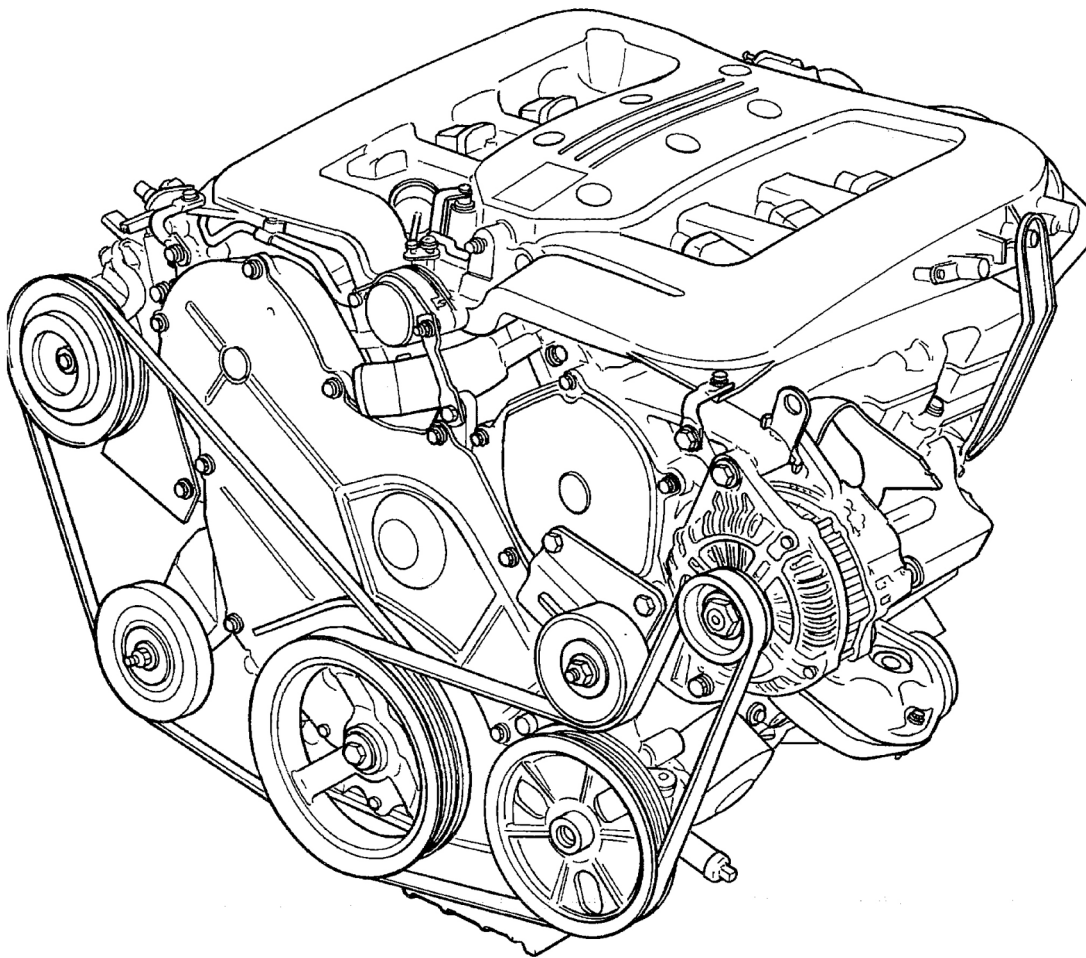


**2004 ENGINE****Engine 3.5L - 300M, Concorde & Intrepid****ENGINE 3.5L****DESCRIPTION**

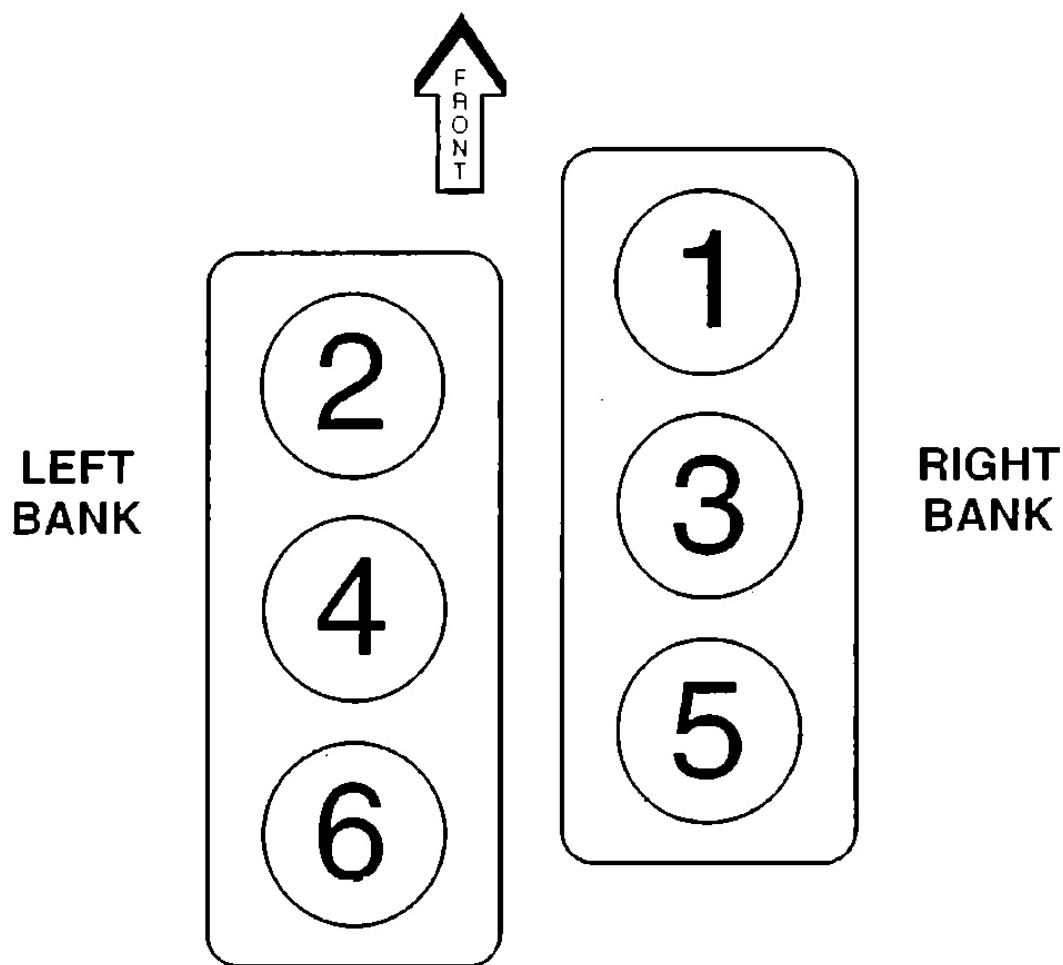
The 3.5 Liter (214 Cubic Inches) 60 degree V-6 engines is a single overhead camshaft design with hydraulic lifters and four valves per cylinder (**Fig. 1**). The engine does not have provisions for a free wheeling valve train.



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**Fig. 1: 3.5L Engine****Courtesy of DAIMLERCHRYSLER CORP.**

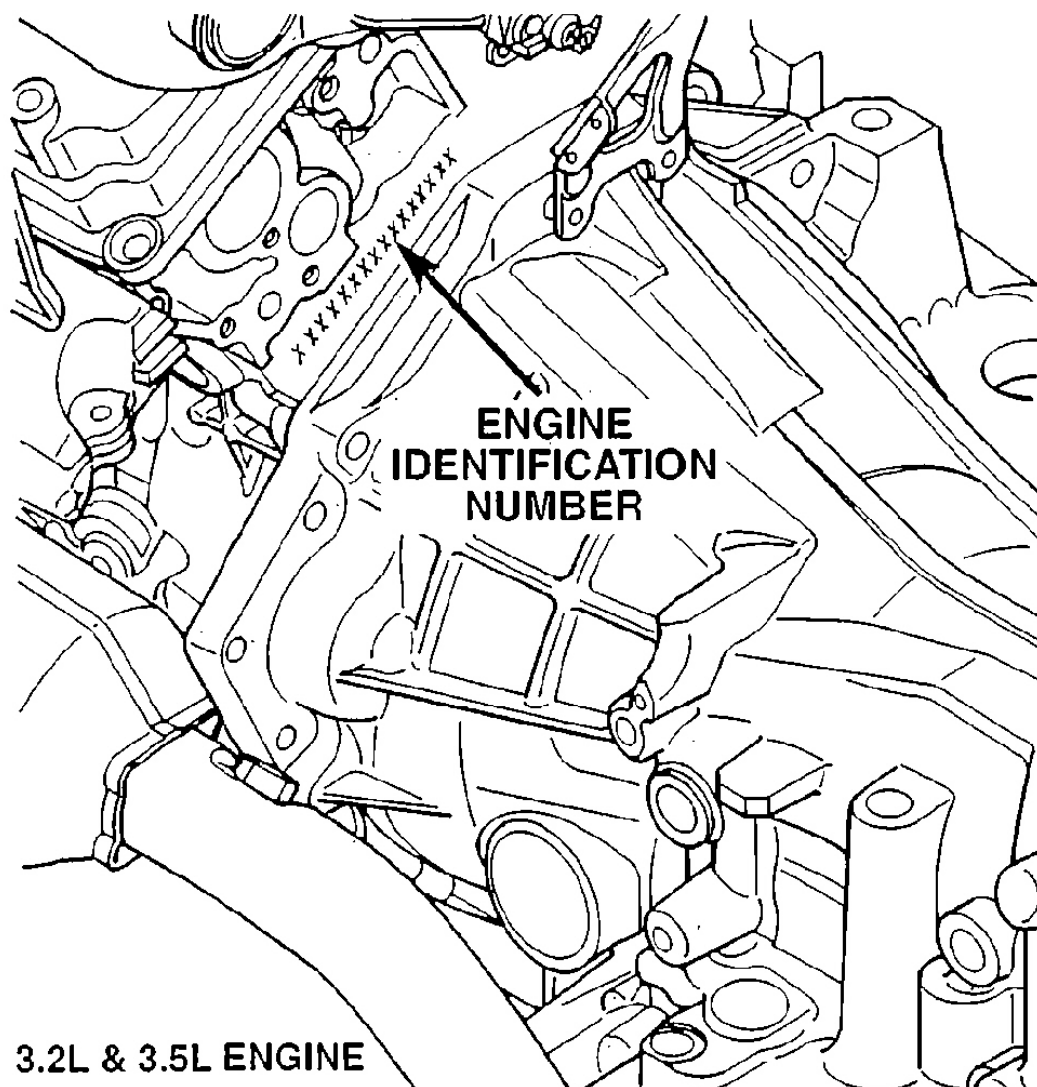
The cylinders are numbered from front to rear, with the right bank odd numbered, and the left bank even numbered (**Fig. 2**). The firing order is 1-2-3-4-5-6.



G03511855

**Fig. 2: Cylinder Numbering & Firing Order - 3.5L**  
Courtesy of DAIMLERCHRYSLER CORP.

The engine identification number is located on the rear of engine block just below the cylinder head (**Fig. 3**).



3.2L &amp; 3.5L ENGINE

| <u>X</u><br>Model<br>Year      | <u>X</u><br>Manufacturing<br>Plant | <u>XXXXX</u><br>Component<br>Code/Usage            | <u>XXXX</u><br>Month/Day | <u>XXXXX</u><br>Serial<br>Code |
|--------------------------------|------------------------------------|----------------------------------------------------|--------------------------|--------------------------------|
| Last digit<br>of model<br>year | Trenton T                          | Engine<br>3.2L<br>3.5L<br><br>Usage<br>Pass Car PC |                          |                                |

G03511856

**Fig. 3: Engine Identification**

Courtesy of DAIMLERCHRYSLER CORP.

## DIAGNOSIS AND TESTING

### DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to **DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL** and **DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE**, for possible causes and corrections of malfunctions.

For fuel system diagnosis, (Refer to **DIAGNOSIS AND TESTING - FUEL DELIVERY SYSTEM** ).

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Engine Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis
- Hydraulic Lash Adjuster Noise Diagnosis
- Engine Oil Leak Inspection

### DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

#### DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

| CONDITION    | POSSIBLE CAUSES                                                                                                                                                                                                                                                                       | CORRECTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NOISY VALVES | <ol style="list-style-type: none"> <li>1. High or low oil level in crankcase.</li> <li>2. Thin or diluted oil.</li> <li>3. Thick oil</li> <li>4. Low oil pressure.</li> <li>5. Dirt in tappets/lash adjusters.</li> <li>6. Worn rocker arms.</li> <li>7. Worn tappets/lash</li> </ol> | <ol style="list-style-type: none"> <li>1. Check and correct engine oil level.</li> <li>2. Change oil to correct viscosity.</li> <li>3.               <ol style="list-style-type: none"> <li>a. Change oil and filter.</li> <li>b. Run engine to operating temperature.</li> <li>c. Change oil and filter again.</li> </ol> </li> <li>4. Check and correct engine oil level.</li> <li>5. Replace rocker arm/hydraulic lash adjuster assembly.</li> <li>6. Inspect oil supply to rocker arms.</li> </ol> |

## 2004 Chrysler 300M

2004 ENGINE Engine 3.5L - 300M, Concorde & Intrepid

|                      |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | <p style="text-align: center;">adjusters.</p> <ol style="list-style-type: none"> <li>8. Worn valve guides.</li> <li>9. Excessive runout of valve seats on valve faces.</li> <li>10. Missing adjuster pivot.</li> </ol>                                                                                                             | <ol style="list-style-type: none"> <li>7. Install new rocker arm/hydraulic lash adjuster assembly.</li> <li>8. Ream guides and install new valves with oversize stems.</li> <li>9. Grind valve seats and valves.</li> <li>10. Replace rocker arm/hydraulic lash adjuster assembly.</li> </ol>                                                                                                                                                                                                                                                                                                                        |
| CONNECTING ROD NOISE | <ol style="list-style-type: none"> <li>1. Insufficient oil supply.</li> <li>2. Low oil pressure.</li> <li>3. Thick / Thin or diluted oil.</li> <li>4. Excessive bearing clearance.</li> <li>5. Connecting rod journal out-of-round.</li> <li>6. Misaligned connecting rods.</li> </ol>                                             | <ol style="list-style-type: none"> <li>1. Check engine oil level.</li> <li>2. Check engine oil level. Inspect oil pump relief valve and spring.</li> <li>3. Change oil to correct viscosity.               <ol style="list-style-type: none"> <li>a. Change oil and filter.</li> <li>b. Run engine to operating temperature.</li> <li>c. Change oil and filter again.</li> </ol> </li> <li>4. Measure bearings for correct clearance. Repair as necessary.</li> <li>5. Replace crankshaft or grind surface.</li> <li>6. Replace bent connecting rods.</li> </ol>                                                     |
| MAIN BEARING NOISE   | <ol style="list-style-type: none"> <li>1. Insufficient oil supply.</li> <li>2. Low oil pressure.</li> <li>3. Thick / Thin or diluted oil.</li> <li>4. Excessive bearing clearance.</li> <li>5. Excessive end play.</li> <li>6. Crankshaft journal out-of-round or worn.</li> <li>7. Loose flywheel or torque converter.</li> </ol> | <ol style="list-style-type: none"> <li>1. Check engine oil level.</li> <li>2. Check engine oil level. Inspect oil pump relief valve and spring.</li> <li>3. Change oil to correct viscosity.               <ol style="list-style-type: none"> <li>a. Change oil and filter.</li> <li>b. Run engine to operating temperature.</li> <li>c. Change oil and filter again.</li> </ol> </li> <li>4. Measure bearings for correct clearance. Repair as necessary.</li> <li>5. Check thrust bearing for wear on flanges.</li> <li>6. Replace crankshaft or grind journals.</li> <li>7. Tighten to correct torque.</li> </ol> |
|                      | <ol style="list-style-type: none"> <li>1. Low oil level.</li> <li>2. Faulty oil pressure sending unit.</li> <li>3. Low oil pressure.</li> <li>4. Clogged oil filter.</li> <li>5. Worn parts in oil pump.</li> </ol>                                                                                                                | <ol style="list-style-type: none"> <li>1. Check engine oil level.</li> <li>2. Install new sending unit.</li> <li>3. Check sending unit and main bearing oil clearance.</li> <li>4. Install new oil filter.</li> <li>5. Replace worn parts or pump.</li> </ol>                                                                                                                                                                                                                                                                                                                                                        |

## 2004 Chrysler 300M

2004 ENGINE Engine 3.5L - 300M, Concorde & Intrepid

|                                       |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OIL PRESSURE DROP                     | <ol style="list-style-type: none"> <li>Thin or diluted oil.</li> <li>Oil pump relief valve stuck.</li> <li>Oil pump suction tube loose.</li> <li>Oil pump cover warped or cracked.</li> <li>Excessive bearing clearance.</li> </ol>                                           | <ol style="list-style-type: none"> <li>Change oil to correct viscosity.</li> <li>Remove valve and inspect, clean, or replace.</li> <li>Remove oil pan and install new tube or clean, if necessary.</li> <li>Install new oil pump.</li> <li>Measure bearings for correct clearance.</li> </ol>                                                                                            |
| OIL LEAKS                             | <ol style="list-style-type: none"> <li>Misaligned or deteriorated gaskets.</li> <li>Loose fastener, broken or porous metal part.</li> <li>Misaligned or deteriorated cup or threaded plug.</li> </ol>                                                                         | <ol style="list-style-type: none"> <li>Replace gasket(s).</li> <li>Tighten, repair or replace the part.</li> <li>Replace as necessary.</li> </ol>                                                                                                                                                                                                                                        |
| OIL CONSUMPTION OR SPARK PLUGS FOULED | <ol style="list-style-type: none"> <li>PCV system malfunction.</li> <li>Worn, scuffed or broken rings.</li> <li>Carbon in oil ring slots.</li> <li>Rings fitted too tightly in grooves.</li> <li>Worn valve guide(s).</li> <li>Valve stem seal(s) worn or damaged.</li> </ol> | <ol style="list-style-type: none"> <li>Check system and repair as necessary. (Refer to Appropriate Diagnostic procedures)</li> <li>Hone cylinder bores. Install new rings.</li> <li>Clean pistons and install new rings.</li> <li>Remove rings and check grooves. If groove is not proper width, replace piston.</li> <li>Replace cylinder head(s).</li> <li>Replace seal(s).</li> </ol> |

### DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

### DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

| CONDITION             | POSSIBLE CAUSE                                                                                                                                                                                                       | CORRECTION                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ENGINE WILL NOT START | <ol style="list-style-type: none"> <li>Weak battery.</li> <li>Corroded or loose battery connections.</li> <li>Faulty starter.</li> <li>Faulty coil(s) or control unit.</li> <li>Incorrect spark plug gap.</li> </ol> | <ol style="list-style-type: none"> <li>Test battery. Charge or replace as necessary. (Refer to <b>BATTERY SYSTEM</b>)</li> <li>Clean and tighten battery connections. Apply a coat of light mineral grease to terminals.</li> <li>Test starting system. (Refer to <b>STARTERS</b>)</li> <li>Test and replace as needed. (Refer to Appropriate Diagnostic Information)</li> <li>Check and adjust gap as needed.</li> </ol> |

**2004 Chrysler 300M**

2004 ENGINE Engine 3.5L - 300M, Concorde &amp; Intrepid

|                               |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <ol style="list-style-type: none"><li>6. Contamination in fuel system.</li><li>7. Faulty fuel pump.</li><li>8. Incorrect engine timing.</li></ol>                                                                                                                                                                                                                                            | <ol style="list-style-type: none"><li>6. Clean system and replace fuel filter.</li><li>7. Test fuel pump and replace as needed. (Refer to Appropriate Diagnostic Information)</li><li>8. Check for a skipped timing belt/chain or a loose camshaft sprocket (3.2/3.5L).</li></ol>                                                                                                                                                                                                                                                                                |
| ENGINE STALLS OR IDLES ROUGH  | <ol style="list-style-type: none"><li>1. Idle speed too low.</li><li>2. Incorrect fuel mixture.</li><li>3. Intake manifold leakage.</li><li>4. Faulty coil(s).</li></ol>                                                                                                                                                                                                                     | <ol style="list-style-type: none"><li>1. Test minimum air flow. (Refer to Appropriate Diagnostic Information)</li><li>2. (Refer to Appropriate Diagnostic Information)</li><li>3. Inspect intake manifold gasket, manifold, and vacuum hoses.</li><li>4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</li></ol>                                                                                                                                                                                                                  |
| ENGINE LOSS OF POWER          | <ol style="list-style-type: none"><li>1. Dirty or incorrectly gapped plugs.</li><li>2. Contamination in fuel system.</li><li>3. Faulty fuel pump.</li><li>4. Incorrect valve timing.</li><li>5. Leaking cylinder head gasket.</li><li>6. Low compression.</li><li>7. Burned, warped, or pitted valves.</li><li>8. Plugged or restricted exhaust system.</li><li>9. Faulty coil(s).</li></ol> | <ol style="list-style-type: none"><li>1. Set gap as needed or replace plug(s).</li><li>2. Clean system and replace fuel filter.</li><li>3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</li><li>4. Correct valve timing as needed.</li><li>5. Replace cylinder head gasket.</li><li>6. Test compression of each cylinder.</li><li>7. Replace valves.</li><li>8. Check exhaust system restriction. Replace parts, as necessary.</li><li>9. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</li></ol> |
| ENGINE MISSES ON ACCELERATION | <ol style="list-style-type: none"><li>1. Dirty or incorrectly gapped spark plugs.</li><li>2. Contamination in Fuel System.</li><li>3. Burned, warped, or pitted valves.</li><li>4. Faulty coil(s).</li></ol>                                                                                                                                                                                 | <ol style="list-style-type: none"><li>1. Set gap as needed or replace plug(s).</li><li>2. Clean fuel system and replace fuel filter.</li><li>3. Replace valves.</li><li>4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</li></ol>                                                                                                                                                                                                                                                                                                |
| ENGINE MISSES AT HIGH SPEED   | <ol style="list-style-type: none"><li>1. Dirty or incorrect spark plug gap.</li><li>2. Faulty coil(s).</li><li>3. Dirty fuel injector(s).</li><li>4. Contamination in fuel</li></ol>                                                                                                                                                                                                         | <ol style="list-style-type: none"><li>1. Set gap as needed or replace plug(s).</li><li>2. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</li></ol> <p>Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</p>                                                                                                                                                                                                                                                                                             |

system.

3. Clean system and replace fuel filter.

**DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE TEST**

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Check engine oil level and add oil if necessary.
2. Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.
3. Disconnect and remove all ignition coils from spark plugs.
4. Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.
5. Be sure throttle blade is fully open during the compression check.
6. Insert compression gauge adaptor Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0-500 psi (Blue) pressure transducer (Special Tool CH7059) with cable adaptors to the DRBIII(R). For Special Tool identification, (Refer to **SPECIAL TOOLS** ).
7. Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.
8. Repeat the previous step for all remaining cylinders.
9. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
10. If one or more cylinders have abnormally low compression pressures, repeat the compression test.
11. If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

**DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE TEST**

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

**WARNING: DO NOT REMOVE THE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.**

Check the coolant level and fill as required. DO NOT install the pressure cap.

Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum, with 552 kPa (80 psi) recommended.

Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the coolant.

All gauge pressure indications should be equal, with no more than 25% leakage per cylinder.

**FOR EXAMPLE:** At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

## STANDARD PROCEDURE

### STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. MOPAR(R) Engine RTV GEN II, MOPAR(R) ATF-RTV, and MOPAR(R) Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

**MOPAR(R) ENGINE RTV GEN II** is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

**MOPAR(R) ATF RTV** is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

**MOPAR(R) GASKET MAKER** is an anaerobic type gasket material. The material cures in the absence of air

when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

**MOPAR(R) BED PLATE SEALANT** is a unique (green-in-color) anaerobic type gasket material that is specially made to seal the area between the bedplate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

**MOPAR(R) GASKET SEALANT** is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multilayer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. MOPAR(R) Gasket Sealant is available in a 13 oz, aerosol can or 4oz./16 oz. can w/applicator.

#### **SEALER APPLICATION**

MOPAR(R) Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

MOPAR(R) Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

MOPAR(R) Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

#### **STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION**

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

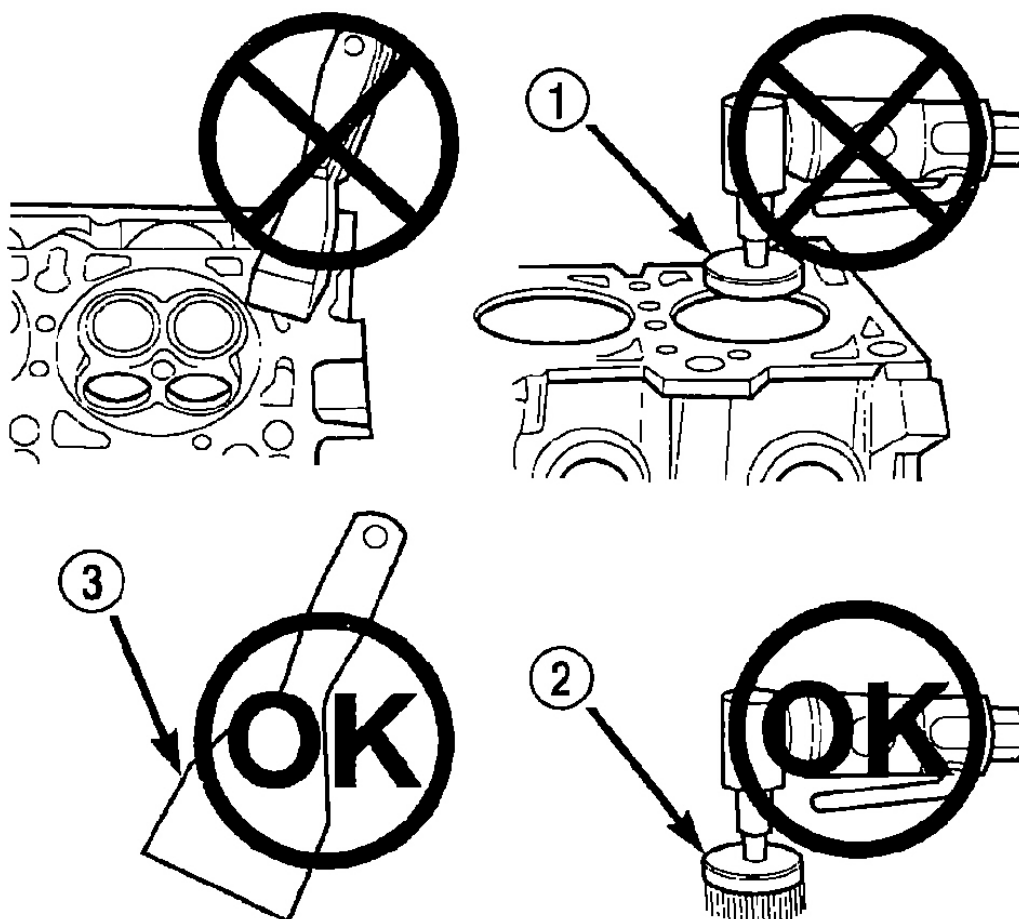
**Never** use the following to clean gasket surfaces:

- Metal scraper
- Abrasive pad or paper to clean cylinder block and head
- High speed power tool with an abrasive pad or a wire brush (**Fig. 4**)

**NOTE:**      **Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.**

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (**Fig. 4**)
- Drill motor with 3M Roloc(tm) Bristle Disc (white or yellow) (**Fig. 4**)



- 1 - ABRASIVE PAD  
2 - 3M ROLOC™ BRISTLE DISC  
3 - PLASTIC/WOOD SCRAPER

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**Fig. 4: Proper Tool Usage For Surface Preparation**  
Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may

**be used on cast iron surfaces with care.**

#### **STANDARD PROCEDURE - REPAIR OF DAMAGED OR WORN THREADS**

Damaged or worn threads (excluding spark plug and camshaft bearing cap attaching threads) can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent) and installing an insert into the tapped hole. This brings the hole back to its original thread size.

**CAUTION: Be sure that the tapped holes maintain the original center line.**

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

#### **STANDARD PROCEDURE - HYDROSTATIC LOCKED ENGINE**

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, the following steps should be used.

**CAUTION: DO NOT use starter motor to rotate the engine, severe damage may occur.**

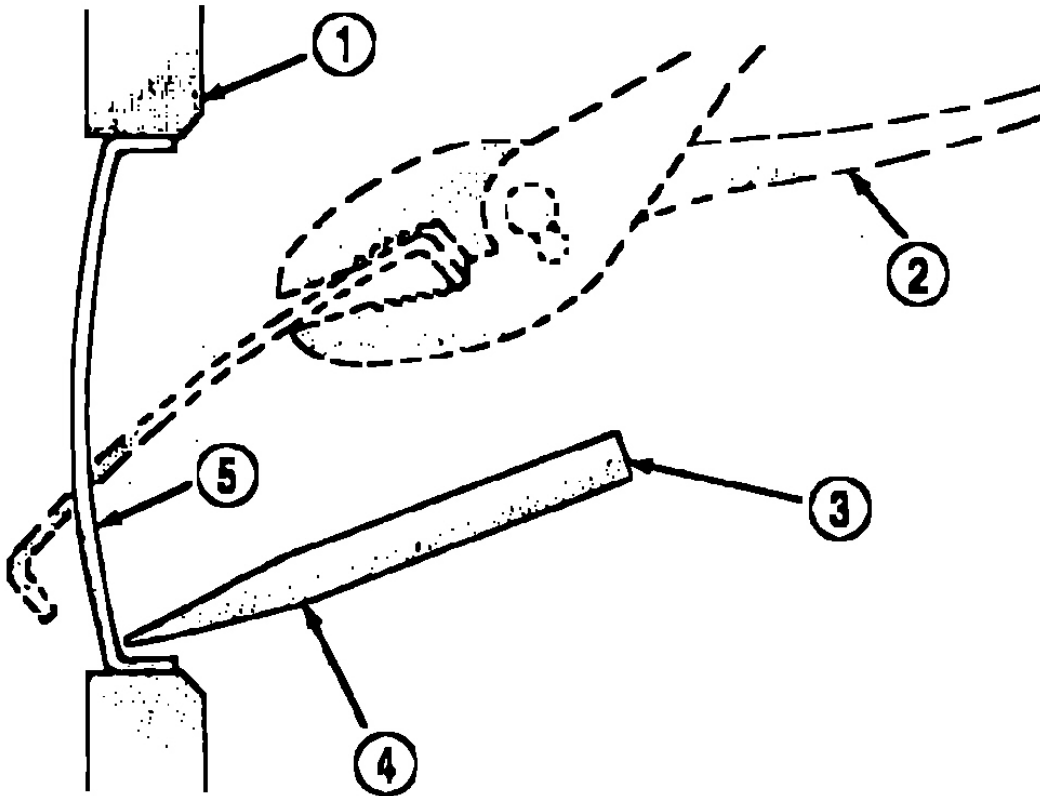
1. Inspect air cleaner, induction system and intake manifold to insure system is dry and clear of foreign material.
2. Remove negative battery cable.
3. Place a shop towel around the spark plugs when removing them from the engine. This will catch any fluid that may possibly be in the cylinder under pressure.
4. With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.
5. Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).
6. Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., connecting rods, pistons, valves, etc.)
7. Repair engine or components as necessary to prevent this problem from re-occurring.

**CAUTION: Squirt approximately one teaspoon of oil into the cylinders, rotate engine to lubricate the cylinder walls to prevent damage on restart.**

8. Install new spark plugs.
9. Drain engine oil and remove oil filter.
10. Install a new oil filter.
11. Fill engine with specified amount of approved oil.
12. Connect negative battery cable.
13. Start engine and check for any leaks.

**STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS**

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (**Fig. 5**).



- 1 - CYLINDER BLOCK
- 2 - REMOVE PLUG WITH PLIERS
- 3 - STRIKE HERE WITH HAMMER
- 4 - DRIFT PUNCH
- 5 - CUP PLUG

G03511858

**Fig. 5: Core Hole Plug Removal**  
Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat

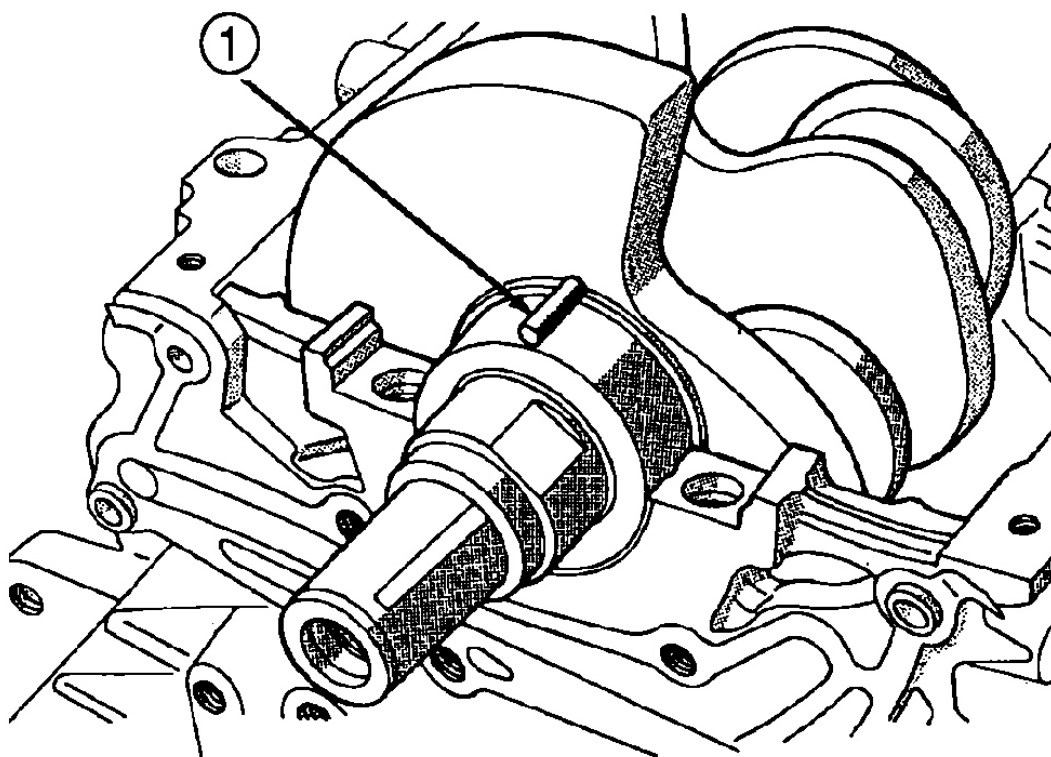
inside of cup plug hole with MOPAR(R) Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

#### **STANDARD PROCEDURE - MEASURING BEARING CLEARANCE USING PLASTIGAGE**

Engine crankshaft bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

1. Remove oil film from surface to be checked. Plastigage is soluble in oil.
2. Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes (**Fig. 6**). (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.



**1 - PLASTIGAGE**

G03511859

**Fig. 6: Plastigage Placed in Lower Shell-Typical**  
**Courtesy of DAIMLERCHRYSLER CORP.**

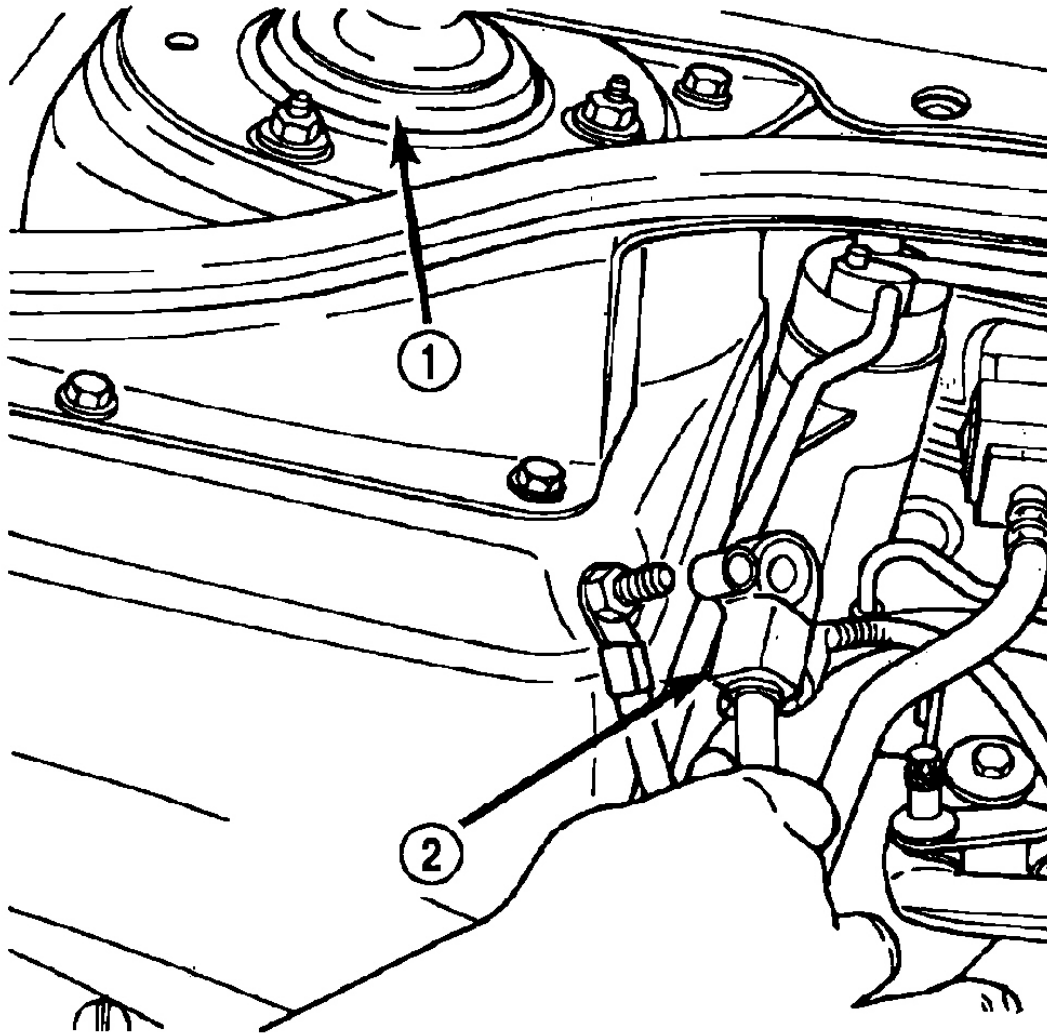
3. Remove the bearing cap and compare the width of the flattened Plastigage with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Compare clearance measurements to specs found in engine specifications (Refer to **SPECIFICATIONS** ). **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

**NOTE:**        **Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.**

4. Install the proper crankshaft bearings to achieve the specified bearing clearances.

#### **REMOVAL - ENGINE ASSEMBLY**

1. Release fuel pressure. (Refer to **STANDARD PROCEDURE - FUEL SYSTEM PRESSURE REL** )
2. Disconnect negative cable at right strut tower (**Fig. 7** ).



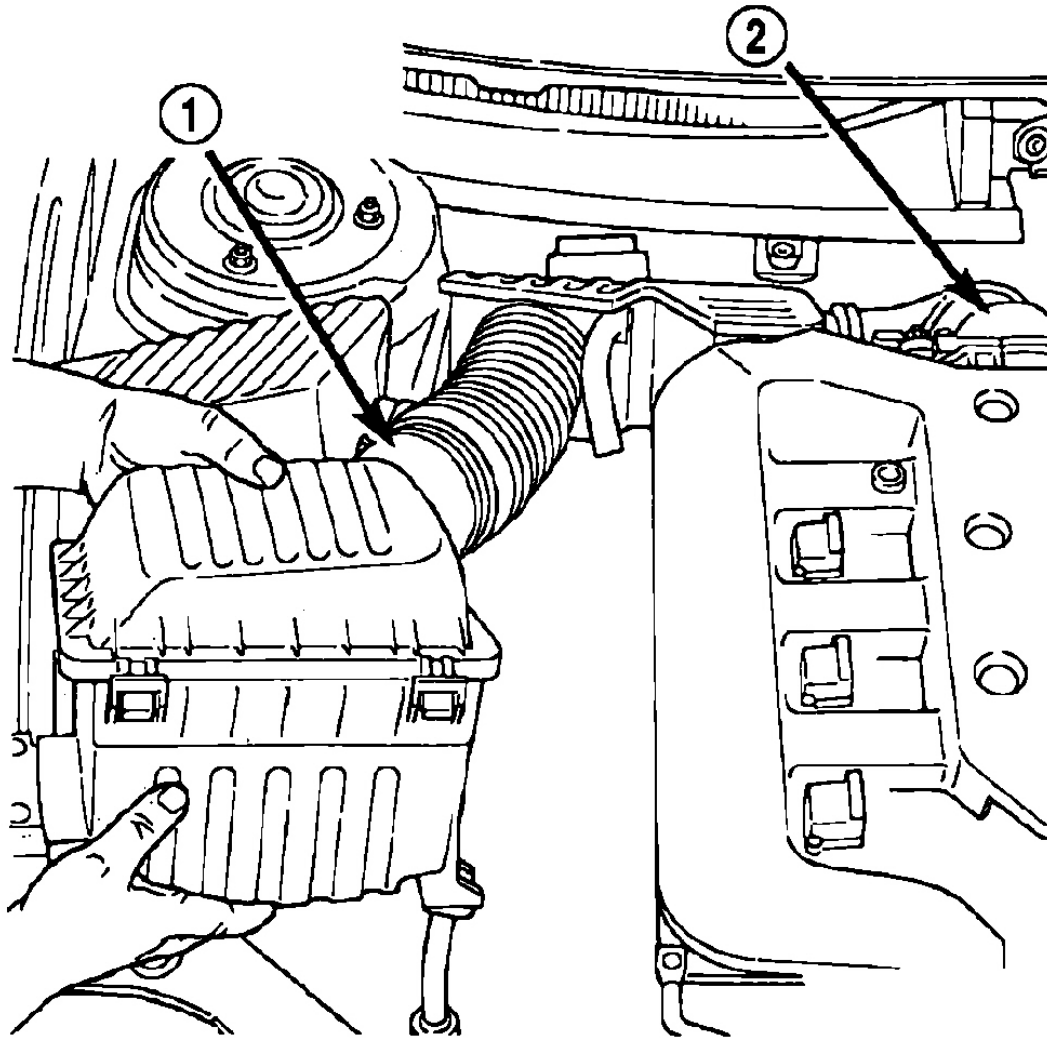
- 1 - RIGHT STRUT TOWER
- 2 - BATTERY NEGATIVE CABLE

G03511860

**Fig. 7: Negative Cable Remote Terminal**  
 Courtesy of DAIMLERCHRYSLER CORP.

3. Mark hood position at hinges and remove hood. (Refer to **HOOD** )
4. Remove both wiper arms. (Refer to **WIPER ARMS** )
5. Remove both right and left cowl screens. (Refer to **COWL GRILLE AND SCREEN** )
6. Remove strut tower brace.(Refer to **FRONT STRUT TOWER TO TOWER BRACE** )

7. Remove air cleaner assembly with air inlet hose (**Fig. 8** ).



1 - AIR CLEANER ASSEMBLY WITH AIR INLET HOSE  
2 - THROTTLE BODY

G03511861

**Fig. 8: Air Cleaner With Inlet Hose**  
Courtesy of DAIMLERCHRYSLER CORP.

8. Remove upper radiator crossmember. (Refer to **GRILLE OPENING REINFORCEMENT** )  
9. Disconnect hood release cable from hood latch.  
10. Drain cooling system. (Refer to **STANDARD PROCEDURE** )

11. Remove radiator fan. (Refer to **RADIATOR FAN** )
12. Remove accessory drive belts. (Refer to **ACCESSORY DRIVE** )
13. Disconnect upper radiator hose at engine.
14. Disconnect lower radiator hose at radiator.
15. Disconnect engine oil and transmission cooler lines at radiator.
16. Remove power steering line bracket at left side of radiator.
17. Remove fasteners attaching air conditioning condenser to radiator.
18. Remove radiator. (Refer to **RADIATOR** )
19. Remove generator. (Refer to **GENERATORS & REGULATORS** )
20. Remove power steering pump mounting bolts and set pump aside (Do not disconnect lines). (Refer to **PUMP** )
21. Remove air conditioning compressor mounting bolts and set aside (Do not disconnect lines).
22. Loosen and remove V-Band clamp at right exhaust manifold.
23. Remove front and rear support bracket fasteners attaching right side catalytic converter down pipe.
24. Disconnect fuel line. (Refer to **FUEL LINES** )
25. Disconnect throttle and speed control cables from bracket. (Refer to **THROTTLE CONTROL CABLE** )
26. Disconnect coolant hoses at coolant recovery/pressure container.
27. Disconnect all vacuum hoses.
28. Disconnect ground straps at both cylinder heads.

**CAUTION: Upper Intake manifold is a composite design. Therefore, manifold should be removed before lifting engine or damage to the manifold could occur.**

29. Remove upper intake manifold and cover intake manifold openings with tape. (Refer to **INTAKE MANIFOLD - UPPER** )
30. Disconnect heater hoses.
31. Remove rear throttle body support bracket.
32. Remove fastener for water pipe at transmission to block bolt.
33. Remove four upper transmission to block bolts.
34. Disconnect all electrical connections.
35. Hoist vehicle.
36. Drain engine oil.
37. Remove structural collar and mark flex plate to torque converter position.
38. Remove bolts holding torque converter to flex plate.
39. Disconnect both transmission oil cooler line brackets from engine.
40. Loosen and remove left exhaust manifold V-Band clamp.
41. For starter removal, loosen the left converter exhaust pipe band clamp and exhaust pipe support bracket at

transaxle.

42. Remove starter. (Refer to **STARTER MOTOR** )
43. Remove left engine mount bolts.
44. Remove right engine mount bolts.
45. Remove crankshaft position sensor. (Refer to **CRANKSHAFT POSITION SENSOR** )
46. Remove two lower transmission to block bolts.
47. Lower vehicle.
48. Attach lifting device to engine.
49. Insert floor jack with small block of wood under transmission pan to support transmission.
50. Hoist engine from engine compartment.

## **INSTALLATION - ENGINE ASSEMBLY**

1. Attach lifting device and lower engine into engine compartment.
2. Align engine mounts and install fasteners but **do not tighten** until all mounting bolts have been installed.
3. Install transmission case to engine block tighten bolts to 102 N.m (75 ft. lbs.).
4. Remove engine lifting device.
5. Raise vehicle.
6. Tighten engine mount fastener to 61 N.m (45 ft. lbs.).
7. Align flex plate to torque converter and install mounting bolts. Tighten bolts to 75 N.m (55 ft. lbs.).
8. Install crankshaft position sensor. (Refer to **CRANKSHAFT POSITION SENSOR** )
9. Install starter. (Refer to **STARTER MOTOR** )
10. Install new V-Band clamp at left side exhaust manifold to catalytic converter. Tighten V-Band clamp to 11 N.m (100 in. lbs.).
11. Install left side catalytic converter down pipe support fastener at transaxle. Tighten fastener to 47 N.m (35 ft. lbs.).
12. Tighten the left converter down pipe band clamp.
13. Install the transmission oil cooler lines bracket to engine.
14. Install structural collar/cover. (Refer to **STRUCTURAL COLLAR / COVER** , )
15. Lower vehicle.
16. Connect all electrical connections.
17. Install four upper transmission to block bolts tighten to 102 N.m (75 ft. lbs.).
18. Install water pipe and retaining fasteners to the transaxle/cylinder block double-ended bolts.
19. Install rear throttle body support bracket.
20. Connect heater hoses.
21. Install upper intake manifold. (Refer to **INTAKE MANIFOLD - UPPER** )
22. Connect ground straps at both cylinder heads.
23. Connect all vacuum hoses.
24. Connect coolant hoses at coolant recovery/pressure container.

25. Connect throttle and speed control cables to bracket and throttle arm. (Refer to **THROTTLE CONTROL CABLE** )
26. Connect fuel line. (Refer to **STANDARD PROCEDURE - HOSES AND CLAMP** )
27. Install new V-Band clamp at right exhaust manifold. Tighten V-Band clamp to 11 N.m (100 in. lbs.).
28. Install and tighten right side catalytic converter down pipe support bracket fastener at transaxle mount.
29. Install air conditioning compressor and tighten fasteners to 28 N.m (250 in. lbs.).
30. Install power steering pump and tighten fasteners to 28 N.m (250 in. lbs.).
31. Install generator. (Refer to **GENERATORS & REGULATORS** )
32. Install radiator. (Refer to **RADIATOR** )
33. Attach air conditioning condenser to radiator.
34. Install power steering line bracket to radiator.
35. Connect engine oil and transmission cooler lines to radiator.
36. Install lower radiator hose.
37. Install upper radiator hose.
38. Install accessory drive belts. (Refer to **ACCESSORY DRIVE** ).
39. Install radiator fan. (Refer to **RADIATOR FAN** )
40. Fill cooling system. (Refer to **STANDARD PROCEDURE** )
41. Fill engine with proper amount of oil.
42. Connect hood release cable to hood latch and install upper radiator crossmember. (Refer to **GRILLE OPENING REINFORCEMENT** )
43. Install air cleaner and air inlet hose.
44. Install strut tower brace. (Refer to **FRONT STRUT TOWER TO TOWER BRACE** )
45. Install both cowl covers. (Refer to **GRILLE OPENING REINFORCEMENT** )
46. Install both wiper arms. (Refer to **WIPER ARMS** )
47. Install hood. (Refer to **HOOD** )
48. Connect negative cable.

## SPECIFICATIONS

### 3.5L ENGINE

#### ENGINE SPECIFICATIONS

| DESCRIPTION       | SPECIFICATION                         |
|-------------------|---------------------------------------|
| Type              | 60° SOHC V-6 24-Valve                 |
| Displacement      | 3.5 Liters<br>(214 Cubic Inches)      |
| Bore and Stroke   | 96.0 x 81.0 mm<br>(3.780 x 3.189 in.) |
| Compression Ratio | 9.9:1                                 |
| Lead Cylinder     | #1 Right Bank                         |

**2004 Chrysler 300M**

2004 ENGINE Engine 3.5L - 300M, Concorde &amp; Intrepid

|                                     |                                                 |
|-------------------------------------|-------------------------------------------------|
| Firing Order                        | 1-2-3-4-5-6                                     |
| <b>Cylinder Block</b>               |                                                 |
| Cylinder Bore Diameter              | 96.0 mm +/-0.0076<br>(3.780 in. +/-0.0003 in.)  |
| Out-of-Round (Max.)                 | 0.076 mm<br>(0.003 in.)                         |
| Taper (Max.)                        | 0.051 mm<br>(0.002 in.)                         |
| <b>Pistons</b>                      |                                                 |
| Type Material                       | Aluminum (Full Floating Pins)                   |
| Piston Diameter                     | 95.98 +/- 0.019 mm<br>(3.7788 +/- 0.0008 in.)   |
| Clearance at Size Location          | -0.007 to +0.047 mm<br>(-0.0003 to +0.0018 in.) |
| Piston Weight - A Size              | 438-443 grams<br>(15.45-15.62 oz.)              |
| Piston Weight - B Size              | 433-438 grams<br>(15.27-15.45 oz.)              |
| Piston Ring Groove Diameter - No. 1 | 87.4-87.6 mm<br>(3.441-3.449 in.)               |
| Piston Ring Groove Diameter - No. 2 | 86.3-86.5 mm<br>(3.397-3.4055 in.)              |
| Piston Ring Groove Diameter - No. 3 | 85.8-86.0 mm<br>(3.378-3.385 in.)               |
| <b>Piston Pins</b>                  |                                                 |
| Type                                | Full Floating                                   |
| Clearance in Piston                 | 0.005-0.015 mm<br>(0.0002-0.0006 in.)           |
| Clearance in Rod                    | 0.007-0.018 mm<br>(0.0003-0.007 in.)            |
| Diameter                            | 23.997-24.000 mm<br>(0.9448-0.9449 in.)         |
| <b>Piston Rings</b>                 |                                                 |
| Ring Gap-Top Compression Ring       | 0.20-0.36 mm<br>(0.008-0.014 in.)               |
| Ring Gap-2nd Compression Ring       | 0.23-0.50 mm<br>(0.0091-0.0197 in.)             |
| Ring Gap-Oil Control (Steel Rails)  | 0.25-0.76 mm<br>(0.010-0.030 in.)               |
| <b>Ring Side Clearance</b>          |                                                 |
| Top and Second Compression Ring     | 0.04-0.08 mm<br>(0.0016-0.0031 in.)             |
| Oil Ring (Steel Rails)              | 0.038-0.184 mm                                  |

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|                                                         |                                                                   |
|---------------------------------------------------------|-------------------------------------------------------------------|
|                                                         | (0.0015-0.0073 in.)                                               |
| <b>Ring Width</b>                                       |                                                                   |
| Top Compression Ring                                    | 1.17-1.19 mm<br>(0.0461-0.0469 in.)                               |
| 2nd Compression Ring                                    | 1.47-1.49 mm<br>(0.058-0.059 in.)                                 |
| Oil Ring (Steel Rings)                                  | 0.445-0.470 mm<br>(0.0176-0.0186 in.)                             |
| <b>Connecting Rods</b>                                  |                                                                   |
| Bearing Clearance                                       | 0.019-0.081 mm<br>(0.0007-0.0031 in.)                             |
| Piston Pin Bore Diameter                                | 24.0076-24.0153 mm<br>(0.9452-0.9455 in.)                         |
| Side Clearance (Max.)                                   | 0.39 mm<br>(0.0153 in.)                                           |
| Total Weight (Less Bearing)                             | 647 grams<br>(22.8223 oz.)                                        |
| <b>Crankshaft Main Bearing Journals</b>                 |                                                                   |
| Diameter                                                | 63.987-64.013 mm<br>(2.519-2.520 in.)                             |
| Main Bearing Diametrical Clearance<br>-(Max. Allowable) | 0.011-0.077 mm<br>(0.0007-0.0030 in.)<br>0.087 mm<br>(0.0034 in.) |
| Out-of-Round (Max.)                                     | 0.015 mm<br>(0.0006 in.)                                          |
| Taper (Max.)                                            | 0.015 mm<br>(0.0006 in.)                                          |
| End Play<br>-(Max.)                                     | 0.10-0.30 mm<br>(0.004-0.012 in.)<br>0.43 mm<br>(0.017 in.)       |
| <b>Connecting Rod Journals</b>                          |                                                                   |
| Diameter                                                | 57.979-58.005 mm<br>(2.283-2.284 in.)                             |
| Bearing Diametrical Clearance                           | 0.019-0.087 mm<br>(0.00075-0.0034 in.)                            |
| Out-of-Round (Max.)                                     | 0.015 mm<br>(0.0006 in.)                                          |
| Taper (Max.)                                            | 0.015 mm<br>(0.0006 in.)                                          |
| <b>Camshaft</b>                                         |                                                                   |
| Bore Diameter                                           | 43.038-43.059 mm<br>(1.6944-1.6952 in.)                           |

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|                                         |                                                                |
|-----------------------------------------|----------------------------------------------------------------|
| Bearing Journal Diameter                | 42.939-42.960 mm<br>(1.6905-1.6913 in.)                        |
| Diametrical Clearance<br>-(Max.)        | 0.078-0.12 mm<br>(0.003-0.0047 in.)<br>0.15 mm<br>(0.0059 in.) |
| End Play                                | 0.11-0.35 mm<br>(0.004-0.014 in.)                              |
| <b>Valve Timing-Intake Valve</b>        |                                                                |
| Opens (ATDC)                            | 3°                                                             |
| Closes (ABDC)                           | 61°                                                            |
| Duration                                | 238°                                                           |
| Centerline                              | 122°                                                           |
| <b>Valve Timing-Exhaust Valve</b>       |                                                                |
| Opens (BBDC)                            | 56°                                                            |
| Closes (ATDC)                           | 16°                                                            |
| Duration                                | 252°                                                           |
| Centerline                              | 112°                                                           |
| Valve Overlap                           | 13°                                                            |
| <b>Cylinder Head</b>                    |                                                                |
| Gasket Thickness (Compressed)           | 1.78 mm<br>(0.070 in.)                                         |
| Valve Seat Angle                        | 45-45.5°                                                       |
| Valve Seat Runout (Max.)                | 0.051 mm<br>(0.002 in.)                                        |
| Valve Seat Width-Intake                 | 0.75-1.25 mm<br>(0.0295-0.0492 in.)                            |
| Valve Seat Width-Exhaust                | 1.25-1.75 mm<br>(0.0492-0.0689 in.)                            |
| Guide Bore Diameter (Std.)              | 6.975-7.00 mm<br>(0.2746-0.2756 in.)                           |
| Valve Guide Height <sup>(1)</sup>       | 9.5-10.5 mm<br>(0.3740-0.4134 in.)                             |
| (1) Measured from cylinder head surface |                                                                |
| <b>Valves</b>                           |                                                                |
| Face Angle                              | 44.5-45°                                                       |
| Head Diameter-Intake                    | 36.37-36.63 mm<br>(1.4319-1.4421 in.)                          |
| Head Diameter-Exhaust                   | 28.87-29.13 mm<br>(1.1366-1.1469 in.)                          |
| Length-Intake (Overall)                 | 114.41-114.99 mm<br>(4.5043-4.5272 in.)                        |
|                                         | 125.67-126.25 mm                                               |

**2004 Chrysler 300M**

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|                                                                                                              |                                                                  |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Length-Exhaust (Overall)                                                                                     | (4.9476-4.9705 in.)                                              |
| Stem Diameter-Intake                                                                                         | 6.935-6.953 mm<br>(0.2730-0.2737 in.)                            |
| Stem Diameter-Exhaust                                                                                        | 6.906-6.924 mm<br>(0.2719-0.2726 in.)                            |
| Stem-to-Guide Clearance-Intake<br>-(Max.) Rocking Method                                                     | 0.022-0.065 mm<br>(0.0009-0.0026 in.)<br>0.29 mm<br>(0.0114 in.) |
| Stem-to-Guide Clearance-Exhaust<br>-(Max.) Rocking Method                                                    | 0.051-0.094 mm<br>(0.002-0.0037 in.)<br>0.370 mm<br>(0.0146 in.) |
| Valve Lift-Intake (Zero Lash)                                                                                | 8.55 mm<br>(0.3367 in.)                                          |
| Valve Lift-Exhaust (Zero Lash)                                                                               | 6.53 mm<br>(0.2571 in.)                                          |
| Valve Margin - Intake:                                                                                       | 0.835-1.165 mm<br>(0.0329-0.0459 in.)                            |
| Valve Margin - Exhaust:                                                                                      | 1.44-1.77 mm<br>(0.0567-0.0697 in.)                              |
| Valve Stem Tip Height-Intake                                                                                 | 42.366-43.655 mm<br>(1.6680-1.7187 in.)                          |
| Valve Stem Tip Height-Exhaust                                                                                | 44.705-45.986 mm<br>(1.760-1.8105 in.)                           |
| <b>Valve Springs</b>                                                                                         |                                                                  |
| Free Length-Intake (Approx.)                                                                                 | 43.675 mm<br>(1.7195 in.)                                        |
| Free Length-Exhaust (Approx.)                                                                                | 44.319 mm<br>(1.7448 in.)                                        |
| Spring Force-Intake (Valve Closed)                                                                           | 309-358 N @ 38.0 mm<br>(69.5-80.5 lbs. @ 1.4961 in.)             |
| Spring Force-Exhaust (Valve Closed)                                                                          | 314-354 N @ 38.0 mm<br>(71-79 lbs. @ 1.4961 in.)                 |
| Spring Force-Intake (Valve Open)                                                                             | 836-907 N @ 29.85 mm<br>(188-204 lbs. @ 1.1594 in.)              |
| Spring Force-Exhaust (Valve Open)                                                                            | 579-640 N @ 31.47 mm<br>(130-144 lbs. @ 1.239 in.)               |
| Number of Coils-Intake                                                                                       | 6.86                                                             |
| Number of Coils-Exhaust                                                                                      | 7.66                                                             |
| Color of Spring (Top of Coils)<br>-Intake (Right Hand Coil Direction)<br>-Exhaust (Left Hand Coil Direction) | Orange<br>Yellow                                                 |
| Wire Diameter-Intake                                                                                         | 4.29-4.34 mm                                                     |

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|                                                                                                |                                     |
|------------------------------------------------------------------------------------------------|-------------------------------------|
|                                                                                                | (0.1689-0.1709 in.)                 |
| Wire Diameter-Exhaust                                                                          | 4.16-4.22 mm<br>(0.1638-0.1661 in.) |
| Spring Installed Height (Spring Seat to Bottom of Retainer)-Intake & Exhaust                   | 38.0 mm<br>(1.4961 in.)             |
| <b>Oil Pump</b>                                                                                |                                     |
| Clearance Over Rotors                                                                          | 0.077 mm<br>(0.003 in.)             |
| Cover Out-of-Flat (Max.)                                                                       | 0.025 mm<br>(0.001 in.)             |
| Inner & Outer Rotor Thickness (Min.)                                                           | 14.299 mm<br>(0.563 in.)            |
| Outer Rotor Thickness (Max.)                                                                   | 0.39 mm<br>(0.015 in.)              |
| Outer Rotor Diameter (Min.)                                                                    | 79.997 mm<br>(3.149 in.)            |
| Tip Clearance Between Rotors (Max.)                                                            | 0.20 mm<br>(0.008 in.)              |
| <b>Oil Pressure</b>                                                                            |                                     |
| <b>NOTE:</b><br><b>At Normal Operating Temperatures)</b>                                       |                                     |
| Pressure @ Curb Idle Speed <sup>(2)</sup>                                                      | 34.47 kPa Min.<br>(5 psi) Min.      |
| Pressure @ 3000 RPM                                                                            | 300-724 kPa<br>(45-105 psi)         |
| <b>CAUTION:</b><br><b>(2) If pressure is zero at curb idle, DO NOT run engine at 3000 RPM.</b> |                                     |

**TORQUE****TORQUE SPECIFICATION**

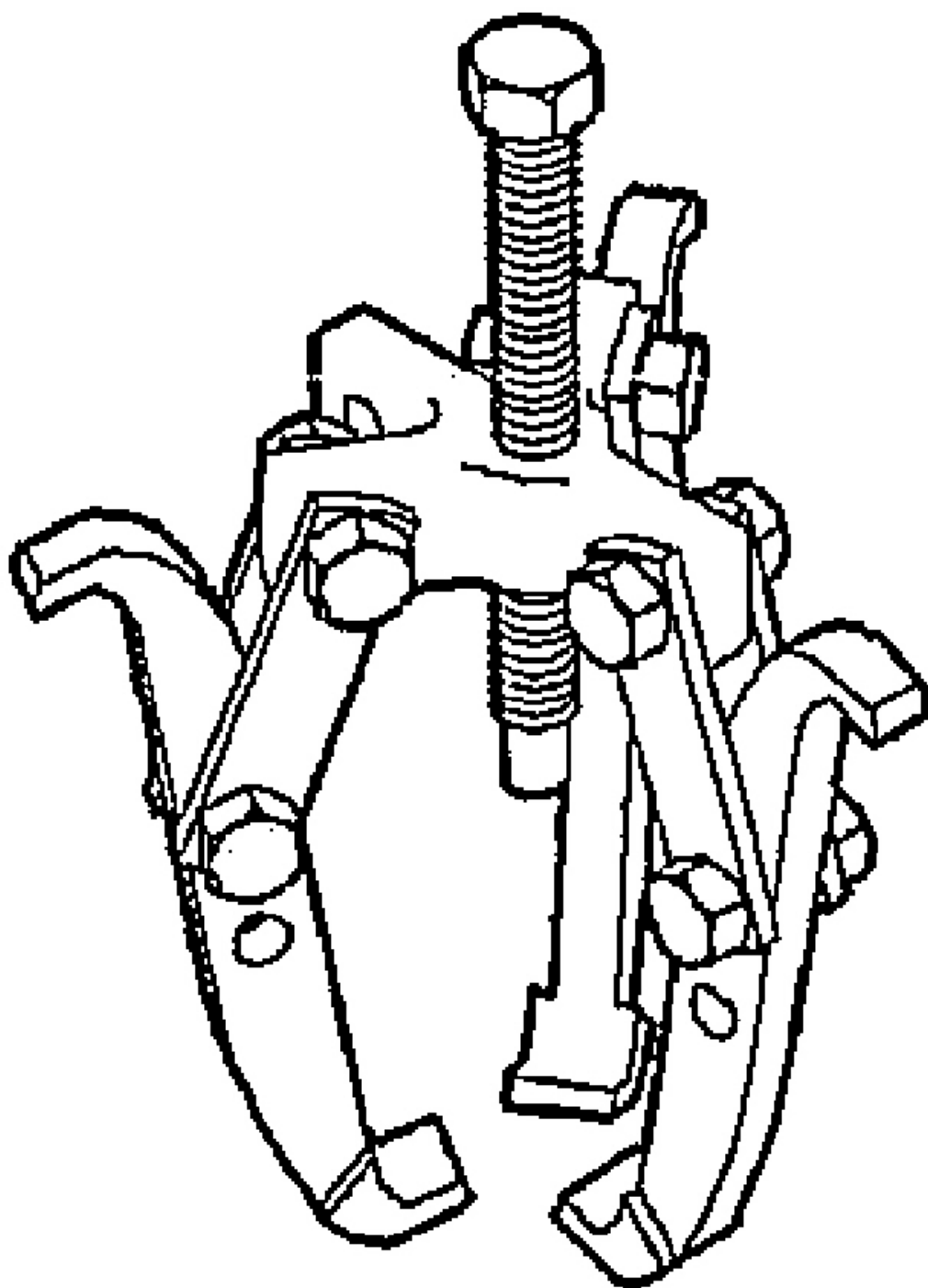
| DESCRIPTION                            | N.m           | Ft. Lbs.     | In. Lbs. |
|----------------------------------------|---------------|--------------|----------|
| A/C Compressor Bracket to Engine-Bolts | 54            | 40           | -        |
| A/C Compressor to Bracket              | 28            | -            | 250      |
| Camshaft Sprocket Bolt-Right Side      | 102 +1/4 Turn | 75 +1/4 Turn | -        |
| Camshaft Sprocket Bolt-Left Side       | 115 +1/4 Turn | 85 +1/4 Turn | -        |
| Camshaft Thrust Plate-Bolts            | 28            | -            | 250      |
| Connecting Rod Cap-Nuts                | 54 +1/4 Turn  | 40 +1/4 Turn | -        |
| Crankshaft Main Bearing Cap            |               |              |          |
| -Inner Main Cap Bolts                  | 20 +1/4 Turn  | 15 +1/4 Turn | -        |
| -Outer Main Cap Bolts                  | 27 +1/4 Turn  | 20 +1/4 Turn | -        |
| -Tie Bolts (Horizontal)                | 28            | -            | 250      |
| Crankshaft Damper-Bolts                | 95            | 70           | -        |

## 2004 Chrysler 300M

2004 ENGINE Engine 3.5L - 300M, Concorde & Intrepid

|                                                                                   |                                              |           |     |
|-----------------------------------------------------------------------------------|----------------------------------------------|-----------|-----|
| Cylinder Head Bolts <sup>(1)</sup>                                                | 61                                           | 45        | -   |
| -Step 1                                                                           | 88                                           | 65        | -   |
| -Step 2                                                                           | 88                                           | 65        | -   |
| -Step 3                                                                           | +1/4 Turn                                    | +1/4 Turn | -   |
| -Step 4                                                                           |                                              |           |     |
| (1) Refer to procedure for tightening sequence . (Refer to <b>CYLINDER HEAD</b> ) |                                              |           |     |
| Cylinder Head Cover-Bolts                                                         | 12                                           | -         | 105 |
| Exhaust Manifold to Cylinder Head-Bolts                                           | 23                                           | -         | 200 |
| Exhaust Manifold Heat Shield-Bolts                                                | 12                                           | -         | 105 |
| Engine Mount Bracket to Block-Bolts                                               | 61                                           | 45        | -   |
| Engine Mount Isolator-Nuts                                                        | 61                                           | 45        | -   |
| Generator Bracket-Bolts                                                           | 54                                           | 40        | -   |
| Intake Manifold                                                                   | 12                                           | -         | 105 |
| -M6 Bolts                                                                         | 28                                           | -         | 250 |
| -M8 Bolts                                                                         |                                              |           |     |
| Oil Pan                                                                           | 12                                           | -         | 105 |
| -M6 Bolts                                                                         | 28                                           | -         | 250 |
| -M8 Bolts                                                                         |                                              |           |     |
| Oil Pan Drain Plug                                                                | 27                                           | 20        | -   |
| Oil Filter                                                                        | 16                                           | 12        | -   |
| Oil Pump to Block-Bolts                                                           | 28                                           | -         | 250 |
| Oil Pump Cover-Bolts                                                              | 12                                           | -         | 105 |
| Oil Pump Pick Up Tube-Bolt                                                        | 28                                           | -         | 250 |
| PCV Valve                                                                         | 7                                            | -         | 60  |
| Crankshaft Rear Seal Retainer                                                     | 12                                           | -         | 105 |
| Rocker Shaft Pedestal Retaining-Bolts                                             | 31                                           | -         | 275 |
| Spark Plugs                                                                       | 28                                           | 20        | -   |
| Structural Collar                                                                 | (Refer to <b>STRUCTURAL COLLAR / COVER</b> ) |           |     |
| Thermostat Housing/Water Inlet Connector-Bolts                                    | 12                                           | -         | 105 |
| Throttle Body-Bolts                                                               | 12                                           | -         | 105 |
| Timing Belt Tensioner-Bolts                                                       | 28                                           | -         | 250 |
| Timing Belt Tensioner Pulley Assembly-Bolt                                        | 61                                           | 45        | -   |
| Timing Belt Cover                                                                 | 12                                           | -         | 105 |
| -M6 Bolts                                                                         | 28                                           | -         | 250 |
| -M8 Bolts                                                                         | 54                                           | 40        | -   |
| -M10 Bolts                                                                        |                                              |           |     |

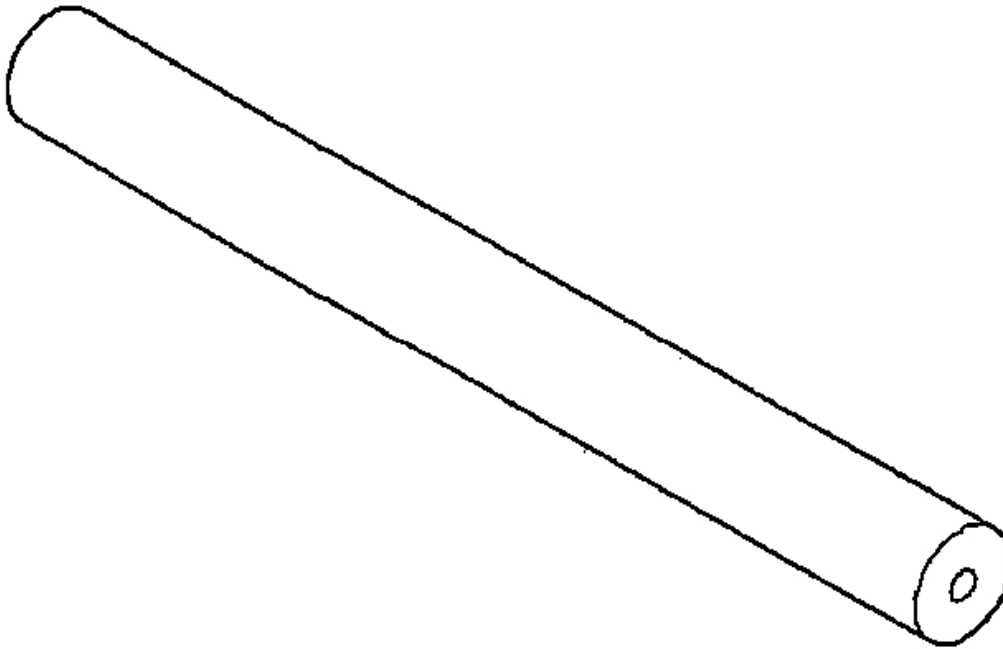
### SPECIAL TOOLS



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**Fig. 9: Puller Damper 1023**

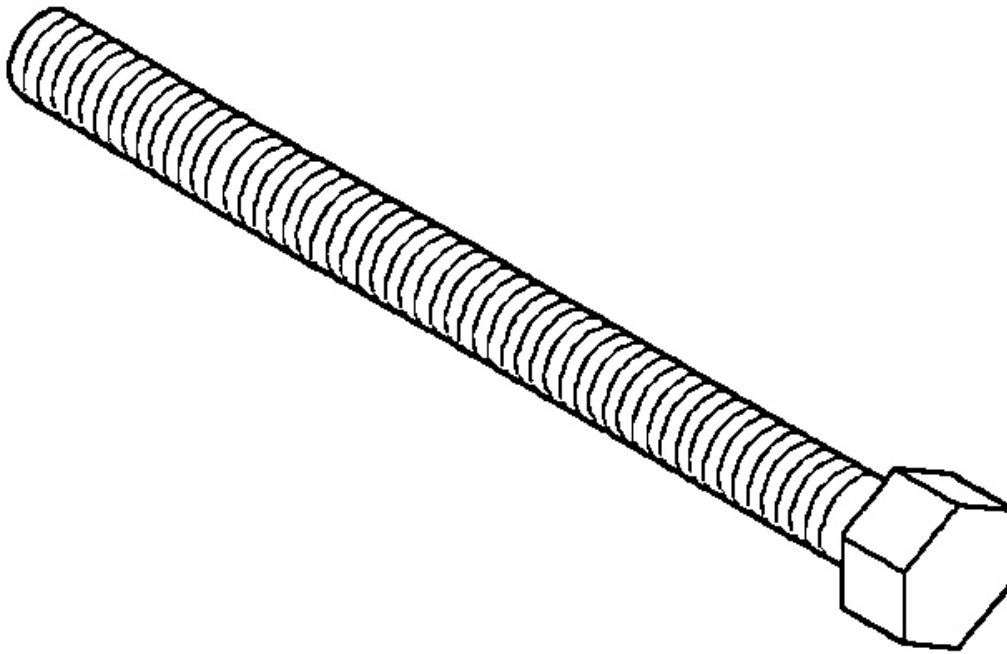
Courtesy of DAIMLERCHRYSLER CORP.



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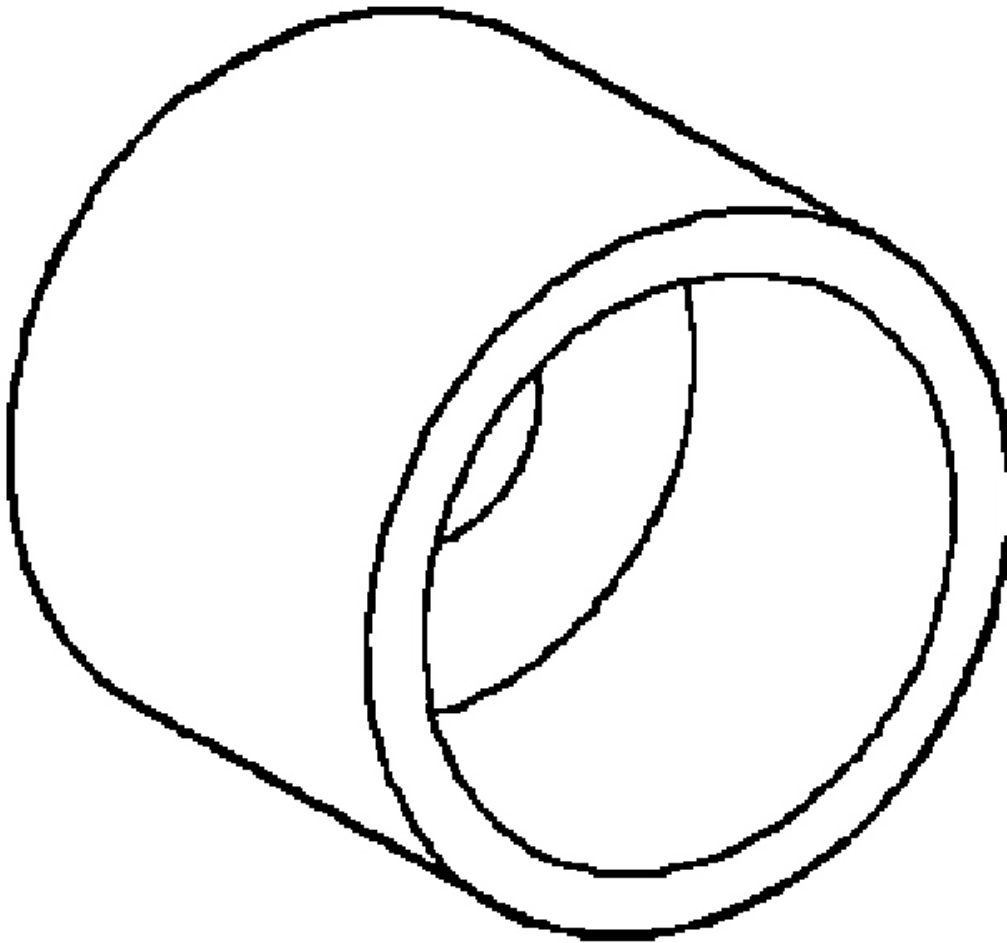
**Fig. 10: Crankshaft Damper Remover Insert C-4685-C2**

Courtesy of DAIMLERCHRYSLER CORP.



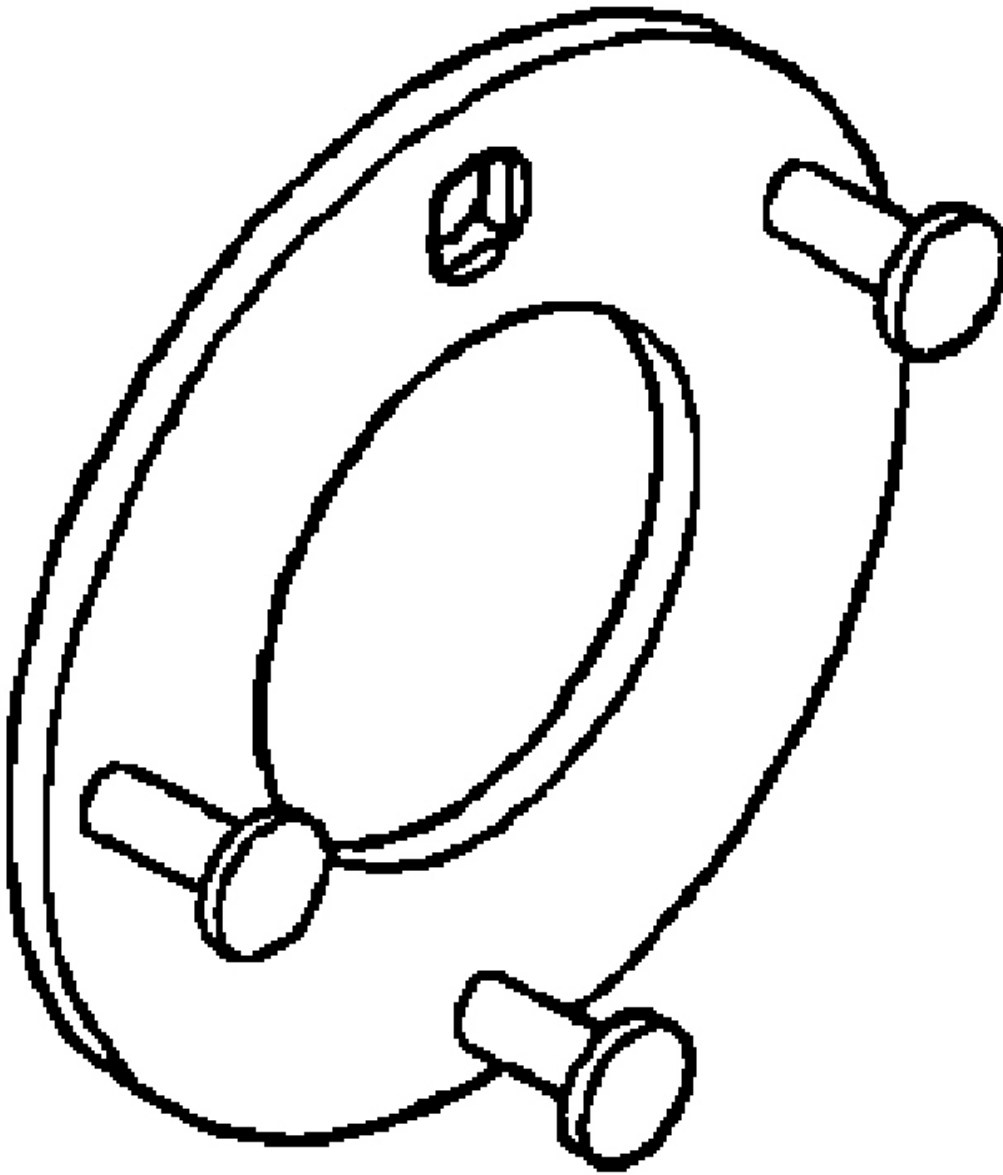
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**Fig. 11: Crankshaft Damper/Sprocket Installer Bolt C-4685-C1**  
Courtesy of DAIMLERCHRYSLER CORP.



