

Torque Specifications

MODELS	BF (Spec A-B)	BFA (Spec A-C)	BGA (Spec A-C)	NH (Spec J-P)
TORQUE SPECIFICATIONS FT-LBS/(N•m)	Use engine oil as a lubricant for all threads EXCEPT the spark plug and armature thru-stud threads.			
Cylinder Head (Cold)	16-18 (22-24 N•m)		17-19 (23-26 N•m)	
Connecting Rod	12-14 (16-19 N•m)		27-29 (37-39 N•m)	
Rear Bearing Plate	25-27 (34-37 N•m)		25-28 (34-38 N•m)	
Flywheel To Crankshaft	35-40 (47-54 N•m)			
Oil Base	18-23 (24-31 N•m)			
Oil Pump	7-9 (9-12 N•m)			
Gearcase Cover	8-10 (11-14 N•m)			
Spark Plug	15-20 (20-27 N•m)		15-20 (1) (20-27 N•m)	
Exhaust Manifold	9-11 (12-15 N•m)		20-23 (27-30 N•m)	
Intake Manifold	6-10 (8-14 N•m)		20-23 (27-30 N•m)	
Armature Thru-Stud Nut	45-50 (61-68 N•m)			
Generator Thru-Bolts	15-18 (20-24 N•m)			

(1) - Use 7-9 Ft-Lbs (9-12 N•m) with tapered plug seat.

Preparing To Service

TROUBLESHOOTING

Before starting to service the generator set, follow a systematic troubleshooting procedure to locate and isolate the problem. For servicing purposes, the generator set can be divided into the following:

- Engine - Primary Systems
- Control
- Generator
- Engine - Block Assembly

A separate section is contained in this manual that covers each area.

Several troubleshooting guides are included in this manual to help the serviceperson locate the cause of various malfunctions. It should be noted that some malfunctions might have several possible causes. For this reason, the serviceperson may have to investigate several likely problem areas in order to isolate the source of the malfunction. Because of the complexity of the product, a troubleshooting chart cannot list every malfunction and the cause. In some situations, the serviceperson will have to rely on experience and a knowledge of the product to locate the problem and service as required.

SPECIAL TOOLS

The following special tools may be needed depending on the service required. Some of these tools may be purchased from Onan while others may be purchased from outside suppliers. A complete listing of the tools available from Onan is contained in the Tool Catalog (900-0019) which is available from Onan Dealers or Distributors.

Engine Tools

Torque wrench (0-175 Ft-Lbs or 0-240 N•m)
Feeler gauge
Pressure gauge
Spark plug gap gauge
Carburetor adjustment wrench
Points adjustment tool
Flywheel puller
Snap ring pliers
Gear puller with puller ring
Cylinder ridge reamer
Combination main and cam bearing remover
Combination main and cam bearing driver
Oil seal loader and driver
Piston ring compressor
Piston ring spreader
Cylinder Hone

Valve seat cutter
Valve spring compressor
Valve lock replacer
Valve seat driver
Valve guide driver
Piston groove cleaner
Outside micrometer set (0 to 4 in.)
Telescoping gauge set (1/2 in. to 6 in.)
Hole gauge (0.300 in. to 0.400 in.)
Plasti-Gage bearing clearance guide

Generator And Control

Lead or dead-blow hammer
Battery hydrometer
VOM multi-tester
Megger (500 to 1,000 volts)
Armature growler
Load test panel
Jumper wires

SAFETY CONSIDERATIONS

Always consider the safety aspects of any service procedure. Generator sets present several hazards that the serviceperson must be aware of if the job is to be completed safely. Read through the safety precautions listed on the inside cover to familiarize yourself with the hazards that exist. Once the hazards are known, approach the job with a safety conscious attitude. Being safety conscious is the most effective way to avoid injury to yourself or others. Reduce the chance that an accident will occur by adopting the following safeguards.

