

CAUTION

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

CAUTION

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

Fuel Filter

The fuel filter is paper and no attempt should be made to clean it. Its useful life will be determined largely by the quality and condition of the fuel used. Under normal conditions, the fuel filter element should be replaced for the first time after 50 hours or one month and then every 300 hours or six months. See Figure 1-7 for location and use the following procedure to service fuel filter.

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

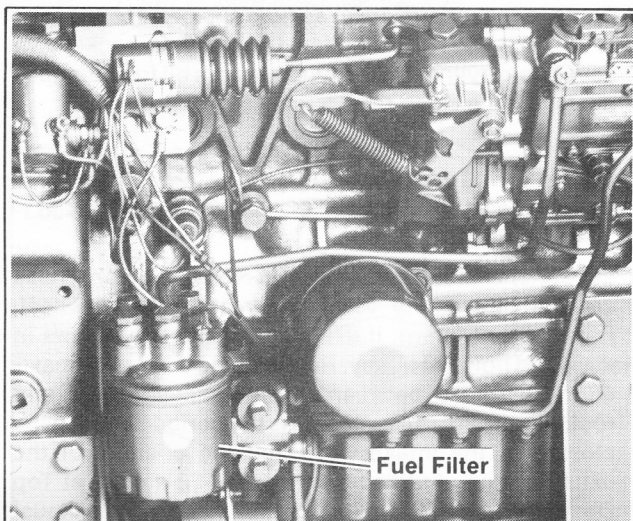


Figure 1-7. Fuel Filter Location

Bleeding

If the generator set engine runs out of fuel, if air leaks develop in the suction side of the fuel system, or if the fuel filter is replaced, it will be necessary to bleed the entire system to prevent starting failures and/or erratic operation. See Figure 1-8 and refer to the following procedure.

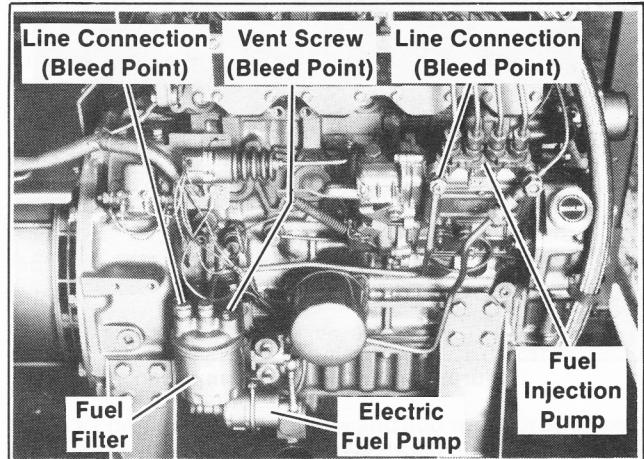


Figure 1-8. Bleeding Fuel System

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

⚠ WARNING

FIRE HAZARD! Spilled fuel may ignite on contact with hot engine parts. Wipe up all spilled fuel after bleeding system.

Air Cleaner Service

The paper element should be replaced at 300-hour/6-month intervals, change more frequently if operating under extremely dirty, dusty conditions. See Figure 1-9 and refer to the following procedure.

1. Loosen eye bolt and clamp enough to remove air cleaner cover.
2. Remove wing nut and slide air cleaner element from threaded rod.

