# ENGINE FEATURES


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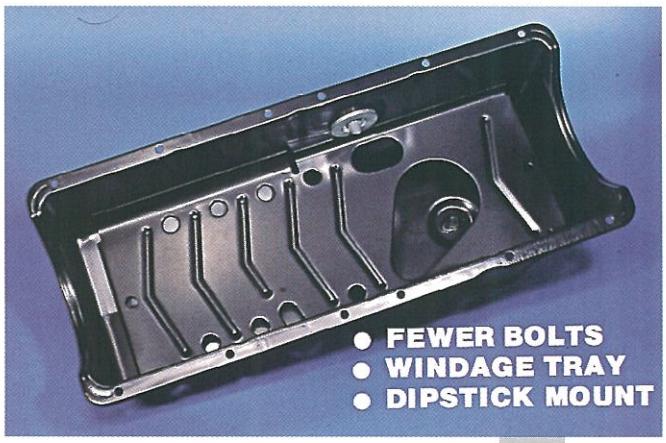
### OIL PICK UP TUBE

- The **oil pump pick up tube** is bolted directly to the engine's front cover and is sealed by an "O"-ring. The pick up tube is also secured by a bracket fastened to a main bearing cap.

### OIL PAN

- The **oil pan** is secured by 12 bolts and is sealed with Wacker® T-95 RTV sealant.
- A **windage tray** is used to minimize oil aeration within the crankcase.
- The **dipstick mount** is sealed with a replaceable "O"-ring.

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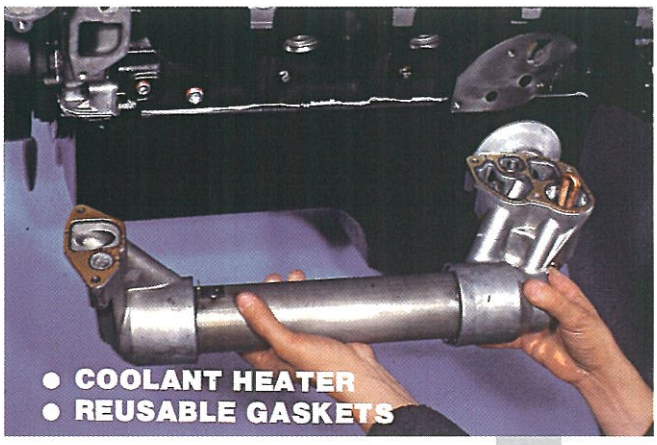


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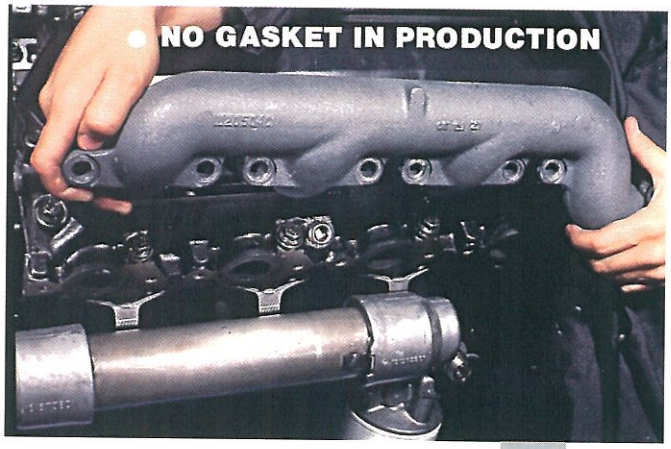
### OIL COOLER

- The **oil cooler** assembly is sealed to the front cover and the crankcase with reusable gaskets.
- The **coolant heater** is threaded into the rear header of the oil cooler.

# ENGINE FEATURES

## EXHAUST MANIFOLD

- The nodular iron **exhaust manifolds** will not be sealed by gaskets in production. Exhaust gaskets will be available for service.
- To ease manifold installation, one manifold bolt hole is smaller in diameter to accurately position the manifold. This bolt should be installed first.

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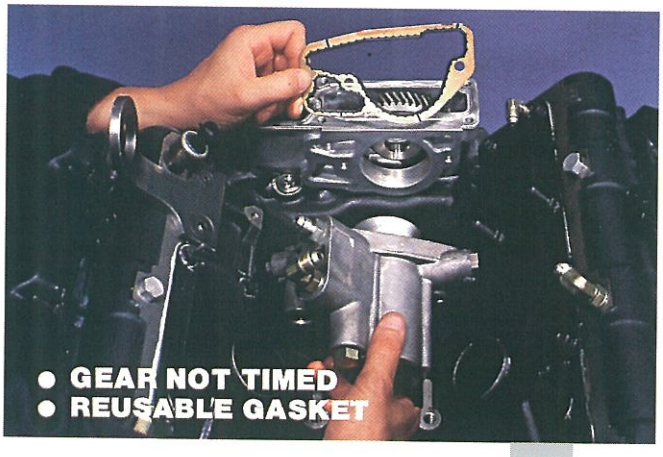


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## HIGH PRESSURE PUMP

- The **high pressure oil pump** is sealed to the front cover with a reusable gasket.
- The high pressure oil pump drive gear is not timed to the camshaft or to the pump.
- The gear is attached to the pump's shaft by a bolt requiring proper torque.

## HIGH PRESSURE PUMP DRIVE

- The **reservoir** which supplies oil to the high pressure pump is filled by a passage in the engine's front cover.
- The reservoir tower, sealed by an "O"-ring on the pressure side and Wacker® T-95 RTV sealant on the splash side, holds a constant supply of engine oil for the high pressure pump.
- The bolt securing the high pressure pump drive gear must be accessed by removing a plate on the front cover.


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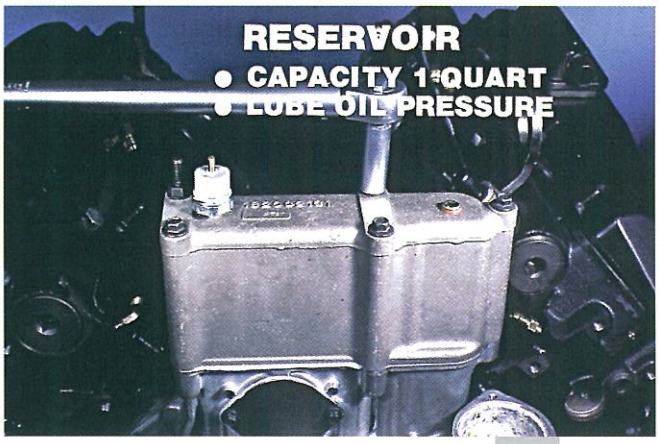
# ENGINE FEATURES

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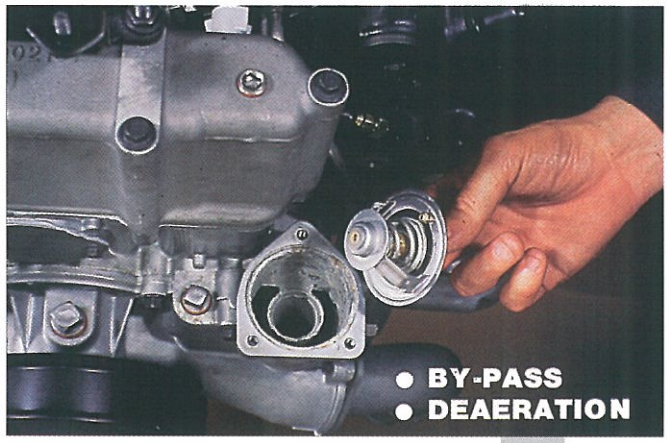
### RESERVOIR

- The **reservoir** contains approximately one quart of oil which is available to the high pressure pump for quick starting.
- The reservoir covers the top of the gear train. Mounted to the aluminum front cover, the attaching bolts must be properly tightened.
- Engine lube oil pressure is monitored by a sending unit in the reservoir.

### THERMOSTAT

- The **bypass** in the cooling system is incorporated into the water pump housing as the thermostat opens, the "hat" moves downward and seals the bypass closed, directing all coolant to the radiator.
- The thermostat incorporates a ball check type deaeration feature that facilitates engine coolant fill.

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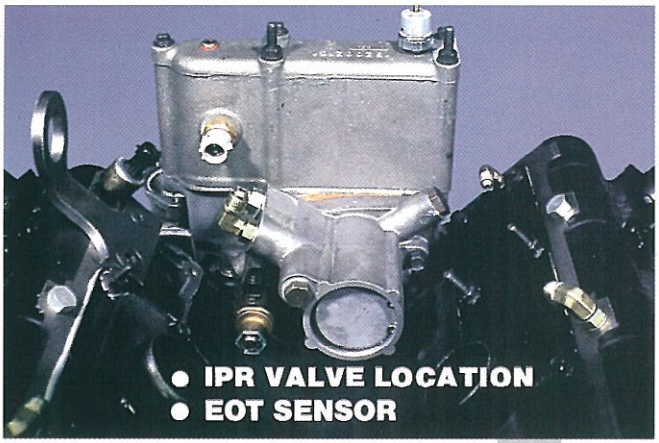


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### IPR VALVE

- The **IPR valve** (Injection Pressure Regulator) is controlled by the PCM to vary the oil pressure used to actuate the injectors.