- **Use Personal Protection-** When the situation calls for it, protect your body by wearing the appropriate safety equipment. Protective clothing includes such items as safety shoes, gloves, safety glasses, and hard hats. Leave rings and jewelry off and don't wear loose clothing that might get caught on equipment.
- **Work to Reduce The Hazard-** The workshop area and all pieces of equipment used can contribute to reducing the hazard potential. Keep guards and shields in place on machinery and maintain equipment in good working condition. Store flammable liquids in approved containers away from open flame. Keep the workshop clean and well-lighted, and provide adequate ventilation. Keep fire extinguishers and safety equipment nearby and be prepared to respond to an emergency.

- **Develop Safe Work Habits-** Unsafe actions are identified as the cause of most accidents involving the use of tools and machines. Be familiar with the equipment and know how to use it safely. Use the correct tool for the job and check its condition before starting. Observe the warnings and cautions in this manual and take special precautions when working around electrical equipment. Don't work alone if possible and don't take risks.

Be prepared if an accident does occur. Numerous agencies such as the Red Cross and your local police and fire departments offer basic courses in first aid, mouth-to-mouth resuscitation, and fire control. Take advantage of these offerings so you are ready to respond when an accident happens. Learn to be Safety-Conscious and make safe practices a part of your work routine.

SET REMOVAL

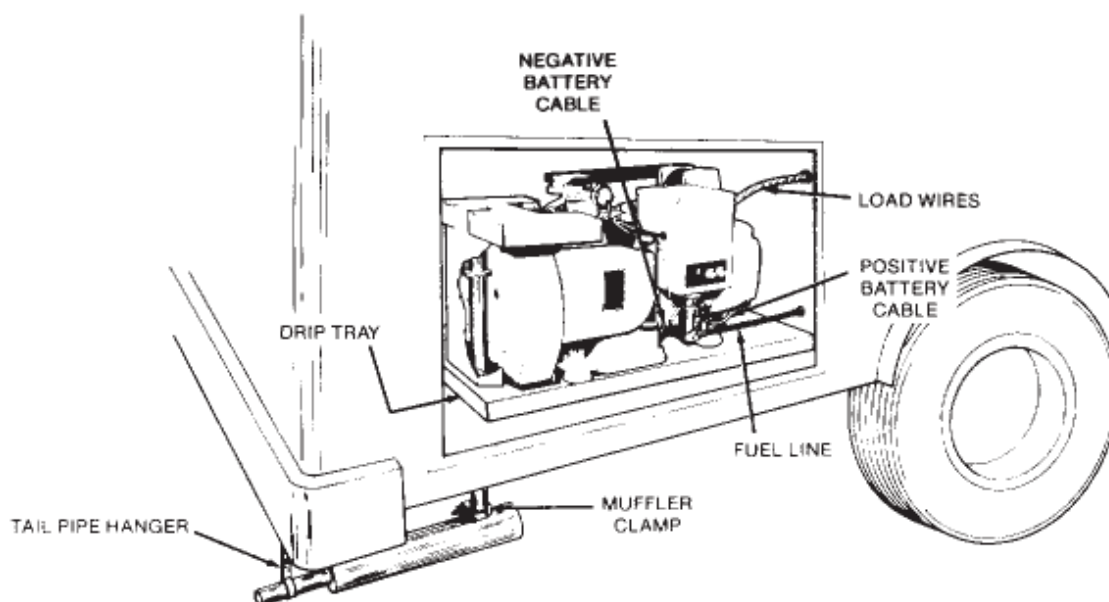
Some service procedures will require that the generator set be removed from the coach. Because of the wide variety of generator set installations, it is impossible to specify the exact removal procedures for each generator set. Depending on the manufacturer, the set might be removable through the side, back, or bottom of the coach. Contact the coach manufacturer to obtain their recommendations before attempting to remove the set from the coach. Use adequate lifting devices and provide sufficient support for the generator set. Keep hands and feet clear during lifting.

Once a satisfactory method for removing the generator set has been determined, disconnect the items listed. Refer to Figure 1 for a typical installation.