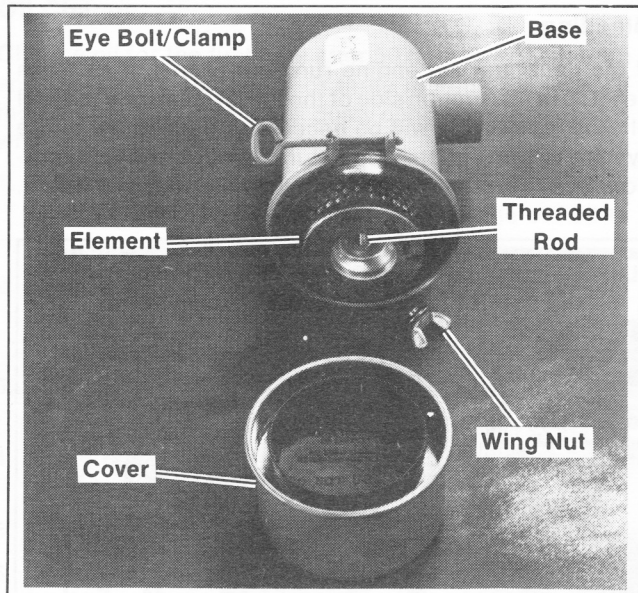


Figure 1-9. Air Cleaner Components

3. Clean dry element by tapping edges on a hard surface. Replace if damaged or very dirty.

NOTE

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

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

Governor

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

This set is designed to operate at 60-63 Hz, 1800 rpm under full load and 1890 rpm under no load. To check speed, use hand tachometer or frequency meter. Loosen locking nut on speed adjusting screw, turn screw in counterclockwise direction to increase speed (and frequency) or in clockwise direction to decrease speed. Tighten lock nut at new setting. See Figure 1-10.

NOTE

The governor spring is not used on later models.

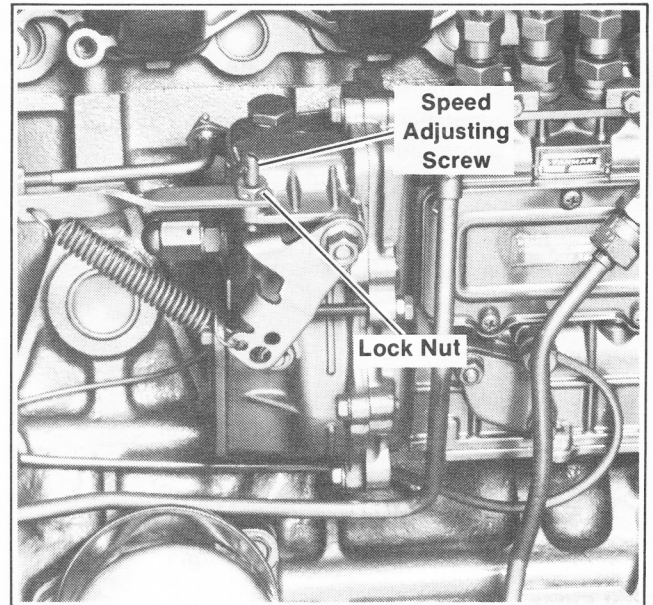


Figure 1-10. Governor

Valve Adjustment

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

NOTE

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

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

NOTE

Be careful not to damage gasket or mating surfaces.

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

WARNING

LOOSE COMPONENTS! When adjusting valves, do not use a ratchet wrench on crankshaft nut. Doing so can loosen nut and result in serious personal injury from nut or pulley flying off engine while unit is running.

3. Insert feeler gauge between rocker arm and exhaust valve. If necessary, loosen lock nut and move adjusting screw so that very slight drag is felt on the feeler gauge as it is withdrawn. Tighten lock nut on adjusting screw. See Figure 1-11. Repeat step for intake valve.
4. Repeat procedure for each additional cylinder to be checked and/or adjusted.
5. With mating surfaces clean and gasket properly aligned, install rocker arm cover and screws. Be careful that O-ring is properly seated in recessed hole.
6. Remove screws from pulley and replace belt guard, if used.