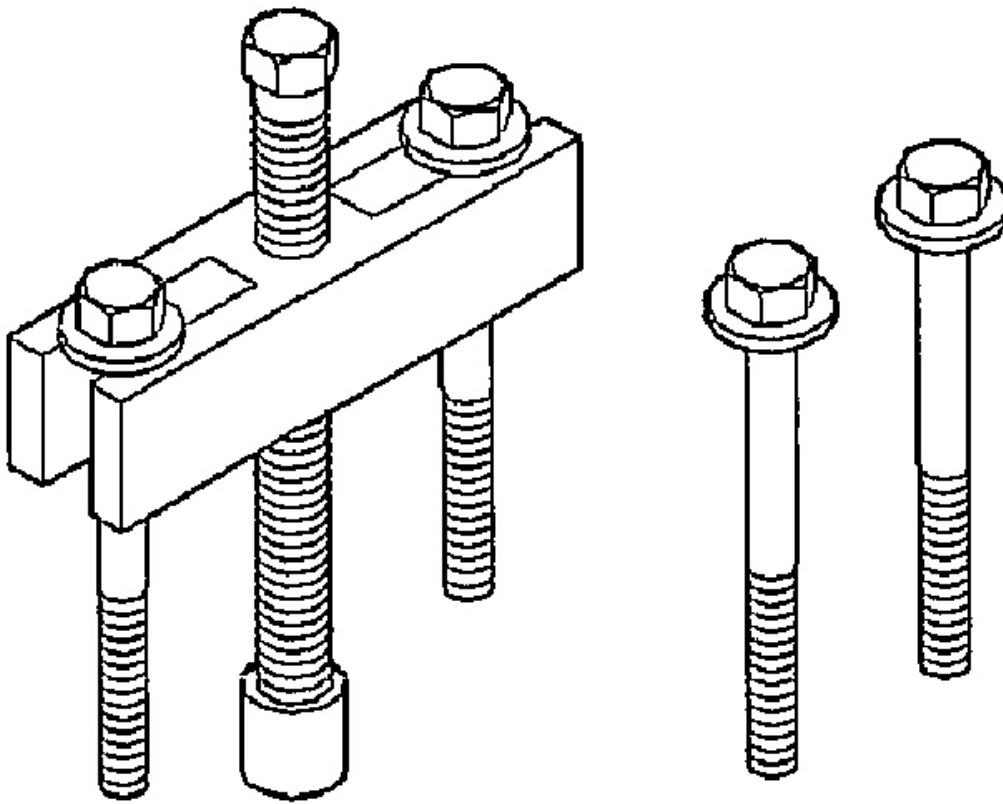
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**Fig. 12: Crankshaft Sprocket Installer 6641**  
**Courtesy of DAIMLERCHRYSLER CORP.**



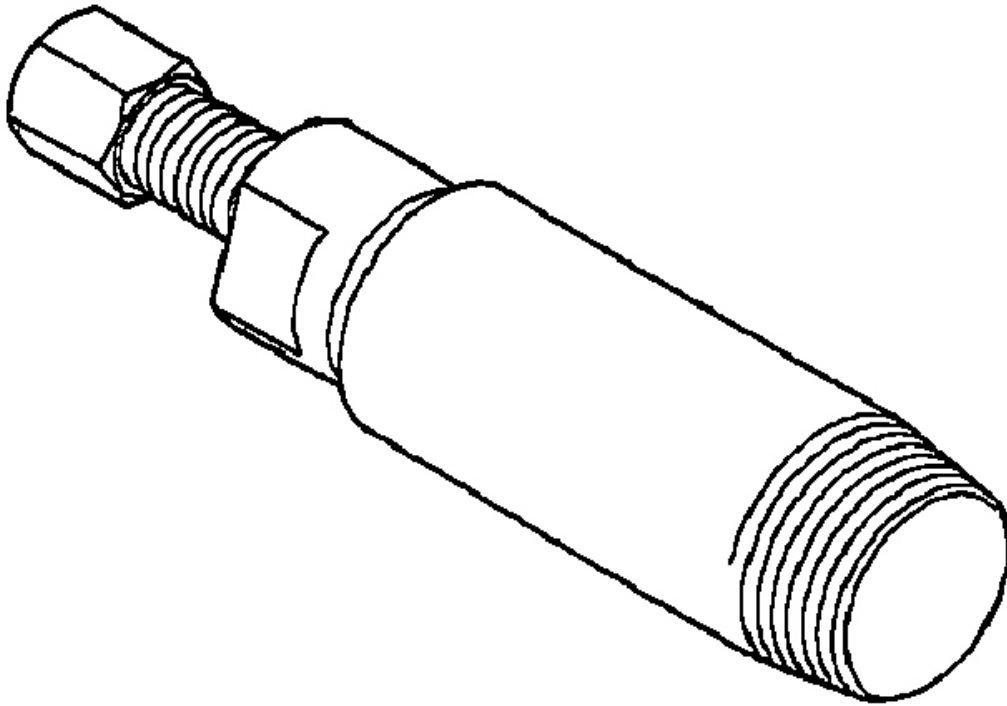
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**Fig. 13: Crankshaft Damper Holder 8191**  
**Courtesy of DAIMLERCHRYSLER CORP.**



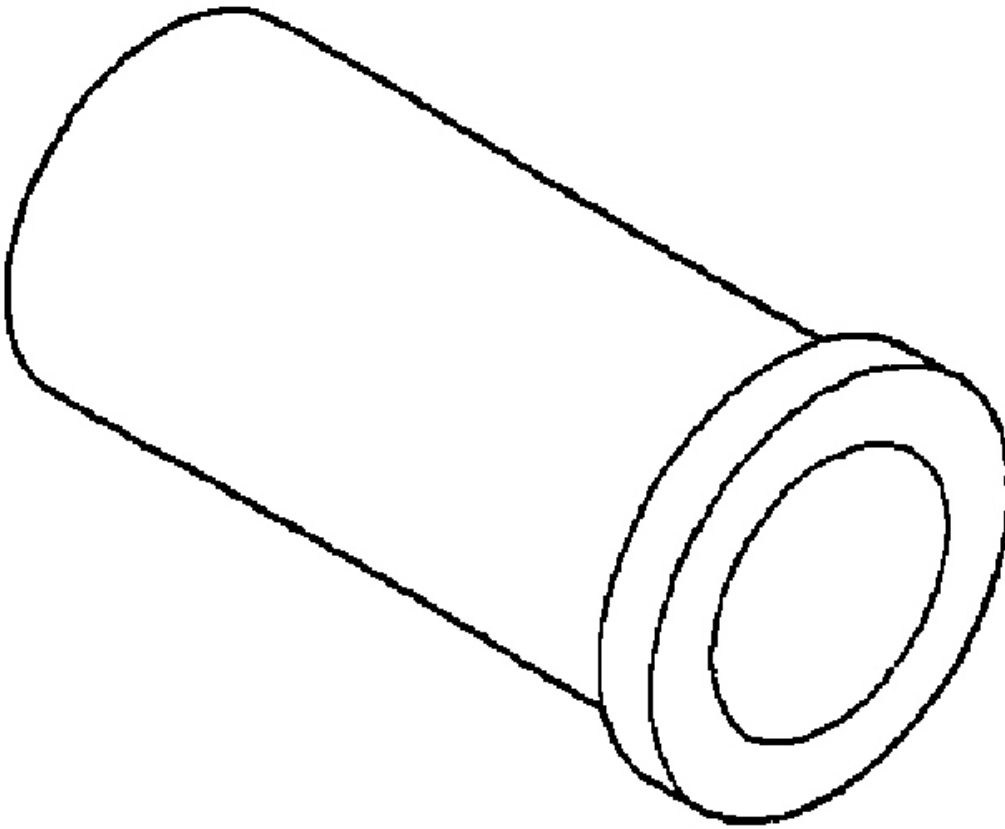
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**Fig. 14: Crankshaft Sprocket Puller L-4407A**  
**Courtesy of DAIMLERCHRYSLER CORP.**



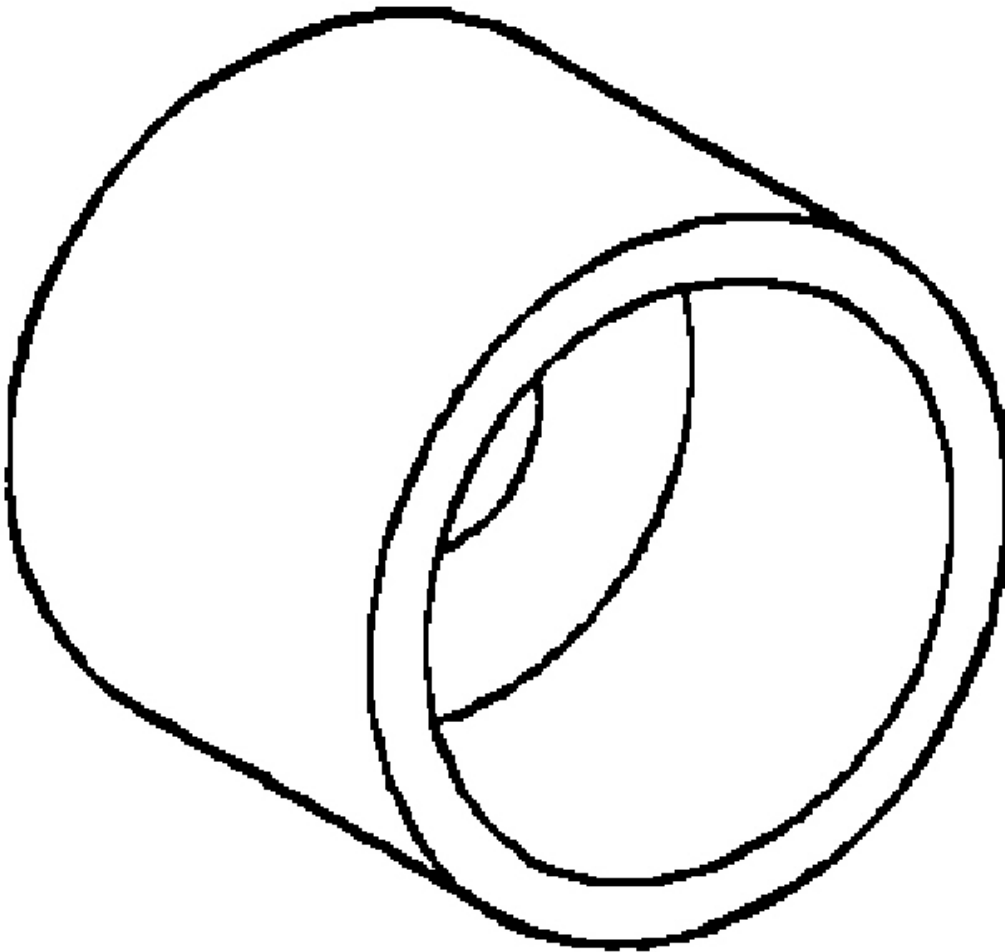
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**Fig. 15: Crankshaft Seal Remover**  
**Courtesy of DAIMLERCHRYSLER CORP.**



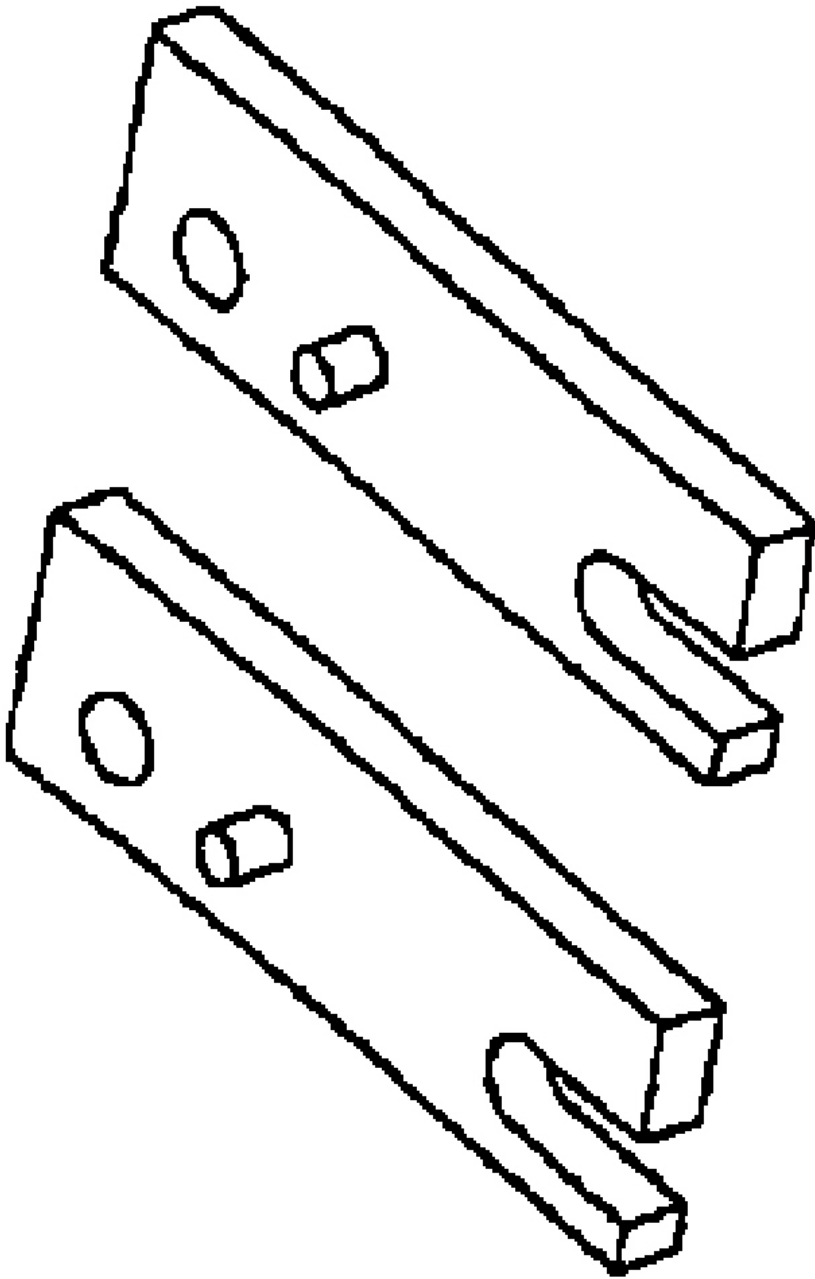
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**Fig. 16: Crankshaft Seal Installer 6342**  
**Courtesy of DAIMLERCHRYSLER CORP.**



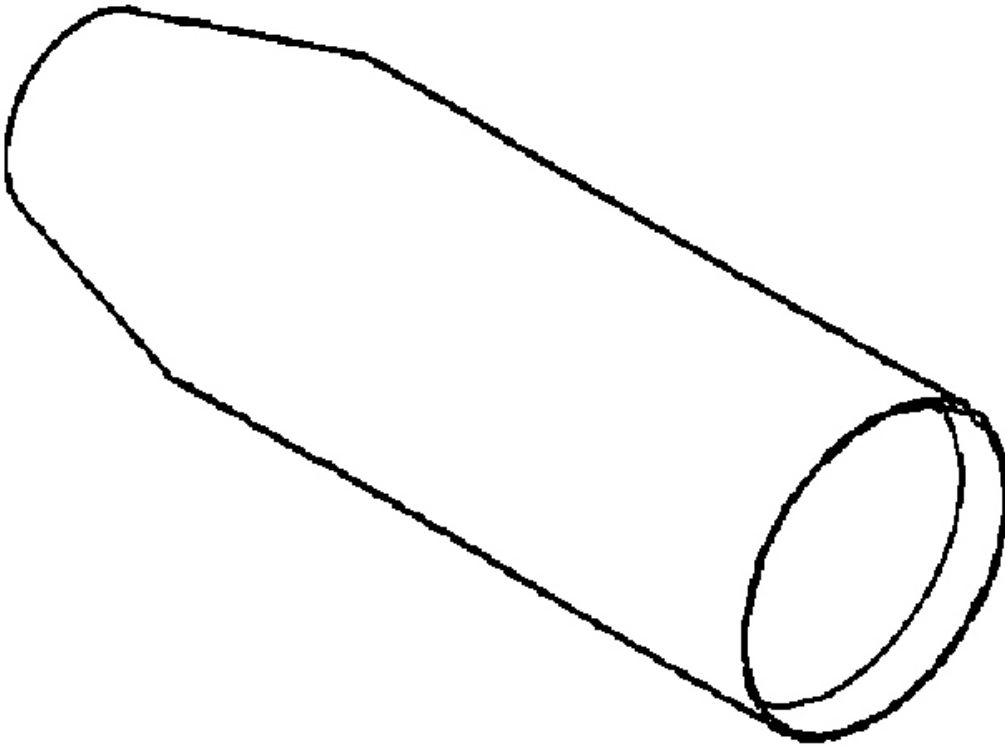
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**Fig. 17: Crankshaft Sprocket Installer 6641**  
**Courtesy of DAIMLERCHRYSLER CORP.**



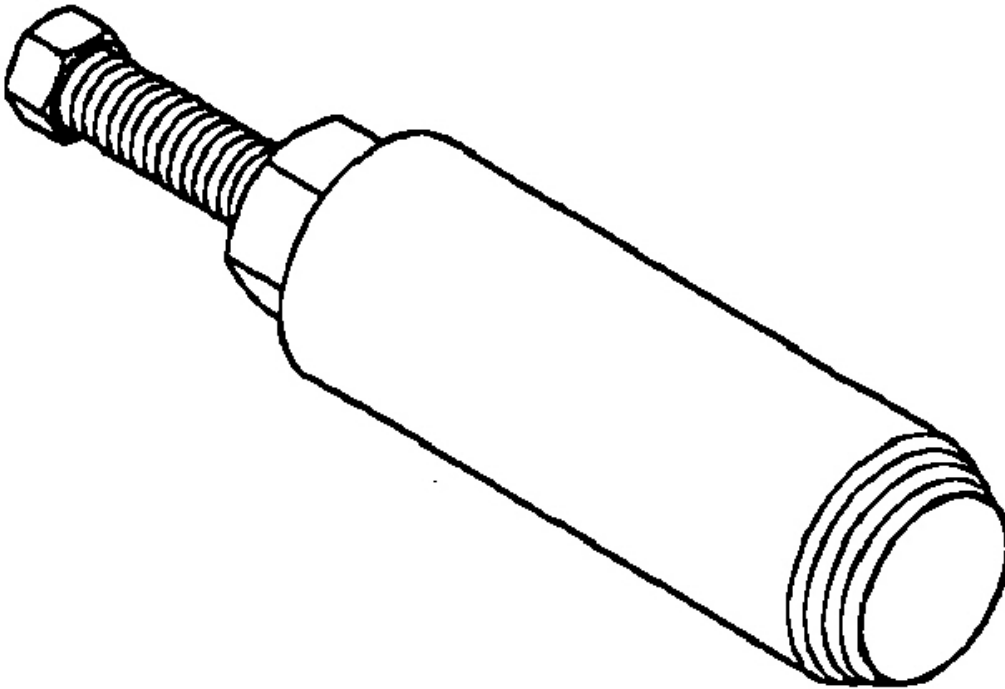
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**Fig. 18: Camshaft Alignment 6642**  
Courtesy of DAIMLERCHRYSLER CORP.



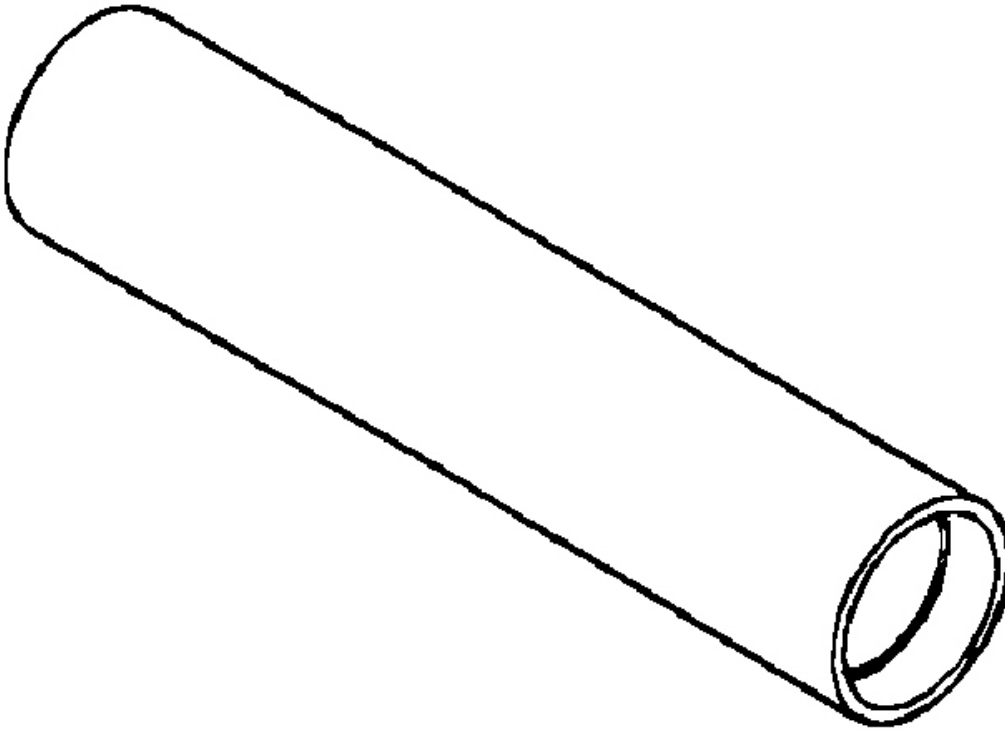
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**Fig. 19: Camshaft Seal Protector 6788**  
**Courtesy of DAIMLERCHRYSLER CORP.**



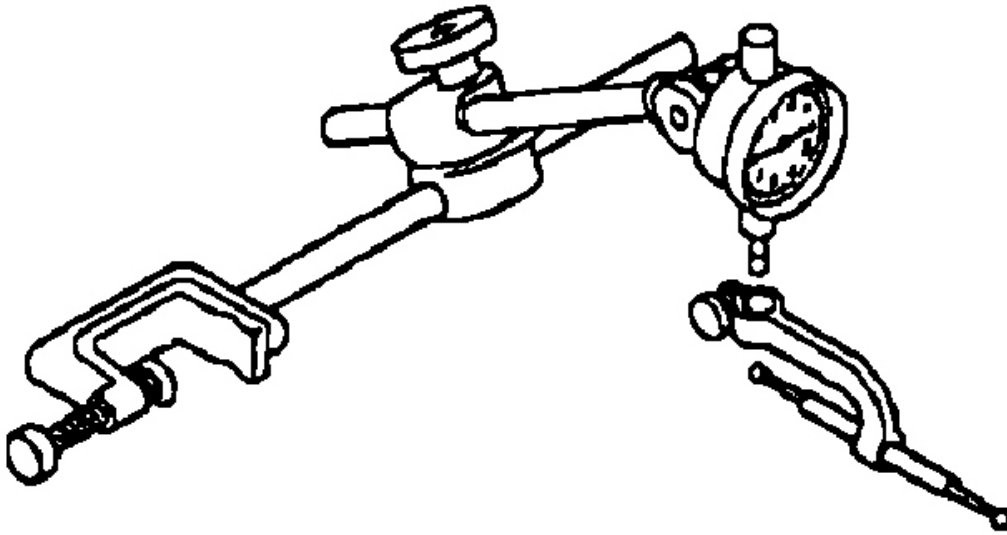
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**Fig. 20: Camshaft Seal Remover C-3981B**  
**Courtesy of DAIMLERCHRYSLER CORP.**



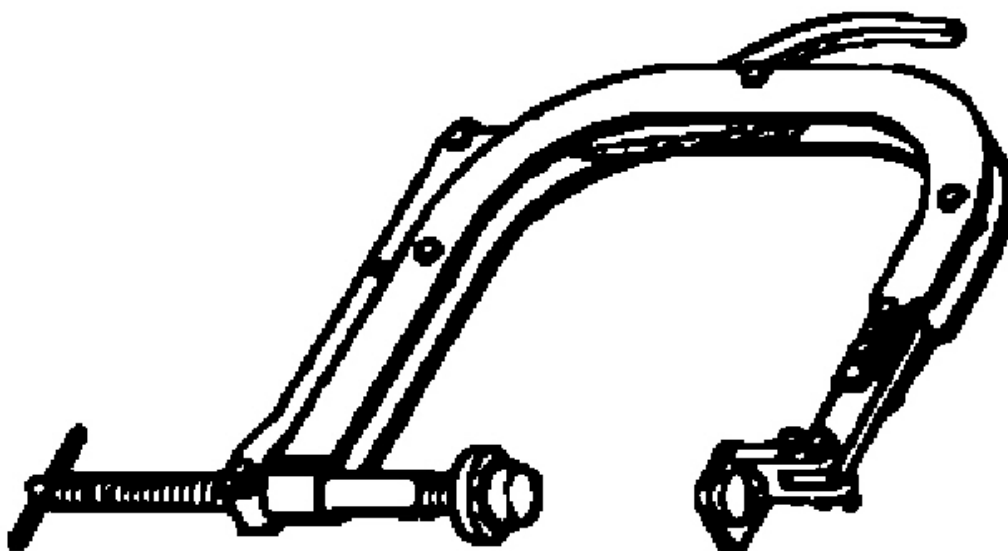
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**Fig. 21: Camshaft Seal Installer 6052**  
**Courtesy of DAIMLERCHRYSLER CORP.**



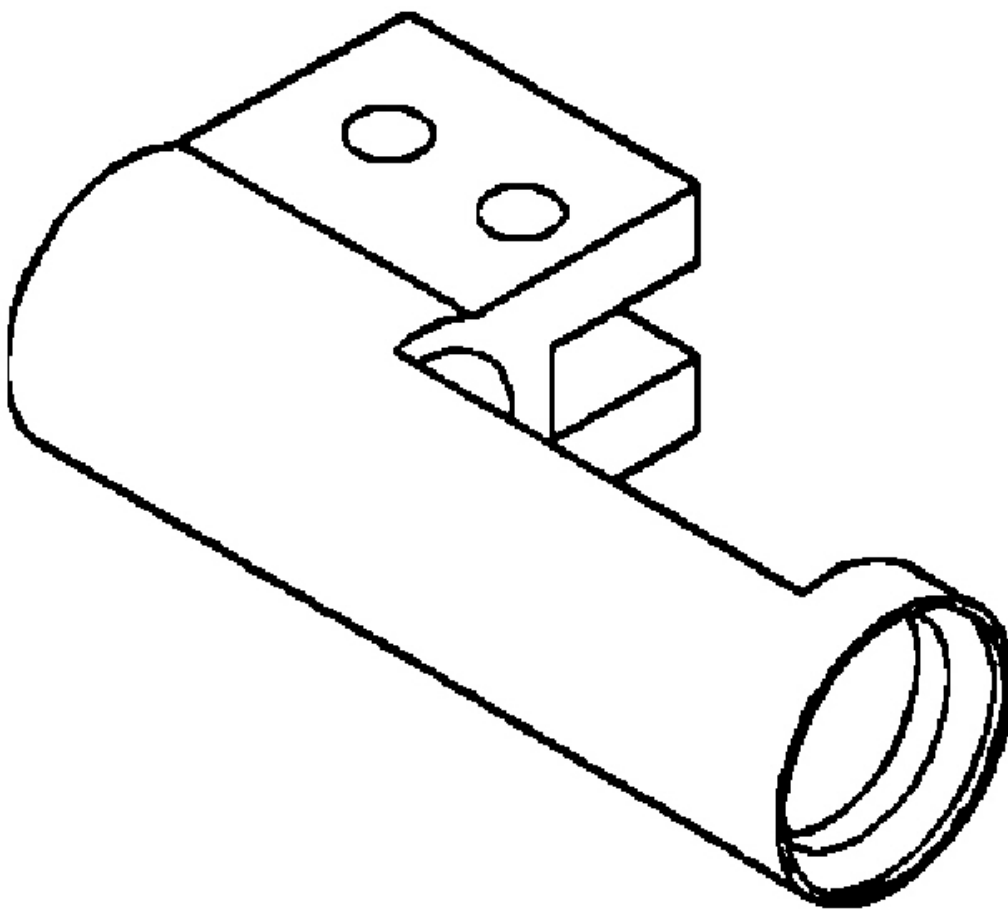
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**Fig. 22: Dial Indicator C-3339**  
**Courtesy of DAIMLERCHRYSLER CORP.**



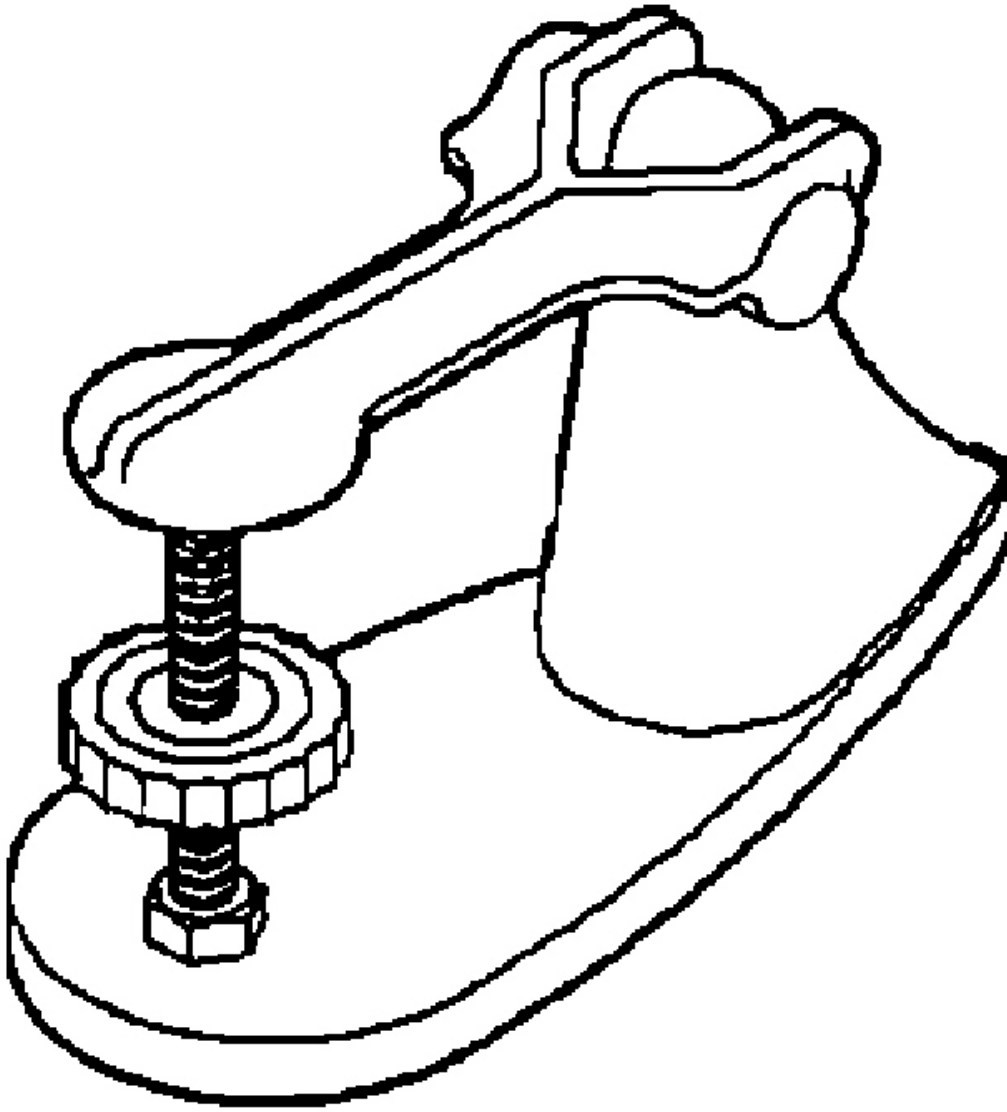
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**Fig. 23: Valve Spring Compressor C-3422-D**  
Courtesy of DAIMLERCHRYSLER CORP.



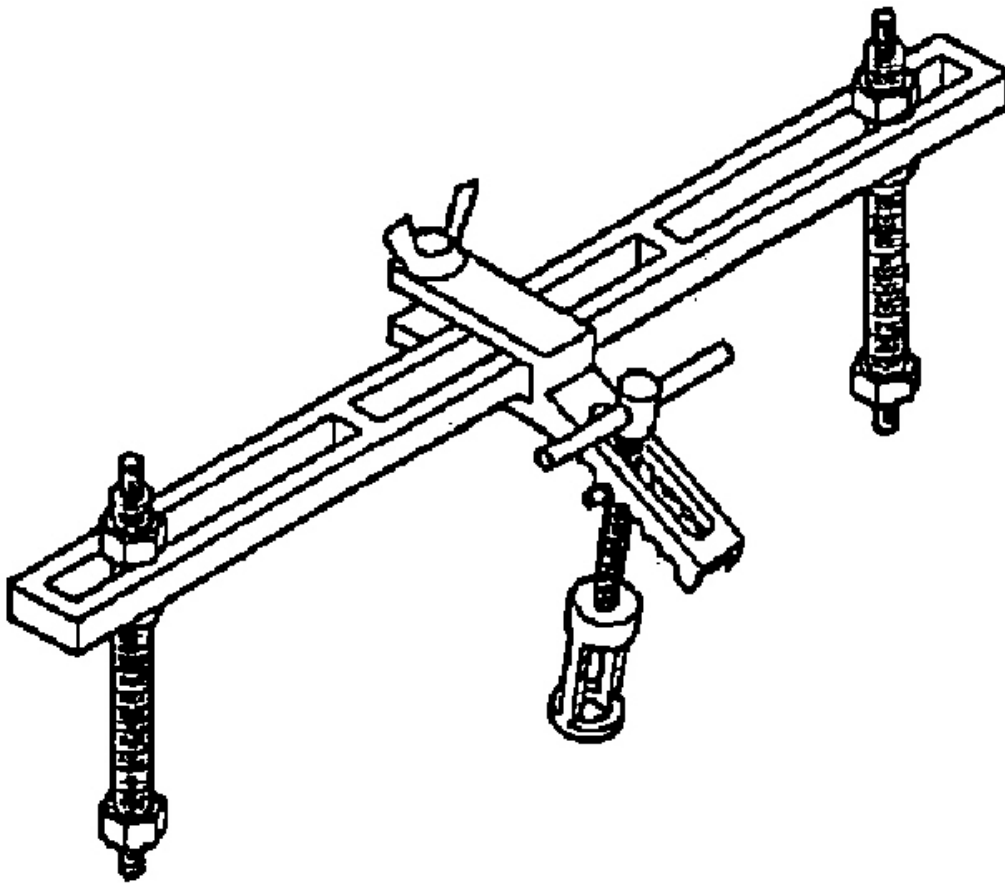
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**Fig. 24: Valve Spring Adapter 6526**  
Courtesy of DAIMLERCHRYSLER CORP.



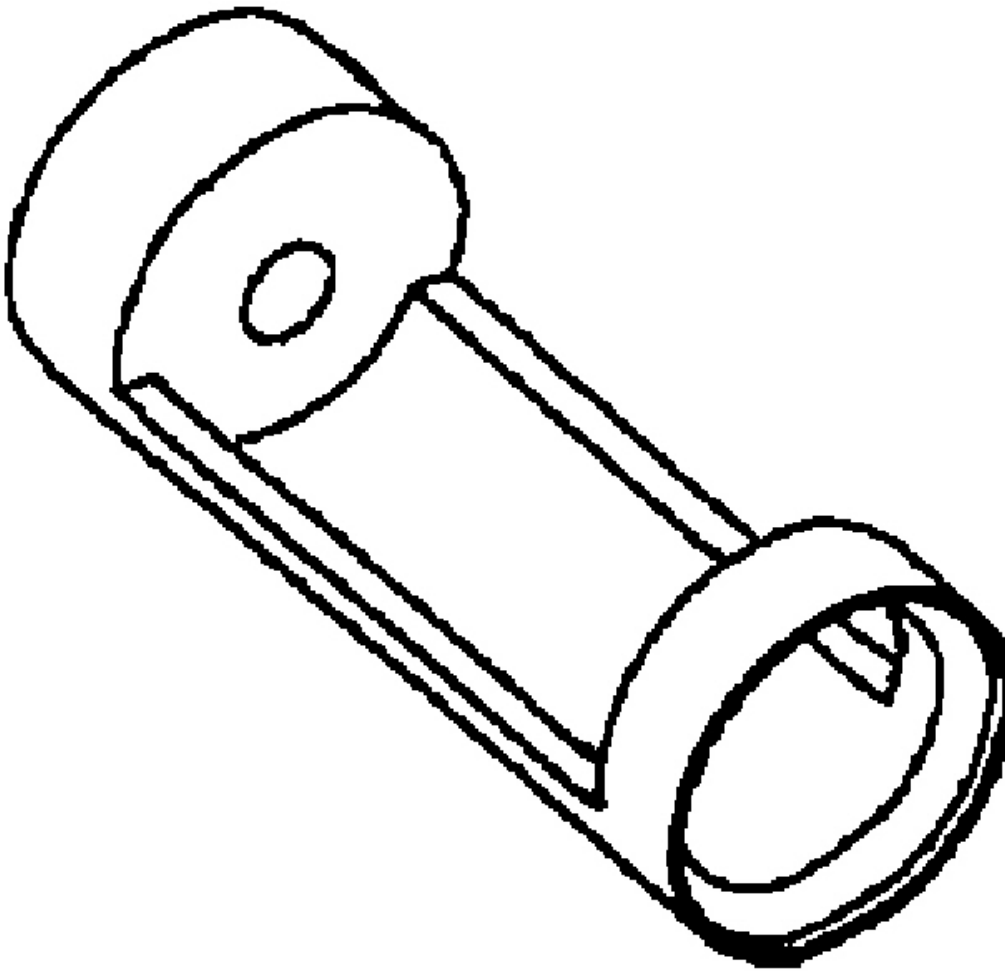
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**Fig. 25: Valve Spring Tester C-647**  
**Courtesy of DAIMLERCHRYSLER CORP.**



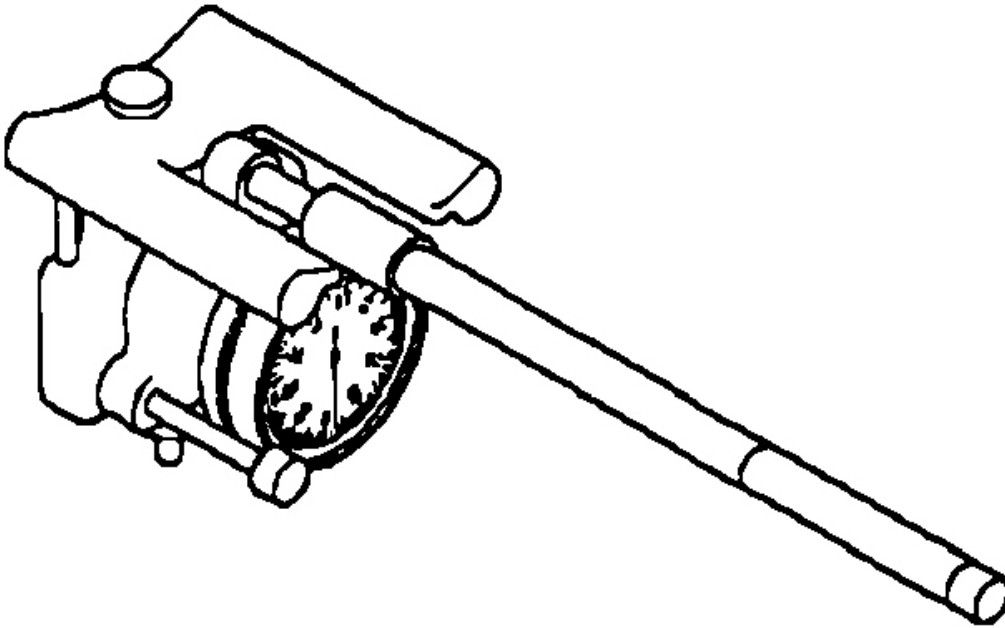
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**Fig. 26: Valve Spring Compressor MD-998772-A**  
Courtesy of DAIMLERCHRYSLER CORP.



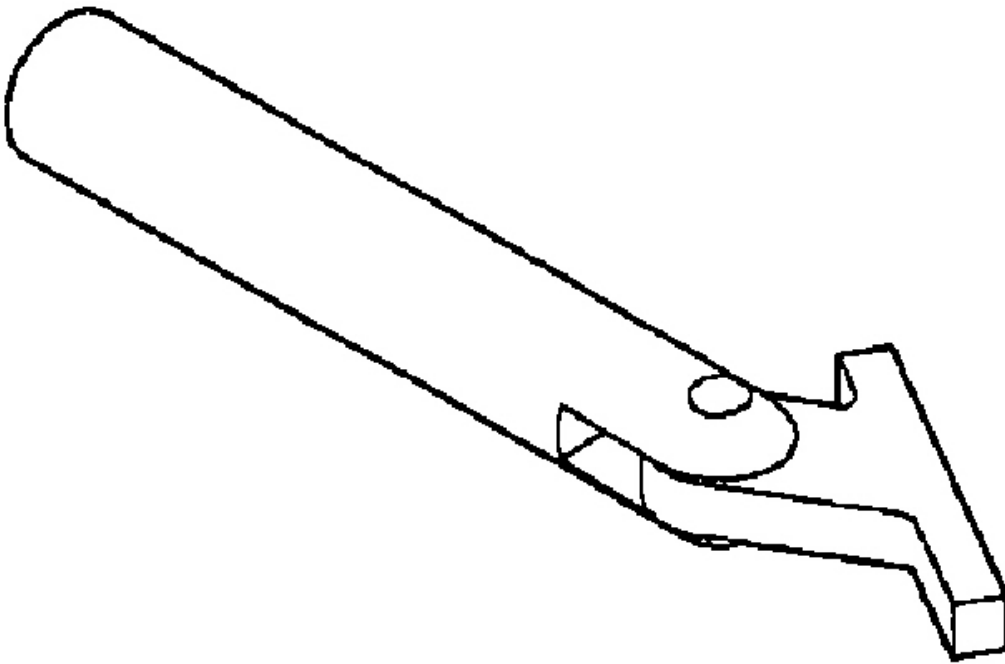
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**Fig. 27: Valve Spring Adapter 6527**  
**Courtesy of DAIMLERCHRYSLER CORP.**



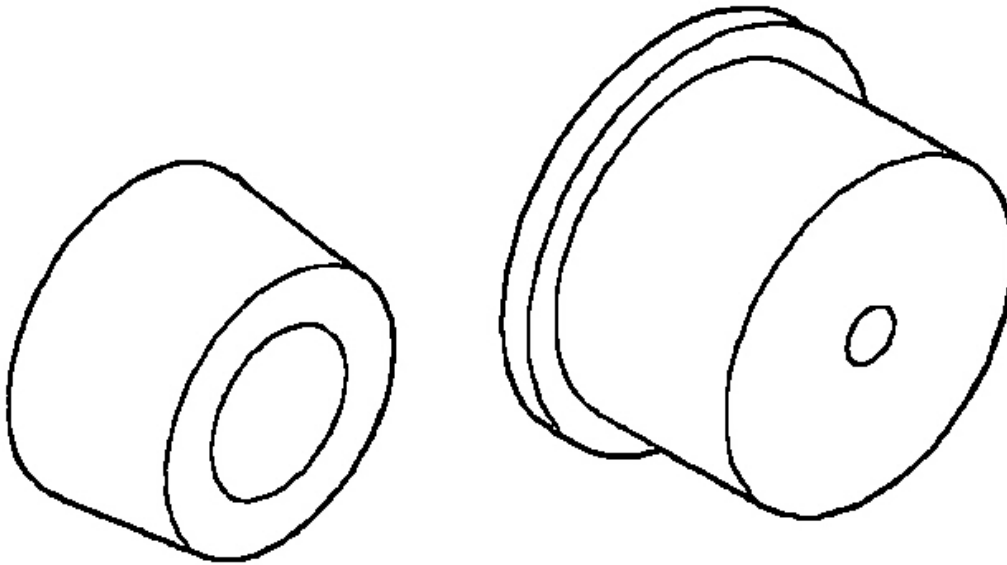
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**Fig. 28: Indicator Bore Size C-119**  
**Courtesy of DAIMLERCHRYSLER CORP.**



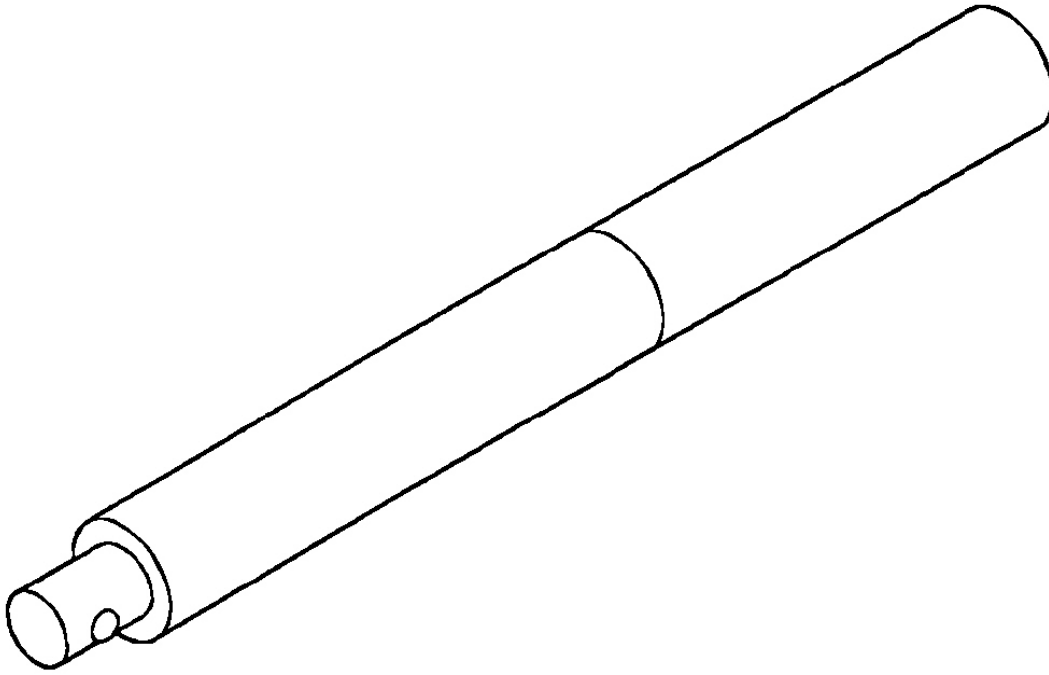
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**Fig. 29: Main Bearing Remover/Installer C-3059**  
**Courtesy of DAIMLERCHRYSLER CORP.**



**G03511883**

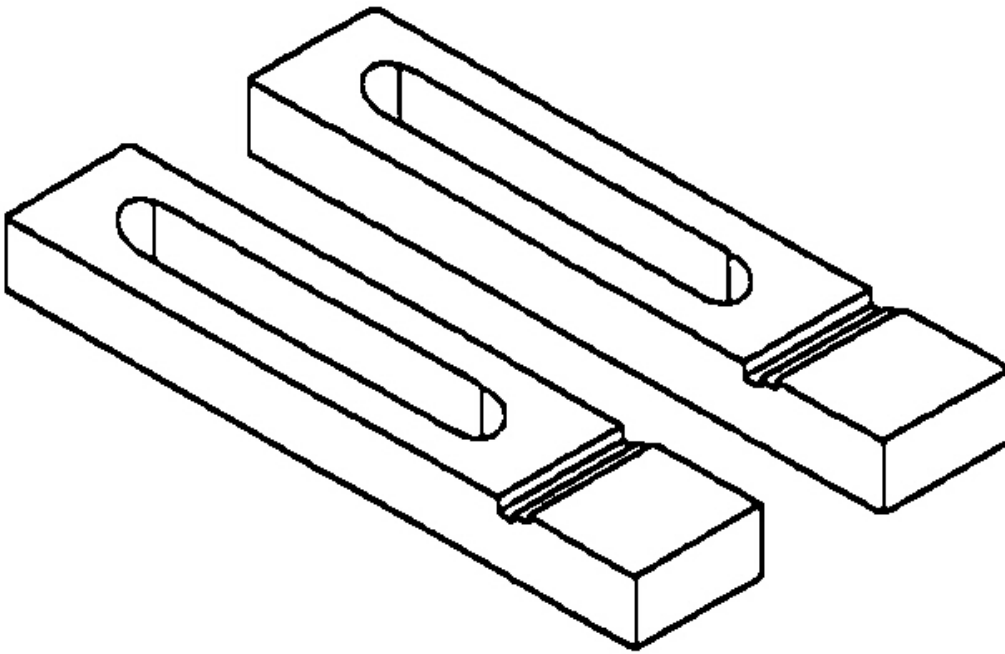
**Fig. 30: Crankshaft Rear Seal Guide 6926-1 & Installer 6926-2**  
**Courtesy of DAIMLERCHRYSLER CORP.**



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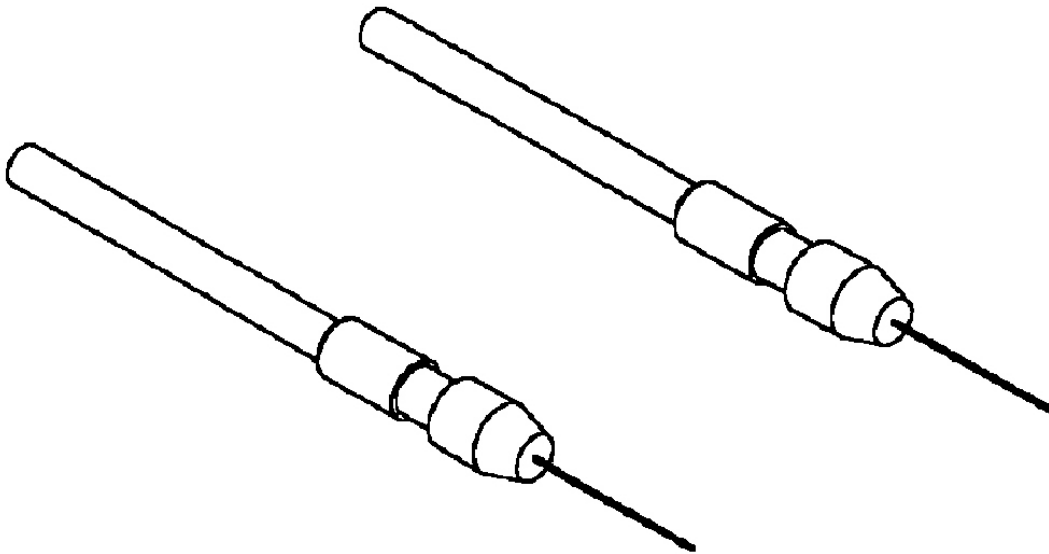
**Fig. 31: Driver Handle C-4171**

**Courtesy of DAIMLERCHRYSLER CORP.**



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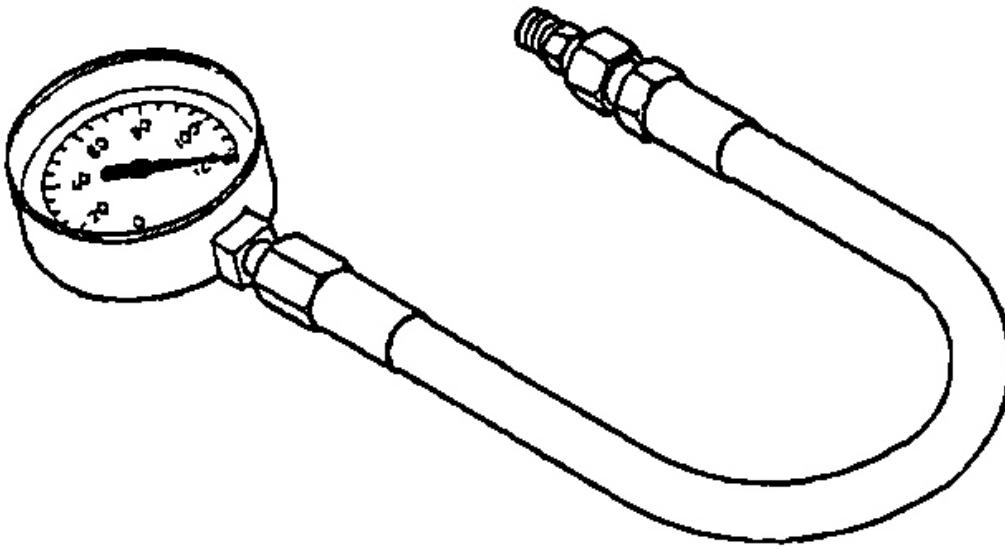
**Fig. 32: Crankshaft Rear Seal Retainer Alignment Fixture 8225**  
Courtesy of DAIMLERCHRYSLER CORP.



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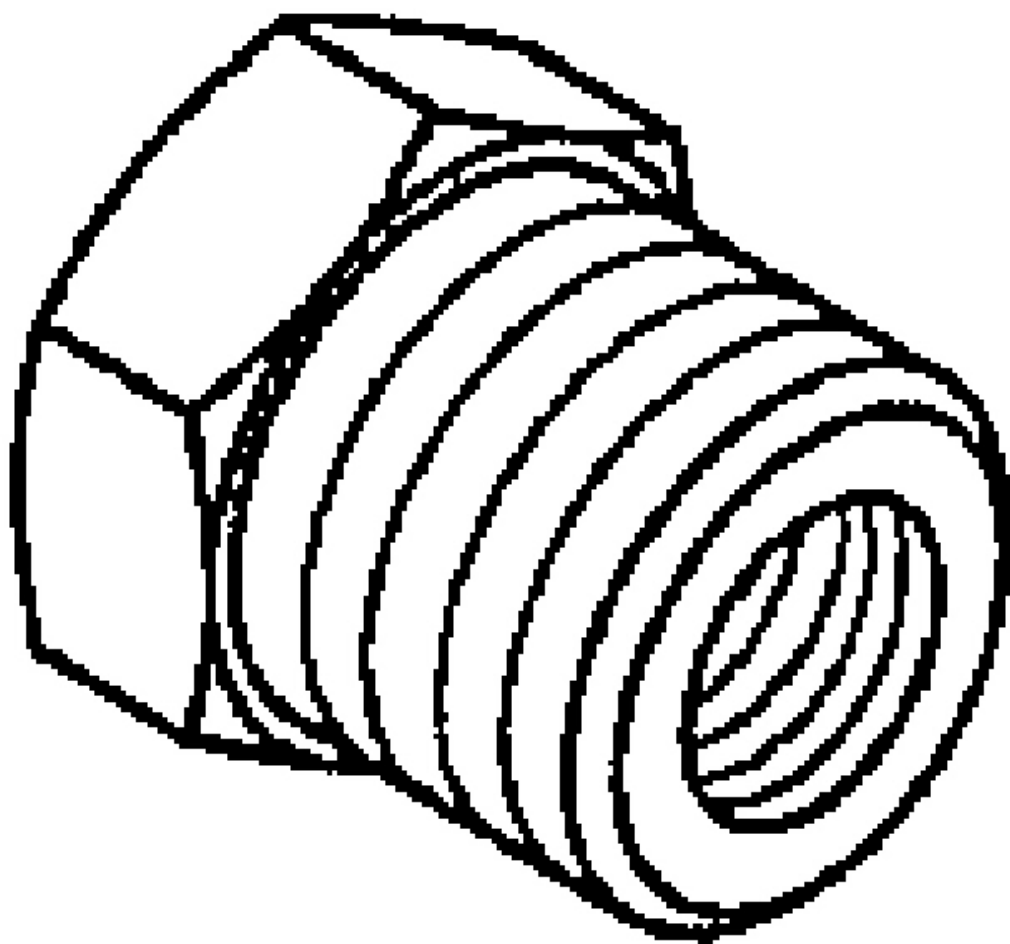
**Fig. 33: Release Probe 8351**

**Courtesy of DAIMLERCHRYSLER CORP.**



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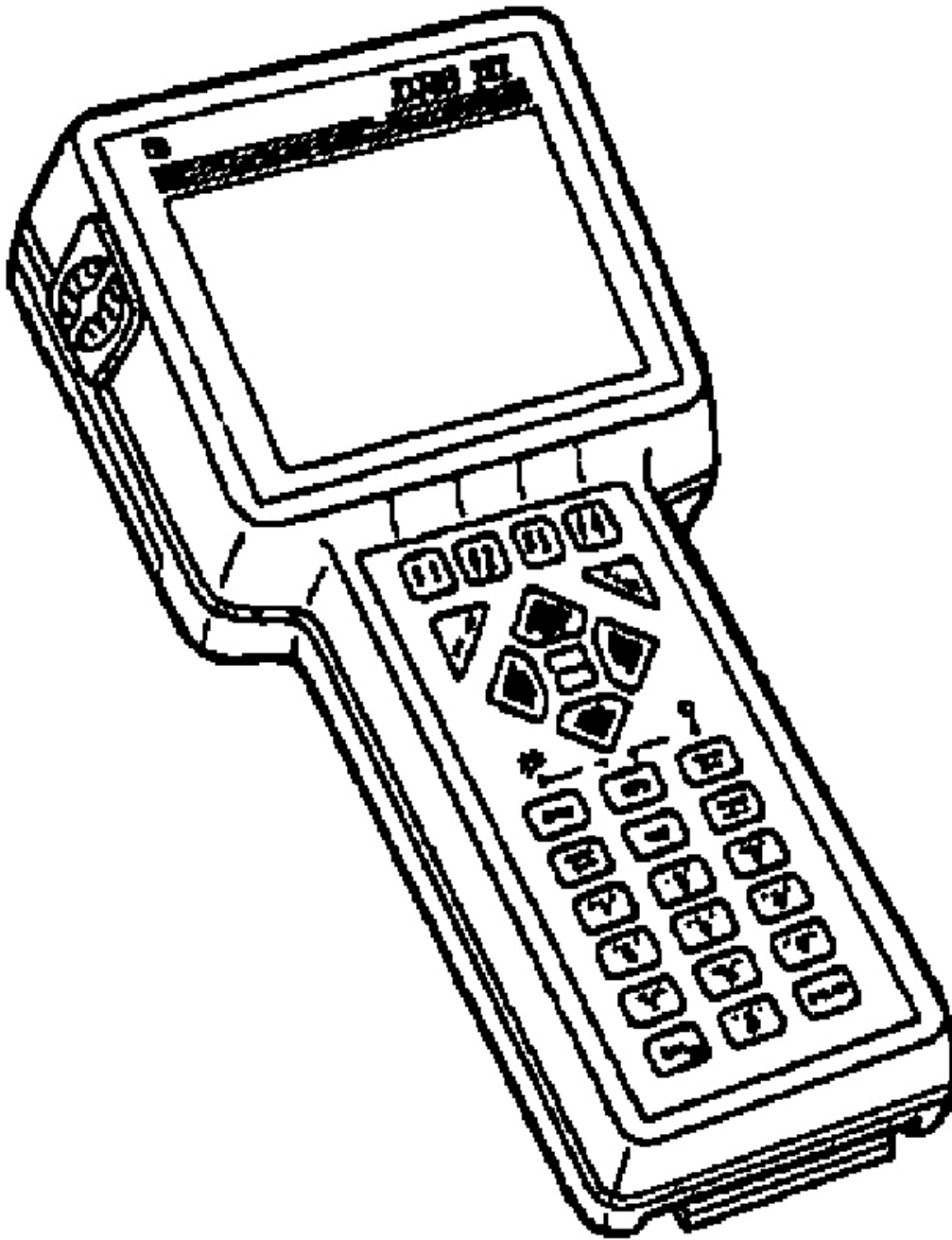
**Fig. 34: Pressure Gauge C-3292**  
**Courtesy of DAIMLERCHRYSLER CORP.**



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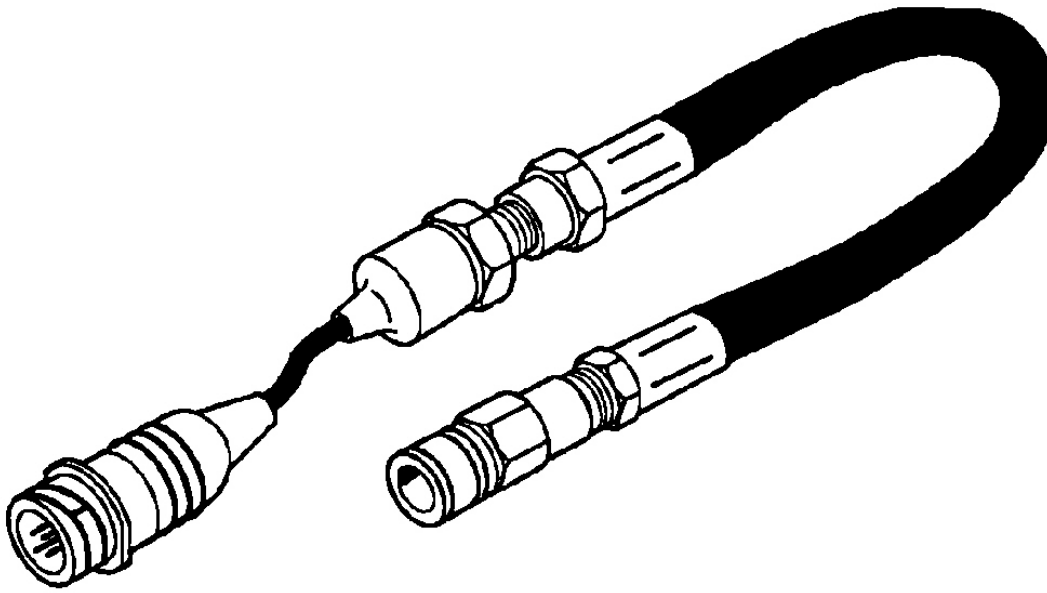
**Fig. 35: Adapter 8406**

Courtesy of DAIMLERCHRYSLER CORP.



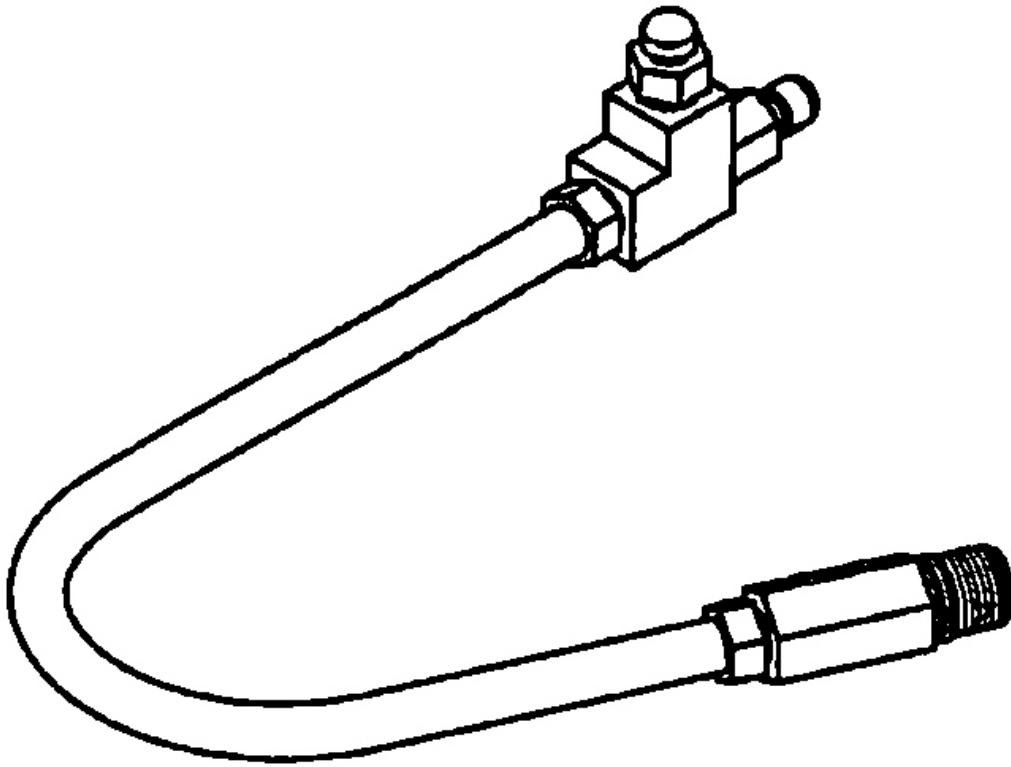
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**Fig. 36: DRB III(R) with PEP Module - OT-CH6010A**  
Courtesy of DAIMLERCHRYSLER CORP.



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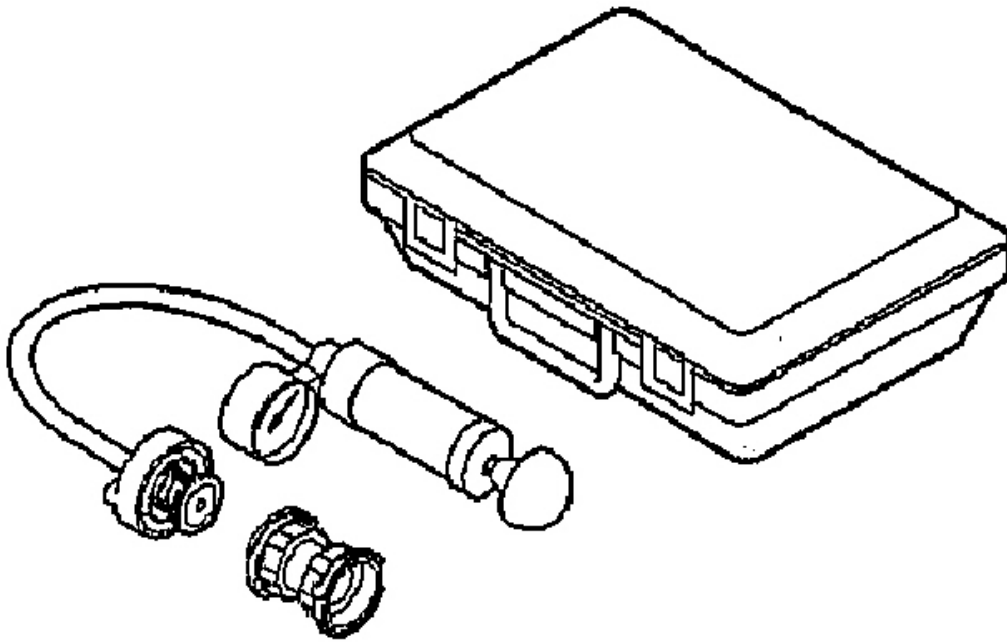
**Fig. 37: Pressure Transducer CH7059**  
**Courtesy of DAIMLERCHRYSLER CORP.**



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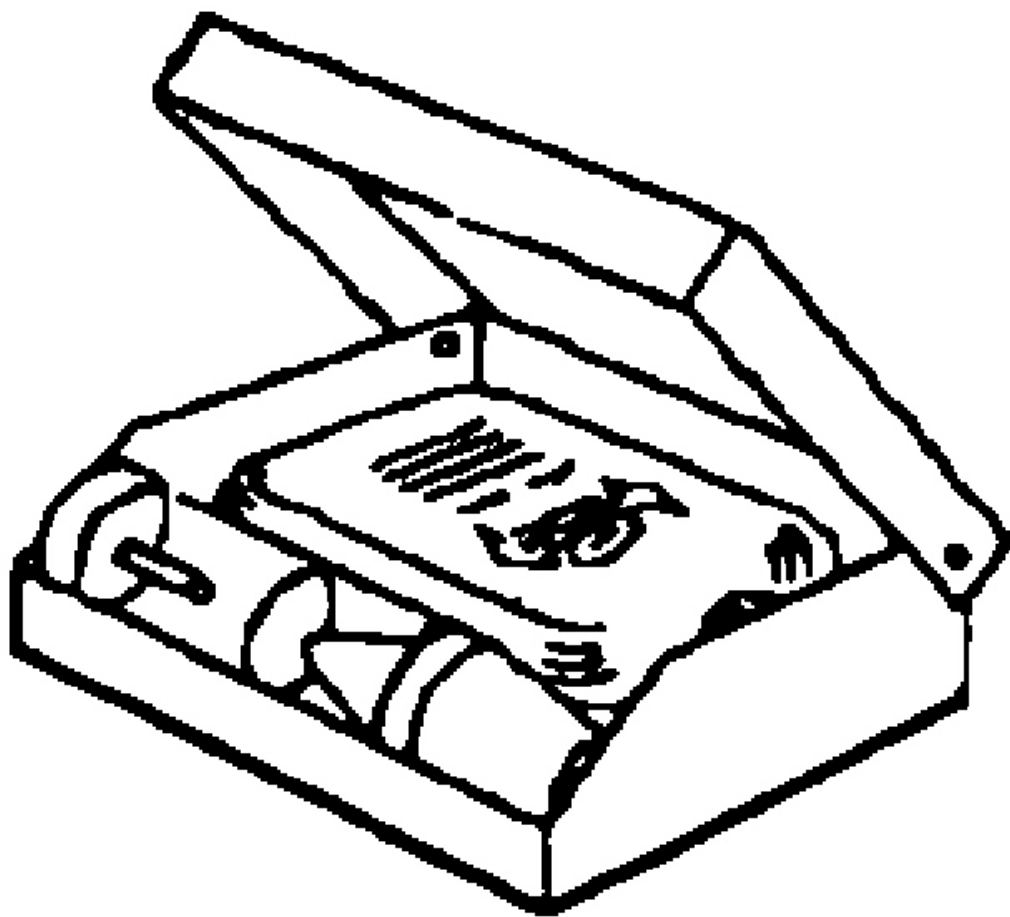
**Fig. 38: Adaptor 8116**

**Courtesy of DAIMLERCHRYSLER CORP.**



**G03511892**

**Fig. 39: Cooling System Tester 7700**  
**Courtesy of DAIMLERCHRYSLER CORP.**



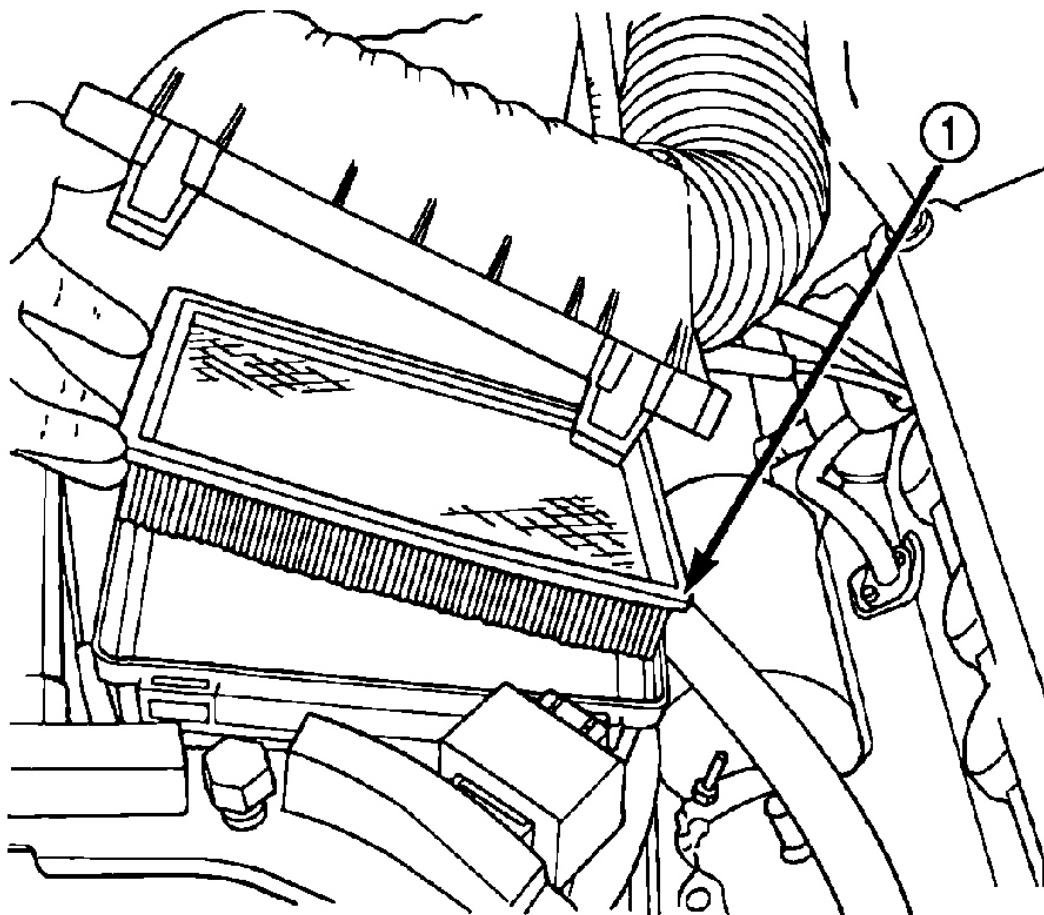
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**Fig. 40: Combustion Leak Tester C-3685-A**  
Courtesy of DAIMLERCHRYSLER CORP.

## AIR CLEANER ELEMENT

### REMOVAL

1. Remove air cleaner lid. Lift lid off of air cleaner housing.
2. Remove filter element (**Fig. 41**).



1 - AIR FILTER ELEMENT

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**Fig. 41: Air Cleaner Housing and Element**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. If necessary, clean the inside of the air cleaner housing.
2. Install new filter element (**Fig. 41**).
3. Place lid over air cleaner housing.

## CYLINDER HEAD

### DESCRIPTION

The aluminum alloy cylinder heads feature cross-flow type intake and exhaust ports. Valve guides and seat inserts are powdered metal. Valves are arranged in a "V", with each camshaft on center. To improve combustion speed the chambers are a compact spherical design with a squish area of approximately 30 percent of the piston top area. The cylinder heads are common to either cylinder bank by reversing the direction of installation.

## **DIAGNOSIS AND TESTING-CYLINDER HEAD GASKET**

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

## **CYLINDER-TO-CYLINDER LEAKAGE TEST**

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to **DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE TEST** ). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50-70% reduction in compression pressure.

## **CYLINDER-TO-WATER JACKET LEAKAGE TEST**

**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.**

## **VISUAL TEST METHOD**

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

## **COOLING SYSTEM TESTER METHOD**

**WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP**

**FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).**

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

#### **CHEMICAL TEST METHOD**

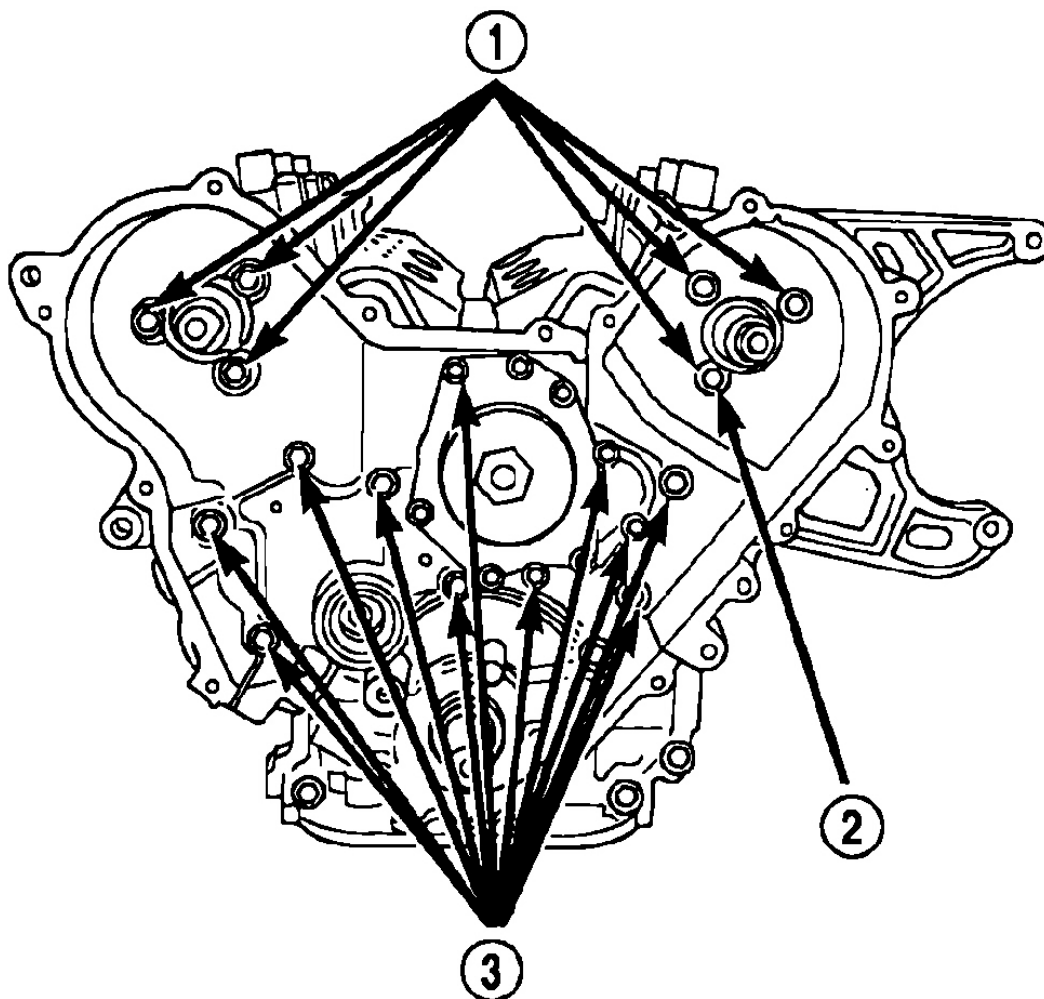
Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

#### **REMOVAL**

1. Perform fuel pressure release procedure **before attempting any repairs.** (Refer to **STANDARD PROCEDURE - FUEL SYSTEM PRESSURE RELEASE** )
2. Disconnect negative cable from remote battery jumper terminal.
3. Drain cooling system. (Refer to **STANDARD PROCEDURE** )
4. Remove crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )
5. Remove front timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** or **TIMING BELT COVER(S) - REAR** )
6. Remove camshaft sprockets. (Refer to **TIMING BELT AND SPROCKETS** )
7. Remove upper and lower intake manifold. (Refer to **INTAKE MANIFOLD - LOWER** )
8. Remove V-Band clamp(s) at exhaust manifold to catalytic converter pipe connection.

**NOTE: Do not reuse V-Band Clamp.**

9. Remove rear timing belt cover to cylinder head fasteners (**Fig. 42** ). Remove the rear covers.

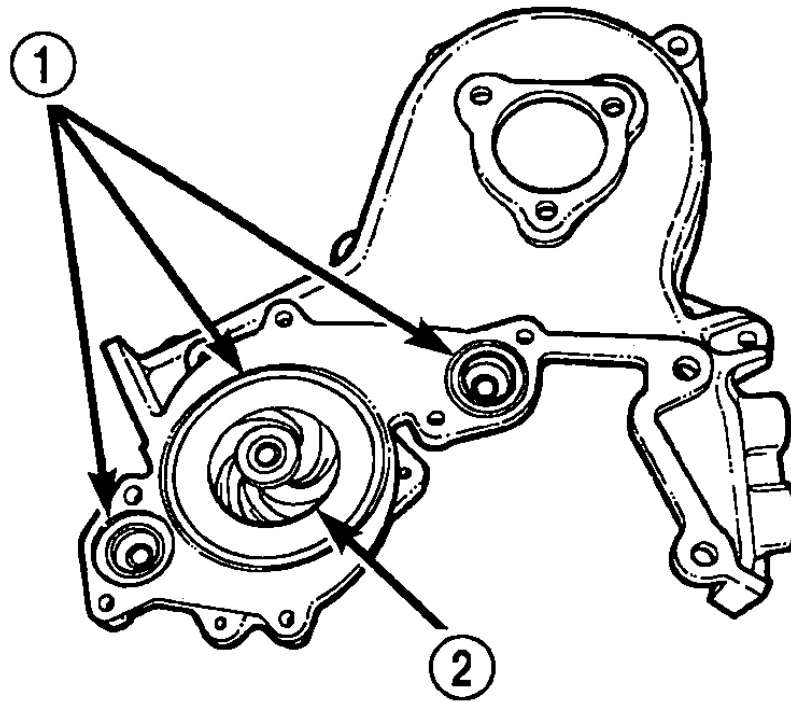


- 1 - REAR COVER TO CYLINDER HEAD BOLTS
- 2 - APPLY SEALANT TO BOLT THREADS
- 3 - REAR COVER TO CYLINDER BLOCK BOLTS

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**Fig. 42: Rear Timing Belt Cover Bolts**  
 Courtesy of DAIMLERCHRYSLER CORP.

10. The right side rear timing belt cover has O-rings to seal the water pump passages to cylinder block (**Fig. 43** ). Do not reuse O-rings.



1 - O-RINGS

2 - WATER PUMP IMPELLER

G03511896

**Fig. 43: Right Side Timing Belt Cover Water Pump O-Rings**  
Courtesy of DAIMLERCHRYSLER CORP.

11. Remove cylinder head bolts in REVERSE of tightening sequence (**Fig. 47** ).
12. Remove cylinder head(s).

## CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

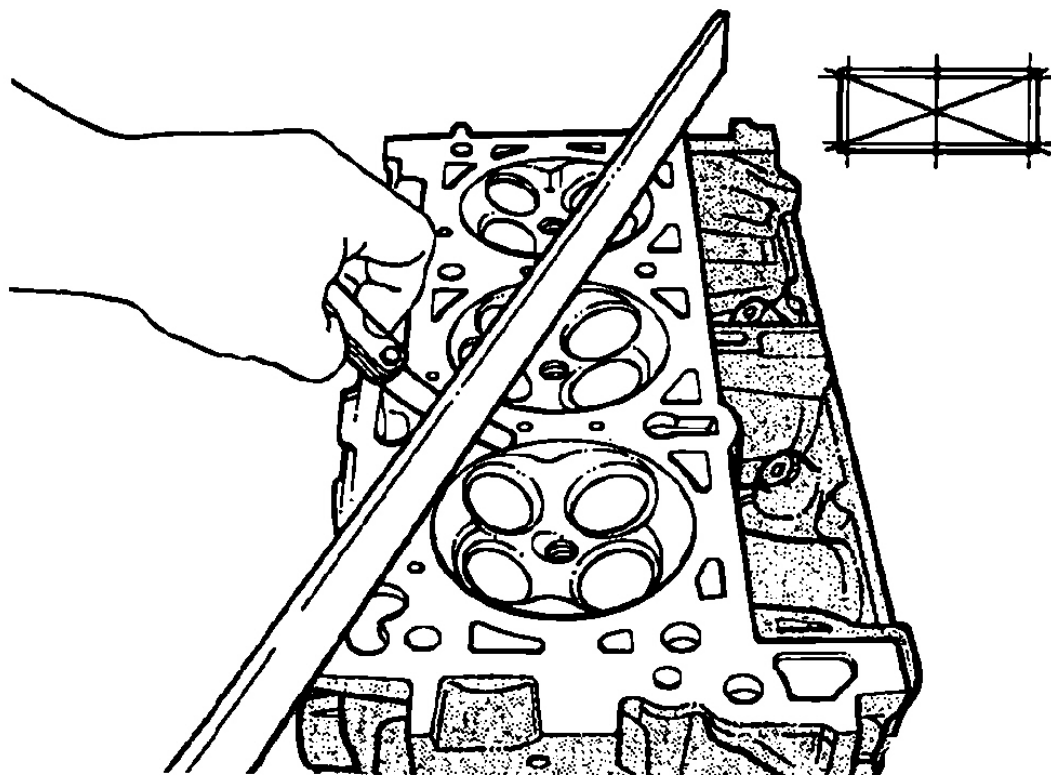
**NOTE:**        **Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.**

Remove all gasket material from cylinder head and block (Refer to **STANDARD PROCEDURE** ). Be careful not to gouge or scratch the aluminum head sealing surface.

Clean all engine oil passages.

## INSPECTION

1. Before cleaning, check for leaks, damage and cracks.
2. Clean cylinder head and oil passages.
3. Check cylinder head for flatness (**Fig. 44**).



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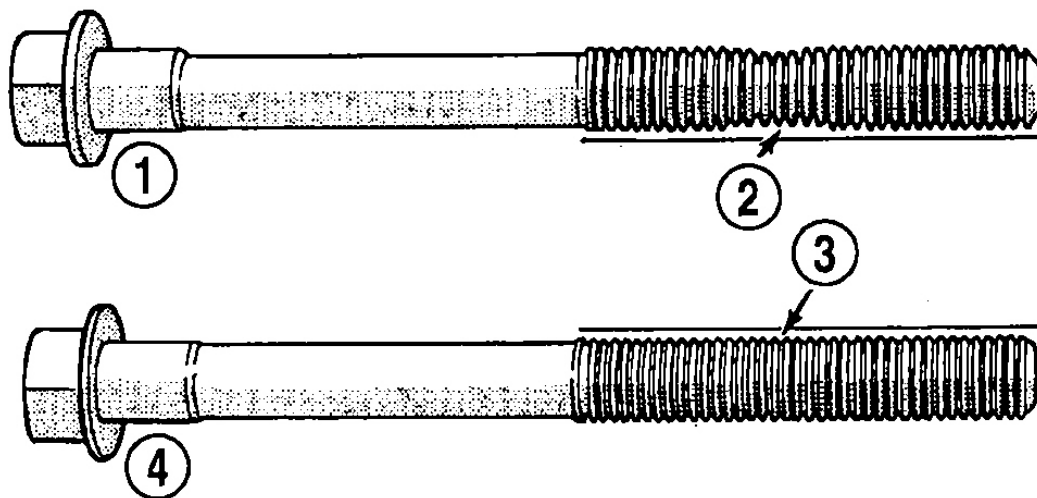
**Fig. 44: Checking Cylinder Head Flatness**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Cylinder head must be flat within:
  - Standard dimension = less than 0.05 mm (0.002 inch.)
  - Service Limit = 0.2 mm (0.008 inch.)
  - Grinding Limit = Maximum of 0.2 mm (0.008 inch.) is permitted.

**CAUTION: 0.20 mm (0.008 in.) MAX is a combined total dimension of the stock removal limit from cylinder head and block top surface (Deck) together.**

## INSTALLATION

The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined **BEFORE** reuse. If the threads are necked down the bolts must be replaced (Fig. 45).



- 1 - STRETCHED BOLT
- 2 - THREADS ARE NOT STRAIGHT ON LINE
- 3 - THREADS ARE STRAIGHT ON LINE
- 4 - UNSTRETCHED BOLT

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**Fig. 45: Checking Bolts for Stretching (Necking)**

Courtesy of DAIMLERCHRYSLER CORP.

Necking can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale the bolt, must be replaced.

