper portion of the tank will cool more rapidly, forming condensation. In cold weather, the warm fuel returning from the injectors heats the fuel in the supply tank. If the fuel is low, condensation may form on the upper part of the tank. **To avoid condensation, fill the fuel tank every time the generator set is used.**

Low Pressure Fuel System

The electric fuel pump, fuel filter and injection pump inlet comprise the low pressure fuel system. See Figure 8. These components are normally primed (purged of trapped air) at set installation. Be sure to check the fuel level in the tank and that the shutoff valve is open.

NOTE: Priming the fuel system and replacing the fuel filter are procedures that are best performed by a Cummins service technician. If you are at all in doubt about these procedures, consult an authorized Cummins service center.

Fuel Filter

The wrong fuel or dirty fuel will shorten the life of the fuel filter. See *Maintenance Schedule* for the filter change interval.

⚠ CAUTION *Dirt or water in the system will cause severe damage to both the injection pump and the injection nozzles. It is extremely important that the fuel be kept clean and free of water.*

If the engine shows signs of fuel starvation (reduced power or surging), the fuel filter should be changed. This involves bleeding the fuel system of trapped air.

Bleeding the system means loosening the fittings of the low-pressure fuel lines one by one, and cranking the electric fuel pump to drive out trapped air. **This procedure must be done by a Cummins service center or a professional diesel technician.**

High Pressure Fuel System: The injection pump, fuel injection lines and fuel injectors are the high pressure fuel system. See Figure 8. The high-pressure system is self-priming; trapped air is forced out through the injection nozzles.