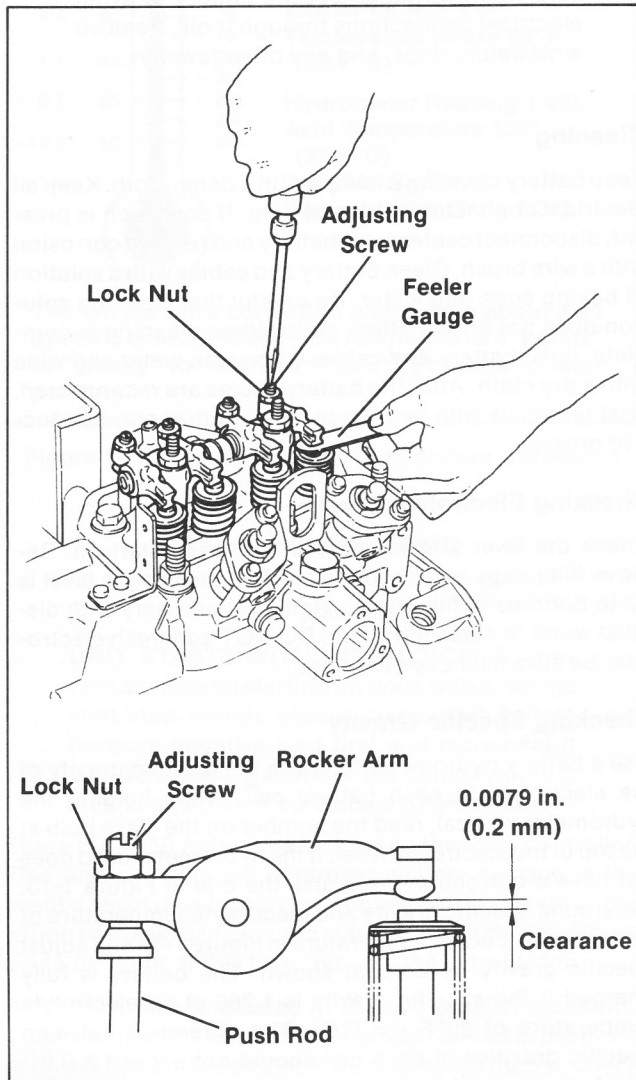


Figure 1-11. Valve Adjustment

Cooling System

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

Consult **coach manufacturer** for cooling system capacity. Coolant capacity of Kohler supplied radiator is 4 gal. (15.1L). A drain petcock is provided on the underside of the radiator and the engine block to drain the system. When draining the coolant, remove the radiator cap and open the block drain located near the flywheel housing; this will allow the entire system to drain and prevent air pockets from forming and restricting coolant passage in the block. When operating in climates subject to freezing temperatures, make sure a sufficient amount of antifreeze solution is added to prevent freeze-up of the system. Mixture proportions (ethylene glycol/water) are given in Table 1-2. For maximum protection, always use a solution which will remain liquid below the lowest anticipated temperature.

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

CAUTION

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

Temperature	16°F (-9°C)	3°F (-16°C)	-11°F (-24°C)	-31°F (-35°C) (Recommended)
Mixture Proportions (Ethylene Glycol/Water)	20/80	30/70	40/60	50/50

Table 1-2. Antifreeze Protection

Belt Tension

The belt tension should be adjusted so that it can be depressed about .38" (10 mm) with about 22 lbs. (10 kg) of force, see Figure 1-12. Use the following procedure to adjust belt.

1. Remove belt guard (if equipped).
2. Loosen pivot and adjusting screws.
3. While prying idler pulley outward, tighten adjusting screw.
4. Tighten pivot screw.
5. Recheck and adjust as necessary.
6. Replace belt guard (if equipped).

⚠ WARNING

MOVING PARTS! Do not open generator set compartment door when unit is running, except for servicing by qualified specialists. Keep hands, feet, and clothing away from belts and related pulleys when unit is running. Replace guards, covers, and screens (if used) before operating generator set.

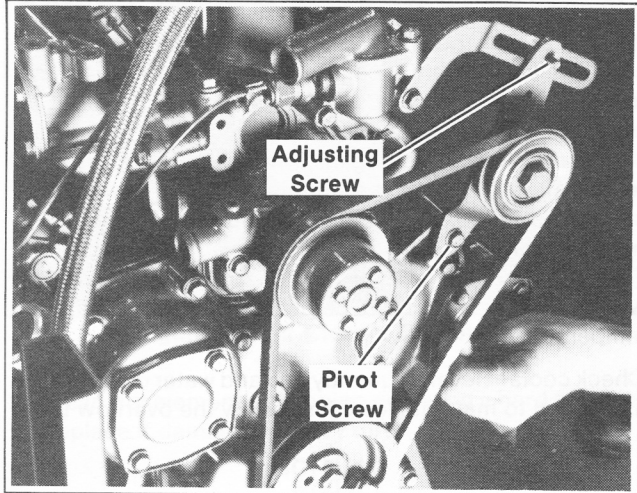


Figure 1-12. Belt Tension

Battery

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

NOTE

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

⚠ WARNING

DANGEROUS ACID! Avoid contact with battery electrolyte. It contains acid which can eat holes in clothing, burn skin, and cause permanent damage to eyes. 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 dangerous spattering of electrolyte.

⚠ WARNING

EXPLOSIVE BATTERY GASES! The gases generated by a battery being charged are highly explosive. 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. Any compartment containing batteries should be well ventilated to prevent accumulation of explosive gases. To avoid sparks, do not disturb charger connections while battery is being charged and always turn charger off before disconnecting.

⚠ WARNING

ELECTRICAL SHOCK! Battery can cause electrical burns and shocks. Exercise reasonable care when working near the battery to avoid electrical connections through tools. Remove wristwatch, rings, and any other jewelry.

