

SERVICE BULLETIN

PLAINTIFF'S EXHIBIT

MAC-49

AUGUST 15, 1980

T

No. Q104 under BRAKES

FOR BRANCHES, DISTRIBUTORS AND CUSTOMERS.

CHASSIS AFFECTED ALLENTOWN ☒ **HAYWARD** ☒ **OAKVILLE** ☒

BRAKE LINING SERVICE KITS

(All With 16-1/2 x 7 Cam Type Rear Axle Brakes)

PURPOSE To inform the field of new service linings made of non-asbestos material.

RECOMMENDATION Install non-asbestos lining kits if improved lining and drum life and/or quieter operation is desired.

INFORMATION The non-asbestos linings provide longer drum and lining life along with reduced noise levels. They are directly interchangeable with standard and combination service kits on axles rated at 20,000 pounds (40,000 per bogie) or less. They can also be used on axles rated up to and including 23,000 pounds (44,000 per bogie) if type 30 brake chambers and six inch slack adjusters are installed.

Lining kits currently available are:

Standard Service Kits	Combination Service Kits	Non-Asbestos Service Kits	Application
202SMH204	202SMH204-P2	202SMM204N	Rockwell Pand Q
not available	202SMH210	202SMM210N	Rockwell P-44,000 lb. bogie
202SMH220	202SMH220	202SMM220N	Eaton

END

CIRCULATION

Service Manager	
Shop Foreman	
Night Foreman	
Night Foreman	
Inspector Leadman	
Inspector Leadman	
Inspector Leadman	
Unit Overhaul Room	
Shop Office	

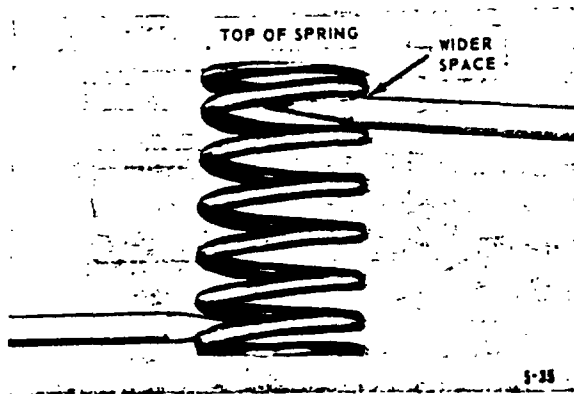


Figure 2-12. Valve Spring

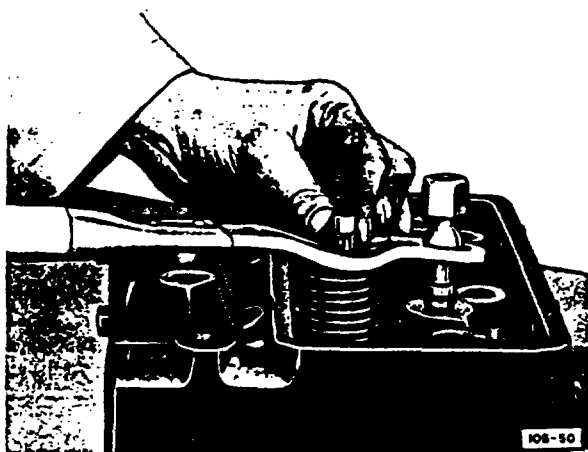


Figure 2-13. Installing Valve Keys

Installing Cylinder Heads

New cylinder head gaskets are installed on the cylinder block with "Top" markup. Check cylinder head studs for secureness in the block; also threads for damage that may cause binding of the stud nuts. Fit cylinder heads over studs lowering onto cylinder head gasket carefully to avoid damage. Install cylinder head stud washers and nuts. Torque nuts in sequence shown with a calibrated torque wrench in progressive steps of 50, 100 and finally 140 lb. ft. (Stud threads oiled). See Figure 2-14.

Install the two water connection flanges, with gaskets, to cylinder head (connecting heads together to permit cooling water circulation through the three cylinder heads), and install thermostat housing (outlet) and gasket to the front head. A blank plate and gasket are used at the rear head.

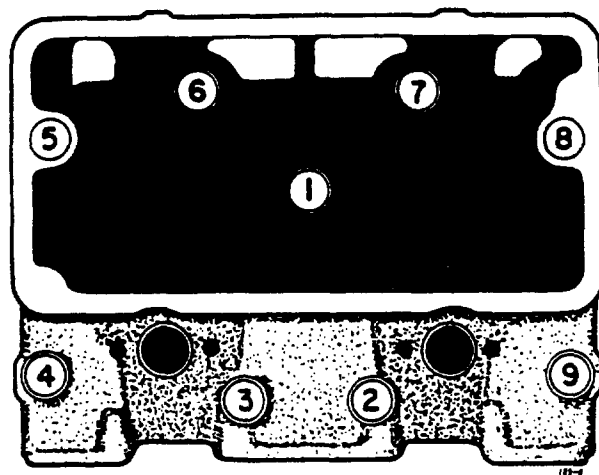


Figure 2-14. Torquing Sequence

Valve Rocker Arm and Shaft Assembly

The valve rocker arm features a bushing. When the bushing is installed, the split must locate on the horizontal plane and face the slipper side of the arm. See Figure 2-15.

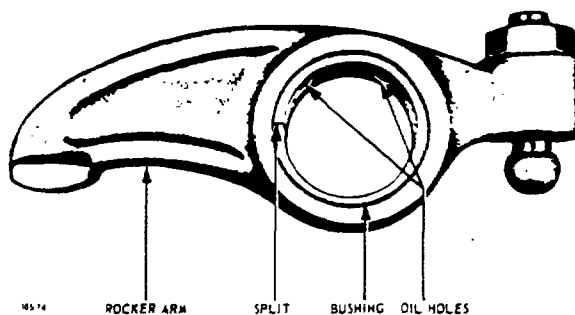


Figure 2-15. Rocker Arm Assembly

Press the bushing in so that it will come flush with the side of the hub which contacts the rocker arm shaft bracket. Two oil holes must be drilled in the bushing. They must be in alignment with the two oil holes provided on top of the arm to feed the slipper and the rocker arm to pushrod adjusting screw with lube oil. Ream bushing I. D. 0.8661 to 0.8669 in., to allow for proper running clearance with a new rocker arm shaft diameter. Check shaft O.D. at unworn area for size, before reaming new bushings to be used with old shaft. Running clearance, 0.0005 to 0.0015 in.

The valve rocker arm shaft is hollow. Two large holes are drilled through the shaft, vertically, at locations where the bracket-to-cylinder head screws are installed. Four positions on the shaft are drilled through the shaft from one side to the other, on a horizontal plane. This provides eight oil feed holes, two for each of four rocker arms. They feed the bushing with lube oil at the 3 and 9 o'clock positions.

The valve rocker arm and shaft assembly must be installed only after the cylinder heads have been properly torqued down.

The valve lifters must be installed with the camshaft in place. The pushrods must then be installed. See Figure 2-16.

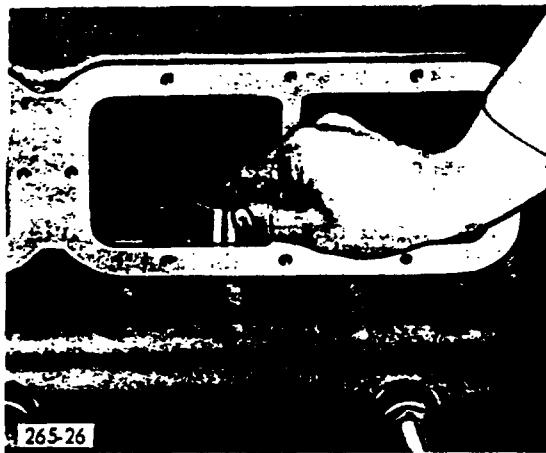


Figure 2-16. Installing Valve Lifter

The rocker arms, shaft, springs and brackets are assembled and secured at each end with large hex head type plugs. The two bracket-to-cylinder head bolts must also be in place before installing the assembly to the head. The bolts are drilled up through the center, and a feed hole drilled on side of the bolt locates inside the rocker arm shaft, on the assembly, to admit lube oil which originates (under pressure) from a passage directed to the bottom of the tapped hole (in the cylinder head) to feed the bracket bolt.

A heavy paper disc type gasket is used between the brackets and cylinder head to prevent oil leakage. Before installing new gaskets, remove any part of the old gaskets that may be adhering to the bracket or head to assure solid seating.

Tighten the bolts equally and finally torque to 40 lbs. ft. maximum. See Figure 2-17.

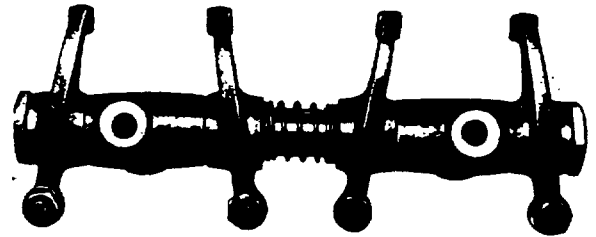


Figure 2-17. Rocker Arm and Shaft Assy.

When the rocker arm and shaft assembly is installed on the engine, carefully check outer rocker arms for possible binding between bracket and hex head plug. Rap opposite end of shaft with hammer to free.

Naturally Aspirated Diesel (END475)

Adjust valve clearance (cold engine setting); inlet valve, 0.014 in. and exhaust valve, 0.018 in.

Turbocharged Diesel (ENDT475)

Inlet valve, 0.014 in. and exhaust valve 0.028 in. Squirt engine oil over valve mechanism and at valve stems for initial protection.

NOTE

As soon as engine is running, observe to be sure lubricating oil is flowing from all rocker arms.

CYLINDER BLOCK

Description

The cylinder and upper crankcase is an integral casting of alloy cast iron. See Figure 2-18. It features replaceable wet-type cylinder sleeves flanged at the top to fit in the counterbores on the cylinder block deck. Three O-ring type seals are employed to seal the lower areas of the sleeve at the water jacket. The O-rings are resistant to oil and heat.

The standard cylinder sleeve I. D. is 4.527. This is the only size available. A worn or scored sleeve must be replaced with a new sleeve because the piston and piston rings are also only available in standard size. Cylinder sleeves may be removed by using puller J-21376 and sleeve puller shoe J-21587. See Figure 2-19.

to 1.457 inch (37mm) is 147.84 lbs. (660N). See Figure 2-19.

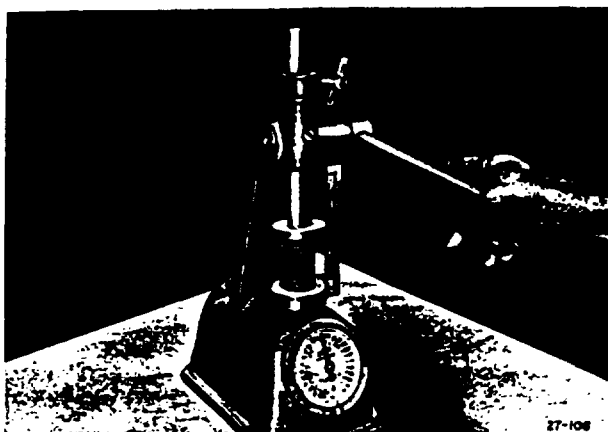


Figure 2-19. Checking Valve Springs

Position inner and outer valve springs over the inlet and exhaust valve stems and install washers, valve stem keys and caps using a suitable spring compressing tool. See Figure 2-20.

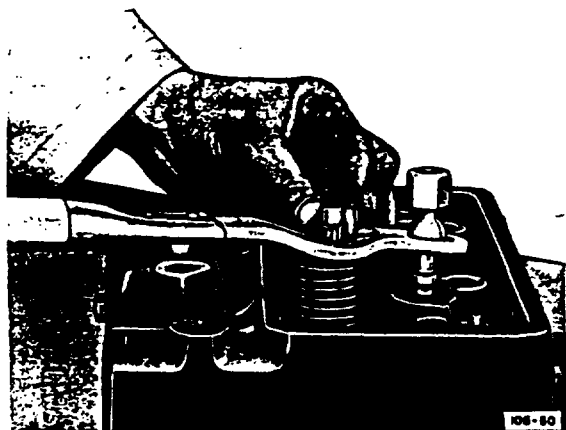


Figure 2-20. Installing Valve Keys

Installing Cylinder Heads

NOTE

A fire ring is formed in the cylinder head gasket when the cylinder head is torqued on the cylinder block; therefore, a new gasket must be used when installing the cylinder head. See Figure 2-21.

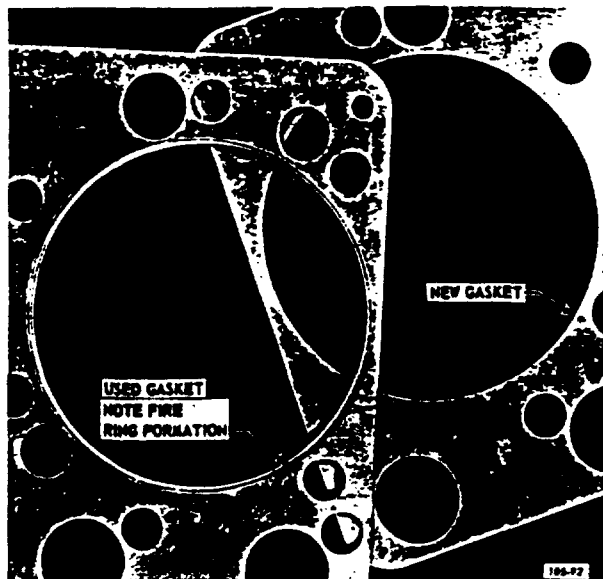


Figure 2-21. Cylinder Head Gasket
(Note: Fire Ring Formed in Left Gasket)

1. Clean the cylinder block deck thoroughly.
2. Check cylinder sleeve height above the deck. (See Figure 2-31.) Install new cylinder head gasket on deck.

NOTE

Do not use a sealing compound or soak cylinder head gasket.