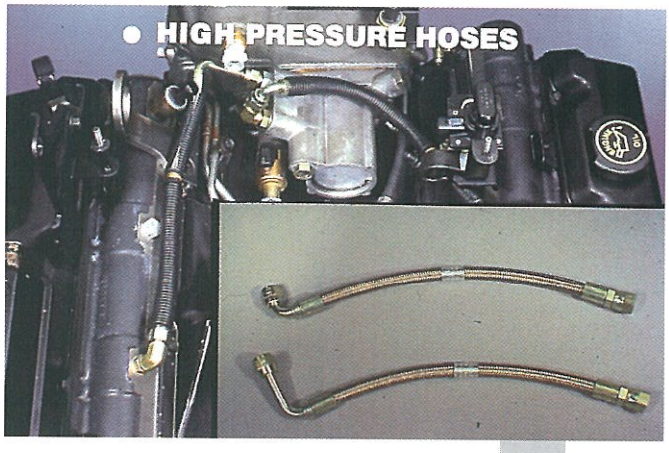
# ENGINE FEATURES

## HIGH PRESSURE HOSE

- **Hoses which have been specifically designed to withstand the high pressures and temperature differentials are used to direct the high pressure oil to the oil galleries in the heads.**

**IMPORTANT**

**Use only FORD certified replacement hoses for this application.**

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## TRANSFER PUMP

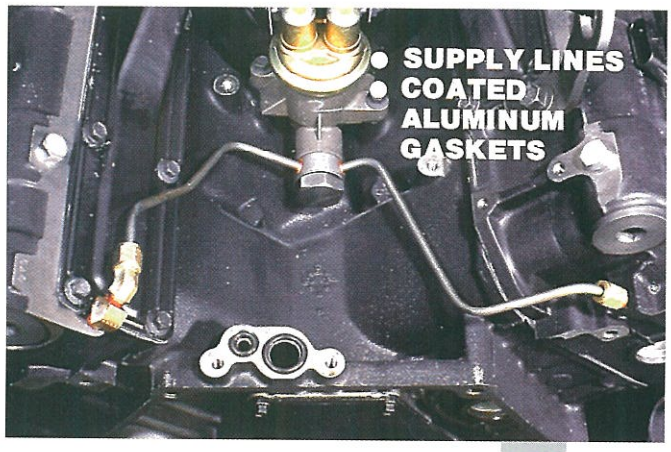
- The **fuel transfer pump** has two stages. The low pressure diaphragm stage lifts fuel from the tank and pumps it to the fuel filter. The high pressure stage raises fuel pressure to 40 to 70 psi in the cylinder head fuel galleries.

- The transfer pump mounts in the crankcase valley and is operated by a lobe of the camshaft using its own tappet.

## TRANSFER PUMP

- The fuel is directed into the rear of each cylinder head **fuel gallery**.

- The **banjo fitting** is sealed by coated aluminum gaskets on both sides. Steel lines are used to deliver the fuel.

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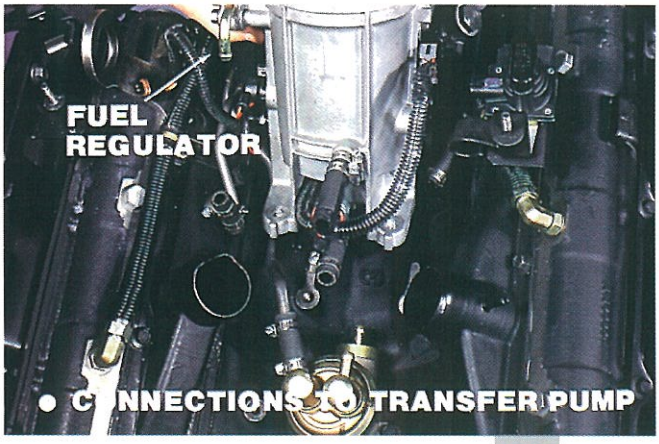
# ENGINE FEATURES

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## FUEL FILTER

- The ports at the top of the transfer pump are the low pressure inlet (left) and outlet (right). Outlet pressure (5-10 psi) is directed to the fuel filter. Filtered fuel is directed back to the transfer pump where its pressure is raised for delivery to the fuel gallerys in the heads.

- **Return fuel** from the fuel gallerys in the heads is directed to the pressure regulator on the filter housing. This pressure regulator also controls the quantity of fuel returned to the tank.

## FUEL RETURN HOSES

- **Use only certified replacement hoses of the correct part number when repairing the 7.3 DIT fuel system. Substituted hoses may not meet pressure and, or flexibility requirements needed for proper fuel system operation.**


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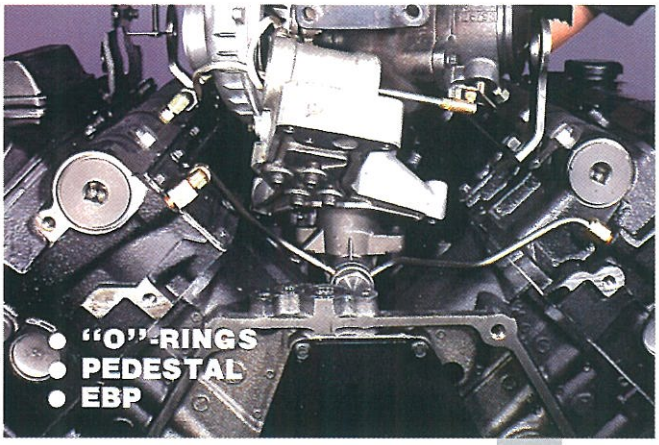


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## TURBOCHARGER

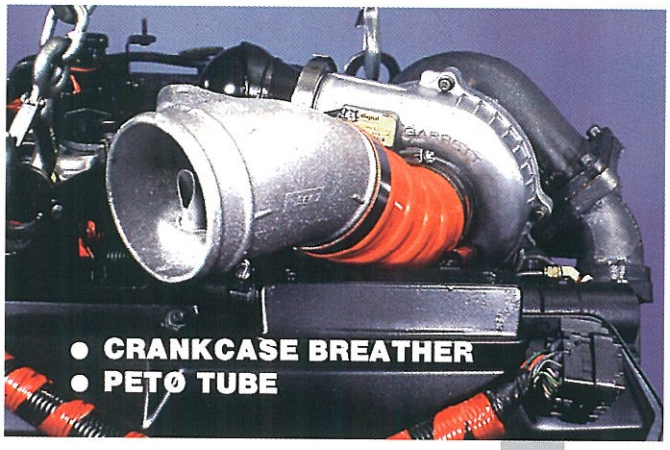
- The **turbocharger mounting pedestal** bolts directly to the crankcase and its internal passages for turbocharger lube and drain are sealed by "O"-rings. The pedestal may be removed from the turbocharger.

- Contained in the pedestal are the EBP (Exhaust Back-Pressure) regulator solenoid and the EBP piston. Oil regulated by the EBP solenoid actuates a piston which in turn operates the back-pressure control valve.

# ENGINE FEATURES

## CRANKCASE BREATHER

- The closed **crankcase breather** allows crankcase vapors to be drawn into the air intake system by intake air flow. The breather filter keeps oil from migrating into the intake system. The crankcase breather is sealed to the valve cover by "O"-rings.

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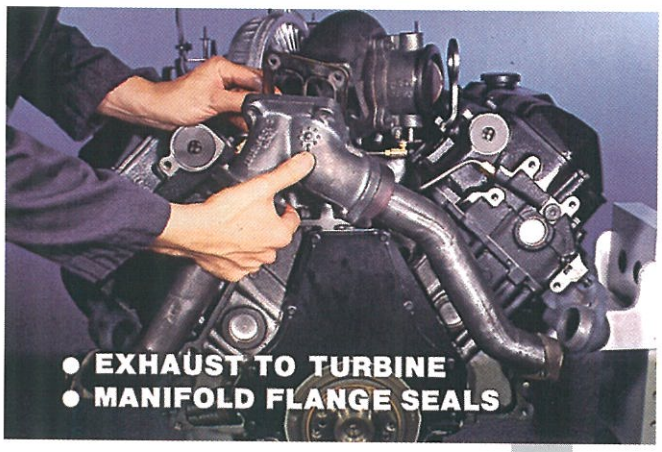


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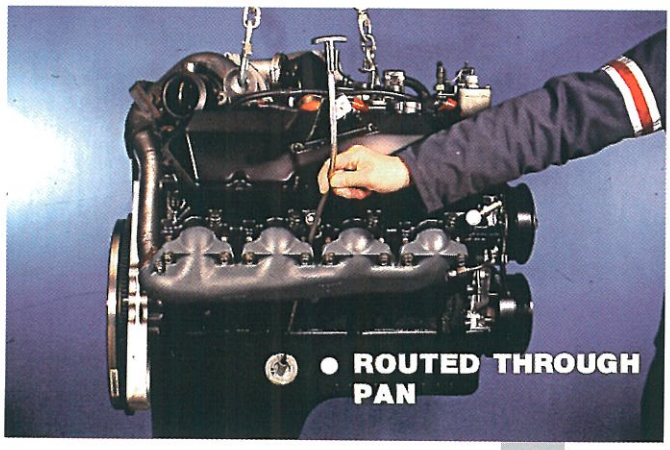
## TURBOCHARGER

- Exhaust gases are directed from the exhaust manifolds to the turbocharger through stainless **steel exhaust pipes**. The pipes are connected to the turbine collector which is designed to dampen exhaust pulsations prior to the turbine wheel.