Cleaning

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

Checking Electrolyte Level

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

Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell. While holding the hydrometer vertical, read the number on the glass bulb at the top of the electrolyte level. If the hydrometer used does not have a correction table, use the one in Figure 1-13. Determine specific gravity and electrolyte temperature of battery cells. Locate temperature in Figure 1-13 and adjust specific gravity by amount shown. The battery is fully charged if the specific gravity is 1.260 at an electrolyte temperature of 80° F (26.7° C). The difference between specific gravities of each cell should not exceed ± 0.01 . The battery should be charged if the specific gravity is below 1.215 at an electrolyte temperature of 80° F (26.7° C).

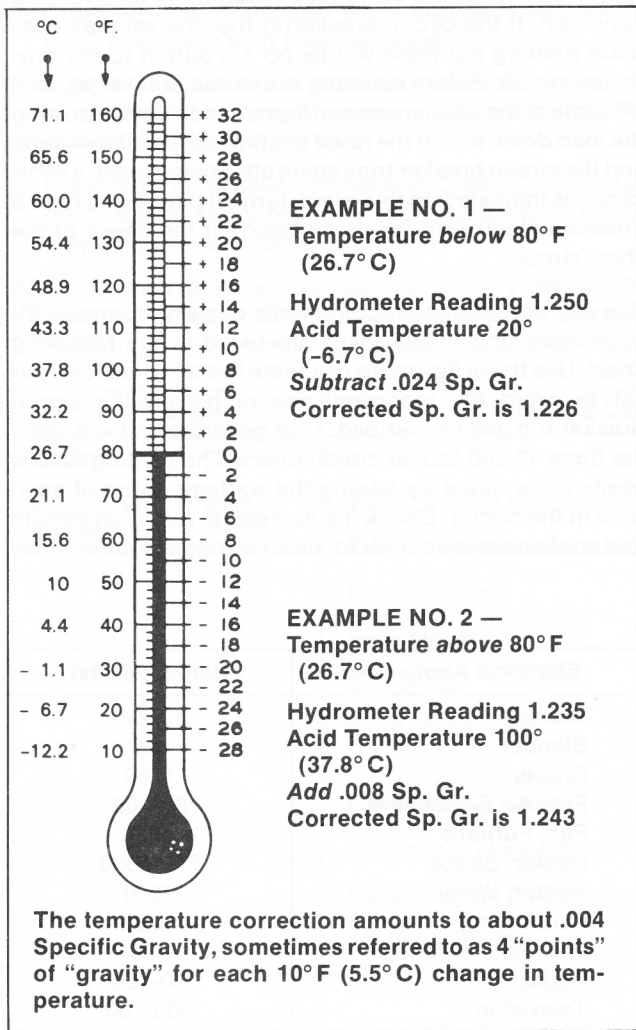


Figure 1-13. Specific Gravity Temperature Correction

Fuse Replacement



WARNING

UNIT STARTS WITHOUT NOTICE! To prevent accidental starting on units with a remote start/stop switch, always disconnect battery (remove negative lead first and reconnect it last) to disable generator set before working on any equipment connected to generator.

There is one 10 Amp. fuse located on the relay controller. This fuse protects the controller against damage in the event a short develops in the engine wiring system or the wiring harness to the remote start/stop switch. See Figure 1-14a or 1-14b. If this fuse "blows," the set will stop.

An 8 Amp. fuse is located in the end bracket assembly. This fuse protects the voltage regulator circuit in the event of an overload in the circuit. If there is no AC output, check the fuse; if blown, replace the fuse, then restart the generator set. If the fuse blows again, contact an Authorized Service Dealer.