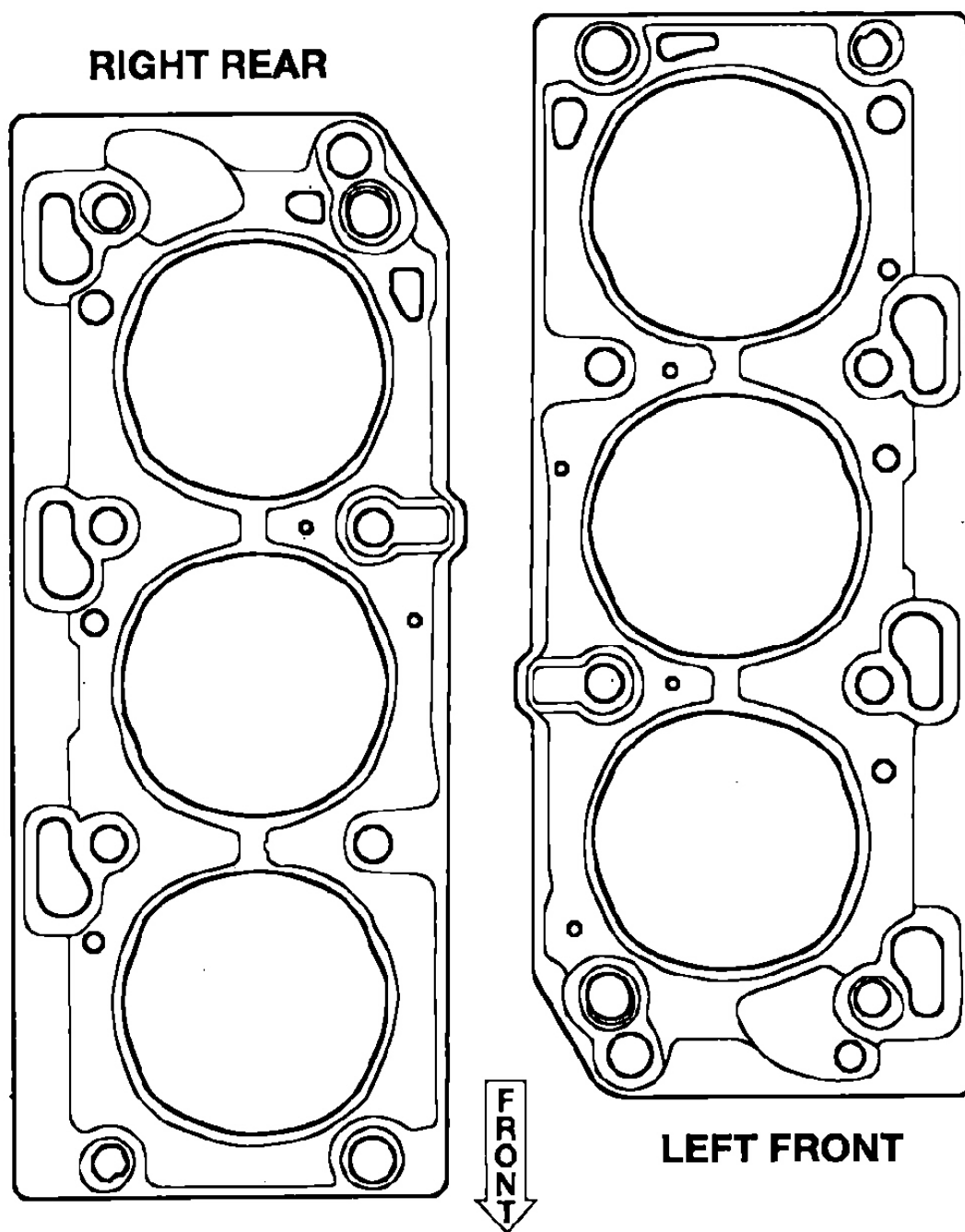
**CAUTION:** When cleaning cylinder head and cylinder block surfaces, **DO NOT** use a metal scraper because the surfaces could be cut or ground. Use **ONLY** a wooden or plastic scraper.

1. Clean sealing surfaces of cylinder head and block.

**CAUTION:** Ensure that the correct head gaskets are used and are oriented

**correctly on cylinder block. The 3.5L engine head gaskets have perfectly round combustion sealing rings. The 3.2L engine does NOT have perfectly round combustion sealing rings.**

2. Install head gasket over locating dowels. Ensure the gasket is installed on the correct side of engine (**Fig. 46**).

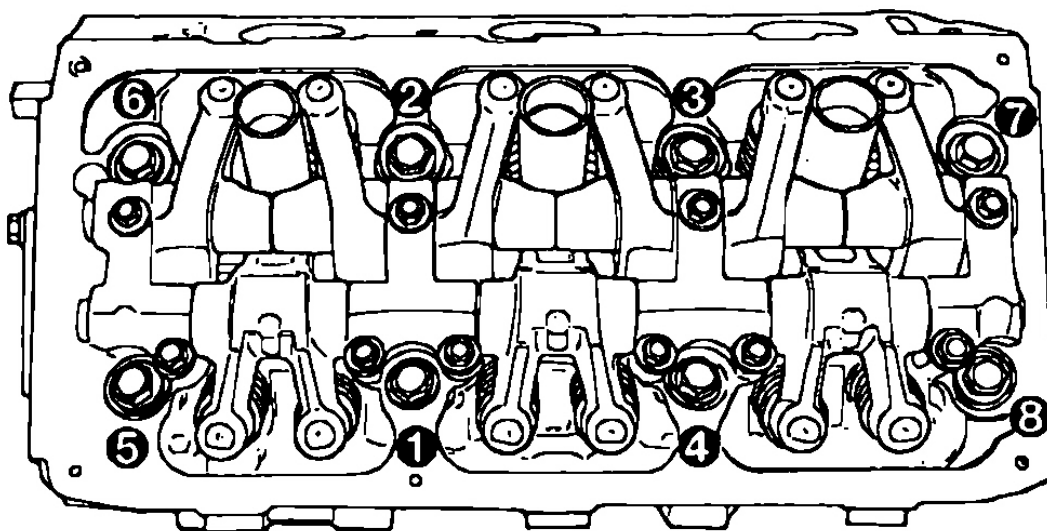


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**Fig. 46: Cylinder Head Gasket Identification**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install cylinder head over locating dowels.

4. Before installing the bolts, lubricate the threads with engine oil.
5. Tighten the cylinder head bolts in the sequence shown in (**Fig. 47** ). Using the 4 step torque-turn method, tighten according to the following torque values:
  - Step 1: All to 61 N.m (45 ft. lbs.)
  - Step 2: All to 88 N.m (65 ft. lbs.)
  - Step 3: All (again) to 88 N.m (65 ft. lbs.)
  - Step 4: + 90° Turn **Do not use a torque wrench for this step.**



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**Fig. 47: Cylinder Head Bolt Tightening Sequence**  
Courtesy of DAIMLERCHRYSLER CORP.

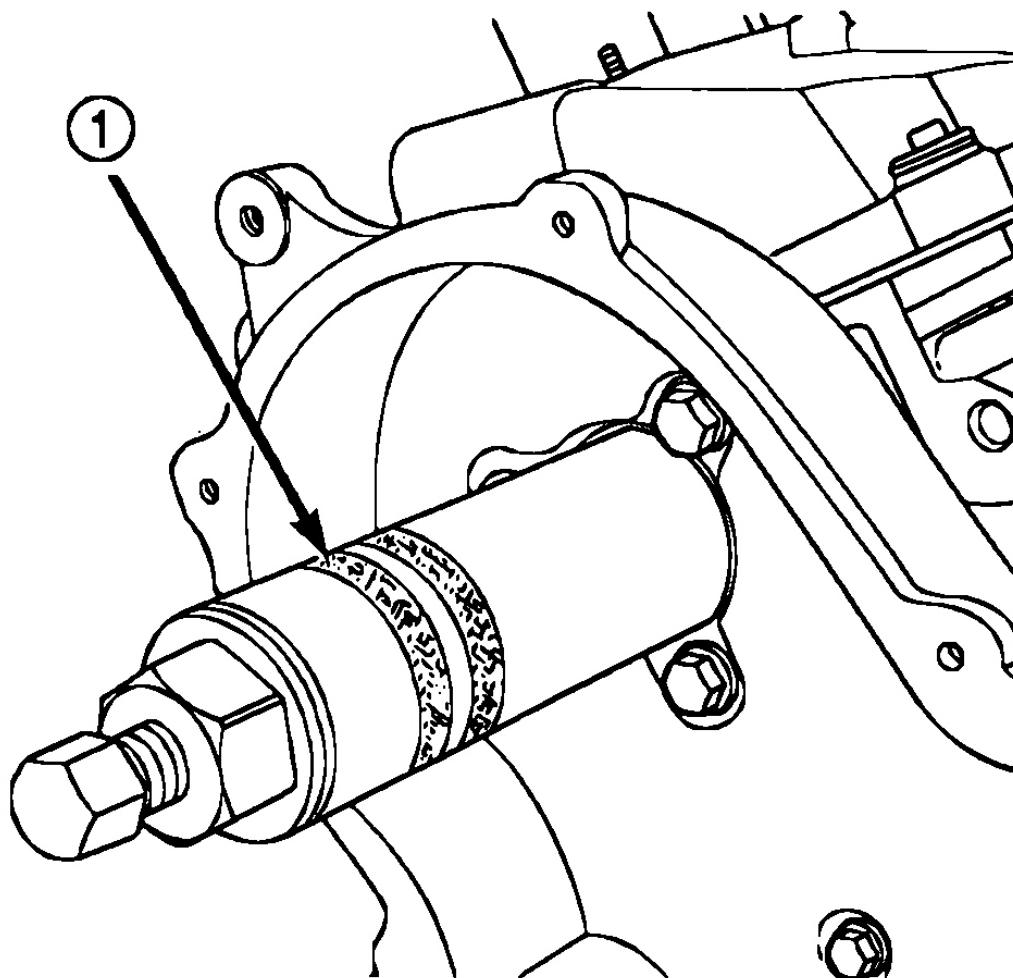
6. Bolt torque after 90° turn should be over 122 N.m (90 ft. lbs.) in the tightening direction. If not, replace the bolt.
7. Clean right rear timing belt cover O-ring sealing surfaces and grooves (**Fig. 43** ). Lubricate new O-rings with MOPAR(R) Dielectric Grease or equivalent to facilitate assembly.
8. Install rear timing belt covers (**Fig. 42** ) and (**Fig. 43** ). Tighten bolts to specified torque:
  - M10-54 N.m (40 ft. lbs.)
  - M8-28 N.m (20 ft. lbs.)
  - M6-12 N.m (105 in. lbs.)
9. Install camshaft sprockets and timing belt. (Refer **TIMING BELT AND SPROCKETS** )
10. Install front timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** or **TIMING BELT COVER(S) - REAR** )
11. Install crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )

12. Install upper and lower intake manifold. (Refer to **INTAKE MANIFOLD - UPPER** and **INTAKE MANIFOLD - LOWER** )
13. Connect catalytic converter to exhaust manifold using a new V-band clamp(s). Tighten clamp to 10 N.m (100 in. lbs.).
14. Fill cooling system. (Refer to **STANDARD PROCEDURE** )
15. Connect negative cable to remote jumper terminal

## **CAMSHAFT OIL SEAL(S)**

### **REMOVAL**

1. Remove camshaft sprocket(s). (Refer to **TIMING BELT AND SPROCKETS** )
2. Use Special Tool C-3981B to remove camshaft oil seal (**Fig. 48** ).



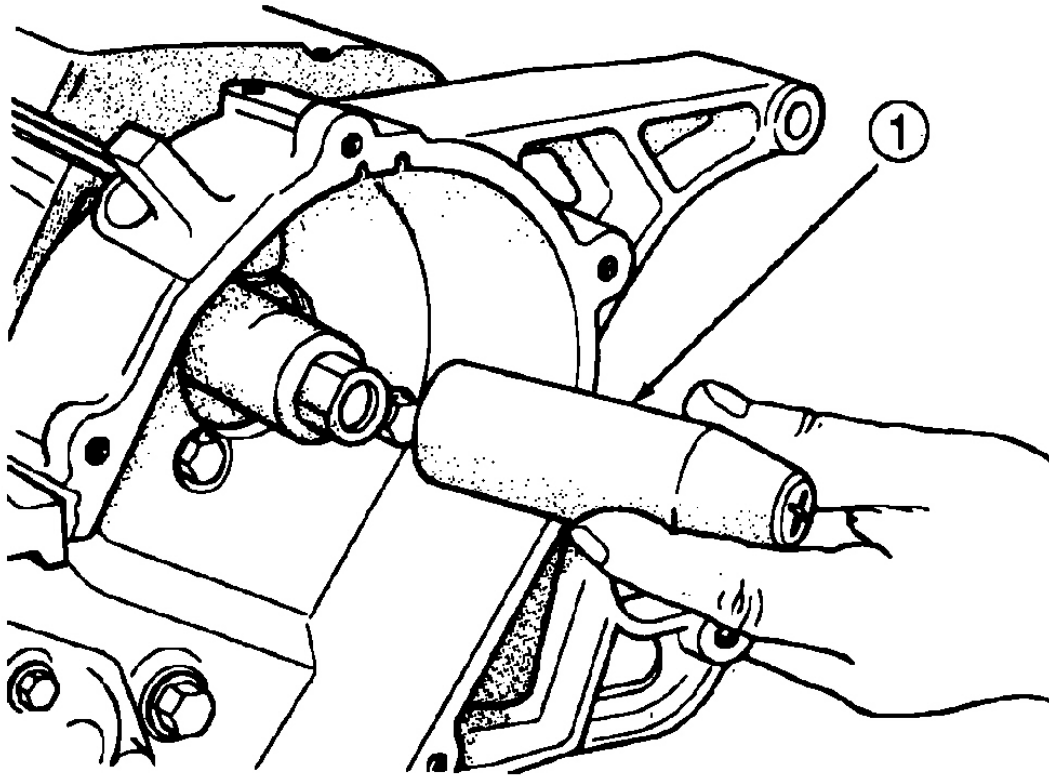
**1 - SPECIAL TOOL C-3981B**

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**Fig. 48: Camshaft Oil Seal - Removal**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

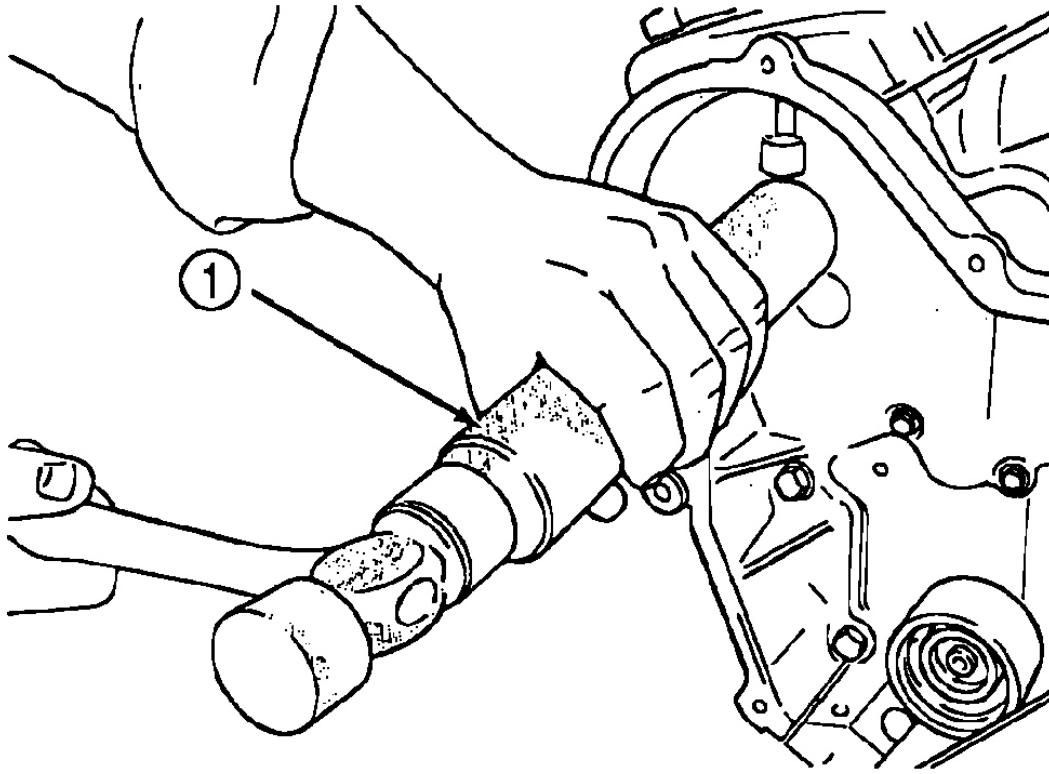
1. Apply light coat of engine oil to the camshaft oil seal lip.
2. Install the oil seal using Special Tool 6788 Seal Protector Sleeve (**Fig. 49**) and Seal Installer 6052 (**Fig. 50**).



1 - SPECIAL TOOL 6788

G03511902

**Fig. 49: Camshaft Oil Seal Protector Sleeve**  
**Courtesy of DAIMLERCHRYSLER CORP.**



1 - SPECIAL TOOL 6052

G03511903

**Fig. 50: Camshaft Oil Seal - Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install camshaft sprocket(s). (Refer to **TIMING BELT AND SPROCKETS** )

## CAMSHAFT(S)

### DESCRIPTION

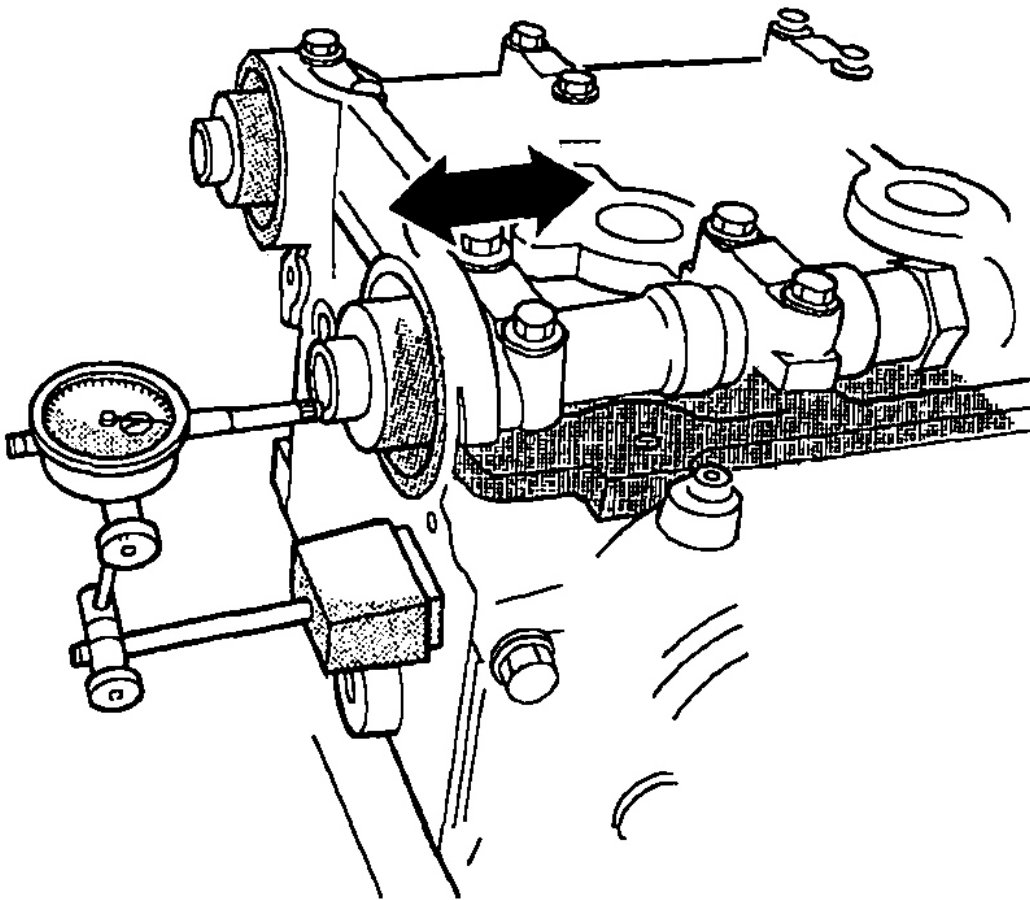
A single overhead camshaft per cylinder head provides valve actuation. The left camshaft accommodates a cam sensor pick-up wheel and is therefore longer. Each camshaft is supported by four bearing journals. Thrust for each camshaft is taken at a thrust plate attached to the rear of each cylinder head. Right and left camshaft driving sprockets are not interchangeable because of the cam sensor pick-up wheel on the left sprocket. Camshaft bearing lubrication is provided via oil feed passage through each rocker shaft pedestal dowel.

### OPERATION

The camshaft is driven by the crankshaft via drive sprockets and belt. The camshaft has precisely machined lobes to provide accurate valve timing and duration.

#### STANDARD PROCEDURE - MEASURING CAMSHAFT END PLAY

1. Oil camshaft journals and install camshaft **WITHOUT** rocker arms. Install rear cam caps and tighten screws to specified torque.
2. Using a suitable tool, move camshaft as far rearward as it will go.
3. Zero dial indicator (**Fig. 51** ).



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**Fig. 51: Camshaft End Play - Typical**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Move camshaft as far forward as it will go.
5. Record reading on dial indicator. For end play specification, (Refer to **3.5L ENGINE** ).

6. If end play is excessive, check cylinder head and camshaft for wear; replace as necessary.

## REMOVAL

Camshafts are removed from the rear of each cylinder head. The cylinder head must be removed.

1. Remove camshaft sprocket(s). (Refer to **TIMING BELT AND SPROCKETS** )
2. Remove cylinder head(s). (Refer to **CYLINDER HEAD** )
3. Mark the rocker arm and shaft assembly before removal. Remove the rocker arm and shaft assembly from the head. (Refer to **ROCKER ARM / ADJUSTER ASSEMBLY** )
4. Remove the rear camshaft cover and O-ring from head.

**CAUTION: Be careful not to nick or scratch the journals when removing the camshaft.**

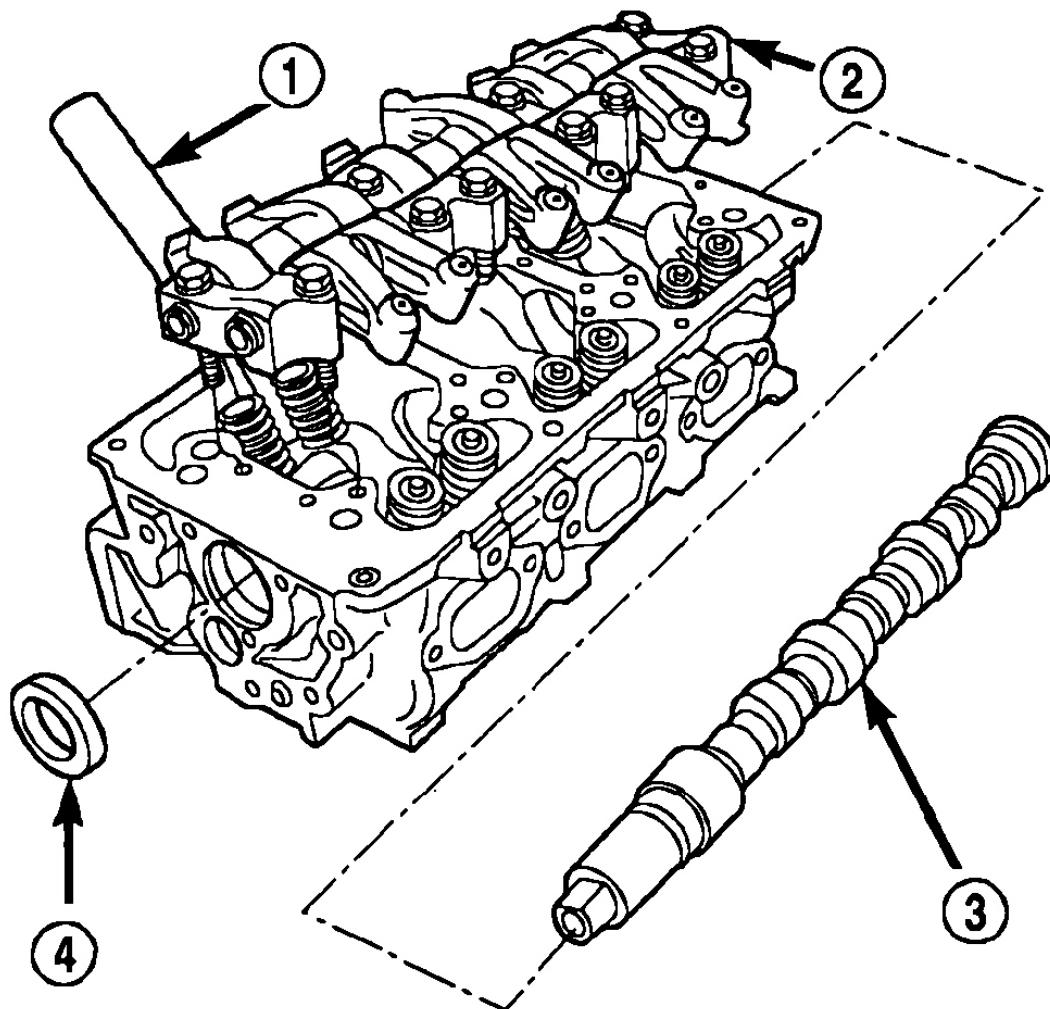
5. Carefully remove the camshaft from the rear of the cylinder head (**Fig. 52** ).

## CLEANING

Clean camshaft with a suitable solvent.

## INSPECTION

1. Inspect camshaft bearing journals for damage and binding (**Fig. 53** ). If journals are binding, check the cylinder head for damage. Also check cylinder head oil holes for clogging.



- 1 - SPARK PLUG TUBE
- 2 - ROCKER ARM ASSEMBLY
- 3 - CAMSHAFT
- 4 - SEAL

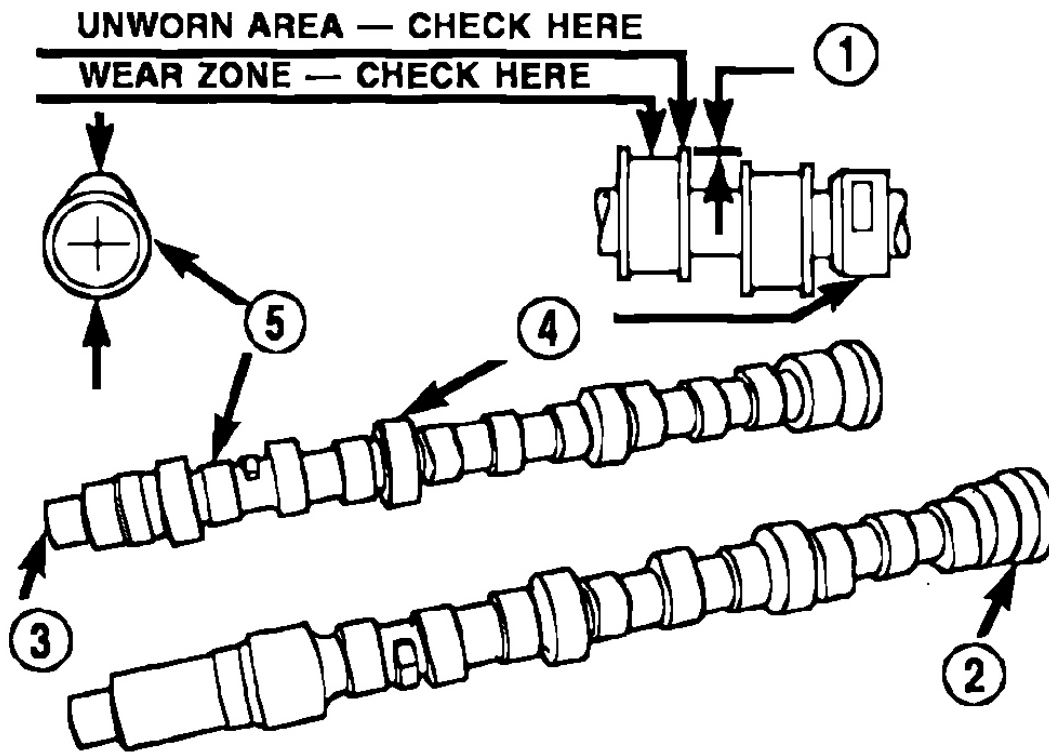
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**Fig. 52: Cylinder Head, Camshaft, and Rocker Arms**  
 Courtesy of DAIMLERCHRYSLER CORP.

2. Check the cam lobe and bearing surfaces for abnormal wear and damage. Replace camshaft if defective.

**NOTE:** If camshaft is replaced due to lobe wear or damage, always replace the rocker arms.

3. Measure the lobe actual wear (**Fig. 53**) and replace camshaft if out of limit. Standard value is 0.0254 mm (0.001 in.), wear **limit** is 0.254 mm (0.010 in.).



- 1 - ACTUAL WEAR
- 2 - LEFT CAMSHAFT
- 3 - RIGHT CAMSHAFT
- 4 - BEARING JOURNAL
- 5 - LOBE

G03511906

**Fig. 53: Camshaft Inspection**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. Lubricate camshaft bearing journals and camshaft lobes with clean engine oil and install camshaft into cylinder head (**Fig. 52**).
2. Install cylinder head(s). (Refer to **CYLINDER HEAD**)

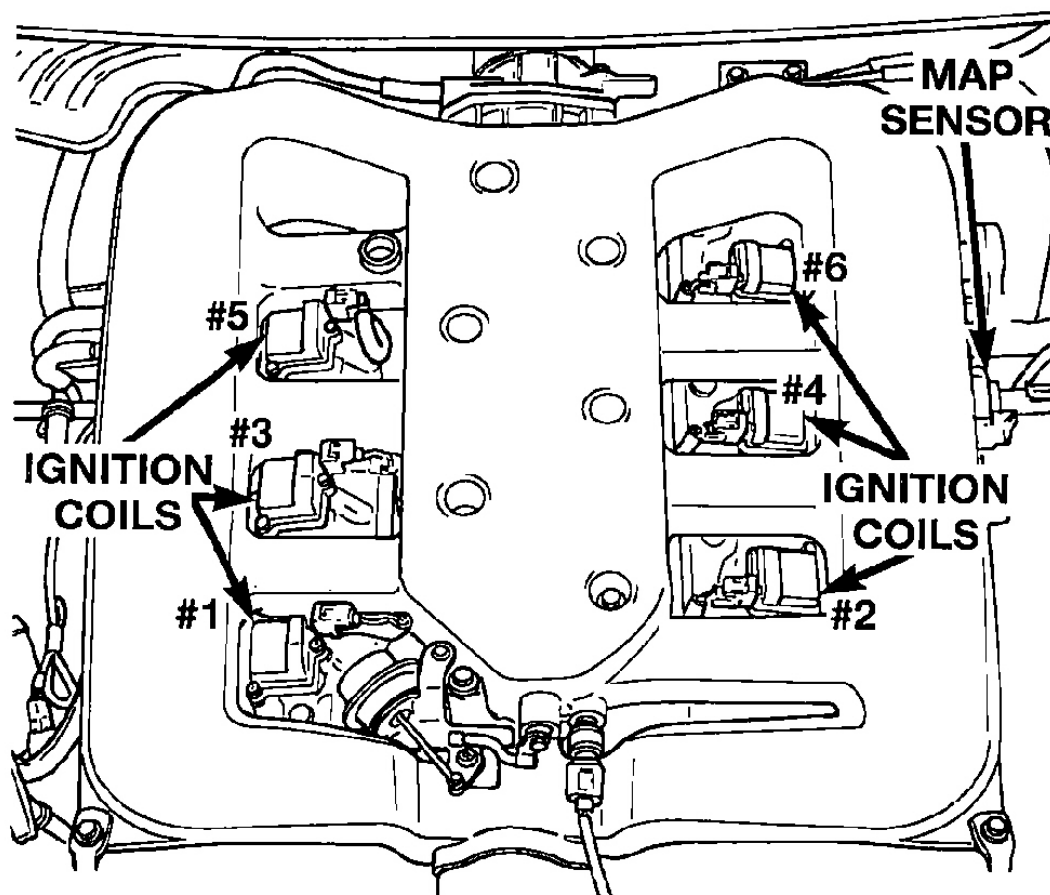
3. Install the rocker arm assembly. (Refer to **ROCKER ARM / ADJUSTER ASSEMBLY** )
4. Install camshaft sprockets and timing belt. (Refer to **TIMING BELT AND SPROCKETS** )

## **CYLINDER HEAD COVER(S)**

### **REMOVAL**

**WARNING: DO NOT START OR RUN ENGINE WITH CYLINDER HEAD COVER REMOVED FROM THE ENGINE. DAMAGE OR PERSONAL INJURY MAY OCCUR.**

1. Remove air cleaner assembly.
2. Remove upper intake manifold. (Refer to **INTAKE MANIFOLD - UPPER** )
3. Cover lower intake manifold with a suitable cover during service.
4. Disconnect electrical connectors and remove ignition coils (**Fig. 54** ).

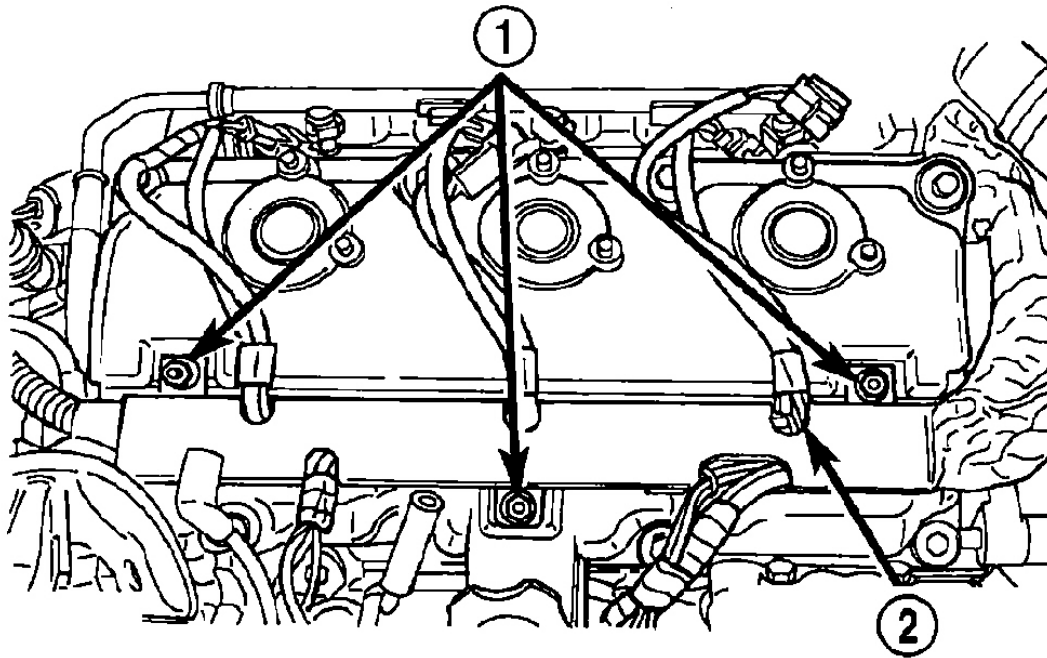


G03511908

**Fig. 54: Ignition Coils**

Courtesy of DAIMLERCHRYSLER CORP.

5. Remove nuts attaching wire harness to cylinder head cover (**Fig. 55**). Move harness for cover removal clearance.

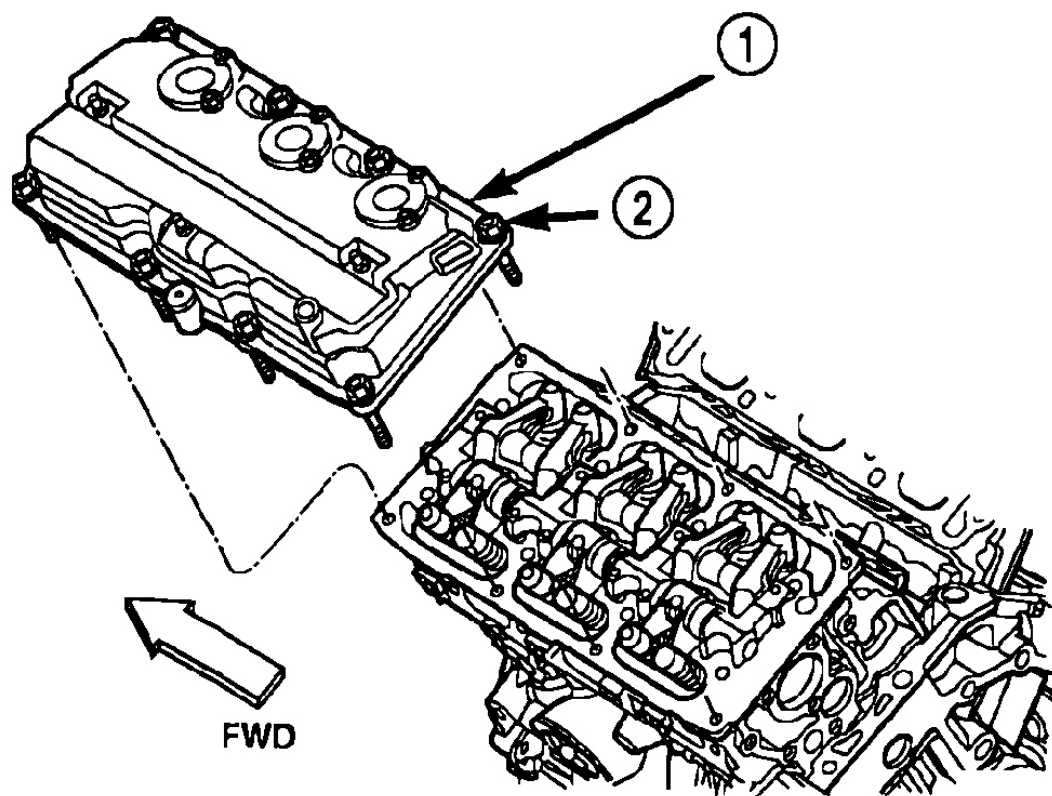


- 1 - NUTS  
2 - WIRE HARNESS

G03511907

**Fig. 55: Wire Harness Retaining Nuts**  
Courtesy of DAIMLERCHRYSLER CORP.

6. For right cylinder head cover removal perform the following:
  - a. Remove A/C compressor belt. (Refer to ACCESSORY DRIVE )
  - b. Remove A/C compressor mounting bolts.
  - c. Move compressor aside for cylinder head cover clearance.
7. Remove cylinder head cover bolts and remove cover (Fig. 56 ).



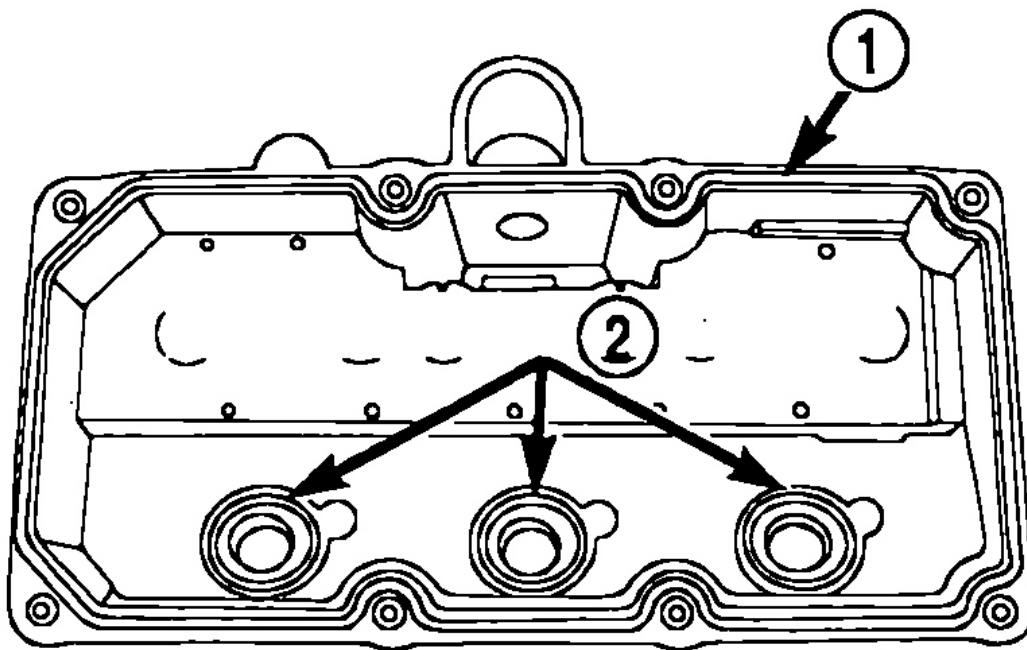
1 - CYLINDER HEAD COVER-LEFT SIDE  
2 - BOLTS (8)

G03511909

**Fig. 56: Cylinder Head Covers**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. Clean cylinder head and cover mating surfaces. Inspect and replace gasket and seals as necessary (**Fig. 57**).



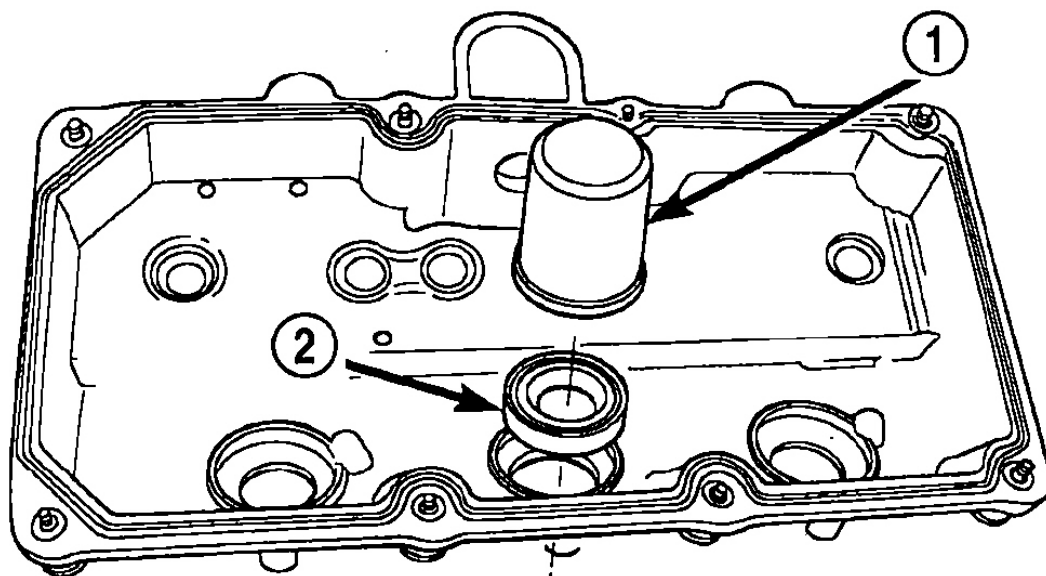
1 - CYLINDER HEAD COVER GASKET

2 - SPARK PLUG TUBE SEALS

G03511910

**Fig. 57: Cylinder Head Cover Gasket and Spark Plug Tube Seals**  
Courtesy of DAIMLERCHRYSLER CORP.

2. To replace spark plug tube seals:
  - a. Using a suitable pry tool, carefully remove tube seals.
  - b. Position new seal with the part number on seal facing cylinder head cover.
  - c. Install seals using Special Tool MD-998306 (**Fig. 58**).



1 - SPECIAL TOOL MD-998306

2 - SPARK PLUG TUBE SEAL

G03511911

**Fig. 58: Spark Plug Tube Seal Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install cylinder head cover bolts and tighten to 12 N.m (105 in. lbs.) (**Fig. 56**).
4. For right cylinder head cover installation perform the following:
  - a. Position A/C compressor on bracket and install mounting bolts.
  - b. Install A/C compressor belt. (Refer to **ACCESSORY DRIVE**)
5. Position wire harness on cylinder head cover and install retaining nuts (**Fig. 55**).
6. Install ignition coils and connect all electrical connectors (**Fig. 54**).
7. Install upper intake manifold. (Refer to **INTAKE MANIFOLD - UPPER**)
8. Install air cleaner assembly.

## INTAKE/EXHAUST VALVES & SEATS

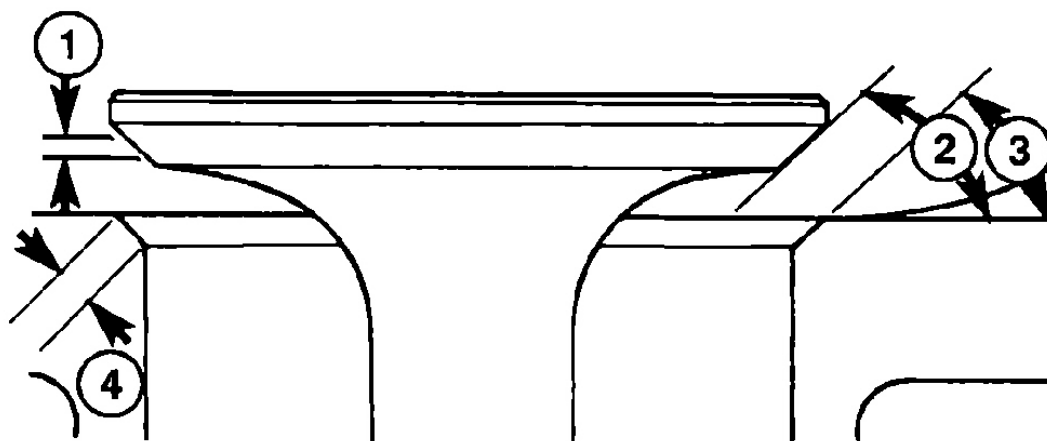
### DESCRIPTION

Valves are made of highly heat-resistant steel and are chrome plated to prevent stem scuffing. The intake valve is a one-piece forging, while the exhaust valve has a forged head with a welded stem for lock groove hardenability. The four valves (two intake and two exhaust) employ a three-groove lock design to help facilitate

valve rotation.

## STANDARD PROCEDURE - VALVE AND VALVE SEAT REFACING

The valve face and valve seat angles are shown in (**Fig. 59** ).



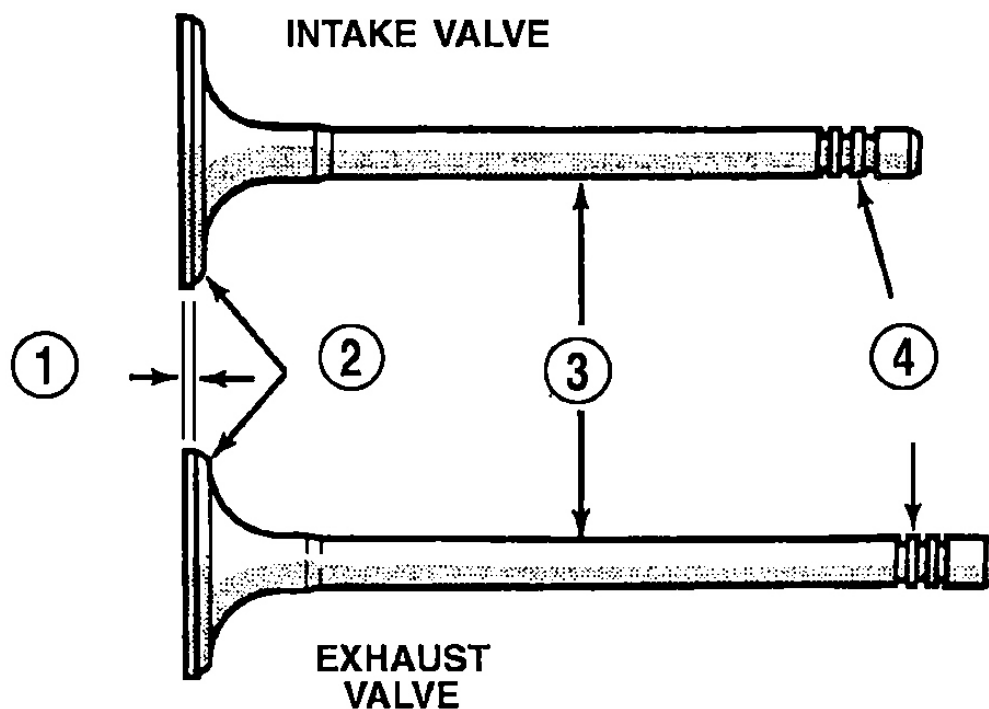
- 1 - SEAT WIDTH
- 2 - FACE ANGLE
- 3 - SEAT ANGLE
- 4 - SEAT CONTACT AREA

G03511913

**Fig. 59: Valve Face and Seat**  
Courtesy of DAIMLERCHRYSLER CORP.

### VALVES

1. Inspect the remaining margin after the valves are refaced (**Fig. 60** ). (Refer to **3.5L ENGINE** )



1 - MARGIN

2 - FACE

3 - STEM

4 - VALVE SPRING RETAINER LOCK GROOVES

G03511912

**Fig. 60: Intake and Exhaust Valves**  
Courtesy of DAIMLERCHRYSLER CORP.

#### VALVE SEATS

1. When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.
2. Measure the concentricity of valve seat using dial indicator. Total runout should not exceed 0.051 mm (0.002 inch.) total indicator reading.
3. Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of valve face, then lower valve seat with a 15 degree stone. If the blue is transferred to the bottom

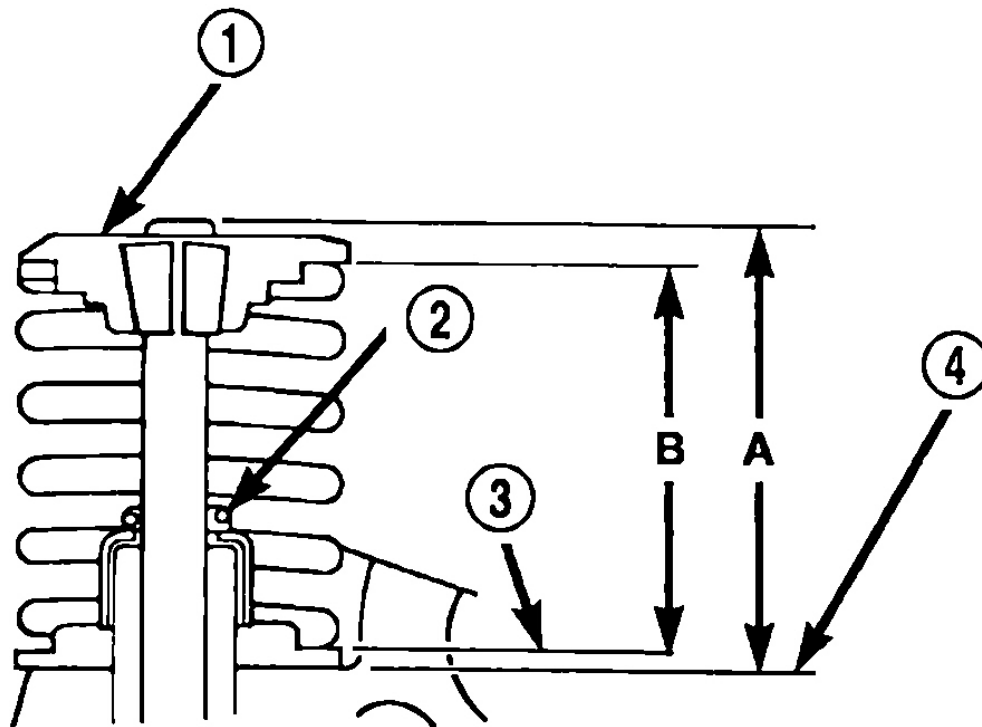
edge of valve face, then raise valve seat with a 65 degree stone.

**NOTE:**      **Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise cylinder head must be replaced.**

4. When seat is properly positioned the width of the intake seats should be 0.75 to 1.25 mm (0.0296 to 0.0493 in.) and exhaust seats should be 1.25 to 1.75 mm (0.049 to 0.069 in.) (**Fig. 59**).

#### **VALVE AND SPRING INSTALLED HEIGHT**

1. Coat valve stems with clean engine oil and insert them in cylinder head.
2. If valves or seats have been refaced, check valve tip height (A) (**Fig. 61**). If valve tip height is greater than 43.65 mm (1.7185 in.) intake or 45.98 mm (1.8102 in.) exhaust, grind valve tip until within specifications. Make sure measurement is taken from cylinder head surface to the top of valve stem.

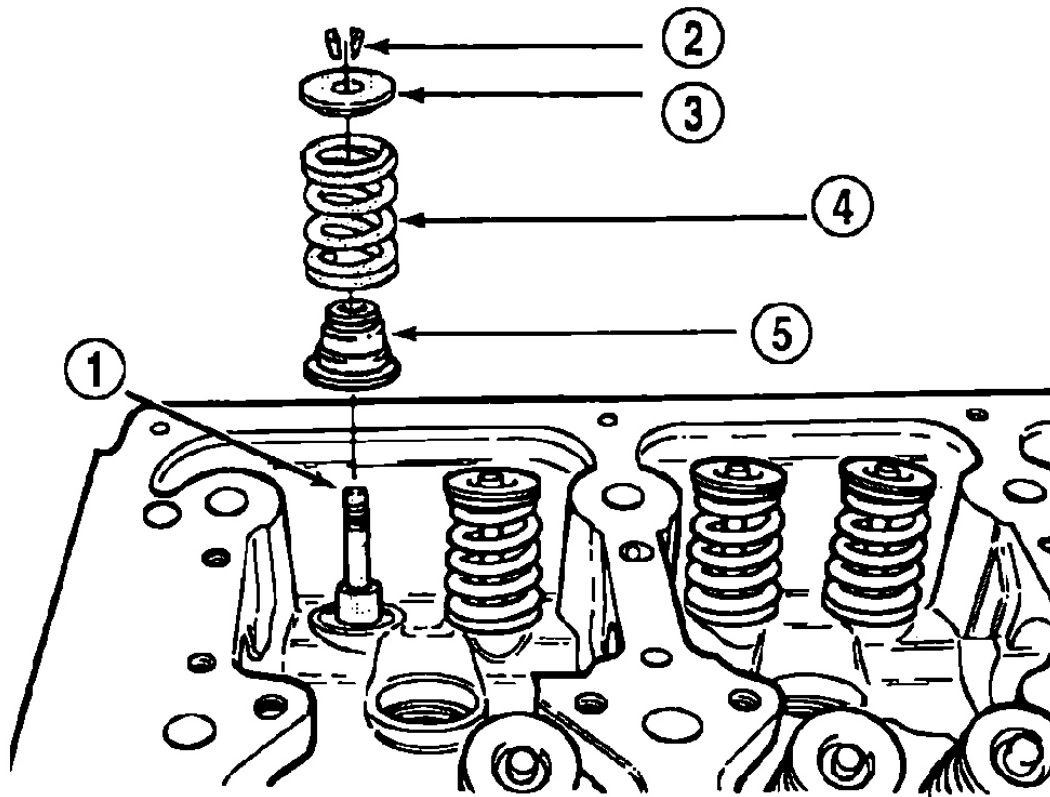


- 1 - SPRING RETAINER
- 2 - GARTER SPRING
- 3 - VALVE SPRING SEAT TOP
- 4 - CYLINDER HEAD SURFACE

G03511914

**Fig. 61: Checking Valve Tip Height and Valve Spring Installed Height**  
**Courtesy of DAIMLERCHRYSLER CORP.**

3. Install valve seal/spring seat assembly over valve guides on all valve stems (**Fig. 62**). Ensure that the garter spring is intact around the top of the rubber seal.

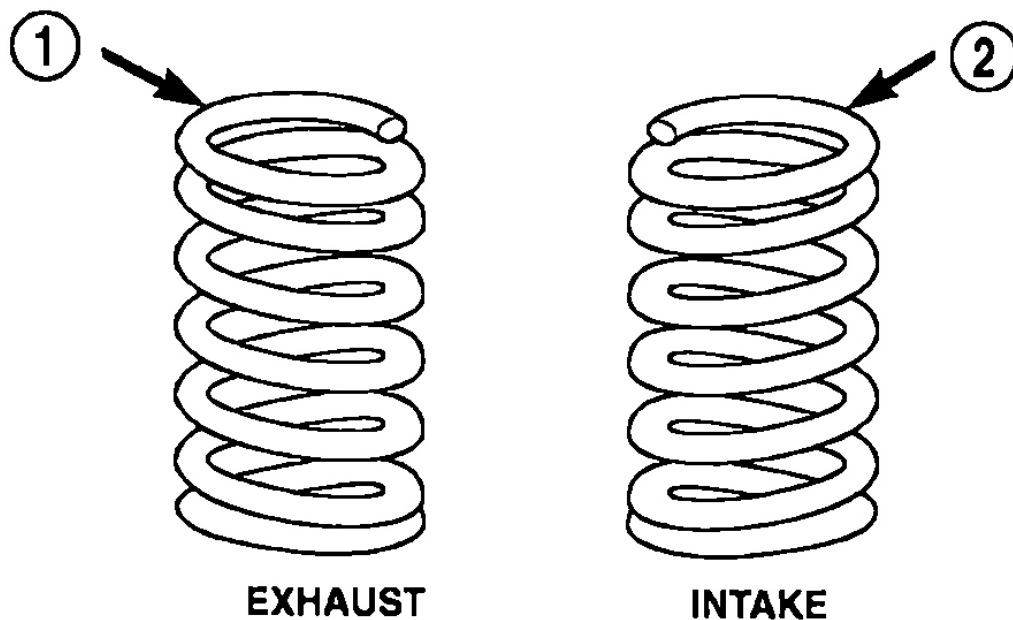


- 1 - VALVE
- 2 - VALVE RETAINING LOCKS
- 3 - VALVE SPRING RETAINER
- 4 - VALVE SPRING
- 5 - VALVE SEAL AND VALVE SPRING SEAT ASSEMBLY

G03511916

**Fig. 62: Valve Seal and Spring**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Place valve spring (color-coded end facing up (**Fig. 63** ) and valve retainer into position on spring seat (**Fig. 62** ).



1 - YELLOW DYE

2 - ORANGE DYE

G03511915

**Fig. 63: Valve Spring Identification**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Compress valve springs with valve spring compressor C-3422-D and adapter 6526 (Refer to **SPECIAL TOOLS** ), install locks and release tool.
6. If valves and/or seats are refaced, measure the installed height of springs (B) (**Fig. 61** ). Measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 38.75 mm (1.5256 in.), install a 0.762 mm (0.030 in.) spacer in head counterbore under the valve spring seat to bring spring height back within specification.

## REMOVAL

1. Remove valve spring. (Refer to **VALVE SPRINGS** )
2. Before removing valve, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.
3. Remove valve(s) from cylinder head.

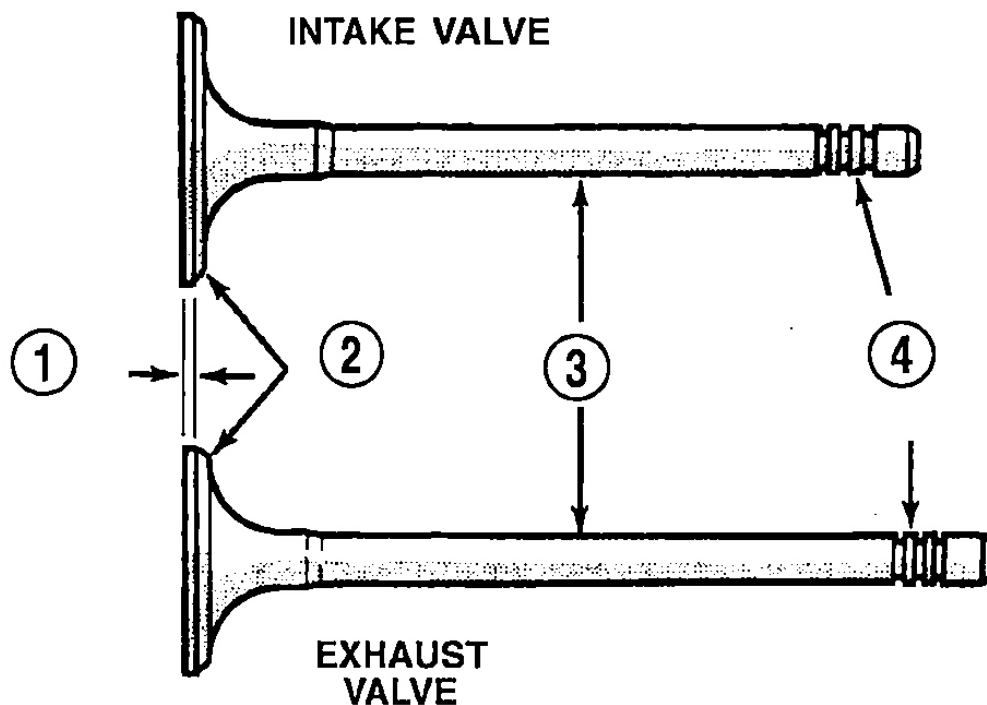
## CLEANING

1. Clean all valves thoroughly and discard burned, warped and cracked valves.

## INSPECTION

### INSPECTION - VALVES

1. Measure valve stems for wear (**Fig. 64**) approximately 60 mm (2.36 in.) below the valve lock grooves.



- 1 - MARGIN
- 2 - FACE
- 3 - STEM
- 4 - VALVE SPRING RETAINER LOCK GROOVES

G03511917

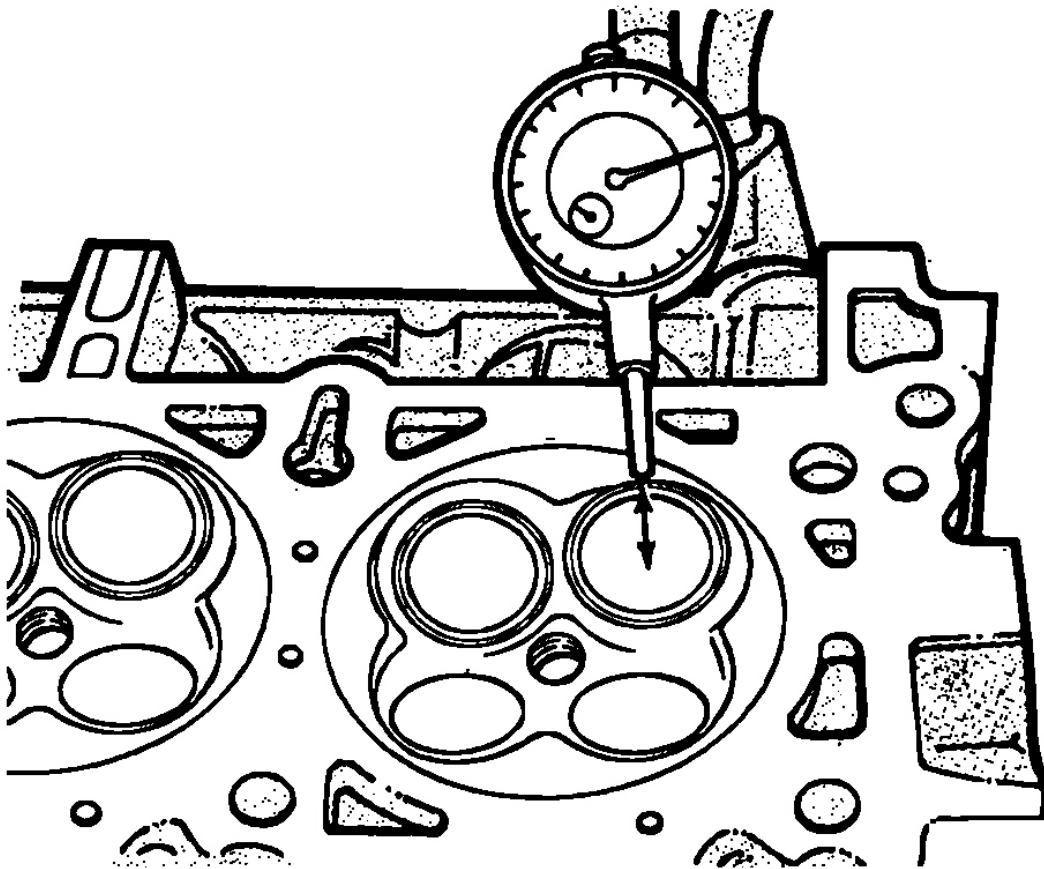
**Fig. 64: Intake and Exhaust Valves**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Compare measurement to specifications, (Refer to 9 - ENGINE - **SPECIFICATIONS** ).

**NOTE:** Valve stems are chrome plated and should not be polished (**Fig. 64** ).

**INSPECTION - VALVE GUIDES**

1. Measure valve stem-to-guide clearance as follows:
2. Install valve into cylinder head so it is 15 mm (0.590 inch.) off the valve seat. A small piece of hose may be used to hold valve in place.
3. Attach dial indicator Tool C-3339 to cylinder head and set it at right angle of valve stem being measured (**Fig. 65** ).



G03511918

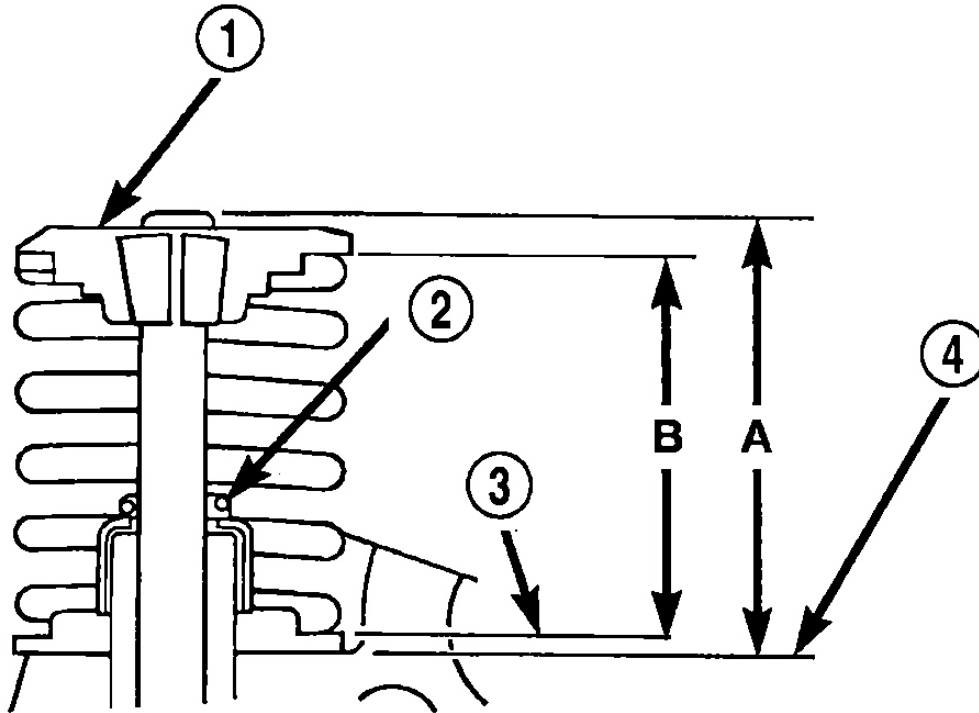
**Fig. 65: Measuring Valve Guide Wear**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Move valve to and from the indicator.
5. Note dial indicator reading and compare to engine specifications. (Refer to **3.5L ENGINE** )

**NOTE:** Replace cylinder head if stem-to-guide clearance exceeds specifications, or if guide is loose in cylinder head.

## INSTALLATION

1. Coat valve stems with clean engine oil and insert them in cylinder head.
2. If valves or seats have been reground, check valve tip height (A) (**Fig. 66**). If valve tip height is greater than 43.65 mm (1.7185 in.) intake or 45.98 mm (1.8102 in.) exhaust, grind valve tip until within specifications. Make sure measurement is taken from cylinder head surface to the top of valve stem.



- 1 - SPRING RETAINER
- 2 - GARTER SPRING
- 3 - VALVE SPRING SEAT TOP
- 4 - CYLINDER HEAD SURFACE

G03511919

**Fig. 66: Checking Valve Tip Height and Valve Spring Installed Height**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install valve stem seals and valve springs. (Refer to VALVE STEM SEALS )

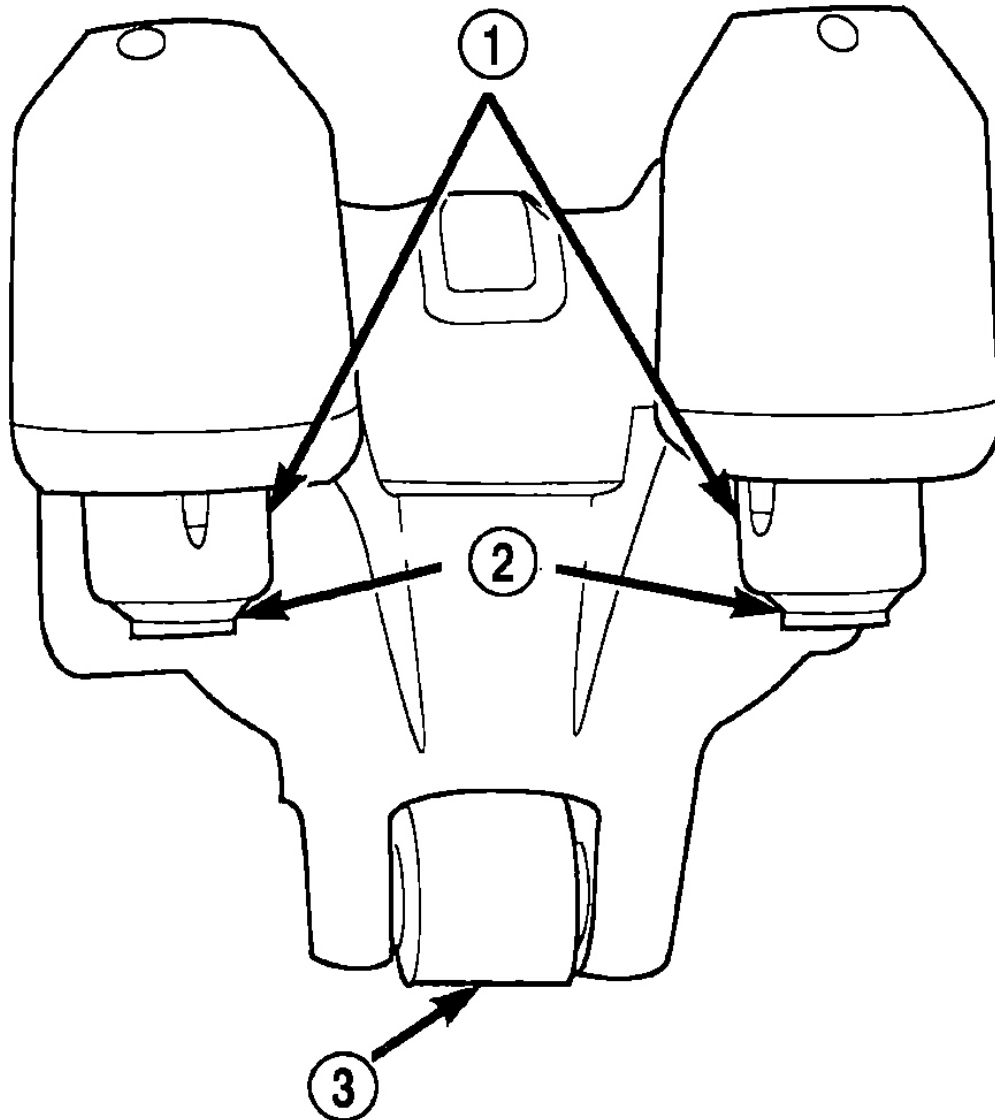
## ROCKER ARM / ADJUSTER ASSEMBLY

## DESCRIPTION

### DESCRIPTION - ROCKER ARM

Rocker arms are made of light weight permanent mold aluminum alloy with a roller type follower operating against the camshaft (**Fig. 67** ), The valve actuating end of the rocker arms are machined to retain hydraulic lash adjusters, eliminating the need for manual valve lash adjustment.

**HYDRAULIC LASH  
ADJUSTER:**



- 1 - RETAINER
- 2 - SWIVEL PAD
- 3 - ROLLER

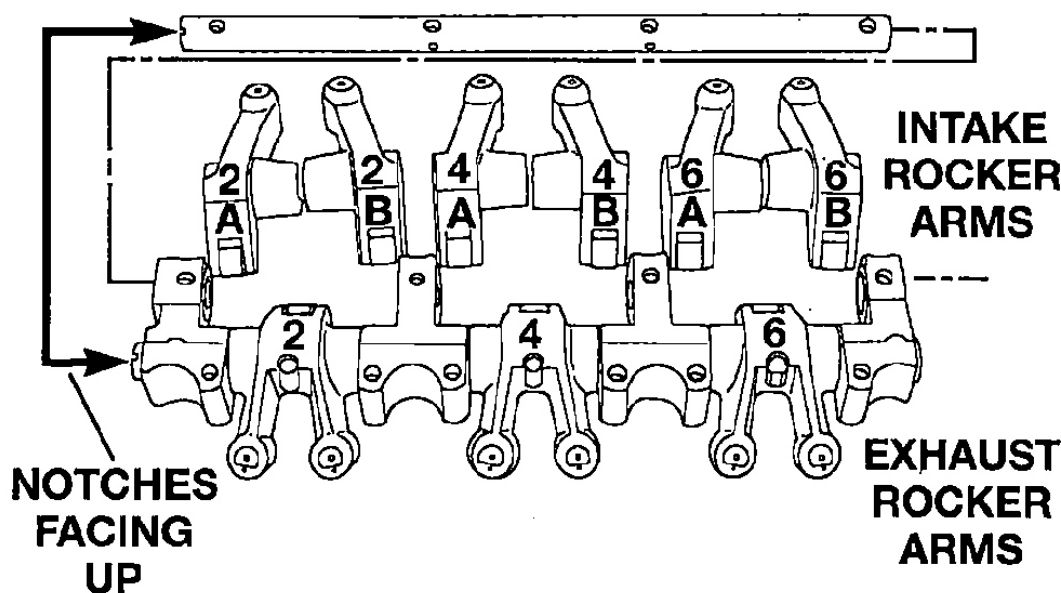
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**Fig. 67: Rocker Arm Assembly**

Courtesy of DAIMLERCHRYSLER CORP.

### DESCRIPTION - ROCKER ARM SHAFTS

The rocker arm shafts (**Fig. 68**) are tubular steel and are supported by several forged aluminum alloy pedestals, which are fastened to the cylinder head. Four shafts are used, one for each intake and exhaust rocker arm bank on each cylinder head. The shafts are hollow to provide a duct for lubricating oil flow from the cylinder head to the valve mechanisms. One hollow dowel per pedestal is used to locate the pedestal to the cylinder head, orient the exhaust rocker shaft, and serve as a cam bearing oil feed passage.



G03511921

**Fig. 68: Rocker Arms and Shafts**

Courtesy of DAIMLERCHRYSLER CORP.

### DIAGNOSIS AND TESTING

#### LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS

Proper noise diagnosis is essential in locating the source of a NVH complaint. Locating a lash adjuster (tappet) type noise can sometimes be difficult. As a result, an initial misdiagnosis may occur.

Refer to the following chart indicating possible lash adjuster (tappet) noise sources and possible sources that could lead to a misdiagnosis.

Refer to **LASH ADJUSTER (TAPPET) NOISE CHART** for Possible Causes and Correction of a lash adjuster (tappet) type noise.

## DIAGNOSIS AND TESTING

| POSSIBLE NOISE SOURCES                                                                                                                                                                                                                                                                                                                                                                | POSSIBLE NOISE MISDIAGNOSIS SOURCES                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Spongy/soft/aerated lash adjusters.<br>Missing lash adjuster swivel contact pads.<br>Intake rocker-to-camshaft bearing journal contact.<br>Rocker arm bind-up.<br>Intake rocker arm-to-spark plug tube contact.<br>Excessive cam end play.<br>Broken valve spring.<br>Broken/loose camshaft sprocket bolt.<br>Incomplete cam lobe machining.<br>Cracked lash adjuster cartridge body. | SRV valve axle chatter.<br>Exhaust rocker arm-to-cylinder head cover contact.<br>Piston pin bore fit.<br>Timing drive hydraulic tensioner tick.<br>Accessory drive belt deterioration.<br>Piston-to-bore clearance knock.<br>Crankshaft bearing noise. |

### LASH ADJUSTER (TAPPET) NOISE CHART

### LASH ADJUSTER (TAPPET) NOISE CHART

| POSSIBLE CAUSES                                                                                                         | CORRECTION                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Engine oil level-too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy. | 1. Check and correct engine oil level.                                                                                                                                                                                                                                                                                                                                                       |
| 2. Insufficient running time after rebuilding cylinder head.                                                            | 2. Low speed running of up to 1 hour may be required to fully evacuate trapped air from the valve train system. During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.                                                                                                          |
| 3. Air trapped in lash adjuster (after 1 hour run time).                                                                | 3. See below:<br>a. Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Very spongy adjusters can be bottomed out easily.<br>b. Before proceeding, perform Lash Adjuster Bleeding procedure.<br>c. If lash adjuster(s) are still spongy, replace with new adjuster/rocker arm assembly*. |
| 4. Low oil pressure                                                                                                     | 4. See below:<br>a. Check and correct engine oil level.<br>b. Check engine oil pressure.<br>c. Check for excessive bearing clearance and correct.<br>d. Check for worn oil pump.                                                                                                                                                                                                             |
| 5. Oil passage to cylinder head(s) plugged with debris.                                                                 | 5. Check cylinder head oil passages and cylinder head gasket restrictor for blockage. Clean or replace as necessary.                                                                                                                                                                                                                                                                         |
| 6. Worn valve guide(s).                                                                                                 | 6. Ream guide(s) and replace valve(s) with oversize valves and seal(s).                                                                                                                                                                                                                                                                                                                      |
| 7. Air injected into oil due to broken or cracked oil pump                                                              | 7. Inspect pickup tube and replace as necessary.                                                                                                                                                                                                                                                                                                                                             |

## 2004 Chrysler 300M

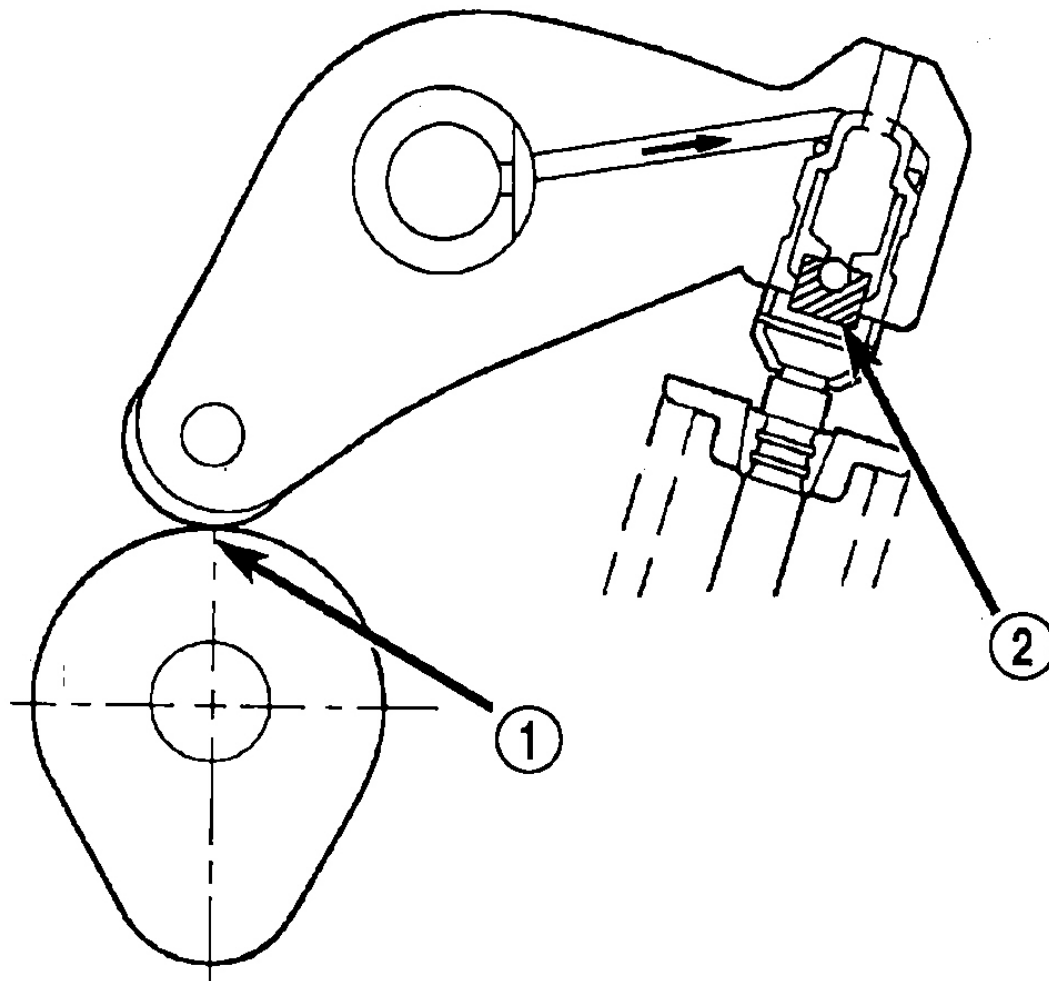
2004 ENGINE Engine 3.5L - 300M, Concorde & Intrepid

|                                                                                           |                                                                                             |
|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| pickup tube.                                                                              |                                                                                             |
| 8. Collapsed lash adjuster due to debris injection.                                       | 8. Clean debris from engine and replace lash adjuster/rocker assembly (1) .                 |
| 9. Intake rocker arm roller clevis ear(s) contacting camshaft bearing journal(s) on side. | 9. Inspect camshaft end play and all valve train components for wear. Replace as necessary. |
| (1) Lash adjusters are serviced with the rocker arms-do not disassemble.                  |                                                                                             |

### STANDARD PROCEDURE - HYDRAULIC LASH ADJUSTER BLEEDING

Use this procedure to manually bleed aerated oil from the lash adjuster and remove sponginess.

1. Run the engine, bringing it to operating temperature in order to freshly pressurize and warm the valvetrain system oil supply.
2. Remove cylinder head cover(s).
3. Ensure the rocker arm is positioned on the base circle of the cam (**Fig. 69** ). Rotate engine as necessary.



1 - CAMSHAFT BASE CIRCLE  
2 - HIGH-PRESSURE CHAMBER

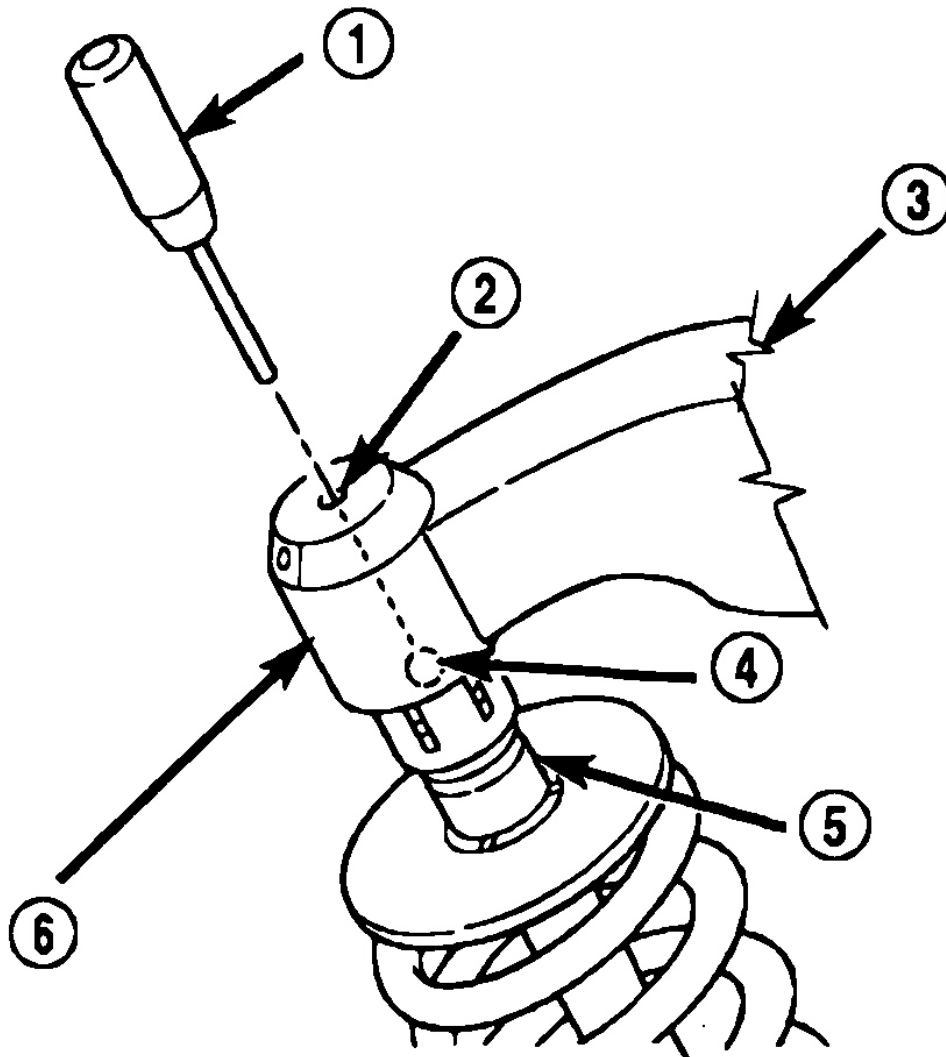
G03511922

**Fig. 69: Rocker Arm Positioned On Base Circle Of Camshaft**  
Courtesy of DAIMLERCHRYSLER CORP.

4. For intake rocker arm positions:
  - a. Adjust Special Tool 8351 Release Probe's gauge pin to extend approximately 20 mm (0.787 in.). Then, carefully insert the release probe gauge pin into the lash adjuster service access hole (**Fig. 70**).