## DIPSTICK

- The **dipstick tube** is bracketed to the valve cover bolts and goes through a mount on the oil pan. The mount in the oil pan is sealed by "O"-rings to the pan and to the tube.

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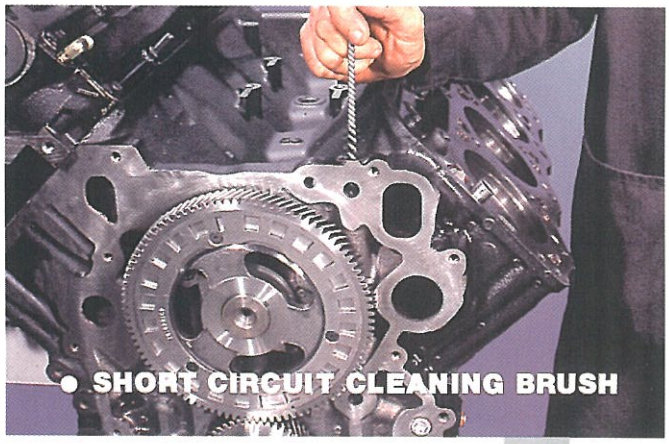
# UNIQUE SERVICE PROCEDURES TABLE OF CONTENTS

# UNIQUE SERVICE PROCEDURES

- The purpose of this section is not to replace the service manual, but rather to highlight unique service procedures. The service manual is designed to be all inclusive.

### SHORT CIRCUIT (OIL BYPASS)

- Inspect the ball and seat for erosion. Cleaning with a nylon brush will ensure cleanliness during engine rebuild.

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### CRANKCASE

- Cup plugs are used to seal the crankcase core clean out holes. This style of plug makes for easier removal and installation.

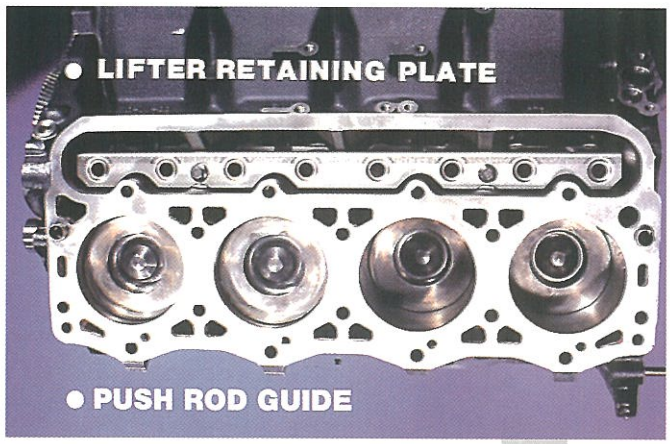
- Sealant should be used on the outer edge of the cup plug to ensure sealing.

- The installing tool, #OTC ZTSE-4309, will position the plug to the proper depth in the crankcase.

### CRANKCASE

- The closed valley of the crankcase requires the cylinder head to be removed to access the valve lifters. The retainer and openings in the cylinder head will not allow lifter removal.

- The retainer holds the guide plates in place and is used to guide the push rods into the valve lifters.

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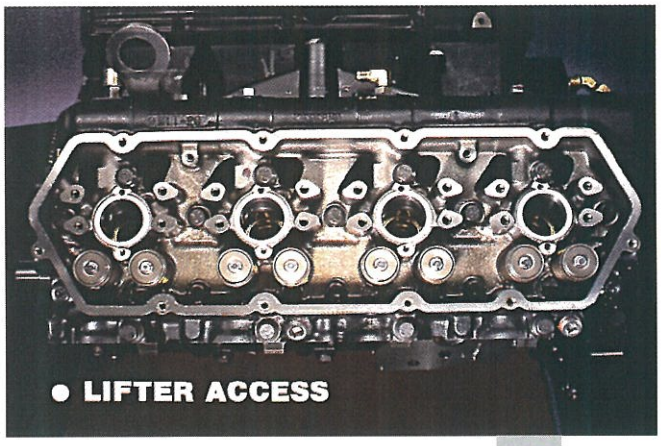
# UNIQUE SERVICE PROCEDURES

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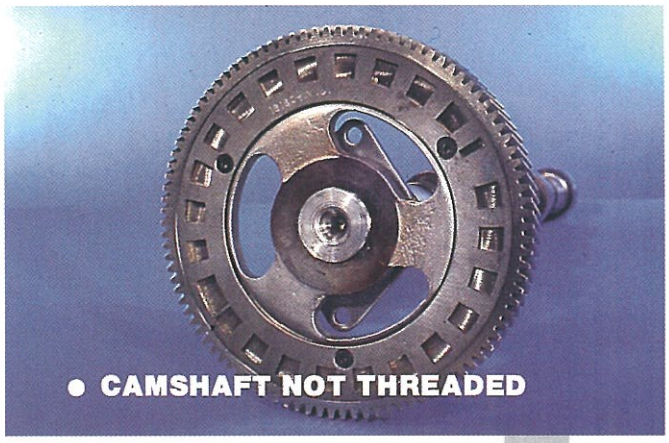
**CRANKCASE**

- With the cylinder heads installed, the tappets cannot be removed.

**CRANKCASE**

- The camshaft thrust plate is located between the camshaft gear and #1 journal.
- The camshaft gear is pressed onto the cam.

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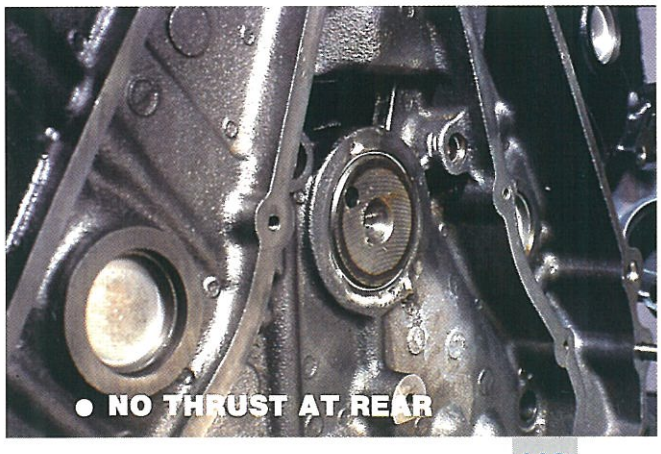


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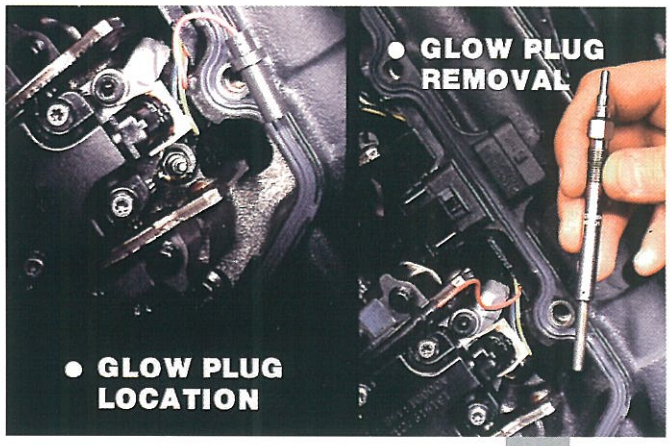
**CRANKCASE**

- Camshaft gear removal and installation should not be attempted with the camshaft in the engine, since the rearward movement of the camshaft is not limited.

# UNIQUE SERVICE PROCEDURES

### CYLINDER HEAD

- Glow plugs are under the valve cover and can be removed without removing rocker arms.
- The glow plug connector is a bullet connector pushed onto the glow plug.
- The glow plug tip extends into the combustion chamber, consequently the plug is longer than the IDI engine's plugs.
- Remove glow plugs, if heads are to be removed, to avoid damage.

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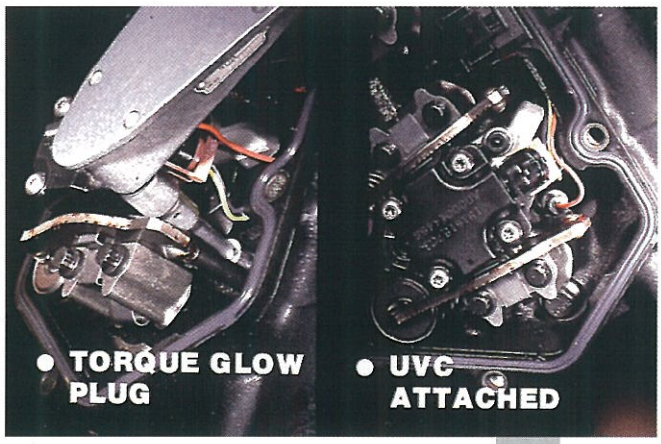


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### CYLINDER HEAD

- Glow plugs must be tightened to a specific torque to insure proper combustion seal. See service manual for specifications.