3. Check gasket position. Be sure that all passages are open and not blocked by the gasket. See Figure 2-22.

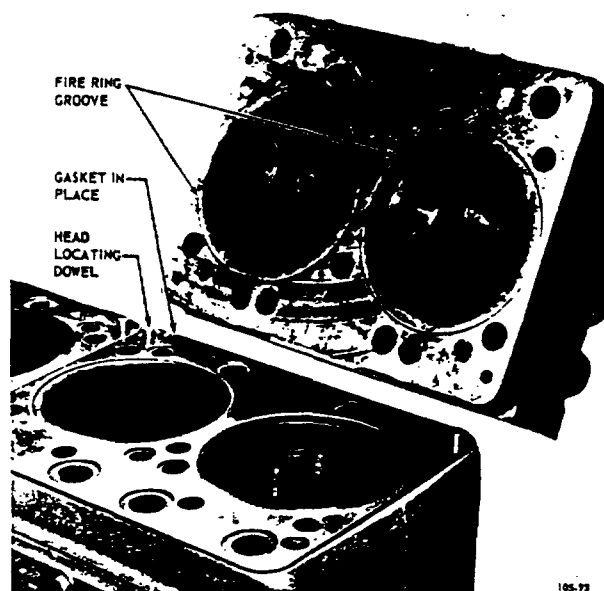
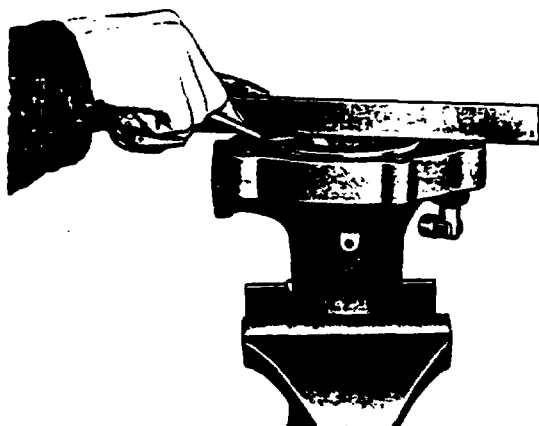


Figure 2-22. Gasket and Cylinder Head Over Cylinder Block



11-43

Figure 2-90. Checking Impeller Clearance

9. Install impeller lockwasher and nut and secure.

THERMOSTAT

The thermostat is located above and to the right of the injection pump. See Figure 2-91.

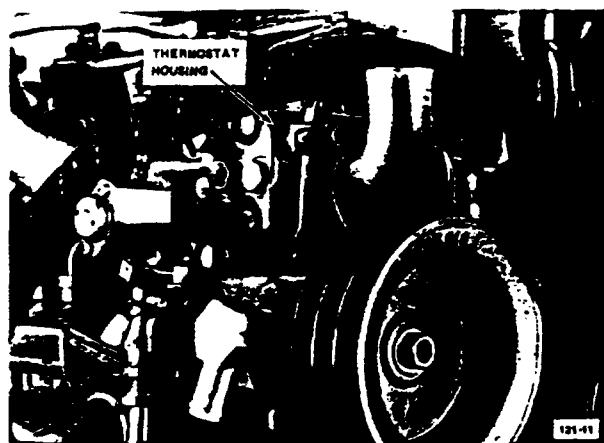
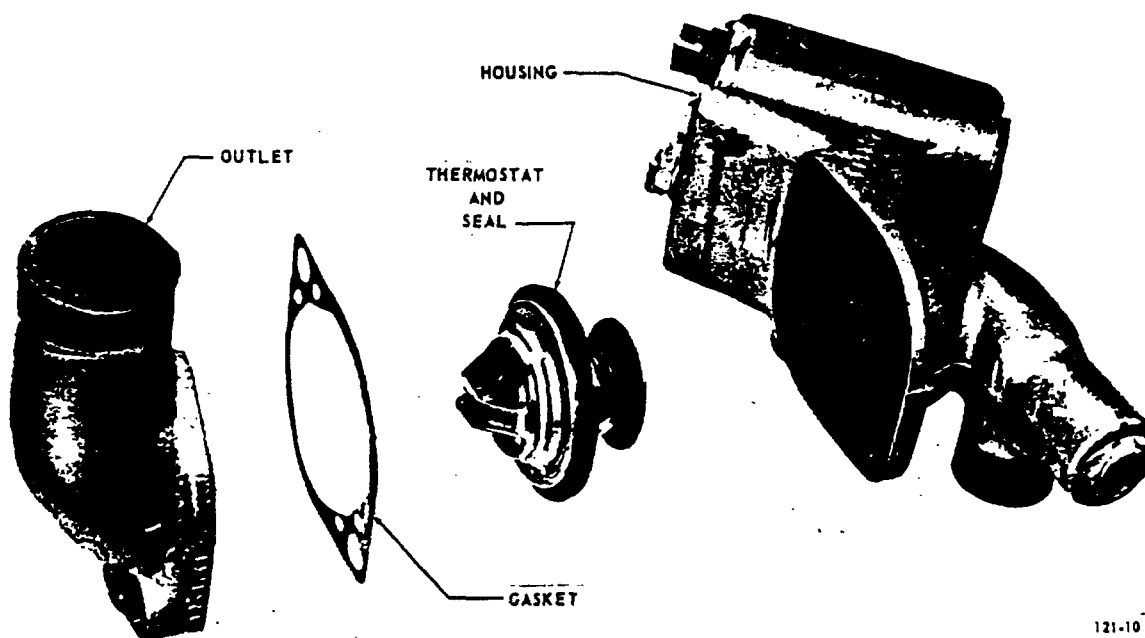


Figure 2-91. Thermostat Housing Location

Removal

To remove the thermostat, first drain the coolant and then remove the outlet housing. See Figure 2-92.



121-10

Figure 2-92. Thermostat Housing Exploded View

TURBOCHARGER

Preliminary

Inspect external and visible internal areas for contamination or damage before installing the unit on the engine. Check the condition of the turbine and exhaust manifold mating flanges for uneven surfaces. The

smooth surface is required to assure good gasket clamping for dependable sealing and for longer gasket life.

Make certain that the air cleaner and air tubes are clean, to avoid restricted air flow. New hose connections and dependable clamps should be used and properly secured.

Insert the proper timing gear cover alignment sleeve in the cover, (J-26583 for 4.250 inch nominal O.D. oil seal, and J-24230, with handle J-8092, for 4.00 inch nominal O.D. seal). The sleeve also protects the seal when installing the timing gear cover.

Install two suitable guide studs and position the timing gear cover on the engine using a new gasket.

Install two timing gear cover screws, finger tight. Then tap the cover with a soft-faced hammer, using a straight edge to align the timing cover with the oil pan rail. See Figure 2-129.

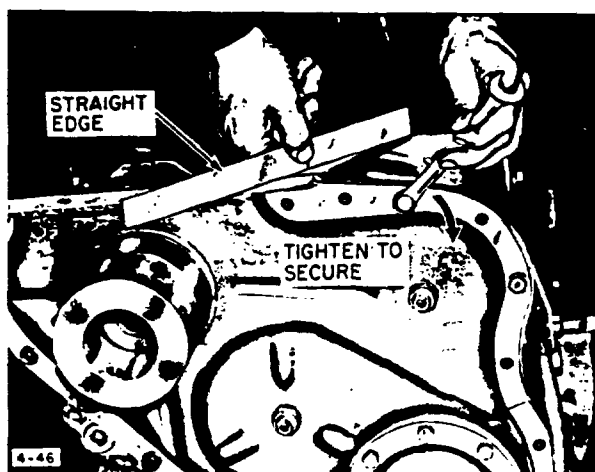


Figure 2-129. Aligning Timing Gear Cover

After timing gear cover has been aligned, remove the guide studs. Install the remaining capscrews and torque to specifications.

To adjust the thrust button, rotate the button clockwise until it is snug against the shaft, (camshaft and auxiliary shaft). Then back out the thrust button 1/4 turn and tighten jam nut. The resulting end-play will then be within specifications. See Figure 2-130.

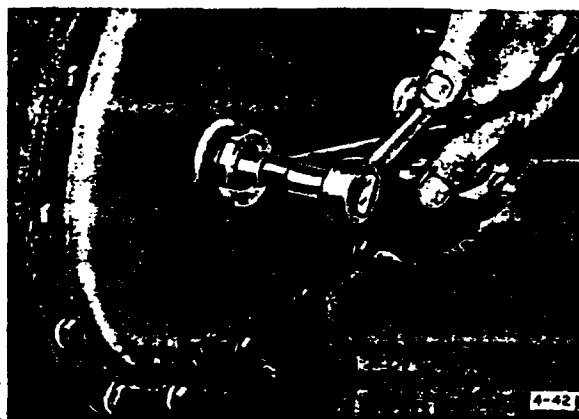


Figure 2-130. Positioning Thrust Button

After thrust buttons have been adjusted, remove the centering sleeve.

Lubricate oil pump drive and driven gears and mount the oil pump assembly to engine. See Figure 2-150.

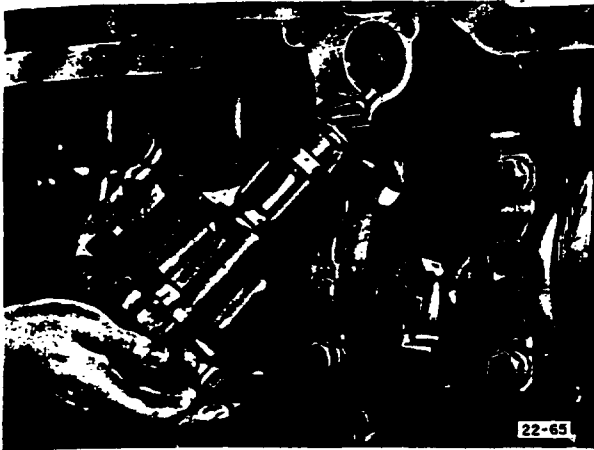


Figure 2-150. Assembly of Oil Pump to Engine

Assemble the oil pump mounting screws and torque to specifications. Check

back lash between gears to make certain that gears are not tight.

Place new gasket on oil pump inlet tube flange and assemble to oil pump. See Figure 2-151.

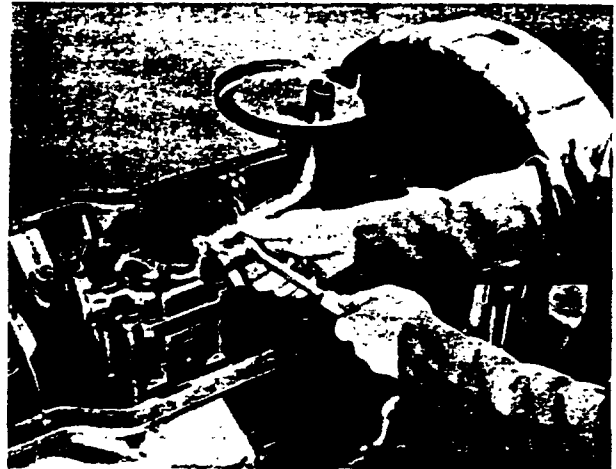


Figure 2-151. Assembling Oil Pump Inlet Tube

To assist in readily identifying the different cap and spring combinations, refer to Table 4.

TABLE 4

OIL PRESSURE RELIEF VALVE CAP AND SPRINGS
(In Oil Pump)

TYPE OF FILTERING SYSTEM	RELIEF VALVE CAP *	RELIEF VALVE SPRING	SPRING INSPECTION LIMITS
By-Pass Filter	226GB121	572GC11	25.0 lbs. $\pm$ 1.8 lbs. at 2-3/4 in.
Full-Flow By-Pass (Pre-ESI)	226GB122	572GC114	40.0 lbs. $\pm$ 4.0 lbs. at 3-5/64 in.
ESI (With 100 PSI Oil Pressure Gage in Cab)	226GB147	572GC114	40.0 lbs. $\pm$ 4.0 lbs. at 3-5/64 in.
ESI (With 150 PSI Oil Pressure Gage in Cab)	226GB122	572GC114	40.0 lbs. $\pm$ 4.0 lbs. at 3-5/64 in.
ESI Plus	226GB122	572GC114	40.0 lbs. $\pm$ 4.0 lbs. at 3-5/64 in.

* The last three digits of the part number (such as "121") are stamped on the end of the cap for identification.

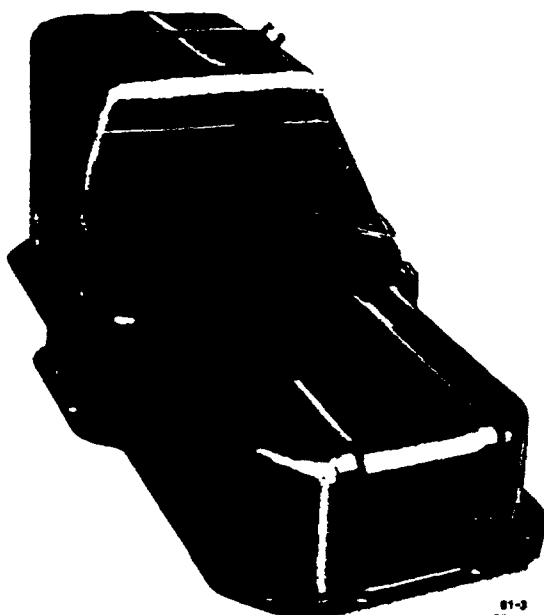


Figure 2-155. Oil Pan for ESI-Plus Engines (51 Quart Capacity)

NOTE

Because of the low mileage normally incurred with on and off highway type vehicles, and also because of ground clearance problems, the new "ESI-Plus" engines are not used in models such as the DM600 or 800, DMM, RD, RM and MB.

Basic Engine Assembly - Oil Pan Applications

Current Basic Engine Assemblies (for Service) are built with the 28 quart capacity oil pan which is required for ESI engines. When this assembly is used to replace an engine not having ESI features, it is recommended that the ESI retrofit kit be installed.

If the original oil filter arrangement is retained, there are two options:

1. Use the new oil pan and add 9 quarts of oil to provide proper oil level in the 28 quart pan.
2. Use oil pan from replaced engine, (19 quart capacity).

If an "ESI-Plus" engine is being replaced, the 28 quart capacity oil pan on the new assembly must be replaced by a 51 quart capacity oil pan.

CYLINDER HEAD

Make certain that cylinder head assembly is in satisfactory condition. (Refer to "Cylinder Head Reconditioning Procedure" on Page 2-225.)

Assemble the correct type of cylinder head gasket to engine. The "folded-steel" type gasket is used with the "flat-flange" type cylinder liner, and the "Maxidyne" type is used with the beaded-flange type liner. See Page 2-155.

All gaskets are pre-coated and do not require any type of sealing compound.