NOTE

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

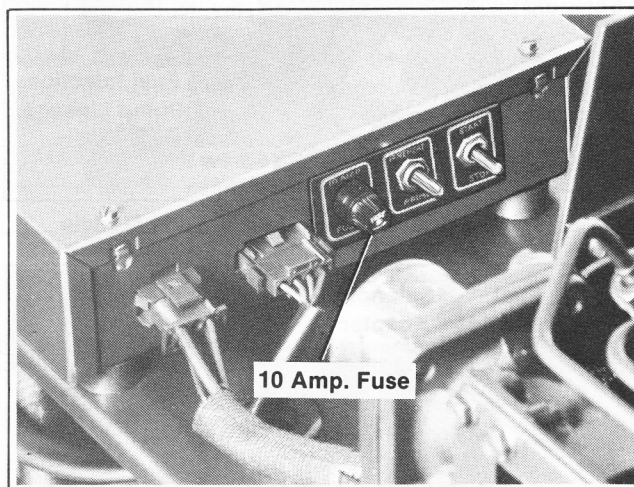


Figure 1-14a. Fuse Replacement — Early Models

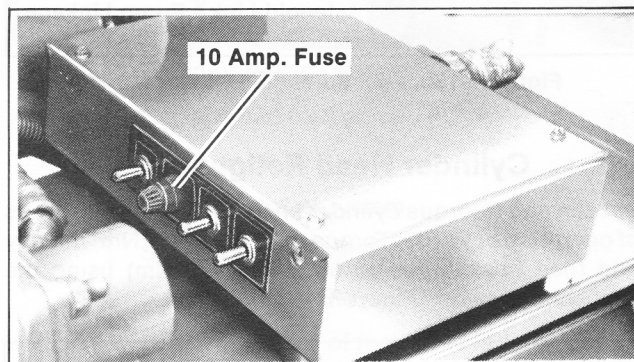


Figure 1-14b. Fuse Replacement — Later Models

Fuel Solenoid

The fuel solenoid serves to stop fuel flow through the fuel injection pump when the start/stop switch is placed in the stop position. If the fuel solenoid is removed or the setting is suspected to be incorrect, use the following procedure and see Figure 1-15a or 1-15b.

1. Loosen lock nut on fuel solenoid linkage (early models only).
2. With fuel solenoid mounted to engine block, compress plunger and adjust fuel solenoid linkage so that linkage connects to fuel control lever 1/16 in. (1.6 mm) before lever contacts internal full stop.
3. Attach cotter pin to fuel solenoid linkage.
4. Tighten fuel solenoid linkage lock nut against plunger body (early models only).

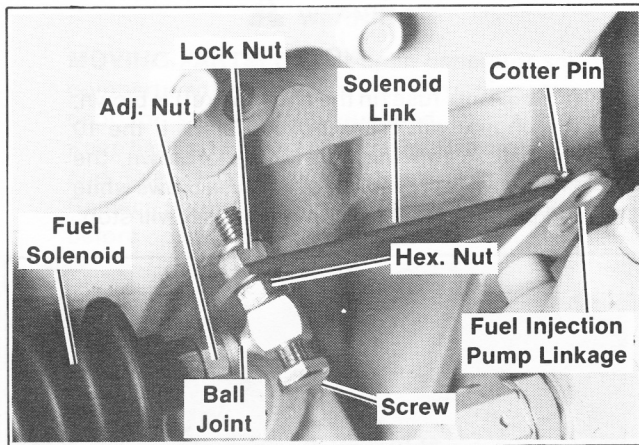


Figure 1-15a. Fuel Solenoid — Early Models

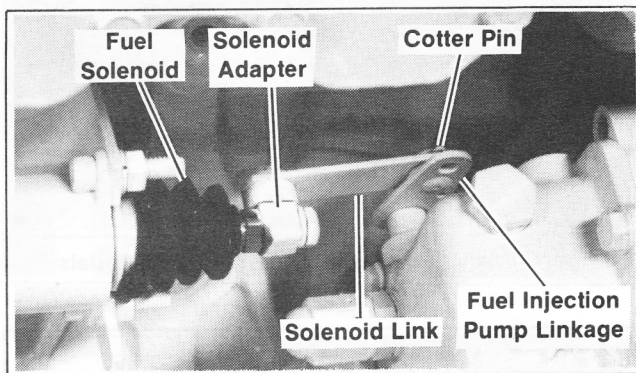


Figure 1-15b. Fuel Solenoid — Later Models

Cylinder Head Retightening

Loosen and retorque cylinder head bolts every 600 hours of operation or yearly. Torque to 29 ft. lbs. (39 Nm) initially and then final torque to 58 ft. lbs. (78 Nm) using the sequence shown in Figure 1-16.