### CYLINDER HEAD

- The UVC connector is removed from the injector by spreading the retaining clips and pushing down on the connector. Care must be taken so the retaining clips are not broken by spreading clips too far.


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# UNIQUE SERVICE PROCEDURES


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### HIGH PRESSURE PUMP

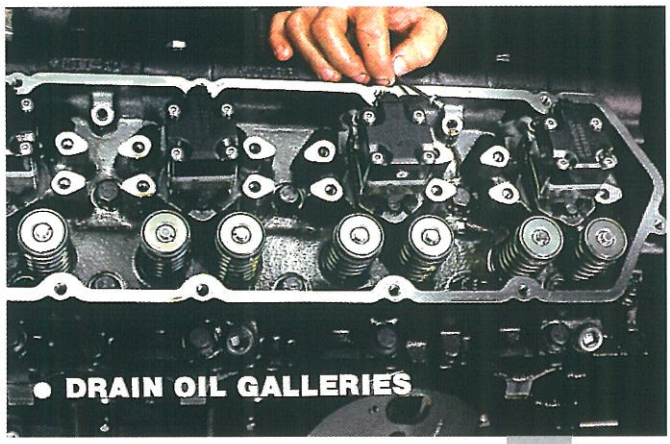
- Prior to removal of the high pressure pump or reservoir housing, the reservoir must be drained. This is accomplished by using a vacuum pump with a one quart container to extract the oil from the reservoir.

- If the reservoir is not drained, about one quart of oil will leak into the engine valley when the high pressure pump or reservoir is removed.

### INJECTOR REMOVAL (1)

- The high pressure oil gallery plugs must be removed to drain the oil. This will drain the gallery so when the injector is removed the oil gallery will not drain into the combustion chamber.

- The drain procedure recommended above will prevent the possibility of hydraulic lock, which will damage the engine when the starter is engaged.

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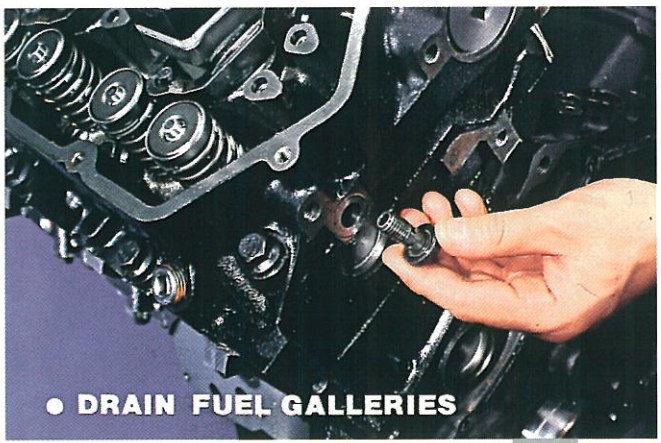


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### INJECTOR REMOVAL (2)

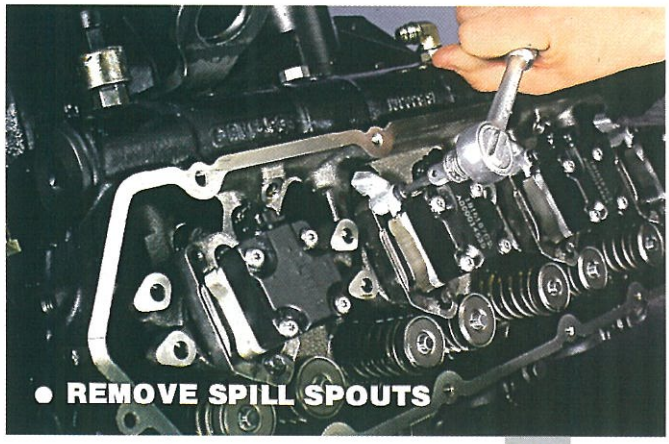
- The fuel gallery must also be drained prior to injector removal. This must be done so that when the injector is removed, the fuel does not drain into the combustion chamber.

- If the plugs at the front or rear of the engine are not accessible and any doubt exists whether liquid is on top of the piston, bar the engine over and use a vacuum pump to remove the liquid.

# UNIQUE SERVICE PROCEDURES

## INJECTOR REMOVAL (3)

- Remove the injector oil spill spouts prior to injector removal. The spill spout is bolted to the hold down clamp.
- The spill spout directs the oil that has been discharged from the injector into the camshaft area of the crankcase. This allows faster oil return to sump.

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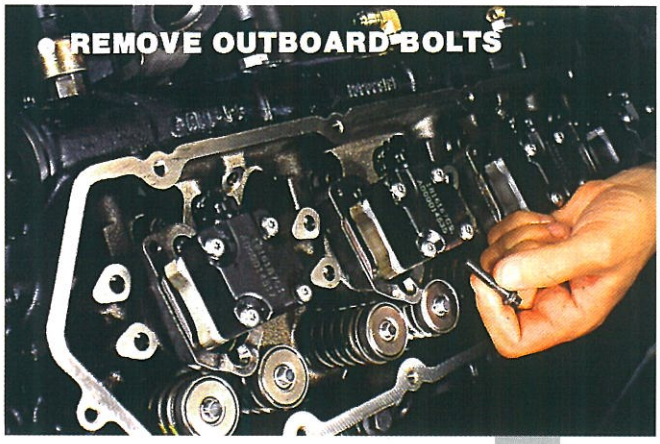


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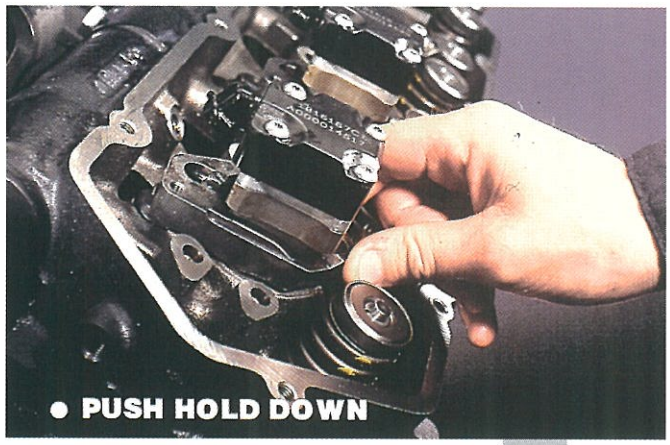
## INJECTOR REMOVAL (4)

- The outboard injector hold down bolt is removed to remove the injector. The inboard (towards valley) cannot be removed until the injector is out of the cylinder head.
- The injector hold down is slotted to facilitate disassembly.
- The inward bolt does not need to be removed or loosened.

## INJECTOR REMOVAL (5)

- With the outboard bolt removed, the hold down clamp can now be pushed towards the valley. This movement will allow the hold down clamp to be lifted over the inboard hold down bolt.

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# UNIQUE SERVICE PROCEDURES


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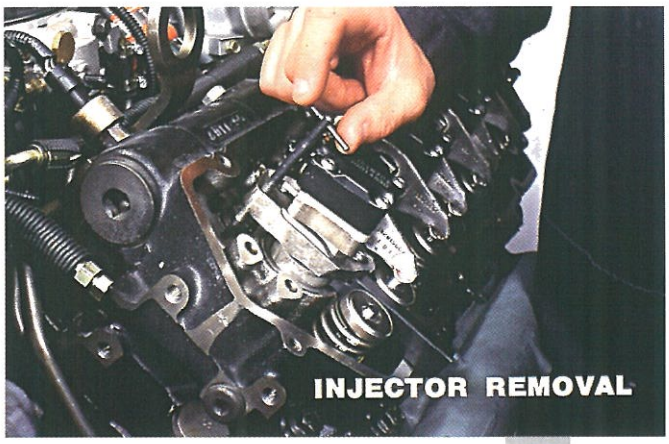
### INJECTOR REMOVAL (6)

- The injector removal tool, #T94T-9000-AH1, consists of two pieces.

### INJECTOR REMOVAL (7)

- With the hold down pushed toward the valley, place the removal tool under the injector hold down and install the T-handle bolt.
- Turning the T-handle will push the injector from its bore.

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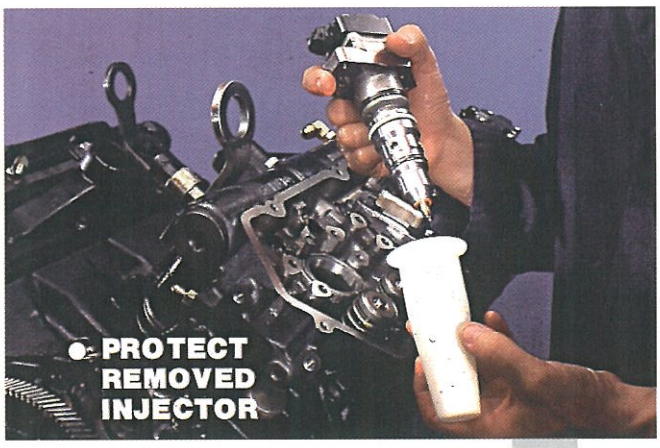


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### INJECTOR REMOVAL (8)

- The injector can be lifted from the cylinder head. This same process is to be used for all injectors.
- The injector should be placed in this protective sleeve for protection from contamination and tip damage. The sleeve tool #014-00933-2 is held on the injector by the injector "O"-rings.