- Disconnect the **vehicle** negative (-) battery cable at the battery terminal.
- Disconnect the **generator set** negative (-) battery cable at the battery terminal and at the generator set.
- Remove the control box cover and disconnect: (A) Positive battery cable from start solenoid. (B) Load wires from terminal block. Tag all load wires to provide positive identification when reconnecting.
- Pull the battery cable and load wires from the control box.
- Disconnect the remote control wiring from the remote terminal block within the control (or disconnect remote control wire plug if applicable).
- Disconnect fuel line at the fuel pump. Securely plug the end of the fuel line to prevent fuel leakage or an accumulation of explosive gasoline vapor.
- Remove the exhaust heat shield (if used) and disconnect the exhaust pipe from the exhaust manifold. (Some models have a flange connection while other models have clamp connection.)

When the items listed in the preceding paragraphs have been disconnected, examine the generator set mounting system. Locate all mounting bolts and supporting members for the set. In most installations, the generator set drip tray is bolted to the coach. Provide adequate support for the generator set before loosening any of the mounting bolts or support members. Remove the generator set as advised by the coach manufacturer. It should be noted that on some models, the air discharge opening extends through the compartment floor.

Once the generator set is removed, support it by placing blocks or other suitable supports under the drip tray. Do not allow the generator set to rest on the air discharge opening.



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FIGURE 1. TYPICAL RV GENERATOR SET INSTALLATION

Engine — Primary Systems

GENERAL

The primary engine systems include the Exhaust, Cooling, Fuel, Ignition, and Crankcase Ventilation systems. These systems can often be serviced without

removing the generator set from the coach. A troubleshooting guide is provided to assist the serviceperson in determining the cause of various engine related malfunctions.

TROUBLE															GASOLINE ENGINE TROUBLESHOOTING GUIDE															CAUSE						
Backfire at Carburetor	Bearing Wear	Black Exhaust	Blue Exhaust	Burned Valves	Connecting Rod Wear	Crank Slowly	Cylinder Wear	Engine Stops	Failure to Start	Governor Hunting	High Oil Pressure	Low Oil Pressure	Loss of Coolant (Water Cooled)	Mechanical Knocks	Mixturing	Overheating (Air Cooled)	Overheating (Water Cooled)	Piston Wear	Poor Compression	Ring Wear	Sticking Valves															
STARTING SYSTEM																						STARTING SYSTEM														
																							Loose or Corroded Battery Connection													
																							Low or Discharged Battery													
																							Faulty Starter													
																							Faulty Start Solenoid													
IGNITION SYSTEM																						IGNITION SYSTEM														
																							Ignition Timing Wrong													
																							Wrong Spark Plug Gap													
																							Worn Points or Improper Gap Setting													
																							Bad Ignition Coil or Condenser													
																							Faulty Spark Plug Wires													
FUEL SYSTEM																						FUEL SYSTEM														
																							Out of Fuel - Check													
																							Lean Fuel Mixture - Readjust													
																							Rich Fuel Mixture or Choke Stuck													
																							Engine Flooded													
																							Poor Quality Fuel													
																							Dirty Carburetor													
																							Dirty Air Cleaner													
																							Dirty Fuel Filter													
																							Defective Fuel Pump													
INTERNAL ENGINE																						INTERNAL ENGINE														
																							Wrong Valve Clearance													
																							Broken Valve Spring													
																							Valve or Valve Seal Leaking													
																							Piston Rings Worn or Broken													
																							Wrong Bearing Clearance													
COOLING SYSTEM (AIR COOLED)																						COOLING SYSTEM (AIR COOLED)														
																							Poor Air Circulation													
																							Dirty or Oily Cooling Fins													
																							Blown Head Gasket													
LUBRICATION SYSTEM																						LUBRICATION SYSTEM														
																							Defective Oil Gauge													
																							Relief Valve Stuck													
																							Faulty Oil Pump													
																							Dirty Oil or Filter													
																							Oil Too Light or Diluted													
																							Oil Level Low													
																							Oil Too Heavy													
																							Dirty Crankcase Breather Valve													
THROTTLE AND GOVERNOR																						THROTTLE AND GOVERNOR														
																							Linkage Out of Adjustment													
																							Linkage Worn or Disconnected													
																							Governor Spring Sensitivity Too Great													
																							Linkage Binding													