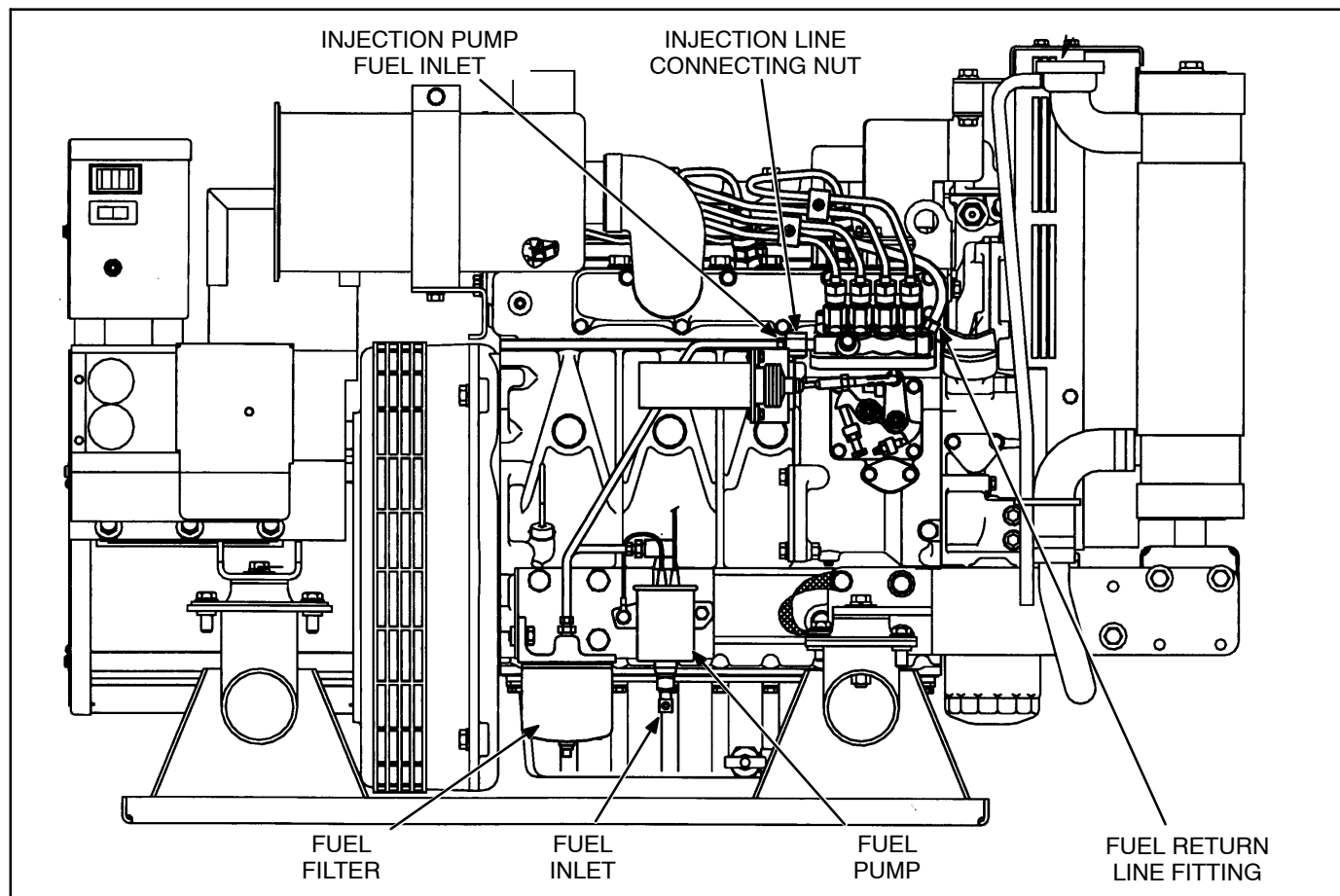


FIGURE 8. FUEL SYSTEM

BIO-DIESEL FUELS B5 – B20

B5 bio-diesel fuel that meets industry specifications and quality is suitable for use with this generator set.

Bio-Diesel Above B5 and up to B20 Bio-Diesel Blends

The following must be verified before using bio-diesel blends up to B20:

- The generator set is at Spec H or higher.
- The vehicle propulsion engine is capable of using B20 when sharing the same fuel tank.
- The OEM has installed B20 compatible fuel line from fuel tank to generator set.
- The OEM has installed a water separator in the fuel line just before the generator set.

Approved Bio-Diesel Fuel:

- For bio-diesel blends above B5 and up to B20, Cummins requires that the fuel meet the specifications outlined in ASTM D7467. The bio-diesel component of this fuel blend must meet ASTM D6751 or EN14214 and the petroleum-diesel component must meet ASTM D975.
- Blended bio-diesels fuels should be bought pre-blended and not made by customers.

Bio-Diesel Properties:

- Bio-diesel has poor oxidation stability which can accelerate fuel oxidation. Fuel oxidation will reduce generator performance. This effect is accelerated at increased ambient temperatures.
- Bio-diesel properties change at low ambient temperatures (below 23°F/-5°C). Necessary precautions must be taken when operating the generator with bio-diesel blends in low ambient temperatures, such as a fuel heater, hose insulation, or additional anti-gel fuel additives.

- Bio-diesel fuel blends are an excellent medium for microbial growth. Microbes cause fuel system corrosion and premature filter plugging. The effectiveness of all commercially available conventional anti-microbial additives, when used in bio-diesel, is not known. Consult your fuel and additive supplier for assistance.

⚠WARNING It is highly recommended that specific market applications are avoided or exercised with extra care due to some of the properties of bio-diesel fuel blends such as cold weather operation, long term storage, material incompatibilities and other effects on engine operating characteristics. Such applications that should use standard fuels include applications that will experience seasonal usage, storage for periods exceeding 90 days, and extreme temperatures or humidity.

Storage Requirements:

- If using bio-diesel for seasonal applications (stored more than 90 days), the generator must be purged before storage by running the engine on pure diesel fuel meeting ASTM D975 for a minimum of 30 minutes.

Warranty Coverage:

Cummins Warranty covers failures that are a direct result of defects in material or factory workmanship. Generator damage, service issues and/or performance issues determined by Cummins to be caused by bio-diesel fuel blends not meeting the specifications outlined in the applicable Installation, Operator, and Service Manuals are not considered to be defects in material or workmanship and may affect your generator's warranty.