# UNIQUE SERVICE PROCEDURES

### INJECTOR (9)

- Place injector and sleeve into holder tool, #014-00933-1, until ready for re-installation.


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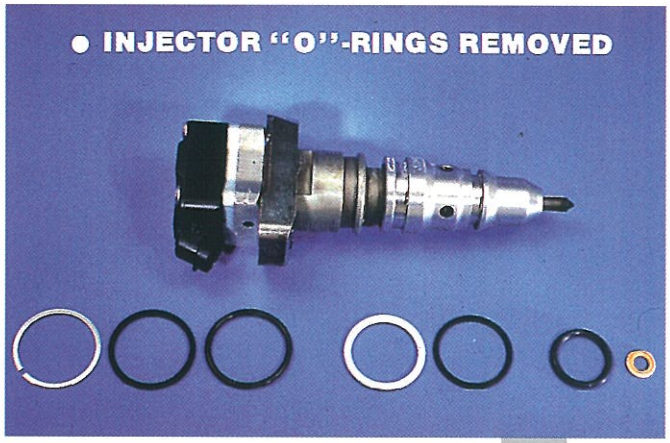
### INJECTOR

- This shows the proper "O"-ring installation. The "O"-rings are color coded for location.
- Engine oil should be used to ease "O"-ring installation.

### INJECTOR

- The "O"-rings are to be installed with the largest "O"-ring to the smallest (Top to Bottom).

| | |
|---|---|
| 1-Steel Back Up Ring | Upper Groove |
| 1-Back Up Rect. Section Ring | Upper Groove |
| 1-"O"-ring | Upper Groove |
| 1-"O"-ring | Middle Groove |
| 1-Back-Up Rect. Section Ring | Middle Groove |
| 1-"O"-ring | Lower Groove |
| 1-Copper Combustion Gasket | Bottom Surface |

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# UNIQUE SERVICE PROCEDURES


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### CYLINDER HEAD INJECTOR SLEEVE

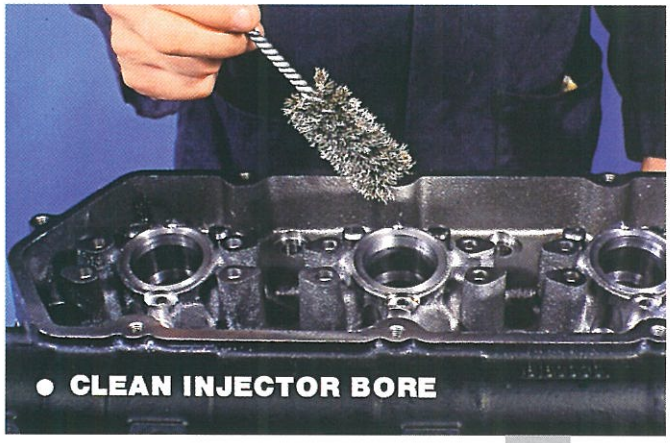
- The injector sleeve penetrates the cooling system so prior to removing the sleeve, the cooling system must be drained.
- Plug the sleeve to prevent debris from entering the power cylinder if the sleeve is removed in the chassis. Tool # 014-00934-3.
- This tap tool, #014-00934-1, threads the sleeve, then is attached to a slide hammer to pull out the sleeve. Use the pilot collar to keep the tap centered in the injector bore.
- Thread the slide hammer into the injector sleeve top and remove the injector sleeve from the cylinder head.

### CYLINDER HEAD

- With a wire brush clean up the injector sleeve bore in the cylinder head.

**IMPORTANT;**

- Remove all residual sealant from the sleeve seat in the cylinder head being careful not to damage the sleeve seat, i.e., scratch with a sharp tool, etc.

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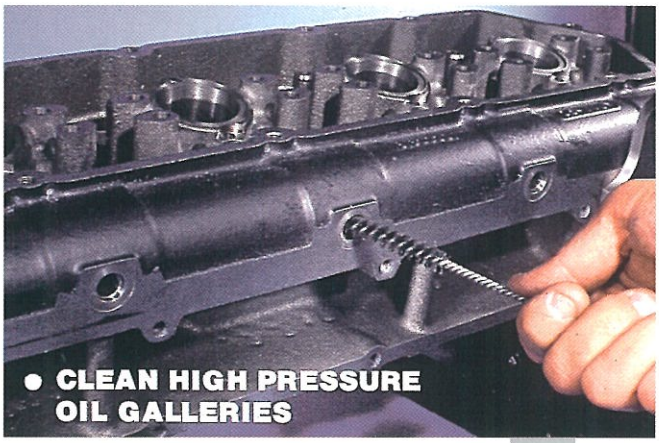


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### CYLINDER HEAD

- Use a rifle brush to clean out the high pressure oil galleries prior to installing new injector sleeve.

# UNIQUE SERVICE PROCEDURES

### CYLINDER HEAD
- Clean the fuel gallery prior to injector sleeve installation, to insure proper injector life.


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### CYLINDER HEAD
- This special tool, #014-00934-4, is used to install the injector sleeve because it is formed to match the sleeve. This will not damage the sleeve during installation. There is an "O"-ring on the tool that retains the sleeve while it is being set into the bore.

### CYLINDER HEAD
- With the injector sleeve on the installation tool, LOCTITE® No. 609 sealant should be applied. Note the two locations of sealant application.


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# UNIQUE SERVICE PROCEDURES


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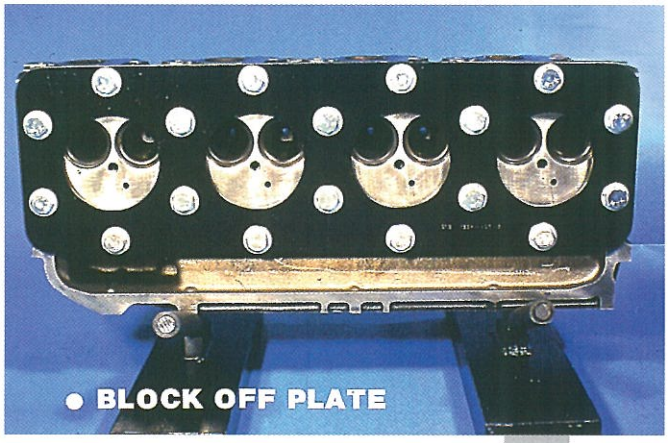
### CYLINDER HEAD

- Drive the sleeve into the injector bore until it bottoms in the cylinder head.

### CYLINDER HEAD

- The (non-essential tool) pressure test plate has a rubber gasket glued to it for sealing of the cylinder head. **This test should only be done when the cylinder head is suspected of leaking coolant.**

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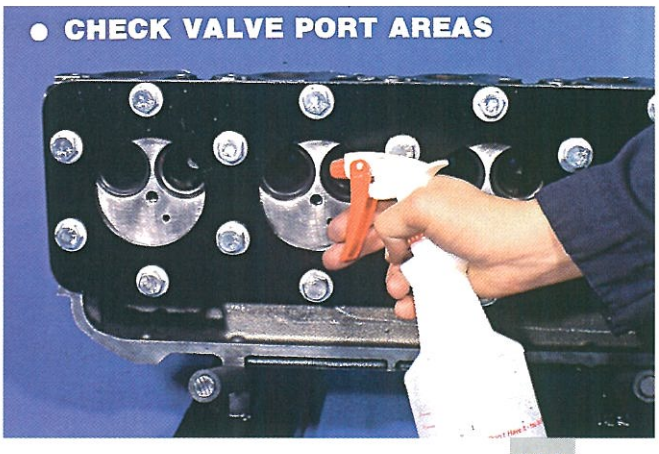


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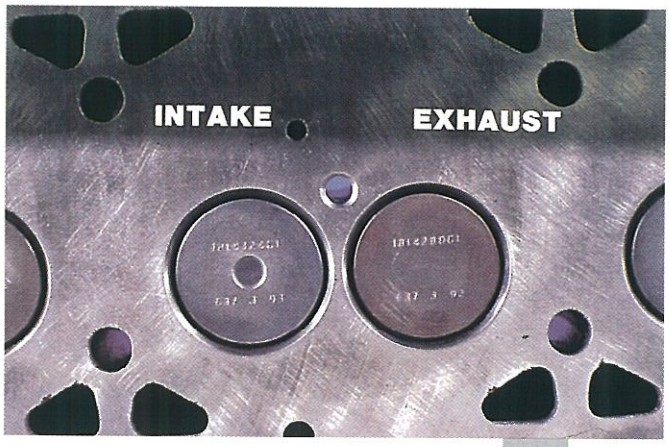
### CYLINDER HEAD

- With regulated air pressure applied to the cylinder head inspect the valve port, injector hole, and glow plug holes for leakage, using soapy water solution.