Assemble gasket in cylinder block locating gasket over guide pins. Make certain that surface of gasket marked "Top" is on the top side. With the "Maxidyne" type gasket, carefully fit a new fire ring over the circular bead on each cylinder liner flange. See Figure 2-156.

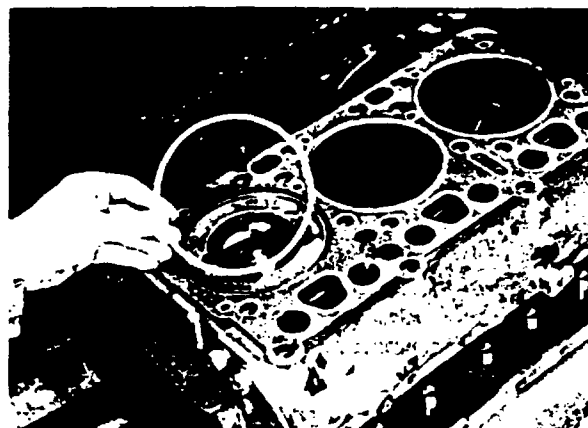


Figure 2-156. Installing Maxidyne Fire Ring

Position the cylinder heads (completely assembled) over the cylinder block, locating the guide holes in the head over the pins in the cylinder block. See Figure 2-157.

If engine has cylinder head studs, check for condition of threads and straightness of shank. Apply a light coat of lubricating oil to threads of studs and install them in cylinder block finger tight, then back off 1/3 turn. Apply a light coat of oil to cylinder head stud washers and nuts and install in position and hand tighten.

6. Continuing adjusting valve lash for the remaining cylinders, in firing order, placing each piston at TDC with respective turning of the engine crankshaft.

NOTE

Engines equipped with the Mack Dynatard® engine brake system will have hydraulic valve lash adjusters in the exhaust rocker arms. Adjust exhaust lash (cold static) using special exhaust valve adjusting tool MVT-36-6. When using tool press downward with hand on exhaust valve adjuster so that the internal clearance in the adjuster is eliminated. Failure to press down on the adjuster will result in unsatisfactory engine performance and unsatisfactory performance of the engine brake.

The MVT-36-6 Exhaust Valve Adjusting Tool is available from:

Automatic Aids
1618 Willow Avenue
La Mott, Philadelphia,
Pennsylvania 19126

For a detailed explanation of the engine brake operation, refer to "Dynatard Engine Brake" section.

CYLINDER HEAD COVER

Check cylinder head covers to make certain that mounting surfaces are flat and clean. Also make certain that gasket surfaces are dry and free from dust.

Apply a thin layer of "Scotch Grip" 3M Co., No. 1711, (or equivalent) contact-type cement to both cover mounting surface and gasket. Let stand for several minutes then assemble adhesive side of gasket to cover.

Allow several minutes for gasket to bond to cover, then assemble covers to engine. Torque capscrews to specifications. See Figure 2-167.

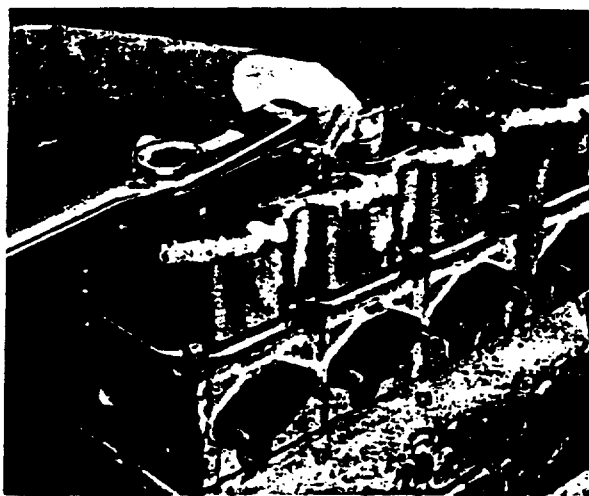


Figure 2-167. Torquing Cylinder Head Cover Capscrews

NOTE

Use of the adhesive between the cover and the gasket will prevent the gasket from squeezing out from under the cover.

Cylinder Head Cover (with Mack Dynatard Engine Brake)

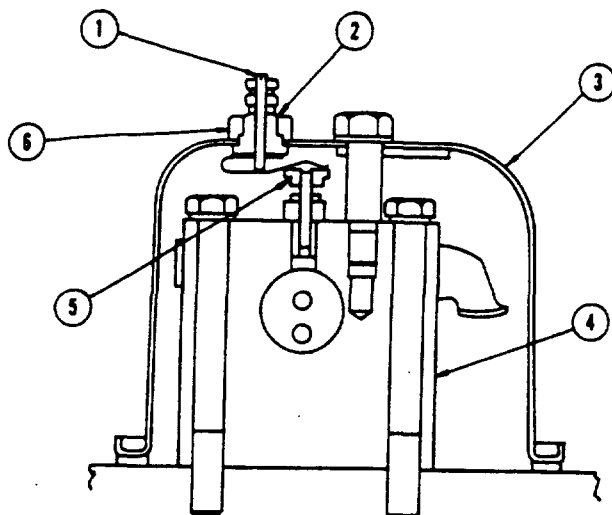
There are two types of terminals assembled to the cylinder head cover. Type No. 1 has a spring steel strip (approximately 3/8 inch wide) which contacts the terminal on the center valve rocker arm shaft bracket. Type No. 2 has a circular contactor spring (approximately 1-5/16 inch in diameter). The circular spring eliminates the need to position the contactor in the horizontal plane.

Type No. 1 Assembly (Non-Current)

1. Assemble insulating washers and/or insulating adapter in terminal hole in cylinder head. See Figure 2-168.

2. Position strip on terminal in cylinder head toward center of engine so that it will come in contact with terminal on center valve rocker arm shaft bracket. Use Loctite and torque nut as specified in Figure 2-168.

3. Loosen nuts holding center screw and adjust screw to obtain dimension shown in Figure 2-168.



5-62

1. Terminal
2. One Drop Loctite 242
3. Cylinder Head Cover
4. Bracket
5. Terminal
6. Torque 15-17 lbs. in.

Figure 2-168. Engine Brake Terminal Arrangement (End View) Non-Current

4. Position terminal blade lengthwise, tighten upper nut, and apply Loctite as shown in Figure 2-169.

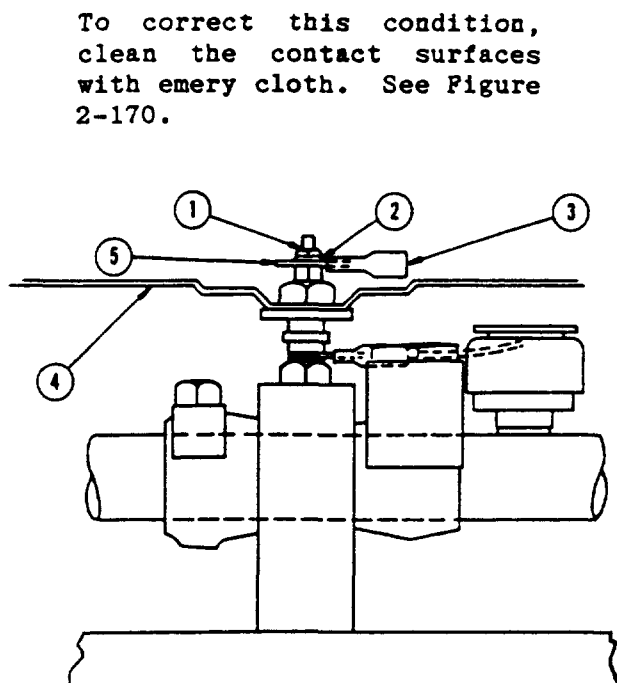
NOTE

When tightening nuts on terminal make certain that adjusting screw and terminal strip are not moved out of position.

5. Apply gasket to cover with adhesive and assemble cover to engine as previously described on Page 2-208.

NOTE

Poor Dynatard engine brake performance can result from any film or residue on the contact surfaces of the engine brake terminals and switch, which prevents adequate current flow to operate Dynatard engine brake.



5-63

1. One Drop Loctite 290 After Assembled
2. Lockwasher
3. Insulator
4. Cylinder Head Cover
5. Terminal Blade

Figure 2-169. Engine Brake Terminal and Solenoid Arrangement (Side View) Non-Current

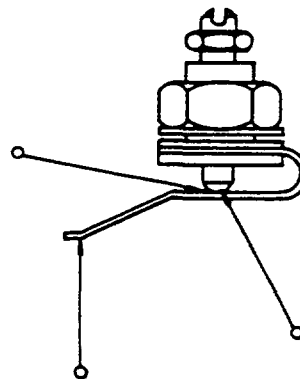
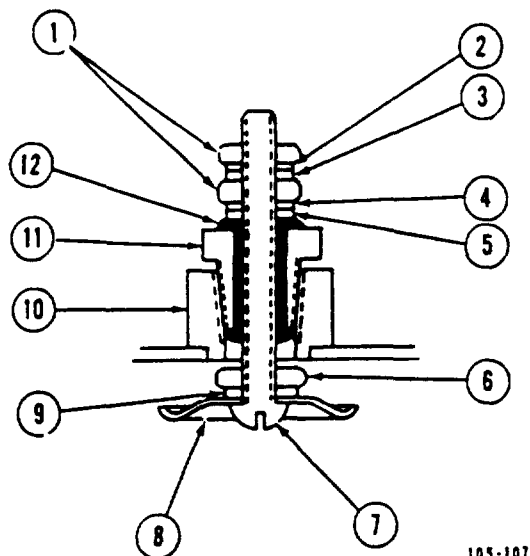


Figure 2-170. Contact Surfaces to be Cleaned

Type No. 2 Assembly (Current)

Assembly arrangement of engine brake terminal parts is shown in Figure 2-171.



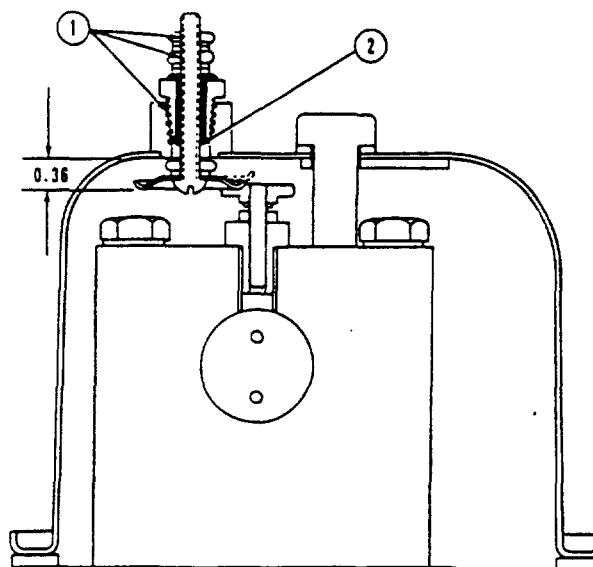
105-107

- | | |
|-------------------|------------------------------|
| 1. Nut | 8. Contactor Spring |
| 2. Lock Washer | 9. Lock Washer |
| 3. Terminal Blade | 10. Cylinder Head Cover Boss |
| 4. Lock Washer | 11. Adapter (Brass) |
| 5. Plain Washer | 12. Insulator (Nylon) |
| 6. Nut | |
| 7. Screw | |

Figure 2-171. Engine Brake Terminal Parts Arrangement Current

To assemble terminal, proceed as follows:

1. Assemble contactor spring to screw with lock washer and nut. Tighten nut.
2. Install the adapter into the cylinder head cover boss, using sealant as specified in Figure 2-172.
3. Assemble screw through the adapter insulator, using sealant. Adjust to dimension as shown in Figure 2-172.
4. Assemble flat washer, lock washer and nut (with sealant) on top side of screw to lock screw at dimension shown in Figure 2-172. Tighten nut.
5. Assemble terminal blade, lock washer, and nut (with sealant), as shown in Figure 2-172. Tighten nut.



105-108

1. Apply one drop of Loctite 290 in threads after assembly. (Three Places).
2. Apply Permatex No. 2 to joint between nylon insert and screw.

Figure 2-172. Engine Brake Terminal Assembly Arrangement (End View) Current

VALVE LIFTER COVER

Check valve lifter covers for flatness. Use new gaskets and assemble front and rear valve lifter covers. See Figure 2-173.

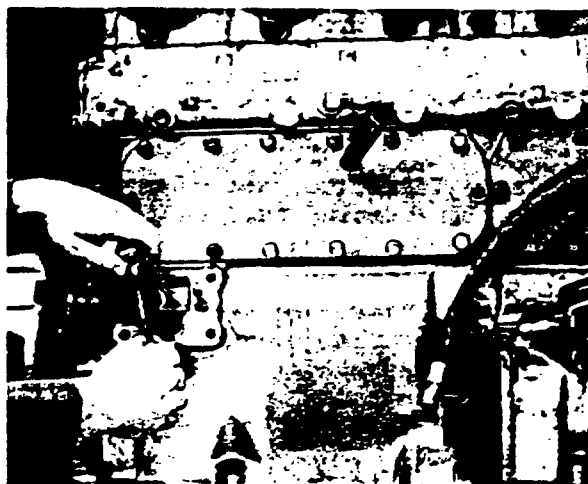


Figure 2-173. Assembling Valve Lifter Covers

NOTE

If any instruction plates are fastened to the original valve lifter cover, make certain that they are replaced when rebuilding engines.

INJECTION PUMP

(American Bosch and Robert Bosch)

Bar the engine, in normal direction of rotation, until the number 1 cylinder is on the compression stroke, and the damper and/or flywheel timing mark indicates correct number of degrees BTC as specified on instruction plate attached to engine.

Coupling Ring Drive Arrangement

Grease front (non-counterbored) face of coupling ring and mount on pump driveshaft flange, with long end of offset indexing pin pointing rearward, and center the coupling ring laterally. See Figure 2-177.

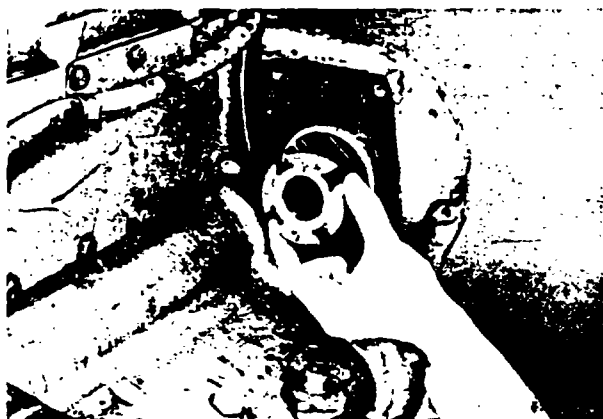


Figure 2-177. Assembling Coupling Ring

Assemble the injection pump upper support mounting bracket (where used) to the injection pump and tighten capscrews.