**CAUTION:** If probe tip breaks off within the lash adjuster, replace the

**affected rocker arm.**



- 1 - SPECIAL TOOL 8351**
- 2 - OIL AIR RELIEF SERVICE ACCESS HOLE**
- 3 - ROCKER ARM ASSY**
- 4 - INTERNAL CHECK BALL**
- 5 - VALVE TIP**
- 6 - HYDRAULIC LASH ADJUSTER WITHIN ROCKER ARM**

G03511923

**Fig. 70: Purging Air From Lash Adjuster**  
**Courtesy of DAIMLERCHRYSLER CORP.**

- b. Gently unseat lash adjuster's internal check ball.
  - c. While the internal check ball is held unseated, press the rocker arm into the valve tip, allowing the lash adjuster to fully collapse. Hold this fully collapsed position for about one second, or longer.
  - d. Slowly release the rocker arm, thereby allowing the lash adjuster to extend, which in turn refills the high pressure chamber with non-aerated oil.
  - e. Remove probe to allow check ball to seat.
  - f. Recheck for sponginess. If the lash adjuster sponginess is not completely or nearly eliminated, then repeat procedure.
  - g. If the spongy condition cannot be removed, replace effected rocker arm(s).
5. For exhaust rocker arm positions:
- a. Adjust Special Tool 8351 Release Probe gauge pin to extend approximately 20 mm (0.787 in.). Then, using two release probes, carefully insert gauge pins into the lash adjuster service access holes (**Fig. 70** ).

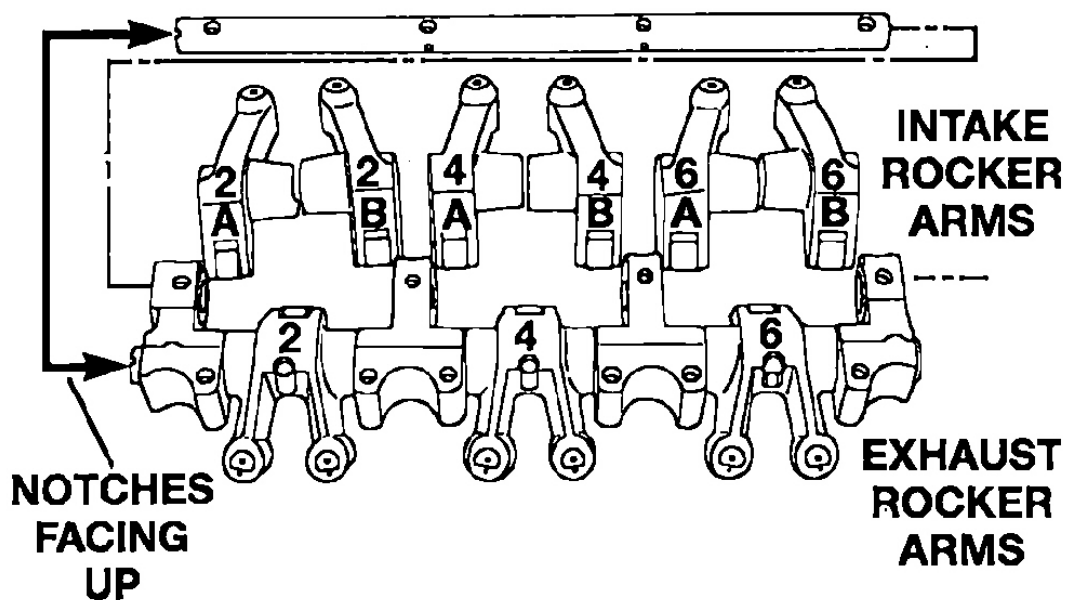
**CAUTION: If probe tip breaks off within the lash adjuster, replace the affected rocker arm.**

- b. Gently unseat BOTH lash adjuster's internal check ball at the same time.
  - c. While the internal check ball is held unseated, press the rocker arm into the valve tip, allowing the lash adjuster to fully collapse. Hold this fully collapsed position for about one second, or longer.
  - d. Slowly release the rocker arm, thereby allowing the lash adjuster to extend, which in turn refills the high pressure chamber with non-aerated oil.
  - e. Remove probes to allow check balls to seat.
  - f. Recheck for sponginess. If the lash adjuster sponginess is not completely or nearly eliminated, then repeat procedure.
  - g. If the spongy condition cannot be removed, replace effected rocker arm(s).
6. Install cylinder head cover(s).

## REMOVAL

**CAUTION: The rocker arm shafts are hollow and are used as lubrication oil passages. The rocker arm and shaft assembly on the RIGHT side of the engine has an oil passage hole from the cylinder head to the third rocker shaft support. The rocker arm shaft assembly on the LEFT side of the engine has an oil passage hole from the cylinder head to the second rocker shaft support.**

1. Remove cylinder head covers. (Refer to **CYLINDER HEAD COVER(S)** )
2. Identify the rocker arm assembly and rocker arms before disassembly (**Fig. 71** ).



G03511924

**Fig. 71: Rocker Arms and Shafts**

Courtesy of DAIMLERCHRYSLER CORP.

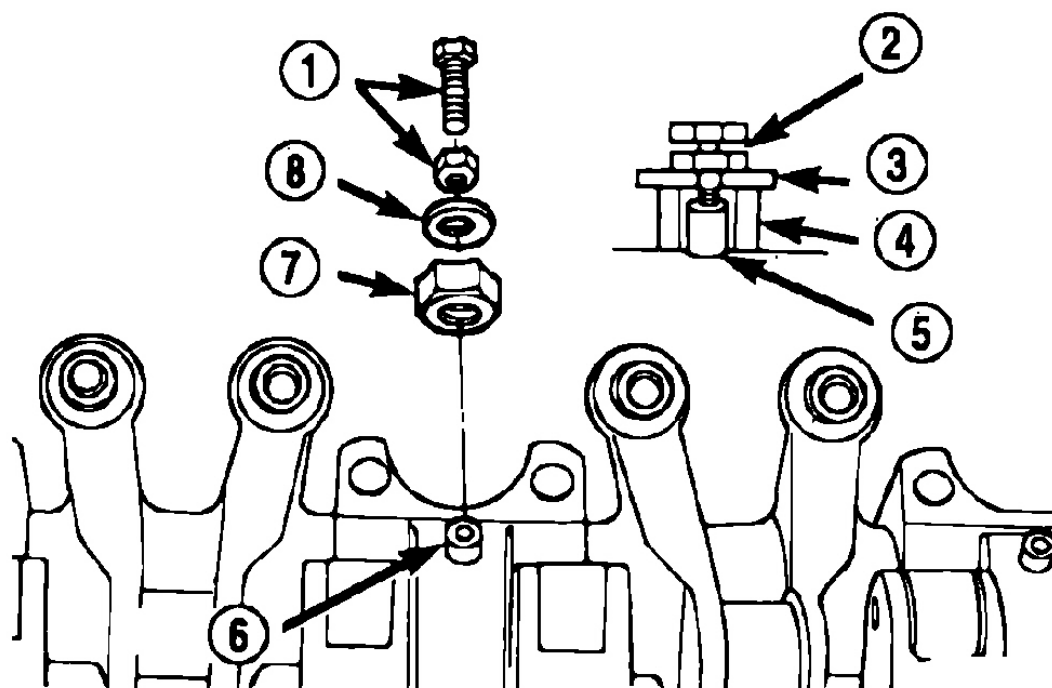
3. Remove rocker arm assembly bolts.
4. Remove rocker arm assembly.

**NOTE:** To prevent air ingestion into lash adjusters, avoid turning rocker arm assembly upside down.

**CAUTION:** Do not allow rocker arm assembly to rest on lash adjusters, as damage may occur to lash adjusters and/or plastic retainers.

## DISASSEMBLY

1. Remove rocker arm and shafts. (Refer to **REMOVAL** )
2. Remove dowel pin using a 4 mm screw, nut, spacer, and washer installed into the pin (**Fig. 72** ). Thread the screw into the pin, then loosen the nut on the screw. This will pull the dowel out of the shaft support. Do not reuse dowel pins. Remove the rocker arms and pedestals in order.



- 1 - 4mm SCREW AND NUT
- 2 - 4mm SCREW AND NUT
- 3 - WASHER
- 4 - SPACER
- 5 - DOWEL
- 6 - DOWEL
- 7 - SPACER
- 8 - WASHER

G03511925

**Fig. 72: Rocker Arms and Shaft - Disassembly**  
 Courtesy of DAIMLERCHRYSLER CORP.

3. Check the rocker arm mounting portion of the shafts for wear or damage. Replace if damaged or heavily worn.
4. Check shaft oil holes for clogging with small wire, clean as required.

## INSPECTION

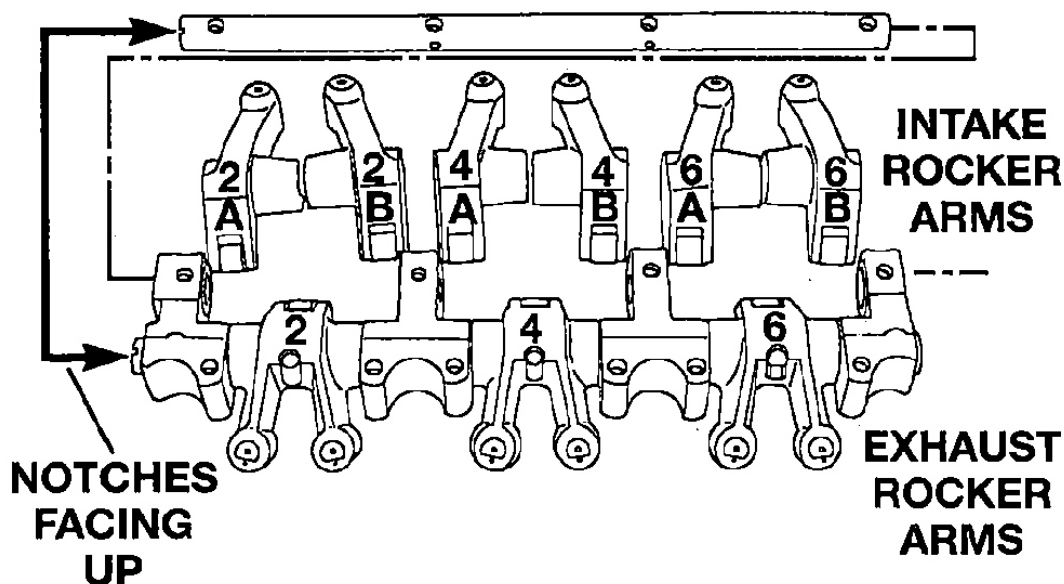
The rocker arm shafts are hollow and are used as lubrication oil ducts. The rocker arm and shaft assembly on the **right** side of the engine has an oil passage hole from the cylinder head located at the third rocker shaft support pedestal. The rocker arm and shaft assembly on the **left** side of the engine has an oil passage hole from

the cylinder head located at the second rocker shaft support pedestal.

**NOTE:** To prevent air ingestion into lash adjusters, avoid turning rocker arm assembly upside down.

**CAUTION:** Do not allow rocker arm assembly to rest on lash adjusters, as damage may occur to lash adjuster and plastic retainer.

The intake and exhaust rocker arms are different. They should be identified before disassembling the assembly (**Fig. 73**).



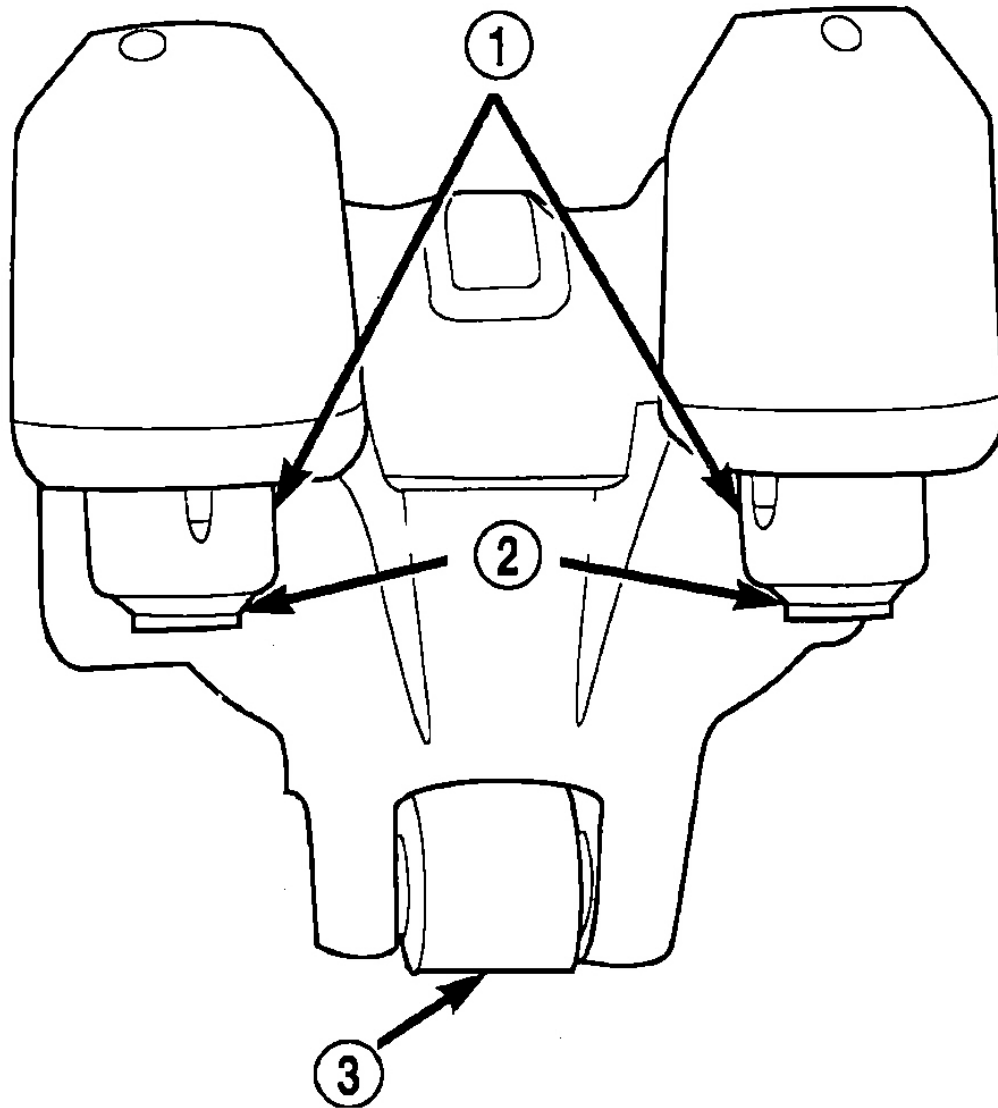
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**Fig. 73: Rocker Arms and Shafts**  
Courtesy of DAIMLERCHRYSLER CORP.

Check rocker arms for wear or damage (**Fig. 74**):

- Roller scuffing or wear
- Shaft bore scuffing or wear
- Swivel pad on lash adjuster missing or broken
- Rocker arm showing signs of fatigue or cracking
- Roller axle protruding from arm

**HYDRAULIC LASH  
ADJUSTER:**



- 1 - RETAINER
- 2 - SWIVEL PAD
- 3 - ROLLER

G03511927

**Fig. 74: Rocker Arm Assembly**  
Courtesy of DAIMLERCHRYSLER CORP.

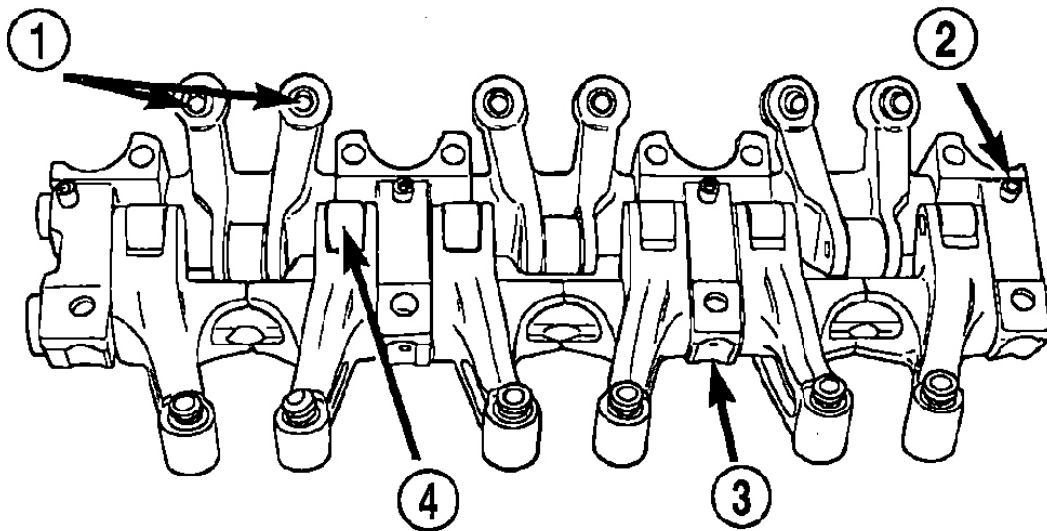
Replace assembly as necessary if any rocker arms shows signs of wear.

**CAUTION:** Do Not remove lash adjuster from rocker arm assembly. Damage to the adjuster and rocker arm will result.

## ASSEMBLY

**CAUTION:** New dowel pins must be installed when reassembling.

1. Install the rocker arms, and pedestals onto the shaft.
2. Install dowel pins (**Fig. 75**). Dowel pins pass through the pedestal into the exhaust rocker shafts. Dowel pins should be pressed in until they bottom-out against the rocker shaft in the pedestal.



- 1 - HYDRAULIC LASH ADJUSTERS
- 2 - DOWEL PIN
- 3 - PEDESTAL
- 4 - ROLLER

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**Fig. 75: Assemble Rocker Arms and Shaft**  
Courtesy of DAIMLERCHRYSLER CORP.

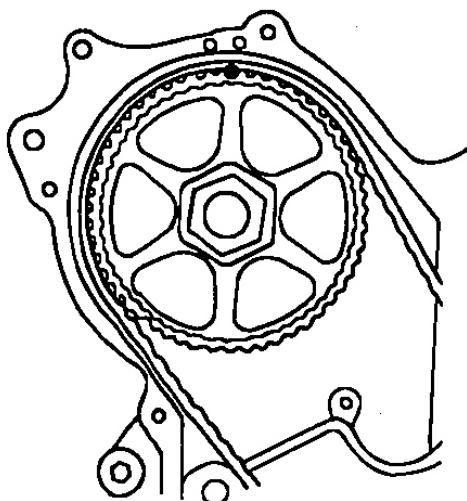
3. Install rocker arm and shafts. (Refer to **INSTALLATION** )

## INSTALLATION

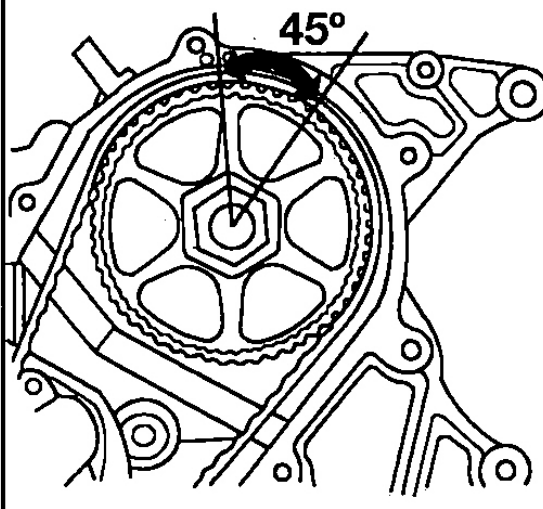
**NOTE:** Rocker arm and shaft assembly can be installed either prior to or after (preferred) cylinder head installation.

1. Rotate camshafts to the position shown in (**Fig. 76**). With the camshafts in these positions the lobes are in a neutral position (no load to the valve). This will allow the rocker arm shaft assembly to be tightened into position with little or no valve spring load on it.

**RIGHT SPROCKET  
NEUTRAL POSITION  
IS WITH THE TIMING  
MARKS ALIGNED  
WITH COVER**



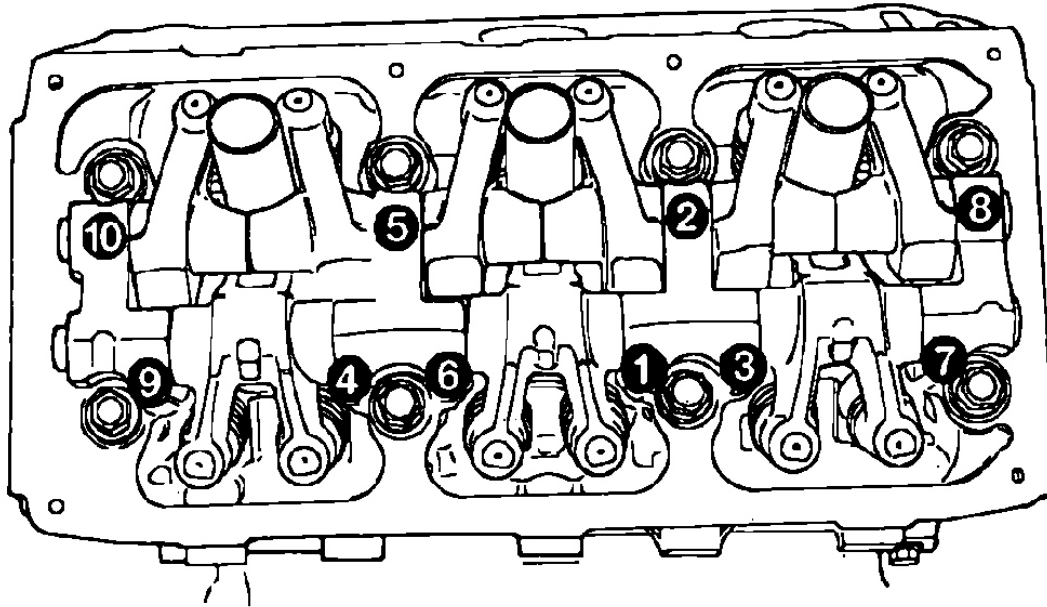
**LEFT SPROCKET  
NEUTRAL POSITION  
IS AT 45° FROM  
TIMING MARKS  
ON COVER**



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**Fig. 76: Camshaft Sprockets Neutral Position**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Install the rocker arm and shaft assembly making sure that the identification marks face toward the front of engine for left head and toward the rear of the engine for right head.
3. Tighten rocker arm/shaft assembly bolts in sequence to 31 N.m (275 in. lbs.) (**Fig. 77**).



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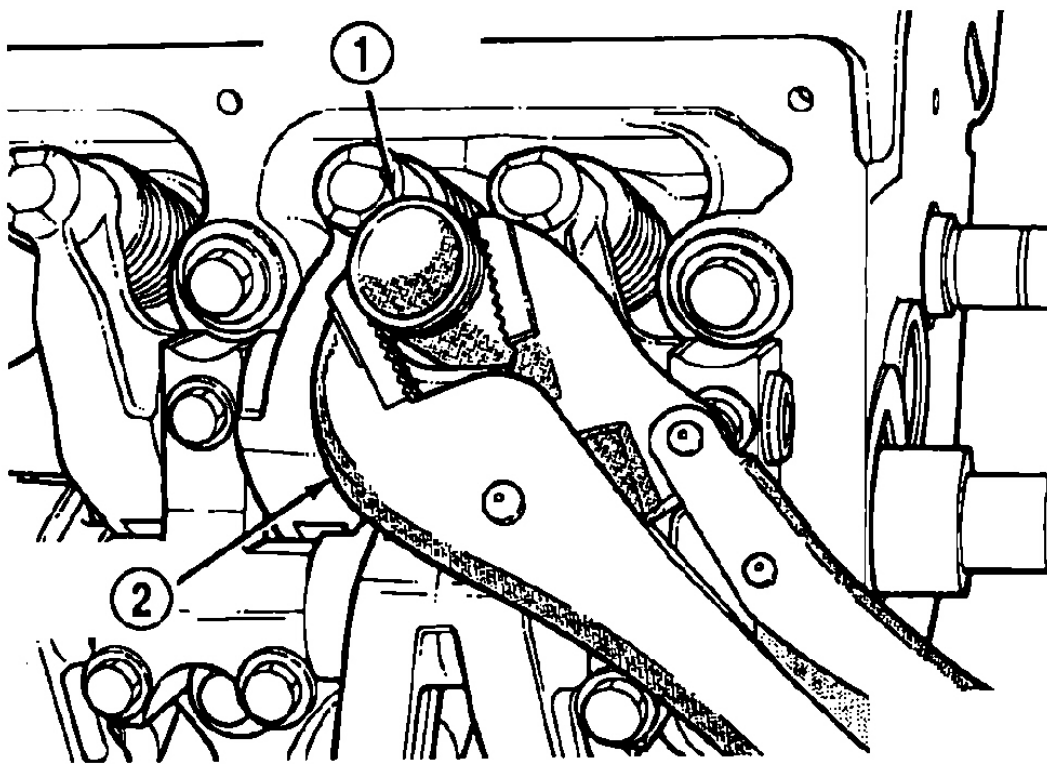
**Fig. 77: Rocker Arm and Shaft Assembly Tightening Sequence**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Install cylinder head covers. (Refer to **CYLINDER HEAD COVER(S)** )

## SPARK PLUG TUBE

### REMOVAL

1. Remove cylinder head cover(s). (Refer to **CYLINDER HEAD COVER(S)** )
2. Using suitable locking pliers, remove the tube from the cylinder head (**Fig. 78** ) and discard tube.



- 1 - SPARK PLUG TUBE  
2 - LOCKING PLIERS

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**Fig. 78: Servicing Spark Plug Tubes**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Clean area around spark plug with MOPAR(R) Parts Cleaner or equivalent.

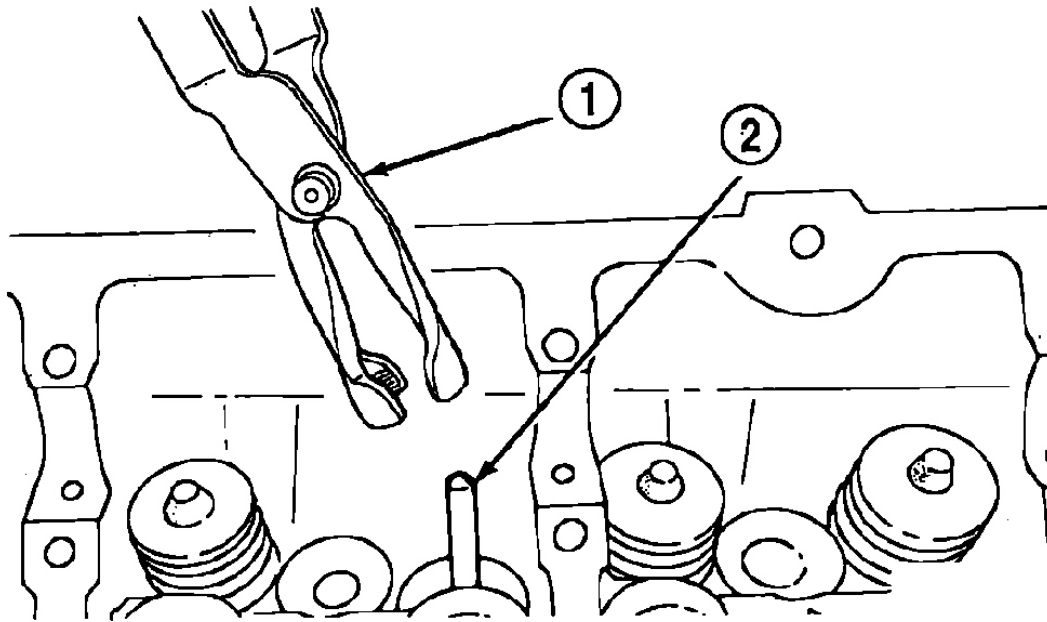
## INSTALLATION

1. Apply MOPAR(R) Stud and Bearing Mount to a new tube approximately 1 mm (0.039 in.) from the end of tube, in a 3 mm (0.118 in.) wide area.
2. Install sealer end of tube into the cylinder head. Then carefully install the tube using a hardwood block and mallet. Install the tube until it is seated into the bottom of the bore.
3. For spark plug tube seal replacement, (Refer to **CYLINDER HEAD COVER(S)** ).
4. Install cylinder head cover(s). (Refer to **CYLINDER HEAD COVER(S)** )

## VALVE STEM SEALS

## REMOVAL

1. Remove valve spring. (Refer to **VALVE SPRINGS** )
2. Remove valve stem seals by using a valve stem seal tool (**Fig. 79** ).



- 1 - VALVE SEAL TOOL  
2 - VALVE STEM

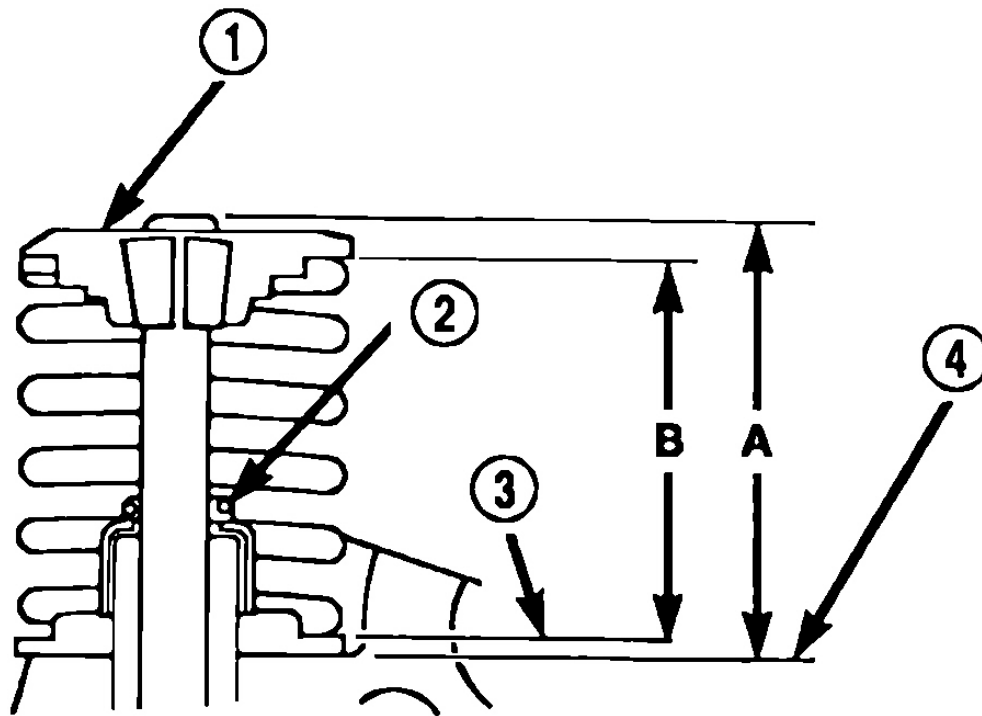
G03511932

**Fig. 79: Valve Stem Seal - Removal**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. The valve stem seal/valve spring seat should be pushed firmly and squarely over the valve guide using the valve stem as guide. **Do Not Force** seal against top of guide. When installing the valve retainer locks, compress the spring **only enough** to install the locks.

**CAUTION:** Do not remove garter spring around the seal at the top of the valve stem seal (**Fig. 80** ).



- 1 - SPRING RETAINER
- 2 - GARTER SPRING
- 3 - VALVE SPRING SEAT TOP
- 4 - CYLINDER HEAD SURFACE

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**Fig. 80: Checking Valve Tip Height and Valve Spring Installed Height**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Install valve spring. (Refer to VALVE SPRINGS )

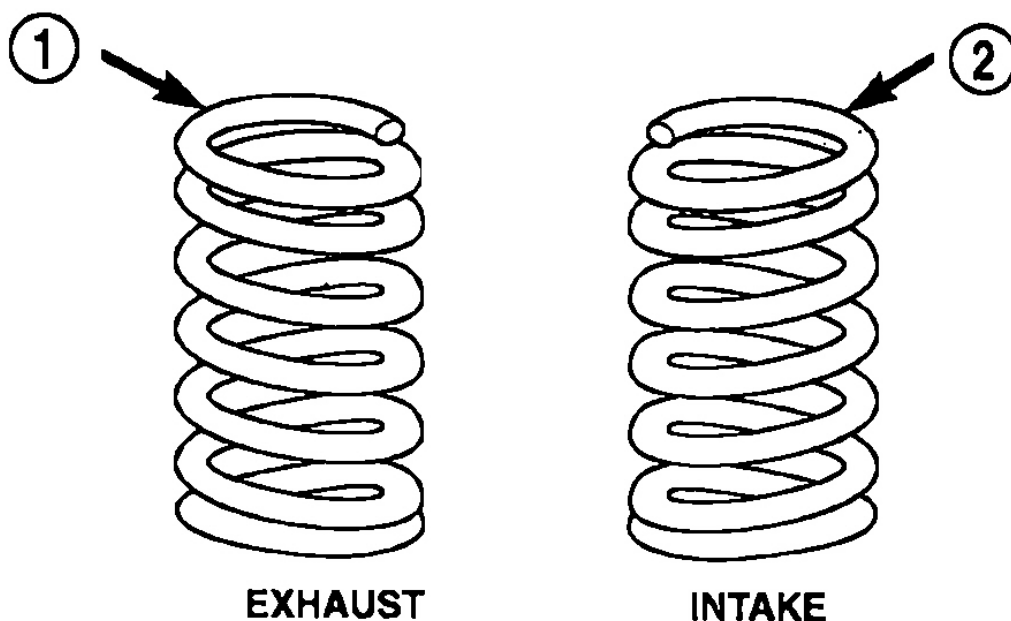
## VALVE SPRINGS

### DESCRIPTION

The valve springs are made from chrome silicon alloy wire and incorporate a "bee-hive" design. Valve spring retainers and locks are common from valve-to-valve. The valve spring seat is integral with the valve stem oil seal, which incorporates a garter spring to maintain consistent lubrication control to the valve stem.

The valve springs are unique for intake compared to exhaust. Both have different lengths and are wound in

opposite directions. The valve springs are color coded, intake spring is right hand coil direction with orange dye on the top coils, and the exhaust spring is left hand coil direction with a yellow dye on the top coils (**Fig. 81** ).



1 - YELLOW DYE

2 - ORANGE DYE

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**Fig. 81: Valve Spring Identification**

Courtesy of DAIMLERCHRYSLER CORP.

## REMOVAL

### REMOVAL - CYLINDER HEAD OFF

1. Using Special Tool C-3422-D (valve spring compressor) with Adapter 6526 compress valve spring and remove valve retaining locks. For Special Tool identification, (Refer to **SPECIAL TOOLS** ).
2. Slowly release valve spring compressor. Remove valve spring retainer and valve spring.
3. Remove valve stem seal assembly (Refer to **VALVE STEM SEALS** ).

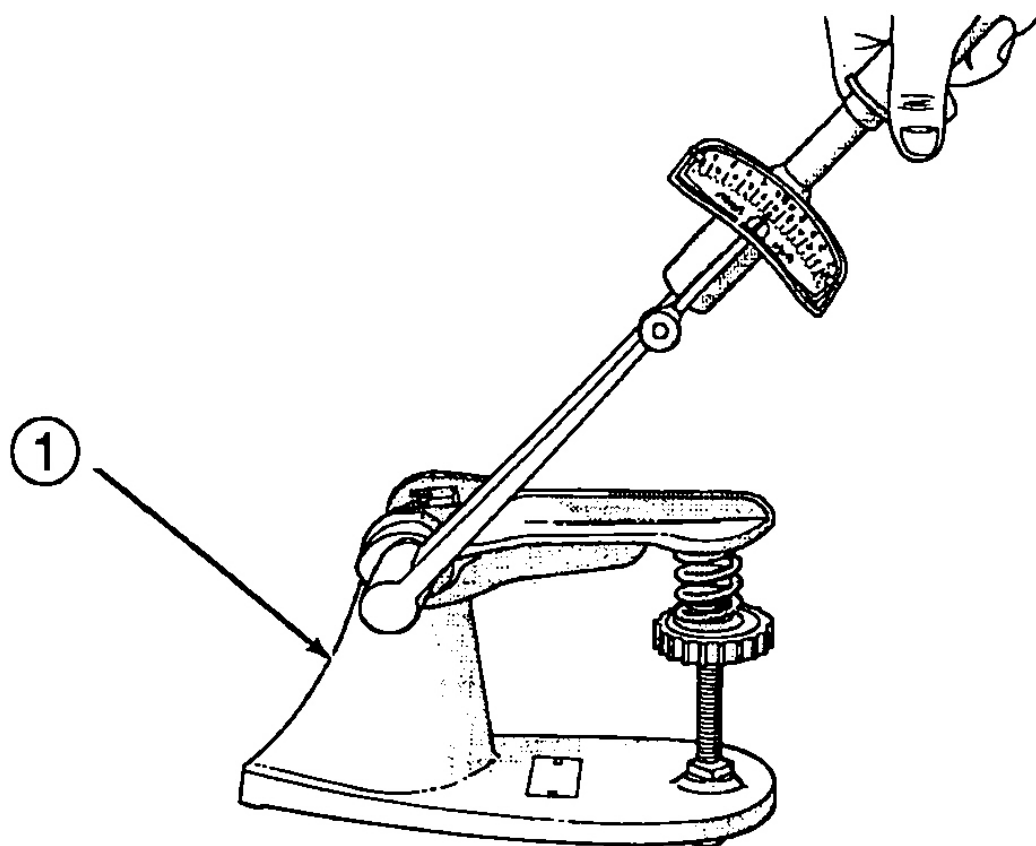
### REMOVAL - CYLINDER HEAD ON

1. Perform fuel system pressure release procedure **before attempting any repairs.** (Refer to **STANDARD PROCEDURE - FUEL SYSTEM PRESSURE REL** )

2. Disconnect negative cable from battery.
3. Remove air cleaner housing and hose assembly.
4. Remove upper intake manifold. (Refer to **INTAKE MANIFOLD - UPPER** )
5. Remove cylinder head covers. (Refer to **CYLINDER HEAD COVER(S)** )
6. Remove rocker arm and shaft assembly. (Refer **ROCKER ARM / ADJUSTER ASSEMBLY** )
7. Remove spark plugs. (Refer to **SPARK PLUG** )
8. Rotate the crankshaft clockwise, until the number 1 piston is at TDC (Top Dead Center) on the compression stroke.
9. With air hose attached to spark plug adapter installed in number 1 spark plug hole, apply 620.5 to 689 kPa (90 to 100 psi) air pressure. This is to hold valves into place while servicing components.
10. Using Tool MD 998772A with adapter 6527 or equivalent, compress valve spring and remove valve locks, retainer, and valve spring.
11. Remove valve stem seal, if required. (Refer to **VALVE STEM SEALS** )
12. Follow the same procedure on the remaining 5 cylinders using the firing sequence 1-2-3-4-5-6. **Make sure piston is at TDC in each cylinder of the valve spring that is being removed.**
13. Remove spark plug adapter tool.

## INSPECTION

When valves have been removed for inspection, reconditioning or replacement, valve springs should be tested (**Fig. 82** ). **As an example;** the compression length of the spring to be tested is 38.00 mm (1.496 in.). Turn table of Tool C-647 until surface is in line with the 38.00 mm (1.496 inches.) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to **3.5L ENGINE** to obtain specified height and allowable tensions. Replace springs that do not meet specifications.



1 - SPECIAL TOOL C-647

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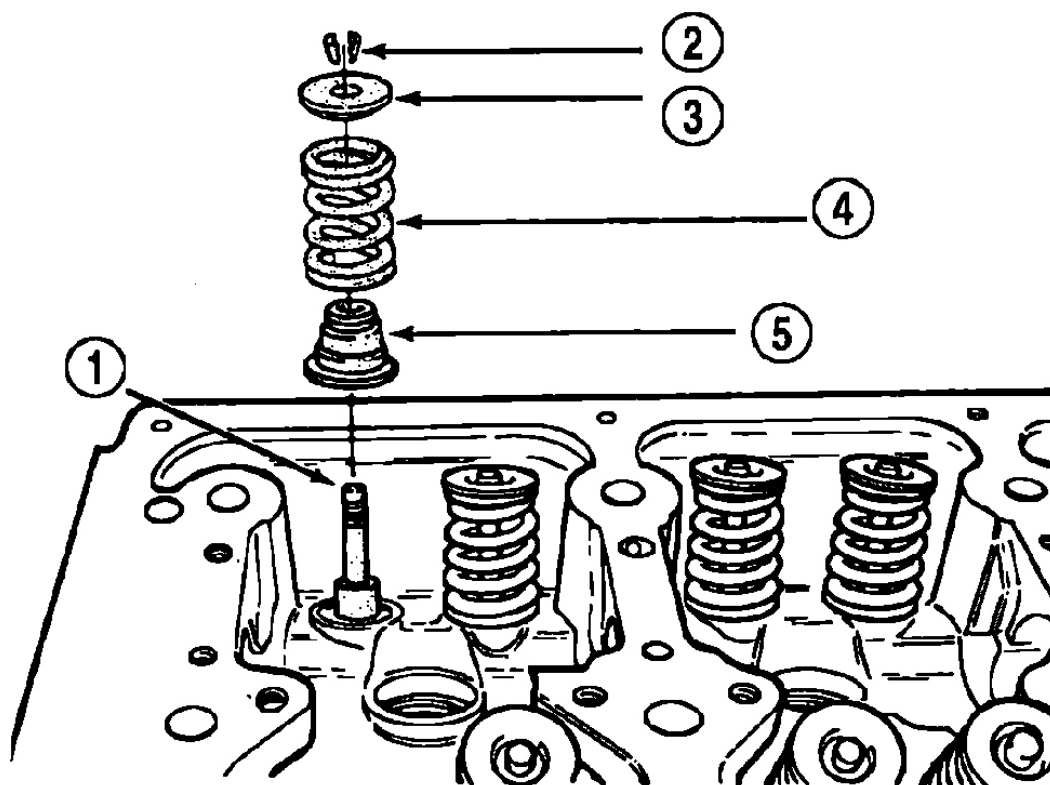
**Fig. 82: Testing Valve Spring**

Courtesy of DAIMLERCHRYSLER CORP.

**INSTALLATION**

**INSTALLATION - CYLINDER HEAD OFF**

1. Install valves if removed.
2. Install valve stem seal/spring seat assembly over valve guides on all valve stems (**Fig. 83**). Ensure that the garter spring is intact around the top of the rubber seal.

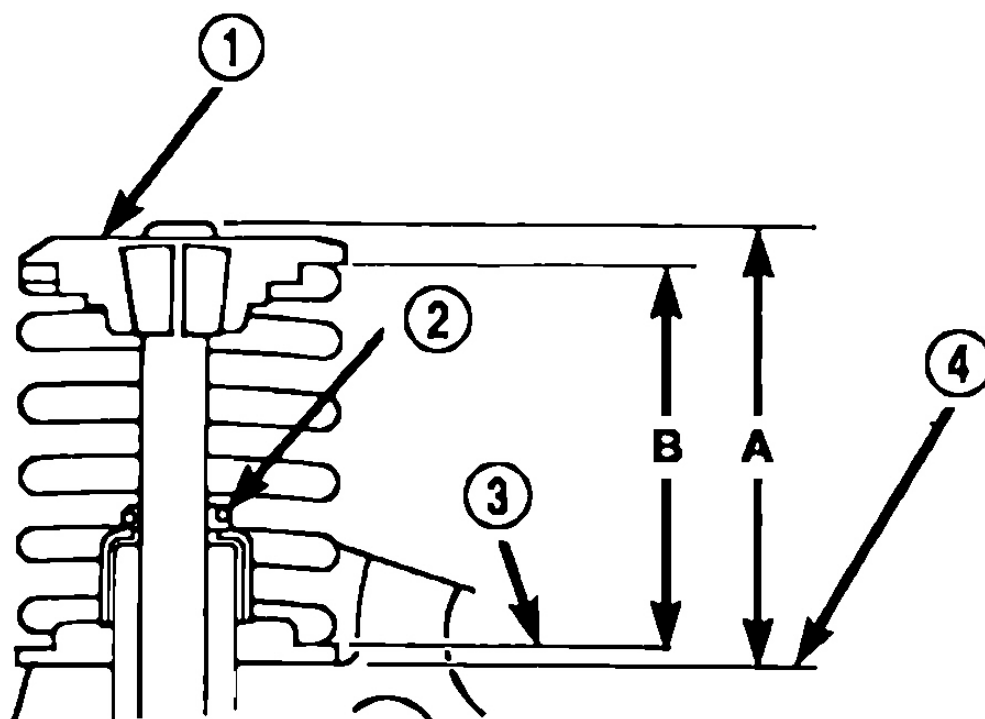


- 1 - VALVE
- 2 - VALVE RETAINING LOCKS
- 3 - VALVE SPRING RETAINER
- 4 - VALVE SPRING
- 5 - VALVE SEAL AND VALVE SPRING SEAT ASSEMBLY

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**Fig. 83: Valve, Spring, and Valve Seal**  
 Courtesy of DAIMLERCHRYSLER CORP.

3. Place valve spring (color-coded end facing up) and valve retainer into position.
4. Compress valve spring with valve spring compressor. Install locks and release tool. **If valves and/or seats are reground, measure the installed height of springs (B) (Fig. 84), make sure measurements are taken from top of spring seat to the bottom surface of spring retainer.** If height is greater than 38.75 mm (1.5256 in.), install a 0.762 mm (0.030 in.) spacer in head counterbore under the valve spring seat to bring spring height back within specification.



- 1 - SPRING RETAINER
- 2 - GARTER SPRING
- 3 - VALVE SPRING SEAT TOP
- 4 - CYLINDER HEAD SURFACE

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**Fig. 84: Checking Valve Tip Height and Valve Spring Installed Height**  
 Courtesy of DAIMLERCHRYSLER CORP.

#### INSTALLATION - CYLINDER HEAD ON

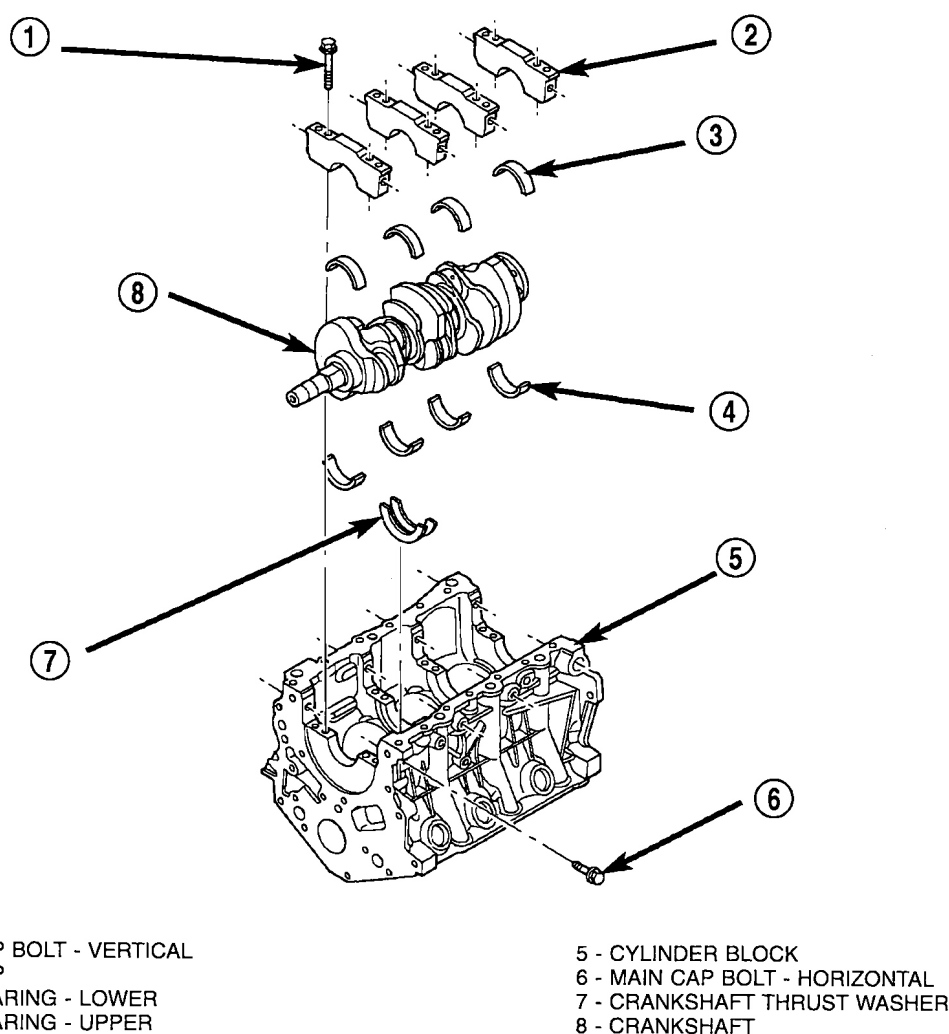
1. Compress valve spring using Special Tool MD 998772A with Adaptor 6527 only enough to install retainer and locks.
2. After installing locks, release tension on valve spring and verify proper installation.
3. Remove Special Tool MD 998772A.
4. Install rocker arm and shaft assembly. (Refer to **ROCKER ARM / ADJUSTER ASSEMBLY** )
5. Install cylinder head covers. (Refer to **CYLINDER HEAD COVER(S)** )
6. Install spark plugs. (Refer to **SPARK PLUG** )
7. Install upper intake manifold. (Refer to **INTAKE MANIFOLD - UPPER** )

8. Connect negative cable.

## ENGINE BLOCK

### DESCRIPTION

The cylinder block (**Fig. 85**) is made of heat treated aluminum with cast-in-place iron liners. The block is a closed deck design with the right bank forward. To provide high rigidity and improved NVH, the block has cast-in contours and ribs, along with powdered metal 6 bolt main caps (4 vertical, 2 horizontal), with a die cast aluminum structural beam windage tray mounted to the main caps.

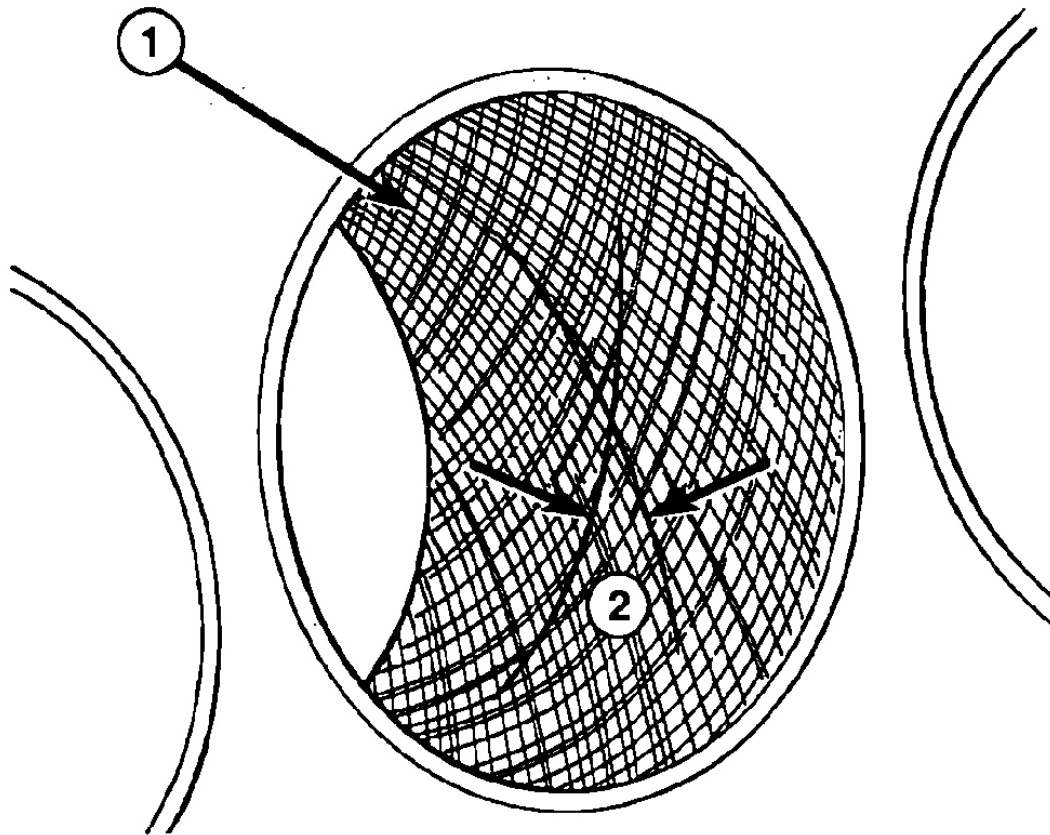


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**Fig. 85: Engine Block And Crankshaft**  
Courtesy of DAIMLERCHRYSLER CORP.

### STANDARD PROCEDURE - CYLINDER BORE HONING

1. Used carefully, the cylinder bore resizing hone, recommended tool C-823 or equivalent, equipped with 220 grit stones, is the best tool for this honing procedure. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.
2. Deglazing of the cylinder walls may be done using a cylinder surfacing hone, recommended tool C-3501 or equivalent, equipped with 280 grit stones, if the cylinder bore is straight and round. 20-60 strokes depending on the bore condition, will be sufficient to provide a satisfactory surface. Use a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.** Inspect cylinder walls after each 20 strokes.
3. Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks **intersect** at 40-60 degrees, the cross hatch angle is most satisfactory for proper seating of rings (**Fig. 86** ).



1 - CROSS-HATCH PATTERN  
2 - 40°-60°

G03511939

**Fig. 86: Cylinder Bore Cross-Hatch Pattern**  
Courtesy of DAIMLERCHRYSLER CORP.

4. A controlled hone motor speed between 200-300 RPM is necessary to obtain the proper cross-hatch angle. The number of up and down strokes per minute can be regulated to get the desired 40-60 degree angle. Faster up and down strokes increase the cross-hatch angle.
5. After honing, it is necessary that the block be cleaned again to remove all traces of abrasive.

**CAUTION:** Ensure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and hot water be used with a brush and the parts then thoroughly dried. The bore can be

**considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil the bores after cleaning to prevent rusting.**

## **CLEANING**

Clean cylinder block thoroughly using a suitable cleaning solvent.

## **INSPECTION**

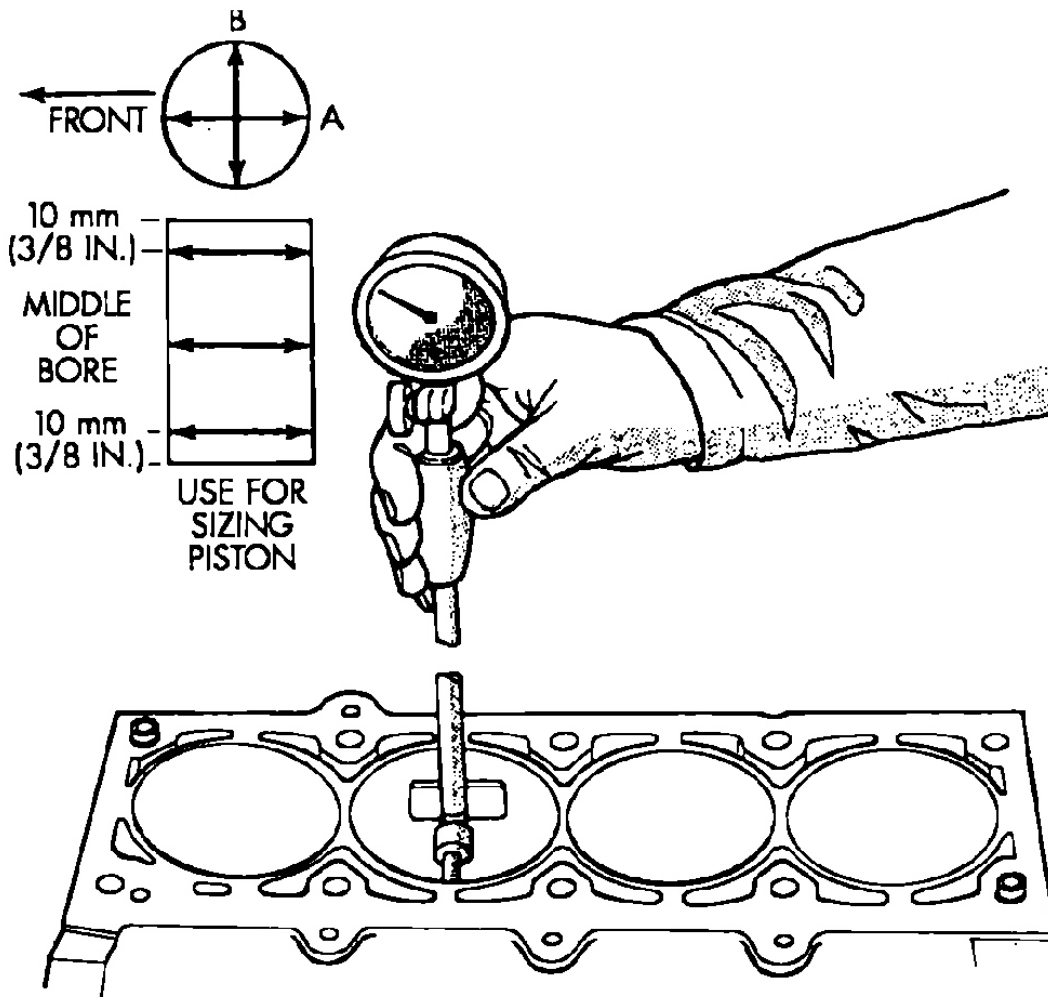
### **ENGINE BLOCK**

1. Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.
2. If new core plugs are to be installed, (Refer to **STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS** ).
3. Examine block and cylinder bores for cracks or fractures.
4. Check block deck surfaces for flatness. Deck surface must be within service limit of 0.1 mm (0.004 in.).

### **CYLINDER BORE**

**NOTE:**        **The cylinder bores should be measured at normal room temperature, 21°C (70° F).**

The cylinder walls should be checked for out-of-round and taper with Tool C119 or equivalent (**Fig. 87** ) (Refer to **SPECIFICATIONS** ). If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.



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**Fig. 87: Checking Cylinder Bore Size**  
 Courtesy of DAIMLERCHRYSLER CORP.

Measure the cylinder bore at three levels in directions A and B (**Fig. 87**). Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from bottom of bore. (Refer to **SPECIFICATIONS**).

## CONNECTING ROD BEARINGS

### STANDARD PROCEDURE - CONNECTING RODS AND BEARINGS

#### CONNECTING ROD BEARINGS

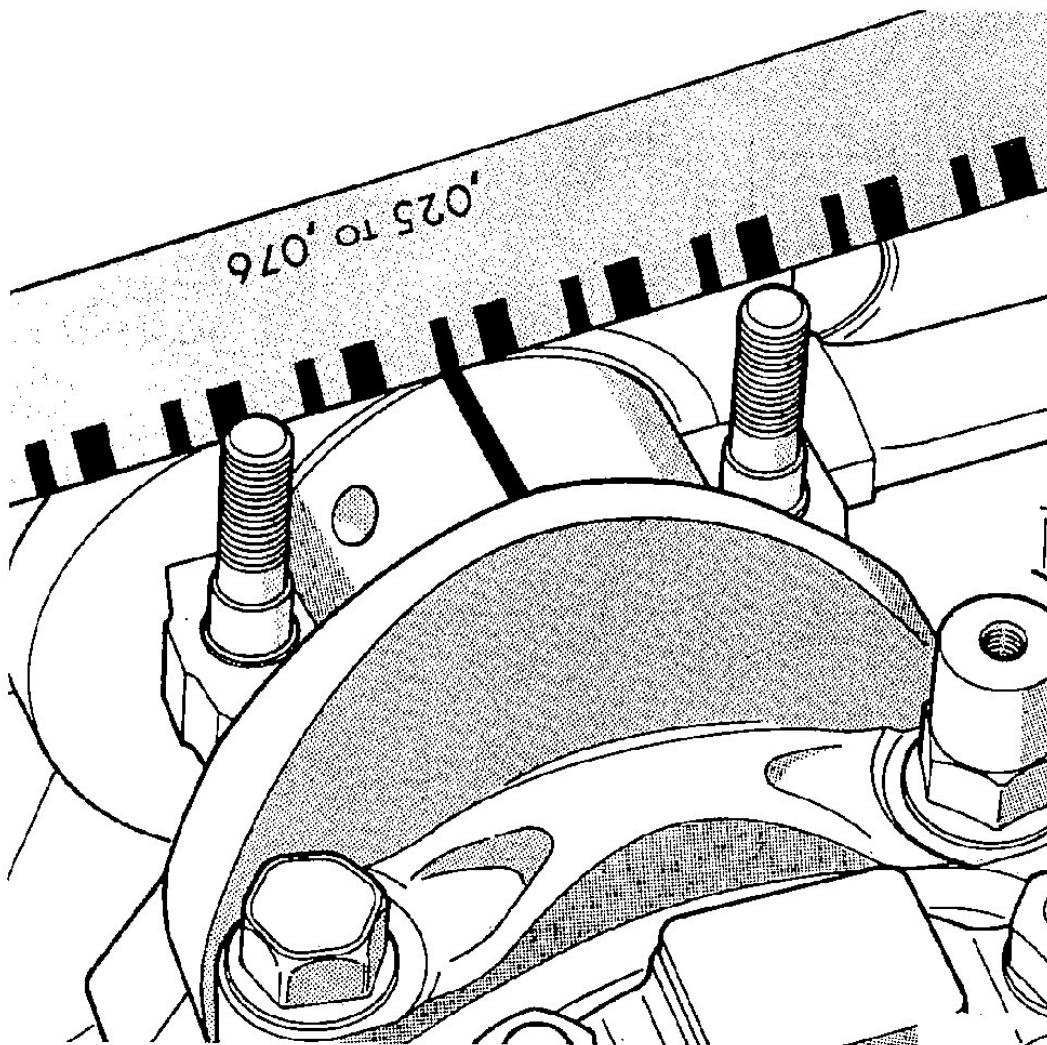
The bearing caps are not interchangeable and should be marked at removal to insure correct assembly.

The bearing shells must be installed with the tangs inserted into the machined grooves in the rods and caps. Install cap with the tangs on the same side as the rod.

Fit all rods on one bank until complete.

Limits of taper or out-of-round on any crankshaft journals should be held to 0.015 mm (0.0006 in.). Bearings are available in standard, 0.025 mm (0.001 in.), and 0.254 mm (0.010 in.) undersizes. **Install the bearings in pairs. Do not use a new bearing half with an old bearing half. Do not file the rods or bearing caps.**

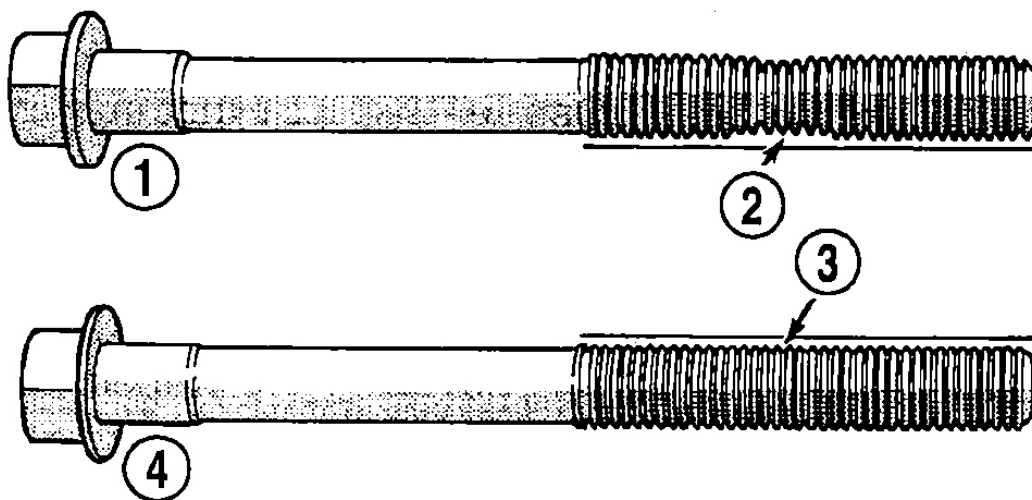
1. For measuring main bearing clearance and connecting rod bearing clearance use plastigage (**Fig. 88**). For more information on using plastigage (Refer to **STANDARD PROCEDURE - MEASURING BEARING CLEARANCE USING PLASTIGAGE**). Refer to **SPECIFICATIONS** for bearing clearance specifications.



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**Fig. 88: Checking Connecting Rod Bearing**  
Courtesy of DAIMLERCHRYSLER CORP.

**NOTE:** The rod bearing bolts should be examined before reuse. If the threads are necked down the bolts must be replaced ([Fig. 89](#) ).



- 1 - STRETCHED BOLT
- 2 - THREADS ARE NOT STRAIGHT ON LINE
- 3 - THREADS ARE STRAIGHT ON LINE
- 4 - UNSTRETCHED BOLT

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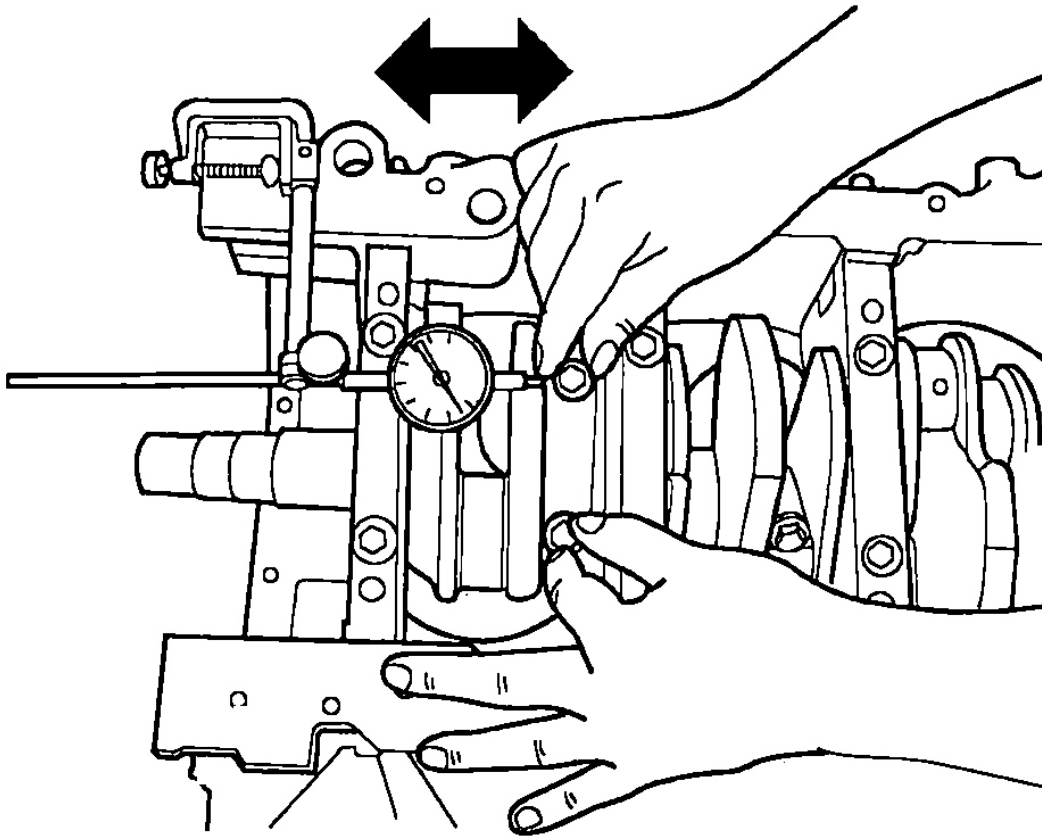
**Fig. 89: Check For Stretched Bolts**  
Courtesy of DAIMLERCHRYSLER CORP.

#### CONNECTING ROD BOLTS

1. Examine connecting rod bolts for stretching. Stretching can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale the bolt must be replaced.
2. Before installing the nuts the threads should be oiled with engine oil.
3. Install nuts on each bolt finger tight. Then alternately torque each nut to assemble the cap properly.
4. Tighten the connecting rod cap nuts to specifications. (Refer to **SPECIFICATIONS** )

#### CONNECTING ROD SIDE CLEARANCE

1. Mount a dial indicator to a stationary point on engine. Locate probe perpendicular to and resting against the connecting rod cap being checked. Move connecting rod all the way to rear of its travel. Zero the dial indicator. Move connecting rod forward to limit of travel and read the dial indicator (**Fig. 90** ). Compare measurement to specification listed in engine specifications (Refer to **SPECIFICATIONS** ). Repeat procedure for each connecting rod. Turn crankshaft for connecting rod accessibility.



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**Fig. 90: Connecting Rod Side Clearance**  
Courtesy of DAIMLERCHRYSLER CORP.

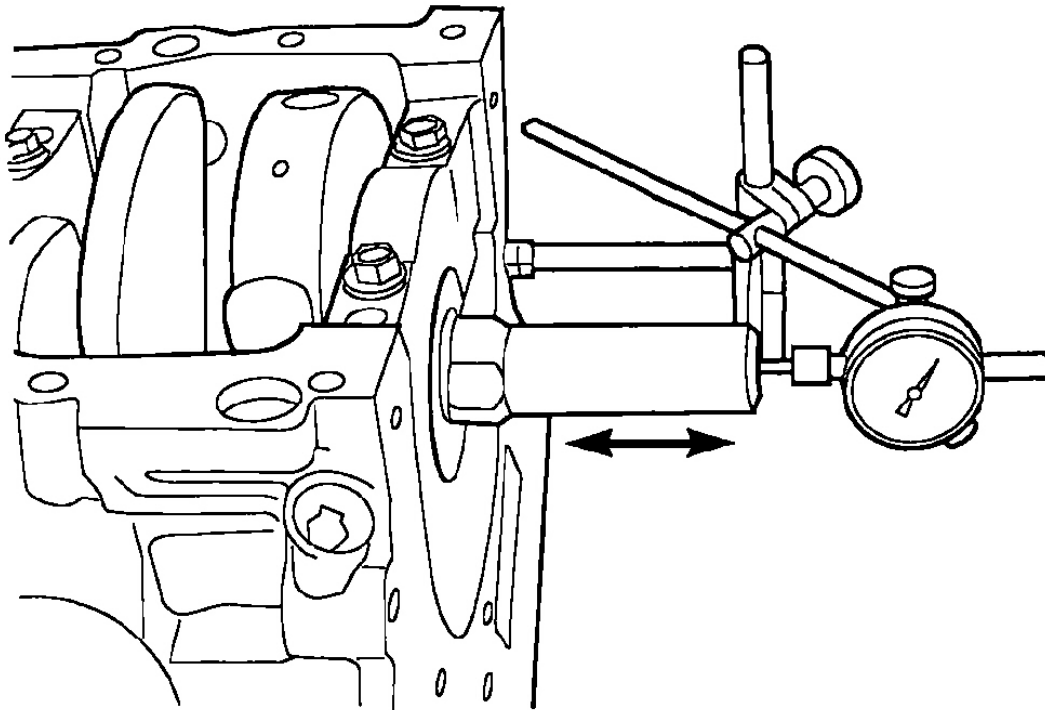
## CRANKSHAFT

### DESCRIPTION

The crankshaft (**Fig. 85**) is constructed of a forged micro alloy steel. A six throw, nine counterweight crankshaft is supported by four select fit main bearings with number two serving as the thrust washer location. The six separate connecting rod throws are an even-firing design which reduces torque fluctuations while a torsional vibration damper is used to control torsion caused vibration of the crankshaft. Rubber lipped seals are used at front and rear. The front seal is retained in the oil pump case and the rear seal is retained in a block-mounted housing.

### STANDARD PROCEDURE - CRANKSHAFT END PLAY

1. Using Dial Indicator C-3339 and Mounting Post L-4438, attach to front of engine, locating probe perpendicular on nose of crankshaft (**Fig. 91**).



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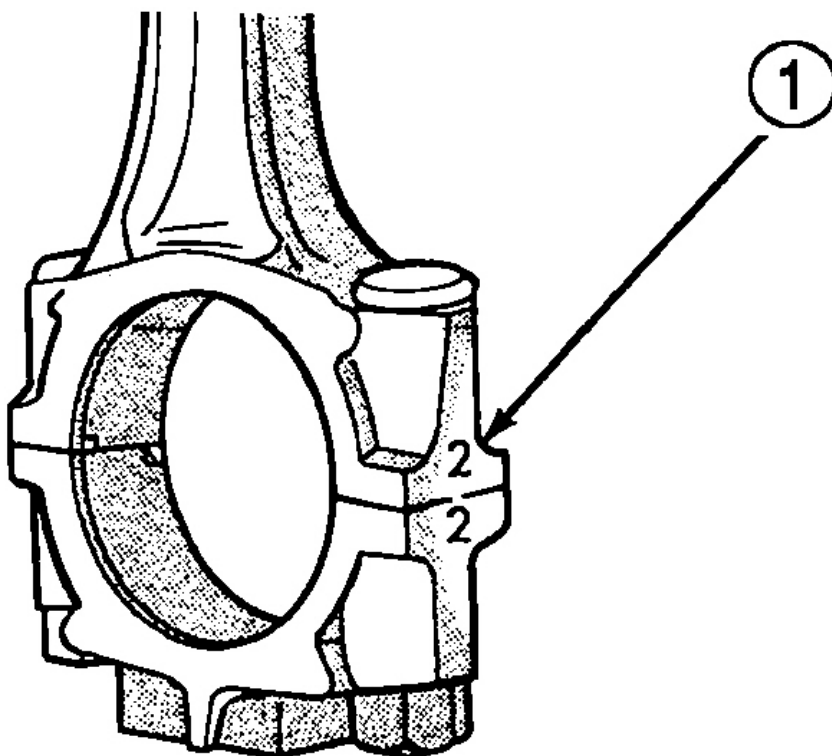
**Fig. 91: Checking Crankshaft End Play**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Move crankshaft all the way to the rear of its travel.
3. Zero the dial indicator.
4. Move crankshaft all the way to the front and read the dial indicator. Refer to **3.5L ENGINE** .

## REMOVAL

1. Remove engine from vehicle. (Refer to **ENGINE 3.5L** )
2. Remove oil pan. (Refer to **OIL PAN** )
3. Remove oil pickup tube.
4. Remove crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )
5. Remove idler pulley for accessory drive belt.
6. Remove front lower timing belt cover.
7. Remove front main timing belt cover.
8. Remove front left side timing belt cover.
9. Remove timing belt tensioner and timing belt.
10. Remove crankshaft sprocket. (Refer to **TIMING BELT AND SPROCKETS** )

11. Tap dowel pin out of crankshaft.
12. Remove oil pump assembly.
13. Remove crankshaft rear oil seal retainer. (Refer to **CRANKSHAFT OIL SEAL - REAR** )
14. Remove connecting rod bearing caps. Connecting rod bearing caps are not interchangeable and should be marked before removal to insure correct assembly (**Fig. 92** ).

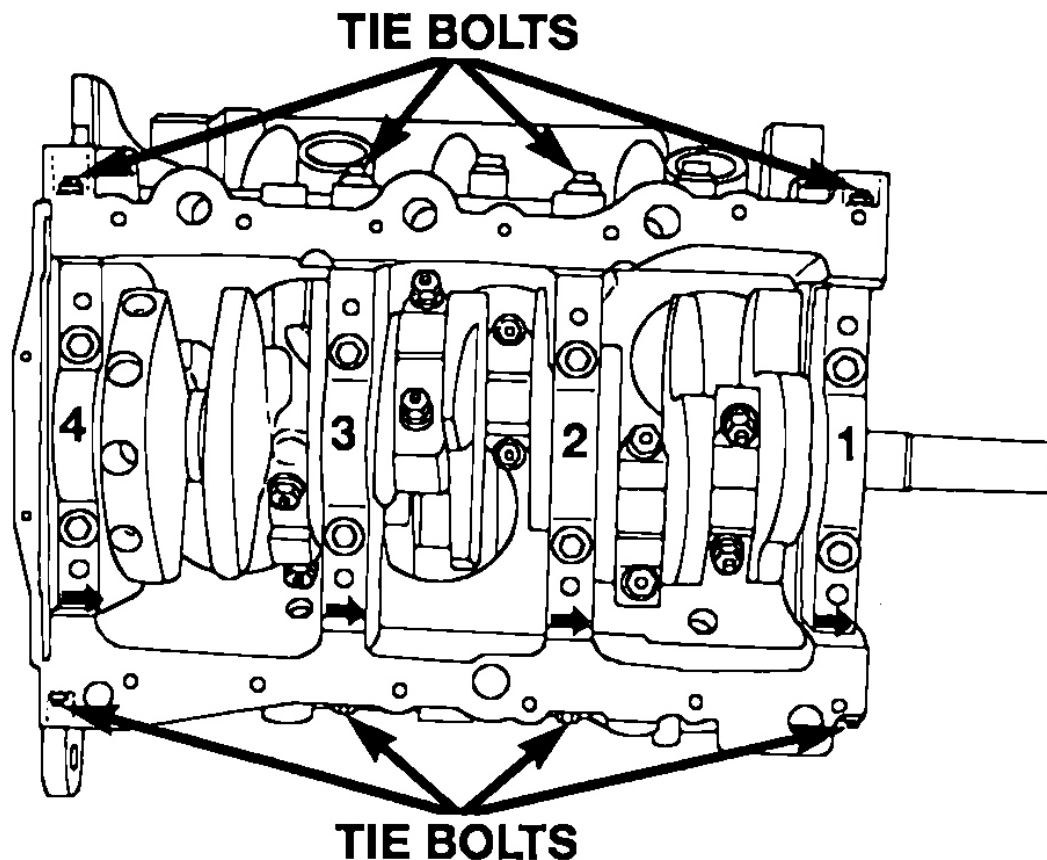


**1 - CYLINDER NUMBER**

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**Fig. 92: Connecting Rod To Cylinder Identification**  
Courtesy of DAIMLERCHRYSLER CORP.

15. Remove main bearing caps. Main bearing caps are not interchangeable and are marked to insure correct assembly (**Fig. 93** ).



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**Fig. 93: Main Bearing Cap Identification**  
Courtesy of DAIMLERCHRYSLER CORP.

16. Remove crankshaft from cylinder block (**Fig. 95**).

**NOTE:** Before installing crankshaft, refer to **CRANKSHAFT MAIN BEARINGS**.

### INSPECTION

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to 0.015 mm (0.0006 in.). Journal grinding should not exceed 0.305 mm (0.012 in.) under the standard journal diameter. DO NOT grind thrust faces of Number 2 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

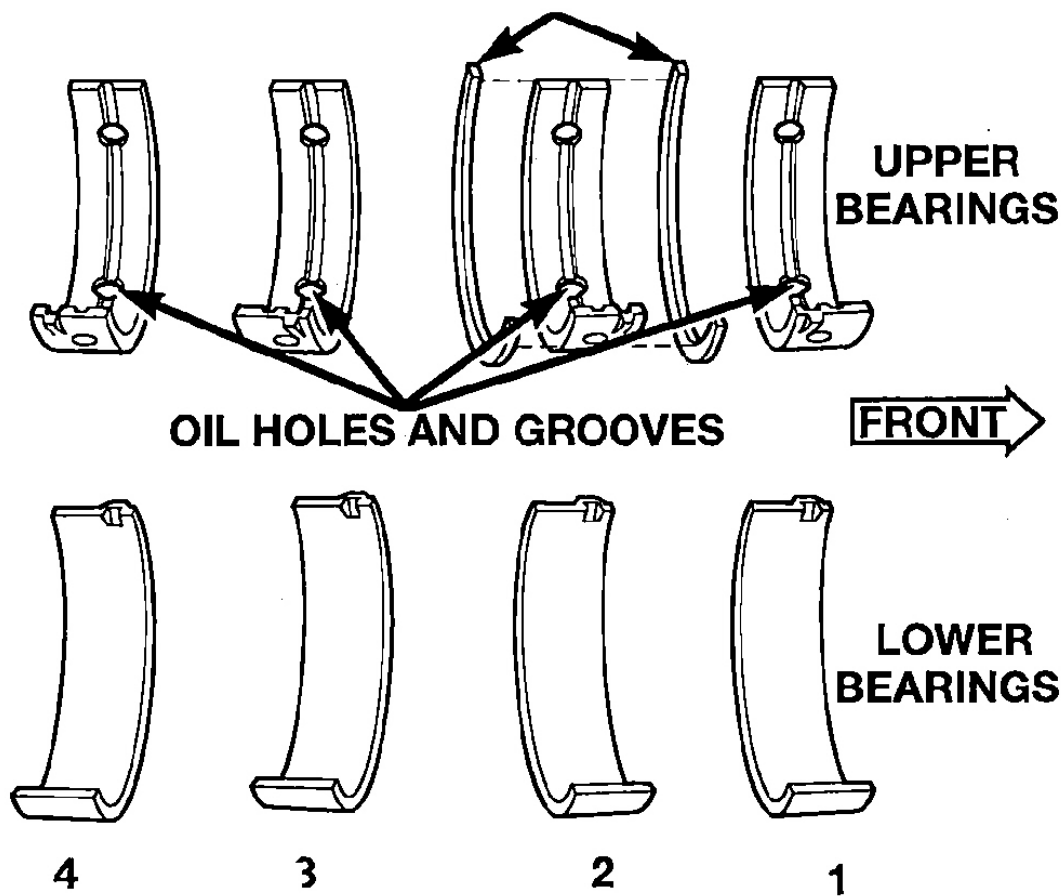
**CAUTION:** With a forged steel crankshaft it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation

in the engine.

## INSTALLATION

**CAUTION:** Main bearings are select fit. (Refer to CONNECTING ROD BEARINGS )

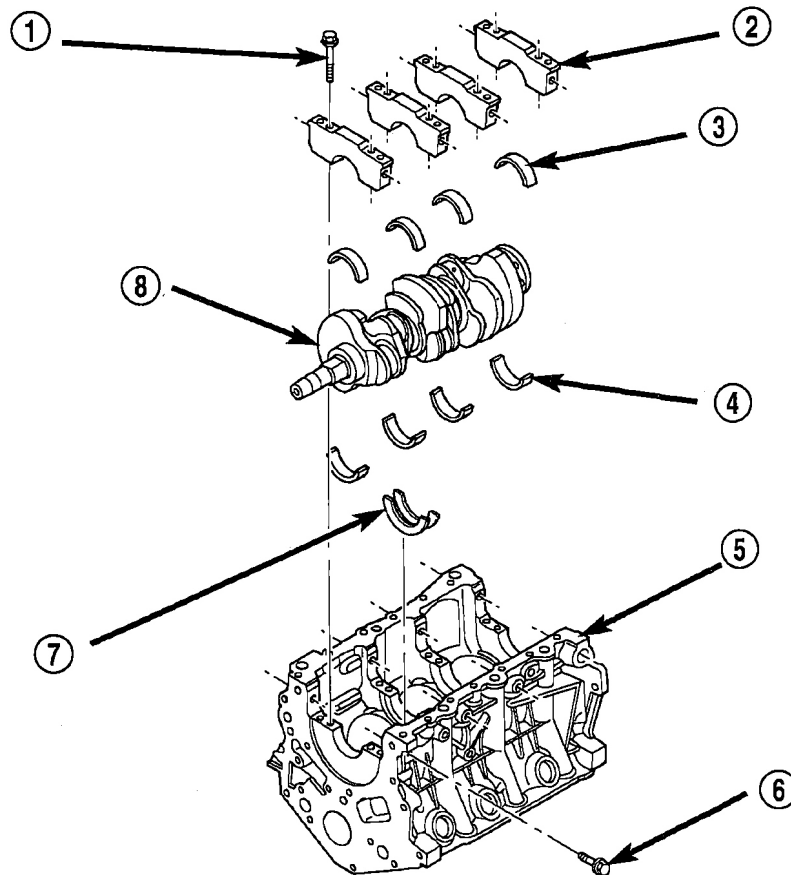
1. Install crankshaft main bearings (**Fig. 94** ). (Refer to CRANKSHAFT MAIN BEARINGS )



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**Fig. 94: Main Bearing Identification**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Install the crankshaft to cylinder block. (**Fig. 95** )



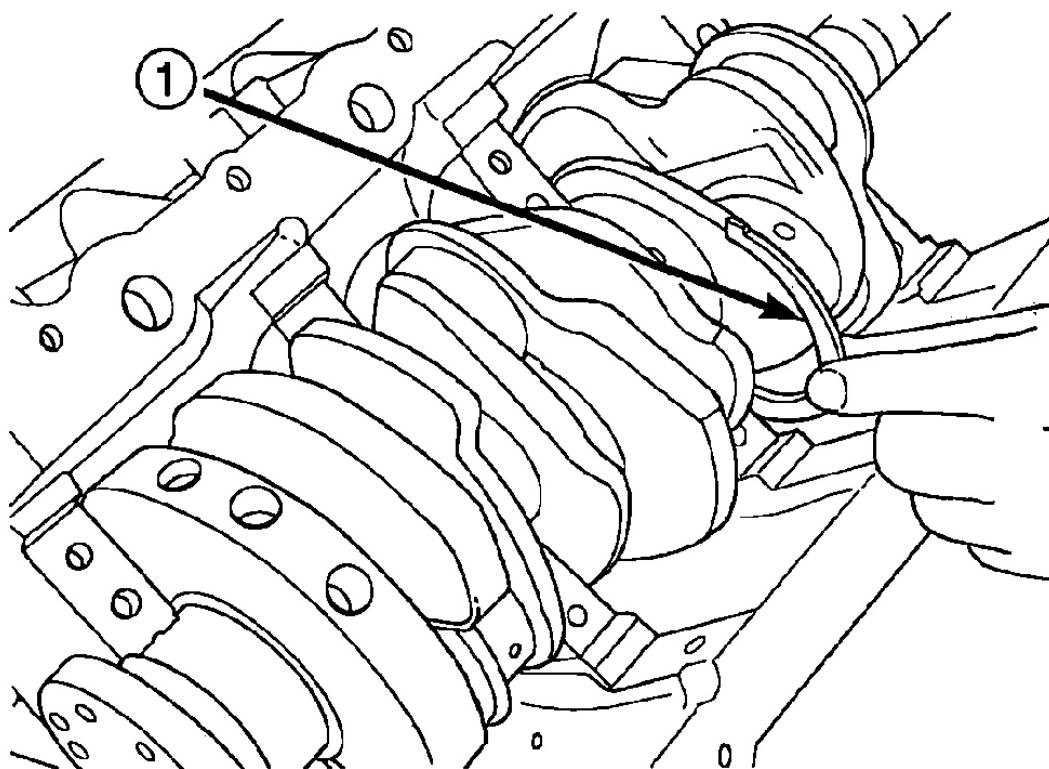
- 1 - MAIN CAP BOLT - VERTICAL
- 2 - MAIN CAP
- 3 - MAIN BEARING - LOWER
- 4 - MAIN BEARING - UPPER

G03511947

- 5 - CYLINDER BLOCK
- 6 - MAIN CAP BOLT - HORIZONTAL
- 7 - CRANKSHAFT THRUST WASHER
- 8 - CRANKSHAFT

**Fig. 95: Engine Block And Crankshaft**  
 Courtesy of DAIMLERCHRYSLER CORP.

3. Move crankshaft forward to limit of travel. Lubricate and install the front thrust washer by rolling the washer onto the machined shelf between the No. 2 upper main bulk head and crankshaft thrust surface (**Fig. 96**).