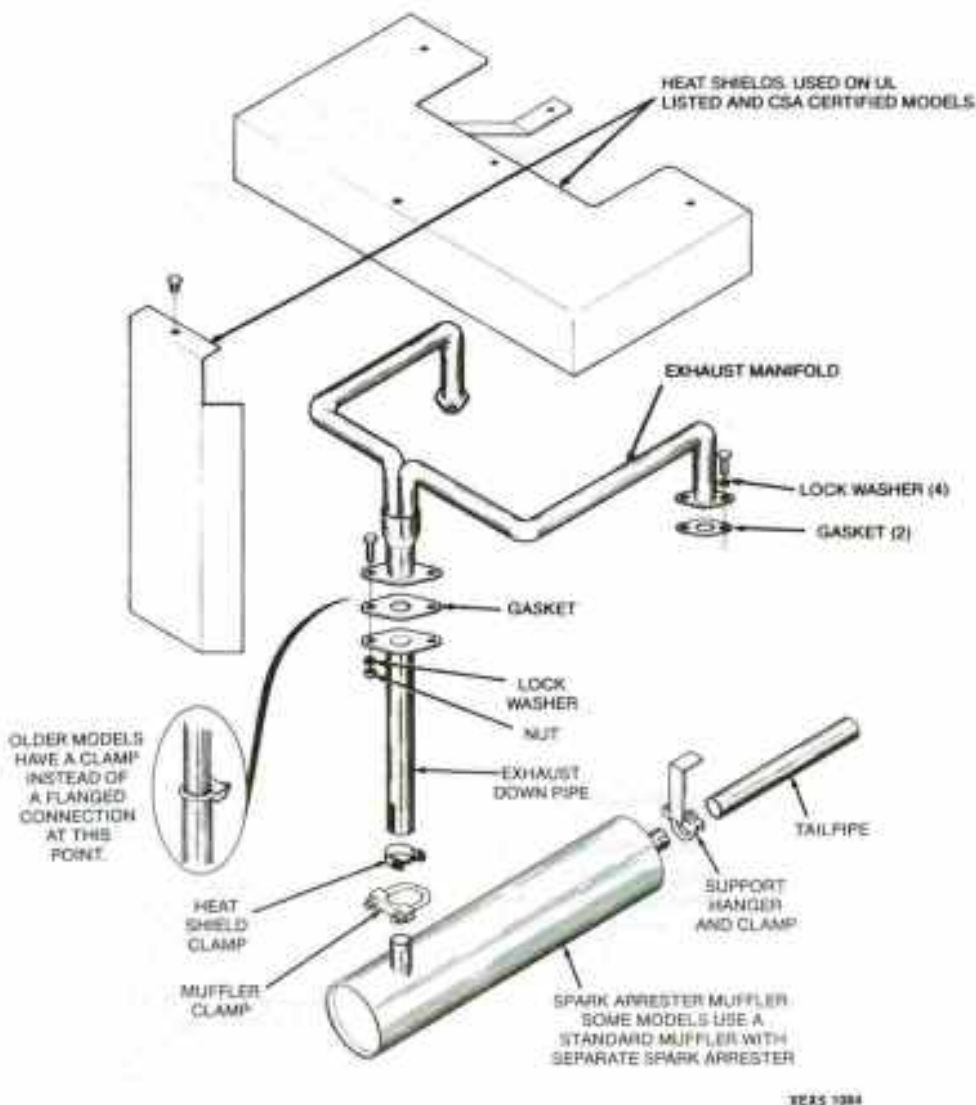
EXHAUST SYSTEM

The condition of the exhaust system is extremely critical on RV generator sets because of the possibility of exhaust gases entering the coach.