Rotate the pump coupling drive flange until the indexing hole is in-line with the pin on the coupling ring. See Figure 2-178.

Position new gasket to injection pump mounting surface and mount pump assembly to engine. As pump moves into position, indexing pin can be observed through adapter inspection hole. See Figure 2-179.



Figure 2-178. Aligning Injection Pump Coupling Flange

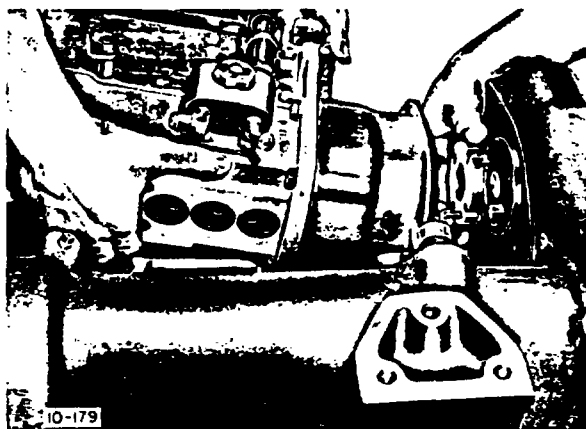


Figure 2-179. Installing Injection Pump

Assemble the injection pump mounting capscrews to cylinder block and tighten.

Assemble the injection pump lower support bracket to the cylinder block and tighten screws lightly. Install and tighten the capscrew connecting the upper and lower support brackets. Then tighten the lower support bracket to cylinder block screws.

Celeron Coupling Drive

This drive arrangement includes a multiple-tooth type drive shaft instead of the tang-type. There is a locating pin in the space between two teeth on the drive shaft to mate with a notched out tooth on the injection pump coupling. This method is used to provide proper timing alignment of the drive shaft with the Celeron coupling.

TACHOMETER DRIVE ASSEMBLY

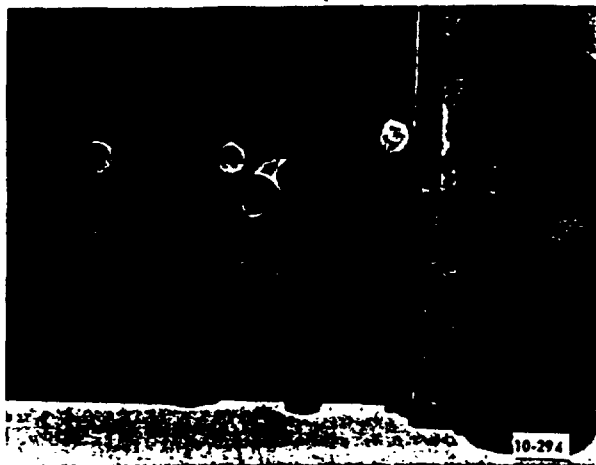


Figure 2-183. Fuel Transfer Pump Mounted to Injection Pump

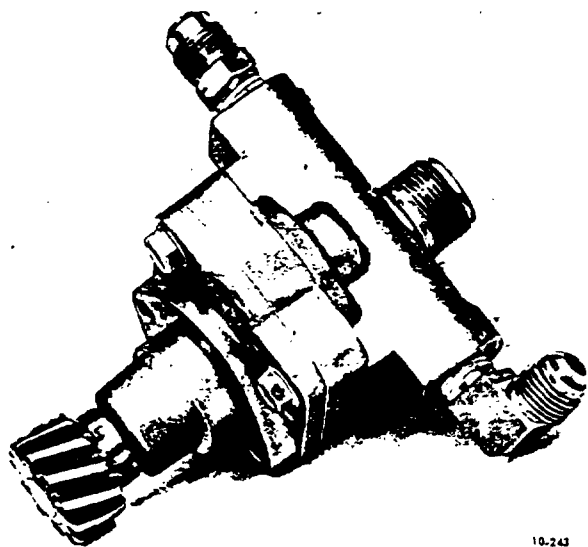


Figure 2-184. Combination Fuel Transfer Pump and Tachometer Drive

This unit is assembled at the tachometer drive hole location. Lubricate shaft and gear. Always use a new gasket when installing pump. Use flat washers and capscrews for securing pump to block. Tighten capscrews.

Assemble fuel inlet line to transfer pump inlet.

NOTE

For complete details on the two types of transfer pumps, refer to the "Fuel Section" in this manual.

There are two types of tachometer drive assemblies in use. One assembly is used solely to drive the tachometer, while the other is a combination fuel transfer pump and tachometer drive. (The combination drive assembly is covered in the preceding section of this manual.)

Lubricate tachometer shaft and gear. Install tachometer drive assembly in cylinder block, using new gaskets and flat washers under mounting capscrews. Tighten capscrews. See Figure 2-185.



Figure 2-185. Installing Tachometer Drive Assembly

EXHAUST MANIFOLD

After checking exhaust manifold for restrictions, cracks or wear, assemble on cylinder head exhaust manifold mounting studs, using new gaskets. Position plain washer and nut locking tab over studs, and assemble nuts to studs. Torque nuts to specifications. See Figure 2-190.

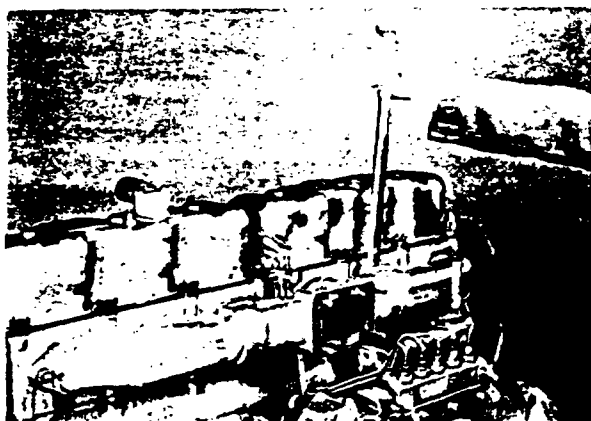


Figure 2-190. Torquing Exhaust Manifold Stud Nuts

After nuts are torqued, bend locking tab to secure nut. One-half of tab is bent against flat on nut and the other half is bent against side of manifold flange.

OIL PRESSURE RELIEF VALVE

Refer to "Lubrication System" on Page 2-256 for correct oil pressure relief valve housing.

Align gasket on mounting flange of relief housing to ensure that proper gasket is used. See Figure 2-191.

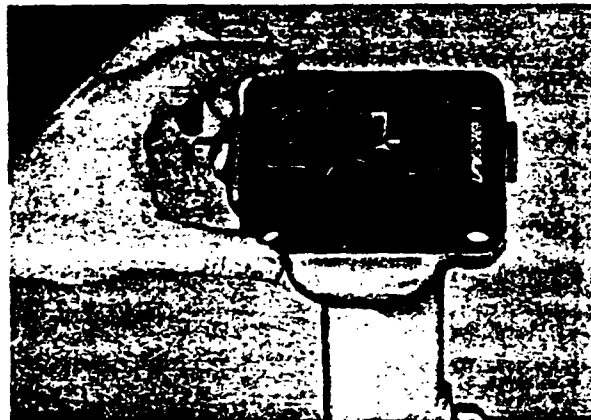


Figure 2-191. Checking Oil Pressure Relief Valve Housing Gasket

CAUTION

Failure to use the proper gasket could result in insufficient oil pressure, and cause engine damage.

NOTE

If in doubt as to the proper gasket, refer to the instructions for installation of service blocks, which is included in this manual. See Page 2-275.

Assemble housing to cylinder block using lockwashers and capscrews. Snug capscrews.

Install two new O-rings on top counterbore of housing. See Figure 2-192.

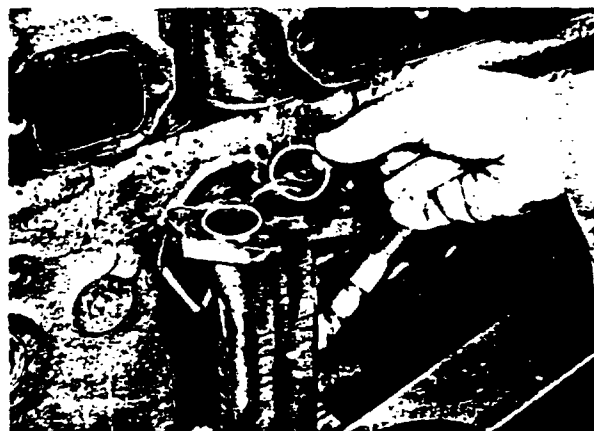


Figure 2-192. Installing O-Rings

Assemble capscrews through lube oil fitting into oil filter adapter, and into oil pressure relief valve housing. Snug capscrews.

After the oil cooler, oil filter fitting, oil filter adapter, valve housing, and oil inlet tube are in position, make certain that all capscrews are "snugged".

Then tighten screws to specifications. Start with oil pressure relief valve housing mounting screws. Then tighten cooler water inlet fitting to water pump screws. Finally, tighten all remaining screws and hose clamps.

OIL COOLER

Make certain that oil cooler is in satisfactory condition. (Refer to "Oil Cooler Rebuild" on Page 2-246.)

Assemble the oil cooler and oil filter lube oil fitting to the oil cooler, using a new O-ring gasket. Snug capscrews.

Assemble thermostat by-pass tube, hoses, and clamps, at the cooler water inlet fitting.

Assemble oil cooler to engine, using new gasket between cooler inlet fitting and water pump. Snug capscrews. See Figure 2-193.



Figure 2-193. Assembling Oil Cooler to Engine

Assemble oil cooler oil inlet tube to cooler, using new O-ring. Before fastening inlet tube to cooler, lubricate O-ring in oil filter fitting and insert tube into fitting. Snug capscrews.

NOTE

The snugged capscrews are tightened when the oil pressure relief valve housing is assembled to the engine. This will permit alignment of all connecting parts.

WATER PUMP

Make certain that water pump is in satisfactory condition. (Refer to "Water Pump Rebuild" on Page 2-250.)

Assemble water pump to cylinder block using new gasket. Install capscrews and lockwashers, and torque to specifications. See Figure 2-194.

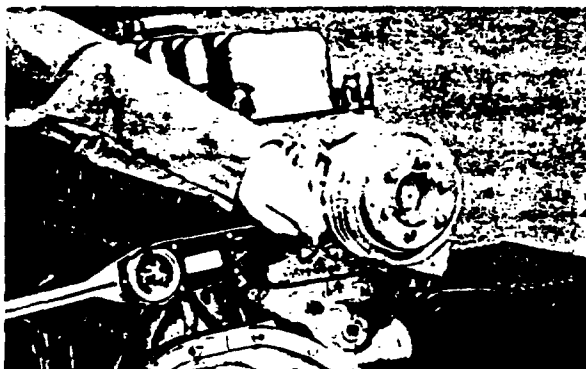


Figure 2-194. Water Pump Installation

WATER MANIFOLDS

Non-Intercooled Engines

Inspect the water manifolds for restrictions, cracks, and flange wear. Assemble hose and clamps at center section of front inlet manifold. Using lockwashers, proper length capscrews, and new gaskets, assemble manifold to engine. Assemble rear water manifold to engine and tighten all capscrews. Position hose to suitable cover front and rear section for proper clamping area. Tighten hose clamps.

Intercooled Engines

On intercooled engines assemble rear section of water outlet manifold after intercooler manifold is in position. Use new gaskets and rubber hose connection. Tighten capscrews to specifications. Tighten hose clamps. See Figure 2-195.

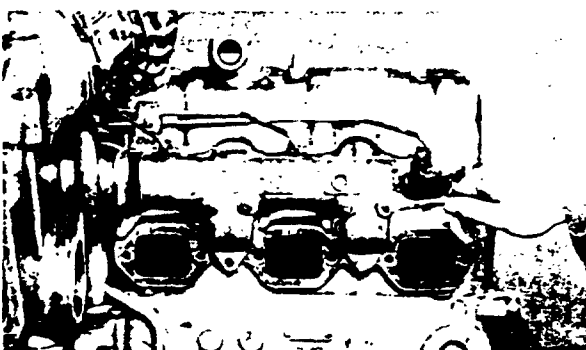


Figure 2-195. Assembling Rear Water Outlet Manifold

INLET MANIFOLD

Check inlet manifold to make certain flanges are flat and there are no cracks or foreign material in manifold.

NOTE

On engines equipped with turbochargers, assemble turbo oil feed line to oil filter adapter before assembling inlet manifold.

CAUTION

If turbocharger oil feed check valve is in system on ESI engines, it should be removed, since field tests indicate it is not required.

Position lockwasher on capscREW and insert in flange holes. Using new gaskets, assemble manifold to engine. Tighten capscREWS to specifications.

NOTE

Some installations use a "Patch-Lock" capscREW for mounting the inlet manifolds. With these screws, lockwashers are not required.

On intercooled engines, assemble rear half of inlet manifold after intercooler header is in position. Use new gaskets and rubber hose connection. Tighten capscREWS to specifications. Tighten hose clamps.

INTERCOOLER AND TIP TURBINE FAN (ON ENGINES SO EQUIPPED)

The intercooler assembly is designed to remove heat from the turbocharged air by air after cooling. The assembly consists of a tip turbine fan, air flow valve, intercooler header, intercooler manifold, and intercooler core. See Figure 2-196.

To install the intercooler manifold, assemble two locating guide pins to the cylinder head to help in positioning manifold. Assemble gasket over guide pins and position intercooler manifold over pins. Install mounting capscREWS. Remove guide pins and replace with capscREWS. Tighten all capscREWS to specifications. See Figure 2-197.

Assemble intercooler manifold support bracket to cylinder head studs with three plain washers and capscREWS. Snug capscREWS. Assemble two plain washers and capscREWS to intercooler manifold and snug capscREWS. Finally tighten all capscREWS to specifications.

Visually inspect the bond between the upper and lower gaskets of the intercooler core. Make certain that gasket is firmly attached all the way around. If any gaps are found, fill with Silastic compound. Also check the vertical end seals. If they are damaged, they must be replaced. See Figure 2-198.