AIR CLEANER

The air cleaner element is a dry type and should never have oil applied to it. Avoid touching the element except when cleaning it. Instructions for cleaning the element are on a label attached to the element. Change the element yearly, or more often in extremely dusty conditions.

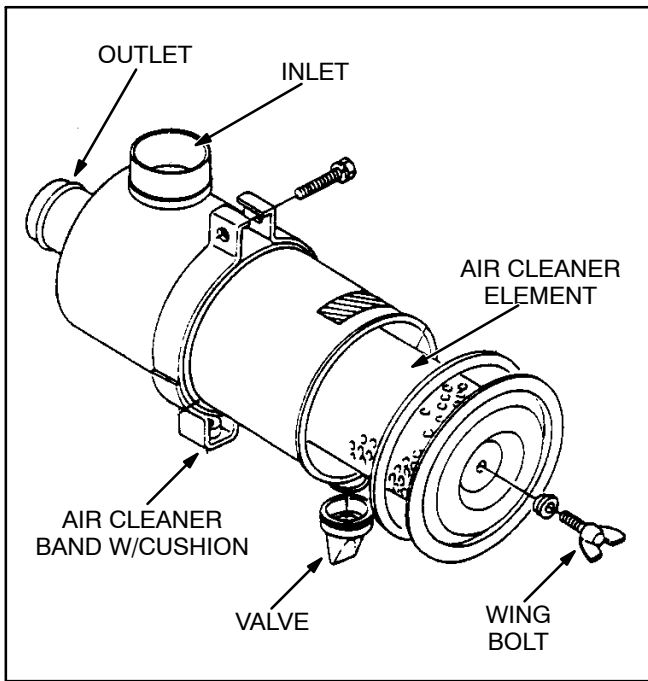


FIGURE 9. AIR CLEANER ASSEMBLY

BATTERY CARE

Service the battery at the intervals shown in the maintenance schedule. Check the electrolyte level more frequently during hot weather.

⚠WARNING Batteries present the hazard of explosion that can result in severe personal injury. Do not smoke or allow any fire, flame, spark, pilot light, arc-producing equipment or other ignition sources around the battery area. Do not disconnect battery cables while the generator set is cranking or running because explosive battery gases could be ignited.

⚠WARNING Battery electrolyte can cause severe eye damage and burns to the skin. Wear goggles, rubber gloves and a protective apron when working with batteries.

1. Keep the battery case clean and dry.
2. Make certain that the battery cable connections are clean and tight. Use a terminal puller tool to remove the battery cables.

Remove corrosion from the battery terminal connections. Wash the terminals with an ammonia solution or a solution consisting of 1/4 pound (about 100 grams) of baking soda in 1 quart (about 1 liter) of water. Be sure the vent plugs are tight to prevent cleaning solution from

entering the cells. After cleaning, flush the outside of the battery and the surrounding areas with clean water.

3. Identify the cable as positive (+) or negative (-) before making the battery connections. Always connect the negative (-) cable last, to reduce the risk of arcing.
4. Maintain the electrolyte level by adding distilled water. Fill each cell to the split-level marker in the battery. The water component of the electrolyte evaporates, but the sulfuric acid component remains. For this reason, add water, not electrolyte to the battery.
5. Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell (Figure 10). Charge the battery if the specific gravity measures less than 1.215. Do not overcharge the battery. Stop charging the battery when the electrolyte specific gravity reaches 1.260, at approximately 80° F (27° C).