# UNIQUE SERVICE PROCEDURES

## INTAKE AND EXHAUST VALVES

- The intake and exhaust valve heads are the same diameter, but the valve seat angles are different. The intake valve has a dimple on it and can also be identified by the P/N stamped on the valve head.
- INTAKE P/N 1814424C1
- EXHAUST P/N 1814280C1

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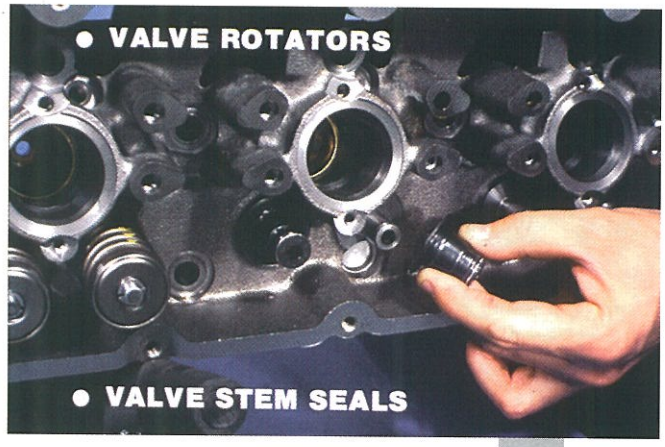


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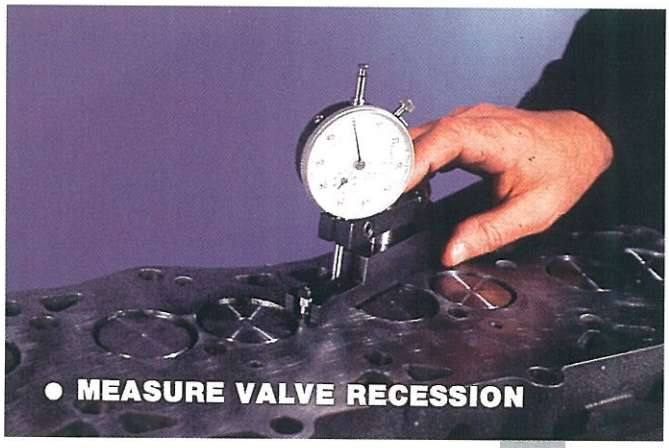
## VALVE STEM SEALS AND ROTATORS

- The valve guide seals fit over the guide and have the valve spring seat as part of the seal. A small spring around the seal maintains proper sealing to the valve stems for excellent oil control. The valve rotators are located on top of the valve spring.

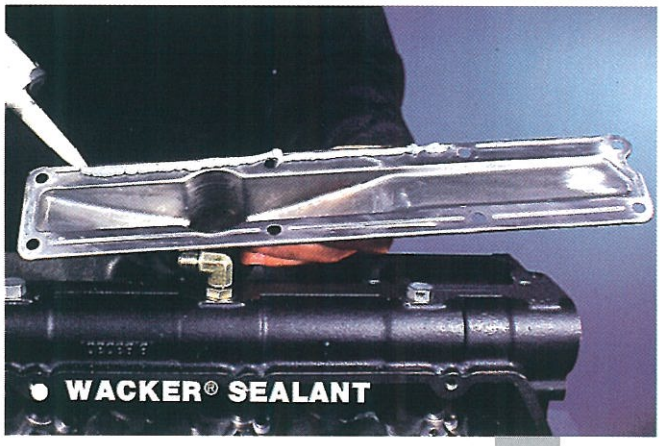
## VALVE RECESSION

- A surface gauge is used to measure valve recession in the cylinder head. This dimension is important because it affects the compression ratio. Zero the surface gauge to the cylinder deck. Then measure on the valve head. The difference is the valve recession. Compare measured dimension to specifications in the service manual. Do this for both intake valve and exhaust valves.
- Valve recession is controlled by grinding seats and valves or replacing valves.




139

# UNIQUE SERVICE PROCEDURES

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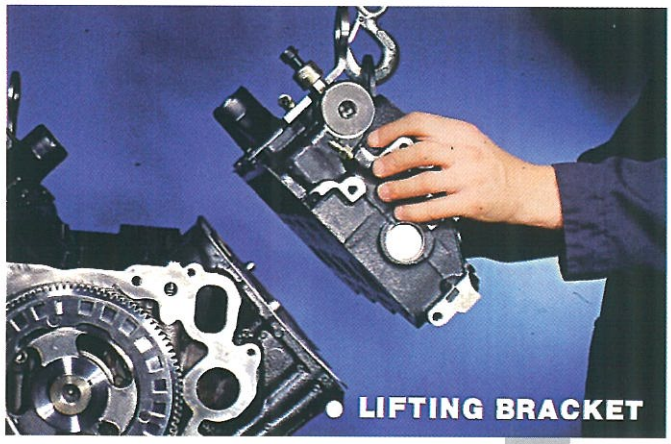
### CYLINDER HEAD

- The intake manifolds are sealed with Wacker® T-95 RTV sealant to the cylinder head. Place manifold on head and secure with capscrews by tightening to specified torque.

### CYLINDER HEAD

- The cylinder head lifting apparatus tool, #014-00932-2, simplifies handling the cylinder heads.

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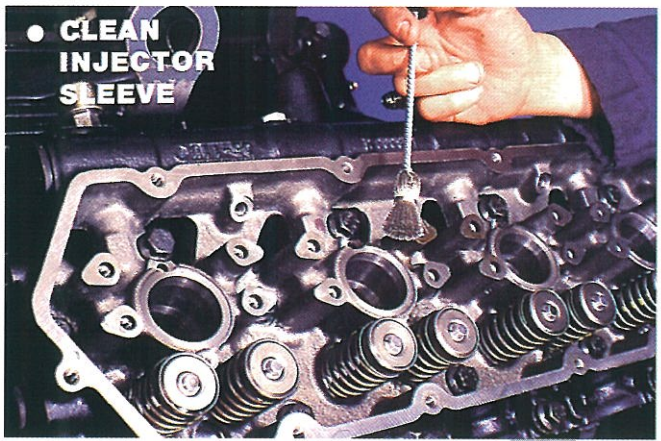


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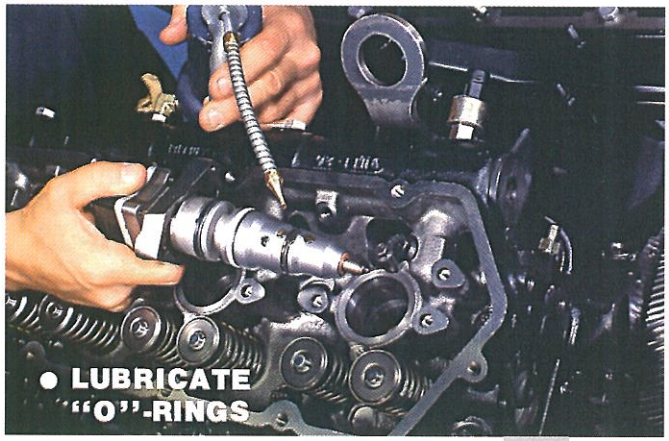
### INJECTOR INSTALLATION (1)

- Using a brush, clean the injector sleeve prior to injector installation.

### INJECTOR INSTALLATION (2)

- Check torque on inboard injector hold down bolts.

- Lubricate injector "O"-rings with clean engine oil prior to injector installation. Use grease on the copper gasket to retain it to the injector during installation.

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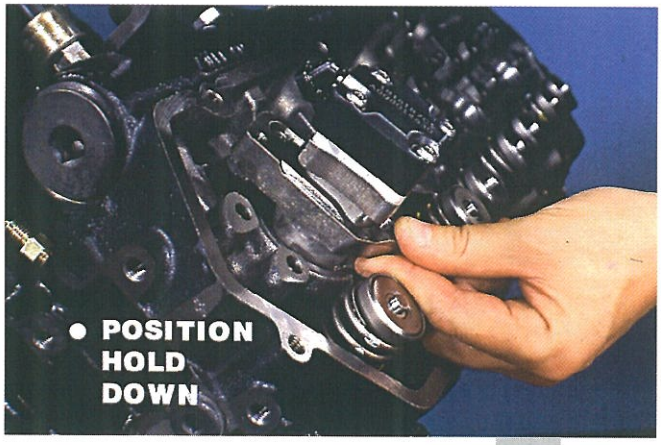


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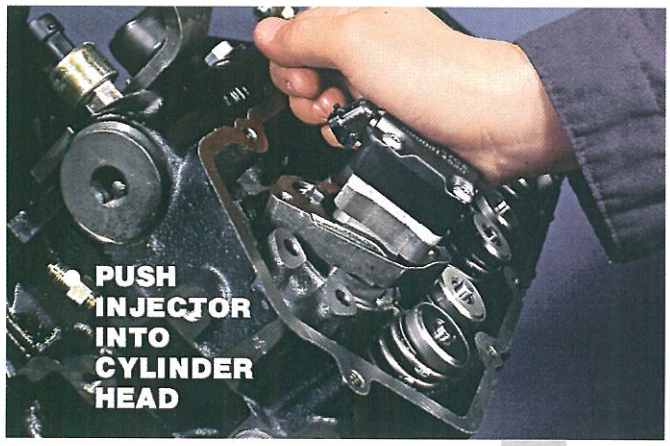
### INJECTOR INSTALLATION (3)

- Set the injector in the bore and push the hold down towards the valley so it drops over the in-board hold down shoulder bolt.