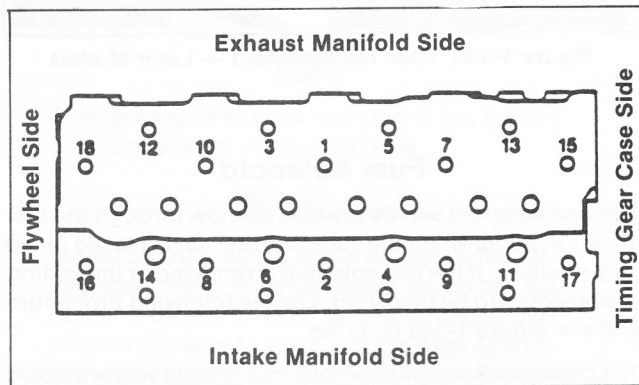


Figure 1-16. Cylinder Head Tightening Sequence

Wattage Requirements

Line circuit breakers should be used to prevent damage to the generator set should the rated capacity of the generator set be exceeded. This could be caused by a short in the

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

The average wattage requirements of some common RV appliances and motor loads are listed in the following chart. Use these figures to calculate the total load on your set to avoid the inconvenience of having the circuit breaker trip due to overload. Your generator set will operate three 13,500 Btu air conditioners. The lighting load is easily determined by adding the wattage rating of each bulb in the circuit. Check the nameplate rating on motors and appliances in your RV for exact wattage requirements.

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

Generator Service

Under normal conditions, generator service will not be required on a regular basis. If operating under extremely dusty and dirty conditions, use dry compressed air to blow dust out of the generator at frequent intervals. Do this with the generator set operating and direct the stream of air in through the cooling slots at the end of the generator. Because of the design of this Kohler generator, brush service should be practically non-existent. The brushes operate at very low amperage and should last indefinitely. Abrasive dust on the controller rings could, however, shorten the life of the brushes. If brush replacement becomes necessary, due to poor or no AC output, return set to a Kohler Generator Service Dealer to have this done.

Storage Procedure

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

1. Drain oil from crankcase while engine is still warm. Refill crankcase with specified weight oil.
2. If generator set has a separate fuel tank, drain fuel completely from tank, otherwise moisture from the fuel system will mix with the fuel.
3. Clean exterior of generator set and spread a light film of oil or silicon spray over any exposed surfaces which may be subject to rust or corrosion.
4. Disconnect and remove battery. Battery should be placed in a warm, dry location for period of storage. Recharge once a month to maintain full charge.

Troubleshooting

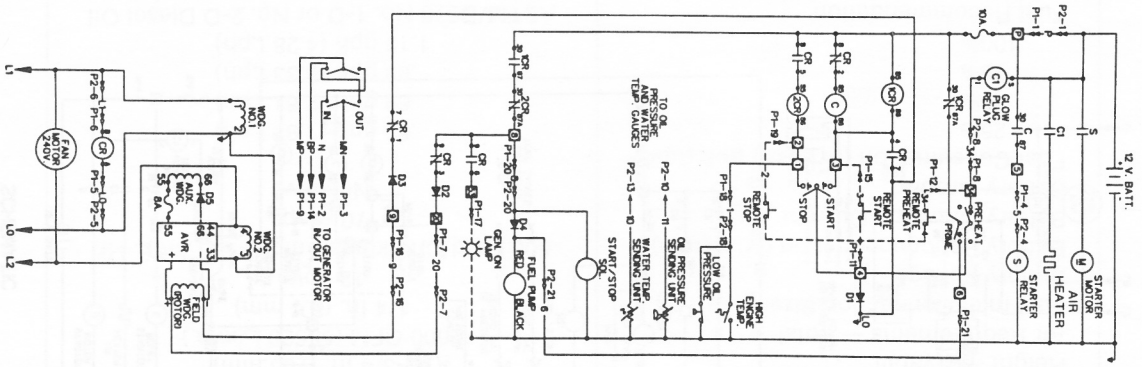
When troubles occur, don't overlook simple causes. A starting problem could be caused, for example, by improper fuel or an empty fuel tank. Make sure all electrical connections are secure. Remember the battery negative must have a good ground. The following charts list some common problems. If procedures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