For detailed procedure in assembling gaskets to intercooler core, refer to rebuild section in this manual.

CAUTION

If intercooler core gasket is not properly sealed, lack of air boost pressure and low power can result. Also dirt could be entering past seals, causing premature engine damage.

To prevent gasket sticking to manifold, wipe the manifold and gasket surfaces with talcum powder or Dow Corning 44 Silicone grease before installing core. DO NOT use petroleum base grease or oil for this purpose.

Install the core in the manifold as indicated by the air flow arrows. See Figure 2-199.

NOTE

If the directional air flow arrows are missing, install the core with the wide fins toward the tip turbine fan.

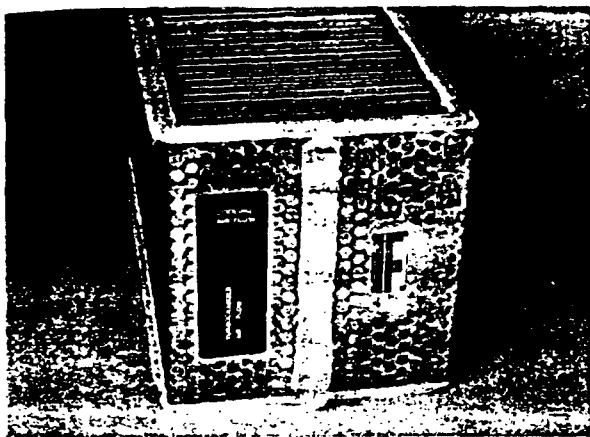


Figure 2-199. Air Flow Arrow Markings on Intercooler Core

Assemble intercooler header on manifold and tighten capscrews and center stud nut to specifications. See Figure 2-200.

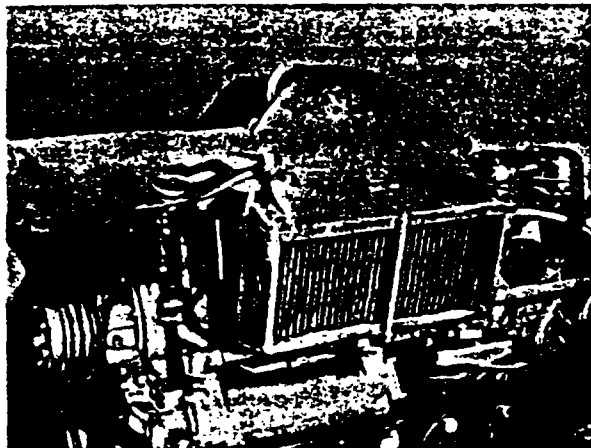


Figure 2-200. Torquing Intercooler Header to Manifold Capscrews and Stud Nut

Attach cross over tube to inlet manifold using new hoses. Tighten clamps.

Assemble rubber hose to tip turbine fan air inlet and position fan to intercooler manifold. See Figure 2-201.

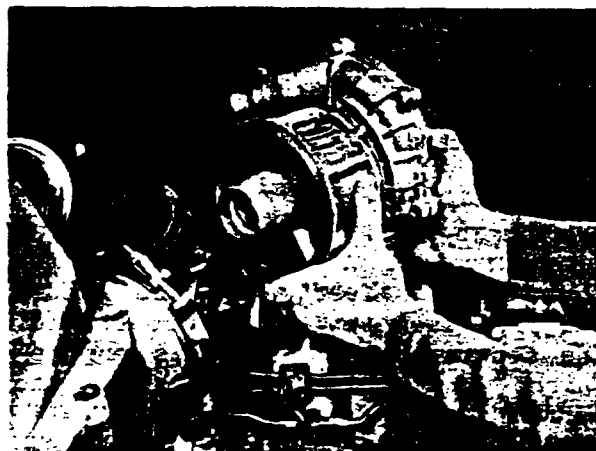


Figure 2-201. Assembling Tip Turbine Fan

Assemble rubber hose to air outlet on intercooler header. Tighten hose clamps. Tighten hose clamps. Tighten V-band clamp to specifications.

There are two basic types of tip turbine fans in use.

Initial production tip turbine fans had a separate air valve assembly and an oil feed and oil return line. See Figure 2-196.

If this type is being replaced by the same type, make certain that the oil lines are reinstalled and the air valve assembly is installed properly. (The arrow on the valve assembly should be pointing towards the tip turbine fan.)

The current production tip turbine fan uses permanently lubricated sealed bearings, therefore, it does not require an oil feed or return line. Also, the air valve has been made part of the tip turbine fan assembly. See Figure 2-202.

THERMOSTAT

Install new thermostat seal in water outlet fitting using tool J-26637. See Figure 2-205.



Figure 2-205. Installing Thermostat Seal

Using new thermostat and gasket, assemble fitting to water outlet manifold.

Attach hose from thermostat by-pass tube to water outlet fitting and tighten hose clamps.

COOLANT CONDITIONER

There are two basic types of coolant conditioner arrangements in use.

Type I. - Engines equipped with 150°F. (or 170°F.) thermostats having a higher opening temperature shutterstat.

Type II. - Engines equipped with a 170°F. thermostat and no shutterstat or a lower opening shutterstat.

Type I

With this arrangement, two ball check valves are assembled in the coolant conditioner adapter. The direction of the coolant flow into the adapter is indicated by cast arrows shown on top of the adapter. See Figure 2-206.

Take note of the direction of the arrows so that check valves can be properly installed. The open end of

the valve should be located in the direction of the arrows. The ball checks are located so that they are unseated by the direction of coolant flow.



Figure 2-206. Coolant Conditioner Adapter

Type II

Engines equipped with the 170°F. thermostat and no shutterstat (or an optional shutterstat which operates at a lower temperature), have an external coolant feed line. This system eliminates the inlet check valve that was in the adapter. Instead, the inlet check valve is included with the water inlet fitting which is assembled into the adapter.

When assembling adapter to thermostat housing, always use new O-ring in check valve counterbore. See Figure 2-207.

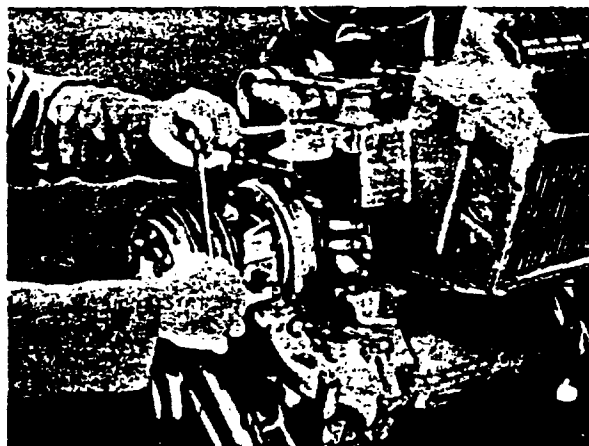


Figure 2-207. Assembling Coolant Conditioner Adapter

Before assembling coolant conditioner to adapter, apply a film of oil to the sealing gasket. Tighten conditioner one full turn after gasket contacts adapter.



Figure 2-287 . Inspect Relief Valve Seat

a. If the seat surface has burrs or nicks, it must be lapped. Place valve lapping compound on plunger seat. See Figure 2-268 .

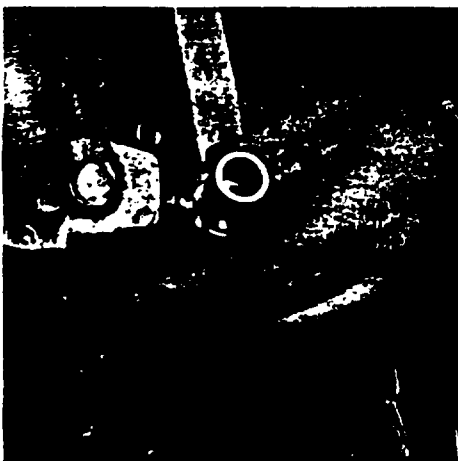


Figure 2-268 . Applying Lapping Compound

b. Seat plunger in relief valve housing and oscillate. See Figure 2-269.

6. Slide oil pump idler gear off shaft. See Figure 2-266 , (5).

7. Turn pump upside down and remove the oil pump driving shaft nut. See Figure 2-266 , (8).

8. Pull oil pump drive gear off of shaft. See Figure 2-266 , (7).

9. Remove driving gear key. See Figure 2-266 , (9).



Figure 2-269 . Lapping Oil Pressure Relief Valve Seat

10. Remove driven gear with shaft from housing. See Figure 2-266 , (13).

11. Remove oil pump inlet flange cover and gasket from housing. See Figure 2-266 , (11 and 12).

Inspecting the Oil Pump Housing

NOTE

After removing all parts from the oil pump housing, thoroughly clean the housing. Inspect the housing for scoring or other damage. If the housing is damaged, it must be replaced.

1. Check the bushings in the oil pump housing for burrs, nicks, or cracks. See Figure 2-270 .

NOTE

The bushings are an integral part of the oil pump housing. If they are damaged, they must be replaced.

OIL COOLER REBUILD

Oil Cooler Disassembly

1. Remove water inlet and outlet end caps. See Figures 2-287 and 2-288.



Figure 2-287. Removing Water Inlet End Cap



Figure 2-288. Removing Water Outlet End Cap

2. Remove bundle from housing. See Figure 2-289.

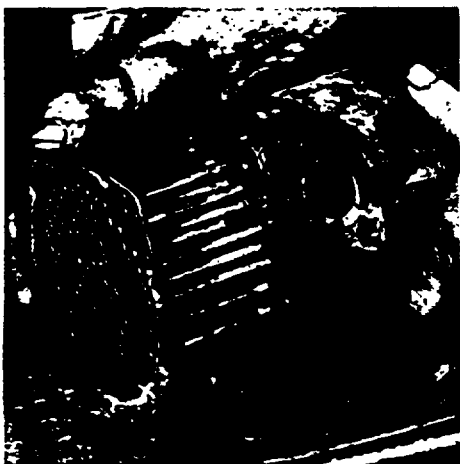


Figure 2-289. Removing Bundle

3. Scrape off end cover gaskets. See Figure 2-290.



Figure 2-290. Scraping End Cover Gasket

4. Remove oil supply line gasket. See Figure 2-291.



Figure 2-291. Scraping Oil Supply Line Gasket

5. Remove O-ring from housing. See Figure 2-292.



Figure 2-292. Removing O-Ring

NOTE

Visually inspect the housing for cracks which could lead to a leak. If the housing is damaged, replace with new.

6. The oil cooler bundle should be checked for leaks by pressurizing with 80 PSI air pressure and submerging in water. If leaks develop, replace bundle with new. See Figure 2-293.

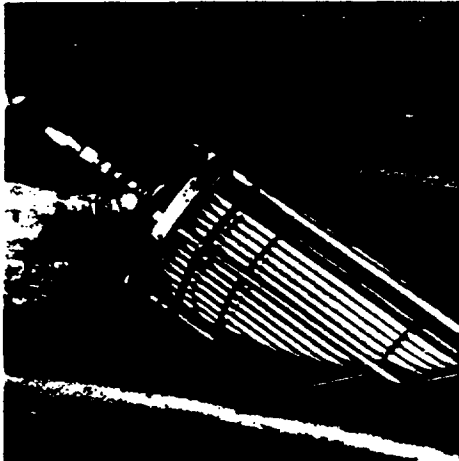


Figure 2-293. Water Testing Bundle

Oil Cooler Assembly

1. Lubricate O-ring. See Figure 2-294.



Figure 2-294. Lubricating O-Ring

2. Install O-ring in groove at water outlet end of the oil cooler. See Figure 2-295.



Figure 2-295. Installing O-Ring

3. Spread Perma-Tex gasket sealer on inlet water flange before installing gasket. See Figure 2-296.



Figure 2-296. Applying Gasket Sealer to Housing

4. Install gasket on water inlet end of housing. See Figure 2-297.



Figure 2-297. Installing Gasket

5. Spread Perma-Tex gasket sealer on top of gasket. See Figure 2-298.



Figure 2-298. Applying Gasket Sealer on Gasket

6. Install bundle. Tap last 1/2 inch with a soft-faced hammer to seat bundle past O-ring. See Figures 2-299 and 2-300 .

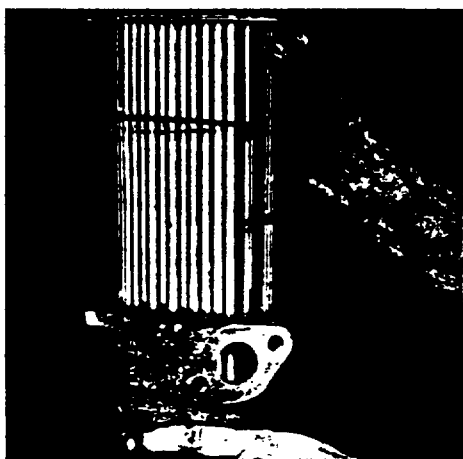


Figure 2-299. Installing Bundle



Figure 2-300. Tapping Bundle into Housing

7. Spread Perma-Tex gasket sealer on bundle end. See Figure 2-301.



Figure 2-301. Applying Gasket Sealer on Bundle

8. Place gasket on bundle end. See Figure 2-302.



Figure 2-302. Placing Gasket on Bundle

9. Spread Perma-Tex gasket sealer on top of gasket before installing the end cap. See Figure 2-303.



Figure 2-303. Applying Gasket Sealer on Gasket

18. Torque pulley nut to 100 lb.ft.
See Figure 2-334.



Figure 2-334. Torquing Pulley Nut

NOTE

When torquing the pulley nut on the shaft, it is necessary to use a strap wrench to keep the pulley and shaft from turning while tightening the pulley nut.

19. Place gasket sealer on the gasket seating surface of the housing. See Figure 2-335.



Figure 2-335. Applying Gasket Sealer

20. Place gasket on sealer making sure to line up the holes. See Figure 2-336.



Figure 2-336. Applying Gasket

21. Position housing cover assembly over housing. See Figure 2-337.

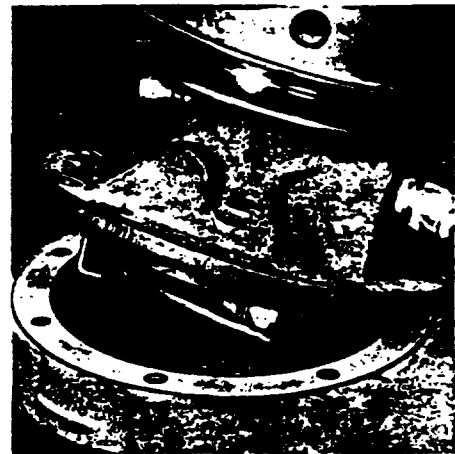


Figure 2-337. Positioning Housing Cover

22. Coat housing cover capscrew threads with sealing compound and tighten. See Figure 2-338.



Figure 2-338. Applying Sealer to Capscrews

CYLINDER HEAD GASKETS

Two (2) types of cylinder head gaskets are currently being used during engine rebuild. The "folded-steel" type gasket (see Figure 11) is used with the "flat-flange" type cylinder liner (see Figure 12).