### INJECTOR INSTALLATION (4)

- By hand, push the injector in place. **Never pound or pry on the solenoid as this could damage the injector. Where space is limited use the special tool to position the injector.**

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# UNIQUE SERVICE PROCEDURES


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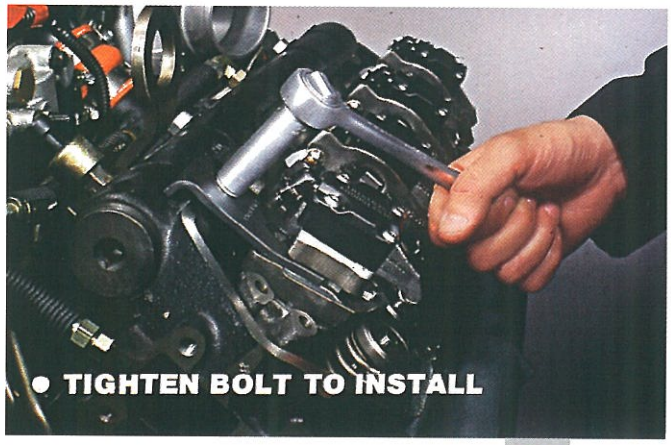
### INJECTOR INSTALLATION (5)

- An installation tool, #T94T-9000-AH2, should be installed to properly seat the injector in the sleeve.

### INJECTOR INSTALLATION (6)

- With a wrench, tighten the installer bolt to bottom the injector into the bore, then remove the tool. At this time, the hold down will fall into place, so the out-board bolt can be installed.

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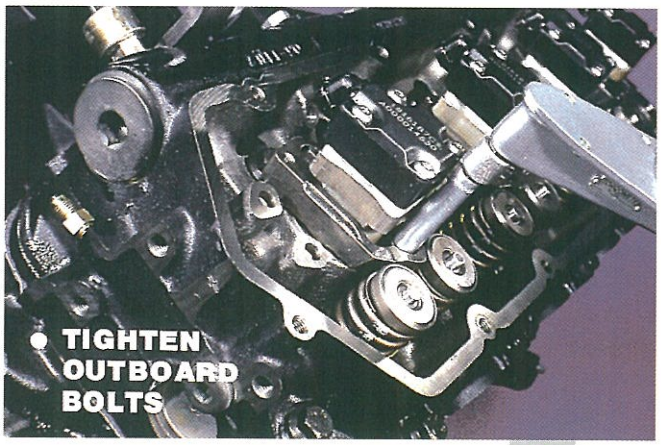


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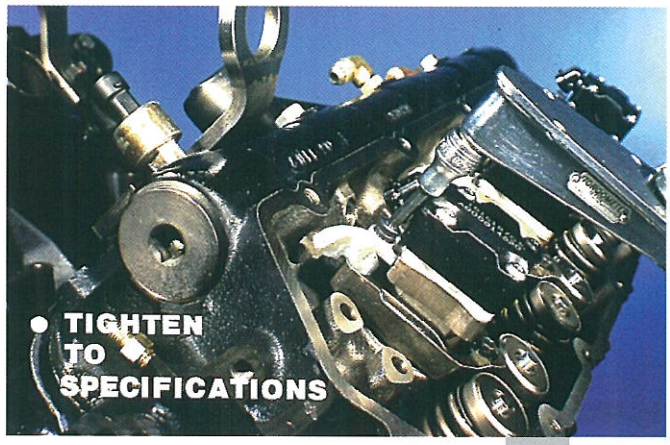
### INJECTOR INSTALLATION (7)

- Tighten the out-board injector hold down bolt to specified torque. Specifications are in the service manual.

# UNIQUE SERVICE PROCEDURES

### INJECTOR INSTALLATION (8)

- Install the injector oil spill spout. Tighten capscrew to specified torque. Injector must be tightened before tightening the oil spill spout.

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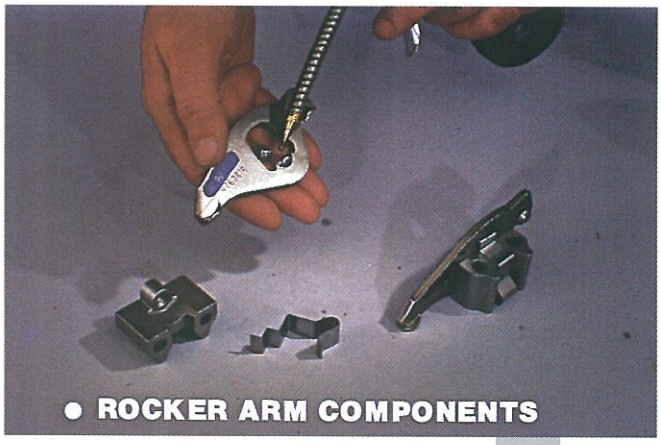


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### ROCKER ARM ASSEMBLY

- The rocker arm ball and socket should be inspected for wear. Removal of the retaining clip will allow disassembly of the rocker. After inspection the parts are to be lubricated for re-assembly.

- Polishing is normal on these components but measurable wear requires replacement.

### ROCKER ARM ASSEMBLY

- Assemble the parts in proper orientation as rocker arm can either be an intake or exhaust. Good mechanical practice is to assemble these components in the same position as disassebled.

- The clip holds the parts together as an assembly.


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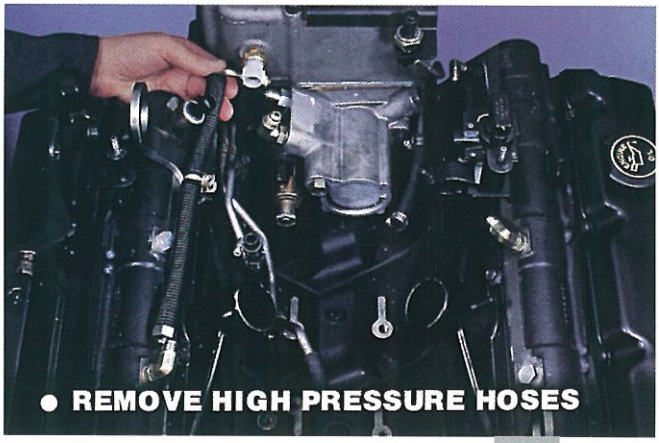
# UNIQUE SERVICE PROCEDURES

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### HIGH PRESSURE PUMP

- To remove the high pressure pump, first remove the high pressure hoses to each cylinder head.
- Notice the location of the ICP sensor in the cylinder head gallery.

**IMPORTANT**

- **Always use FORD specified hoses designed for this application.**

### HIGH PRESSURE PUMP RESERVOIR

- Remove reservoir once oil has been extracted. Note location of stud bolts for proper re-assembly.


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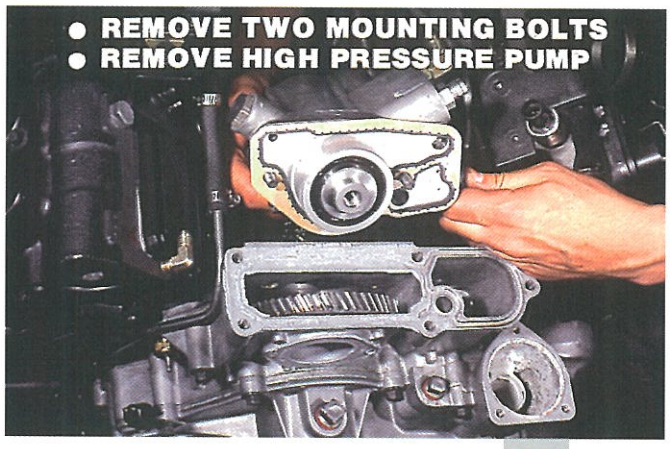
### HIGH PRESSURE PUMP

- After removing the front access cover plate the retaining bolt for the high pressure pump gear to shaft can be removed.
- The gear is not keyed to the pump or timed to the camshaft.

# UNIQUE SERVICE PROCEDURES

### HIGH PRESSURE PUMP

- The high pressure pump is sealed to the front cover with a reusable gasket and attached with two bolts. The gear is not tapered or pinned to the pump shaft.