1 - FRONT THRUST WASHER

G03511949

**Fig. 96: Thrust Washer Installation**

Courtesy of DAIMLERCHRYSLER CORP.

4. Move crankshaft rearward to limit of travel. Lubricate and install the rear thrust washer by rolling the washer onto the machined shelf between the No. 2 upper main bulk head and crankshaft thrust surface.
5. Lubricate lower main bearings with clean engine oil.

**NOTE:** Lubricate main bearing cap bolts with engine oil before installation.

6. Install each main cap and tighten bolts finger tight.

The main bearing cap bolts must be tightened in the proper sequence. First the inner main cap bolts, secondly the windage tray bolts, lastly the main cap tie (horizontal) bolts.

7. Install the inside main bearing cap bolts and tighten to 20 N.m + 1/4 turn (15 ft. lbs. + 1/4 turn).
8. Measure crankshaft end play. (Refer to **STANDARD PROCEDURE - CRANKSHAFT END PLAY** )
9. Install connecting rods and measure side clearance. (Refer to **CONNECTING ROD BEARINGS** )

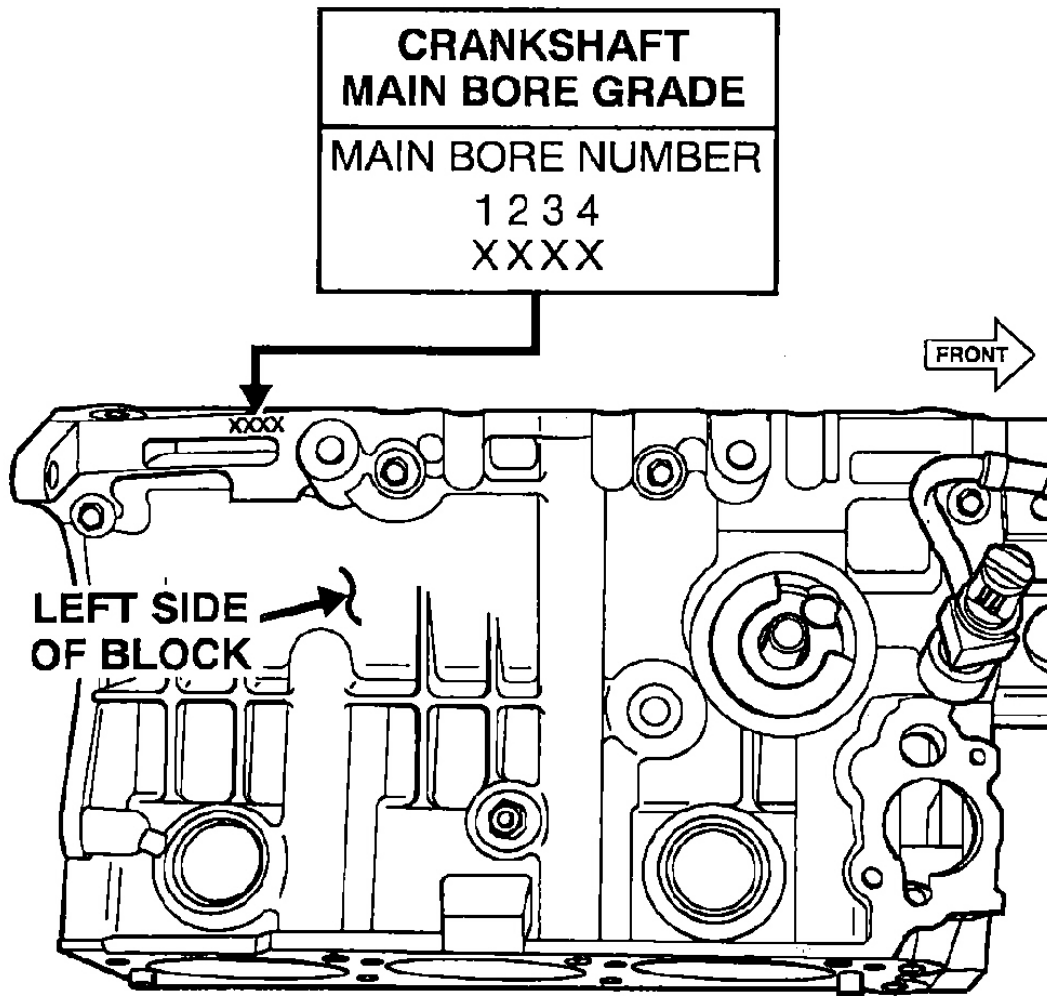
10. Install windage tray. Lubricate bolts with engine oil and tighten to 27 N.m + 1/4 turn (20 ft. lbs. + 1/4 turn).
11. Install the main cap tie (horizontal) bolts and tighten to 28 N.m (250 in. lbs.).
12. Install rear crankshaft oil seal retainer and oil seal. (Refer to **CRANKSHAFT OIL SEAL - REAR** ).
13. Install oil pump assembly. (Refer to **OIL PUMP** )
14. Install dowel pin in crankshaft. (Refer to **CRANKSHAFT OIL SEAL - FRONT** )
15. Install crankshaft sprocket. Refer to **CRANKSHAFT OIL SEAL - FRONT** for procedure.
16. Install camshaft sprockets and timing belt. (Refer to **TIMING BELT AND SPROCKETS** )
17. Install timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** or **TIMING BELT COVER(S) - REAR** )
18. Install crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )
19. Install idler pulley for accessory drive belt.
20. Install oil pickup tube and tighten bolt to 28 N.m (250 in. lbs.).
21. Install oil pan. (Refer to **OIL PAN** )
22. Install engine assembly. (Refer to **ENGINE 3.5L** )
23. Fill engine crankcase with proper amount of oil.

## **CRANKSHAFT MAIN BEARINGS**

### **STANDARD PROCEDURE - CRANKSHAFT MAIN BEARING FITTING**

The main bearings are a "select fit" to achieve proper oil clearances. For main bearing selection, the block and crankshaft have grade identification marks.

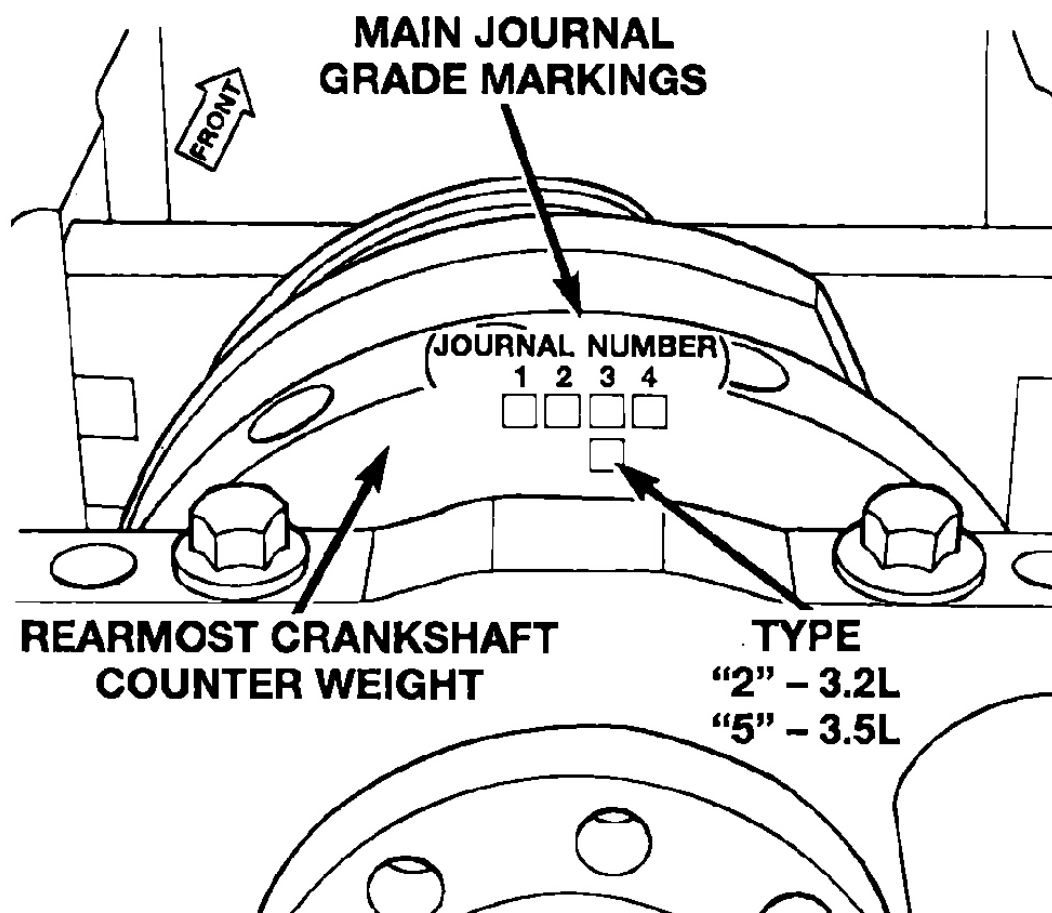
The marks for the cylinder block main bore grade are located on the left side pan rail, just rear of the left engine mount bracket (**Fig. 97** ). These grade marks (1, 2, or 3) are read left to right, corresponding to main bore 1, 2, 3, 4.



G03511950

**Fig. 97: Cylinder Block Main Bore Grade Marking Location**  
Courtesy of DAIMLERCHRYSLER CORP.

The grade marks for the crankshaft are located on the rearmost crankshaft counter weight as shown in (**Fig. 98**). The crankshaft journal grade marks (A, B, or C) are read left to right, corresponding with journal number 1, 2, 3, 4.



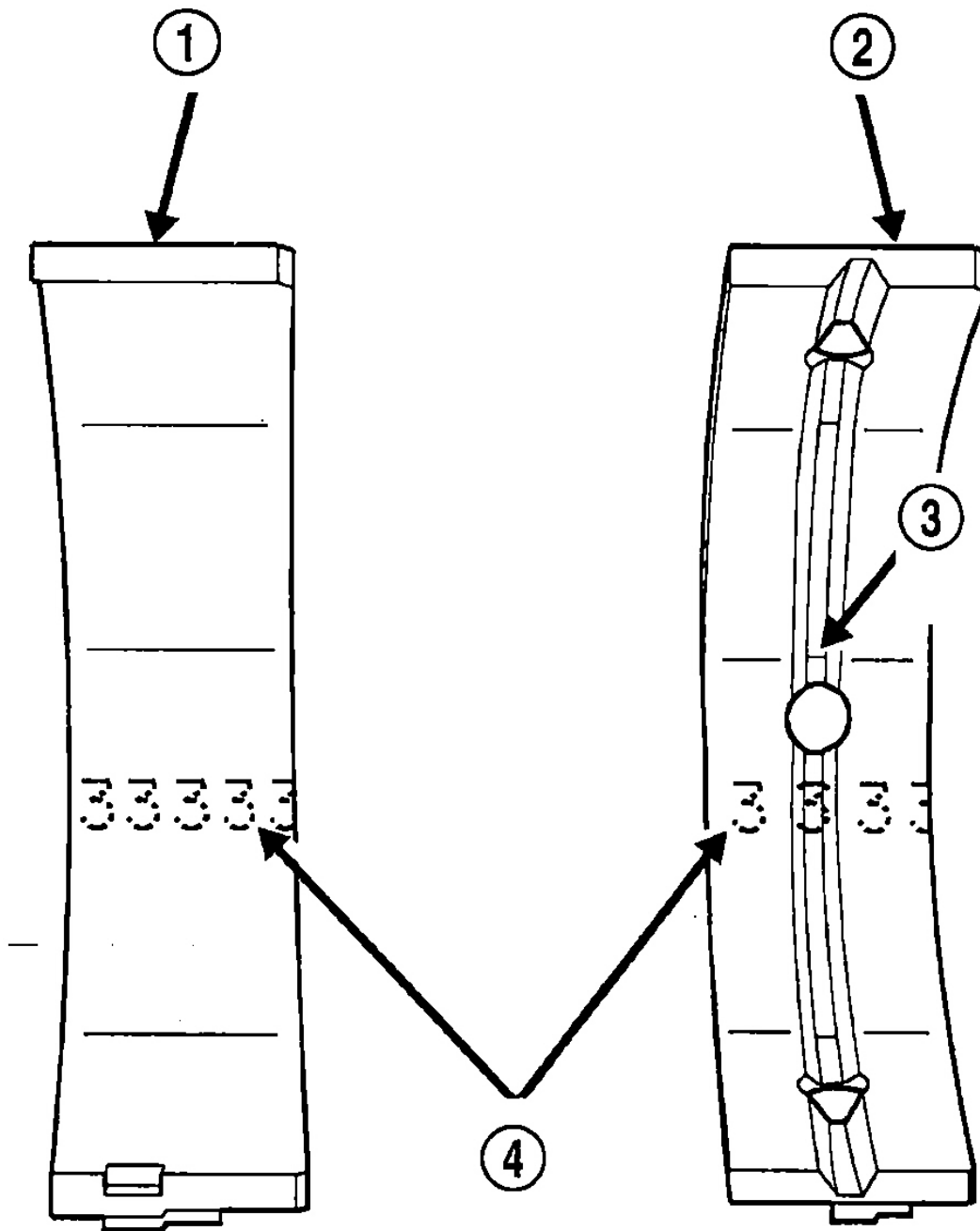
G03511951

**Fig. 98: Crankshaft Main Journal Grade Marking Location - Rear Of Block (Inverted) View**  
 Courtesy of DAIMLERCHRYSLER CORP.

Refer to the **MAIN BEARING SELECTION CHART-3.2/3.5L** to properly select the main bearings. For an example, if the main bore grade is 3 and the journal grade is B, the proper select fit bearing would be a (2) +0.003 mm (+0.0002 in.).

**NOTE:** Service main bearings have a number from (1-5) marked in ink on the bearing surface (Fig. 99). For verification, refer to the **MAIN BEARING SELECTION CHART-3.2/3.5L** for number to size identification.

The upper main bearing has a oil feed hole and a center groove to allow lubrication of the main journal and must be properly positioned in the block.



- 1 - LOWER MAIN BEARING
- 2 - UPPER MAIN BEARING
- 3 - OIL FEED HOLE AND GROOVE
- 4 - GRADE SELECTION INK MARKS

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**Fig. 99: Main Bearing Grade Marks**

Courtesy of DAIMLERCHRYSLER CORP.

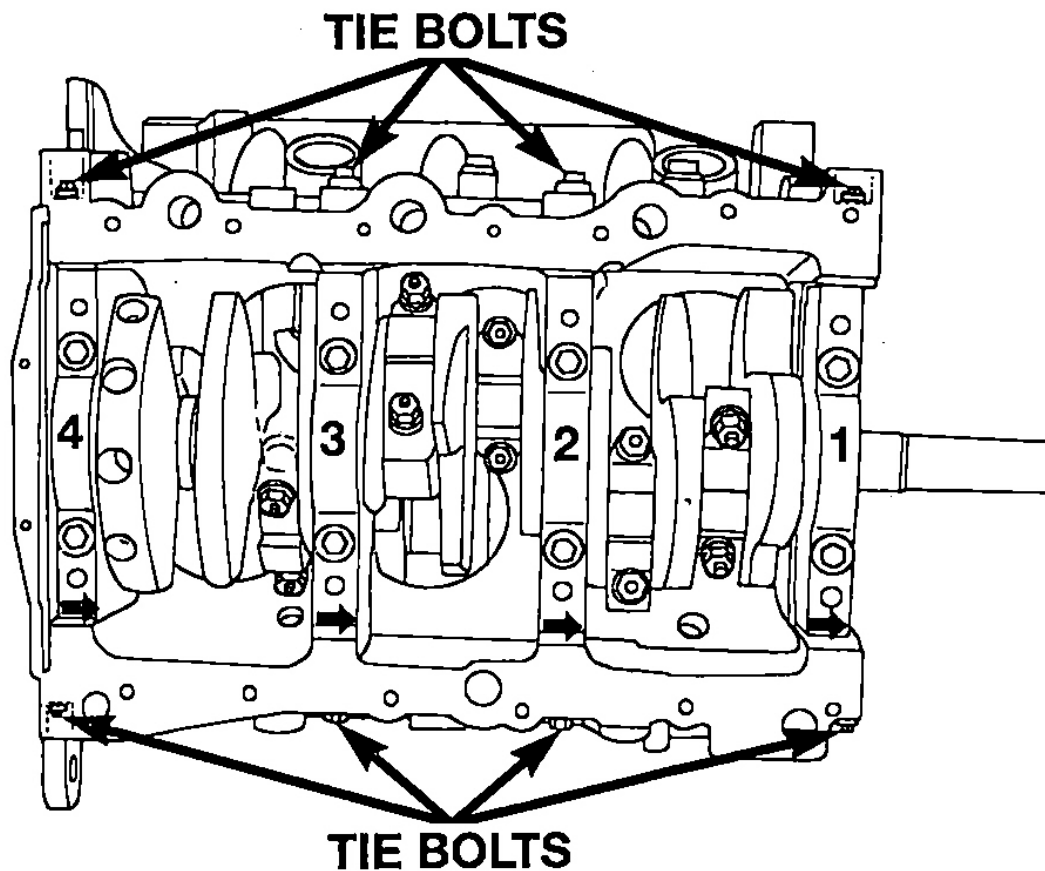
**MAIN BEARING SELECTION CHART-3.2/3.5L****MAIN BEARING SELECTION CHART-3.2/3.5L**

| Main Bearing Bore Grade Marks              |          |                             |                             |                             |
|--------------------------------------------|----------|-----------------------------|-----------------------------|-----------------------------|
| 1                                          |          |                             | 2                           | 3                           |
| <b>Crankshaft Main Journal Grade Marks</b> | <b>A</b> | (3) standard                | (2) +003 mm (+0.0002 in.)   | (1) +0.006 mm (+0.0003 in.) |
|                                            | <b>B</b> | (4) -0.003 mm (-0.0002 in.) | (3) standard                | (2) +003 mm (+0.0002 in.)   |
|                                            | <b>C</b> | (5) -0.006 mm (-0.0003 in.) | (4) -0.003 mm (-0.0002 in.) | (3) standard                |

**REMOVAL**

Bearing caps are not interchangeable and are marked to insure correct assembly (**Fig. 100**). Upper and lower bearing halves are NOT interchangeable.

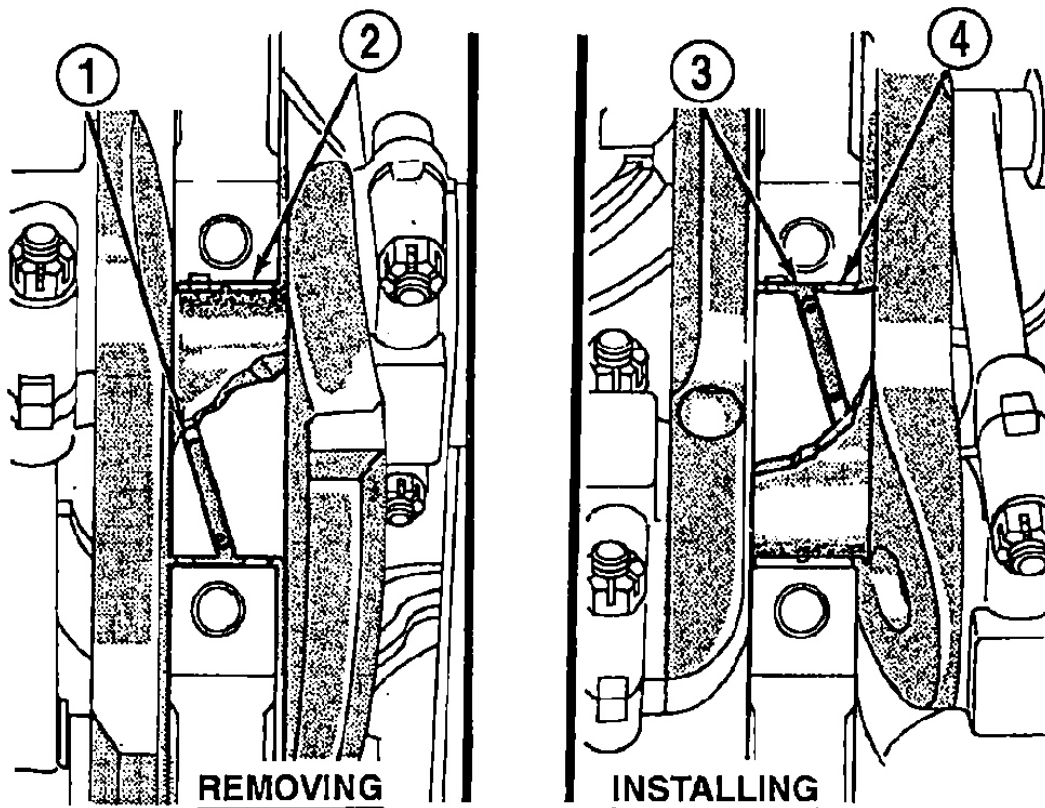
1. Remove oil pan. (Refer to **OIL PAN** )
2. Remove oil pick-up tube and windage tray.
3. Identify bearing caps before removal (**Fig. 100** ).



G03511953

**Fig. 100: Main Bearing Cap Identification**  
 Courtesy of DAIMLERCHRYSLER CORP.

4. Remove bearing caps one at a time. Remove upper half of bearing by inserting Special Main Bearing Tool C-3059 (**Fig. 101**) into the oil hole of crankshaft.



- 1 - SPECIAL TOOL C-3059
- 2 - BEARING
- 3 - SPECIAL TOOL C-3059
- 4 - BEARING

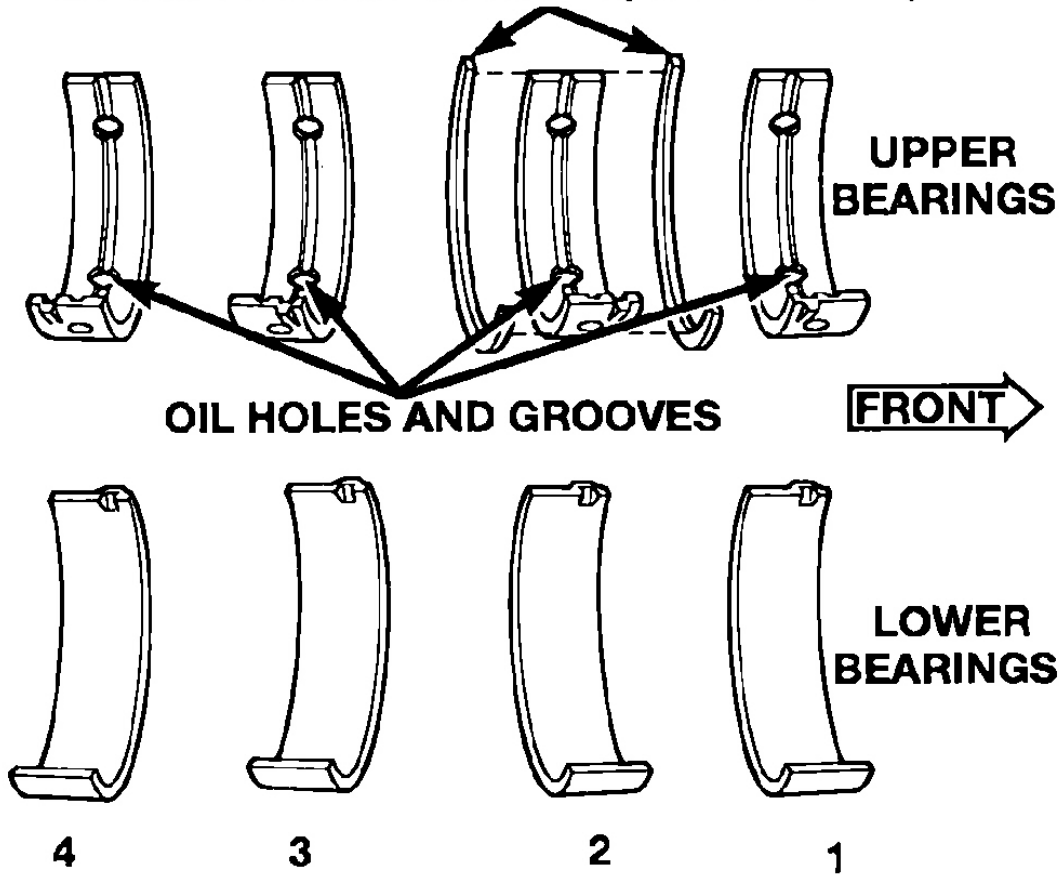
G03511954

**Fig. 101: Removing And Installing Upper Main Bearing With Special Tool C- 3059**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

## INSTALLATION

Bearing caps are not interchangeable and are marked to insure correct assembly. Upper and lower bearing halves are NOT interchangeable (**Fig. 102** ).

**2 PIECE THRUST WASHER (UPPER ONLY)**

G03511955

**Fig. 102: Main Bearing Cap Identification**  
 Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Main bearings are select fit. (Refer to REMOVAL )

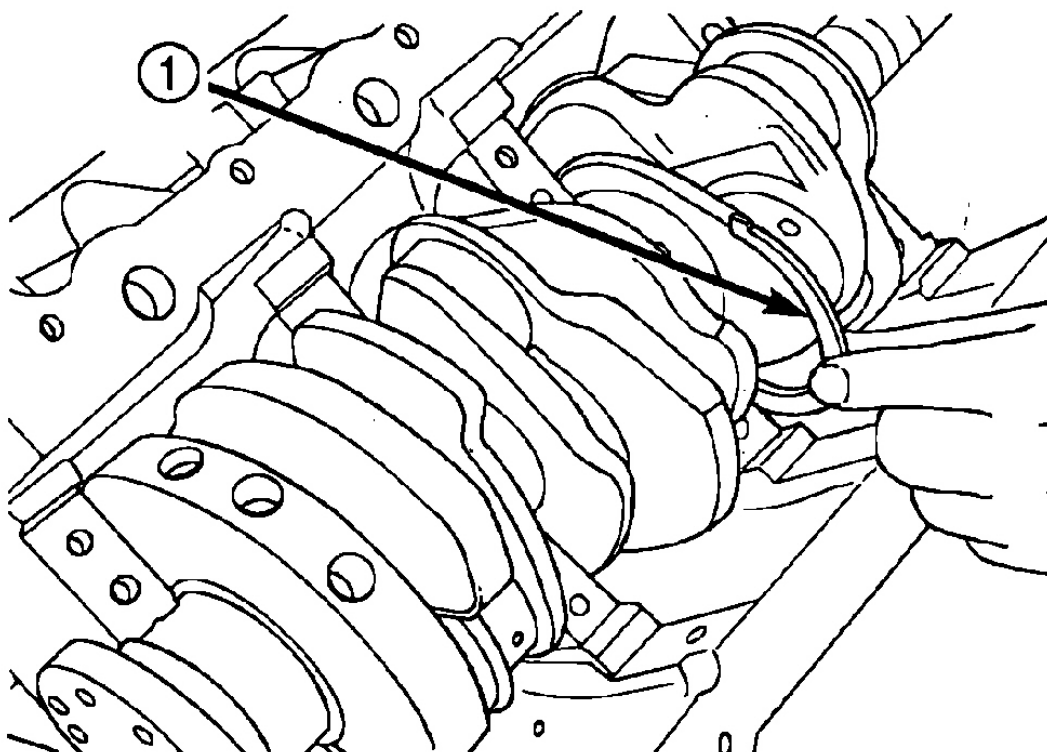
**NOTE:** Only one main bearing should be selectively fitted while all other main bearing caps are properly tightened.

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

1. Lubricate main bearing with clean engine oil.
2. Start bearing in place, and insert Main Bearing Tool C-3059 into oil hole of crankshaft (**Fig. 101** ).
3. Slowly rotate crankshaft counterclockwise sliding the bearing into position. Remove Special Main Bearing Tool C-3059.

**NOTE:** Lubricate main bearing cap bolts with engine oil before installation.

4. Lubricate and install lower bearing half and main cap Tighten bolts finger tight.
5. For installing thrust washers at the No. 2 main bearing location, use the following procedure:
  - a. Move crankshaft forward to limit of travel. Lubricate and install the front thrust washer by rolling the washer onto the machined shelf between the No. 2 upper main bulk head and crankshaft thrust surface (**Fig. 103** ).



**1 - FRONT THRUST WASHER**

G03511956

**Fig. 103: Thrust Washer Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

- b. Move crankshaft rearward to limit of travel. Lubricate and install the rear thrust washer by rolling the washer onto the machined shelf between the No. 2 upper main bulk head and crankshaft thrust surface.

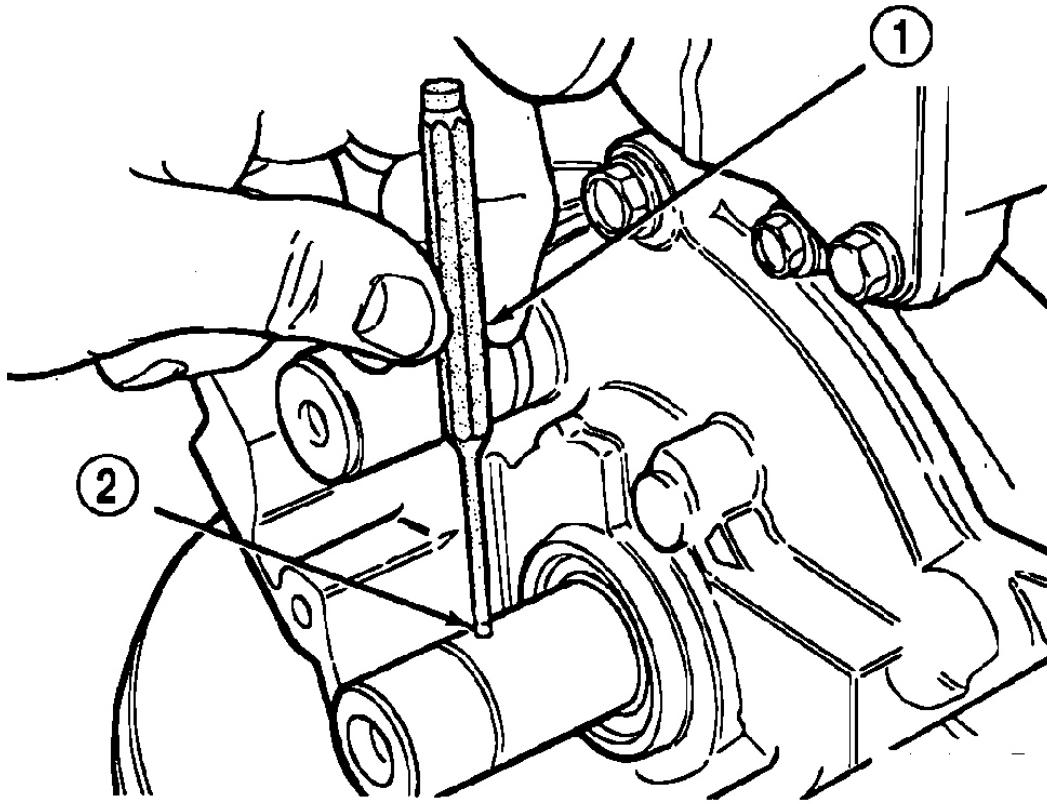
The main bearing cap bolts must be tightened in the proper sequence. First the inner main cap bolts, secondly the windage tray bolts, lastly the main cap tie (horizontal) bolts.

6. Install each main bearing cap and tighten inner bolts finger tight.
7. Tighten inner main bearing cap bolts to 20 N.m + 1/4 turn (15 ft. lbs. + 1/4 turn).
8. Measure crankshaft end play. (Refer to **STANDARD PROCEDURE - CRANKSHAFT END PLAY** )
9. Install windage tray. Lubricate bolts with engine oil and tighten to 27 N.m + 1/4 turn (20 ft. lbs. + 1/4 turn).
10. Install the main cap tie (horizontal) bolts and tighten to 28 N.m (250 in. lbs.).
11. Install oil pick-up tube.
12. Install oil pan. (Refer to **OIL PAN** )
13. Fill engine crankcase with proper oil to correct level.

## **CRANKSHAFT OIL SEAL - FRONT**

### **REMOVAL**

1. Remove the crankshaft sprocket. (Refer to **TIMING BELT AND SPROCKETS** )
2. Tap the dowel pin out of the crankshaft (**Fig. 104** ).

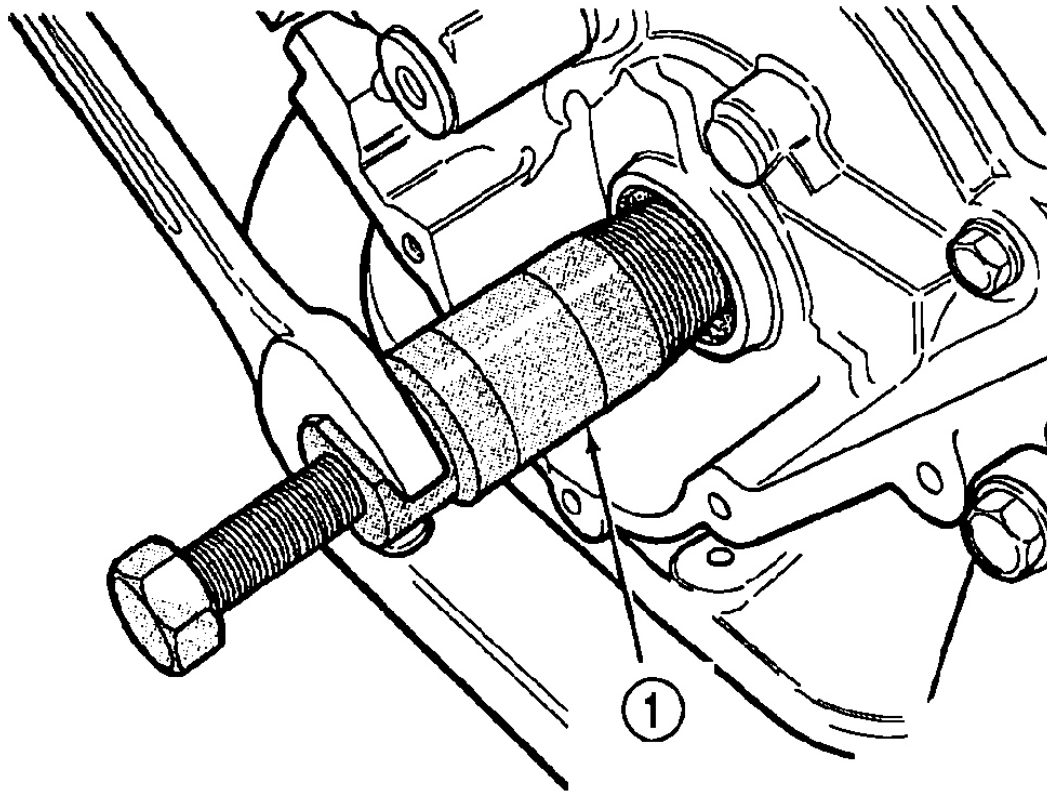


1 - PIN PUNCH  
2 - DOWEL

G03511957

**Fig. 104: Crankshaft Dowel Pin - Removal/Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Remove crankshaft seal using Special Tool 6341A (**Fig. 105**).



1 - SPECIAL TOOL 6341A

G03511958

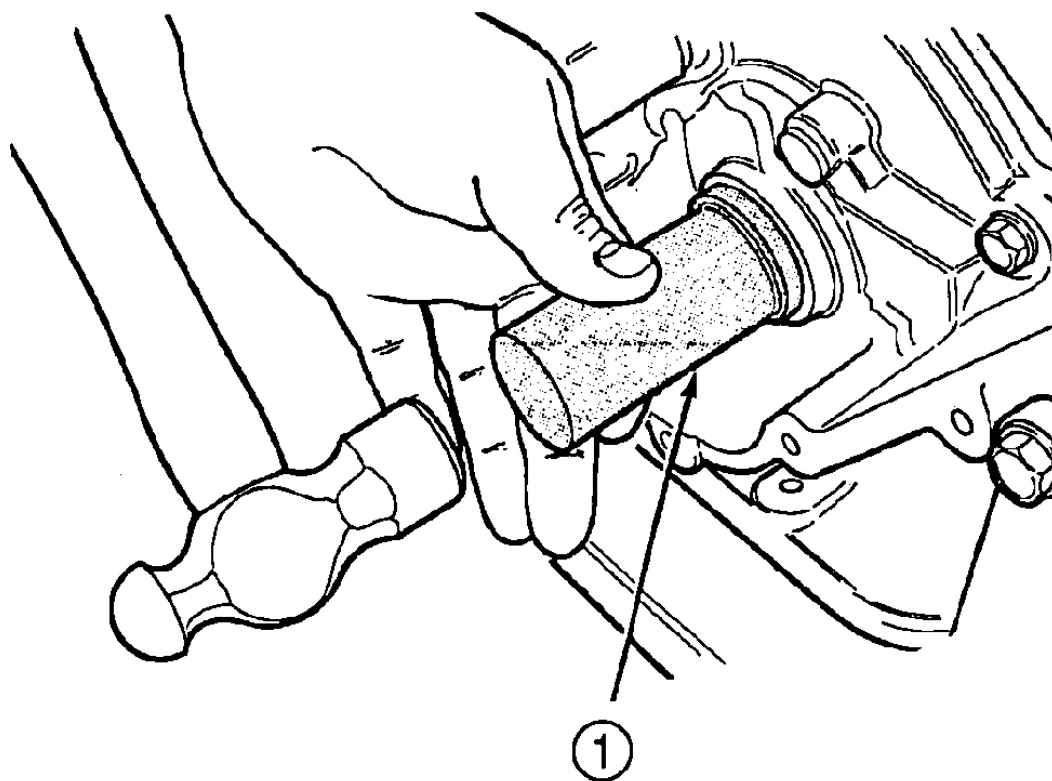
**Fig. 105: Removing Crankshaft Oil Seal With Special Tool**  
Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Do not nick shaft seal surface or seal bore.

4. Shaft seal lip surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

## INSTALLATION

1. Install crankshaft seal using Special Tool 6342 (**Fig. 106** ).



1 - SPECIAL TOOL 6342

G03511959

**Fig. 106: Installing Crankshaft Oil Seal With Special Tool**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Install the dowel pin into the crankshaft to 1.2 mm (0.047 in.) protrusion (**Fig. 104**).
3. Install the crankshaft sprocket. (Refer to **TIMING BELT AND SPROCKETS** )

## CRANKSHAFT OIL SEAL - REAR

### REMOVAL

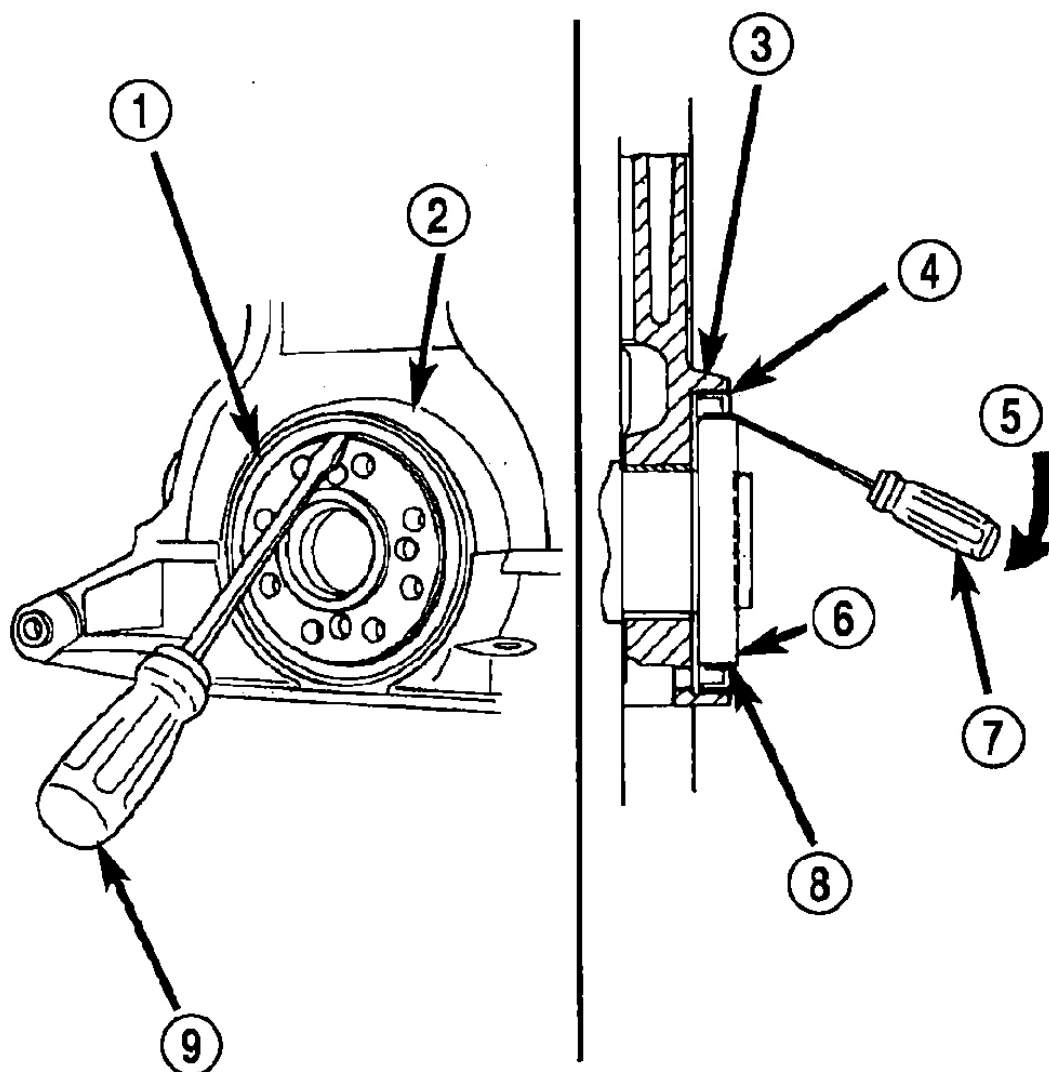
1. Remove transaxle from vehicle. (Refer to **OVERHAUL - 42LE** )
2. Remove drive plate.
3. Insert a 3/16" wide flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (**Fig. 107** ) through the dust lip against the metal case of the seal. Pry out seal.

**CAUTION: Do not allow the screwdriver blade to contact the crankshaft seal**

## 2004 Chrysler 300M

2004 ENGINE Engine 3.5L - 300M, Concorde & Intrepid

**surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.**



- 1 - REAR CRANKSHAFT SEAL
- 2 - ENGINE BLOCK
- 3 - ENGINE BLOCK
- 4 - REAR CRANKSHAFT SEAL METAL CASE
- 5 - PRY IN THIS DIRECTION
- 6 - CRANKSHAFT
- 7 - SCREWDRIVER
- 8 - REAR CRANKSHAFT SEAL DUST LIP
- 9 - SCREWDRIVER

G03511960

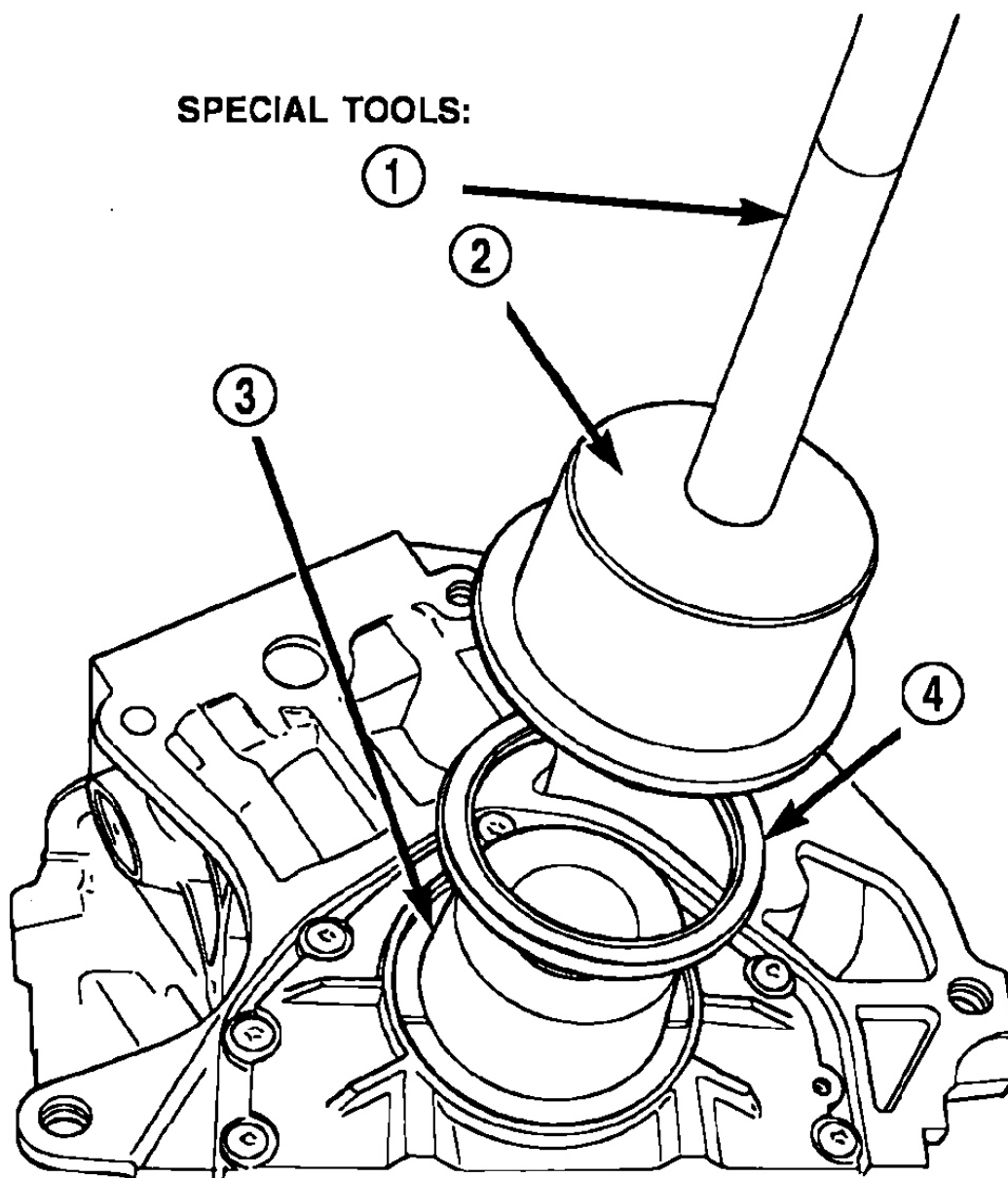
**Fig. 107: Rear Crankshaft Oil Seal Removal - Typical**

Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

**CAUTION:** If a burr or scratch is present on the crankshaft edge (chamfer), clean surface using 400 grit sand paper to prevent seal damage during installation.

1. Place Special Tool 6926-1 Guide on crankshaft (**Fig. 108** ). This is a pilot tool with a magnetic base.



- 1 - C-4171 HANDLE
- 2 - 6926-2 INSTALLER
- 3 - 6926-1 GUIDE
- 4 - SEAL

G03511961

**Fig. 108: Crankshaft Rear Seal - Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

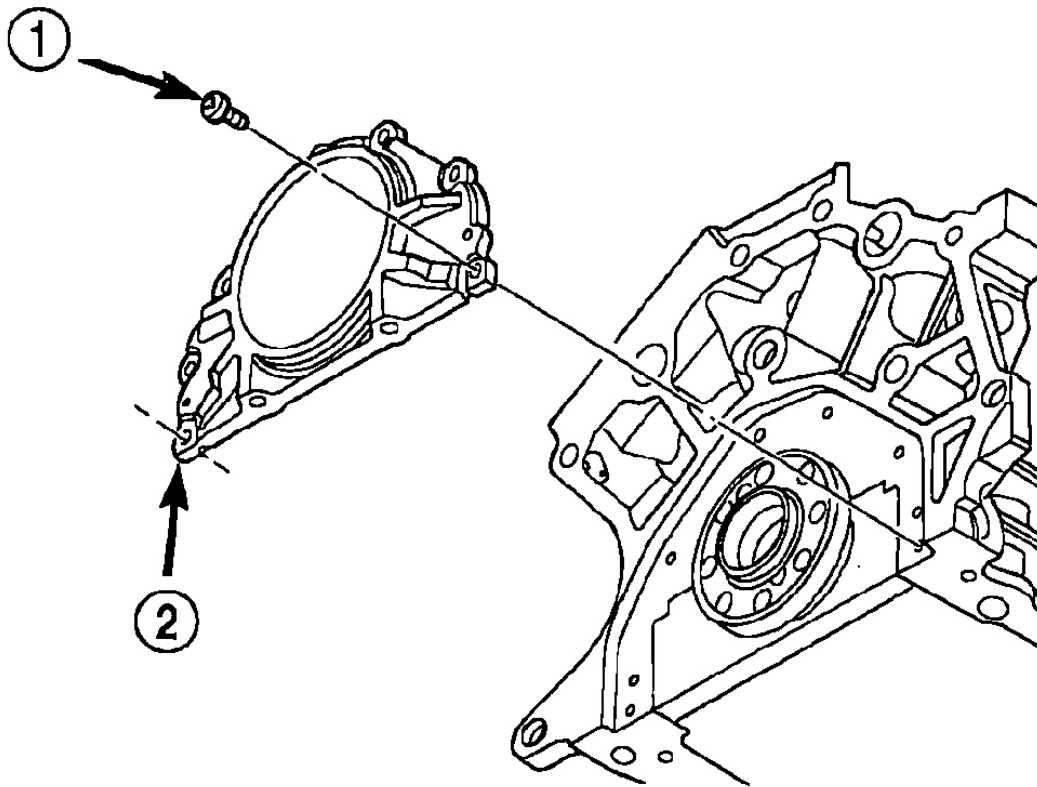
2. Position seal over pilot tool. Assure that lip of seal is facing towards the crankshaft during installation. The pilot tool remains on crankshaft during seal installation.
3. Using Special Tool 6926-2 Installer, and C-4171 Handle (**Fig. 108** ), drive seal into the retainer housing until seal is flush with housing surface.
4. Install drive plate and transaxle. (Refer to **OVERHAUL - 42LE** )

## **CRANKSHAFT REAR OIL SEAL RETAINER**

### **REMOVAL**

1. Remove crankshaft rear oil seal. (Refer to **CRANKSHAFT OIL SEAL - REAR** )
2. Remove oil pan. (Refer to **OIL PAN** )
3. Remove seal retainer attaching screws.
4. Remove seal retainer (**Fig. 109** ).

**NOTE:**        **Seal retainer gasket is bonded to the retainer and must be replaced as an assembly.**



- 1 - SCREWS (7)  
2 - SEAL RETAINER

G03511962

**Fig. 109: Oil Seal Retainer**

Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

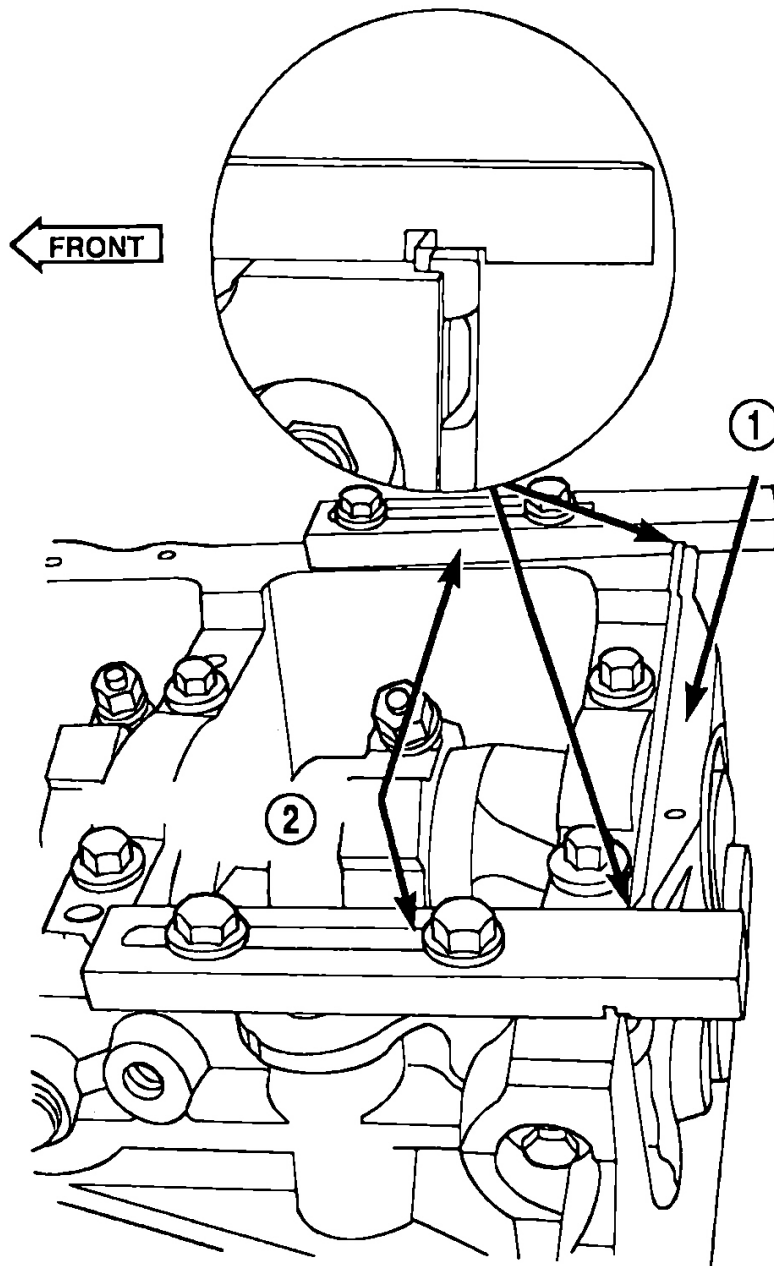
1. Clean all sealing surfaces. Replace retainer assembly if gasket is torn or damaged.
2. Install seal retainer to block, but do not tighten attaching screws at this time.

**NOTE:** The following steps must be performed to prevent oil leaks at sealing joints.

3. Attach Special Tools 8225 to pan rail using the oil pan fasteners (**Fig. 110**).

**NOTE:** Make sure the marking "3.2/3.5L" on Special Tools 8225, is facing towards the cylinder block pan rail surface (notch on tool is towards the seal)

retainer).



- 1 - SEAL RETAINER
- 2 - SPECIAL TOOLS 8225

G03511963

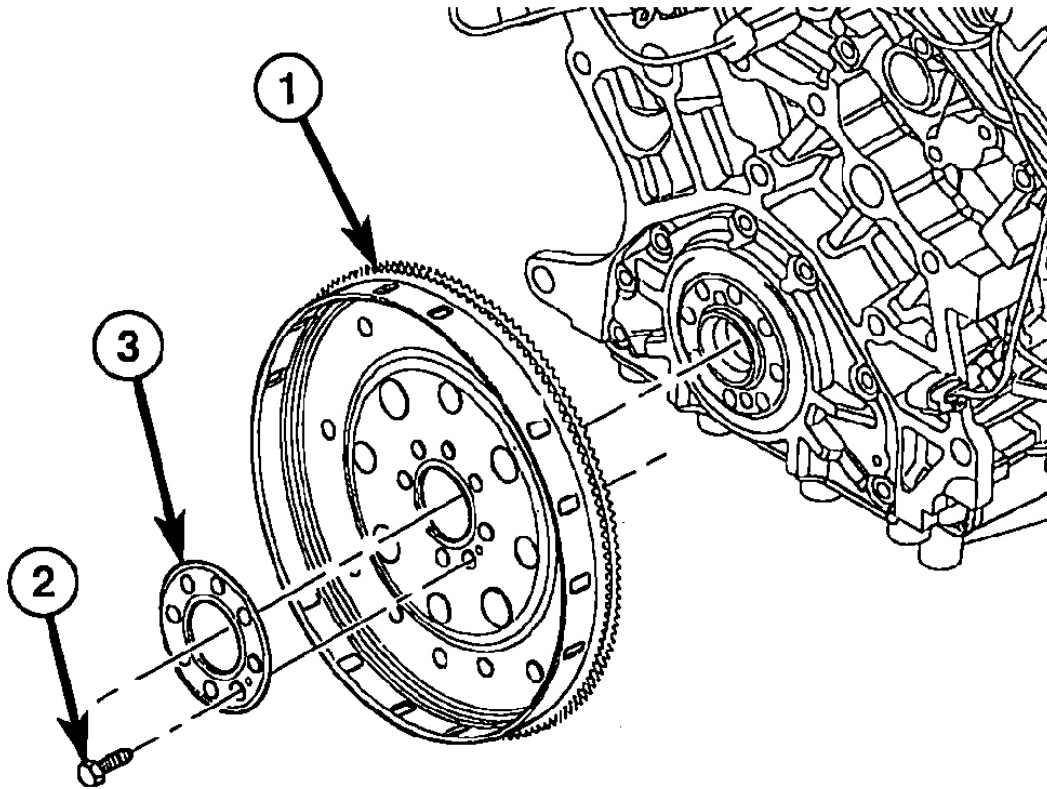
**Fig. 110: Rear Crankshaft Seal Retainer Alignment**  
Courtesy of DAIMLERCHRYSLER CORP.

4. While applying firm pressure to the seal retainer against Special Tools 8225 (**Fig. 110** ), tighten seal retainer screws to 12 N.m (105 in. lbs.).
5. Install crankshaft rear oil seal. (Refer to **CRANKSHAFT OIL SEAL - REAR** )
6. Install oil pan. (Refer to **OIL PAN** )

## FLEX PLATE

### REMOVAL

1. Remove the transaxle. (Refer to **OVERHAUL - 42LE** )
2. Remove flex plate attaching bolts.
3. Remove the flex plate (**Fig. 111** ).



- 1 - FLEX PLATE  
2 - BOLT (QTY. 8)  
3 - BACKING PLATE

G03511964

**Fig. 111: Flex Plate**

Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. Position flex plate with backing plate on the crankshaft (**Fig. 111** ).
2. Apply Mopar(R) Lock & Seal Adhesive to the flex plate bolts.
3. Install flex plate bolts (**Fig. 111** ). Tighten bolts to 95 N.m (70 ft. lbs.).
4. Install the transaxle. (Refer to **OVERHAUL - 42LE** )

## PISTON & CONNECTING ROD

### DESCRIPTION

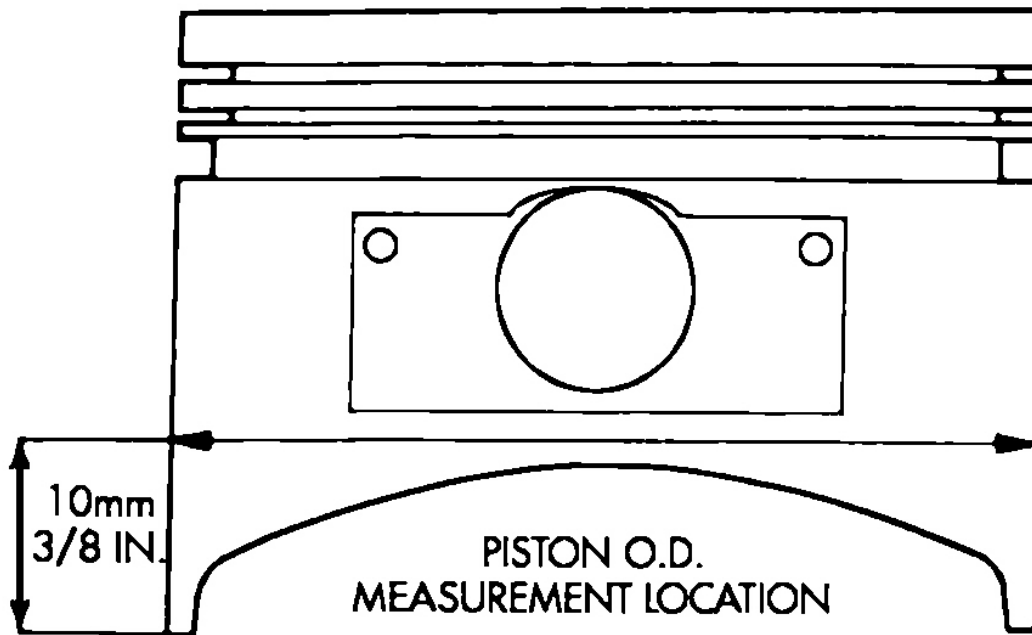
**NOTE:** Valve reliefs were removed from the pistons for the 2003MY. It is possible when ordering a service piston/rod assembly that valve reliefs are present. These may be used in the engine, and will not affect engine operation.

The pistons are made of a high strength aluminum alloy. Top land height has been decreased to reduce emissions. Piston skirts are coated with a solid lubricant for scuff resistance. Connecting rod is forged steel with a squirt hole and attaches to the piston with a full floating pin retained by lock rings.

### STANDARD PROCEDURE - FITTING PISTONS

The pistons are machined to two different weight specifications and matched to rods based on weight. All piston and rod assemblies weigh the same to maintain engine balance.

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin at size location shown in (**Fig. 112** ). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line (Refer to **SPECIFICATIONS** ). **Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).**



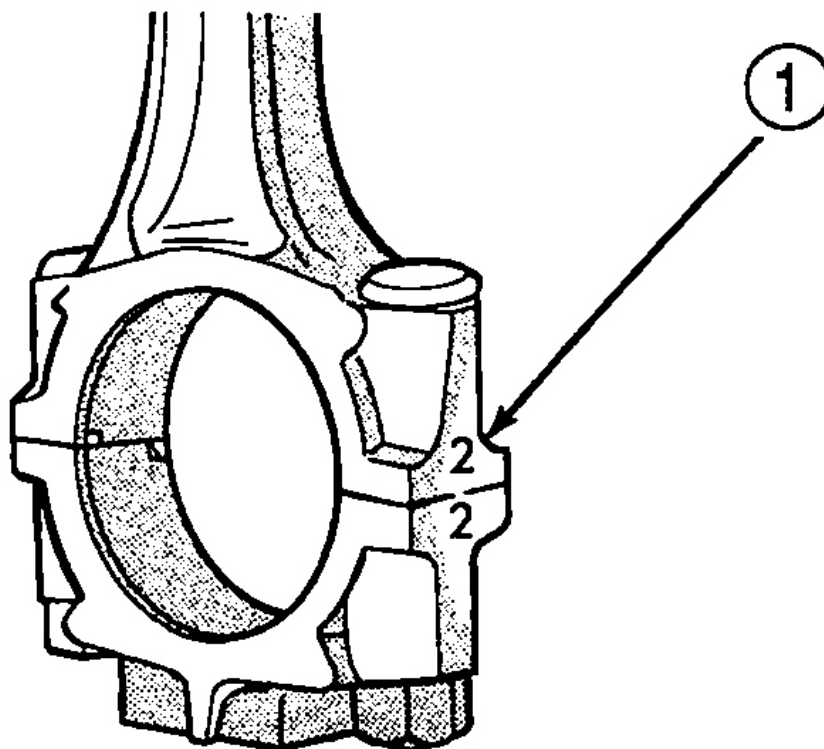
G03511965

**Fig. 112: Piston Measurements**

Courtesy of DAIMLERCHRYSLER CORP.

**REMOVAL**

1. Remove the cylinder heads (Refer to **CYLINDER HEAD** )
2. Remove the oil pan. (Refer to **OIL PAN** )
3. Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation. Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so that each connecting rod is centered in cylinder bore.**
4. Inspect connecting rods and connecting rod caps for cylinder identification. Identify them if necessary (**Fig. 113** ).



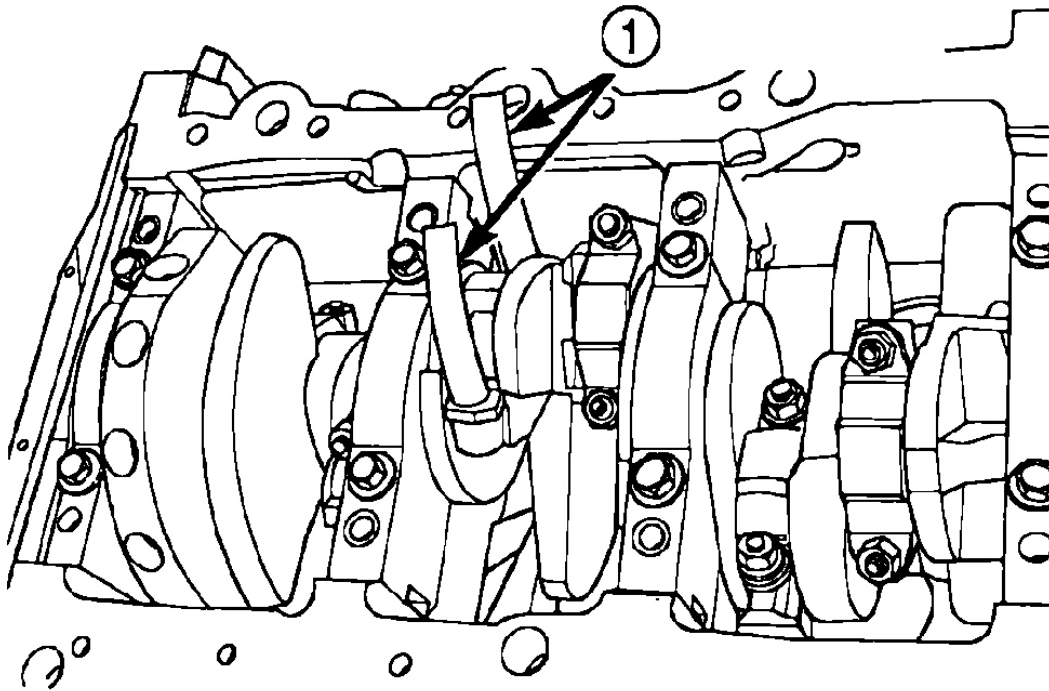
## 1 - CYLINDER NUMBER

G03511966

**Fig. 113: Connecting Rod To Cylinder Identification**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Remove connecting rod cap. Install protectors on connecting rod bolts (**Fig. 114** ). Push each piston and rod assembly out of cylinder bore.

**NOTE:** Be careful not to nick crankshaft journals.



1 - COVER ROD BOLTS WITH A SUITABLE COVERING WHEN REMOVING OR INSTALLING PISTON ASSEMBLY

G03511967

**Fig. 114: Connecting Rod Guides And Crankshaft Protectors**  
Courtesy of DAIMLERCHRYSLER CORP.

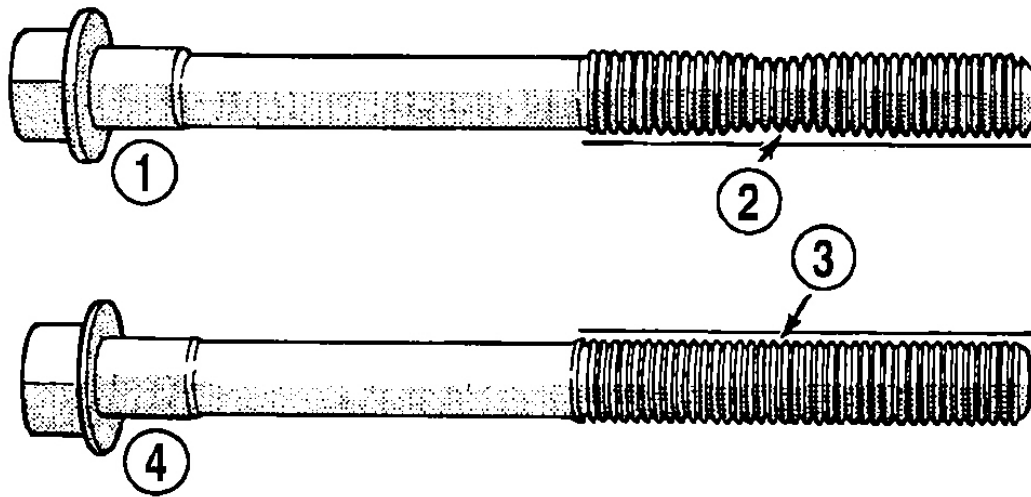
6. After removal, install bearing cap on the mating rod.

## INSTALLATION

1. Install the piston rings. (Refer to **PISTON RINGS** )

**NOTE:**      The connecting rod bearing cap bolts must be examined before reuse. If the threads are necked down, the bolts must be replaced.

2. Check connecting rod bolts for necking by holding a scale or straight edge against the threads. If all threads do not contact the scale, the bolt must be replaced (**Fig. 115** ).

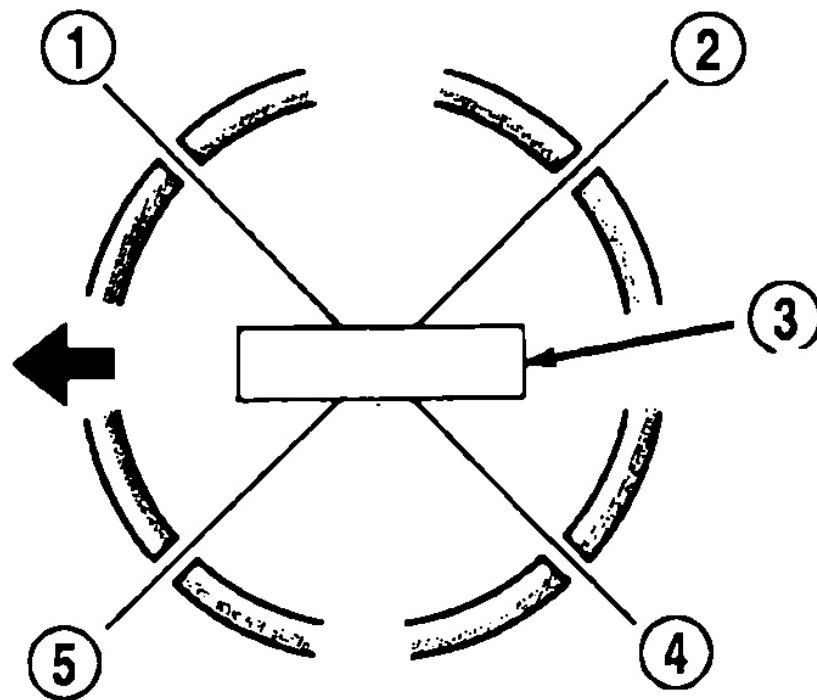


- 1 - STRETCHED BOLT
- 2 - THREADS ARE NOT STRAIGHT ON LINE
- 3 - THREADS ARE STRAIGHT ON LINE
- 4 - UNSTRETCHED BOLT

G03511968

**Fig. 115: Check For Stretched Bolts**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Before installing pistons and connecting rod assemblies into the bore, ensure that compression ring gaps are staggered so that neither is in line with oil ring rail gap (**Fig. 116** ).

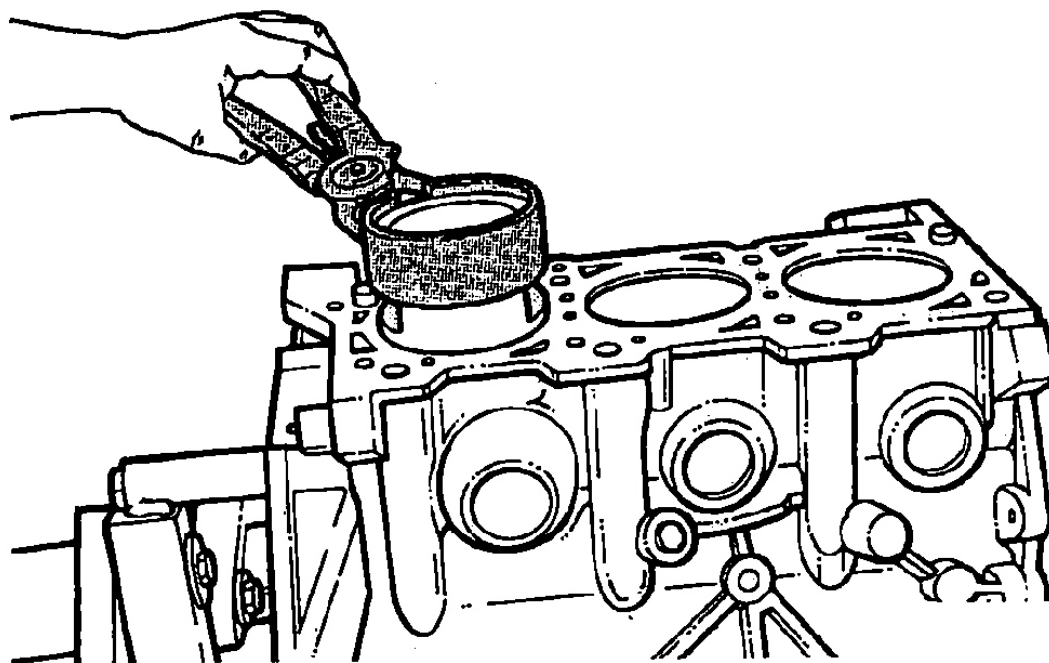


- 1 - SIDE RAIL UPPER
- 2 - NO. 1 RING GAP
- 3 - PISTON PIN
- 4 - SIDE RAIL LOWER
- 5 - NO. 2 RING GAP AND SPACER EXPANDER GAP

G03511969

**Fig. 116: Piston Ring End Gap Position**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Immerse the piston head and rings in clean engine oil, slide the ring compressor over the piston and tighten with the special wrench (**Fig. 117**). **Ensure position of rings does not change during this operation.**



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**Fig. 117: Piston - Installation**

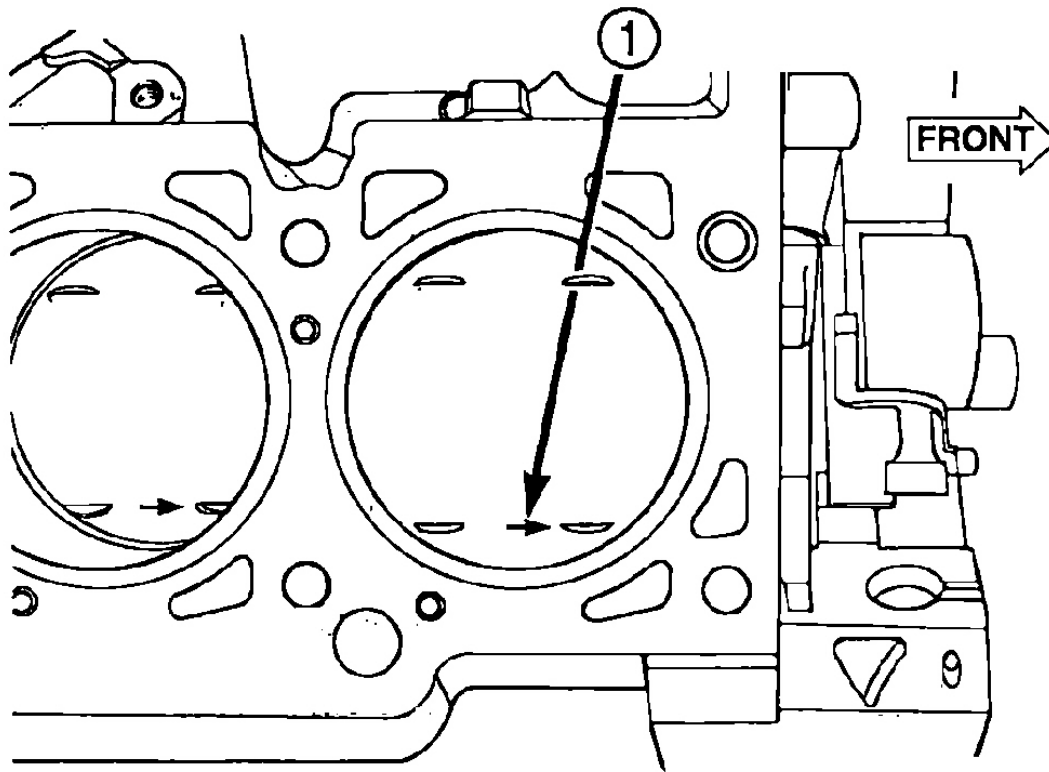
Courtesy of DAIMLERCHRYSLER CORP.

5. Install connecting rod bolt protectors on rod bolts (**Fig. 114**).
6. Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

**CAUTION: Do Not interchange piston assemblies cylinder-to-cylinder or bank-to-bank.**

**NOTE:** Valve reliefs were removed from the pistons for the 2003MY. It is possible when ordering a service piston/rod assembly that valve reliefs are present. These may be used in the engine, and will not affect engine operation.

7. The arrow on top of piston must be pointing toward front of engine (**Fig. 118**) and oil squirt hole on connecting rod faces the major thrust (right) side of the cylinder bore (**Fig. 119**).

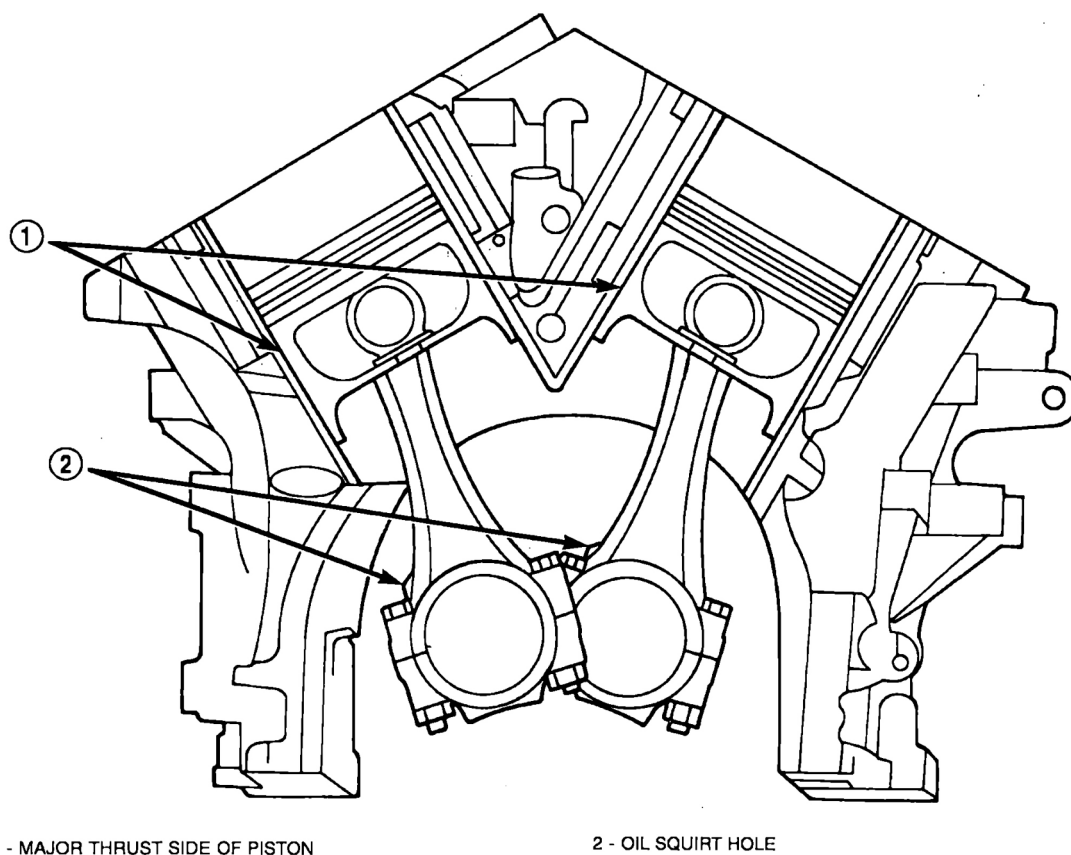


1 - ARROW FACES FRONT OF ENGINE

G03511971

**Fig. 118: Piston Orientation**

Courtesy of DAIMLERCHRYSLER CORP.



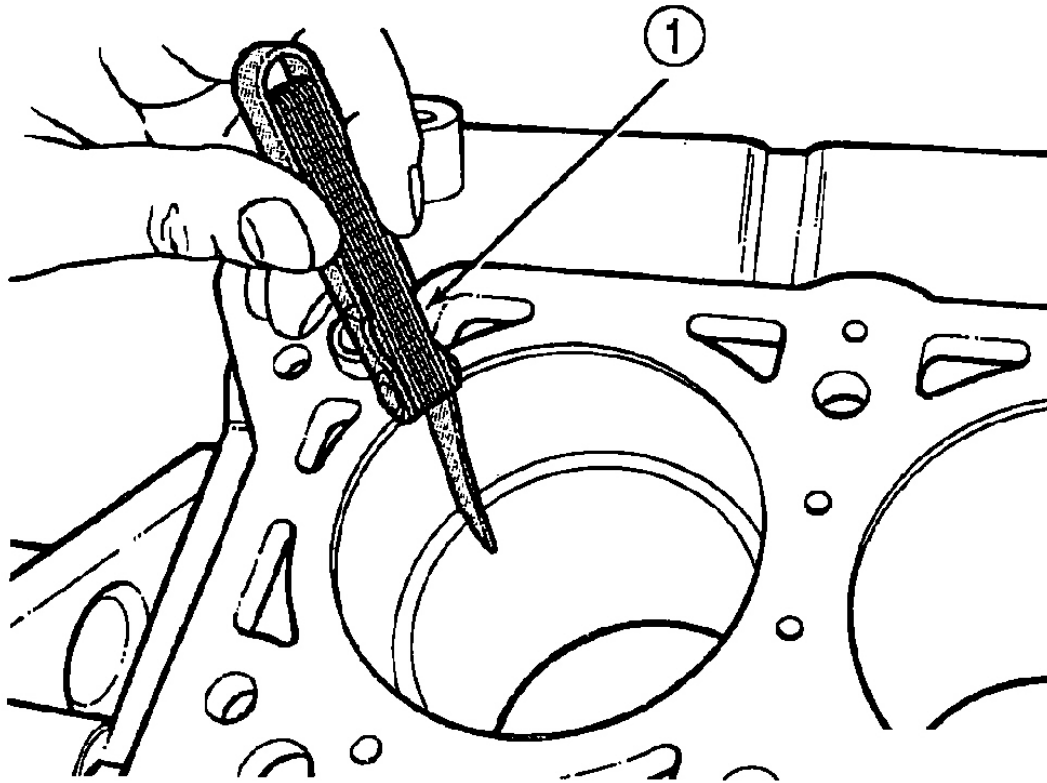
**Fig. 119: Piston And Connecting Rod Positioning (Front View Of Engine)**  
Courtesy of DAIMLERCHRYSLER CORP.

8. Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.
9. Install rod caps. Install nuts on cleaned and oiled rod bolts and tighten nuts to 54 N.m (40 ft. lbs.) Plus 1/4 turn.
10. Install the cylinder head(s) (Refer to **CYLINDER HEAD** )
11. Install the oil pan. (Refer to **OIL PAN** )

## PISTON RINGS

### STANDARD PROCEDURE - PISTON RING FITTING

1. Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore. Check gap with feeler gauge (**Fig. 120** ). For clearance specifications, (Refer to **3.5L ENGINE** ).

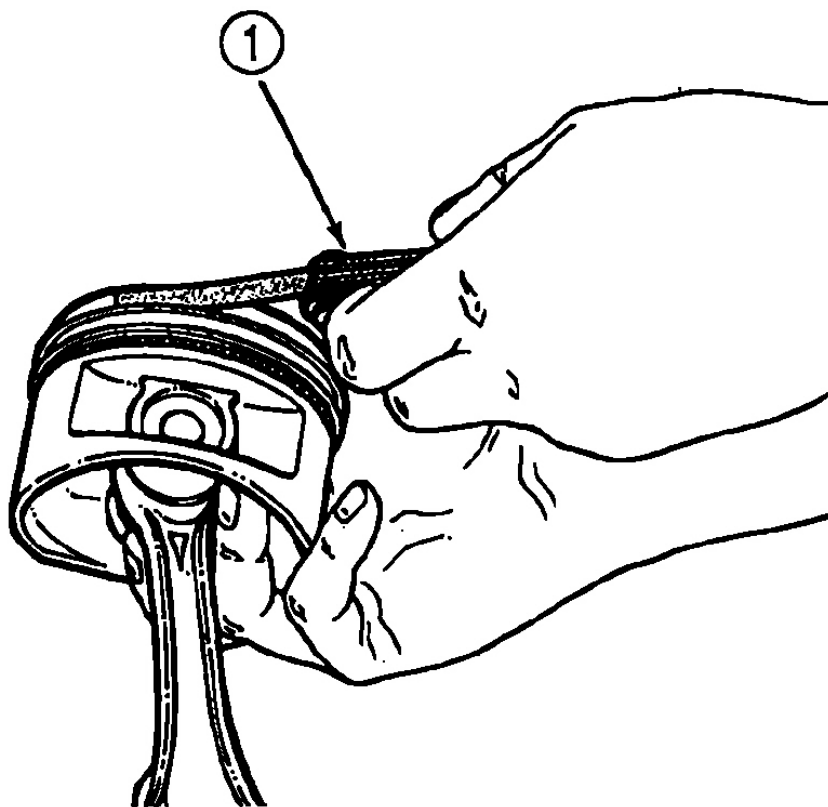


1 - FEELER GAUGE

G03511973

**Fig. 120: Check Gap On Piston Rings**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Check piston ring to groove clearance: (**Fig. 121** ). For clearance specifications, (Refer to **3.5L ENGINE** ).



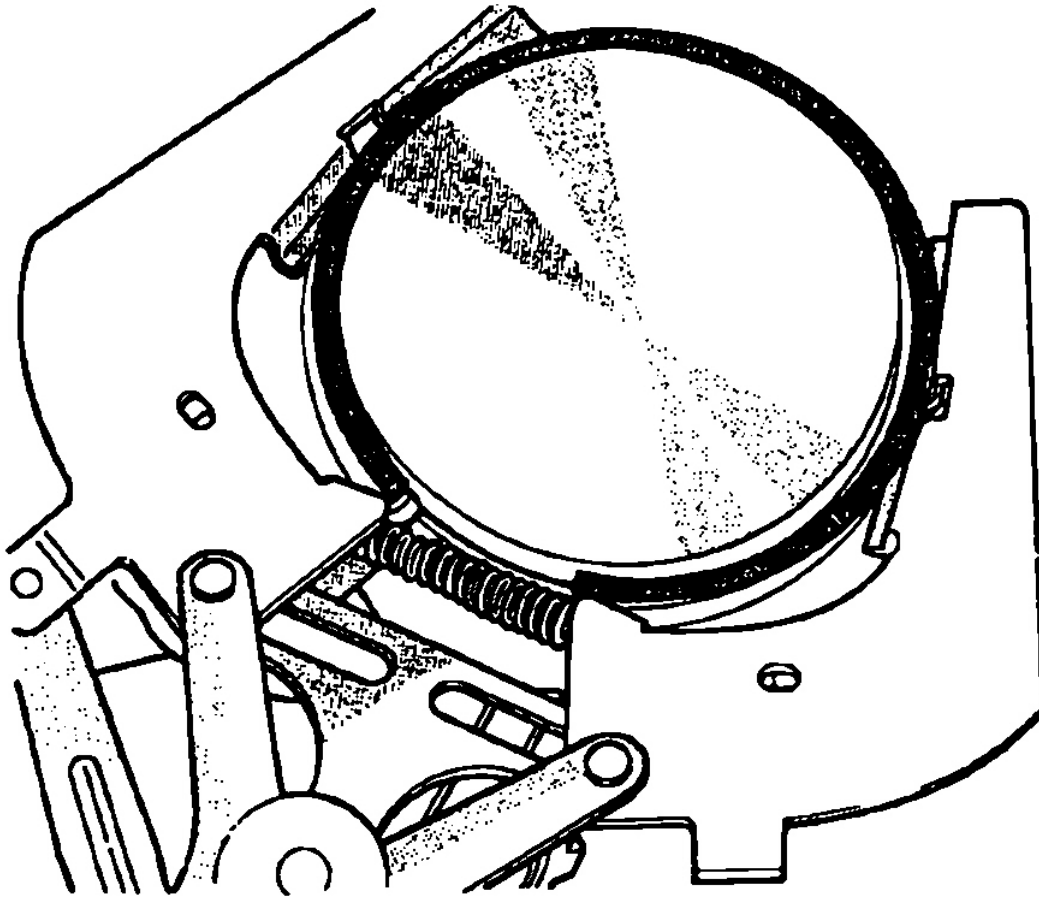
**1 - FEELER GAUGE**

G03511974

**Fig. 121: Measuring Piston Ring Side Clearance**  
Courtesy of DAIMLERCHRYSLER CORP.

**REMOVAL**

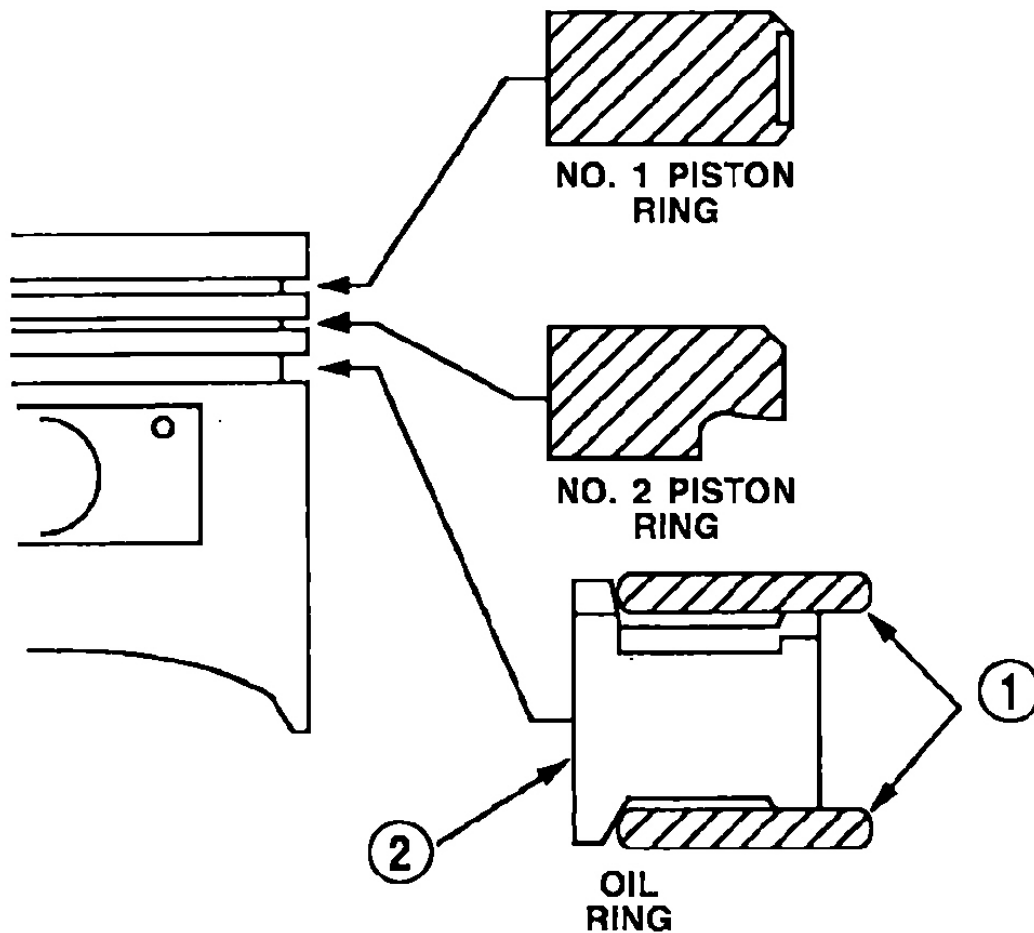
1. Remove piston and connecting rod. (Refer to **PISTON & CONNECTING ROD** )
2. Remove No. 1 and No.2 piston rings from piston using a ring expander tool (**Fig. 122** ).



G03511977

**Fig. 122: Upper And Intermediate Rings**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Remove upper oil ring side rail (**Fig. 123** ).



1 - SIDE RAIL  
2 - SPACER EXPANDER  
G03511975

**Fig. 123: Piston Ring - Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Remove lower oil ring side rail (**Fig. 123**).
5. Remove oil ring expander (**Fig. 123**).

## INSTALLATION

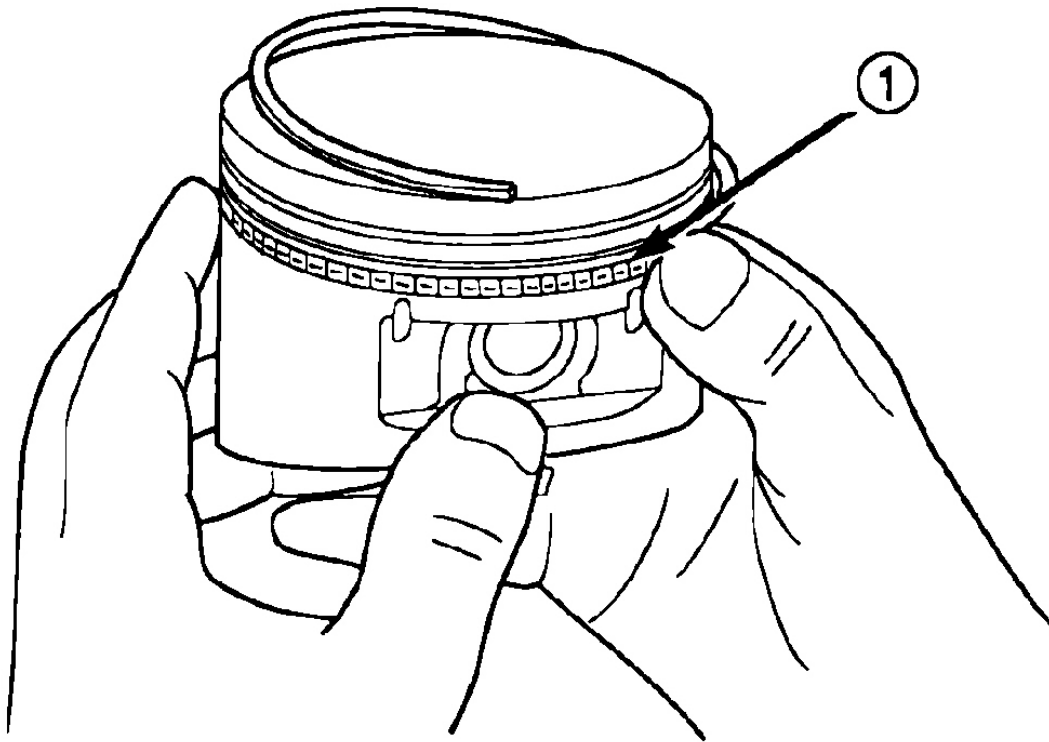
1. Measure clearance of piston rings to the cylinder bore and piston. (Refer to **STANDARD PROCEDURE - PISTON RING FITTING** )

The No. 1 and No. 2 piston rings have a different cross section. Insure that the No. 2 ring is installed with

manufacturers I.D. mark (dot) facing up, towards top of the piston (**Fig. 123** ).

**CAUTION: Install piston rings in the following order:**

- Oil ring expander.
  - Upper oil ring side rail.
  - Lower oil ring side rail.
  - No. 2 Intermediate piston ring.
  - No. 1 Upper piston ring.
2. Install oil ring expander.
  3. Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander during this step (Fig. 124 ).**



**1 - SIDE RAIL END**

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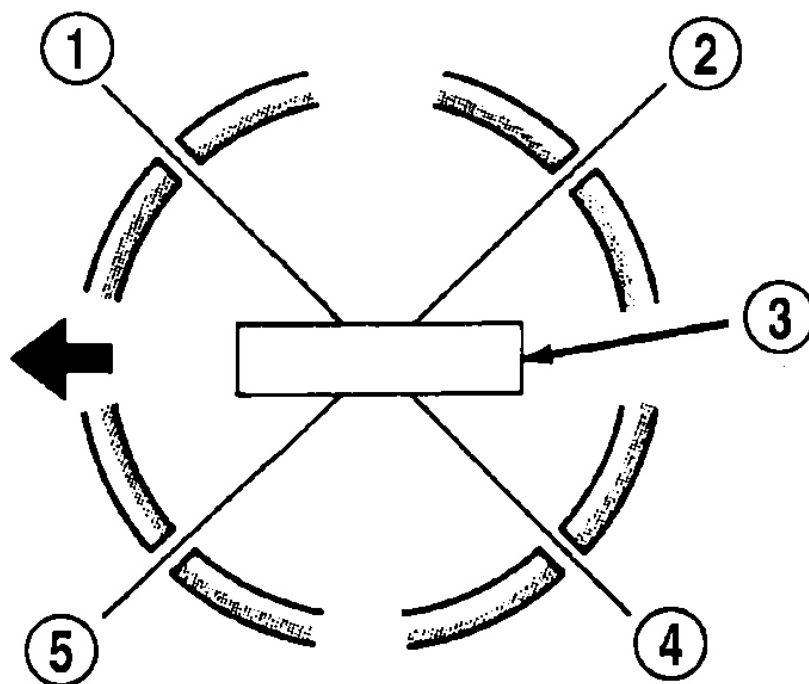
**Fig. 124: Side Rail - Installation**

Courtesy of DAIMLERCHRYSLER CORP.

4. Install upper side rail first and then the lower side rail.

The No. 1 and No. 2 piston rings have a different cross section. Insure that the No. 2 ring is installed with manufacturers I.D. mark (dot) facing up, towards top of the piston (**Fig. 123** ).

5. Install No. 2 piston ring and then No. 1 piston ring (**Fig. 122** ).
6. Position piston ring end gaps as shown in (**Fig. 125** ).



1 - SIDE RAIL UPPER

2 - NO. 1 RING GAP

3 - PISTON PIN

4 - SIDE RAIL LOWER

5 - NO. 2 RING GAP AND SPACER EXPANDER GAP

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**Fig. 125: Piston Ring End Gap Position**

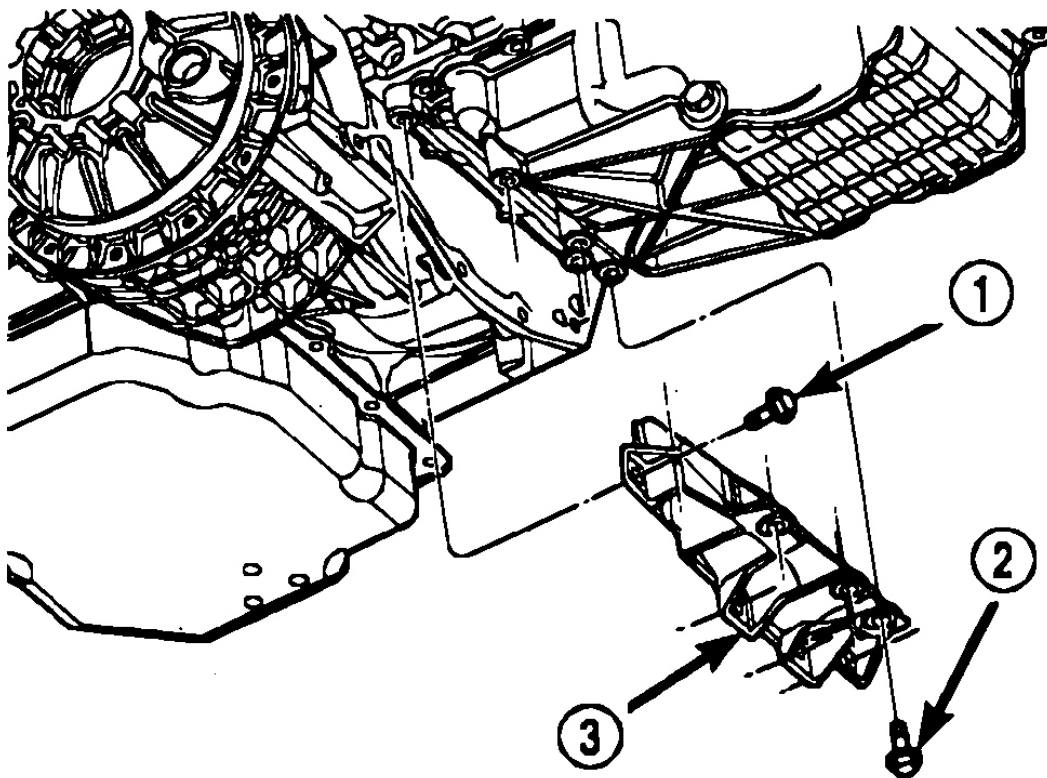
Courtesy of DAIMLERCHRYSLER CORP.

7. Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction. Staggering ring gap is important for oil control.

## STRUCTURAL COLLAR / COVER

### REMOVAL

1. Raise vehicle on hoist.
2. Remove bolts attaching structural collar to oil pan and transmission housing (**Fig. 126**).



- 1 - BOLT-HORIZONTAL
- 2 - BOLT-VERTICAL
- 3 - STRUCTURAL COLLAR

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**Fig. 126: Structural Collar**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Remove collar (**Fig. 126** ).

## INSTALLATION

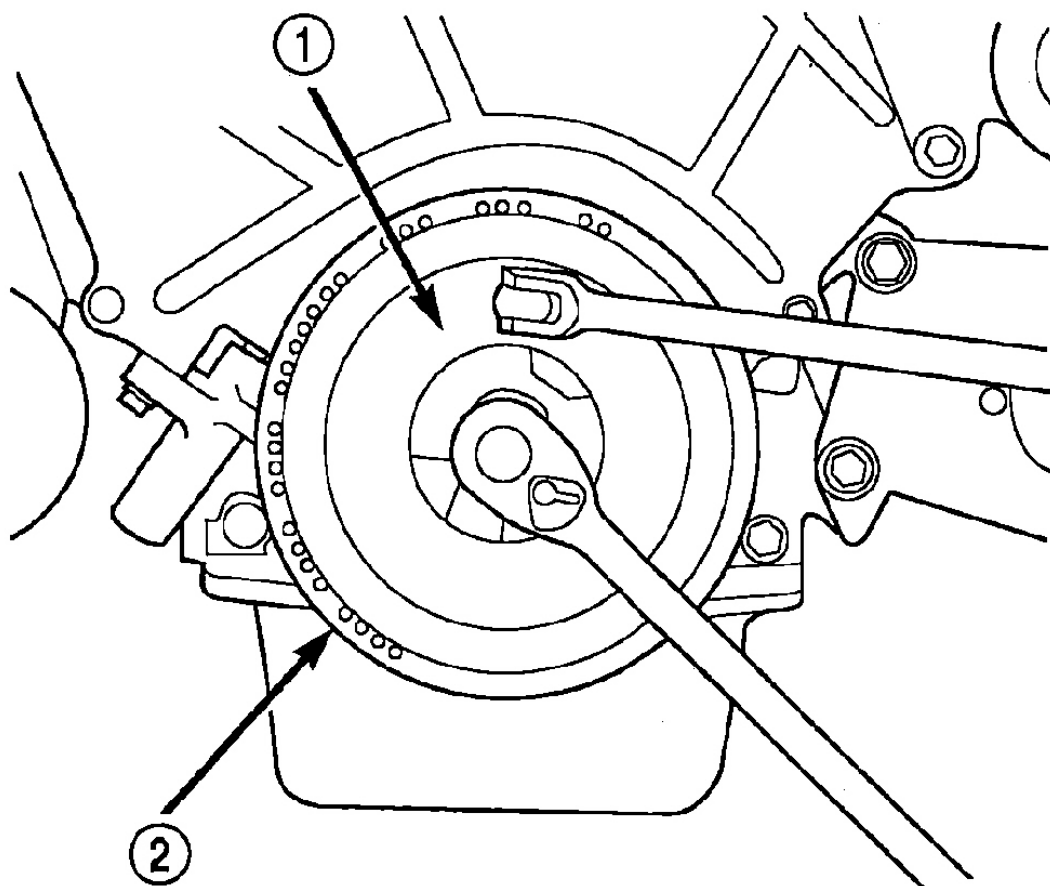
**CAUTION:** The collar must be tighten using this service procedure, as damage to collar and/or oil pan may occur.

1. Install structural collar (**Fig. 126** ) using the following tightening sequence:
  - a. Install the **vertical** collar to oil pan bolts. Torque bolts initially to 1.1 N.m (10 in. lbs.).
  - b. Install the **horizontal** collar to transmission bolts and torque to 55 N.m (40 ft. lbs.).
  - c. Starting with the center vertical bolts and working outward, final torque bolts to 55 N.m (40 ft. lbs.).
2. Lower vehicle.

## VIBRATION DAMPER

### REMOVAL

1. Disconnect negative cable at right strut tower.
2. Remove upper radiator crossmember. (Refer to **GRILLE OPENING REINFORCEMENT** )
3. Remove radiator fan. (Refer to **RADIATOR FAN** )
4. Remove the accessory drive belts. (Refer to **ACCESSORY DRIVE** )
5. Use Special Tool 8191 to hold crankshaft damper while removing center bolt (**Fig. 127** ).

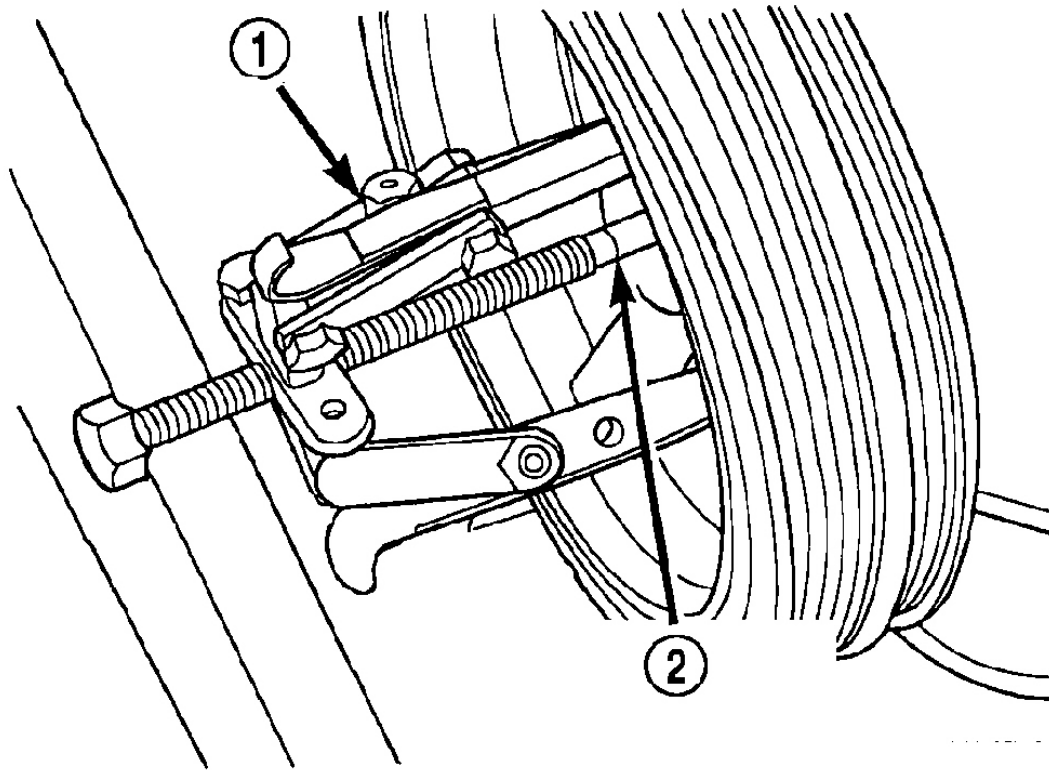


- 1 - SPECIAL TOOL 8191
- 2 - CRANKSHAFT DAMPER

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**Fig. 127: Crankshaft Damper Center Bolt - Removal And Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

6. Use Special Tool 1023 puller, and insert C-4685-C2, remove crankshaft damper (**Fig. 128**).



1 - SPECIAL TOOL  
1023

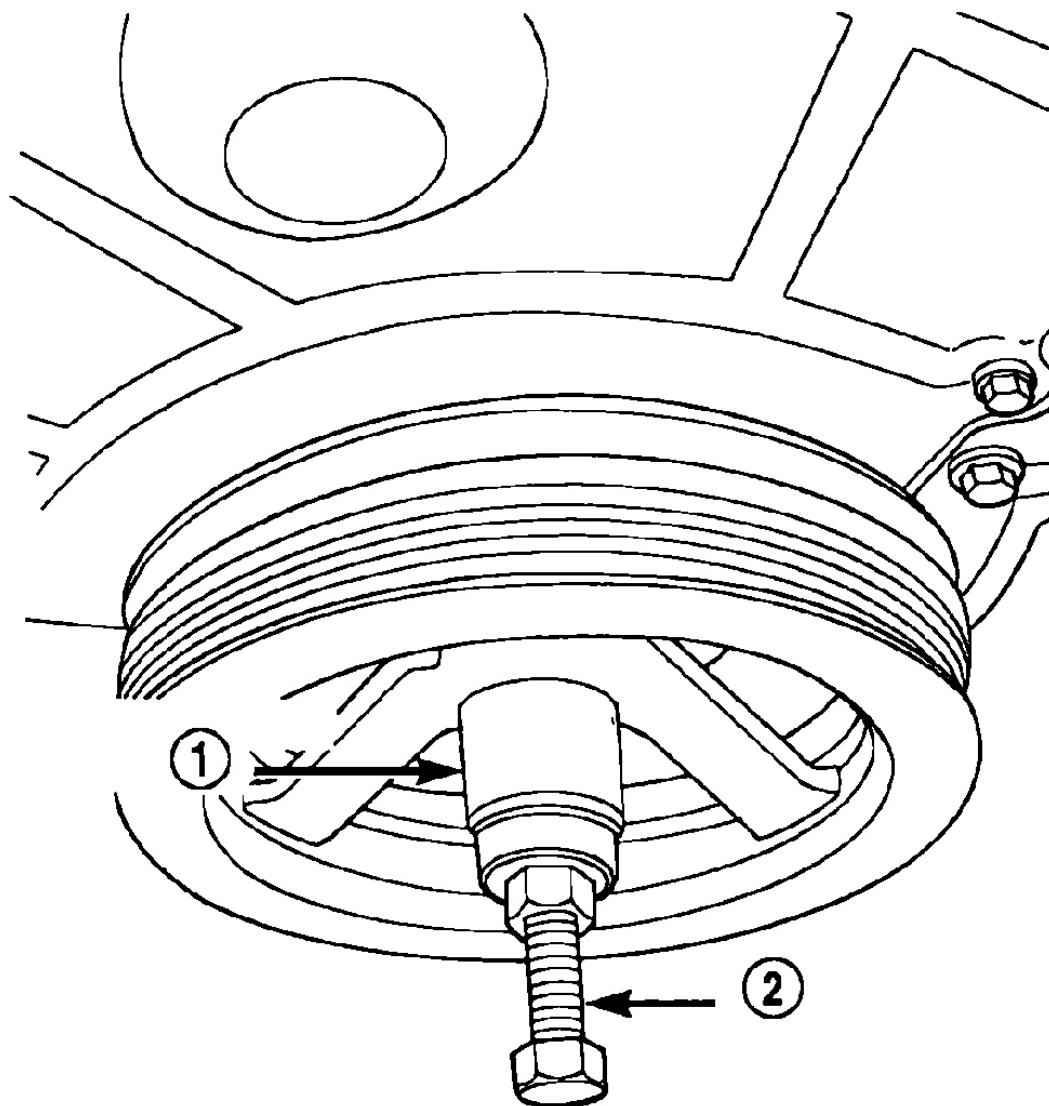
2 - SPECIAL TOOL  
C-4685-C2  
INSERT

G03511981

**Fig. 128: Crankshaft Damper - Removal**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. Install crankshaft damper using Special Tools C-4685-C1 (5.9 in.) Bolt, with Nut and Thrust Bearing from 6792, and 6792-1 Installer (**Fig. 129**). Install center bolt and tighten to 115 N.m (85 ft. lbs.) (**Fig. 127**).



- 1 - SPECIAL TOOL  
6792-1  
2 - SPECIAL TOOL  
C-4685-C1

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**Fig. 129: Crankshaft Damper - Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

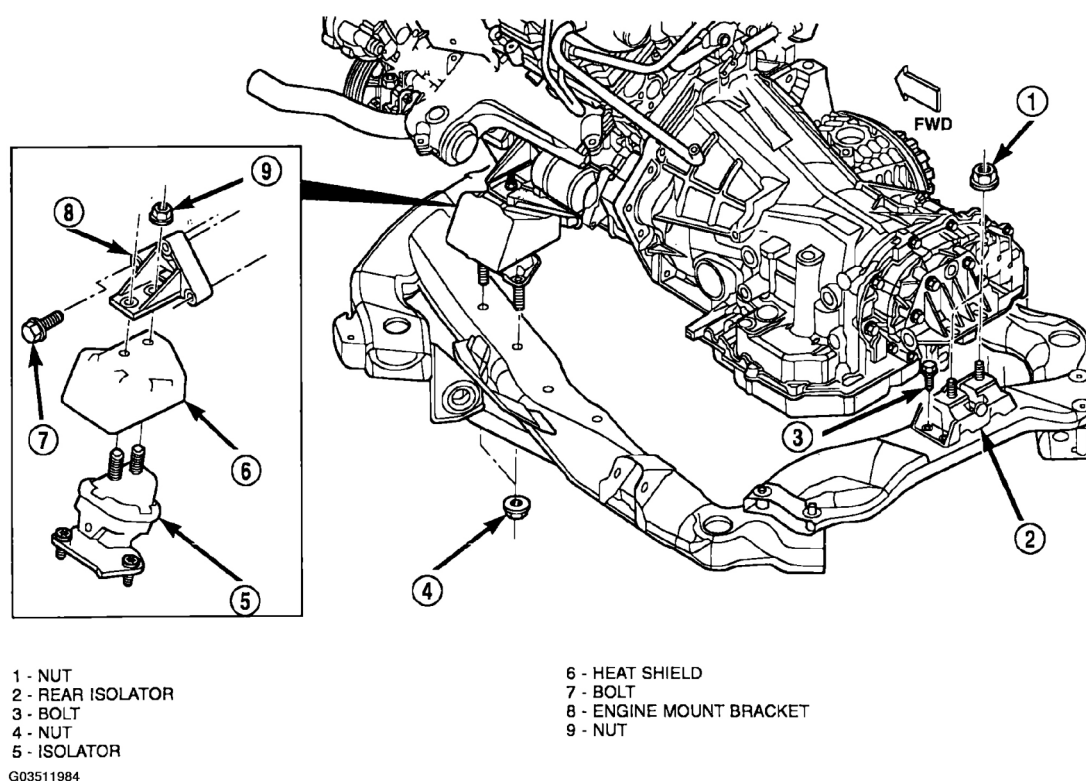
2. Install accessory drive belts. (Refer to **ACCESSORY DRIVE** )
3. Install radiator fan. (Refer to **RADIATOR FAN** )

4. Install upper radiator crossmember. (Refer to **GRILLE OPENING REINFORCEMENT** )
5. Connect negative cable.

## ENGINE MOUNTING

### DESCRIPTION

The engine mounting system consist of three mounts; two hydro-type mounts are attached to the right and left side of the engine block, and one molded rubber type rear mount is attached to the transaxle (**Fig. 130** ). All three mounts attach to the suspension crossmember/engine cradle.



**Fig. 130: Engine Mounting**

Courtesy of DAIMLERCHRYSLER CORP.

The engine hydro-type mounts contain a liquid that is encased in a solid rubber housing.

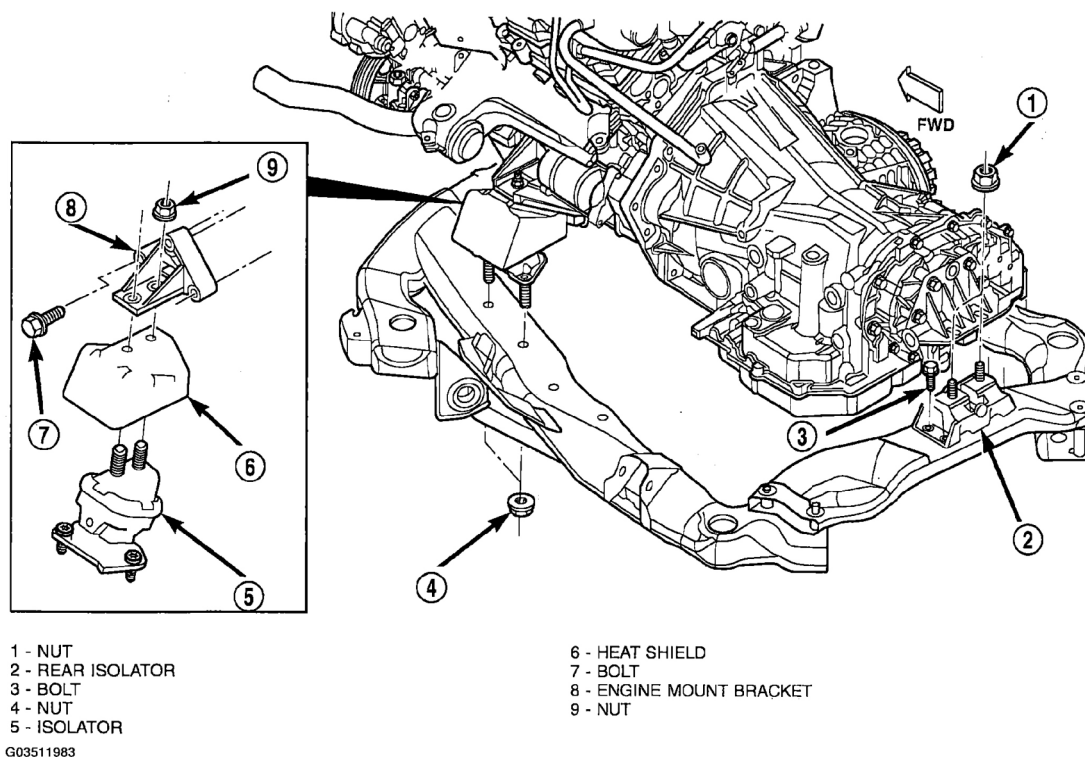
### INSPECTION

Engine hydro-mounts may show surface cracks. This will not effect performance and mount should not be replaced. Only replace the engine hydro-mounts when leaking fluid.

### LEFT MOUNT

## REMOVAL

1. Raise vehicle on hoist.
2. Remove the isolator attaching nuts from top of the mounting bracket (**Fig. 131**).



**Fig. 131: Engine Mounting**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Support the engine with a jack and a block of wood across the full width of the oil pan.
4. Remove the lower attaching nuts from the bottom of the isolator to the frame (**Fig. 131**).
5. Raise engine carefully with jack enough to remove the isolator with heat shield from its mount.

## INSTALLATION

1. Install isolator mount with heat shield onto the frame.
2. Lower the engine onto the isolator mount.
3. Remove jack from vehicle.
4. Tighten the isolator to frame nuts to 61 N.m (45 ft. lbs.) (**Fig. 131**).
5. Install the upper attaching nuts to mount and tighten to 61 N.m (45 ft. lbs.) (**Fig. 131**).
6. Lower vehicle.

## REAR MOUNT

## REMOVAL

1. Raise vehicle on hoist.
2. Support transaxle with a jack.
3. Remove isolator nuts from the mount to trans-axle mount bracket (**Fig. 130** ).
4. Remove rear mount isolator bolts to crossmember and remove mount (**Fig. 130** ).

## INSTALLATION

1. Position isolator onto crossmember.
2. Install bolts attaching isolator to crossmember and tighten to 33 N.m (250 in. lbs.) (**Fig. 130** ).
3. Lower transaxle onto isolator.
4. Install isolator nuts and tighten to 61 N.m (45 ft. lbs.) (**Fig. 130** ).
5. Lower vehicle.

## RIGHT MOUNT

### REMOVAL

1. Raise vehicle on hoist.
2. Remove the isolator attaching nuts from top of the mounting bracket (**Fig. 130** ).
3. Support the engine with a jack and a block of wood across the full width of the oil pan.
4. Remove the lower attaching nuts from the bottom of the isolator to the frame (**Fig. 130** ).
5. Raise engine carefully with jack enough to remove the isolator with heat shield from its mount.

### INSTALLATION

1. Install isolator mount with heat shield onto the frame.
2. Lower the engine onto the isolator mount.
3. Remove jack from vehicle.
4. Tighten the isolator to frame nuts to 61 N.m (45 ft. lbs.) (**Fig. 130** ).
5. Install the upper attaching nuts to mount and tighten to 61 N.m (45 ft. lbs.) (**Fig. 130** ).
6. Lower vehicle.

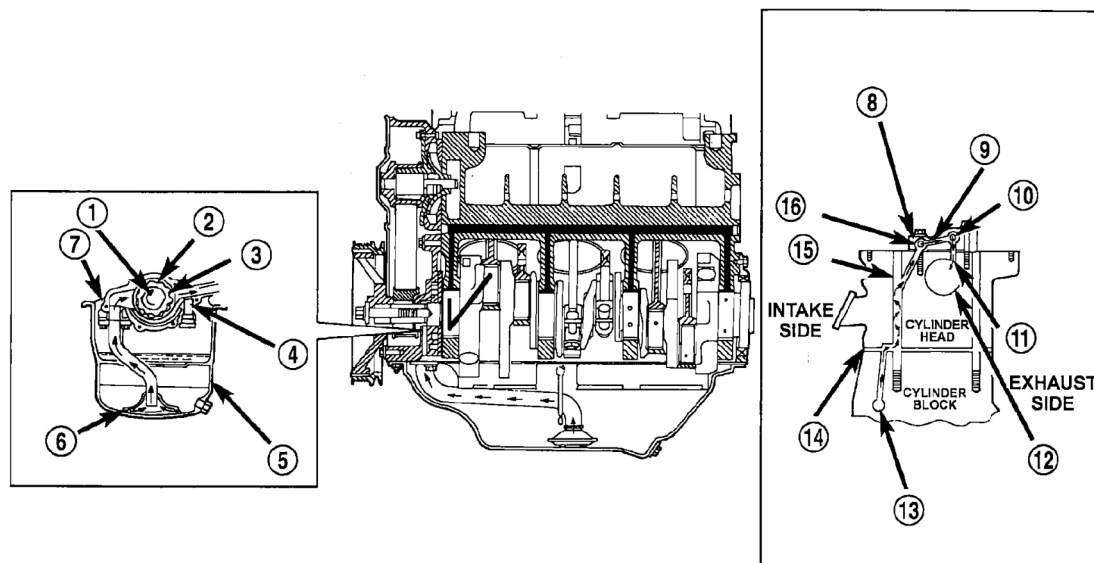
## LUBRICATION

### DESCRIPTION

System is a full-flow filtration, pressure feed type. The oil pump body is mounted to the engine block. The pump inner rotor is driven by the crankshaft. A windage tray, increases power by minimizing oil windage at high engine RPM. For increased oil cooling, an oil-to-coolant oil cooler is used. This cooler is mounted inside the radiator tank.

## OPERATION

Engine oil stored in the oil pan is drawn in and discharged by a gerotor type oil pump. The oil pump is directly coupled to the crankshaft. Oil pressure is regulated by a relief valve. The oil is fed through an oil filter and to the crankshaft journals from the oil gallery in the cylinder block. This gallery also feeds oil under pressure to the cylinder heads. Oil flows through each cylinder heads oil passage to the rocker shafts. Oil then feeds the camshaft journals, rocker arms, and hydraulic lash adjusters (**Fig. 132**).



- 1 - CRANKSHAFT
- 2 - OUTER ROTOR
- 3 - INNER ROTOR
- 4 - RELIEF VALVE
- 5 - OIL PAN
- 6 - OIL SCREEN
- 7 - OIL PUMP CASE

8 - OIL FLOWS TO ONLY ONE PEDESTAL ON EACH HEAD - SECOND FROM REAR ON RIGHT HEAD - SECOND FROM FRONT ON LEFT HEAD

- 9 - PEDESTAL DRILLED PASSAGE
- 10 - EXHAUST ROCKER SHAFT
- 11 - SHAFT/PEDESTAL DOWEL PASSAGE
- 12 - CAMSHAFT BEARING BORE
- 13 - CYLINDER BLOCK OIL GALLERY
- 14 - CYLINDER HEAD GASKET
- 15 - HEAD BOLT HOLE
- 16 - INTAKE ROCKER SHAFT

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**Fig. 132: Oil Lubrication System**

Courtesy of DAIMLERCHRYSLER CORP.

## DIAGNOSIS AND TESTING

### DIAGNOSIS AND TESTING - ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated

with a bright yellow color under a black light.

3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair as necessary.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.
5. **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method as follows:
  - Disconnect the fresh air hose (make-up air) at the cylinder head cover and plug or cap the nipple on the cover.
  - Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve nipple on the cover.
  - Attach an air hose with pressure gauge and regulator to the dipstick tube.

**CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.**

- Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provides the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service procedures.
  - If the leakage occurs at the crankshaft rear oil seal area, refer to **INSPECTION FOR REAR SEAL AREA LEAK**.
6. If no leaks are detected, turn off the air supply. Remove the air hose, all plugs, and caps, Install the PCV valve and fresh air hose (make-up air). Proceed to next step.
  7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

**NOTE:** If oil leakage is observed at the dipstick tube to block location; remove the tube, clean and reseal using Mopar(R) Stud & Bearing Mount (press fit tube applications only), and for O-ring style tubes, remove tube and replace the O-ring seal,

#### INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area, remove transmission for further inspection.

- a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
  - b. Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.
4. If no leaks are detected, pressurize the crankcase as previously described.

**CAUTION: Do not exceed 20.6 kPa (3 psi).**

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

**CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.**

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.
7. After the oil leak root cause and appropriate corrective action have been identified, replace component(s) as necessary.

#### DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE

1. Remove the oil pressure switch. (Refer to **OIL PRESSURE SWITCH** )
2. Install oil pressure test gauge assembly, Special Tools C-3292 with 8406 adaptor.
3. Start engine and monitor gauge readings.

**CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM**

4. Oil Pressure (engine at operating temperature): **Curb Idle** 34.5 kPa (5 psi) minimum **3000 RPM** 300-724 kPa (45-105 psi).
5. If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open or a clogged oil pickup screen.
6. Install oil pressure switch after testing is completed. (Refer to **OIL PRESSURE SWITCH** )

## OIL

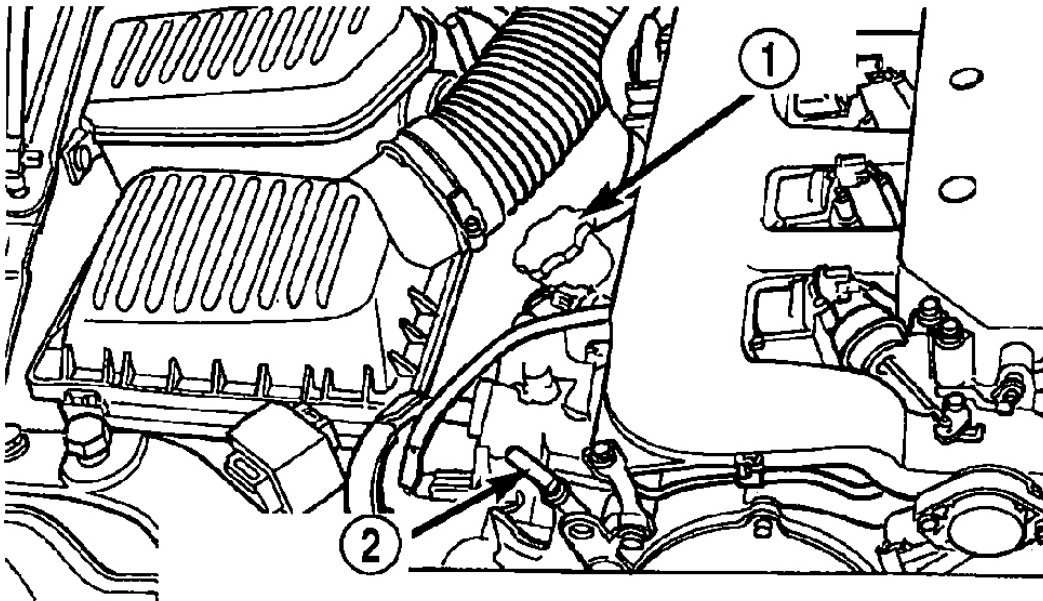
### DESCRIPTION

For engine oil type and capacity (Refer to owner's manual)

**STANDARD PROCEDURE****STANDARD PROCEDURE - ENGINE OIL LEVEL CHECK**

The best time to check engine oil level is after it has sat overnight, or if the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading (**Fig. 133**). Add only when the level is at or below the ADD mark.



- 1 - ENGINE OIL FILL
- 2 - ENGINE OIL DIPSTICK

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**Fig. 133: Engine Oil Fill And Dipstick Locations**  
Courtesy of DAIMLERCHRYSLER CORP.

**STANDARD PROCEDURE - ENGINE OIL AND FILTER CHANGE**

Change engine oil at mileage and time intervals described in the Maintenance Schedule. (Refer to owner's manual)

**WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY**

**WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.**

#### **TO CHANGE ENGINE OIL**

1. Run engine until achieving normal operating temperature.
2. Position the vehicle on a level surface and turn engine off.
3. Hoist and support vehicle on safety stands.
4. Remove oil fill cap.
5. Place a suitable drain pan under crankcase drain.
6. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.
7. Remove oil filter. (Refer to **OIL FILTER** )
8. Install drain plug in crankcase.
9. Install new oil filter. (Refer to **OIL FILTER** )
10. Lower vehicle and fill crankcase with specified type and amount of engine oil. (Refer to owner's manual)
11. Install oil fill cap.
12. Start engine and inspect for leaks.
13. Stop engine and inspect oil level.

#### **OIL FILTER SPECIFICATION**

All engines are equipped with a high quality full-flow, disposable type oil filter. When replacing oil filter, use a Mopar(R) filter or equivalent.

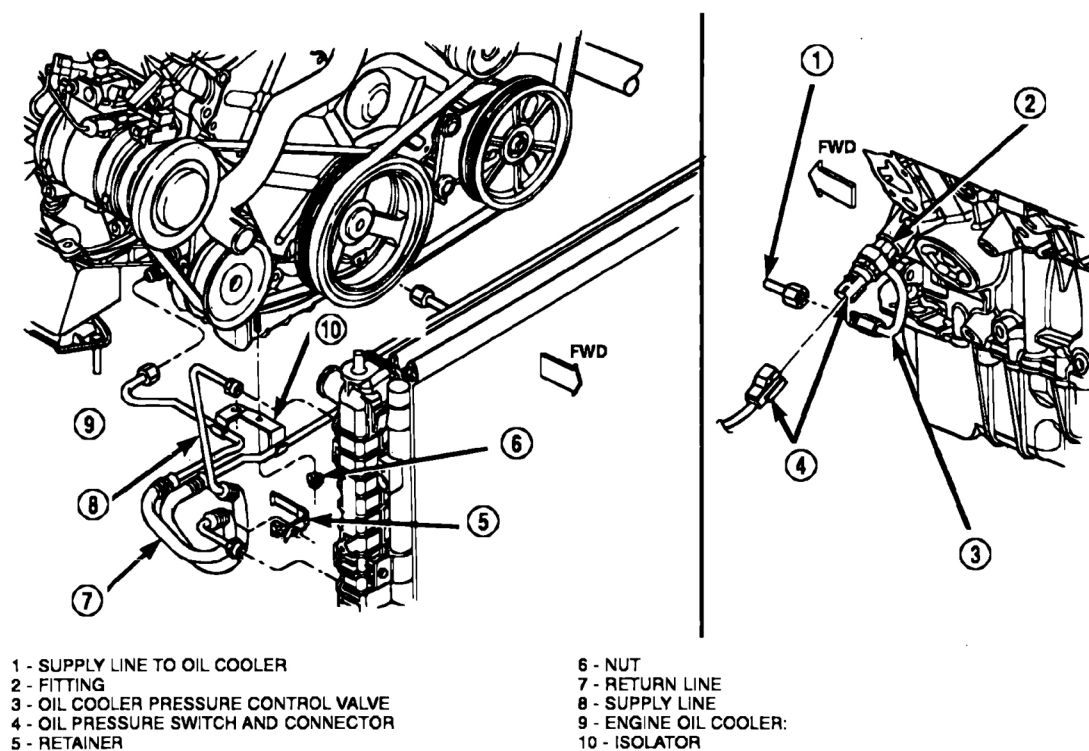
#### **USED ENGINE OIL DISPOSAL**

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING above.

### **OIL COOLER & LINES**

#### **DESCRIPTION**

Depending on vehicle options, some models use an engine oil cooler that is mounted inside the right radiator tank. An oil cooler pressure control valve is used to control flow to the cooler (**Fig. 134** ).



**Fig. 134: Engine Oil Cooler - 3.5L**  
Courtesy of DAIMLERCHRYSLER CORP.

## OPERATION

Engine oil travels from the control valve through the supply line and into the cooler. The control valve allows engine oil flow when pressure is above 138-207 kPa (20-30 psi) and an internal orifice limits oil flow to a maximum of 11.3 LPM (3 GPM). The engine oil exits the cooler through the oil return line and is returned to the engine oil pan (**Fig. 134**).

## REMOVAL

### ENGINE OIL COOLER

1. The engine oil cooler is serviced with the radiator (Refer to **RADIATOR**).

### COOLER LINES

1. Disconnect cooler lines at radiator (**Fig. 134**).
2. Disconnect lines at the pressure control valve and oil pan fitting (**Fig. 134**).
3. Disconnect lines for support retainer and isolator.
4. Remove lines.

**PRESSURE CONTROL VALVE**

1. Disconnect oil pressure switch connector (**Fig. 134**).
2. Disconnect cooler supply line for valve.
3. Remove valve from engine block by unscrewing fitting.

**INSTALLATION****ENGINE OIL COOLER**

1. Install radiator assembly (Refer to **RADIATOR** . Tighten lines to radiator fittings to 18 N.m (160 in. lbs.) (**Fig. 134** ).

**COOLER LINES**

1. Position cooler lines and connect lines to radiator fittings. Tighten lines to radiator fittings to 18 N.m (160 in. lbs.) (**Fig. 134** ).
2. Connect lines to pressure control valve and oil pan fitting. Tighten lines to 30 N.m (260 in. lbs.) (**Fig. 134** ).
3. Connect lines to support retainer and isolator.

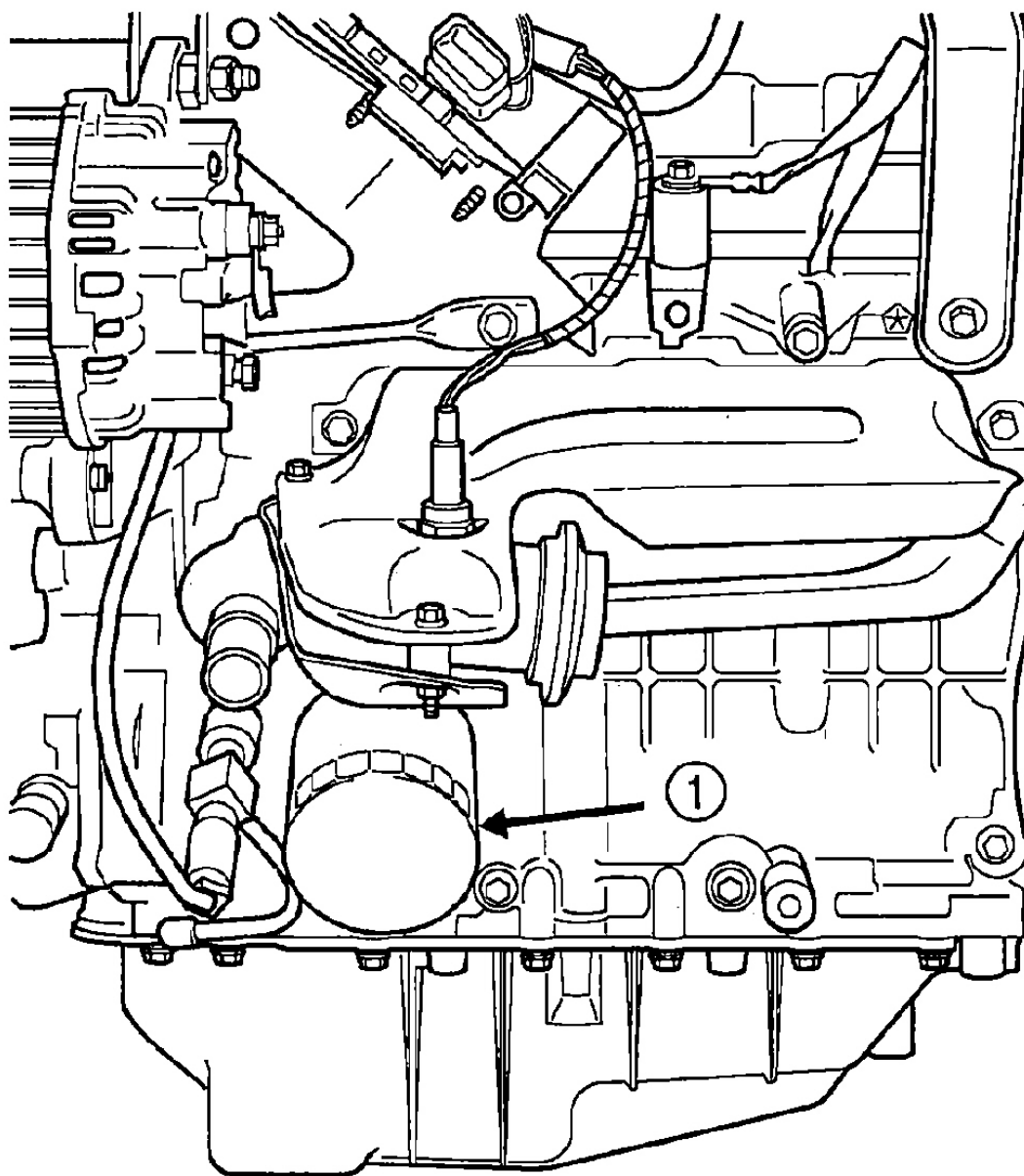
**PRESSURE CONTROL VALVE**

1. For installation of a NEW control valve:
  - a. Install fitting into block. Tighten fitting to 30 N.m (260 in. lbs.).
  - b. Position control valve to fitting. Push line into fitting until it locks in place. Ensure proper connection is made by pulling in-and-out on valve.
2. For installation of original control valve:
  - a. Install pressure control valve to engine block. Tighten fitting to 30 N.m (260 in. lbs.).
3. Connect oil cooler supply line. Tighten to 30 N.m (260 in. lbs.) (**Fig. 134** ).
4. Connect oil pressure switch connector.

**OIL FILTER****REMOVAL**

**NOTE:** When servicing the oil filter, avoid deforming the filter can. Install the remove/install tool band strap against the base lock seam. The lock seam joining the can to the base is reinforced by the base plate.

1. Using a suitable oil filter wrench, unscrew filter from base and discard (**Fig. 135** ).



1 - OIL FILTER

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**Fig. 135: Oil Filter**

Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

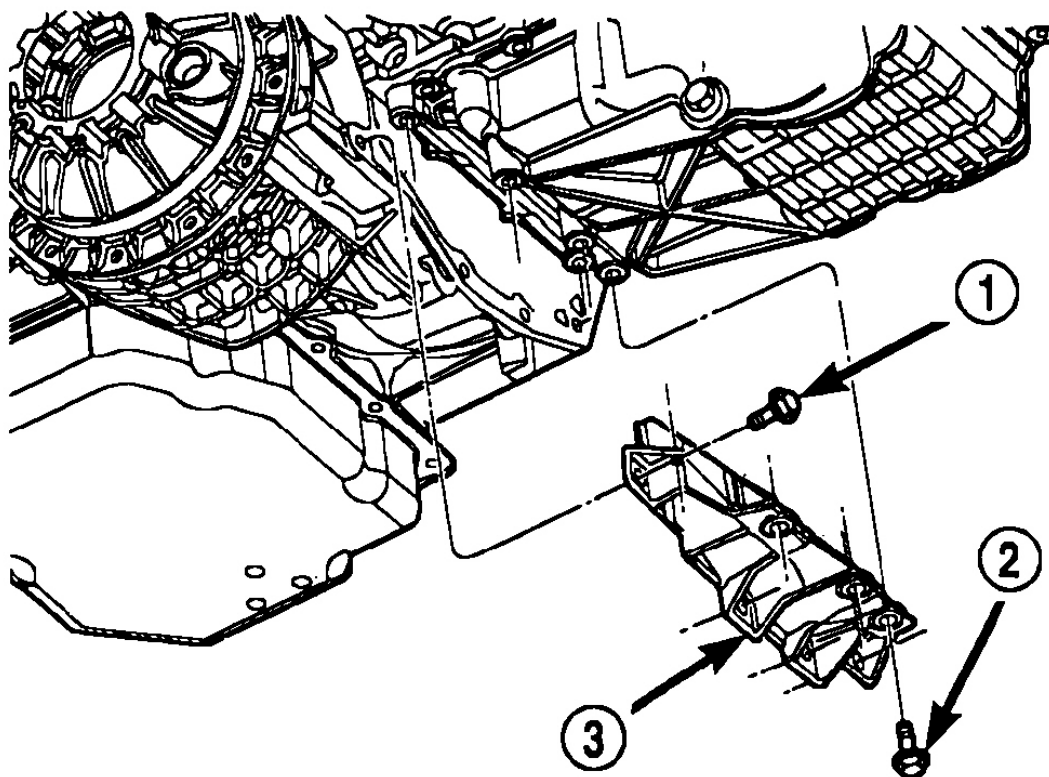
1. Wipe base clean, then inspect gasket contact surface.

2. Lubricate gasket of new filter with clean engine oil.
3. Install and tighten filter to 16 N.m (12 ft. lbs.) of torque after gasket contacts base (**Fig. 135**). Use filter wrench if necessary.
4. Start engine and check for leaks.

## **OIL PAN**

### **REMOVAL**

1. Disconnect negative cable from remote jumper terminal.
2. Remove dipstick and tube.
3. Raise vehicle on hoist and drain engine oil.
4. Remove structural collar from rear of oil pan and transmission housing (**Fig. 136**).



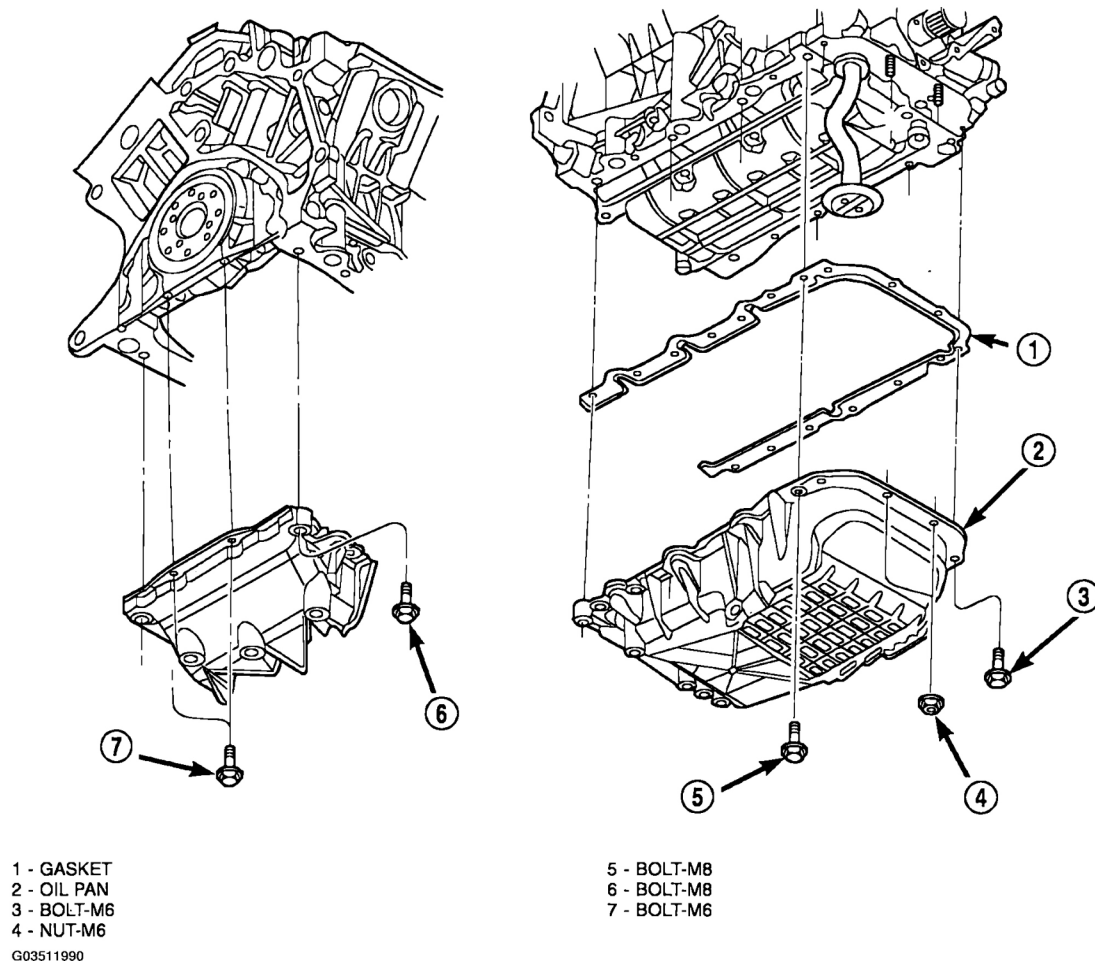
- 1 - BOLT-HORIZONTAL
- 2 - BOLT-VERTICAL
- 3 - STRUCTURAL COLLAR

G03511989

**Fig. 136: Structural Collar**

Courtesy of DAIMLERCHRYSLER CORP.

5. Disconnect engine oil cooler line from pan.
6. Disconnect transmission oil cooler line clips.
7. Remove oil pan (**Fig. 137**).



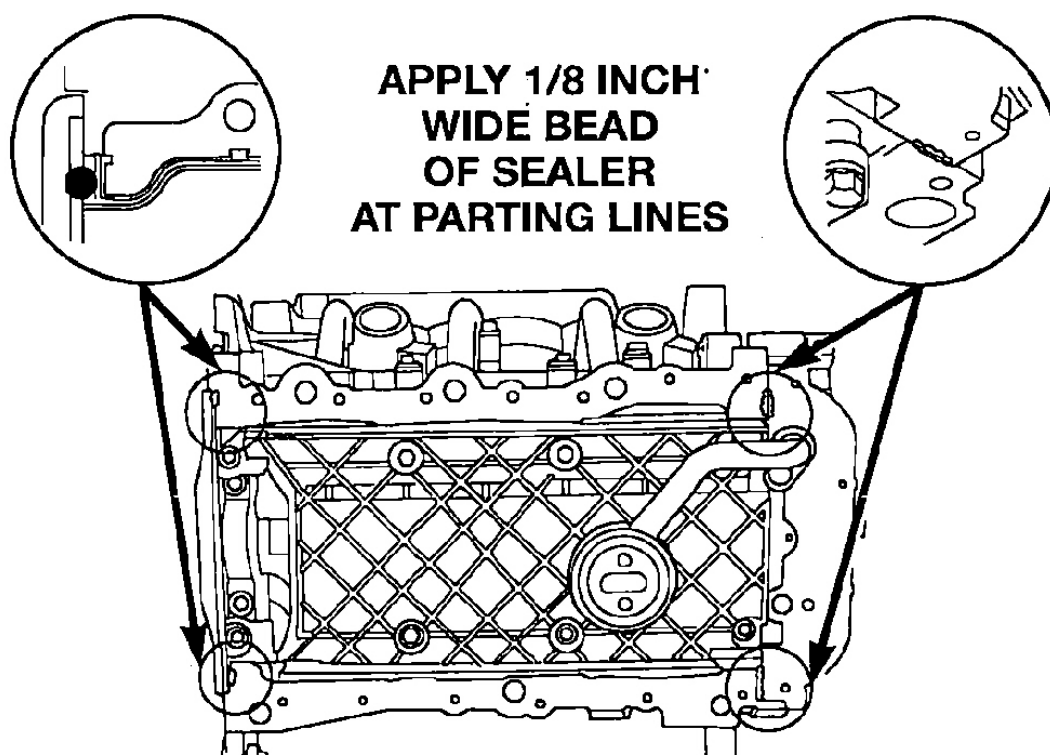
**Fig. 137: Oil Pan**

Courtesy of DAIMLERCHRYSLER CORP.

8. Remove oil pan gasket.
9. Clean oil pan and all gasket surfaces.

## INSTALLATION

1. Apply a 1/8 inch bead of Mopar(R) Engine RTV GEN II at the parting line of the oil pump housing and the rear seal retainer (**Fig. 138**).



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**Fig. 138: Oil Pan Sealing**

Courtesy of DAIMLERCHRYSLER CORP.

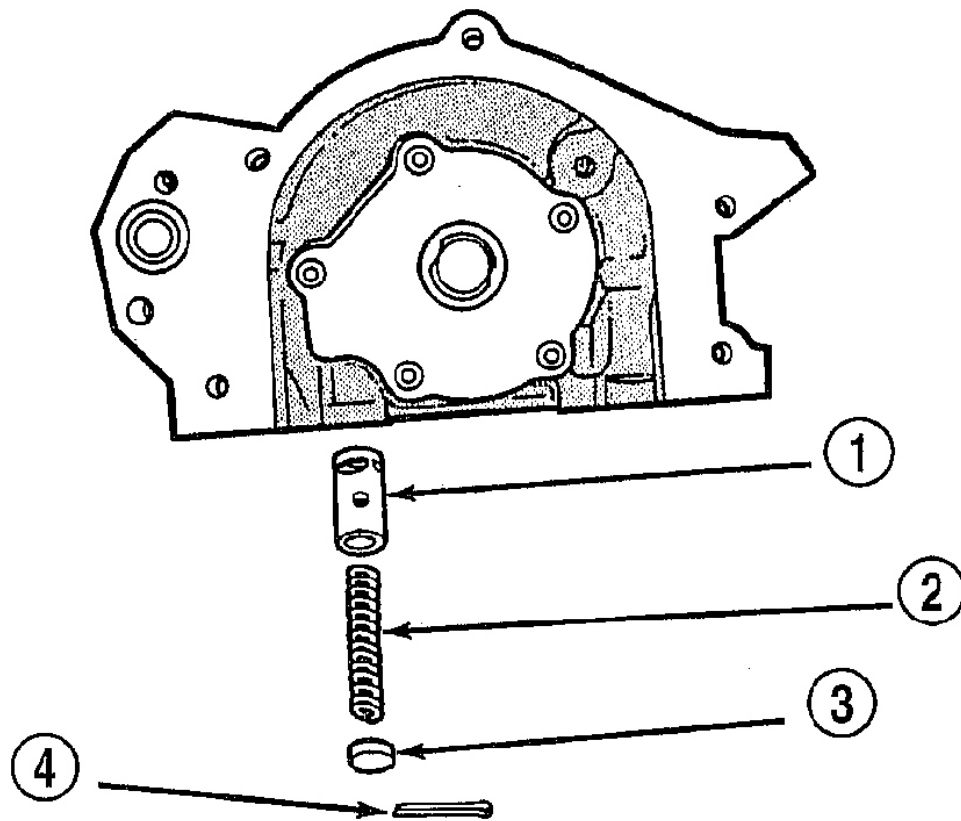
2. Install oil pan gasket to the engine block.
3. Install pan and attaching fasteners (**Fig. 137**).
4. Install the structural collar (**Fig. 136**), using the follow procedure:
  - a. Install the **vertical** collar to oil pan bolts. Pre-torque bolts to 1.1 N.m (10 in. lbs.).
  - b. Install the **horizontal** collar to transmission bolts and tighten to 55 N.m (40 ft. lbs.).
  - c. Starting with center vertical bolts and working outward, final torque all bolts to 55 N.m (40 ft. lbs.).
5. Lower vehicle and install dipstick and tube.
6. Fill engine crankcase with proper oil to correct level.
7. Connect negative cable.

## OIL PRESSURE RELIEF VALVE

### REMOVAL

1. Remove the oil pan. (Refer to **OIL PAN** )

2. To remove the relief valve, proceed as follows:
  - a. Remove the cotter pin that retains the retainer cap.
  - b. Drill a 3.175 mm (1/8 inch.) hole into the relief valve retainer cap
  - c. Insert a self-threading sheet metal screw into cap.
  - d. Using a suitable slide hammer tool, remove retainer cap. Discard retainer cap
  - e. Remove spring and relief valve (**Fig. 139** ).



- 1 - RELIEF VALVE  
2 - SPRING  
3 - RETAINER CAP  
4 - COTTER PIN

G03511992

**Fig. 139: Oil Pressure Relief Valve**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSPECTION

1. Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.
2. The relief valve spring has a free length of approximately 49.5 mm (1.95 in.) it should test between 101-110 N (23-25 lbs.) when compressed to 34 mm (1.34 in.). Replace spring that fails to meet specifications.

## INSTALLATION

1. Lubricate relief valve with oil.

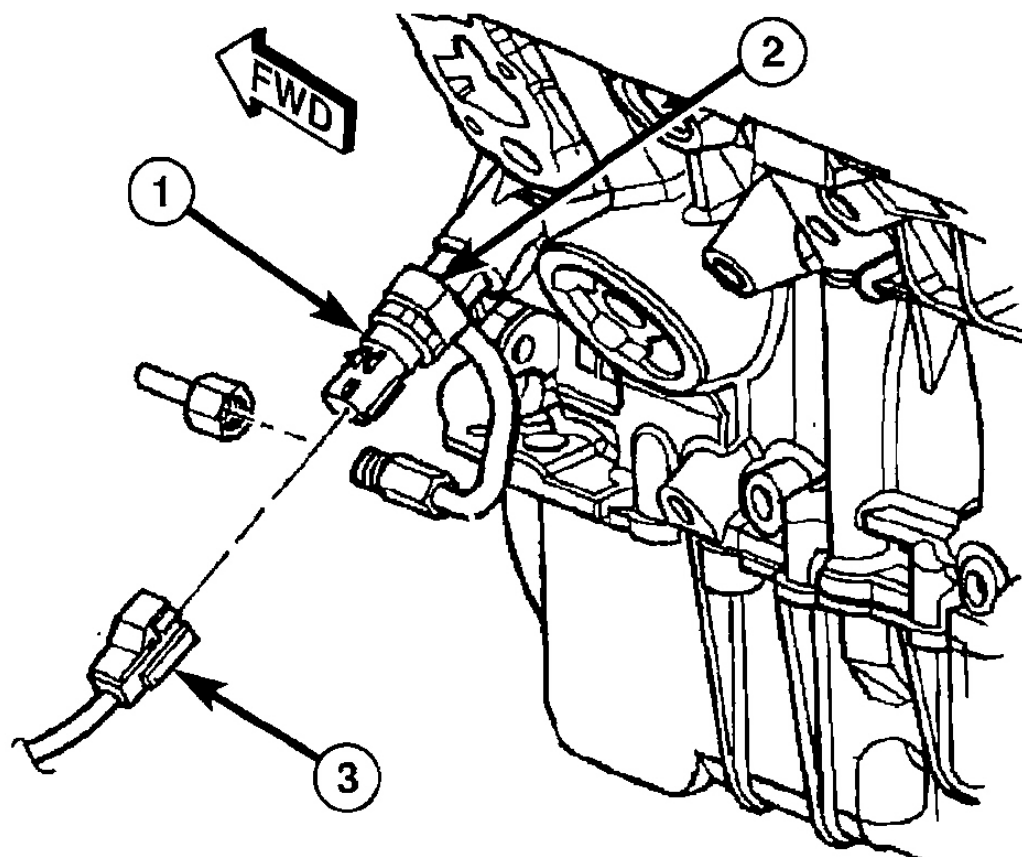
**CAUTION:** The pressure relief valve must be installed as shown in (**Fig. 139** ), or engine damage may occur.

2. Install valve, spring and retainer cap (**Fig. 139** ).
3. Install new cotter pin.
4. Install the oil pan. (Refer to **OIL PAN** )

## OIL PRESSURE SWITCH

### DESCRIPTION

The engine oil pressure switch is located on the lower left front side of the engine (**Fig. 140** ). It screws into the engine oil cooler adapter fitting that is installed into the engine main oil gallery. The normally closed switch provides an input through a single wire to the low pressure indicator light on the instrument cluster.



- 1 - OIL PRESSURE SWITCH
- 2 - OIL COOLER FITTING
- 3 - ELECTRICAL CONNECTOR

G03511993

**Fig. 140: Oil Pressure Switch**

Courtesy of DAIMLERCHRYSLER CORP.

## OPERATION

The oil pressure switch provides a ground for the instrument cluster low oil pressure indicator light. The switch receives oil pressure input from the engine main oil gallery. When engine oil pressure is greater than 27.5 Kpa (4 psi), the switch contacts open, providing an open circuit to the low pressure indicator light. For wiring circuits and diagnostic information, (Refer to Appropriate Wiring/Diagnostic Information).

## REMOVAL

1. Raise vehicle on hoist.
2. Position an oil collecting container under switch location.
3. Disconnect electrical connector (**Fig. 140** ).
4. Hold oil cooler fitting with a wrench.
5. Unscrew oil pressure switch from fitting (**Fig. 140** ).

## INSTALLATION

1. Apply Mopar(R) Thread Sealant to the switch threads.
2. Install oil pressure switch to fitting (**Fig. 140** ).
3. Hold oil cooler fitting with a wrench and tighten oil pressure switch.
4. Connect electrical connector (**Fig. 140** ).
5. Lower vehicle.
6. Start engine and check for leaks.
7. Check engine oil level and adjust as necessary.

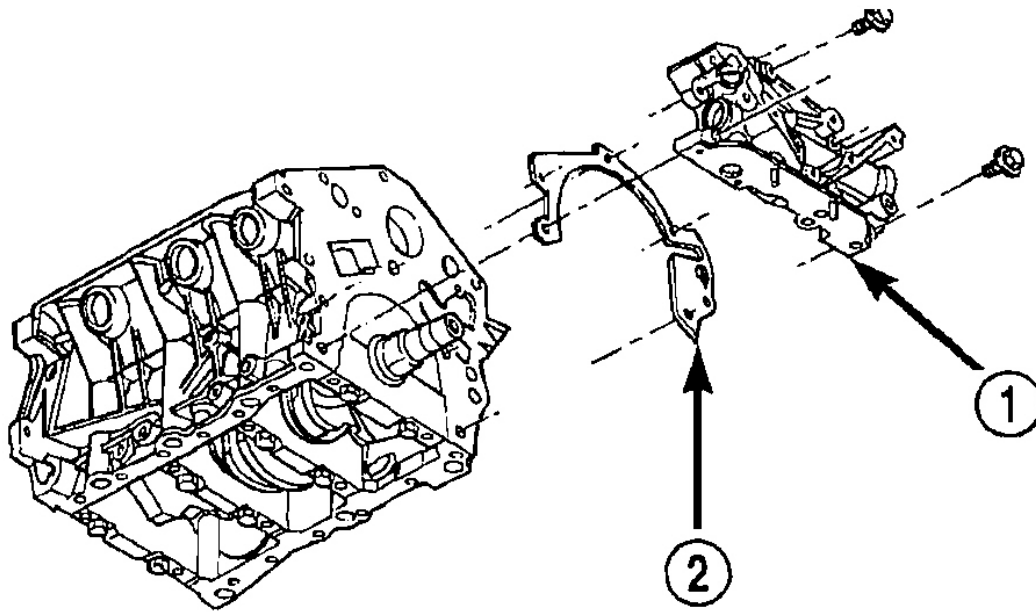
## OIL PUMP

### REMOVAL

It is necessary to remove the oil pump body to service the oil pump rotors.

The oil pump pressure relief valve can be serviced by removing the oil pan. (Refer to **OIL PRESSURE RELIEF VALVE** )

1. Drain the cooling system. (Refer to **STANDARD PROCEDURE** )
2. Remove the radiator fan. (Refer to **RADIATOR** )
3. Remove the accessory drive belts. (Refer to **ACCESSORY DRIVE** )
4. Remove the timing belt. (Refer to **TIMING BELT AND SPROCKETS** )
5. Remove the crankshaft sprocket. (Refer to **TIMING BELT AND SPROCKETS** )
6. Remove the oil pan. (Refer to **OIL PAN** )
7. Remove the oil pickup tube.
8. Remove the oil pump fasteners. Remove pump and gasket from engine (**Fig. 141** ).



1 - OIL PUMP

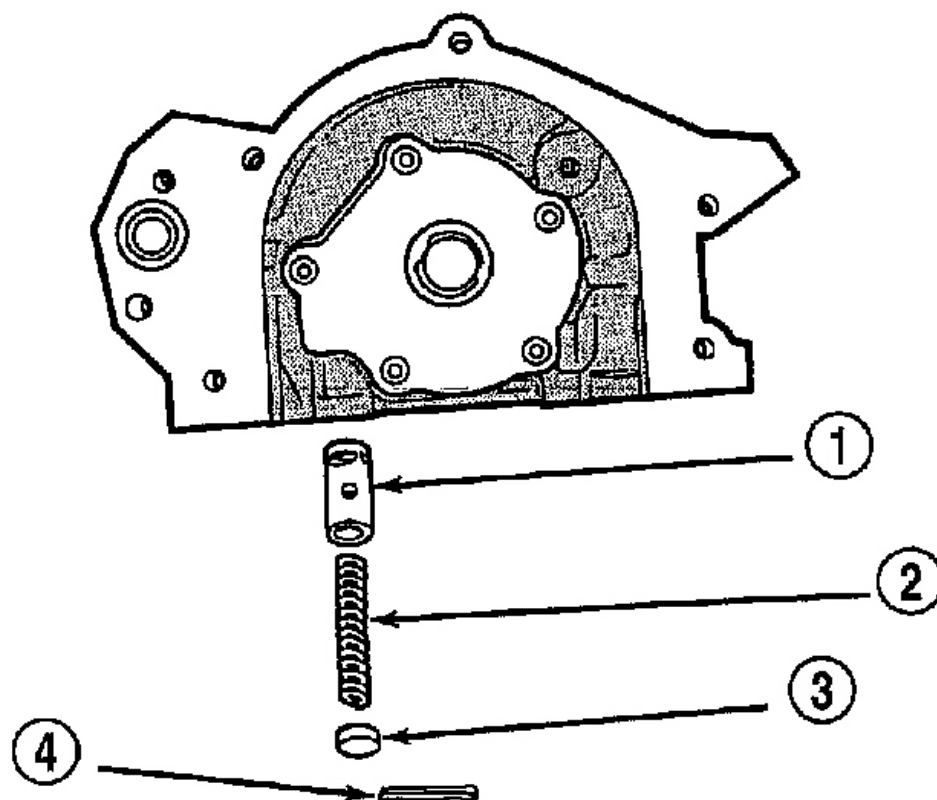
2 - GASKET

G03511994

**Fig. 141: Oil Pump - Removal/Installation**  
**Courtesy of DAIMLERCHRYSLER CORP.**

## DISASSEMBLY

1. To remove the relief valve, proceed as follows:
2. Remove cotter pin. Drill a 3.175 mm (1/8 inch.) hole into the relief valve retainer cap and insert a self-threading sheet metal screw into cap.
3. Clamp screw into a vise and while supporting oil pump body, remove cap by tapping oil pump body using a soft hammer. Discard retainer cap and remove spring and relief valve (**Fig. 142**).

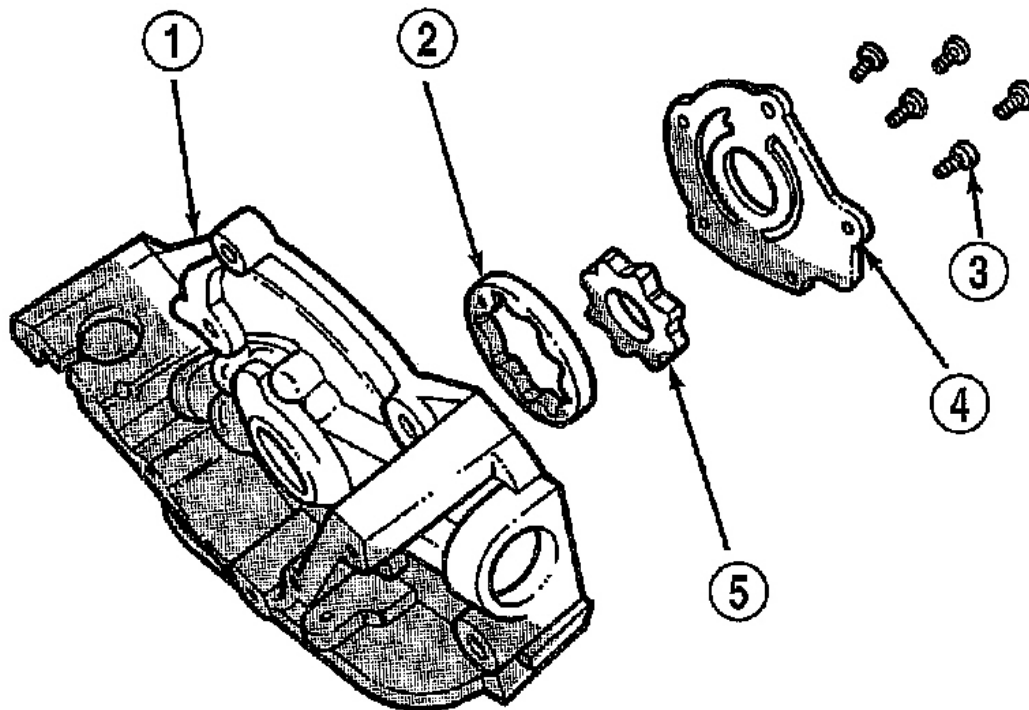


- 1 - RELIEF VALVE
- 2 - SPRING
- 3 - RETAINER CAP
- 4 - COTTER PIN

G03511995

**Fig. 142: Oil Pressure Relief Valve**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Remove oil pump cover screws, and lift off cover.
5. Remove pump rotors.
6. Wash all parts in a suitable solvent and inspect carefully for damage or wear (**Fig. 143**).



- 1 - OIL PUMP BODY
- 2 - OIL PUMP OUTER ROTOR
- 3 - SCREWS
- 4 - OIL PUMP COVER
- 5 - OIL PUMP INNER ROTOR

G03511996

**Fig. 143: Oil Pump**

Courtesy of DAIMLERCHRYSLER CORP.