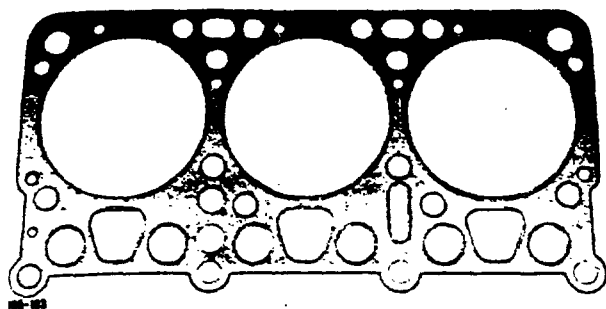


Figure 11. Folded-Steel Type Gasket

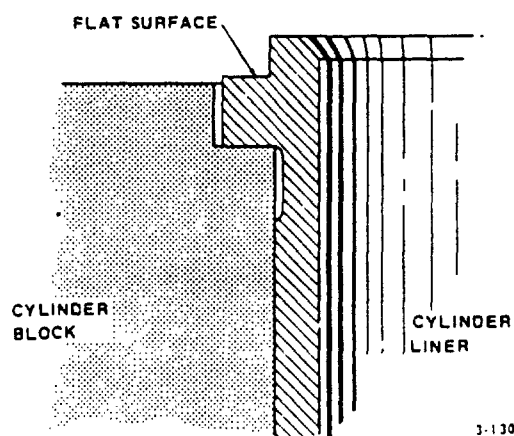


Figure 12. Flat-Flange Type Cylinder Liner

The "Maxidyne-Type" gasket (consisting of a one-piece composition gasket and three (3) fire rings as shown in Figure 13) must be used with the beaded-type liners as shown in Figures 14 and 15.

NOTE

Before assembly of cylinder head, always check the circular grooves in the head surface directly opposite the liner bead. They must be 0.008 in. deep and absolutely clean to assure a good fire ring seal.

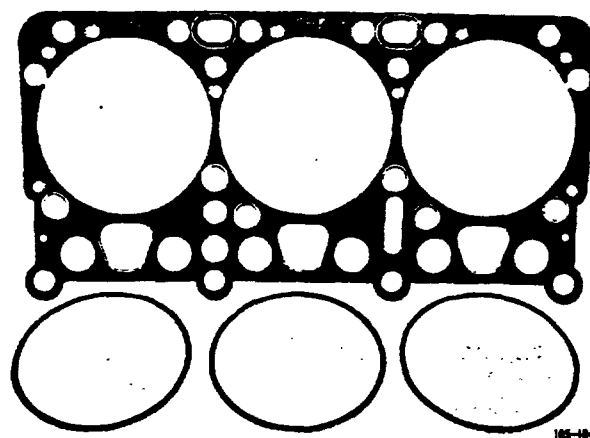


Figure 13. Maxidyne-Type Gasket (with Fire Rings)

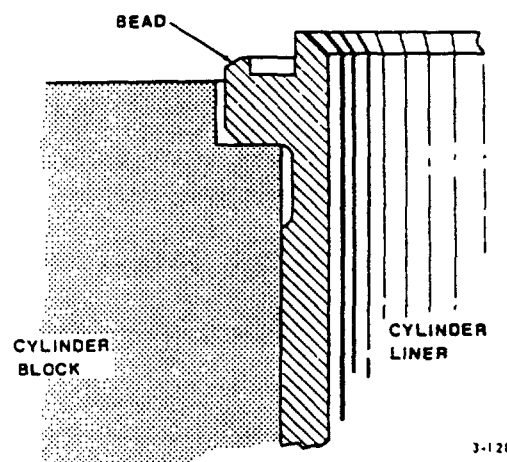


Figure 14. Beaded-Type Cylinder Liner (4-7/8 In. Bore)

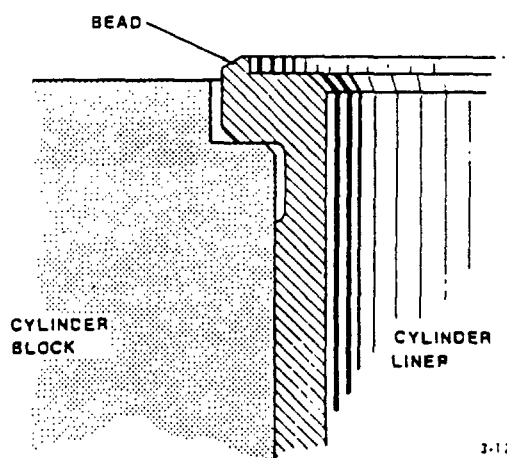


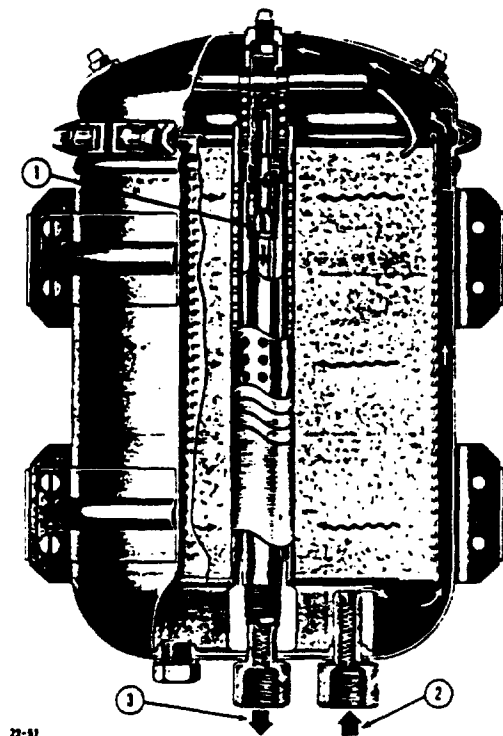
Figure 15. Beaded-Type Cylinder Liner (5 In. Bore-END707 and END711 Engines)

CAUTION

Always use new gaskets and fire rings when assembling engines.

OIL FILTERS

Early engine models had by-pass type oil filters. The quantity of oil going through this type of filter is controlled by a metering orifice. See Figure 65.

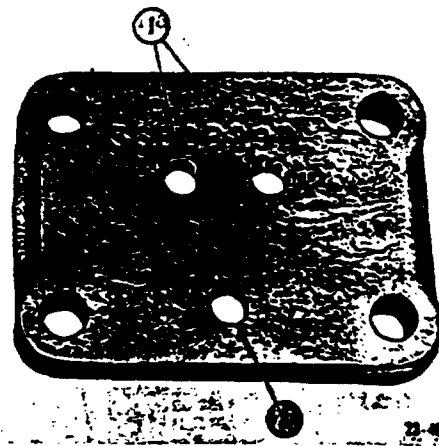


1. Metering Orifice
2. Oil Inlet
3. Oil Outlet

Figure 65. By-Pass Type Filter

This filter used flexible lines for oil supply to filter and oil return to engine. The oil lines are connected to a cover which is assembled to the oil filter pad on the left-hand side of the engine.

Because of revisions that have been made to the cast contours of the pad on the current cylinder blocks, oil filter pad cover, 368GB29D, and gasket, 590GB1152B, must be used with a by-pass filter installation. See Figures 66, 67, and 68.



1. Oil Pressure Feed Holes
2. Oil Drain Hole

Figure 66. Top View of Oil Filter Pad Cover

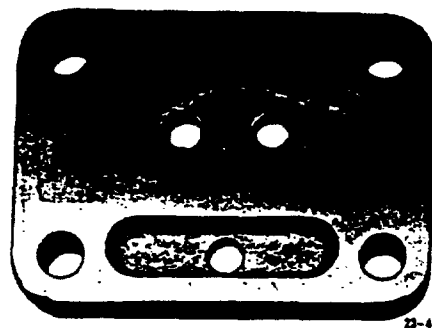


Figure 67. Bottom View of Oil Filter Pad Cover

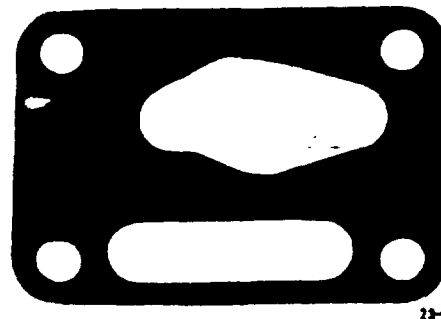


Figure 68. Oil Filter Pad Cover Gasket

CAUTION

Failure to use the correct cover and gasket, on current cylinder blocks, will result in low oil pressure and possible engine damage.

If the replaced engine has a full-flow by-pass type of filter, as shown in Figure 69 or a spin-on type filter, as shown in Figure 70, use the adapters or housings from the original engine.

Provisions have been made on both sides of the case to install buttress screws which fit into the main bearing cap. The buttress screws are used on both sides of all main bearing caps. They must be removed in order to remove the main bearing caps.

Block Preparation

1. Check the cylinder block deck surface for warpage. If warpage is excessive be sure that the maximum amount of material removal limit is not exceeded.

CAUTION

The piston travel above the cylinder block deck is critical and must be checked during assembly to insure proper clearance of piston with cylinder head and valve.

2. Remove all core plugs and fittings from the cylinder block and remove any accumulation of rust and sludges.

3. Check block for cracks, the condition of threaded holes and the straightness of the mating flanges.

4. Thoroughly inspect the upper edge of the cylinder sleeve counterbore in the block for signs of pitting or erosion. Rework as required. Shims are available to obtain correct sleeve height at reassembly.

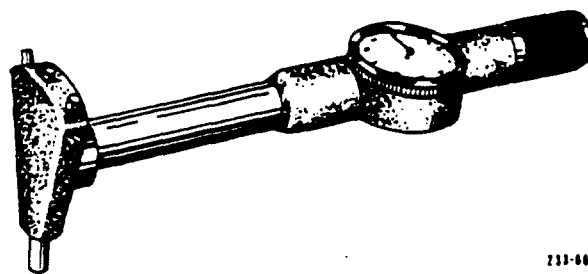
5. Blow all passages thoroughly with compressed air.

6. Coat new O-ring with sealant, place on core plugs and install plugs in block.

7. Install all oil gallery plugs and gaskets using Permatex sealant or equivalent to insure positive sealing.

Cylinder Sleeve

The cylinder sleeves are wet type, centrifugal cast iron and are available in standard size. A bead is provided around top of seating flange for using a fire ring type cylinder head gasket. Clean sleeve flanges using a brass wire rotary brush to be sure of effective fire ring sealing. Check cylinder sleeve for out-of-round and taper. Use tool J5347-01 and measure each sleeve I.D. See Figure 2-9. Take readings in two directions at each of three levels: top, center, and bottom.



211-44

Figure 2-9 Cylinder Sleeve Bore Measuring Tool

Check the sleeve height above the cylinder block deck. Use gage J26948. See Figure 2-10.

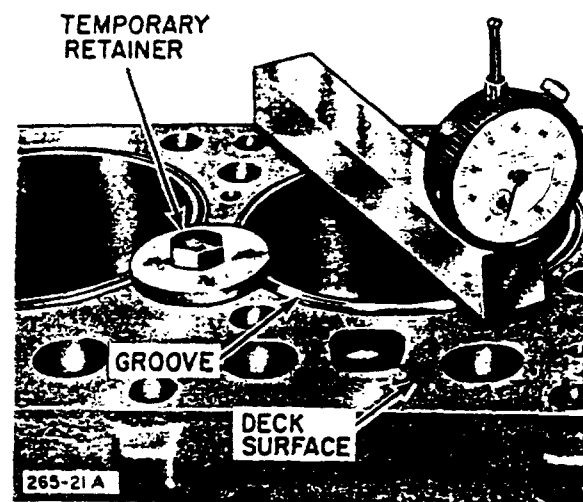


Figure 2-10. Checking Sleeve Height Above Block Deck

Honing

If sleeve bore when in place does not exceed out-of-round and taper limit, clean up I.D. with a suitable hone, 150 to 220 grit, to produce a diamond criss-cross pattern surface finish of 25 to 40 micro-inch rms.

Wash liner bore with a solution of household laundry detergent and air blow dry. Wipe liner bore with a clean oil soaked cloth.

Sleeve Rebore

If sleeve exceeds out-of-round and taper limit, the sleeve may be resized using boring bar equipment to receive the next applicable oversize piston. After re-sizing, hone 150 to 220 grit to produce a diamond criss-cross pattern surface finish of 25 to 40 micro-inch rms.

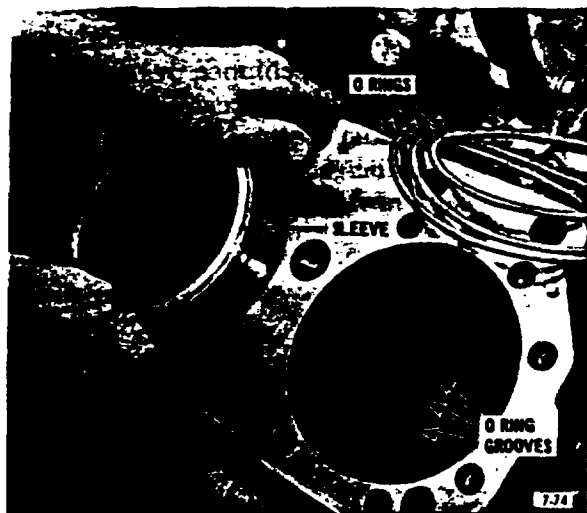


Figure 2-13. Installing Cylinder Sleeve

CAUTION

If for any reason the sleeve is backed out even as little as 1/8 inch, it may roll the top seal over the relief edge damaging the seal. Remove sleeve and replace seals.

8. Secure cylinder sleeve in pairs using keeper washer and capscrew at center cylinder head capscrew hole until pistons, rings and cylinder heads are installed.