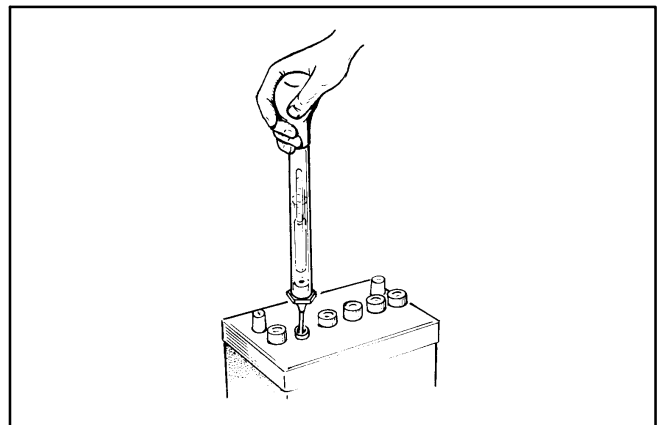


FIGURE 10. BATTERY CHECK

CRANKCASE BREATHER

Clean the crankcase breather element at the scheduled intervals, using the following procedure (see Figure 11).

1. Remove the cap nuts and gaskets from the top of the valve cover. Carefully remove the cover. Avoid damaging the gasket.
2. From inside the cover, remove two machine screws securing the breather element, plates and shield.
3. Clean the element in a suitable solvent. Dry the element, then saturate with engine oil before replacing.

⚠️WARNING Many cleaning solvents present a hazard of severe personal injury or death. Follow the manufacturer's instructions and proceed with care.