Problem	Possible Cause	Corrective Action
Engine Engine hard to start or will not start	Weak or dead battery Battery connections made in reverse Faulty ground Fuse blown Out of fuel Fault shutdown Clogged fuel filter Air cleaner clogged Defective fuel feed pump Air in fuel system Water, dirt in fuel system Dirty or faulty injectors Improper compression Improper type of fuel Improper type of crankcase lube oil	Recharge or replace Check connections Clean and retighten Replace Replenish Check low oil pressure and high water temperature shutdown switches Replace filter element Clean or replace element Replace fuel feed pump Bleed air Drain, flush fuel system See Authorized Service Dealer See Authorized Service Dealer Use proper type of fuel; consult fuel supplier Use proper lube oil
Engine knocks	Improper type of fuel Incorrect fuel injection timing Improper cylinder top clearance Defective piston or piston ring Defective crankshaft bearing or piston pin bearing Improper valve clearance Air in injectors	Use proper type of fuel; consult fuel supplier Check injection timing See Authorized Service Dealer See Authorized Service Dealer See Authorized Service Dealer Adjust proper valve clearance Bleed air
Engine runs irregularly or stalls frequently	Vent in fuel tank cap obstructed Clogged fuel filter Water, dirt, or air in fuel system	Clean cap in solvent, blow dry Replace fuel filter element Drain, flush, fill, and bleed air in the system

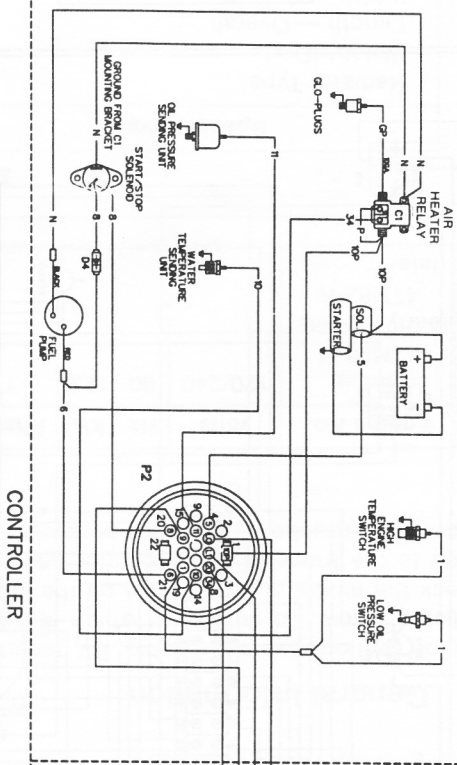
Problem	Possible Cause	Corrective Action
Engine runs irregularly or stalls frequently	Dirty or faulty injectors Faulty governor linkage Defective fuel feed pump Improper valve clearance Defective valve spring Improper compression	See Authorized Service Dealer See Authorized Service Dealer Replace fuel feed pump Adjust proper valve clearance Replace valve spring See Authorized Service Dealer
Lack of engine power	Engine overloaded Air intake restriction Clogged fuel filter Improper type of fuel Improper valve clearance Dirty or faulty injectors Incorrect fuel injection Improper engine compression Vent in fuel tank cover obstructed	Reduce load Service air cleaner Replace filler element Use proper fuel Adjust proper valve clearance See Authorized Service Dealer Check fuel injection timing See Authorized Service Dealer Clean cap in solvent; blow dry
Engine overheats	Engine overloaded Defective cooling system Loose or defective water pump V-belt Cooling system needs flushing Defective thermostat Defective high water temperature switch Cooling water leaks from water passages Radiator clogged with dirt or oil	Reduce load Check water pump Adjust belt tension or replace belt Flush cooling system Replace thermostat Replace switch Check water passages Clean with water soluble grease remover and flush cooling system
Engine emits black or gray exhaust smoke	Improper type of fuel Clogged or dirty air cleaner Defective injection pump Faulty injectors Incorrect fuel injection timing Improper valve clearance Lube oil level too high Improper/lube oil	Use proper fuel Service air cleaner element See Authorized Service Dealer See Authorized Service Dealer Check the injection timing Adjust valve clearance Drain out surplus Use proper viscosity oil
Low lube oil pressure	Low lube oil level Improper lube oil viscosity Defective lube oil pump Defective oil pressure switch	Add lube oil Drain, fill with proper viscosity oil See Authorized Service Dealer Replace switch
High lube oil consumption	Too light viscosity oil Oil leaks	Use proper viscosity oil Check for leaks in lines, around gasket, and drain plug