Camshaft Bushings

There are two camshaft bushing widths. The front camshaft bushing is the wider bushing; the remaining bushings are of a narrower width. All bushings are located at set distances measured from the forward machined surface of the camshaft thrust washer recess to the forward edge of subsequent bushings. Use special tool kit J-21428 to install or remove bushings. Coat outer surface of the bushings with engine oil before installation. The oil supply hole in the bushing should be located to the right as viewed from above and standing to the rear of the engine. The camshaft bushing interlocking split should be installed upward. See Figure 2-14.

NOTE

The rear camshaft bushing can be removed, using special tool J-21385, without removing the flywheel housing.



Figure 2-14. Installing Camshaft Bushing

Expand the front oil gallery plug to offer resistance upon entering bore. The front oil gallery plug is further secured by installing the camshaft thrust washer which partially covers the plug. Patchlock countersunk Allenhead capscrews are used to secure the thrust washer in place. It is imperative that the mating surfaces be clean and new Patchlock screws are used. See Figure 2-15.

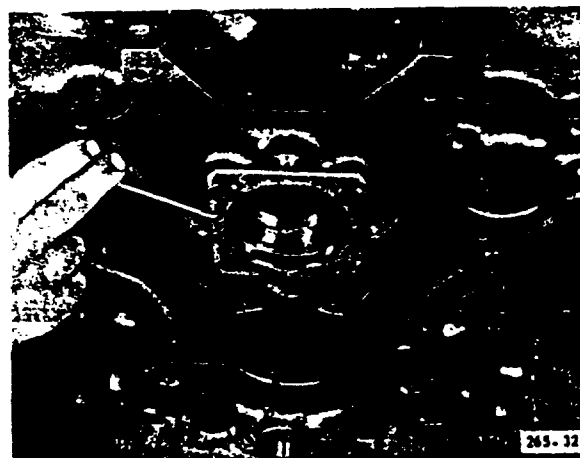


Figure 2-15. Installing Camshaft Thrust Washer

Apply a coat of Permatex to the rear oil gallery plug and gasket and install in rear oil gallery. See Figure 2-16.

4. Remove front bearing retainer and drive front bearing and spacer from housing out through the front.

5. Reverse housing and drive rear bearing from housing out through the rear.

Inspection

1. Inspect the water pump drive gear for wear pattern and condition of teeth.

2. Inspect and check shaft for journal wear and condition of internal spline.

3. Inspect and check condition of the bearings.

Assembly

1. Install front bearing (double row ball bearing) in housing from the front.

2. Install retaining ring, tapered side outward, in housing groove.

3. Start water pump drive gear and shaft assembly into the bearing bore. Do not completely install.

4. Rotate gear and tap with a soft face hammer until gear rotates concentric with the bearing.

5. Press gear and shaft assembly into bearing until it bottoms on shoulder on shaft.

6. Invert housing and gear and install spacer.

7. Install rear bearing with seal side outward in housing.

8. Clamp assembly in a suitable clamping fixture to hold gear and install water pump drive shaft screw. Tighten to recommended torque. 50 lb. ft.

9. Install O-ring in the groove on outer periphery of the housing.

10. Lubricate O-ring seal generously and install drive assembly in cylinder block recess with flat side of housing toward camshaft gear.

NOTE

It is important to generously lubricate O-ring seal before installing in block. This will prevent the O-ring from rolling on upper surface and restricting oil supply to the water pump bearings.

11. Install three water pump housing capscrews securing assembly in position. Tighten to recommended torque. 26 lb. ft.

TIMING GEAR COVER

Inspection

Inspect timing gear cover for dents, condition of threaded holes and straightness of flanges.

Installation

1. Install crankshaft front oil seal into the cover using tool J-21375.

2. Install the adjustable camshaft thrust button from the inside and position the washer and jam nut on the outside of the cover.

3. Adjust camshaft thrust button to its retracted position.

4. Install six guide studs. Two guide studs are used at the lowest point, highest point and one adjacent to the water pump drive and the final stud adjacent to the drive provision directly opposite the water pump drive.

5. Install the timing gear gasket over guide studs.

6. Install the timing gear cover over the guide studs and push cover into position.

7. Install all cover capscrews loosely.

8. Install water pump drive alignment tool J-21382 and crankshaft oil seal alignment tool J-21381. Torque all capscrews.

CRANKSHAFT VIBRATION DAMPER AND HUB

Inspection

1. Inspect crankshaft vibration damper hub for scoring, condition of flange, threaded holes and keyway.

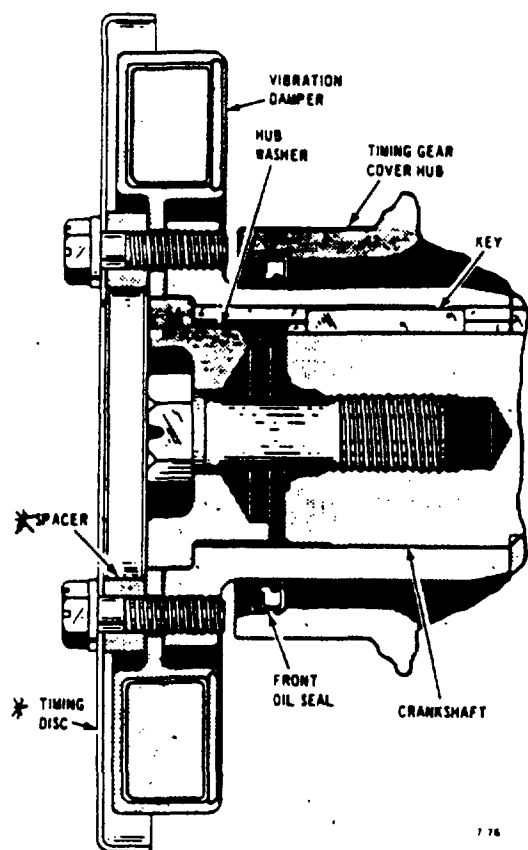
2. Inspect the vibration damper for general condition, mounting threaded holes and housing.

Installation

1. Position crankshaft keyway UP and install key.

2. Heat crankshaft vibration damper hub in hot oil to 250 degrees F.

3. Align crankshaft hub on key and install hub. See Figure 2-49.



* Not required on Current Production Engines

Figure 2-49. Vibration Damper and Hub Arrangement

4. Install hub washer and retaining screws. Torque screws.

5. Install vibration damper, spacer and timing disc on crankshaft hub; the holes will only line up one way.

6. Install retaining capscrews securing assembly.

NOTE

When all parts are assembled on the crankshaft, keyway up, the scribe mark on the damper rim must be up. The TDC mark must align with the timing indicator 30 degrees to the left of the engine centerline.

OIL PAN

Inspection

1. Inspect oil pan for dents, cracks and condition of flange.

2. Inspect and check the bolt holes for elongation and baffle for security.

3. Inspect and check drain hole for condition of threads.

Installation

1. Position gasket on oil pan and position oil pan on cylinder block.

2. Install and tighten oil pan retaining capscrews evenly to prevent oil leakage.

AUXILIARY DRIVE ASSEMBLY
NON-CURRENT (Figure 2-50) Prior to following:

Engine	Serial Number
ENDT(B)865	TB865 5F 9380
ENDT(B)865C	T865C 5M 5045
ENDT(B)866	T866 5F 8981
ENDT(B)866C	T866C 5M 4357

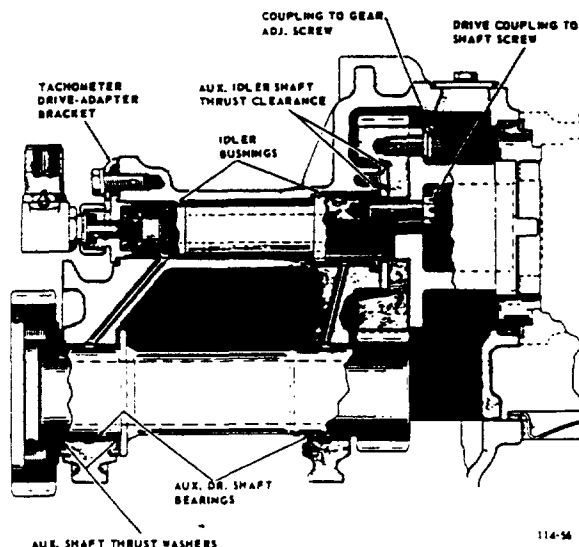


Figure 2-50. Auxiliary Drive Assembly

Description

The auxiliary drive is a complete unit sub-assembly located between the cylinder heads on the front of the engine. The auxiliary drive consists of a drive housing, idler shaft and gear assembly and drive shaft. It is gear driven from the camshaft.

DRIVE HOUSING

Description

The auxiliary drive housing is an alloy casting and supports the drives for the injection pump, air compressor, tachometer drive and hydraulic steering pump.

Installation

1. Time auxiliary drive to camshaft gear. Install both push rods in No. 6 cylinder location. Bar engine over until movement is felt in both push rods simultaneously and the timing indicator pointer indicates TDC for No. 1 and 6 cylinders. The single punch mark on the camshaft gear will be in the upright position.

2. Install O-ring in oil passage port at right hand front top edge of cylinder block.

3. Apply a bead of 243SX32 gasket compound or equivalent to mating surfaces of the auxiliary drive housing.

4. Place auxiliary housing assembly on top of the block carefully.

NOTE

Be sure timing gear cover gasket is properly positioned and the single timing mark on the camshaft gear aligns with the single timing mark on the auxiliary drive gear.

5. Install all nine capscrews and washers hand tight.

6. Torque the two lower timing gear cover to auxiliary housing capscrews.

7. Torque all auxiliary housing to cylinder block capscrews.

8. Release the torque on the two timing gear cover to auxiliary housing capscrews then retorque the same capscrews.

NOTE

This procedure will align auxiliary housing to front face of the cylinder block and permit block surface to butt fully to mating surface of auxiliary housing.

9. Check backlash between camshaft gear and auxiliary drive gear. If backlash is not within limits, loosen auxiliary housing capscrews and reposition housing by tapping with a soft faced mallet. Retorque capscrews and recheck backlash.

NOTE

Care must be taken at this time to have all pipe plugs in the auxiliary drive oil gallery passages. Access to these plugs becomes increasingly difficult at later assembly points.

VALVE LIFTER COVERS

The center valve lifter cover is a steel stamping and requires a new gasket at assembly. The rear valve lifter cover is cast aluminum. At assembly apply a bead of gasket compound 243SX32 to the cover and cylinder block mating area.

INJECTION PUMP

Installation

1. Bar engine over in the normal direction of rotation until the No. 1 cylinder piston is at TDC, as indicated by the timing indicator, and the timing marks on the auxiliary drive shaft gear aligns with the timing mark on the auxiliary drive idler. The pin hole location will be at the five o'clock position and the coupling tangs are at 12 degrees 36 minutes off the horizontal. See Figure 48.

2. Bar engine back approximately 40 degrees.

3. Bar engine over in the normal direction of rotation until timing indicator reads the B.T.C. setting as specified on the injection pump name plate. In this position the tangs on the drive coupling will be approximately horizontal and the drive coupling pin hole will be approximately at the 4:30 o'clock position. The gear marks will be approximately 15 degrees 30 minutes to the right. See Figure 2-55.

NOTE

End play is controlled by the drive shaft thrust washers. Check the following if the end play does not fall within the correct specification. Make corrections as required.

1. Worn thrust washers.
2. Worn thrust journals.
3. Shaft bushings not properly installed.

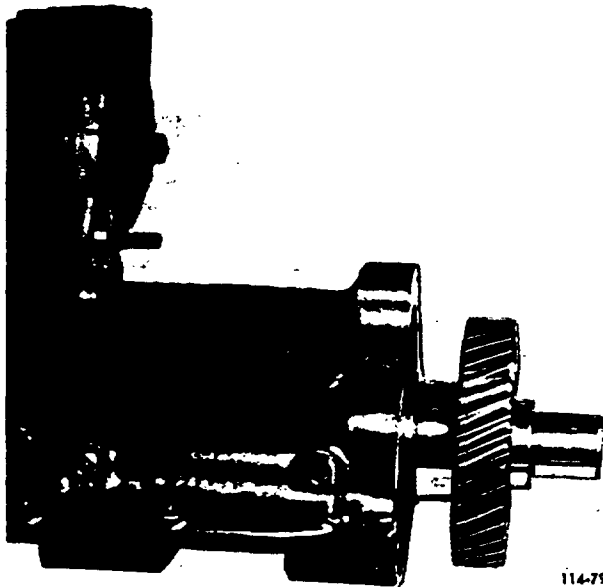


Figure 2-79. Auxiliary Drive Gear

13. Install auxiliary drive gear retaining ring. See Figure 2-80.

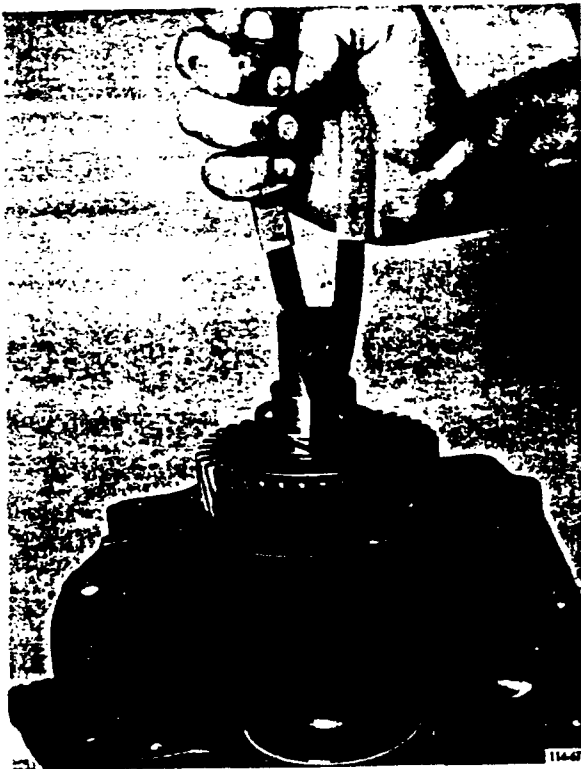


Figure 2-80. Installing Retaining Ring

14. Place the auxiliary housing on end and check end play with a dial indicator.

INSTALLATION

1. Thoroughly clean the auxiliary housing mounting surface on the engine block and remove the exposed portion of the timing gear cover gasket.
2. Carefully cut a new timing gear cover gasket to the exact size of the removed portion and install on the timing gear cover using a good grade gasket sealer.