4. If necessary, clean other breather components in solvent before reassembling.

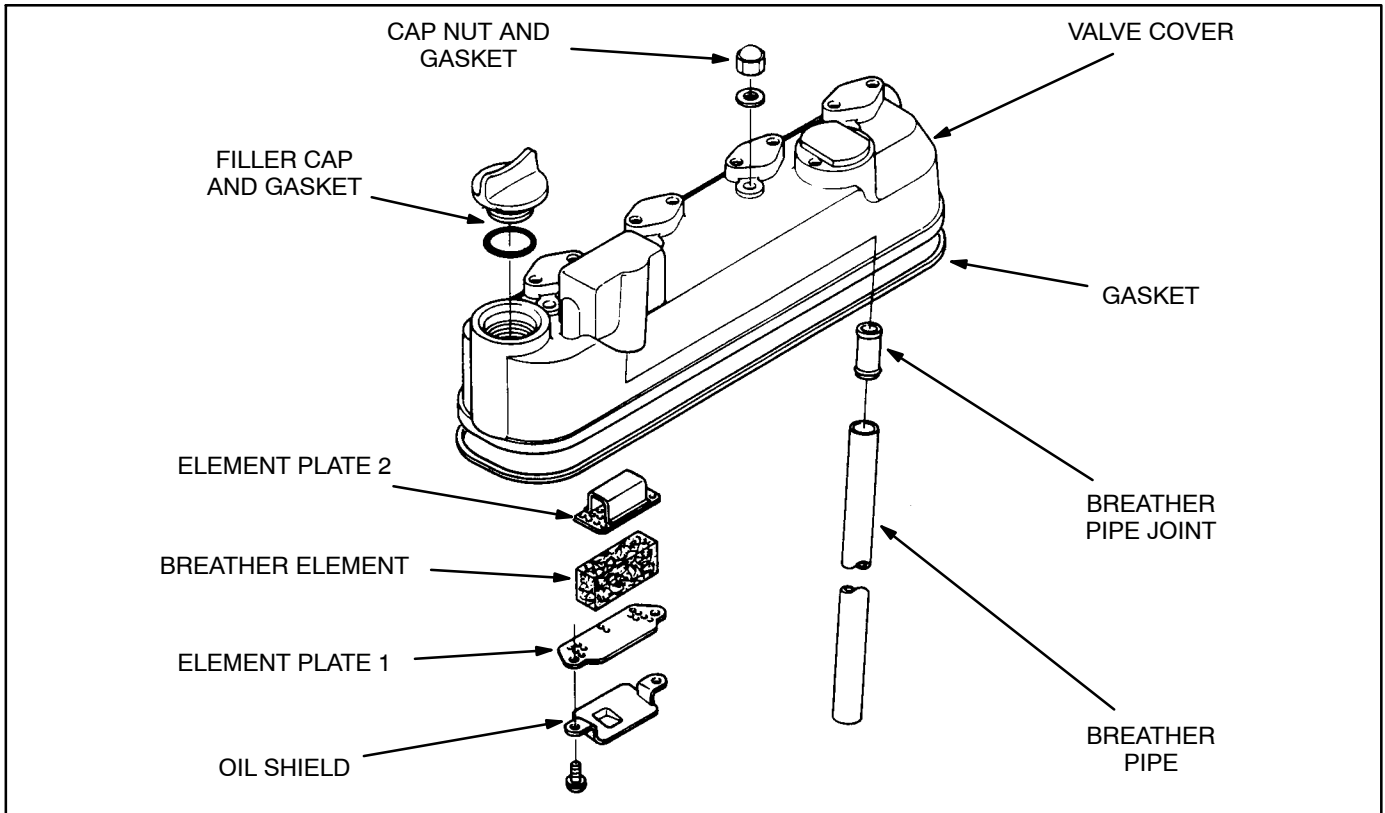


FIGURE 11. CRANKCASE BREATHER

AC GENERATOR

Generator Brushes

The generator should be inspected for brush wear and cleaning as required per the Periodic Maintenance Schedule. This procedure should be performed by an authorized Cummins service technician.

⚠️WARNING Accidental starting of the generator set can cause severe personal injury or death. Stop the generator set and disable by disconnecting the starting battery cables (negative [-] cable first) before inspecting the generator.

Generator Bearing

Inspect the bearing for evidence of outer case rotation every 1000 hours of use. The bearing should be replaced every five years because the bearing grease gradually deteriorates due to oxidation. See

the Service Manual for the bearing replacement procedure. If the generator requires major repair or service, contact an authorized Cummins dealer or distributor.

CLEANING THE GENERATOR SET

Clean the generator set at least once every six months. Dust usually can be removed with a damp cloth. Some road contaminants may require steam cleaning. Do not steam clean the generator set while the engine is running. When cleaning, protect the area so spray is not directed into the generator, air cleaner, control box, fuel solenoid, or electrical connections. Do not clean with solvents; they can damage electrical connectors.

MUFFLER/SPARK ARRESTER

It may be necessary to clean out the spark arrester if the generator set is experiencing low power. Park the vehicle away from grass, brush or debris that

could be ignited by sparks expelled during this procedure. The spark arrester meets U.S. Forest Service requirements.

To clean the spark arrester, remove the 1/8 inch pipe plug from the bottom of the muffler. Run the generator set with a full load for five minutes. Stop the generator set and allow the muffler to cool. Replace the pipe plug in the muffler. See Figure 12.

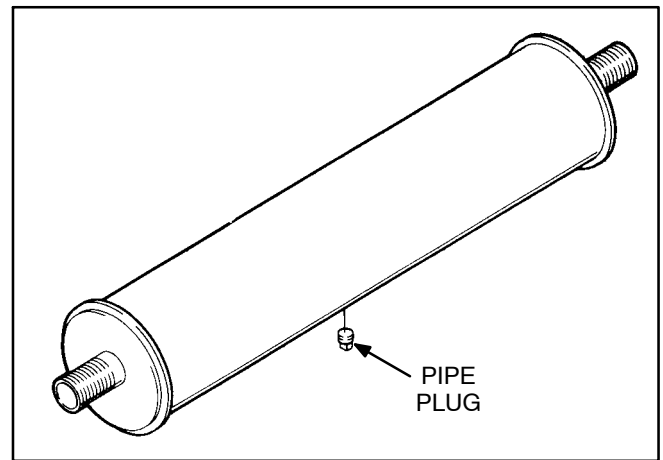


FIGURE 12. EXHAUST MUFFLER

Generator Set Storage

OUT-OF-SERVICE PROTECTION

The lubricating qualities of No. 2 diesel fuel should protect the cylinders of a diesel engine at least 30 days when the set is not being run. For storage longer than 30 days, proceed as follows:

1. Exercise the generator set (see *Operating Recommendations*) until the engine is at operating temperature.
2. Shut down the generator set and disconnect the battery cables (negative [-] cable first). Store the battery in a cool, dry place and connect to a trickle charger once every 30 days to maintain full charge.