The exhaust system must be serviced immediately if inspection reveals leaking joints or connections, loose fasteners, or broken or damaged components.

Always replace worn components with new original equipment replacement parts. Do not attempt to repair a broken exhaust pipe or manifold by welding and do not replace worn out components with parts that do not meet factory specifications.

WARNING *Inhalation of exhaust gases might result in serious personal injury or death. Modifying the exhaust system (other than shortening the downpipe) might allow poisonous exhaust gases to enter the coach. Use only original equipment replacement parts when servicing the exhaust system. Unauthorized modifications will also void the warranty and cancel the UL Listing/CSA Certification. Liability for injury or damages due to unauthorized modifications becomes the responsibility of the person making the change.*



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FIGURE 2. EXHAUST SYSTEM

Heat Shields (UL/CSA)

The exhaust shields must be properly installed to maintain compartment temperatures within the limits specified by the following regulations:

ANSI/RVIA-EGS-1-1976

UL Subject 1248

CSA Bulletin #946

Follow the disassembly and reassembly recommendations to avoid damage and ensure safe operation.

Disassembly: Remove the 1/4 inch locking head bolt that secures the top of the downpipe shield to the exhaust manifold shield. Remove the downpipe shield by pulling it upward and outward until the tab (see Figure 3) is disengaged from the clamp screw. Remove the three 1/4 inch locking head bolts that secure the exhaust manifold shield to the mounting brackets and scroll and lift off the manifold shield. The manifold shield mounting brackets and heat shield clamp may be left attached unless complete disassembly is required.

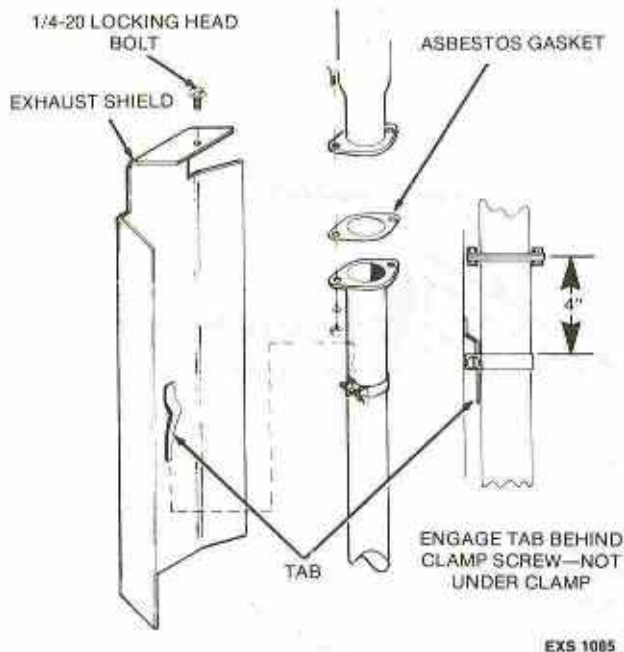


FIGURE 3. EXHAUST SHIELD TAB ENGAGEMENT

Assembly: Secure the exhaust manifold shield to the mounting brackets and scroll using three 1/4 inch locking head bolts. Install the downpipe shield by engaging the tab (on inside of shield) behind the clamp screw on the downpipe. The clamp screw must be positioned on the outside of the downpipe as shown in Figure 3.

CAUTION *Installing the downpipe shield clamp incorrectly will cause downpipe tab to break off due to vibration. Place tab behind clamp screw and not under clamp.*

Secure the top of the shield by installing the top 1/4 inch locking bolt in the exhaust manifold shield. If the downpipe shield is loose, adjust the clamp higher up on the downpipe as shown in Figure 3 and tighten securely. Recheck and tighten any loose bolts.

WARNING *To prevent overheating of compartment walls and the possibility of fire, all exhaust shielding supplied with unit must be properly installed.*

Exhaust Pipe And Muffler

The exhaust system consists of the exhaust manifold, exhaust downpipe, muffler, spark arrester, and tailpipe. Older models might have a separate spark arrester. However, on most models, the spark arrester will be integral with the muffler. When service is necessary, disassemble and reassemble as specified in the following sections.