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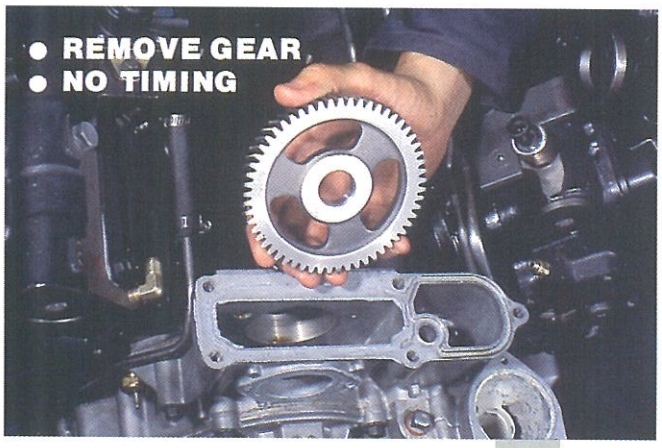


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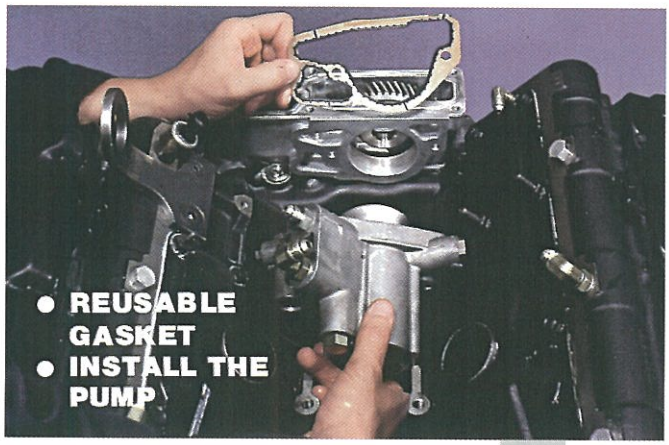
### HIGH PRESSURE PUMP

- The drive gear is not timed.
- The high pressure pump has a relief valve that will dump if pressure goes above 4000 psi. This dumps into the gear train area of the front cover and returns to sump.

### HIGH PRESSURE PUMP INSTALLATION

- Install the reusable gasket and bolt the pump to the front cover. Be sure the gear is in the front cover prior to installing pump.

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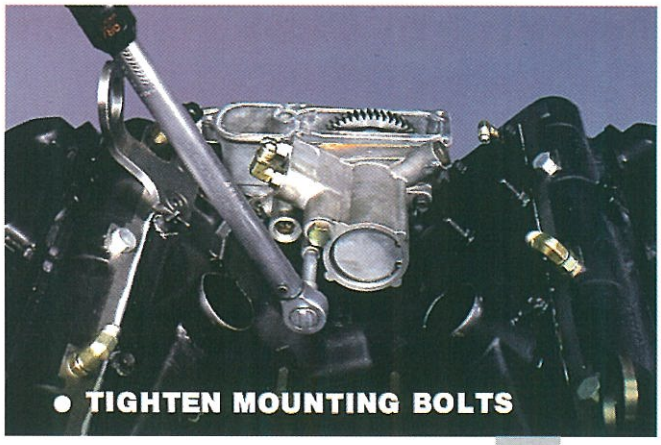
# UNIQUE SERVICE PROCEDURES

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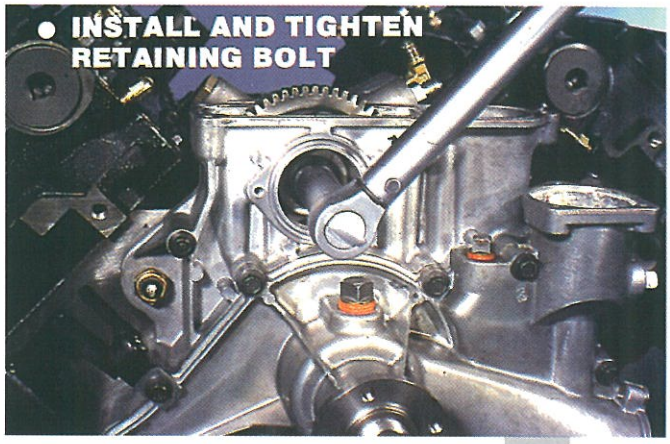
### HIGH PRESSURE PUMP

- Be sure the center of the gear is on the pump shaft, and engaged to the cam gear before tightening the pump mounting bolts. If the gear is off center, it could get jammed between the shaft and front cover.

- Tighten bolts to the proper torque. Specifications are in the service manual.

### HIGH PRESSURE PUMP

- Install the high pressure pump gear to shaft retaining bolt and tighten to specifications.

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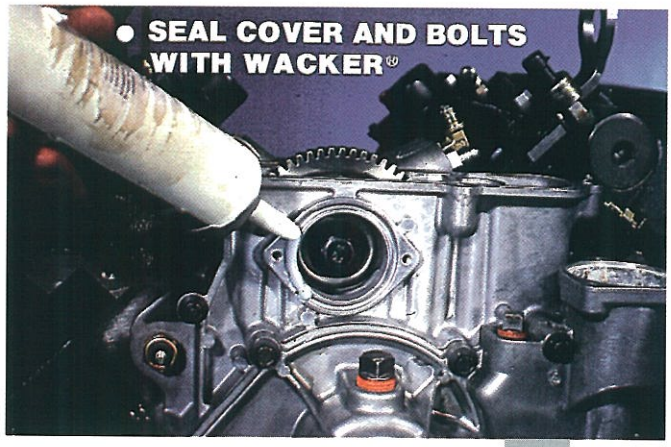
### HIGH PRESSURE PUMP

- Check the pump gear to camshaft gear back lash. Rock the gear one way and zero the indicator, then rock the gear the opposite direction and the indicator reading is the gear backlash. Specifications are in the service manual.

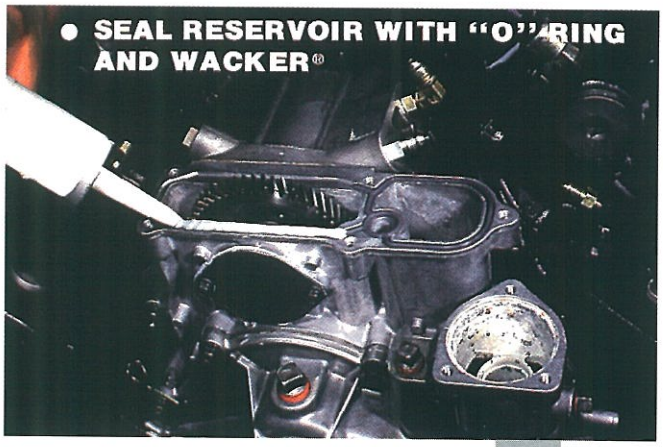
# UNIQUE SERVICE PROCEDURES

### HIGH PRESSURE PUMP

- Use Wacker® T-95 RTV sealant on the plate and retaining bolt threads to ensure sealing.




161

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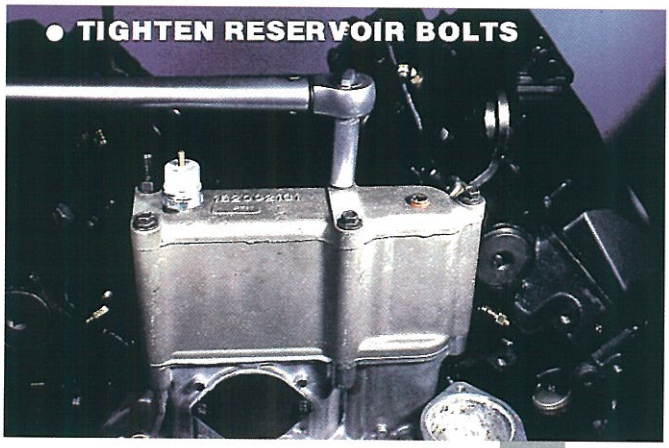
### HIGH PRESSURE PUMP

- The engine oil pressure side of the reservoir is sealed by an "O"-ring and the gear train side with Wacker® T-95 RTV sealant.

### HIGH PRESSURE PUMP

- The aluminum front cover requires that the reservoir bolts (5) be tightened to specified torque. Specifications are in the service manual.

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# UNIQUE SERVICE PROCEDURES


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## HIGH PRESSURE PUMP

- To remove the regulator valve from the pump, remove the solenoid from the regulator valve. A retaining nut secures the solenoid to the valve body.

- This valve is used to regulate pressure in the high pressure lube system during engine operation. The valve is sealed to the pump housing by an "O"-ring. The reservoir does not need to be empty to replace this valve as long as it is installed in a timely manner.

- CAUTION: The IPR must be kept clean. The valve should be rinsed in clean solvent and blown dry.

## INSTALLING IPR

- The bore should be swabbed clean prior to installing the IPR.

- Be sure the valve starts into the threads squarely and can be turned by hand until the "O"-ring seal contacts the pump housing.


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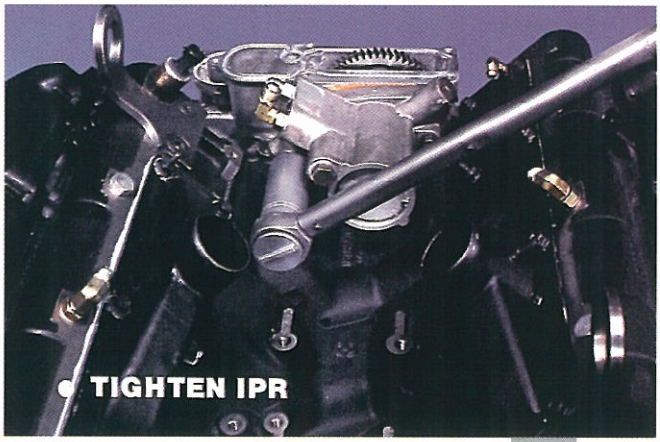


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## TIGHTEN IPR

- This valve must be tIghtened to the specified torque into the aluminum pump housing. Over-tightening may distort the valve body and cause it not to function properly.