⚠WARNING *Battery electrolyte can cause severe eye damage and burns to the skin. Wear goggles, rubber gloves and a protective apron when working with batteries.*

3. Drain the crankcase oil while still warm. Replace the oil filter. Refill the crankcase and attach a tag indicating oil viscosity.
4. Check the coolant level. Add more coolant if low. If freezing temperatures are possible, test the coolant mixture.
5. Plug the exhaust outlet to prevent entrance of moisture, bugs, dirt, etc.
6. Clean and wipe the entire generator set. Lightly coat parts that may rust with grease or oil.

Returning the generator set to Service

See *Maintenance Procedures* for specific maintenance procedures.

1. Remove the plug from the exhaust outlet.
2. Check the tag on oil base and verify that oil viscosity is still correct for existing ambient temperatures.
3. Clean and check the battery. Measure the electrolyte specific gravity with a hydrometer (1.260 @ 80° F [27° C]) and verify the proper level. If the specific gravity is low, charge the battery until the value is correct. If the level is low, add distilled water and charge until the specific gravity reading is correct. DO NOT OVERCHARGE.

⚠WARNING *Battery electrolyte can cause severe eye damage and burns to the skin. Wear goggles, rubber gloves and a protective apron when working with batteries.*

4. Prime the fuel system.
5. Connect the starting battery, negative (-) cable last.
6. Remove all loads before starting the generator set.
7. After starting, apply load of at least 50 percent rated capacity.
8. Check all gauges for normal readings. generator set is ready for operation.

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Troubleshooting

AC CONTROL

The AC control consists of the line circuit breakers connected between the generator output and the load. On the single-phase generator set, two 45-amp breakers are mounted on the side of the AC control box on the set. The three-phase generator set uses a three-pole 35-amp breaker.

If the breaker trips, the electrical load is too great for the generator set. This may be caused either by running too many appliances at once, or by a short circuit.

Consult *Wattage Requirements* to determine the wattage needed by typical appliances.

DC CONTROL

The DC control has a number of sensors that continuously monitor the engine for abnormal conditions such as low oil pressure and high coolant temperature. If any one of these conditions occur, the control stops the engine. See Figure 13. If a major problem is indicated, contact a Cummins dealer or distributor for help or service.

Fault Reset Breaker

The control panel fault reset breaker will trip for any one of the fault conditions described separately below. The white breaker reset button pops out about 1/4 inch (6mm) when a fault occurs. Locate the problem and make the necessary corrections be-

fore resetting breaker and starting the generator set. All fault shutdowns except overspeed are delayed 5 seconds to avoid nuisance tripping.

Low Oil Pressure

Remove dipstick and check oil level. If low, add oil to bring level up to the Full mark. Inspect engine exterior for leaks and repair as necessary. The oil pressure switch actuates the fault circuit if pressure drops below 9 psi (62 kPa).

⚠WARNING *Crankcase pressure can blow out hot oil and cause SEVERE burns. Do NOT check oil while the generator set is operating.*