Disassembly: Remove heat shields as described in the previous section and then proceed as indicated.

1. Loosen muffler clamp and support hanger clamp(s) and remove the muffler and tailpipe assembly (see Figure 2).
2. Loosen the exhaust downpipe flange bolts and remove the downpipe and asbestos flange gasket. Some models may have a clamp connection instead of a flange.
3. Loosen the four exhaust manifold bolts and remove the exhaust manifold and two manifold gaskets.

Assembly: Obtain the required replacement parts and proceed as indicated.

1. Install the exhaust manifold using new gaskets. Tighten the four exhaust manifold screws to the specified torque.
2. Secure the exhaust downpipe to the exhaust manifold using 5/16-18 bolts, lock washers, and nuts. Use a new asbestos gasket between the exhaust manifold flanges to prevent leaks and tighten securely. Do not use sealer on the gasket.
3. Attach the inlet of the muffler to the downpipe using a 1-5/8 inch automotive type U-bolt clamp **ONLY** (see Figure 4) and tighten securely. If downpipe must be shortened, cut two 1/2 inch slots in the end of the downpipe after shortening.
4. If replacing the original tailpipe, refer to the following guidelines for selecting and locating the tailpipe.

WARNING *Inhalation of exhaust gases might result in severe personal injury or death. Exhaust gases might enter the coach interior if the tailpipe is damaged, missing, or improperly installed. Follow the recommended exhaust system replacement procedures to ensure safe operation.*

- Use 1-3/8 inch ID, 18 gauge, rigid steel tubing for tailpipe. Do not use flexible exhaust tailpipe since it might break due to road shock and vibration.
- Use 1-1/2 inch U-bolt type automotive muffler clamps and shock mounted hangers for attaching and supporting the muffler and tailpipe. Only approved SAE automotive muffler clamps are acceptable for fastening the exhaust tailpipe to the muffler.
- Install exhaust tailpipe at least 1-1/2 inches away from the fuel tank and any combustible material. If 1-1/2 inches clearance cannot be maintained, install suitable heat shielding between tailpipe and combustible material or fuel tank to prevent excessive heating.