Problem	Possible Cause	Corrective Action
High lube oil consumption	Improper type of oil Clogged breather system Defective piston ring, piston cylinder liner, valve guide, or valve seat	Use oil of proper viscosity Clean breather system See Authorized Service Dealer
High fuel consumption	Improper type of fuel Clogged or dirty air cleaner element Engine overloaded Improper valve clearance Incorrect fuel injection timing Low engine temperature Improper compression Fuel leakage	Use proper fuel Service air cleaner element Reduce load Adjust valve clearance Check injection timing Check thermostat See Authorized Service Dealer Check for leaks at fuel tank, lines, and engine fuel system
Electrical System		
Battery will not charge	Loose or corroded connections Sulfated or worn-out battery Defective vehicle alternator Loose or defective vehicle alternator belt	Clean and tighten connection Check electrolyte level and specific gravity (batteries with filler caps only) Replace vehicle alternator Adjust belt tension or replace belt
Starter does not work properly	Loose or corroded connections Low battery output Defective starter solenoid Defective starter switch Defective wiring	Clean and tighten connection Check electrolyte level and specific gravity (batteries with filler caps only) Replace starter solenoid Replace starter switch Check wiring
Starter cranks slowly	Low battery output Too heavy viscosity lube oil Loose or corroded wiring High starter current draw	Check electrolyte level and specific gravity (batteries with filler caps only) Use proper viscosity oil Clean and tighten loose connections Rebuild or replace starter
Generator		
No AC output	AC circuit breaker(s) in OFF position No DC power to controller Fuse blown in end bracket Generator malfunction such as sticking brushes, broken brush leads, or other internal fault	Return to ON position Check battery connections Replace fuse See Authorized Service Dealer
Low output	Engine speed too low Set overloaded Engine in poor condition	Check governor operation Make sure set capacity is not being exceeded. See "Wattage Requirements." If routine services are performed and condition persists, see Authorized Service Dealer

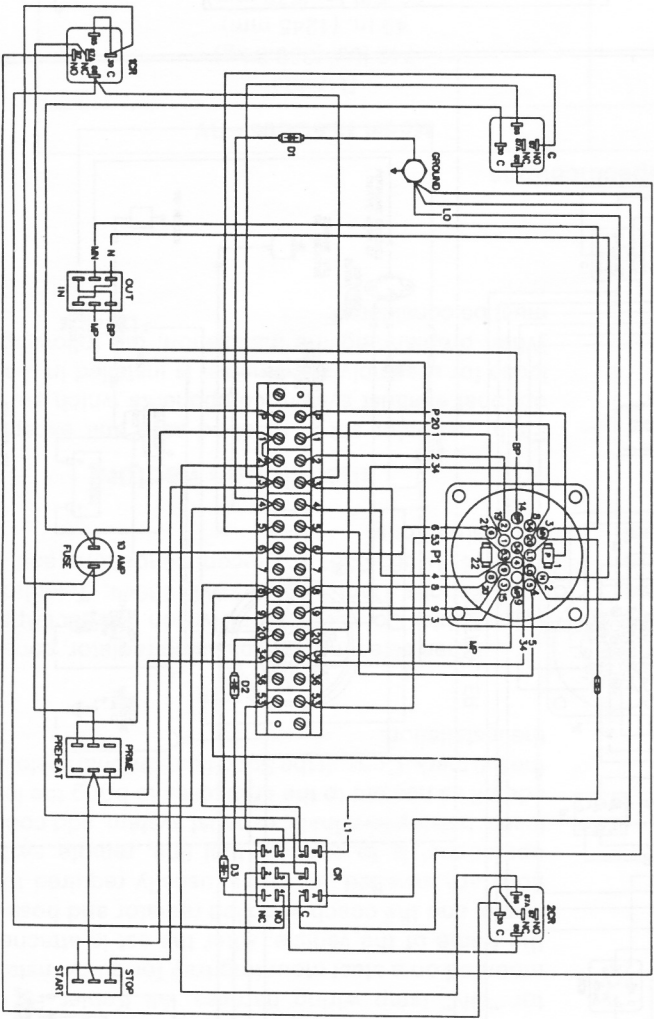
SCHEMATIC



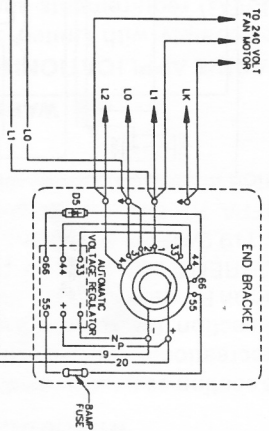
ENGINE



CONTROLLER



GENERATOR



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**Wiring Diagram—12.5 kW Tray Mounted Model
Remote Mounted Controller (without accessory plug P2)**