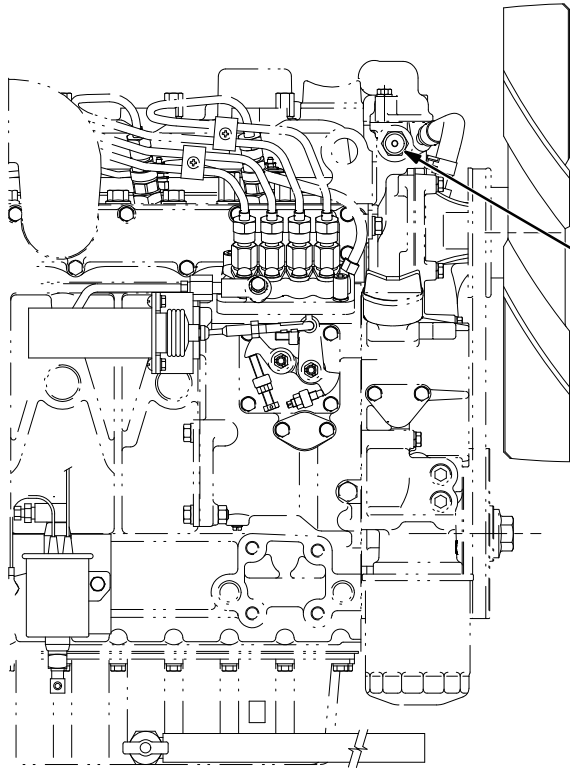
High Coolant Temperature

If fault occurred during operation, observe Coolant Temperature Gauge (option) for indication of temperature over 230° F (110° C). The coolant thermostat switch closes at this temperature and actuates the fault circuit.

Check coolant level in radiator after allowing engine to cool down. See that the pump belt is OK and has proper tension. Also check cooling system cleanliness (freedom from contaminants, rust, sludge buildup, etc.).

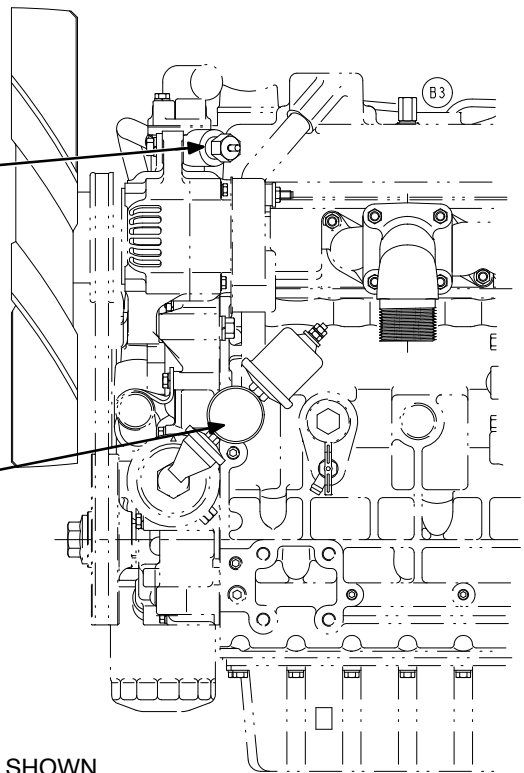
⚠WARNING *Contact with hot coolant can result in SEVERE burns. Allow cooling system to cool before releasing pressure and removing radiator cap or release of hot coolant can result.*

SERVICE ACCESS SIDE (FRONT) OF GENERATOR SET

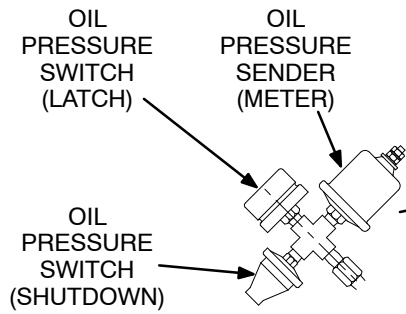


COOLANT
TEMPERATURE
SENDER
(METER)

REAR OF GENERATOR SET



COOLANT
TEMPERA-
TURE SWITCH
(SHUTDOWN)



NOTE: GUARDS, BRACKETS, SHEET METAL PARTS NOT SHOWN

FIGURE 13. OIL AND COOLANT SENSORS

Specifications

GENERATOR

Type	4-pole revolving field, brush-type, reconnectible
Standby ratings: 50 Hz	
Standard three-phase:	8.0 kW, three phase, 0.8 power factor 8.0 kW, single phase, 1.0 power factor
Standby ratings: 60 Hz	
Standard single-phase:	10.0 kW, single phase, 1.0 power factor
Standard three-phase:	10.0 kW, three phase, 0.8 power factor 6.7 kW, single phase, 1.0 power factor
Extended-stack three-phase:	10.0 kW, three phase, 0.8 power factor 10.0 kW, single phase, 1.0 power factor
Extended-stack three-phase (heavy-duty):	10.0 kW, three phase, 0.8 power factor 10.0 kW, single phase, 0.8 power factor
Frequency regulation under varying load:	
50 Hz	±5 percent
60 Hz	±5 percent
Voltage regulation under varying load:	3 Hz maximum
Random voltage variation:	±1 percent