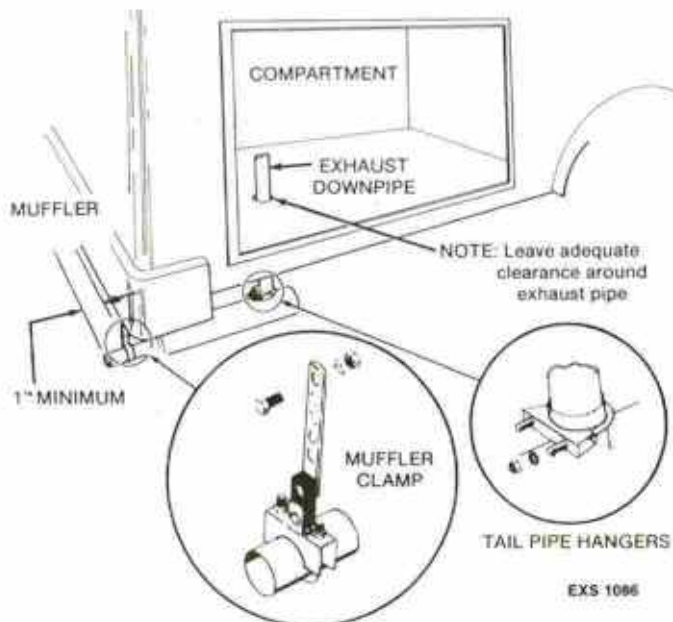


FIGURE 4. MUFFLER INSTALLATION

- Do **not** terminate the exhaust tailpipe:
 - a. Under a window, door, or any opening that might allow exhaust gases to enter the coach interior.
 - b. Ahead of or under the generator compartment air intake to prevent recirculation of exhaust gases. Terminate tailpipe to the **rear** of the compartment air intake.
 - c. Under the fuel tank fill spout to prevent spilled fuel from being ignited by a hot tailpipe.
 - d. Under the vehicle to prevent exhaust gases from entering the coach interior through small openings in the underside of the vehicle.
- Extend the tailpipe at least **one inch** (25mm) beyond the perimeter of the vehicle. Direct exhaust gases **down** and **away** from the vehicle and **away** from windows, doors, or compartment openings.
- Do not connect the generator set exhaust tailpipe to the vehicle exhaust system. Exhaust gases will be forced into the non-running engine and might be released through the carburetor air inlet. Water vapor from the exhaust might also damage the non-running engine.

5. Attach the tailpipe to the outlet end of the muffler and provide support using a shock mounted support hanger with clamp (see Figure 4).

CAUTION To prevent excessive vibration transfer to the vehicle, mount muffler and tailpipe hanger brackets directly above the component being supported and **NOT** at an angle.

6. Run the generator set for five minutes and check entire exhaust system (visually and audibly) for leaks or excessive noise.
7. Clean spark arrester muffler every 100 hours of operation. Remove 1/8 inch pipe plug in bottom of muffler and run set for five minutes. Then replace pipe plug. Inspect exhaust system (visually and audibly) for leaks daily (at least every eight hours of running time).

COOLING SYSTEM

A constant airflow is critical for engine and generator cooling to prevent excessive heat build-up. All B and N series generator sets use a Vacu-Flo cooling system to provide the required airflow. With Vacu-Flo cooling, a flywheel fan draws cool air in from the generator end of the compartment (see Figure 5). The cool air passes over the cooling fins on the engine and absorbs the heat. The heated air is then discharged through the opening in the bottom of the vacu-flo scroll.

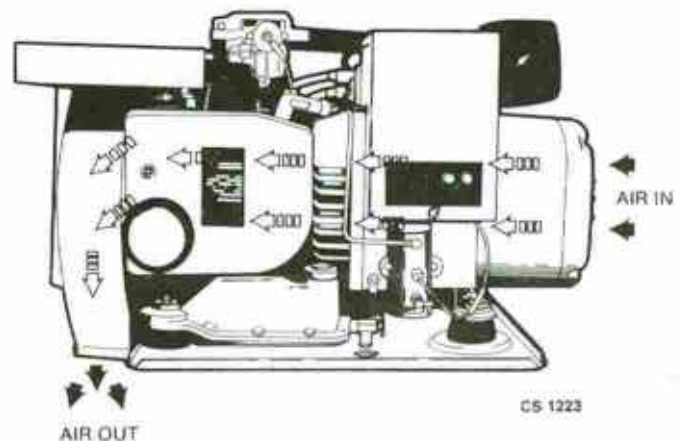


FIGURE 5. COOLING AIR FLOW

CAUTION Discharged cooling air might contain poisonous exhaust gases. Never use discharged cooling air for heating the coach interior.

The generator compartment air inlet is sized (see SPECIFICATIONS) to allow the required flow rate of air. The air inlet opening and the air discharge opening must be kept free of any obstructions to avoid restricting airflow. Dirt, dust, or other debris that may clog the air duct openings should be removed during periodic maintenance. Dirt might also become lodged between the cooling fins on the engine block and cylinder heads. If this happens, heat transfer is greatly reduced and overheating can occur if the fins are not cleaned.

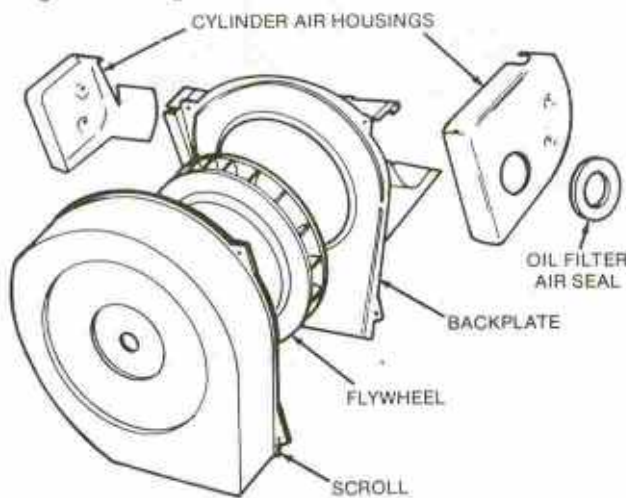
The cooling system consists of the left and right cylinder air housings, scroll, flywheel, and scroll backplate. When service is necessary, disassemble and assemble as specified in the following sections.