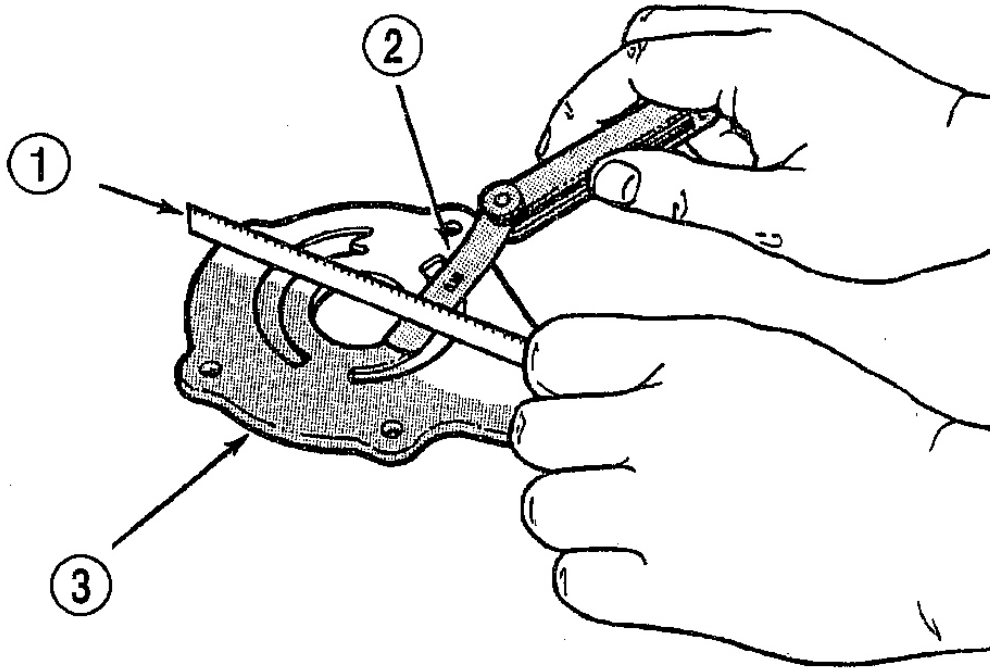
## CLEANING

1. Clean all parts thoroughly in a suitable solvent.

## INSPECTION

1. Disassemble oil pump. (Refer to **DISASSEMBLY**)
2. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. Replace pump cover if scratched or grooved.

3. Lay a straightedge across the pump cover surface (**Fig. 144**). If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

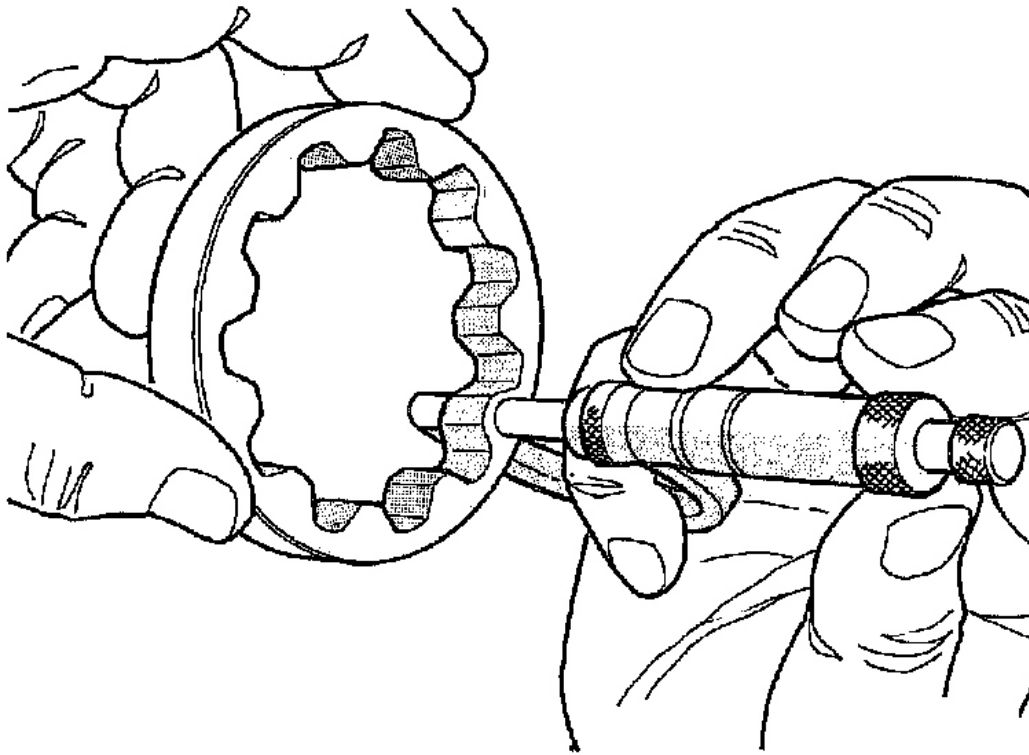


- 1 - STRAIGHT EDGE
- 2 - FEELER GAUGE
- 3 - OIL PUMP COVER

G03511997

**Fig. 144: Checking Oil Pump Cover Flatness**  
Courtesy of DAIMLERCHRYSLER CORP.

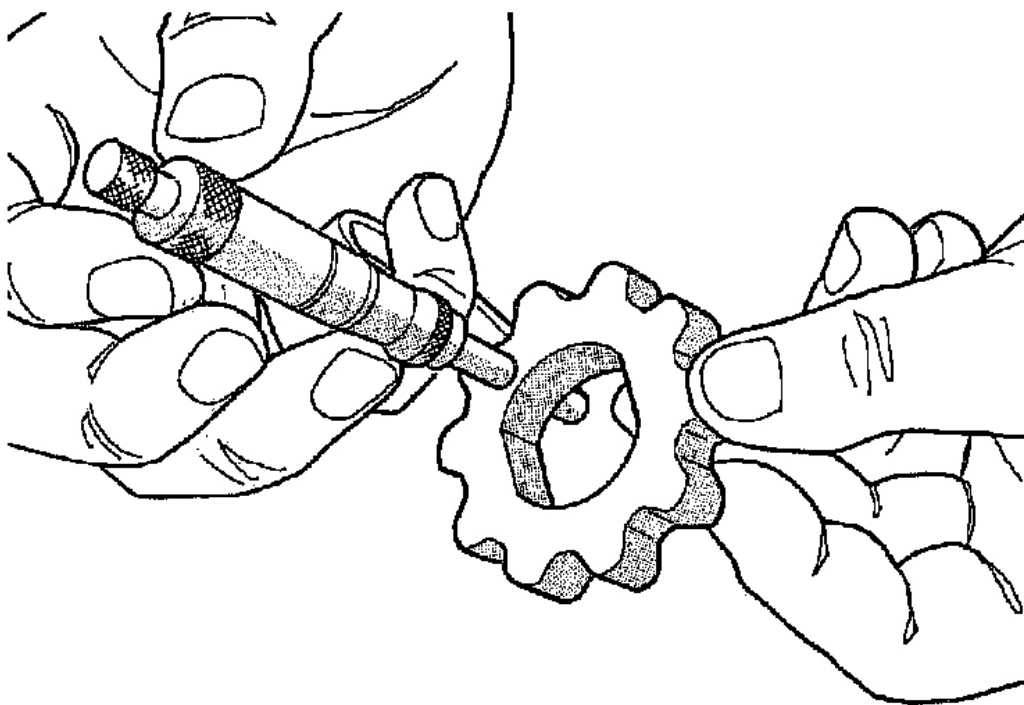
4. Measure thickness and diameter of outer rotor. If outer rotor thickness measures 14.299 mm (0.563 in.) or less (**Fig. 145**), or if the diameter is 79.78 mm (3.141 inches.) or less, replace outer rotor.



G03511998

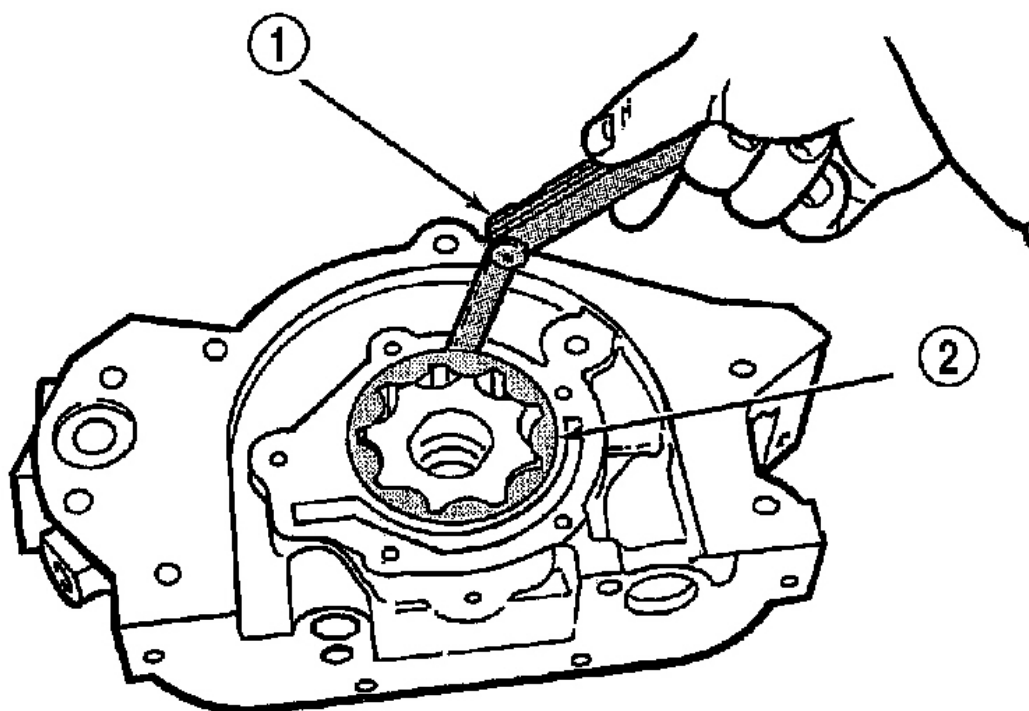
**Fig. 145: Measuring Outer Rotor Thickness**  
Courtesy of DAIMLERCHRYSLER CORP.

5. If inner rotor measures 14.299 mm (0.563 in.) or less replace inner rotor (**Fig. 146**).

**G03511999**

**Fig. 146: Measuring Inner Rotor Thickness**  
**Courtesy of DAIMLERCHRYSLER CORP.**

6. Slide outer rotor into body, press to one side with fingers and measure clearance between rotor and body (**Fig. 147**). If measurement is 0.39 mm (0.015 inch.) or more, replace body only if outer rotor is in specifications.

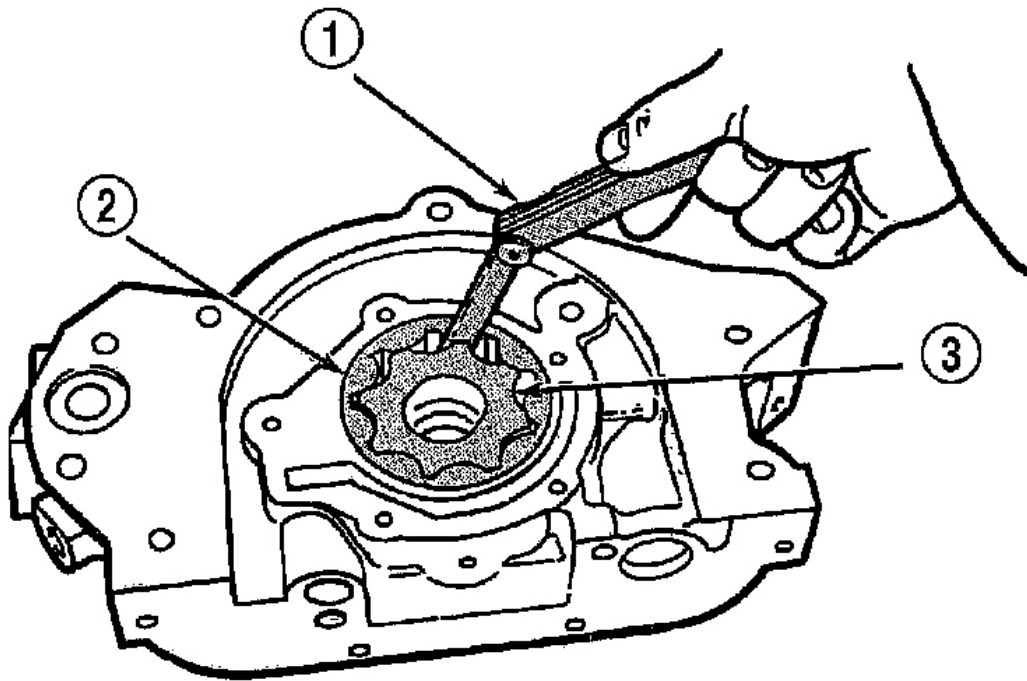


1 - FEELER GAUGE  
2 - OUTER ROTOR

G03512000

**Fig. 147: Measuring Outer Rotor Clearance In Housing**  
Courtesy of DAIMLERCHRYSLER CORP.

7. Install inner rotor into body. If clearance between inner and outer rotors (**Fig. 148**) is 0.20 mm (0.008 inch.) or more, replace both rotors.

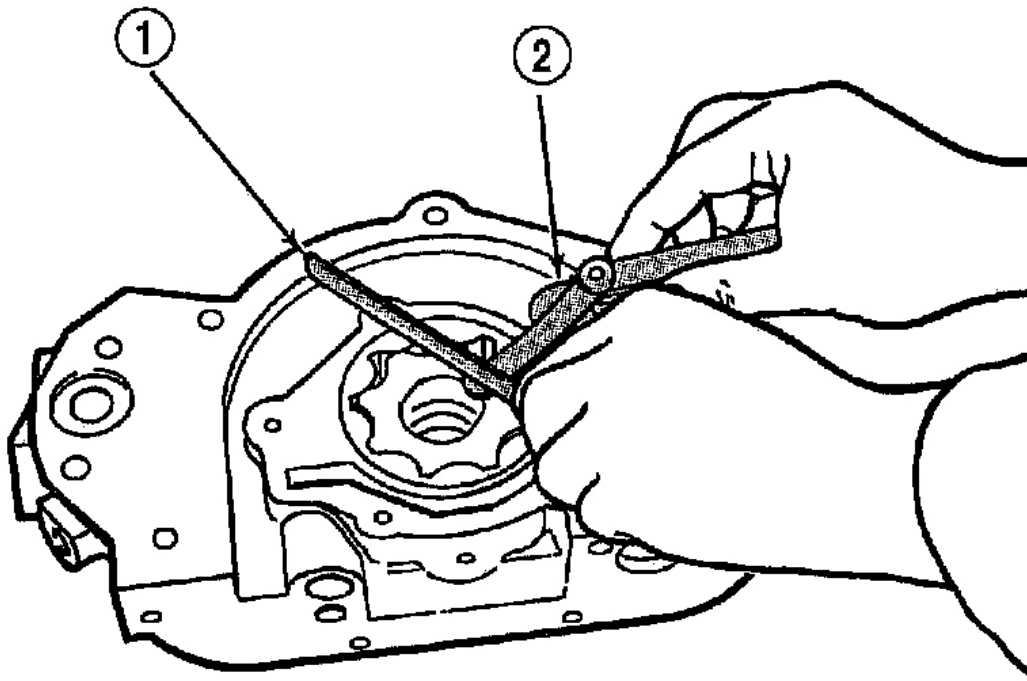


- 1 - FEELER GAUGE
- 2 - OUTER ROTOR
- 3 - INNER ROTOR

G03512001

**Fig. 148: Measuring Clearance Between Rotors**  
Courtesy of DAIMLERCHRYSLER CORP.

8. Place a straightedge across the face of the body, between bolt holes. If a feeler gauge of 0.077 mm (0.003 in.) or more can be inserted between rotors and the straightedge, replace pump assembly (**Fig. 149**) **ONLY** if rotors are in specs.

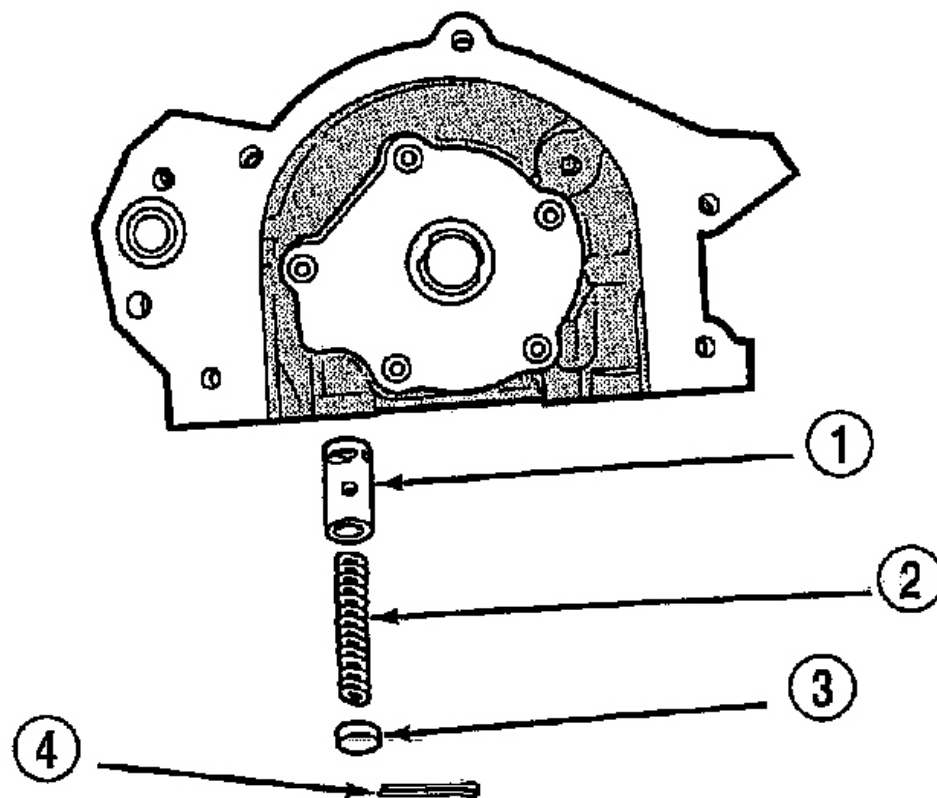


1 - STRAIGHT EDGE  
2 - FEELER GAUGES

G03512002

**Fig. 149: Measuring Clearance Over Rotors**  
Courtesy of DAIMLERCHRYSLER CORP.

9. Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.
10. The relief valve spring (**Fig. 150**) has a free length of approximately 49.5 mm (1.95 in.) it should test between 101-110 N (23-25 lbs.) when compressed to 34 mm (1-11/32 in.). Replace spring that fails to meet specifications.



- 1 - RELIEF VALVE
- 2 - SPRING
- 3 - RETAINER CAP
- 4 - COTTER PIN

G03512003

**Fig. 150: Oil Pressure Relief Valve**  
Courtesy of DAIMLERCHRYSLER CORP.

11. Assemble oil pump. (Refer to ASSEMBLY )

#### ASSEMBLY

1. Assemble oil pump using new parts as required.
2. Tighten cover screws to 12 N.m (105 in. lbs.) (**Fig. 143** ).

3. Prime oil pump before installation by filling rotor cavity with engine oil.
4. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

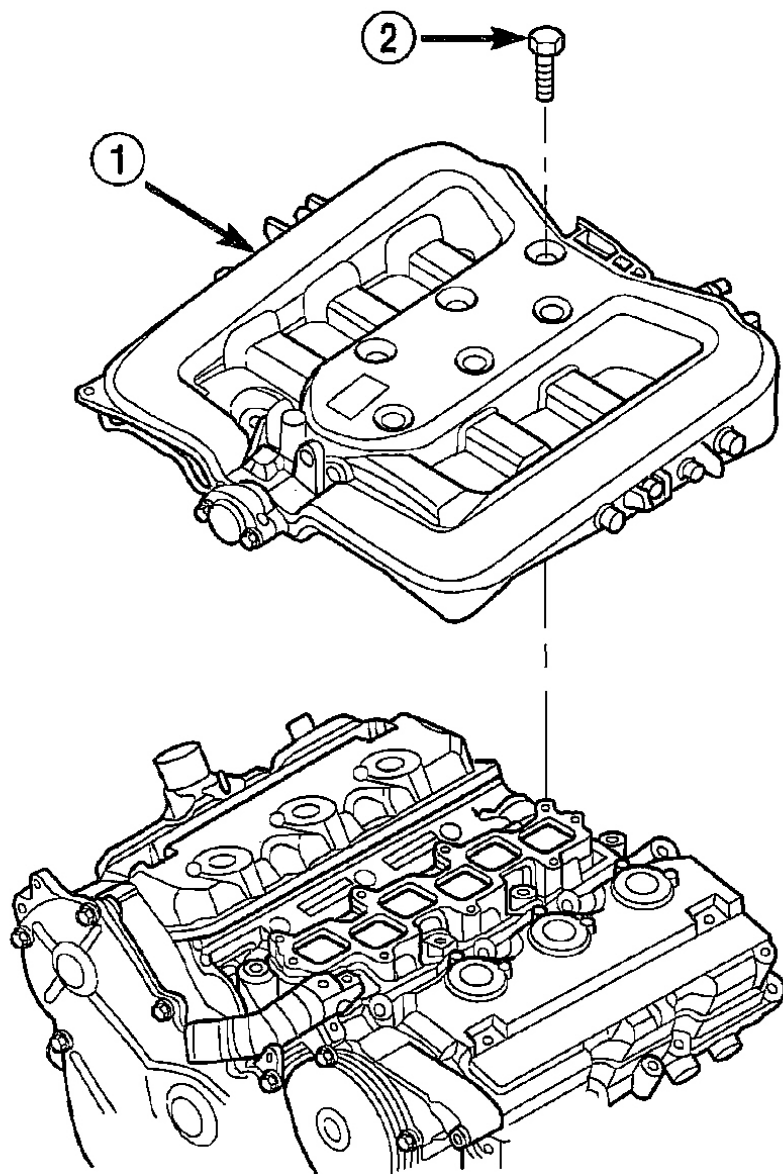
## INSTALLATION

1. Prime oil pump before installation by filling rotor cavity with engine oil.
2. Install oil pump and gasket carefully over the crankshaft. Position pump onto block and tighten bolts to 28 N.m (250 in. lbs.)
3. Install new O-ring on oil pickup tube.
4. Install oil pickup tube.
5. Install oil pan. (Refer to **OIL PAN** )
6. Install crankshaft sprocket. (Refer to **TIMING BELT AND SPROCKETS** )
7. Install timing belt. (Refer to **TIMING BELT AND SPROCKETS** )
8. Install the timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** or **TIMING BELT COVER(S) - REAR** )
9. Install the crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )
10. Install the accessory drive belts. (Refer to **ACCESSORY DRIVE** )
11. Install the radiator fan. (Refer to **RADIATOR FAN** )
12. Fill the cooling system. (Refer to **STANDARD PROCEDURE** )
13. Fill engine crankcase with proper oil to the correct level.

## INTAKE MANIFOLD

### DESCRIPTION

The composite upper intake manifold is a cross-flow type with long runners to improve air charge inertia (**Fig. 151** ). An active Short Runner Valve (SRV) opens during certain operating conditions to improve top end performance. A Manifold Tuning Valve (MTV) connects the plenums at specific engine speeds to maximize low RPM torque without reducing high RPM power.



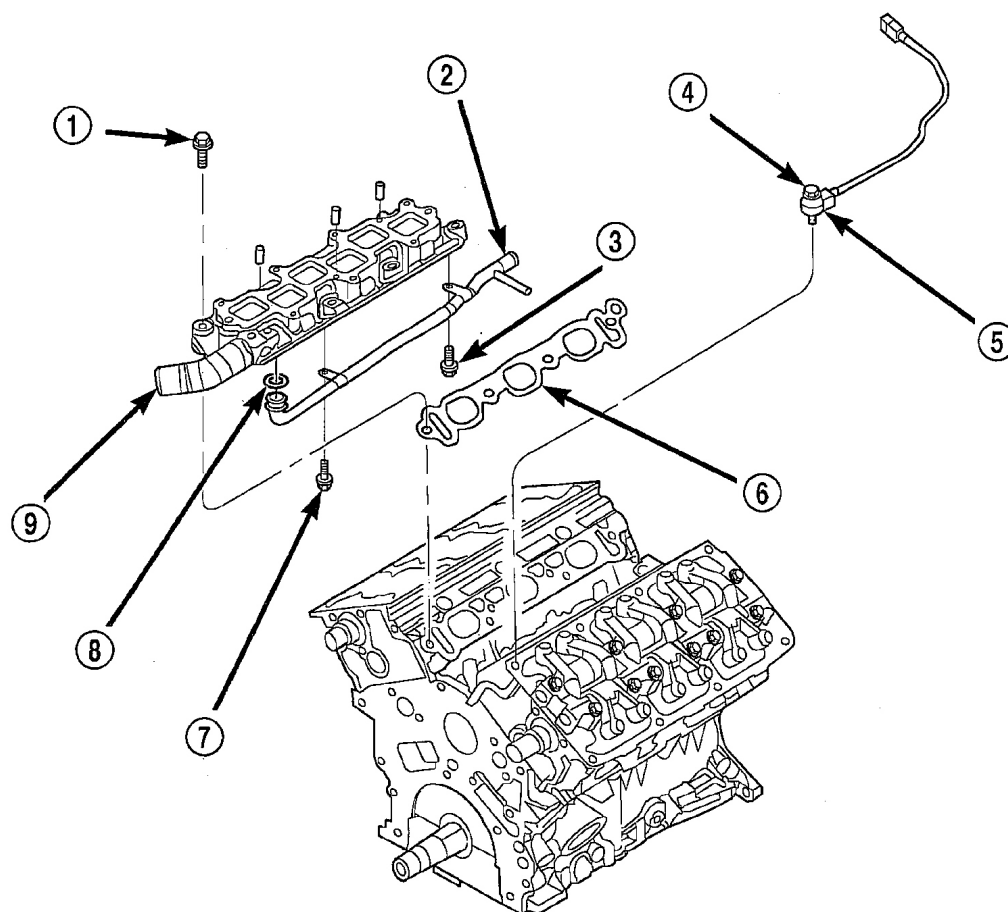
1 - INTAKE MANIFOLD-UPPER  
2 - BOLT

G03512004

**Fig. 151: Upper Intake Manifold**  
Courtesy of DAIMLERCHRYSLER CORP.

The aluminum lower intake manifold attaches to each cylinder head and uses a gasket for sealing (**Fig. 152**). The manifold coolant passage allows coolant to flow between cylinder heads. An attached steel tube, allows

coolant flow to the heater.



- 1 - BOLT
- 2 - HEATER SUPPLY TUBE
- 3 - BOLT
- 4 - BOLT
- 5 - KNOCK SENSOR

- 6 - GASKET
- 7 - BOLT
- 8 - O-RING
- 9 - INTAKE MANIFOLD-LOWER

G03512005

**Fig. 152: Lower Intake Manifold**

Courtesy of DAIMLERCHRYSLER CORP.

## DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

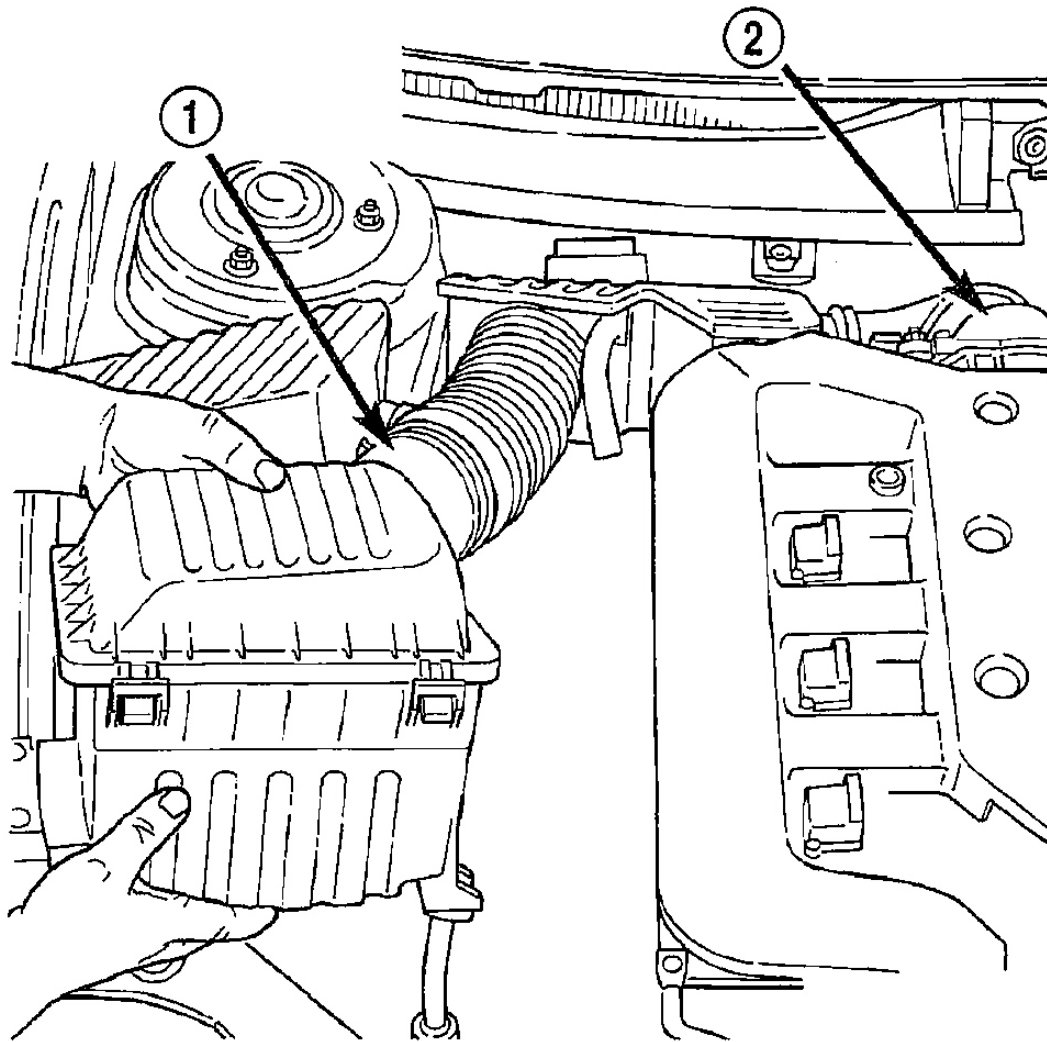
**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.**

1. Start the engine.
2. Spray a small stream of water (Spray Bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.
4. Repair as required.

## **INTAKE MANIFOLD - UPPER**

### **REMOVAL**

1. Disconnect negative cable from remote jumper terminal.
2. Disconnect the Inlet Air Temperature (IAT) Sensor connector. Remove air cleaner housing and inlet hose (**Fig. 153** ).



1 - AIR CLEANER ASSEMBLY WITH AIR INLET HOSE

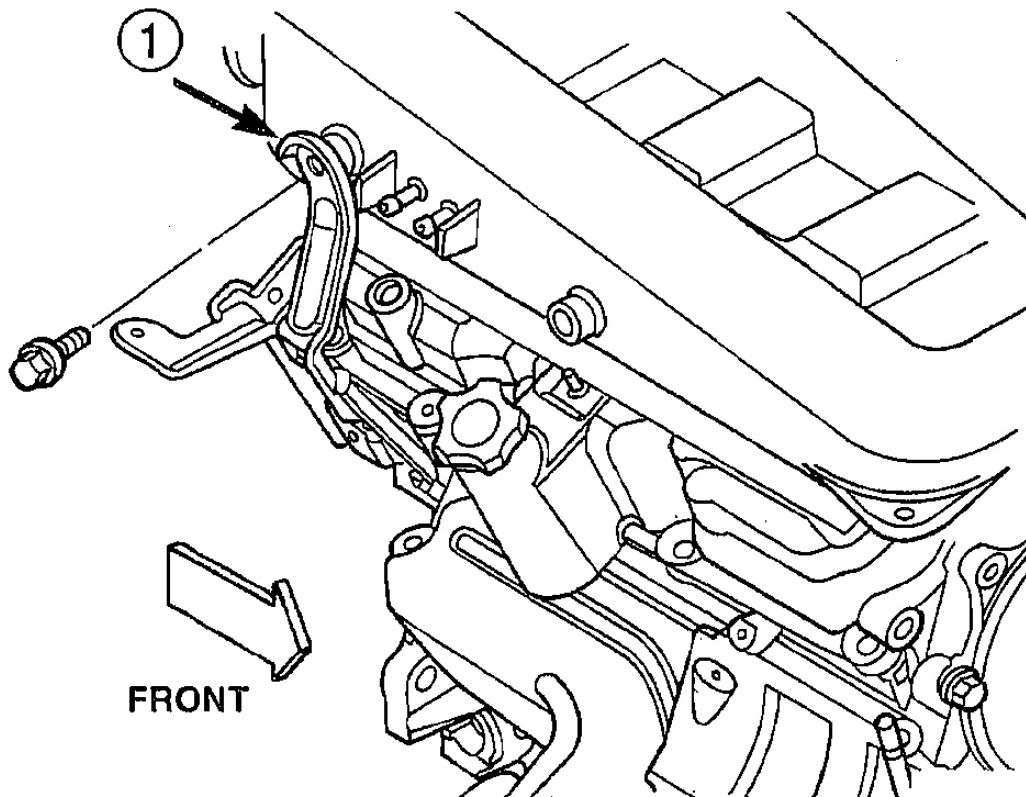
2 - THROTTLE BODY

G03512006

**Fig. 153: Air Cleaner With Inlet Hose**  
 Courtesy of DAIMLERCHRYSLER CORP.

3. Remove throttle and speed control cables from throttle arm and bracket (Refer to **THROTTLE CONTROL CABLE** ).
4. Disconnect electrical connectors from the following sensors and actuators:
  - Short Runner Valve (SRV)(If Equipped)

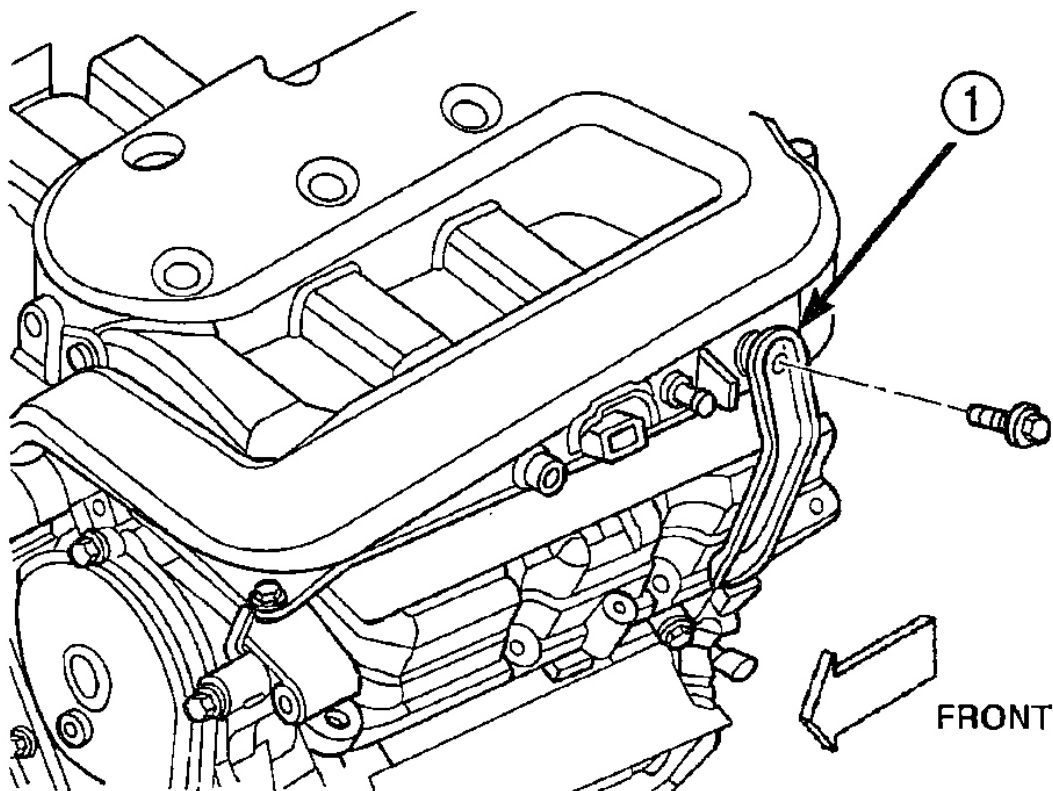
- Manifold Tuning Valve (MTV)(If Equipped)
  - Throttle Position Sensor (TPS)
  - Idle Air Control (IAC)
  - Manifold Absolute Pressure (MAP)
5. Disconnect vacuum hoses from the following:
- Speed Control Reservoir
  - Positive Crankcase Ventilation (PCV) Valve
  - Proportional Purge Solenoid
  - Power Brake Booster
6. Remove right side (**Fig. 154** ) and left side (**Fig. 155** ) intake manifold supports.



1 - SUPPORT BRACKET

G03512007

**Fig. 154: Intake Manifold Support - Right**  
**Courtesy of DAIMLERCHRYSLER CORP.**

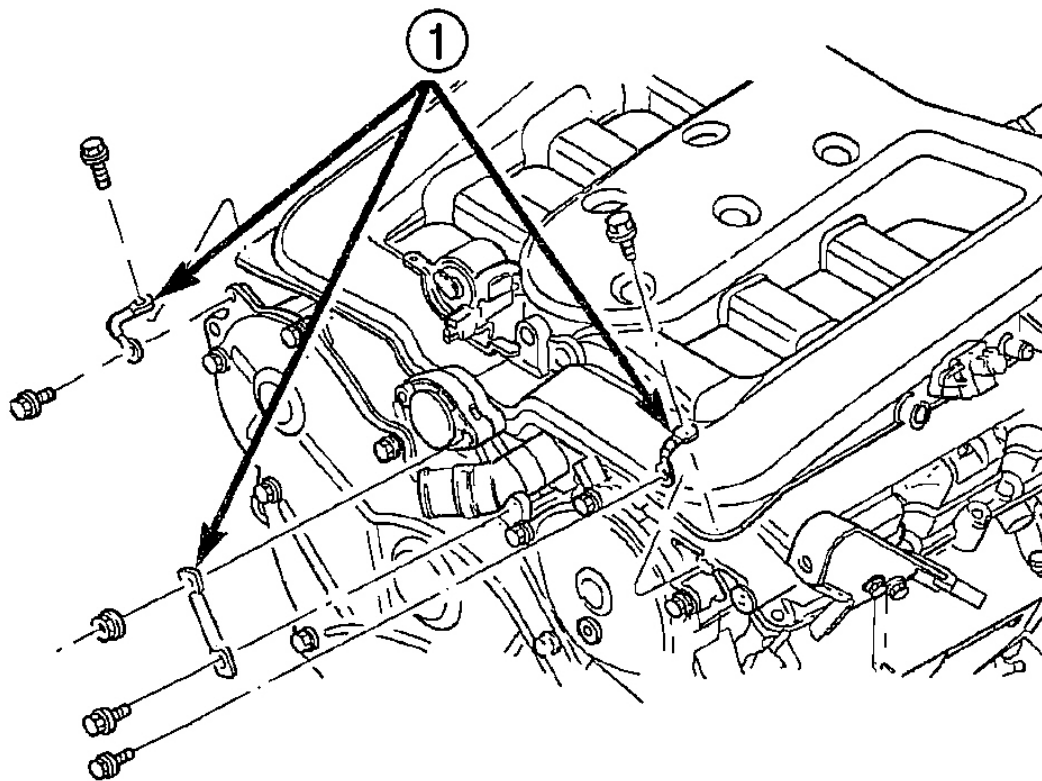


1 - SUPPORT BRACKET

G03512008

**Fig. 155: Intake Manifold Support - Left**  
Courtesy of DAIMLERCHRYSLER CORP.

7. Remove support brackets at intake manifold front corners and at MTV (**Fig. 156** ).

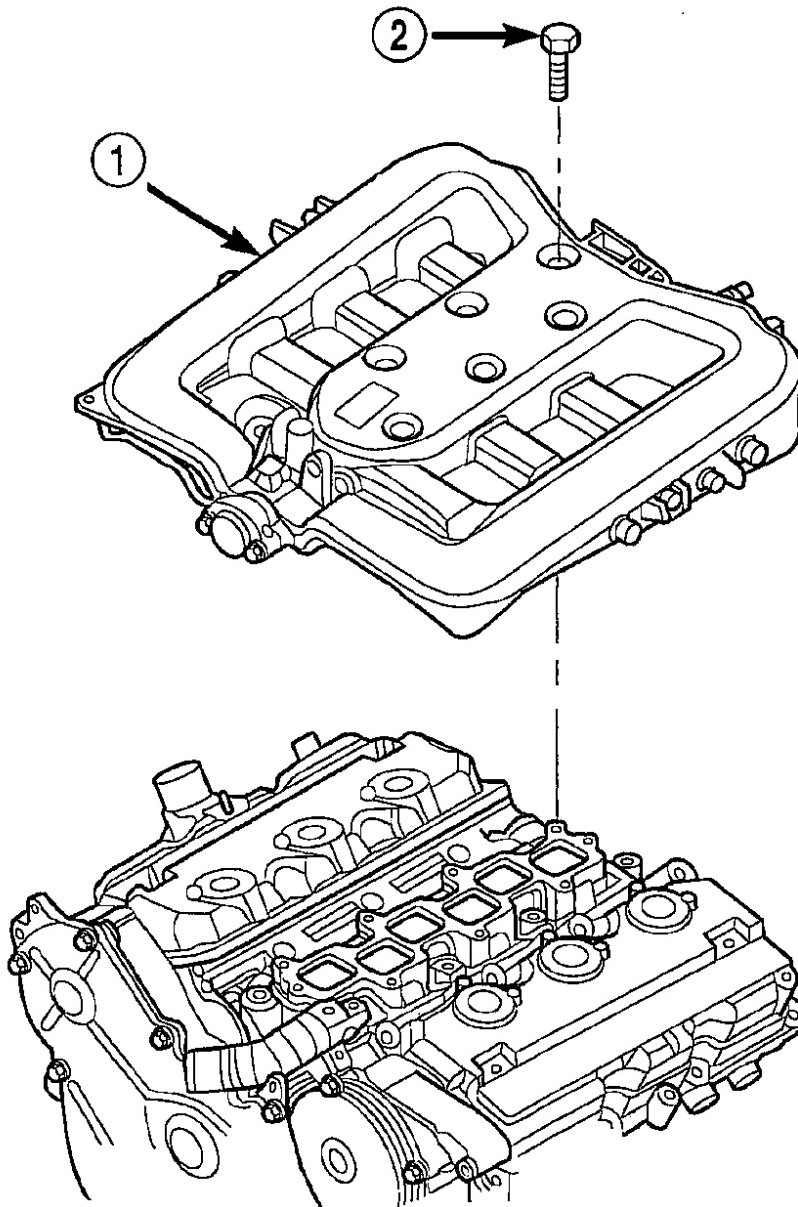


1 · SUPPORT BRACKETS

G03512009

**Fig. 156: Intake Manifold Supports - Front**  
Courtesy of DAIMLERCHRYSLER CORP.

8. Loosen upper fastener attaching throttle body to support bracket.
9. Remove bolts attaching intake manifold and remove manifold (**Fig. 157**).



1 - INTAKE MANIFOLD-UPPER

2 - BOLT

G03512010

**Fig. 157: Upper Intake Manifold**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSPECTION

Check manifold for:

- Damage and cracks
- Gasket surface damage or warpage
- Damaged or clogged EGR ports

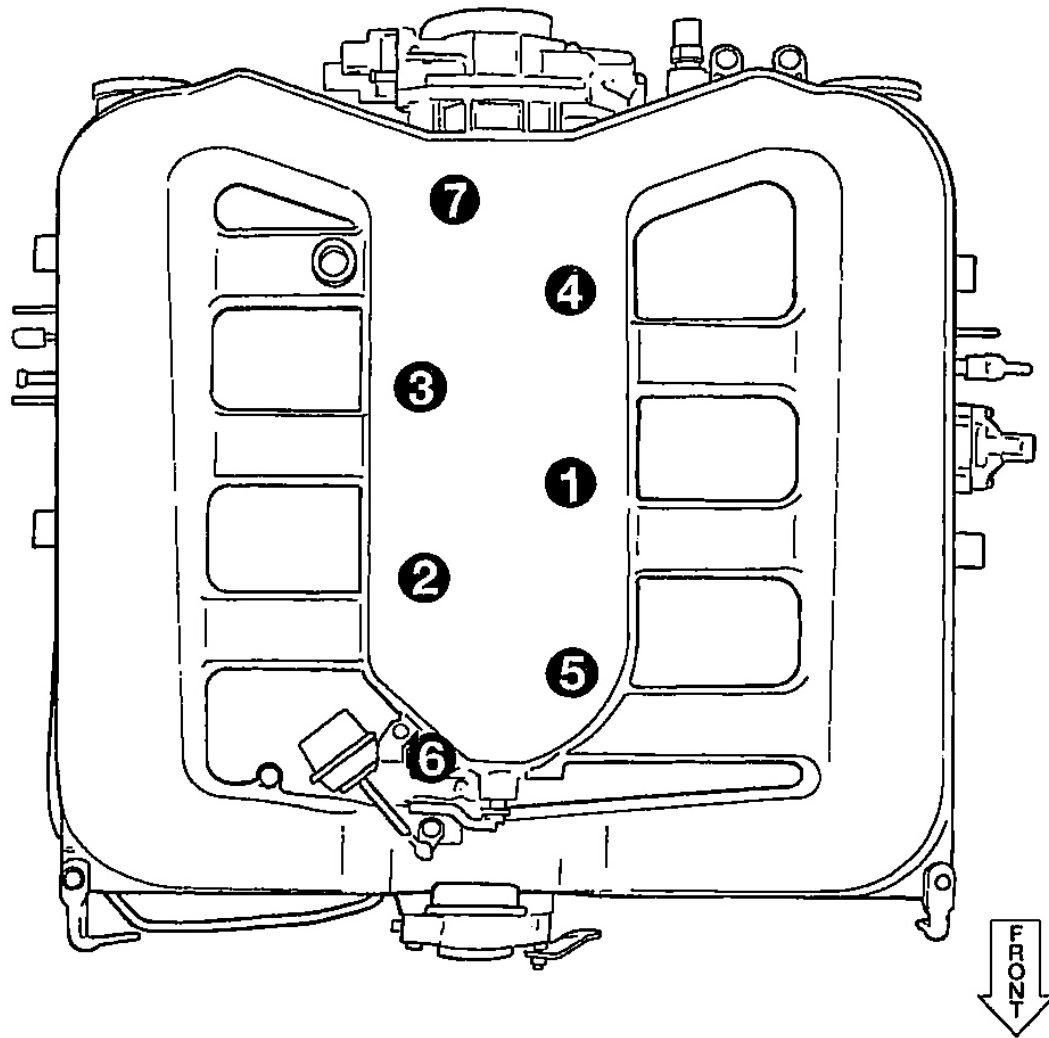
If the manifold exhibits any damaged or warped conditions, replace the manifold. Clean EGR ports as necessary.

## INSTALLATION

1. Clean and inspect gasket sealing surfaces.

**NOTE:** Intake gaskets can be reused, provided they are free of cuts or tears.

2. Inspect gasket for cuts or tears. Replace gaskets as necessary.
3. Install intake manifold (**Fig. 157**) and hand start all attaching bolts.
4. Tighten bolts gradually in sequence shown in (**Fig. 158**) until a torque of 12 N.m (105 in. lbs.) is obtained.



G03512011

**Fig. 158: Upper Intake Manifold Tightening**  
Courtesy of DAIMLERCHRYSLER CORP.

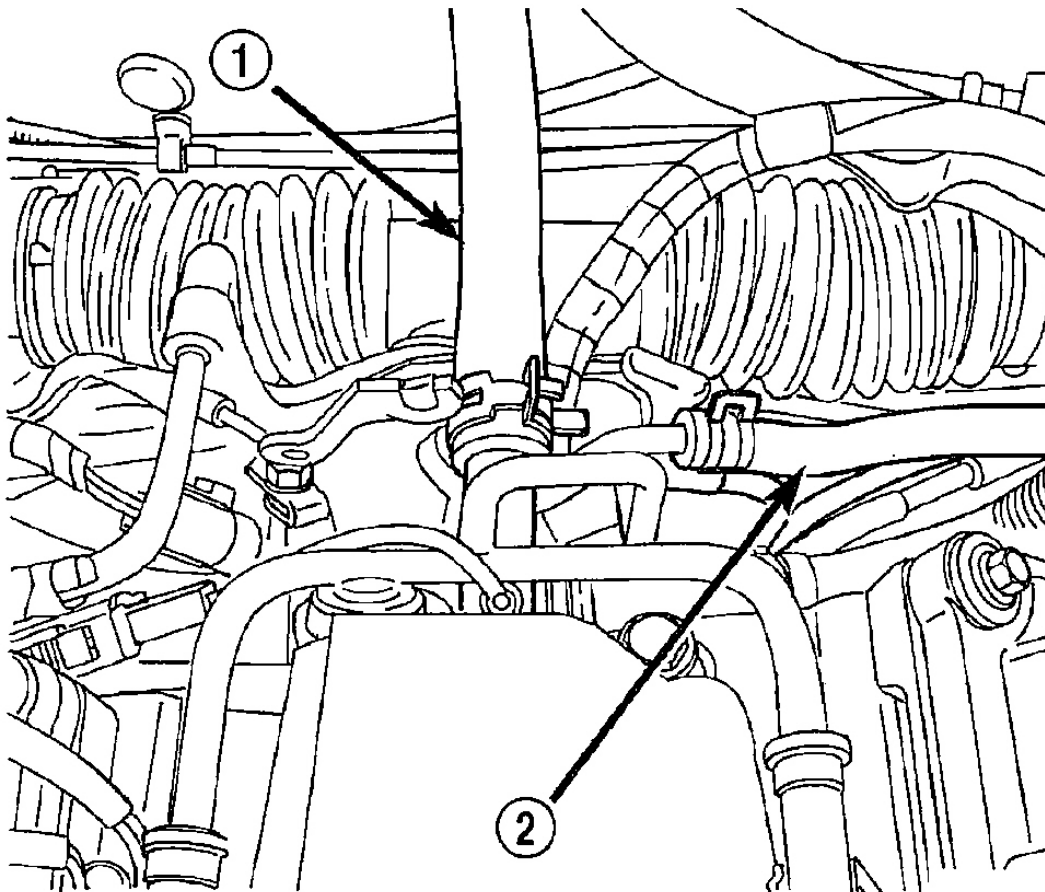
5. Install right side (**Fig. 154** ) and left side (**Fig. 155** ) intake manifold supports.
6. Install manifold support brackets at front corners and at MTV (**Fig. 156** ).
7. Tighten fastener attaching throttle body to support bracket.
8. Connect vacuum lines to the following:
  - Speed Control Reservoir
  - Positive Crankcase Ventilation (PCV) Valve
  - Proportional Purge Solenoid
  - Power Brake Booster

9. Connect electrical connectors to the following:
  - Short Runner Valve (SRV)(If Equipped)
  - Manifold Tuning Valve (MTV)(If Equipped)
  - Throttle Position Sensor (TPS)
  - Idle Air Control (IAC)
  - Manifold Absolute Pressure (MAP)
10. Install throttle and speed control cables to bracket and throttle arm (Refer to **THROTTLE CONTROL CABLE** ).
11. Install air cleaner housing and inlet hose (**Fig. 153** ). Connect Inlet Air Temperature (IAT) Sensor connector.
12. Connect negative cable to remote jumper terminal.

## **INTAKE MANIFOLD - LOWER**

### **REMOVAL**

1. Perform fuel pressure release procedure. (Refer to **STANDARD PROCEDURE - FUEL SYSTEM PRESSURE REL** )
2. Drain the cooling system. (Refer to **STANDARD PROCEDURE** )
3. Disconnect the radiator upper hose from the coolant outlet at front of manifold.
4. Remove the upper intake manifold. (Refer to **INTAKE MANIFOLD - UPPER** )
5. Disconnect the electrical connectors to fuel injectors and coolant temperature sensor.
6. Disconnect heater and coolant bottle supply hoses from coolant tube at rear of intake manifold (**Fig. 159** ).

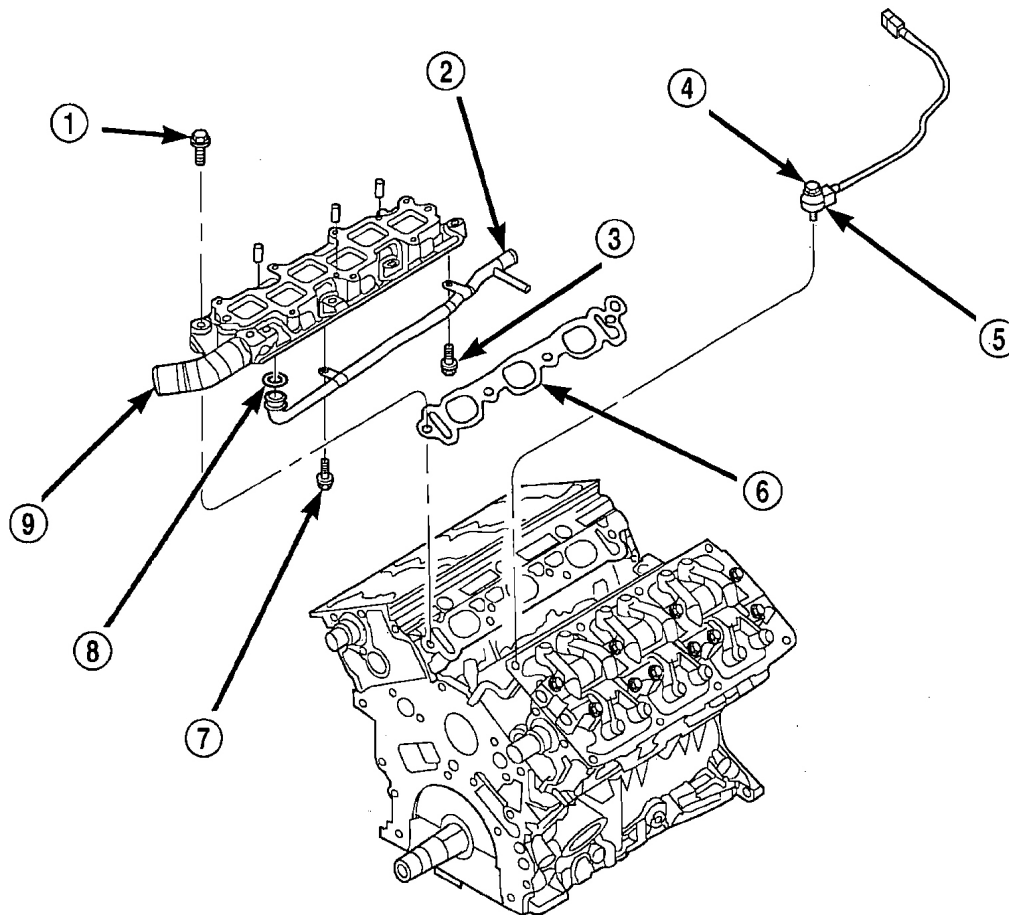


1 - HEATER SUPPLY HOSE  
2 - COOLANT BOTTLE SUPPLY HOSE

G03512012

**Fig. 159: Heater Supply Hose Connections**  
Courtesy of DAIMLERCHRYSLER CORP.

7. Disconnect the fuel supply hose from fuel rail. (Refer to **STANDARD PROCEDURE - HOSES AND CLAMP** )
8. Remove the screw attaching the fuel rail support bracket to the throttle body support bracket.
9. Remove the bolts attaching fuel rail.
10. Remove fuel rail and injectors as an assembly.
11. Remove bolts attaching lower intake and remove intake manifold (**Fig. 160** ).



- 1 - BOLT
- 2 - HEATER SUPPLY TUBE
- 3 - BOLT
- 4 - BOLT
- 5 - KNOCK SENSOR

- 6 - GASKET
- 7 - BOLT
- 8 - O-RING
- 9 - INTAKE MANIFOLD-LOWER

G03512013

**Fig. 160: Lower Intake Manifold**  
**Courtesy of DAIMLERCHRYSLER CORP.**

## INSPECTION

Check manifold for:

- Damage and cracks
- Gasket surface damage or warpage
- Damaged fuel injector ports

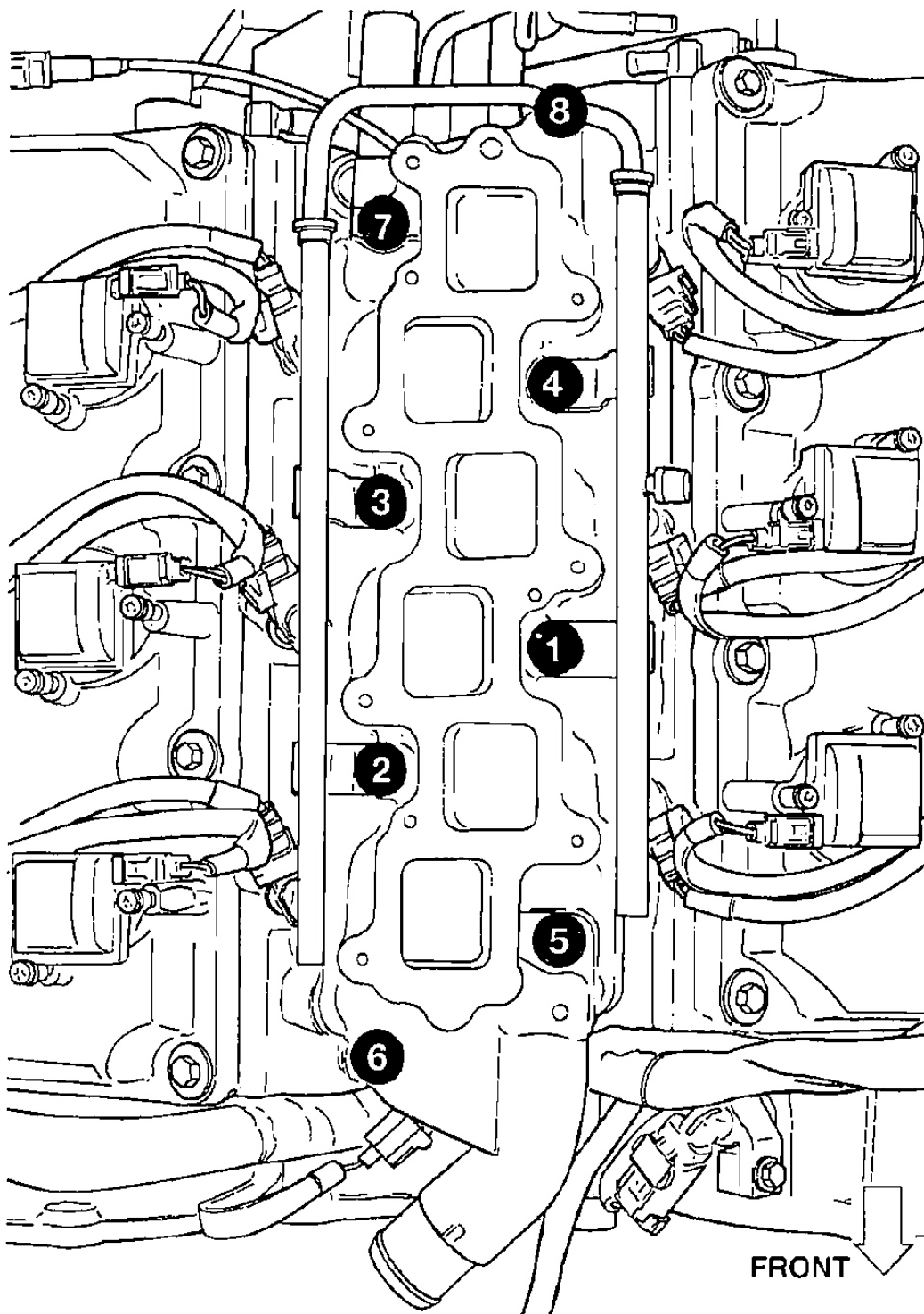
If the manifold exhibits any of these conditions, replace the manifold.

**INSTALLATION**

1. Clean all sealing surfaces.

**NOTE:**        **Gaskets can be reused provided they are free of tears or cuts.**

2. Inspect gaskets for tears or cuts. Replace as necessary.
3. Position gaskets and intake manifold on cylinder head surfaces.
4. Install fuel rail with injectors.
5. Install intake manifold bolts and gradually tighten in sequence shown in (**Fig. 161** ) until a torque of 28 N.m (250 in. lbs.) is obtained.



G03512014

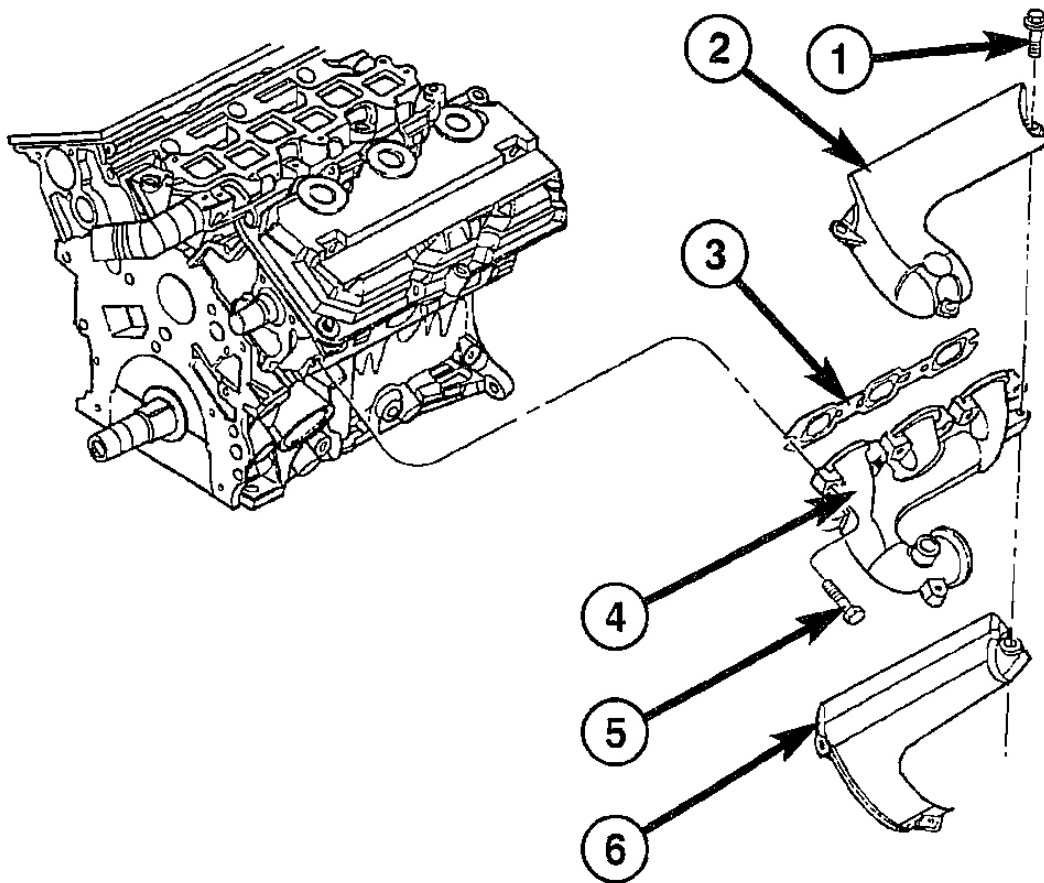
**Fig. 161: Lower Intake Manifold Tightening**

**Courtesy of DAIMLERCHRYSLER CORP.**

6. Install screw attaching fuel rail support bracket to the throttle body support bracket.
7. Connect fuel supply hose to fuel rail. (Refer to **STANDARD PROCEDURE - HOSES AND CLAMP** )
8. Connect heater and coolant bottle supply hoses to coolant tube at rear of intake manifold (**Fig. 159** ).
9. Connect electrical connectors to fuel injectors and coolant temperature sensor.
10. Install the upper intake manifold. (Refer to **INTAKE MANIFOLD - UPPER** )
11. Connect the radiator upper hose to the coolant outlet at front of lower manifold.
12. Fill the cooling system. (Refer to **STANDARD PROCEDURE** )

**EXHAUST MANIFOLD****DESCRIPTION**

Both manifolds are a log style made of ductile cast iron (**Fig. 162** ). The outlets are designed for V-Band clamp attachment of close coupled catalytic converters.



- 1 - BOLT - HEAT SHIELD
- 2 - HEAT SHIELD
- 3 - GASKET
- 4 - EXHAUST MANIFOLD
- 5 - BOLT - EXHAUST MANIFOLD
- 6 - HEAT SHIELD

G03512015

**Fig. 162: Exhaust Manifold**  
Courtesy of DAIMLERCHRYSLER CORP.

## EXHAUST MANIFOLD - RIGHT

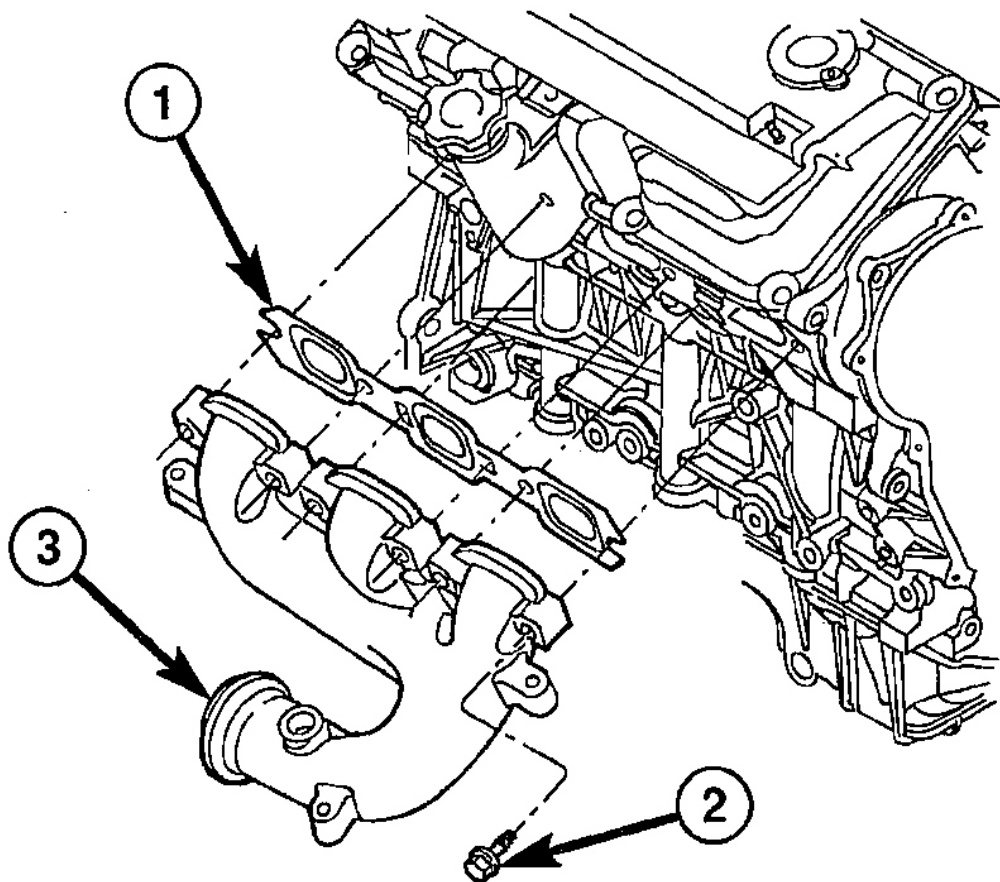
### REMOVAL

1. Disconnect negative cable from remote jumper terminal.

2. Raise vehicle on hoist.
3. Remove the exhaust system. (Refer to **EXHAUST SYSTEM** )
4. Loosen converter pipe support attaching bolt at transaxle mount.
5. Loosen the A/C belt. (Refer to **ACCESSORY DRIVE** )
6. Lower vehicle.
7. Remove air cleaner housing and air inlet tube.
8. Loosen and remove V-Band clamp at exhaust manifold connector.

**NOTE:        Do not reuse V-Band clamp.**

9. Remove the A/C compressor attaching bolts and set compressor aside.
10. Remove engine oil dipstick tube.
11. Remove the A/C compressor bracket.
12. Disconnect oxygen sensor electrical connector and remove sensor.
13. Remove heat shield attaching bolts and remove heat shields (**Fig. 162** ).
14. Remove the exhaust manifold, attaching bolts (**Fig. 163** ).



- 1 - GASKET
- 2 - BOLT - EXHAUST MANIFOLD
- 3 - EXHAUST MANIFOLD

G03512016

**Fig. 163: Exhaust Manifold - Right Side**  
Courtesy of DAIMLERCHRYSLER CORP.

15. Remove the exhaust manifold and gasket (**Fig. 163**).

## INSPECTION

1. Inspect exhaust manifolds for damage or cracks.
2. Check manifold flatness.
3. Inspect the exhaust manifold gasket for obvious discoloration or distortion.

4. Check distortion of the cylinder head mounting surface with a straightedge and thickness gauge.

## INSTALLATION

1. Install exhaust manifold and gasket. Tighten bolts starting at the center working outward to 23 N.m (200 in. lbs.) (**Fig. 163** ).
2. Install heat shields and tighten attaching bolts to 12 N.m (105 in. lbs.) (**Fig. 162** ).
3. Install oxygen sensor to manifold and connect electrical connector.
4. Install the A/C compressor mounting bracket.
5. Install engine oil dipstick tube.
6. Install the A/C compressor and drive belt. For belt installation procedure, (Refer to **ACCESSORY DRIVE** ).
7. Install a new V-Band clamp and tighten to 11 N.m (100 in. lbs.).
8. Raise vehicle on hoist.
9. Install the exhaust system. (Refer to **EXHAUST SYSTEM** )
10. Install and/or tighten nut attaching converter pipe support to transaxle mount to 47 N.m (35 ft. lbs.).
11. Lower the vehicle.
12. Install air cleaner housing and air inlet tube.
13. Connect negative cable.

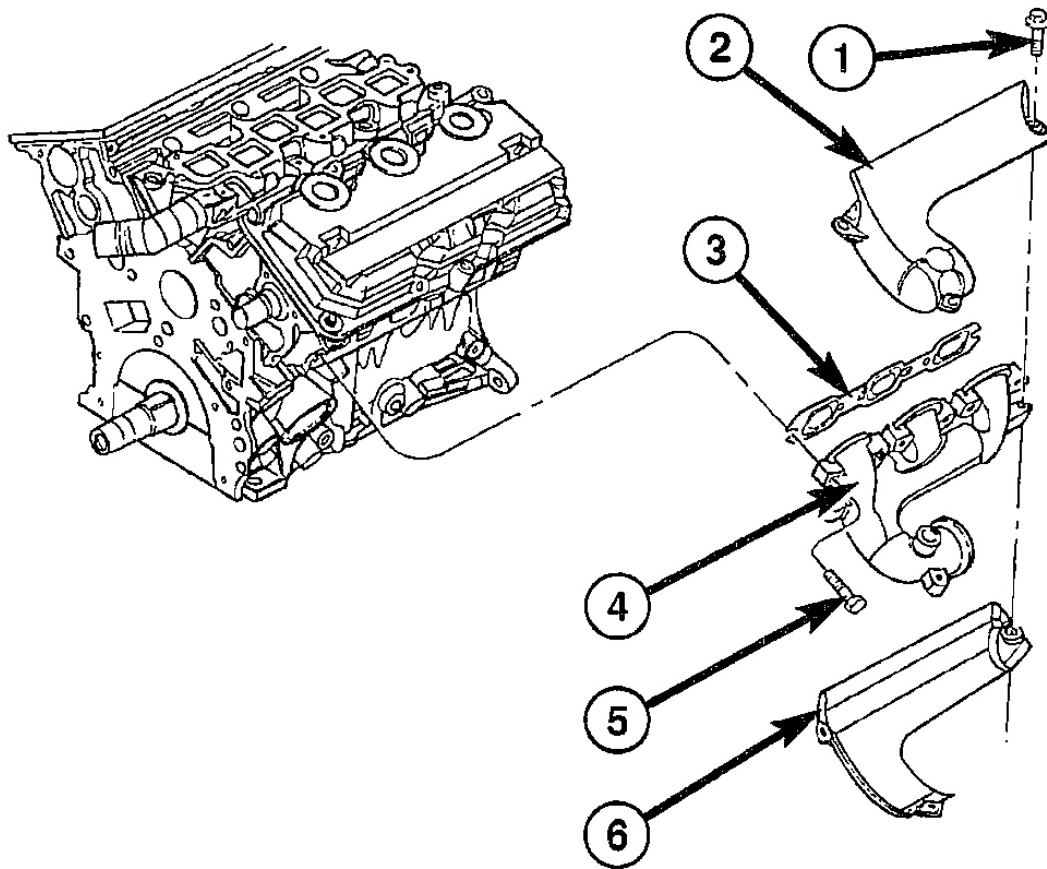
## EXHAUST MANIFOLD - LEFT

### REMOVAL

1. Disconnect negative cable from remote jumper terminal.
2. Raise the vehicle on hoist.
3. Remove the exhaust system. (Refer to **EXHAUST SYSTEM** )
4. Loosen converter pipe support attaching bolt at transaxle mount.
5. Lower the vehicle.
6. Loosen and remove the V-Band clamp at exhaust manifold connector.

**NOTE:**        **Do not reuse V-Band clamp.**

7. Remove electrical connector harness bracket.
8. Disconnect oxygen sensor electrical connector and remove sensor from manifold.
9. Remove heat shield attaching bolts and remove heat shield (**Fig. 164** ).



- 1 - BOLT - HEAT SHIELD
- 2 - HEAT SHIELD
- 3 - GASKET
- 4 - EXHAUST MANIFOLD
- 5 - BOLT - EXHAUST MANIFOLD
- 6 - HEAT SHIELD

G03512017

**Fig. 164: Exhaust Manifold**

Courtesy of DAIMLERCHRYSLER CORP.

- 10. Remove exhaust manifold attaching bolts (**Fig. 164**).
- 11. Remove exhaust manifold and gasket (**Fig. 164**).

## INSPECTION

- 1. Inspect exhaust manifolds for damage or cracks.

2. Check manifold flatness.
3. Inspect the exhaust manifold gasket for obvious discoloration or distortion.
4. Check distortion of the cylinder head mounting surface with a straightedge and thickness gauge.

## INSTALLATION

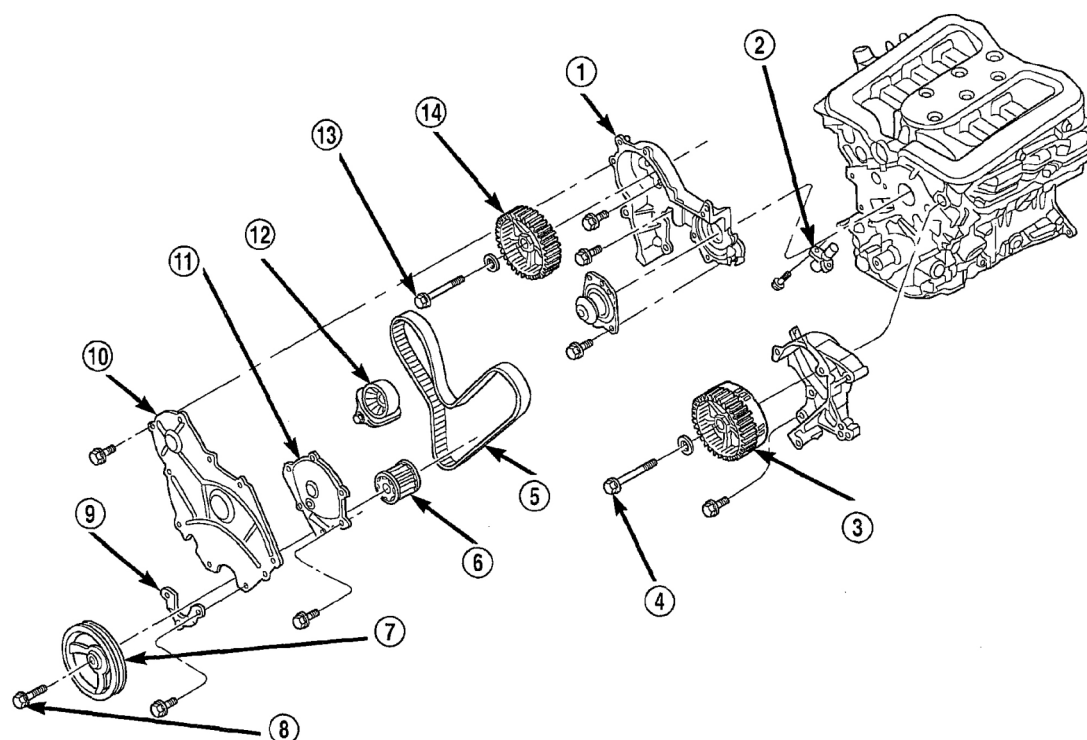
1. Install the exhaust manifold and gasket. Tighten bolts starting at the center working outward to 23 N.m (200 in. lbs.) (**Fig. 164** ).
2. Install heat shields and tighten bolts to 12 N.m (105 in. lbs.) (**Fig. 164** ).
3. Install oxygen sensor to manifold and connect electrical connector.
4. Attach electrical connector bracket to brace.
5. Install a new V-Band clamp and tighten to 11 N.m (100 In. lbs.).
6. Raise vehicle on hoist.
7. Install and/or tighten nut attaching converter pipe support to transaxle mount to 47 N.m (35 ft. lbs.).
8. Install the exhaust system. (Refer to **EXHAUST SYSTEM** )
9. Lower vehicle and connect negative cable.

## VALVE TIMING

### DESCRIPTION

The timing drive system (**Fig. 165** ) has been designed to provide quiet performance and reliability to support a **NON** free-wheeling engine.

The timing drive components include a crankshaft sprocket, camshaft sprockets, tensioner pulley, hydraulic tensioner and a timing belt. The water pump is driven by the back side of the timing belt. The right and left camshaft sprockets are not interchangeable because of the cam sensor pick-up wheel on the left sprocket.



- 1 - TIMING BELT COVER - RIGHT REAR
- 2 - TENSIONER-TIMING BELT
- 3 - CAMSHAFT SPROCKET
- 4 - BOLT-CAMSHAFT SPROCKET
- 5 - TIMING BELT
- 6 - CRANKSHAFT SPROCKET
- 7 - CRANKSHAFT DAMPER

G03512018

- 8 - BOLT-CRANKSHAFT DAMPER
- 9 - TIMING BELT COVER-LOWER
- 10 - TIMING BELT COVER-RIGHT
- 11 - TIMING BELT COVER-LEFT
- 12 - TENSIONER PULLEY
- 13 - BOLT-CAMSHAFT SPROCKET
- 14 - CAMSHAFT SPROCKET

**Fig. 165: Timing Drive System**

Courtesy of DAIMLERCHRYSLER CORP.

## STANDARD PROCEDURE - VALVE TIMING VERIFICATION

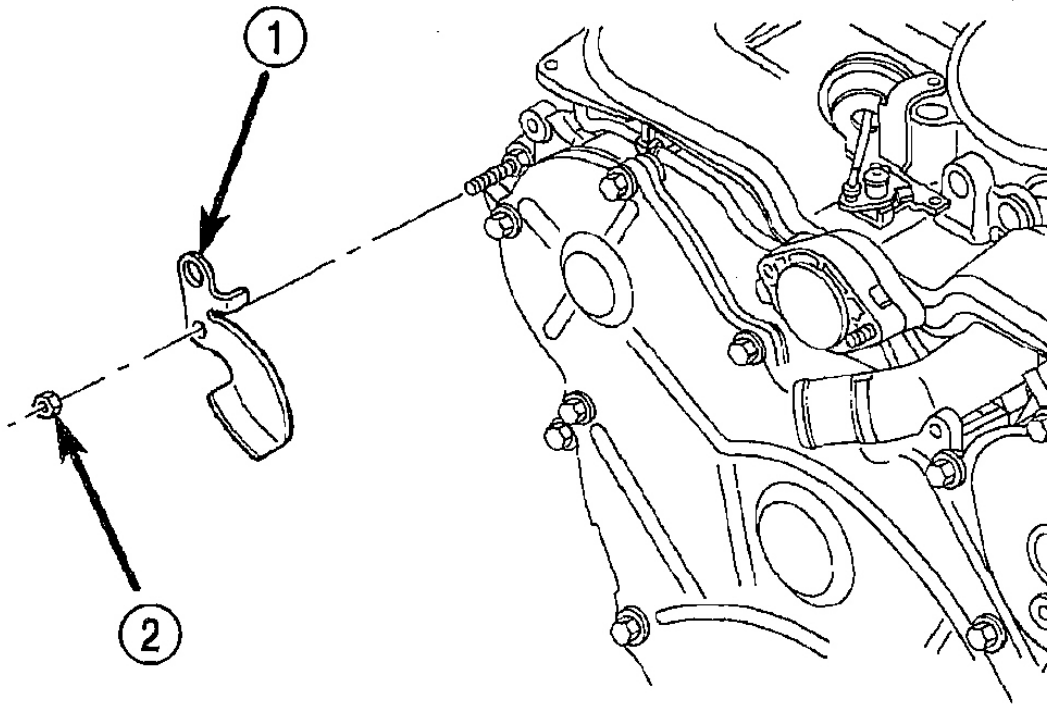
1. Refer to Camshaft Sprocket Removal procedure for verification of valve timing (Refer to **TIMING BELT AND SPROCKETS** )

## TIMING BELT COVER(S) - FRONT

### REMOVAL

1. Disconnect negative cable from remote jumper terminal.
2. Remove upper radiator crossmember. (Refer to **GRILLE OPENING REINFORCEMENT** )
3. Remove the radiator fan (Refer to **RADIATOR FAN** )
4. Remove the accessory drive belts. (Refer to **ACCESSORY DRIVE** )
5. Remove crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )

6. Remove the lower belt cover located behind the crankshaft vibration damper (**Fig. 167**).
7. Remove the A/C belt guide/lift bracket (**Fig. 166**).

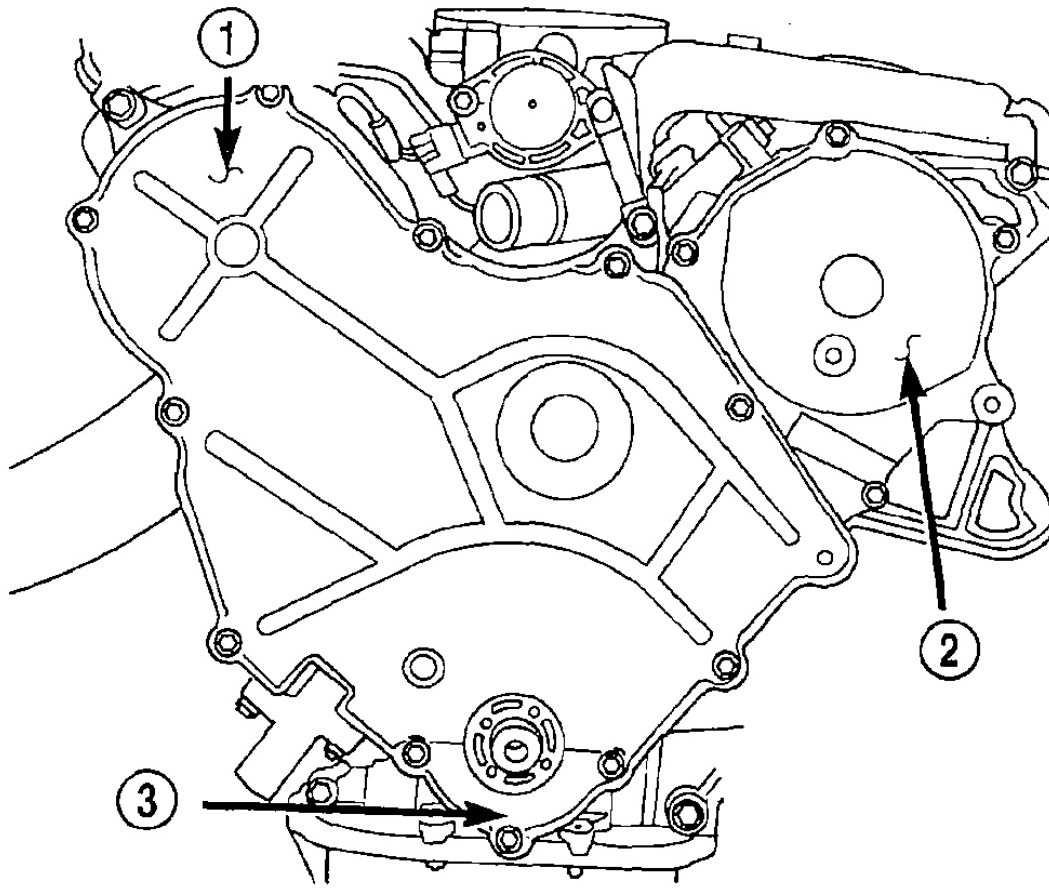


1 - A/C BELT GUIDE/LIFT BRACKET  
2 - NUT

G03512019

**Fig. 166: A/C Belt Guide/Lift Bracket**  
Courtesy of DAIMLERCHRYSLER CORP.

8. Remove the stamped steel cover (**Fig. 167**). **Do not remove the sealer on the cover, it is reusable (Fig. 168).** If some sealer is missing use Mopar(R) Engine RTV GEN II to replace the missing sealer.