ENGINE—KUBOTA V1505-E3BG

Engine type	Vertical, water-cooled, 4-cycle diesel
Number of cylinders	4
Bore and stroke	78 x 78.4 mm (3.07 x 3.09 inch)
Total displacement	1498 cm ³ (91.4 cubic inch)
Combustion chamber	Spherical type
Engine speed (50 Hz)	1500 rpm
Engine speed (60 Hz)	1800 rpm
Fuel	2-D Diesel (ASTM D975)
Fuel inlet	5/16 inch hose fitting
Fuel return	3/16 inch hose fitting
Maximum fuel pump lift (self-priming)	914.4 mm (36 inch) in 15 sec.
Maximum fuel consumption:	
Full load	3.78 L/h (1.0 gph)
Half load	2.12 L/h (.56 gph)
Exhaust outlet size, ID	1-1/4 inch NPT, male
Battery requirement	
Voltage	12
Cold cranking amps (0° F [-18° C])	425
Coolant capacity:	4.7 liters (5 quarts)
Lubricating oil capacity (with oil filter)	6.0 liters (6.34 quarts)

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Information for California Generator Set Users

These generator sets meet the requirements of California's Exhaust Emissions Standards for 1995 and later for Utility and Lawn and Garden Equipment Engines.

As a California user of these generator sets, please be aware that unauthorized modifications or replacement of fuel, exhaust, air intake, or speed control system components that affect engine emissions are prohibited. Unauthorized modification, removal or replacement of the generator set label is prohibited.

You should carefully review Operator (Owner), Installation and other manuals and information you receive with your generator set. If you are unsure that the installation, use, maintenance or service of your generator set is authorized, you should seek assistance from an authorized dealer.

California generator set users may use Table 5 as an aid in locating information related to the California Air Resources Board requirements for emissions control.

TABLE 5. EMISSIONS CONTROL INFORMATION

generator set Warranty Information	The California emissions control warranty statement is located in the same packet of information as this manual when the engine is shipped from the factory.
Engine Fuel Requirements	The engine is certified to operate on diesel fuel. See FUEL RECOMMENDATIONS in <i>Pre-Start Checks</i> .
Engine Lubricating Oil Requirements	See ENGINE OIL RECOMMENDATIONS in <i>Pre-Start Checks</i> .
Engine Adjustments	High Idle Speed. This is a service procedure requiring trained personnel and proper tools. See the Service Manual.
Engine Emission Control System	The engine emission control system consists of engine design and precision manufacture. (IFI)

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How to Obtain Service

When you need parts or service for your generator set contact the nearest authorized dealer or distributor. Cummins has factory-trained representatives to handle your needs for generator set parts and service. To locate the nearest authorized distributor:

1. Check the U.S. and Canada Sales and Service Directory (F-118) and the International Sales and Service Directory (IN-1013) supplied with your generator set. These directories list authorized distributors who will assist you in locating the nearest authorized dealer.
2. Call 1-800-Cummins™ (1-800-286-6467) for the name and telephone number of the nearest Cummins distributor in the United States or Canada. (This automated service utilizes touch-tone phones only). By calling this number you can also request a directory of authorized RV servicing dealers: RV Sales and Service Directory F-919.

To get service, contact the authorized dealer or distributor nearest you, explain the problem and make an appointment. If you have difficulty in arranging for service or resolving a problem, please contact the dealer coordinator or service manager at the nearest Cummins distributor for assistance.

Before calling for service, have the following information available:

1. *The complete generator set model number and serial number.*
2. *The date of purchase.*
3. *The nature of the problem.*

⚠️ WARNING *Improper service or replacement of parts can result in severe personal injury, death, and/or equipment damage. Service personnel must be qualified to perform electrical and/or mechanical service.*

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