NOTE

Apply an extra bead of gasket sealer where the new gasket meets the old gasket.

3. Install a new O-ring seal in the engine block to auxiliary oil supply port.
4. Apply a bead of Silastic to the mounting surface of the block. Use extreme care not to allow the Silastic to enter/block the oil supply port. See Figure 2-81.

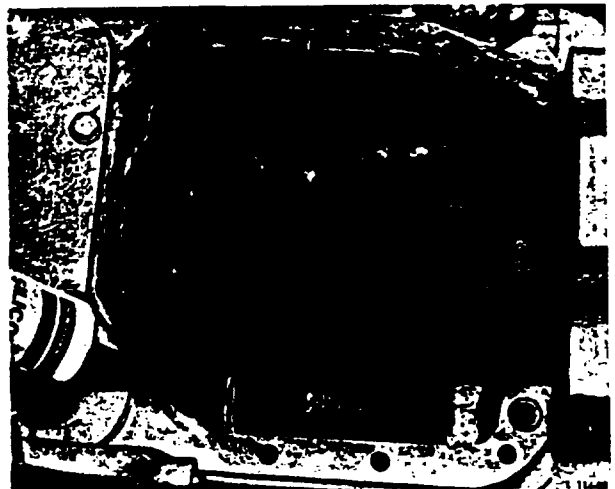


Figure 2-81. Applying Silastic

5. Install the auxiliary housing on the engine block.

CYLINDER HEAD INSTALLATION

NOTE

New cylinder head gaskets and fire rings must be installed each time cylinder heads are removed.

1. Clean the cylinder block deck thoroughly.
2. Install new cylinder head gasket on deck. Position of gasket is determined by guide pins in the upper deck.

NOTE

Do not use a sealing compound or soak cylinder head gaskets. They are all pre-coated.

3. Install new fire ring carefully fitted over circular bead on cylinder sleeve flange. See Figure 2-102.

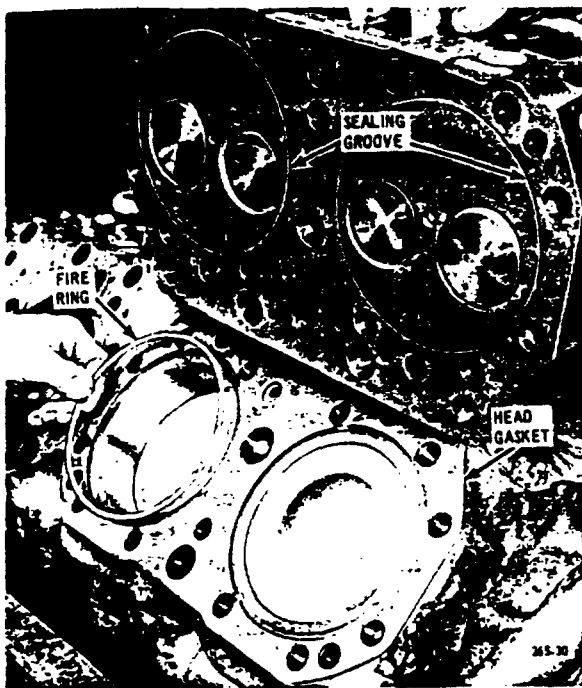


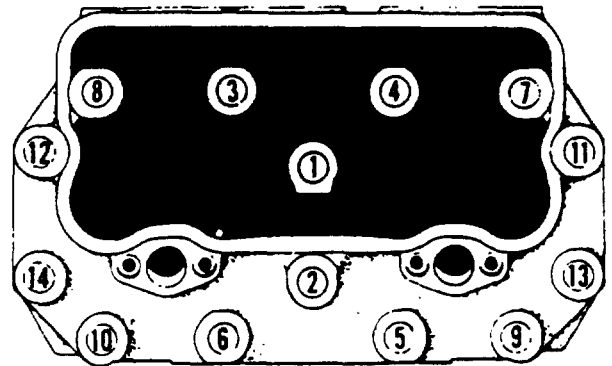
Figure 2-102. Cylinder Head Installation

4. Clean the surface of the cylinder head and circular groove for the fire ring.
5. Carefully position the cylinder head assembly over the cylinder block deck aligning the guide pins in the block with the guide holes in cylinder head.

6. Install cylinder head on block.

7. Install fourteen cylinder head capscrews.

8. Torque capscrews on each head progressively in steps of 50 to 100 to 175, and finally to 225 lb. ft. in sequence as shown. See Figure 2-103.



105-73

Figure 2-103. Cylinder Head Tightening Sequence

PUSH RODS

Description

The push rods for the intake and exhaust valve rocker arms are tubular steel with spherical ends. Engines not fitted with the Dynatard engine brake feature identical 1/2 inch O.D. x 14-17/64" push rods; however, when the engine is fitted with the Dynatard engine brake system the exhaust valve rocker arm push rod is a solid steel rod 5/8 inch O.D. x 14 inches long.

Inspection

1. Inspect and check the push rods for length and straightness. Replace any that are bent.
2. Inspect and check the spherical surfaces for wear and tightness to tube.

Installation

Apply a light coat of lubricating oil to the spherical ends and install the push rods in the valve lifters.

4. Continue adjusting valve lash for the remaining cylinder pistons in firing order placing each cylinder piston at TDC with respective 1/4 turns of the engine crankshaft.

5. Properly secure adjusting screw locknut after each cylinder piston valve lash adjustment.

INLET MANIFOLD

Inspection

1. Inspect and check the inlet manifolds for restrictions.

2. Inspect and check mounting flanges for erosion, cracks and straightness.

Installation

1. Place new gaskets between the inlet manifold and cylinder head.

2. Install right and left hand inlet manifolds and lifting eyes. Secure to cylinder head by installing attaching capscrews and tighten to the recommended torque.

3. Place a new inlet manifold fitting gasket on the top of each inlet manifold and install inlet manifold inlet fitting.

4. Install tee fitting and complete inlet manifold assembly.

WATER OUTLET MANIFOLD

Inspection

1. Inspect water outlet manifold for restrictions.

2. Inspect and check mounting flanges for cracks and straightness.

Installation

1. Place new gasket between right bank and left bank water manifold and the mating cylinder heads.

2. Install and tighten attaching capscrews to the proper torque.

3. Install thermostats in the right and left bank water manifolds.

4. Install thermostat gaskets, water outlet fittings, thermostat seals and water outlet by-pass elbows.

5. Secure assembly to the water manifold by installing the attaching capscrews.

EXHAUST MANIFOLD

Inspection

1. Inspect and check the exhaust manifold for restrictions.

2. Inspect and check the mounting flanges for erosion, cracks and straightness.

Installation

1. Place new gaskets between exhaust manifold and cylinder head.

2. Install and tighten the attaching capscrews and washers to the proper torque.

CYLINDER HEAD COVERS

Inspection

1. Inspect and check the cylinder head covers for cleanliness, dents and straightness of flange.

2. Inspect and check breather in cover, if applicable, to be sure it is not plugged.

Installation

1. Cement a new gasket to the mounting flange of the cylinder head cover.

2. Position the cylinder head cover over rocker arms.

3. Install and torque cover retaining capscrews.

TURBOCHARGER

Description

The turbocharger is an exhaust gas driven air compressor. See Figure 2-106. The purpose of the turbocharger is to increase the supply of air to the cylinders and thus burn more fuel which in turn produces more power.

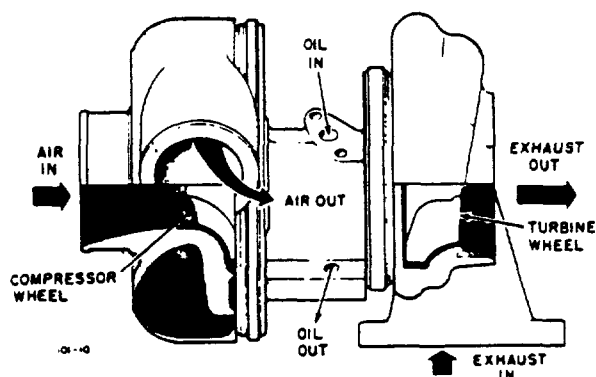


Figure 2-106. Exhaust Driven Turbocharger

The turbocharger consists of three main parts; the turbine housing, the bearing housing and the compressor housing. The turbine housing is located at one end of the bearing housing and the compressor housing is located at the other end. A common shaft connects the turbine wheel and compressor wheel.

The turbine end of the turbocharger uses exhaust gas energy normally discharged to the atmosphere. The exhaust gas enters the turbocharger through the flange connection on the exhaust manifold. The exhaust gas

flows around the turbine housing and radially inward causing the turbine wheel to rotate. The exhaust gas is then discharged through the center of the turbine housing into the exhaust pipe.

The bearing housing contains the through-shaft, bearings, seals, and oil passages.

The bearings are of the floating sleeve type and are pressure lubricated from the engine oil supply system. Piston ring type oil seals are used at each end of the shaft to effectively seal off the oil.

The compressor housing contains the compressor wheel and air enters at the center of the compressor wheel and flows radially outward into the compressor wheel and flows radially outward into the compressor housing. The air leaves through a tangential outlet on the outside of the compressor housing and is ducted to the inlet manifold.

Checks Before Removal

If turbocharger malfunction is suspected, make the following checks before removal of turbocharger from the engine.

1. Start engine and check for unusual noise or vibration from turbocharger. This will indicate out-of-balance, rubbing or damage to compressor or turbine wheels.
2. Check for leaks in the air system from turbocharger to intake manifold and from intake manifold to cylinder block. Be sure all bolts, clamps and connections are tight and gaskets are not blown and are in proper location.
3. Check air cleaner and air intake system, from the air cleaner to turbocharger, for restrictions to air flow or leaks.
4. Check exhaust system from cylinder block to turbocharger for exhaust leaks. Be sure all bolts, clamps and connections are tight and gaskets are not blown and are in proper location.
5. Check exhaust system from turbocharger to outlet for restrictions.

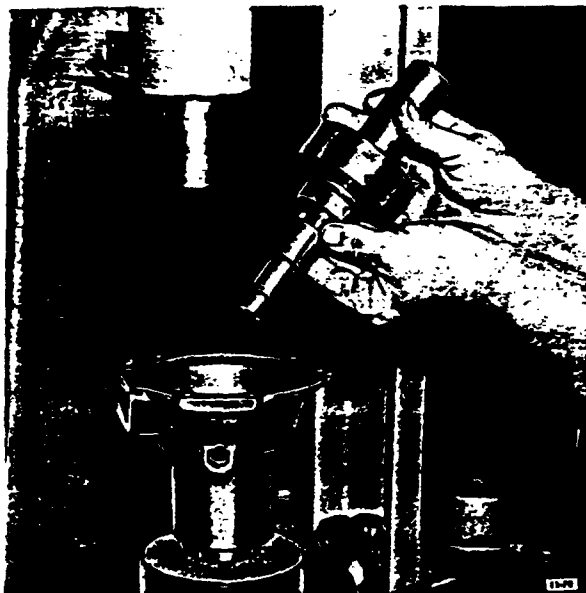


Figure 2-109. Installing Fan Drive Shaft
V-8 Series

9. Invert housing on press stand and support coupling end of shaft on press base. Install long housing capscrew and lockwasher before installing fan drive pulley.

10. Install long key in shaft, align, and using a suitable tool to engage inner part of hub, press hub on shaft. See Figure 2-110.

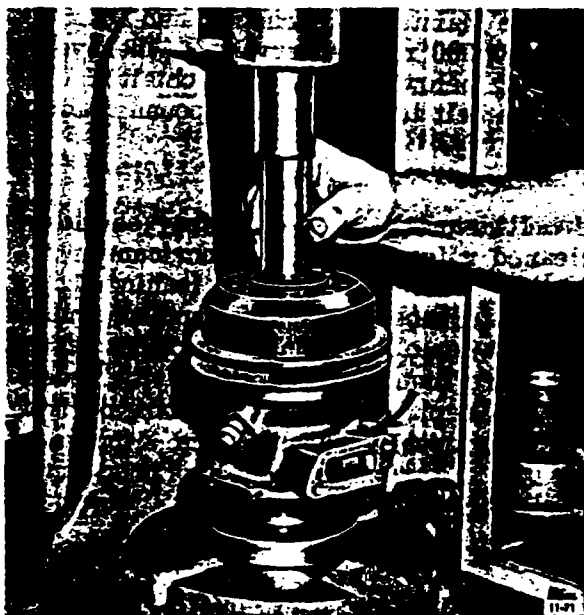


Figure 2-110. Installing Fan Drive Hub

11. Place housing assembly on a suitable adaptor in vise and install hub retaining washer and locknut. See Figure 2-111.

12. Install grease vent. (Install auxiliary driveshaft extension, if removed).

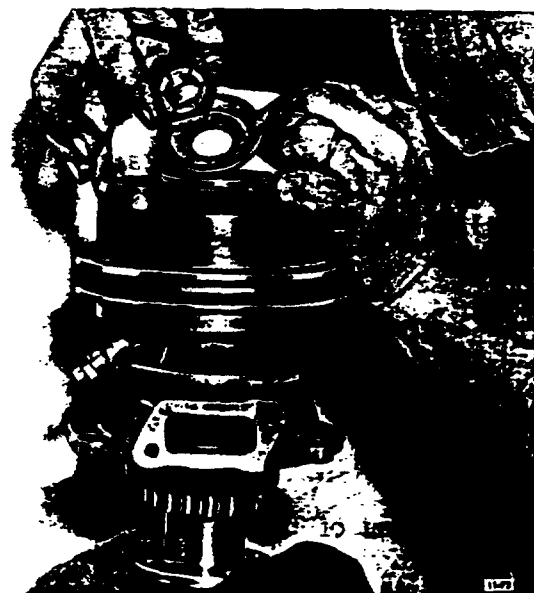


Figure 2-111. Installing Hub Retaining
Washer and Locknut

Installation

1. Place new gasket on housing and install housing, grease vent at top, aligning coupling with auxiliary driveshaft extension.

2. Assemble fan to hub. Be sure bolts are proper length, 3/8-16 x 7/8 inch.

CAUTION

Longer bolts will engage inner member and cancel out vibration absorbing effect of elastic insulator and shorten service life of fan drive assembly.

3. Install fan belt. Refer to Fan Belts for proper tensioning.