Disassembly: Remove the heat shields, exhaust downpipe, and exhaust manifold as described in the Exhaust System section and then proceed as indicated.

1. Remove the rubber air seal from around the oil filter (see Figure 6).
2. Loosen the 1/4 inch hex head cap screws that secure the left and right air housings to the cylinder heads and remove the air housings.
3. Loosen the 1/4 inch hex head cap screws that secure the scroll to the backplate and remove the scroll.

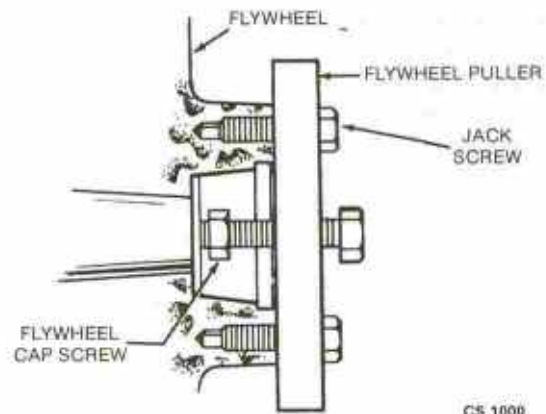
Do not remove the guard screen from the scroll opening.

4. Loosen the flywheel capscrew and remove the flywheel washer. Replace the capscrew and tighten finger tight.
5. Attach puller tool to the flywheel as shown in Figure 7. The tool has two jack screws that fit into the tapped holes in the flywheel.
6. Tighten the puller center screw until the flywheel is loose and then remove the flywheel. Use care to avoid dropping the flywheel when it comes loose. Replace the flywheel if any air vanes are missing.
7. Remove the lead from the low oil pressure cut-off switch.
8. Loosen the 1/4 inch hex head cap screws that secure the backplate to the engine and remove the backplate. Note that the N-series generator sets have a two piece backplate.
9. Use a brush or low pressure compressed air to remove any dirt or debris that may be lodged on the engine cooling fins.



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FIGURE 6. COOLING SYSTEM (B-SERIES)



CS 1000

FIGURE 7. FLYWHEEL PULLER

Assembly: Cooling system assembly is the reverse of disassembly. When installing the flywheel, align the keyway in the flywheel with the woodruff key on the crankshaft. Use non-hardening sealer on the flywheel capscrew threads and tighten to the specified torque.

CAUTION *Overheating might result in engine damage. To avoid overheating, never operate the generator set with any of the cooling system components removed.*

FUEL SYSTEM

The fuel system must be in good condition and properly adjusted for efficient generator set operation. The main components of the fuel system are the air cleaner assembly, carburetor, choke, intake manifold, fuel filter, fuel pump, governor control, and air preheater. When servicing, disassemble, assemble, and adjust as specified in the following sections.

Air Filter Assembly

Two air filter assemblies are in use with B and N series generator sets. Models BF and NH Spec J generator sets use the assembly shown in Figure 8. Models BFA, BGA, and NH Spec K-P generator sets use the assembly shown in Figure 9.

BF and NH Spec J Disassembly/Assembly: To disassemble, loosen the air filter wing nut and remove the air filter and cover. Loosen the hose assembly clamps (2) located at the carburetor air inlet and behind the support bracket and remove the hose assembly. Loosen the 1/4 inch hex head cap screws that secure the bracket to the generator and remove bracket assembly. Assembly is the reverse of disassembly.