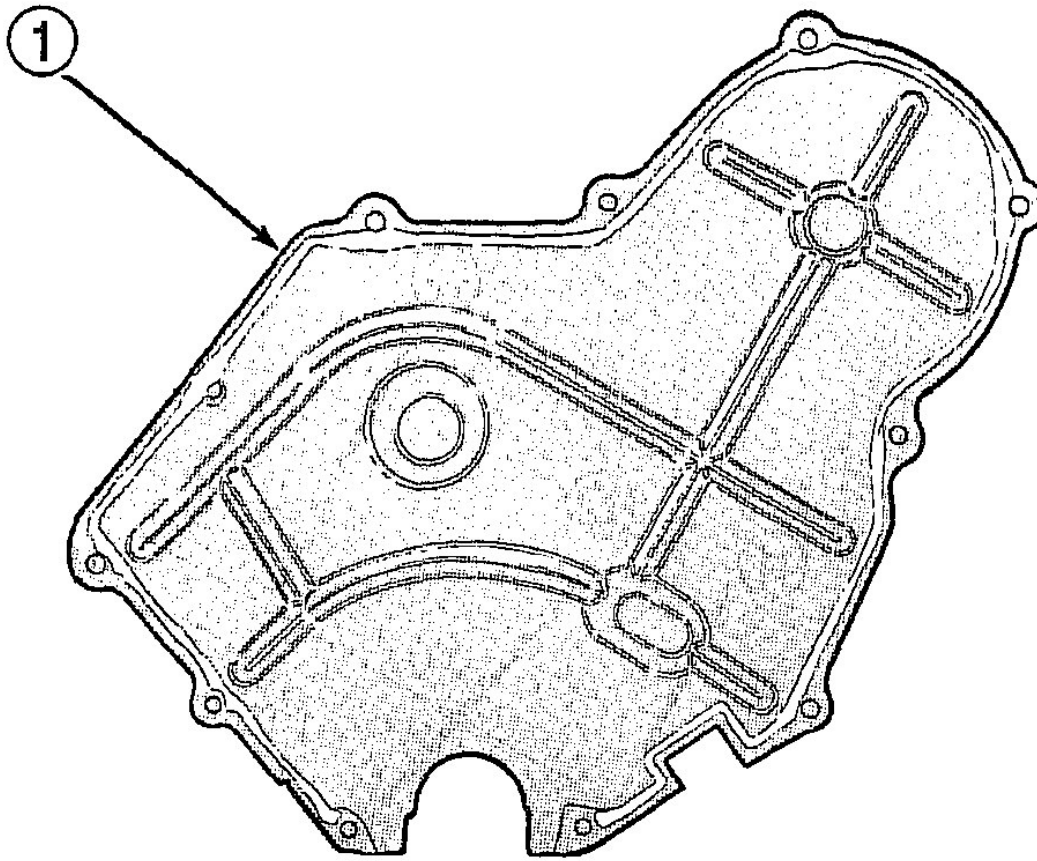


- 1 - RIGHT SIDE COVER (STAMPED)
- 2 - LEFT SIDE COVER (CAST)
- 3 - LOWER COVER

G03512020

**Fig. 167: Timing Belt Covers**

Courtesy of DAIMLERCHRYSLER CORP.



1 - SEALER

G03512021

**Fig. 168: Timing Belt Cover Sealer**  
Courtesy of DAIMLERCHRYSLER CORP.

9. Remove the left cast cover (**Fig. 167** ).

## INSTALLATION

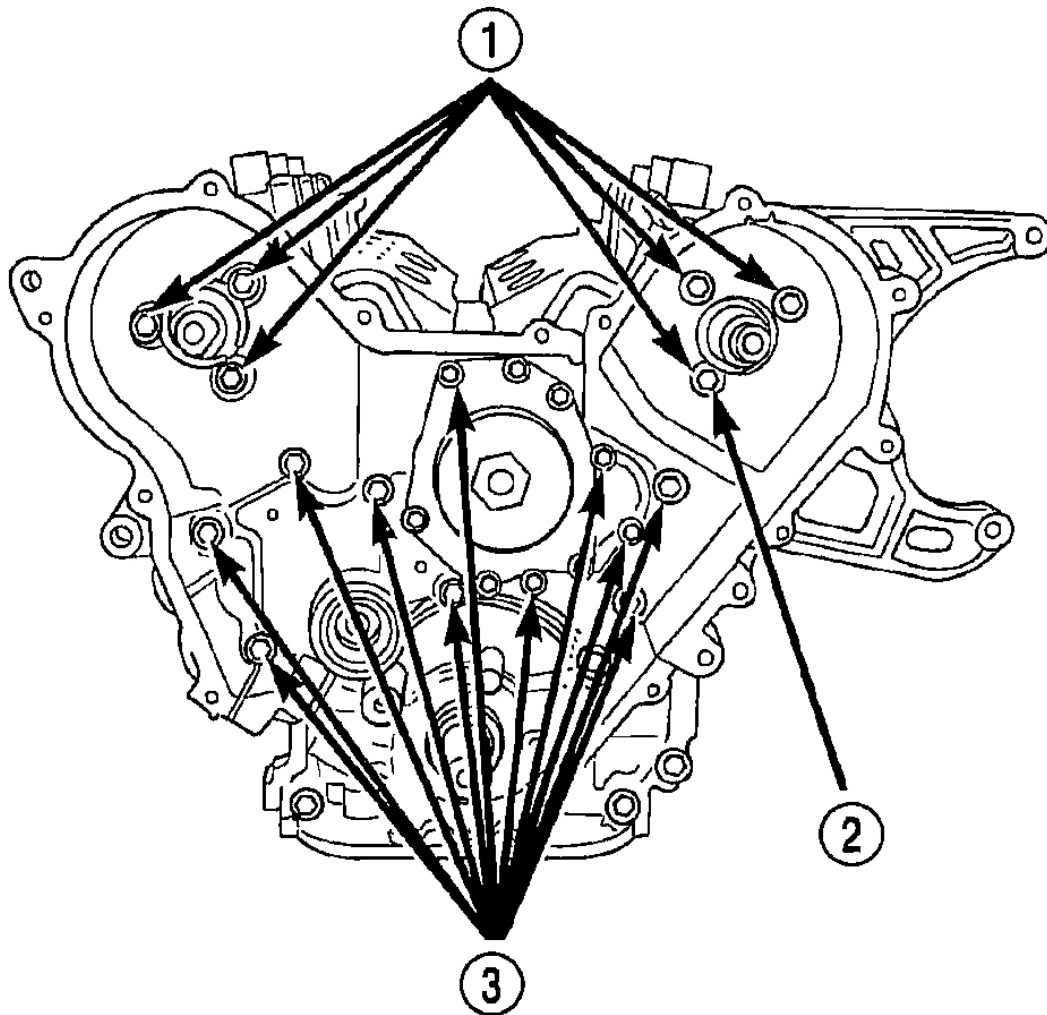
1. Install the left cast cover (**Fig. 167** ) and generator/power steering belt tensioner pulley and bracket.
2. Install the right stamped steel cover (**Fig. 167** ).
3. Install A/C belt guide/lift bracket (**Fig. 166** ).
4. Install the lower cover (**Fig. 167** ).
5. Install the crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )
6. Install the accessory drive belts. (Refer to **ACCESSORY DRIVE** )
7. Install the radiator fan. (Refer to **RADIATOR FAN** )

8. Install upper radiator crossmember. (Refer to **GRILLE OPENING REINFORCEMENT** )
9. Connect negative cable to remote jumper terminal.

## **TIMING BELT COVER(S) - REAR**

### **REMOVAL**

1. Remove camshaft sprocket(s). (Refer to **TIMING BELT AND SPROCKETS** )
2. Remove rear timing belt cover bolts (**Fig. 169** ).

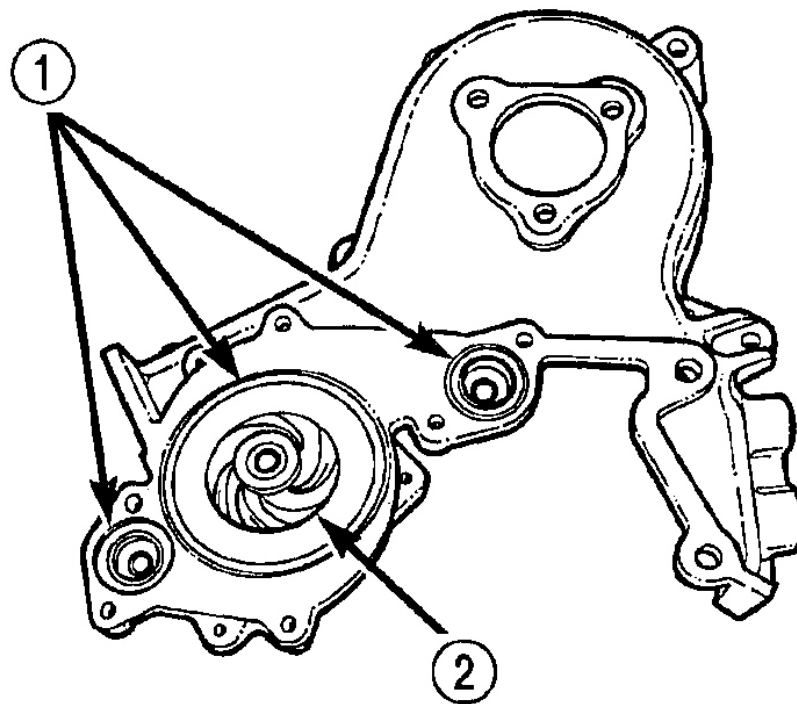


- 1 - REAR COVER TO CYLINDER HEAD BOLTS
  - 2 - APPLY SEALANT TO BOLT THREADS
  - 3 - REAR COVER TO CYLINDER BLOCK BOLTS
- G03512022

**Fig. 169: Rear Timing Belt Cover Bolts**  
 Courtesy of DAIMLERCHRYSLER CORP.

3. Remove the rear cover(s).

**NOTE:** The right side rear timing belt cover has O-rings to seal the water pump passages to cylinder block ([Fig. 170](#) ). Do not reuse the O-rings.

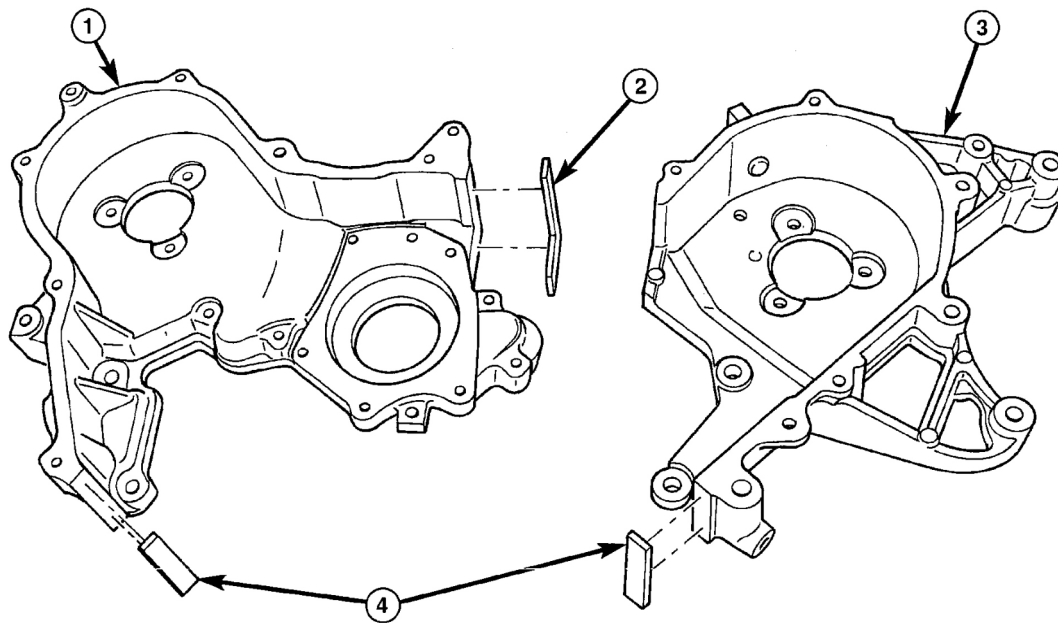


1 - O-RINGS  
2 - WATER PUMP IMPELLER  
G03512024

**Fig. 170: Right Side Timing Belt Cover O-Rings**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. Inspect the rear cover foam seals for damage or wear (**Fig. 171** ). Replace as necessary.

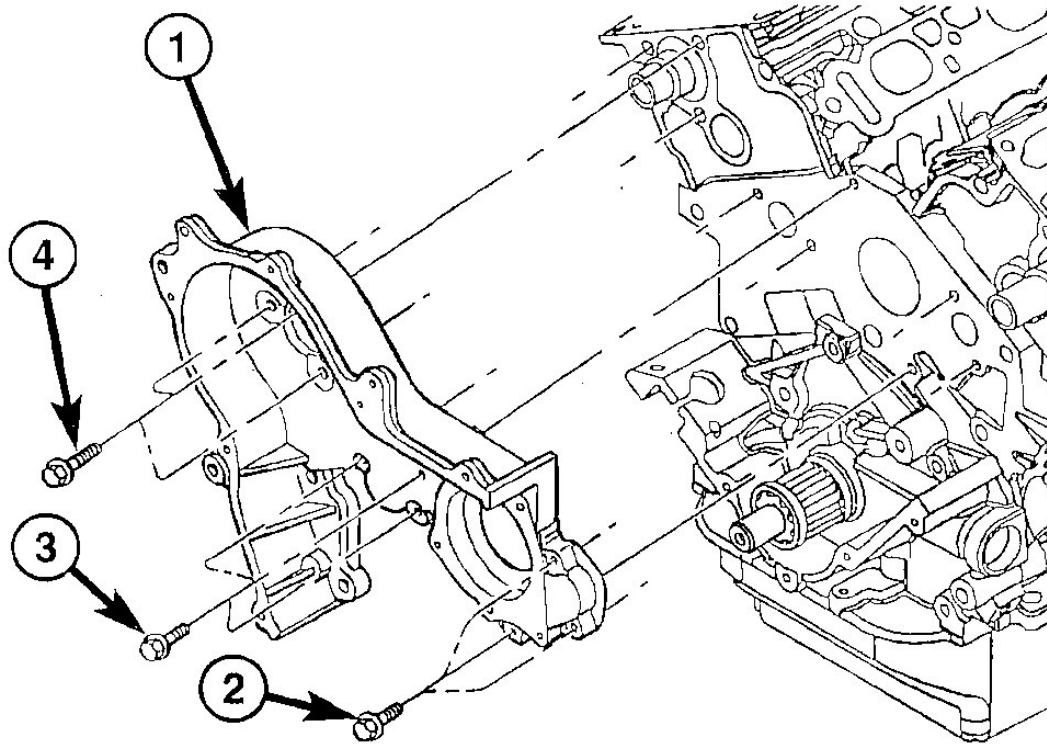


1 - REAR COVER - RIGHT SIDE  
2 - FOAM SEAL  
G03512023

3 - REAR COVER - LEFT SIDE  
4 - FOAM SEALS

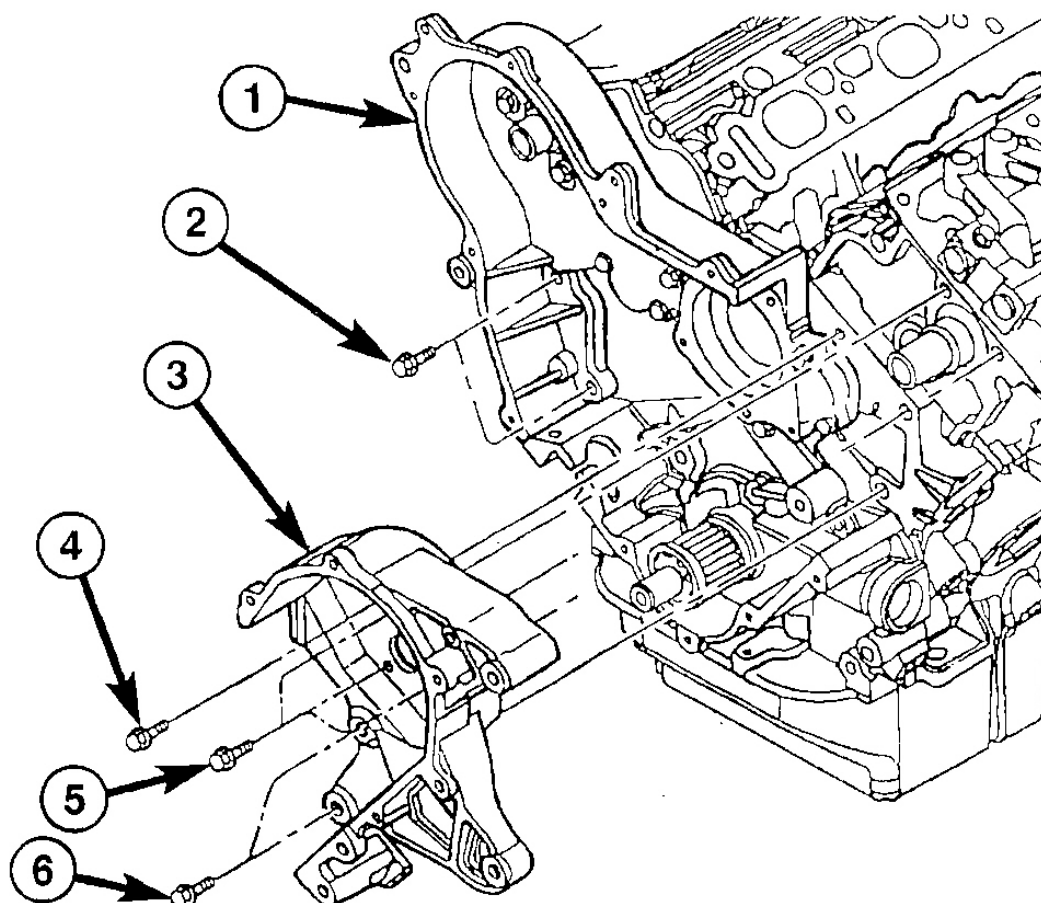
**Fig. 171: Timing Cover Rear Seals**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Clean right rear timing belt cover O-ring sealing surfaces and grooves (**Fig. 170**). Lubricate new O-rings with Mopar(R) Dielectric Grease or equivalent to facilitate assembly.
3. Position NEW O-rings on cover (**Fig. 170**).
4. Install rear timing belt covers (**Fig. 172**) and (**Fig. 173**). Tighten bolts to the following specified torque:
  - M10-54 N.m (40 ft. lbs.)
  - M8-28 N.m (20 ft. lbs.)
  - M6-12 N.m (105 in. lbs.)



- 1 - REAR COVER - RIGHT SIDE
  - 2 - BOLT
  - 3 - BOLT
  - 4 - BOLT
- G03512025

**Fig. 172: Rear Cover - Right**  
Courtesy of DAIMLERCHRYSLER CORP.



- 1 - REAR COVER - RIGHT SIDE
- 2 - BOLT
- 3 - REAR COVER - LEFT SIDE
- 4 - BOLT
- 5 - BOLT
- 6 - BOLT

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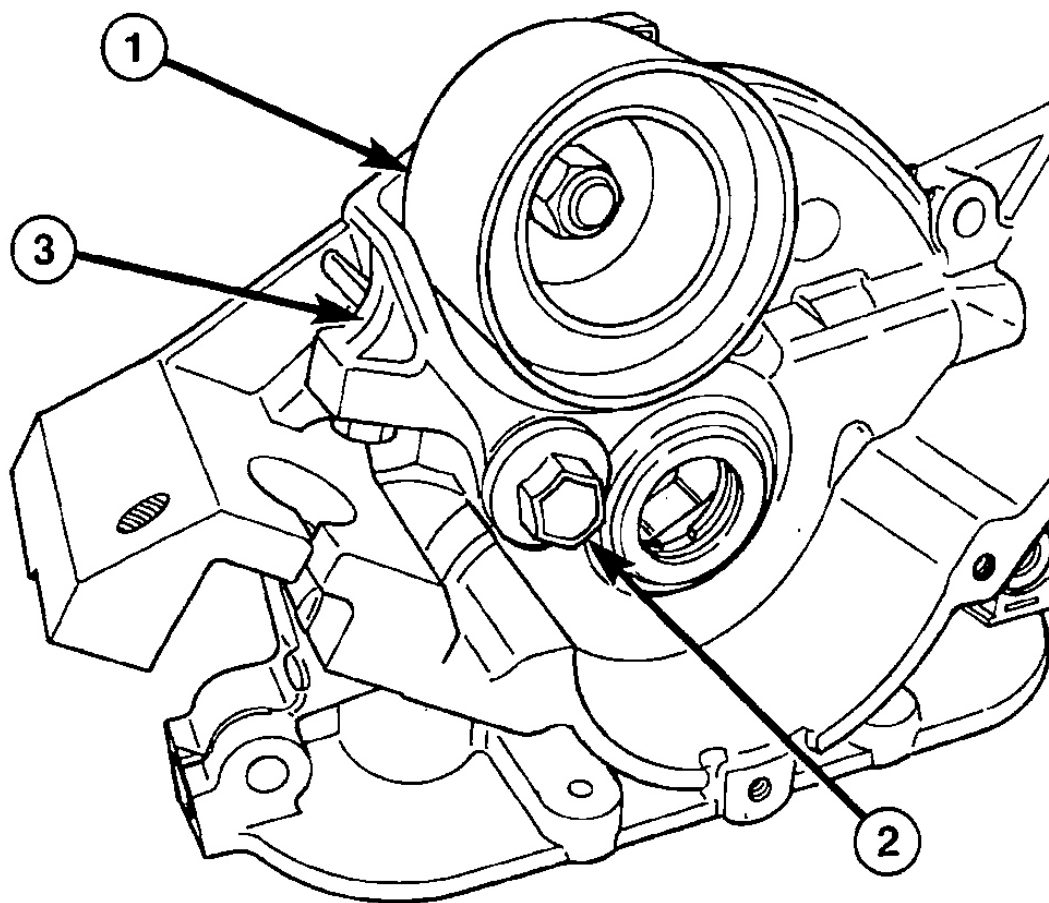
**Fig. 173: Rear Cover - Left**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Install camshaft sprockets and reassemble all components. (Refer to **TIMING BELT AND SPROCKETS** )

## TIMING BELT TENSIONER & PULLEY

**REMOVAL****REMOVAL - TENSIONER PULLEY ASSEMBLY**

1. Remove the timing belt. (Refer to **TIMING BELT AND SPROCKETS** )
2. Remove the timing belt tensioner pulley and bracket assembly by unscrewing the pivot bolt from the oil pump housing (**Fig. 174** ).



- 1 - TENSIONER PULLEY
- 2 - PIVOT BOLT
- 3 - TENSIONER BRACKET

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**Fig. 174: Tensioner Pulley Assembly**

**Courtesy of DAIMLERCHRYSLER CORP.**

## **REMOVAL - TENSIONER**

1. For timing belt tensioner removal procedure (Refer to **TIMING BELT AND SPROCKETS** )

## **INSPECTION**

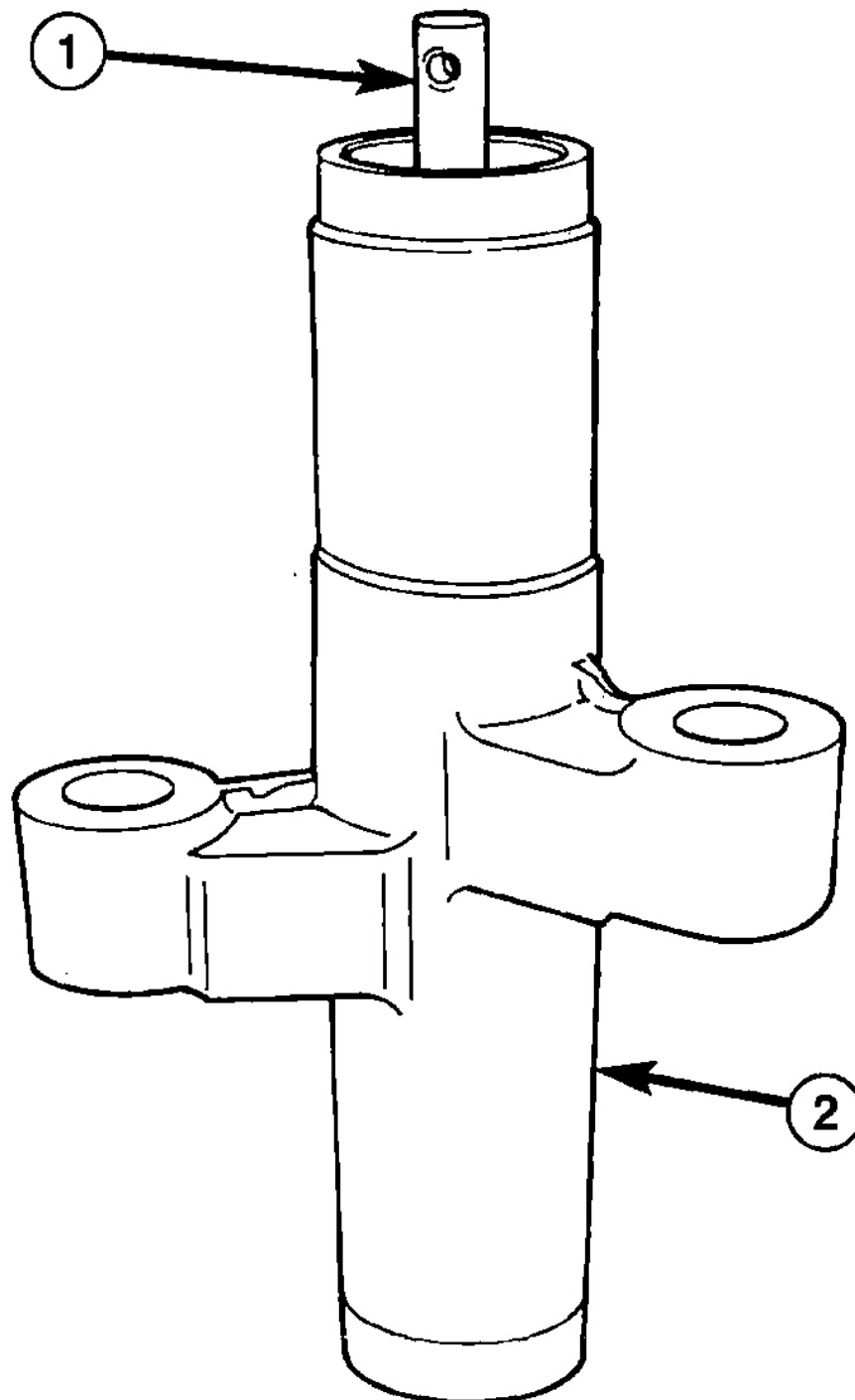
### **INSPECTION - TENSIONER PULLEY ASSEMBLY**

**NOTE:**        **The tensioner pulley, bracket, and pivot bolt is serviced as an assembly.**

1. Inspect pulley for free movement (**Fig. 174** ). Replace if pulley is loose, seized, or rough turning
2. Inspect pulley bearing and seal (**Fig. 174** ). Replace if damaged.
3. Inspect pivot bolt for free movement in tensioner bracket (**Fig. 174** ). Replace assembly if seized or excessive looseness.

### **INSPECTION - TENSIONER**

1. Inspect hydraulic tensioner for fluid loss around the plunger seal (**Fig. 175** ). Replace tensioner if leaking.



- 1 - PLUNGER (EXTENDED POSITION)
- 2 - TENSIONER HOUSING

G03512028

**Fig. 175: Timing Belt Tensioner**

Courtesy of DAIMLERCHRYSLER CORP.

**INSTALLATION****INSTALLATION - TENSIONER PULLEY ASSEMBLY**

1. Install the timing belt tensioner pulley assembly (**Fig. 174** ). Tighten the pivot bolt to 61 N.m (45 ft. lbs.).
2. Install the timing belt. (Refer to **TIMING BELT AND SPROCKETS** )

**INSTALLATION - TENSIONER**

1. For timing belt tensioner installation procedure (Refer to **TIMING BELT AND SPROCKETS** ).

**TIMING BELT AND SPROCKETS****REMOVAL****REMOVAL - TIMING BELT**

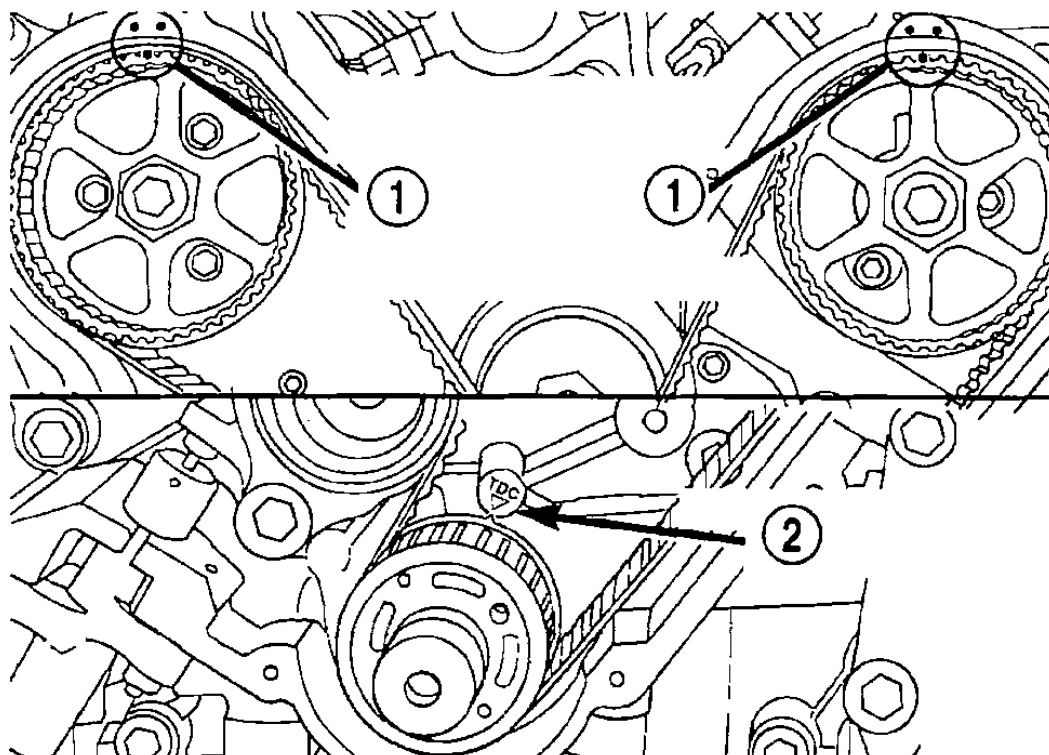
**CAUTION:** The following procedure can only be used when the camshaft sprockets **HAVE NOT BEEN LOOSENED** or removed from the camshafts. Once the camshaft sprockets are loosened, an engine timing procedure is required. This procedure is detailed in the Camshaft Removal and Installation procedures (Refer to **CAMSHAFT(S)** ).

**CAUTION:** The 3.2/3.5L are NOT freewheeling engines. Therefore, care should be taken not to rotate the camshafts or crankshaft with the timing belt removed.

1. Disconnect negative cable from remote jumper terminal.
2. Remove radiator upper crossmember. (Refer to **GRILLE OPENING REINFORCEMENT** )
3. Remove the radiator fan. (Refer to **RADIATOR FAN** )
4. Remove the accessory drive belts. (Refer to **ACCESSORY DRIVE** )
5. Remove the crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )
6. Remove the front timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** )
7. Mark belt running direction, if timing belt is to be reused.

**CAUTION:** When aligning timing marks, always rotate engine by turning the crankshaft. Failure to do so will result in valve and/or piston damage.

8. Rotate engine clockwise until crankshaft mark aligns with the TDC mark on oil pump housing and the camshaft sprocket timing marks are between the marks on the rear covers (**Fig. 176** ).



- 1 - ALIGN CAMSHAFT SPROCKET TIMING MARK BETWEEN MARKS ON REAR TIMING BELT COVER  
2 - CRANKSHAFT AT TDC

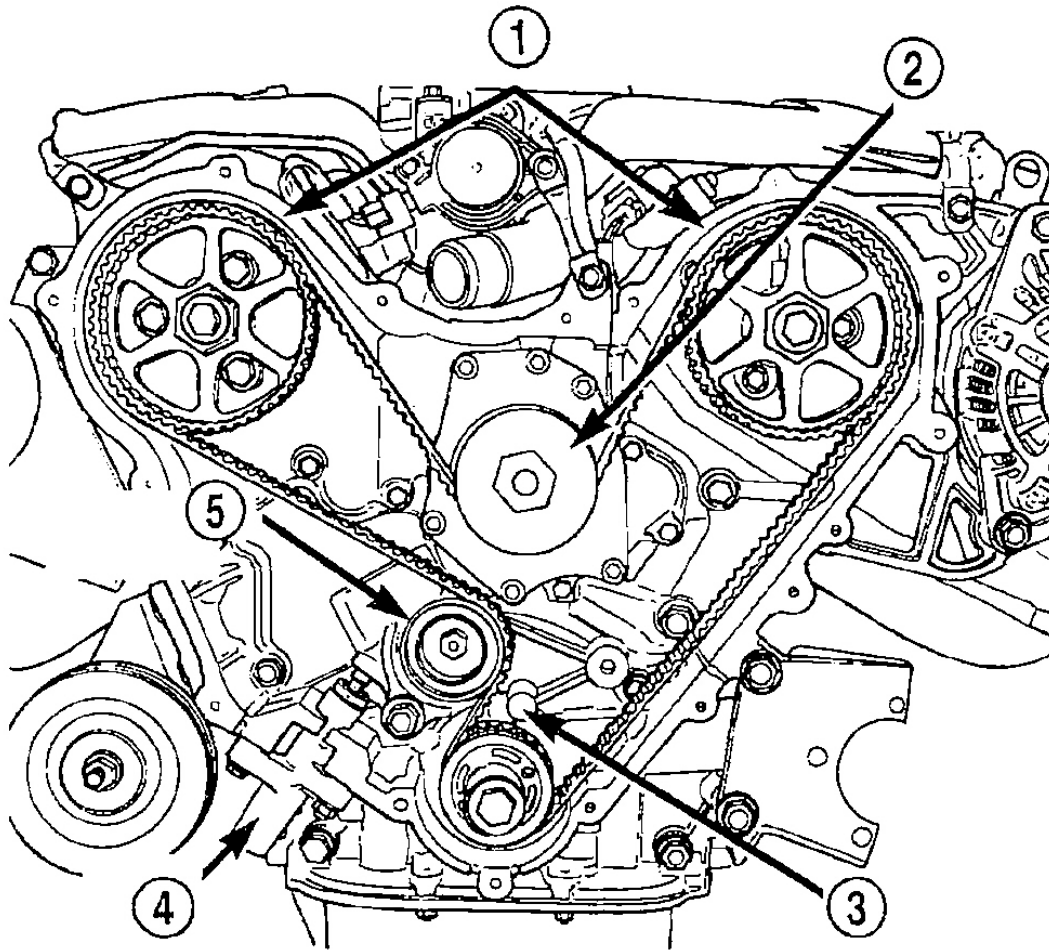
G03512029

**Fig. 176: Engine Timing**

Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Align the camshaft sprockets between the marks on rear belt covers before timing belt removal or damage to valve and/or pistons could occur.

9. Using a ink or paint marker; mark the exact position of the camshaft sprocket timing mark relative to the two timing marks on the rear timing cover.
10. Remove the timing belt tensioner (**Fig. 177**) and remove timing belt.



- 1 - REAR TIMING BELT COVERS
- 2 - WATER PUMP
- 3 - TDC INDICATOR
- 4 - BELT TENSIONER
- 5 - TENSIONER PULLEY

G03512030

**Fig. 177: Timing Belt System**

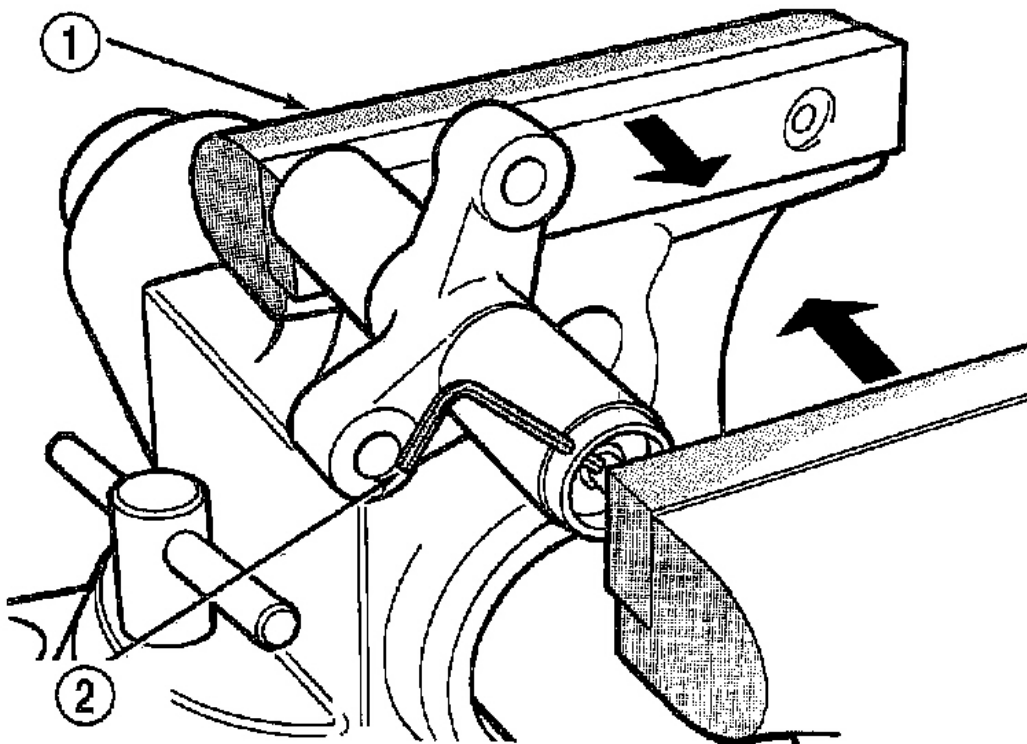
Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Compress the tensioner slowly, as damage to tensioner could result.

11. When tensioner is removed from the engine it is necessary to compress the plunger into the tensioner body.

**CAUTION:** Index the tensioner in the vise the same way it is installed on the engine. This ensures proper pin orientation when tensioner is installed on the engine.

- a. Place the tensioner into a vise and SLOWLY compress the plunger (**Fig. 178**). Total bleed down of tensioner should take about 5 minutes.



1 - VISE  
2 - LOCKING PIN

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**Fig. 178: Compressing Timing Belt Tensioner**  
Courtesy of DAIMLERCHRYSLER CORP.

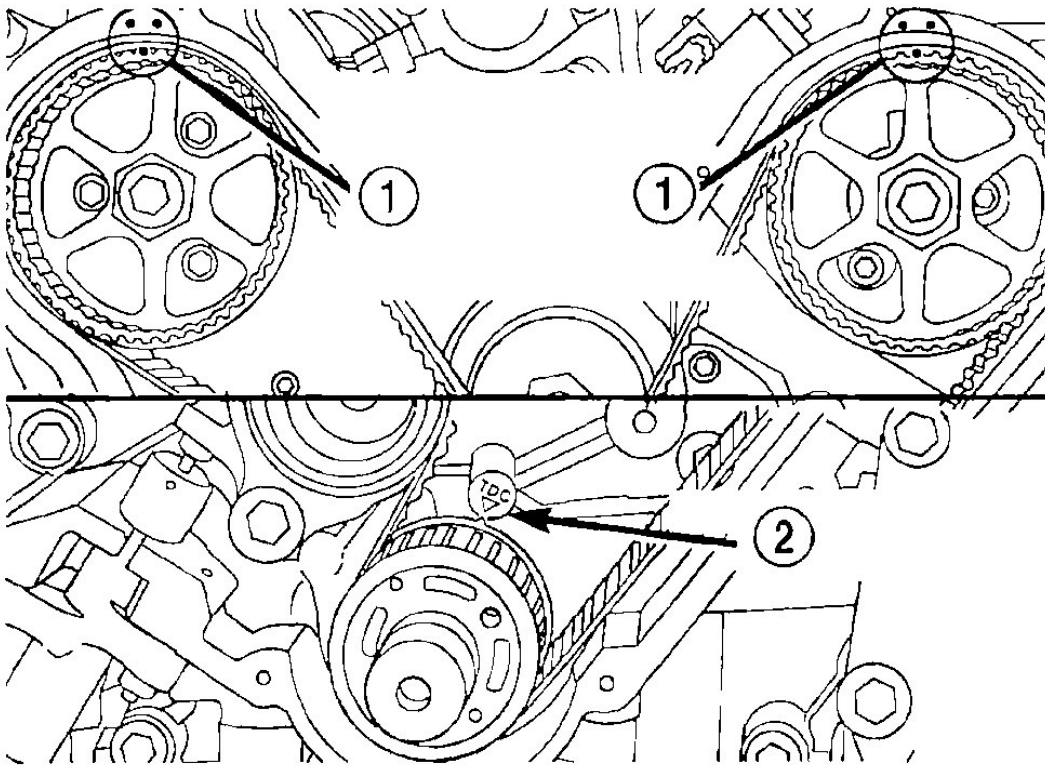
- b. When plunger is compressed into the tensioner body install a pin through the body and plunger to retain plunger in place until tensioner is installed.

#### REMOVAL - CAMSHAFT SPROCKETS

**CAUTION:** The 3.2/3.5L engines are NOT a freewheeling design. Therefore, care should be taken not to rotate the camshafts or crankshaft with the timing belt removed.

**CAUTION:** When camshaft sprocket bolts are loosened or removed, the camshafts must be re-timed to the engine. Also, the camshaft sprocket bolts must NOT be reused.

1. Remove front timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** )
2. Position crankshaft sprocket to the TDC mark on the oil pump housing by turning crankshaft in the clockwise direction (**Fig. 179** ).



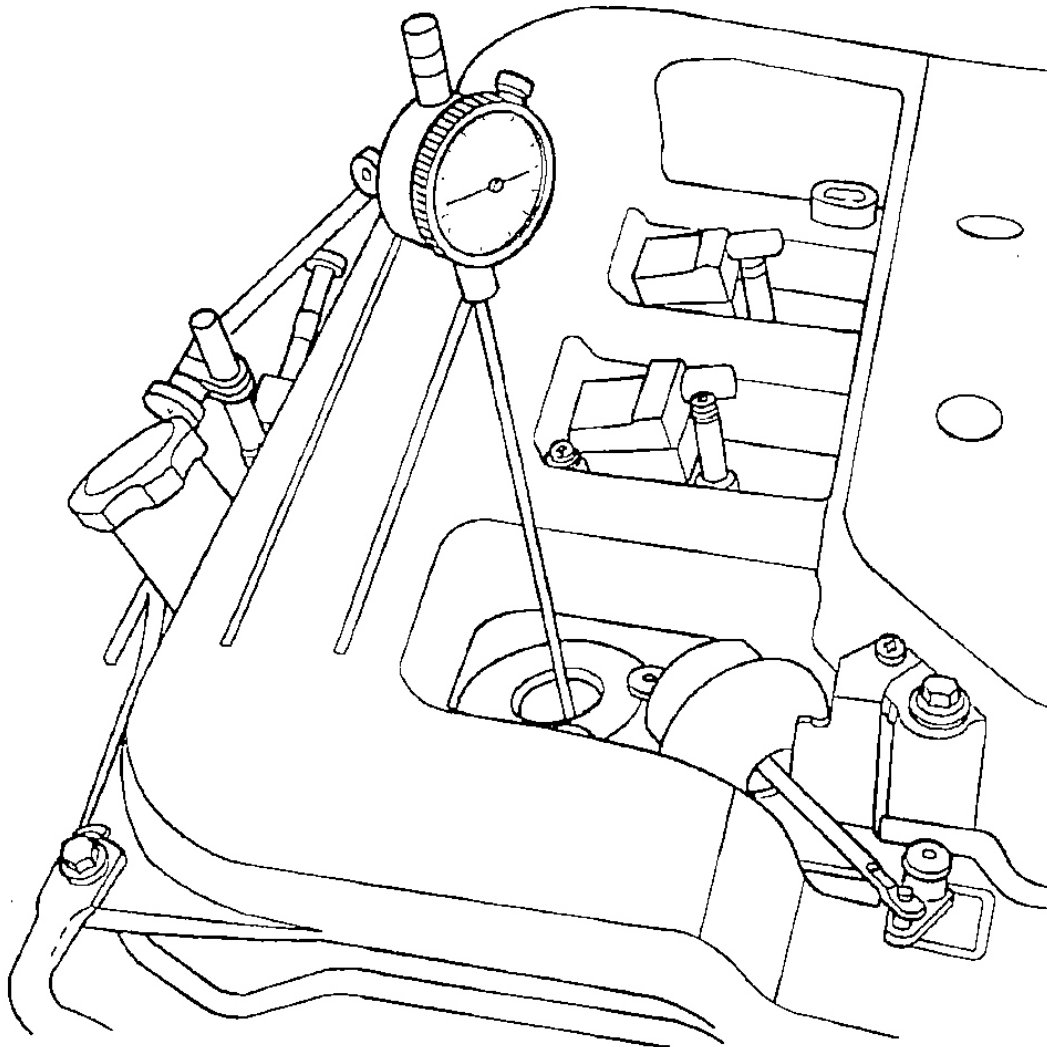
1 - ALIGN CAMSHAFT SPROCKET TIMING MARK BETWEEN MARKS ON REAR TIMING BELT COVER

2 - CRANKSHAFT AT TDC

G03512032

**Fig. 179: Camshaft Sprocket Timing Marks**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install a dial indicator in number 1 cylinder to check TDC of the piston (**Fig. 180**). Rotate the crankshaft until the piston is at exactly TDC.



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**Fig. 180: Dial Indicator**

Courtesy of DAIMLERCHRYSLER CORP.

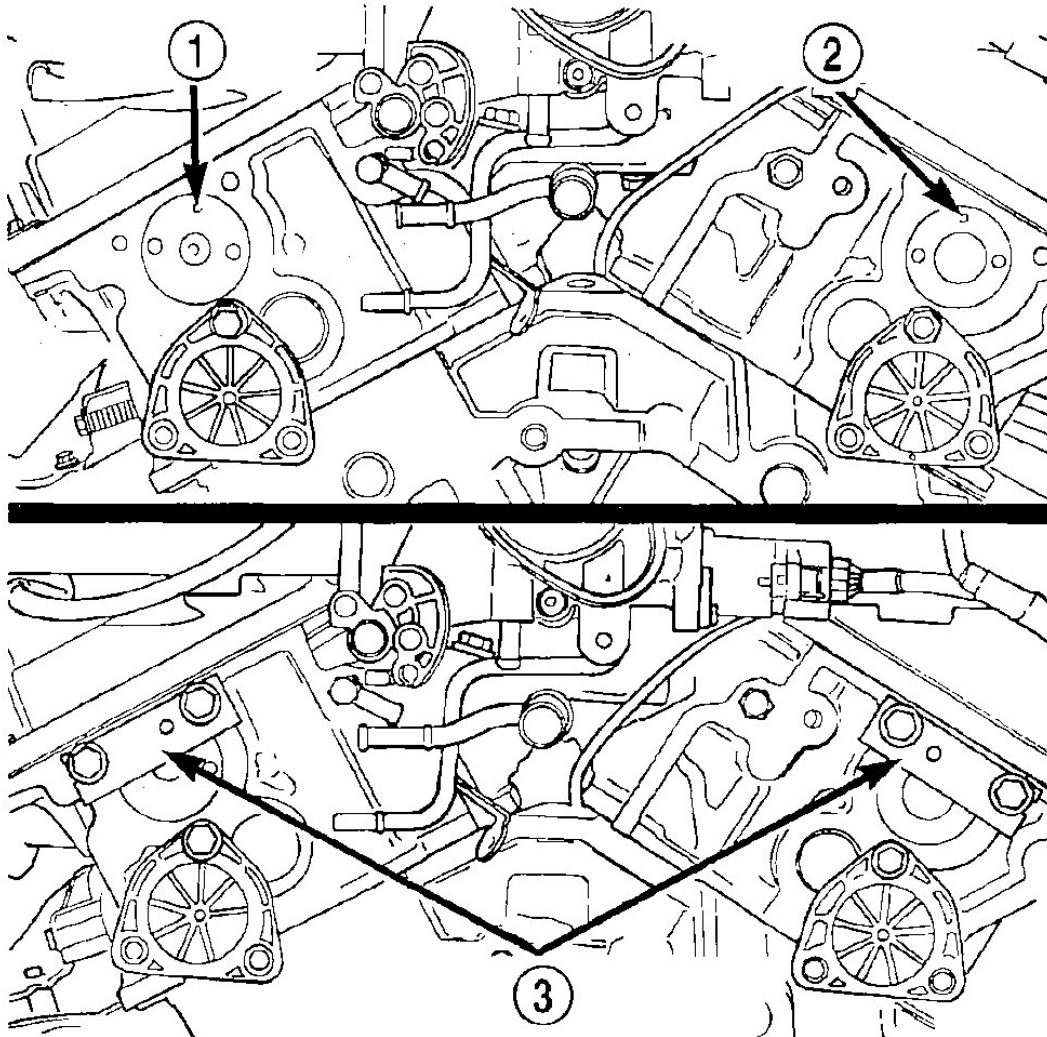
4. Remove camshaft retainer/thrust plates from rear of cylinder heads. To access the right side plate, remove the EGR valve. (Refer to **EXHAUST GAS RECIRCULATION**)

**NOTE:**      **Special Tool 6642 is interchangeable between cylinder banks.**

5. Install Special Tools 6642 Camshaft Alignment tools to the rear of each cylinder head by inserting pin on

the alignment tool to the pilot hole on the camshaft. Attach tools using the retainer plate bolts. (**Fig. 181**).

**NOTE:** If the alignment tools do not properly line-up to install attaching bolts, first remove the timing belt tensioner, then slowly rotate camshaft with a wrench until bolts can be installed.



- 1 - LEFT CAMSHAFT PILOT HOLE
- 2 - RIGHT CAMSHAFT PILOT HOLE
- 3 - CAMSHAFT ALIGNMENT SPECIAL TOOLS 6642

G03512034

**Fig. 181: Camshaft Alignment Holding Tools**  
**Courtesy of DAIMLERCHRYSLER CORP.**

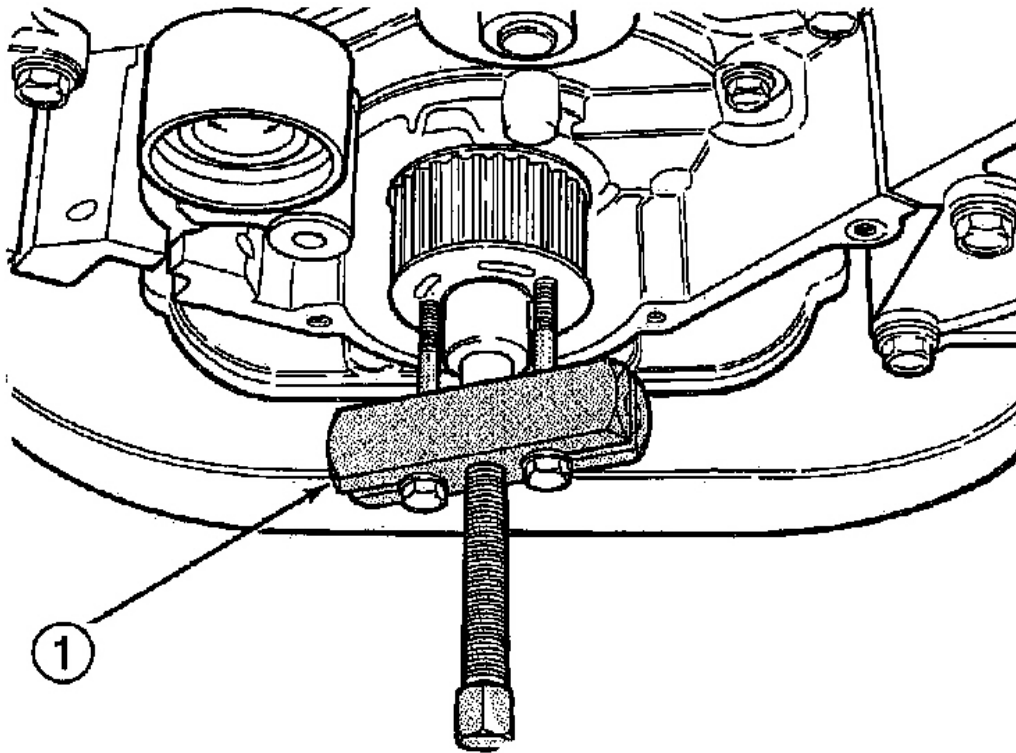
6. Remove the timing belt. (Refer to **REMOVAL - TIMING BELT** )
7. Hold camshaft sprocket with 36 mm (1 7/16 in.) box end wrench.
8. Loosen and remove bolt and washer. To remove the camshaft sprocket bolts with engine in the vehicle, it may be necessary to lift the engine to allow bolt removal clearance. The right bolt is 213 mm (8 3/8 in.) long and the left bolt is 255 mm (10.0 in.) long.

**NOTE:**        **Each sprocket has a "D" shaped hole that allows it to rotate several degrees in each direction on its shaft. This design requires the crankshaft-to-camshaft to be properly timed to ensure proper engine performance.**

9. Remove the camshaft sprockets.

**REMOVAL - CRANKSHAFT SPROCKET**

1. Remove the timing belt. (Refer to **REMOVAL - TIMING BELT** )
2. Remove crankshaft sprocket using Special Tool L-4407-A (**Fig. 182** ).



1 - SPECIAL TOOL L-4407-A

G03512035

**Fig. 182: Crankshaft Sprocket - Removal**  
Courtesy of DAIMLERCHRYSLER CORP.

#### INSPECTION - TIMING BELT

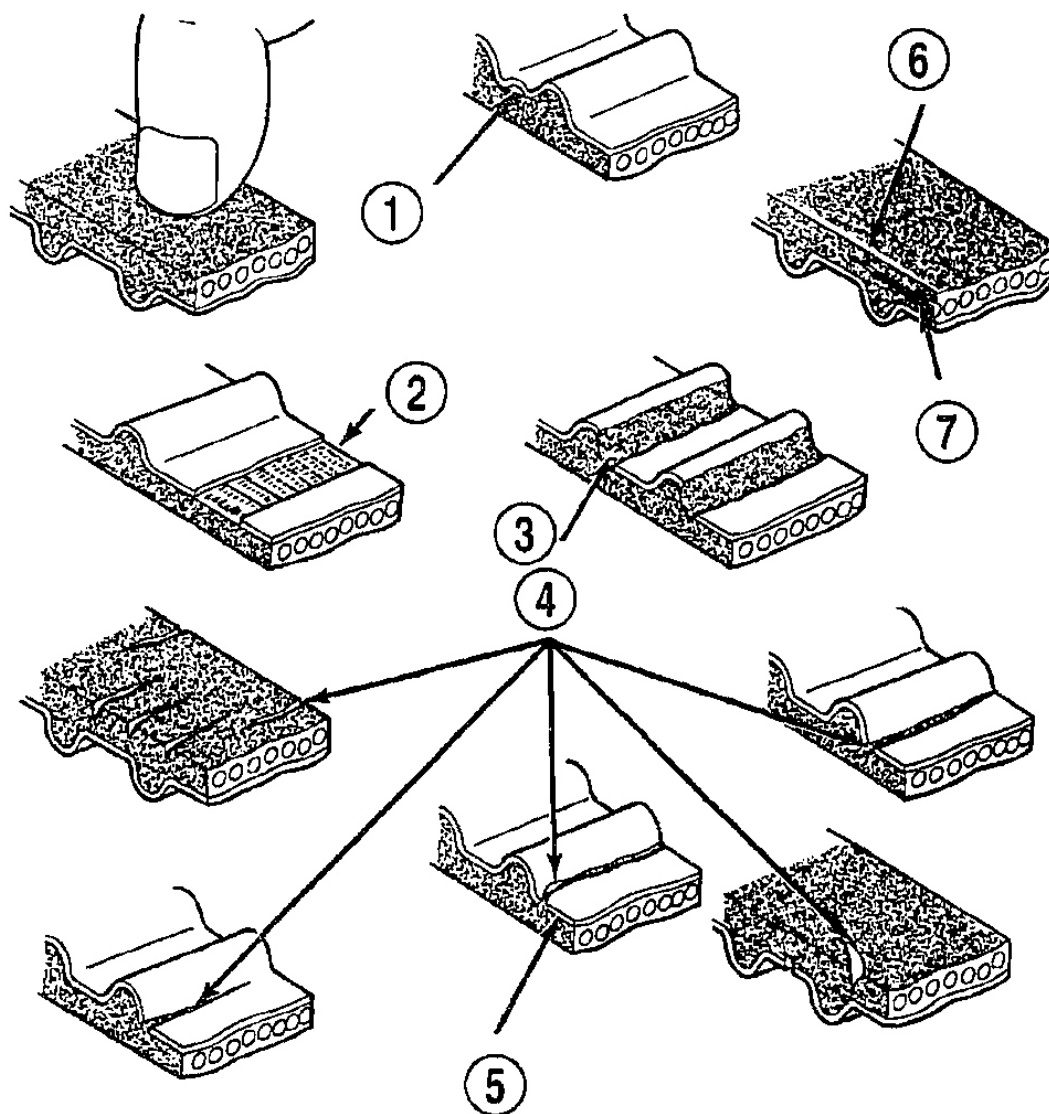
1. Remove timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** and **TIMING BELT COVER(S) - REAR** )
2. Inspect both sides of the timing belt. Replace belt if any of the following conditions exist (**Fig. 183** ):
  - a. Hardening of back rubber back side is glossy without resilience and leaves no indent when pressed with fingernail.
  - b. Cracks on rubber back.
  - c. Cracks or peeling of canvas.
  - d. Cracks on rib root.
  - e. Cracks on belt sides.

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- f. Missing teeth.
  - g. Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.
  - h. Vehicle mileage or time at component maintenance requirement. (Refer to owner's manual)
3. If none of the above conditions are seen on the belt, the belt cover can be installed.

**NOTE:        If belt requires replacing, ensure the proper length belt is used.**



- 1 - PEELING
- 2 - TOOTH MISSING AND CANVAS FIBER EXPOSED
- 3 - RUBBER EXPOSED
- 4 - CRACKS
- 5 - PEELING
- 6 - ROUNDED EDGE
- 7 - ABNORMAL WEAR (FLUFFY STRAND)

G03512036

**Fig. 183: Timing Belt Inspection**

Courtesy of DAIMLERCHRYSLER CORP.

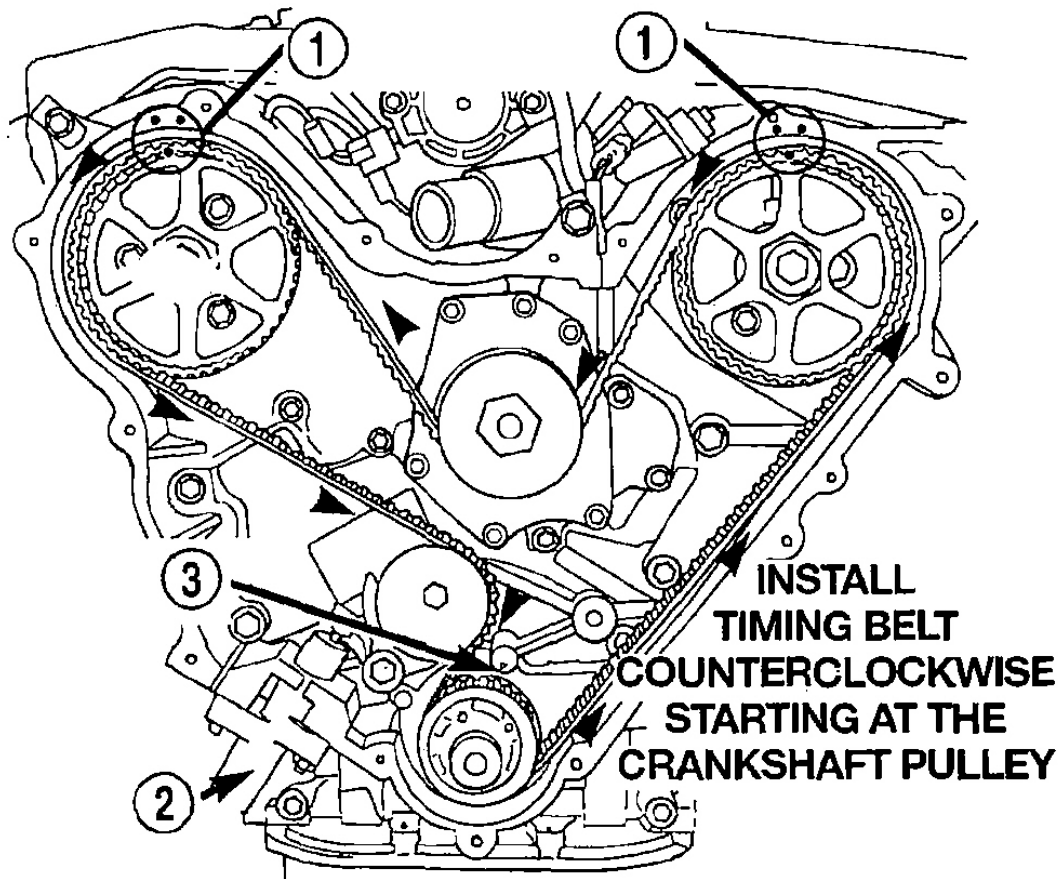
**INSTALLATION**

**INSTALLATION - TIMING BELT**

**CAUTION:** This procedure can only be used when the camshaft sprockets **HAVE NOT BEEN LOOSENEED** or removed from the camshafts.

**CAUTION:** If camshafts have moved from the timing marks, always rotate camshaft towards the direction nearest to the timing marks (**DO NOT TURN CAMSHAFTS A FULL REVOLUTION OR DAMAGE** to valves and/or pistons could result).

1. Align the crankshaft sprocket with the TDC mark on oil pump cover (**Fig. 184** ).



- 1 - ALIGN CAMSHAFTS WITH TIMING MARKS
- 2 - INSTALL TENSIONER LOOSE
- 3 - CRANKSHAFT AT TDC

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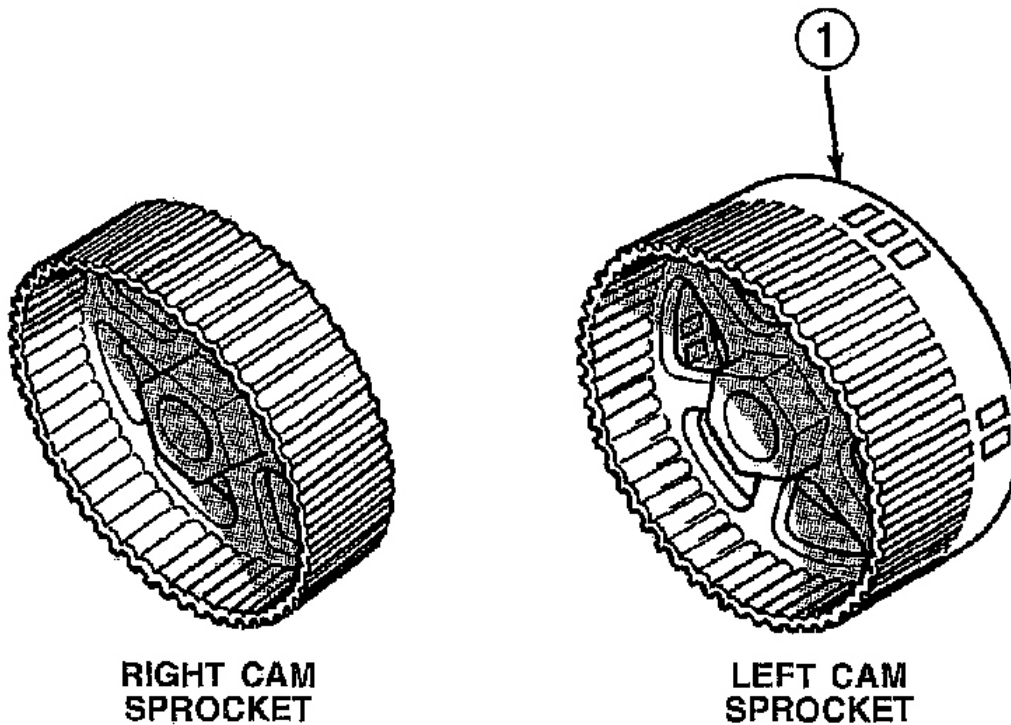
**Fig. 184: Timing Belt - Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Align the camshaft sprockets (to reference mark made upon removal) between the marks on the rear covers (**Fig. 176**).
3. Install the timing belt starting at the crankshaft sprocket going in a counterclockwise direction (**Fig. 184**). Install the belt around the last sprocket. Maintain tension on the belt as it is positioned around the tensioner pulley.
4. Holding the tensioner pulley against the belt, Install the tensioner into the housing and tighten to 28 N.m (250 in. lbs.). Each camshaft sprocket mark should still fall between the cover marks.
5. When tensioner is in place pull retaining pin to allow the tensioner to extend to the pulley bracket.

6. Rotate crankshaft sprocket 2 revolutions and check the timing marks on the camshafts and crankshaft. The marks should line up within their respective locations (**Fig. 184** ). If marks do not line up, repeat procedure.
7. Install the front timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** and **TIMING BELT COVER(S) - REAR** )
8. Install the crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )
9. Install the accessory drive belts. (Refer to **ACCESSORY DRIVE** )
10. Install the radiator fan. (Refer to **RADIATOR FAN** )
11. Install upper radiator crossmember. (Refer to **GRILLE OPENING REINFORCEMENT** )
12. Connect negative cable to remote jumper terminal.

**INSTALLATION - CAMSHAFT SPROCKETS**

**CAUTION:** The camshaft sprockets are not interchangeable from side to side (**Fig. 185** ).



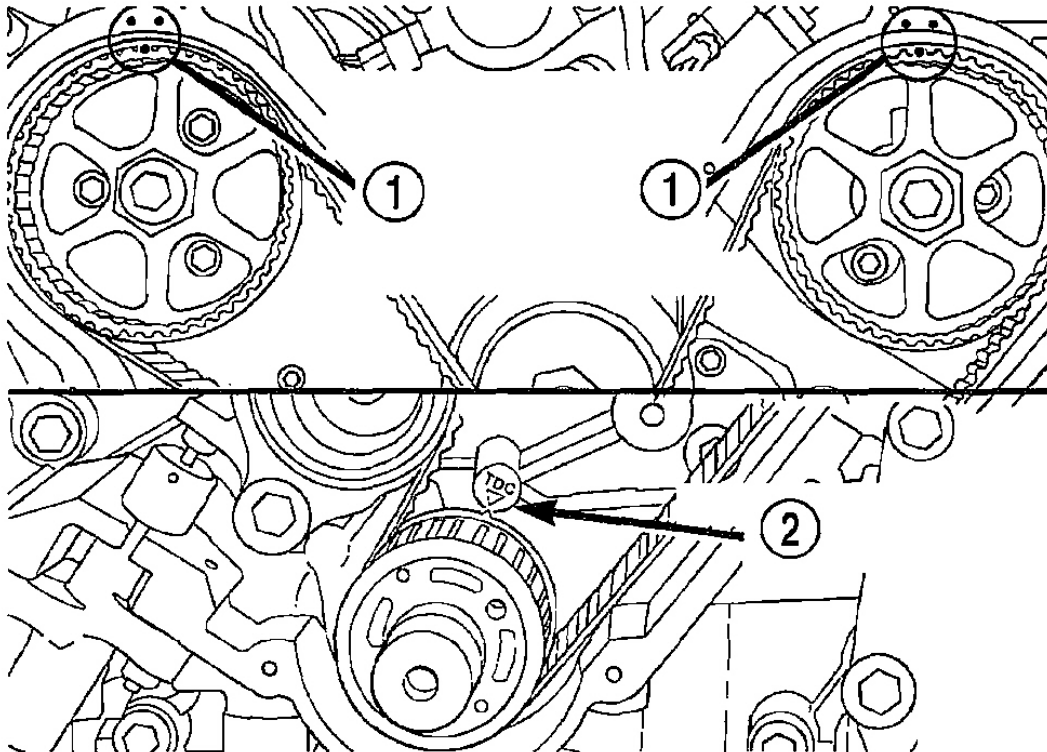
1 - DIS PICKUP SLOTS

G03512038

**Fig. 185: Camshaft Sprockets**

Courtesy of DAIMLERCHRYSLER CORP.

1. Install camshaft sprockets onto the camshafts. Install **NEW** sprocket attaching bolts into place. The 255 mm (10 in.) bolt is to be installed in the left camshaft and the 213 mm (8 3/8 in.) bolt is to be installed into the right camshaft. **Do not tighten the bolts; tightened at later step.** Camshaft sprocket mark should be positioned between the marks on the cover at both sprockets (**Fig. 186**).



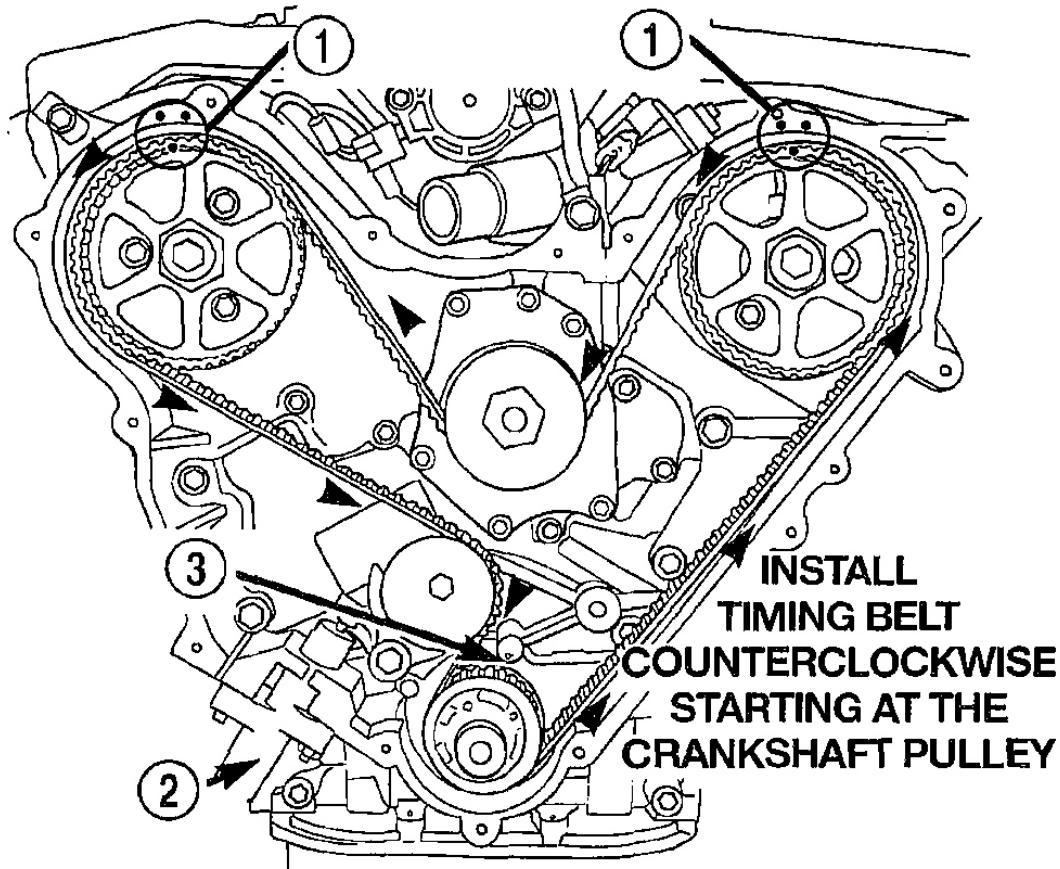
1 - ALIGN CAMSHAFT SPROCKET TIMING MARK BETWEEN  
MARKS ON REAR TIMING BELT COVER

2 - CRANKSHAFT AT TDC

G03512039

**Fig. 186: Camshaft Sprocket Timing Marks**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Install the timing belt starting first at the crankshaft sprocket, then to remaining components in a counterclockwise direction (**Fig. 187** ).



- 1 - ALIGN CAMSHAFTS WITH TIMING MARKS
- 2 - INSTALL TENSIONER LOOSE
- 3 - CRANKSHAFT AT TDC

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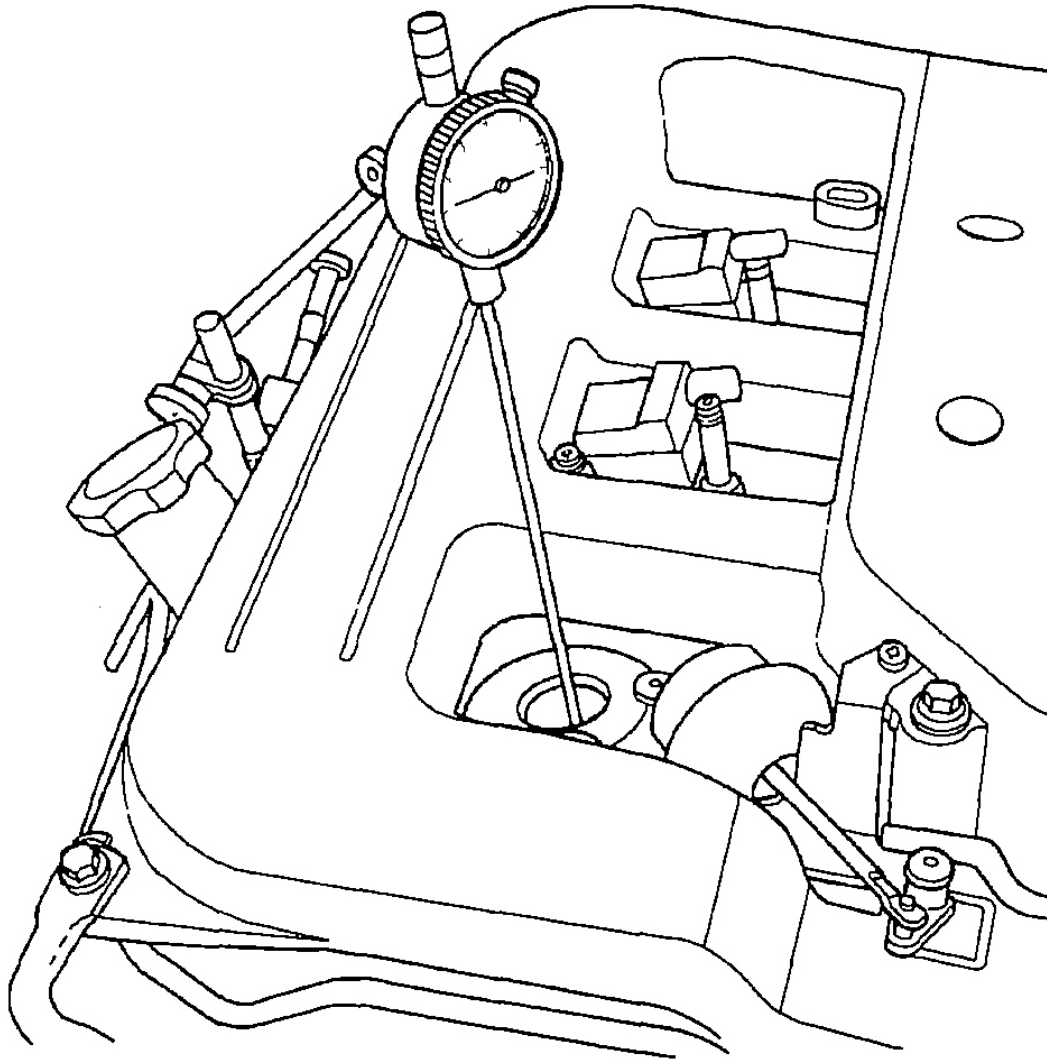
**Fig. 187: Timing Belt - Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install the belt around the last sprocket. Maintain tension on the belt as it is positioned around the tensioner pulley. Each camshaft sprockets mark should still fall between the cover marks (**Fig. 187**).

**NOTE:** For timing belt tensioner reset procedure, (Refer to **INSPECTION - TIMING BELT** ).

4. Hold the tensioner pulley against the belt and install the reset (pinned) timing belt tensioner into the housing. Tighten attaching bolts to 28 N.m (250 in. lbs.).
5. Remove tensioner retaining pin to allow the tensioner to extend to the pulley bracket.

6. Using a dial indicator, position the number 1 piston at TDC (**Fig. 188**).



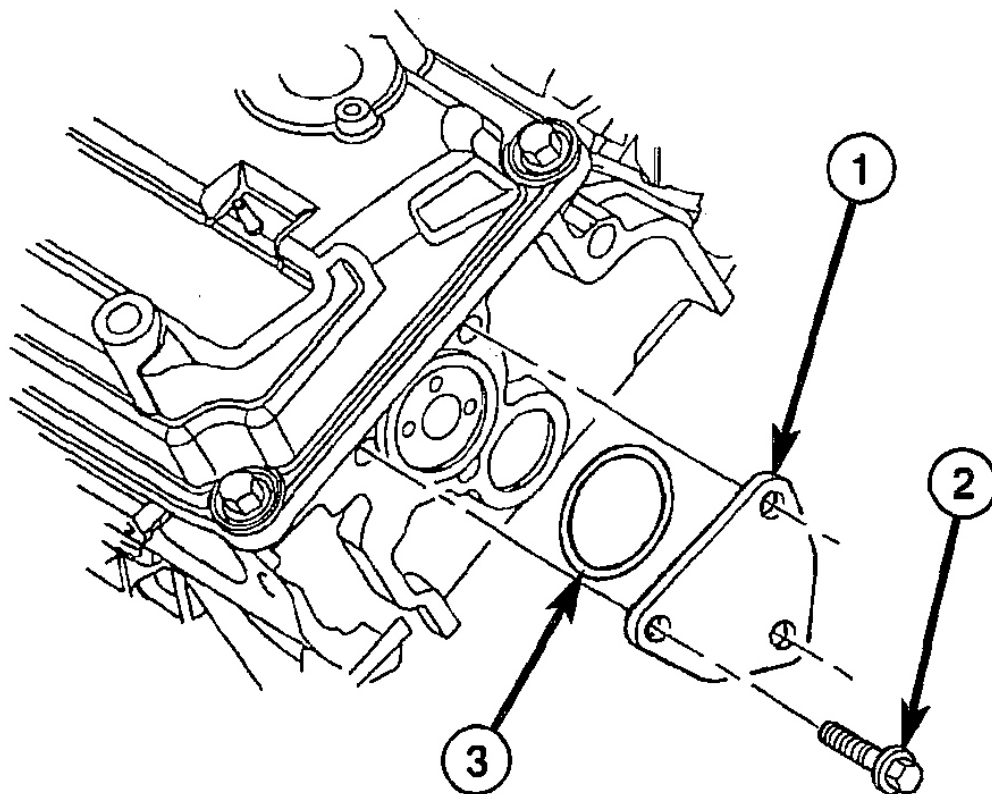
G03512041

**Fig. 188: Dial Indicator**

Courtesy of DAIMLERCHRYSLER CORP.

7. Hold the camshaft sprocket hex with a 36 mm (1 7/16 in.) wrench and tighten the camshaft bolts to the following:
  - Right side = 102 N.m (75 ft. lbs.) +90° turn
  - Left side = 115 N.m (85 ft. lbs.) +90° turn
8. Remove dial indicator and install spark plug.
9. Remove Special Tools 6642.

10. Install cam retainer/thrust plates and O-rings (**Fig. 189**). Tighten bolts to 28 N.m (250 in. lbs.).



- 1 - CAMSHAFT THRUST PLATE  
2 - BOLT  
3 - O-RING

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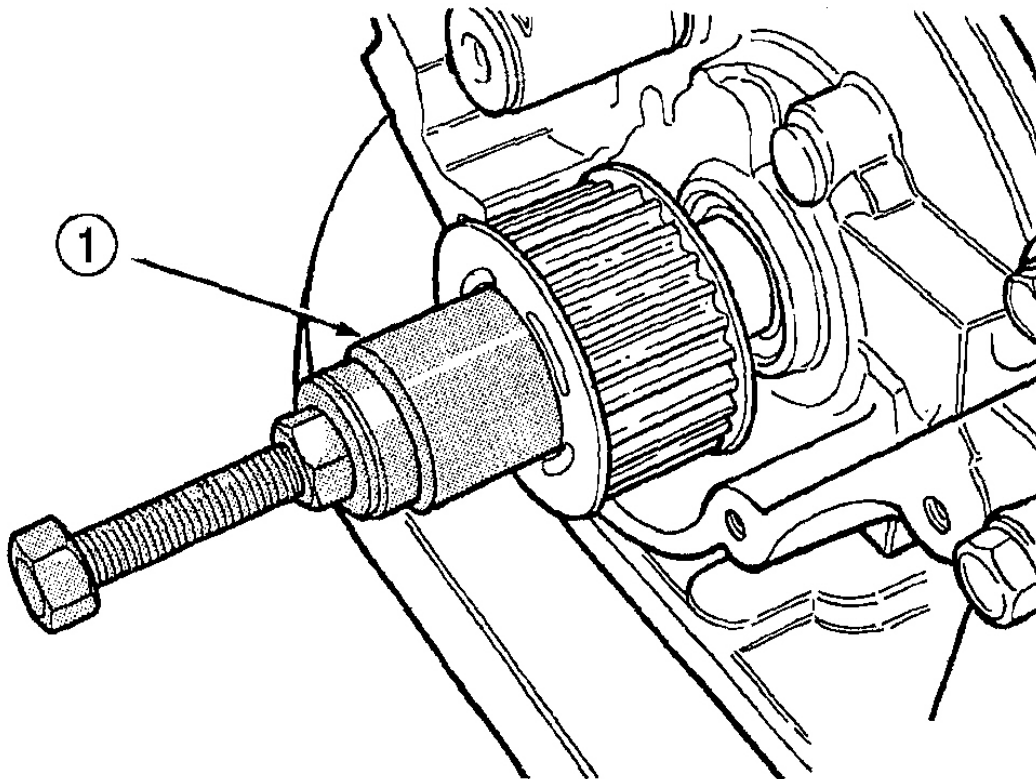
**Fig. 189: Camshaft Thrust Plate**  
Courtesy of DAIMLERCHRYSLER CORP.

11. Install timing belt covers. (Refer to **TIMING BELT COVER(S) - FRONT** and **TIMING BELT COVER(S) - REAR** )
12. Install crankshaft vibration damper. (Refer to **VIBRATION DAMPER** )
13. Install accessory drive belts. (Refer to **ACCESSORY DRIVE** )
14. Fill cooling system. (Refer to **STANDARD PROCEDURE** )

#### INSTALLATION - CRANKSHAFT SPROCKET

**CAUTION:** To ensure proper installation depth of crankshaft sprocket, Special Tool 6641 must be used.

1. Install crankshaft sprocket using Special Tools 6641 and C-4685-C1 (**Fig. 190** ).



1 - INSTALL WITH SPECIAL TOOL 6641 WITH 12mm SCREW  
C-4685-C1 AND THRUST BEARING AND WASHER

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**Fig. 190: Crankshaft Sprocket Installation**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Install timing belt. (Refer to **INSTALLATION - TIMING BELT** )