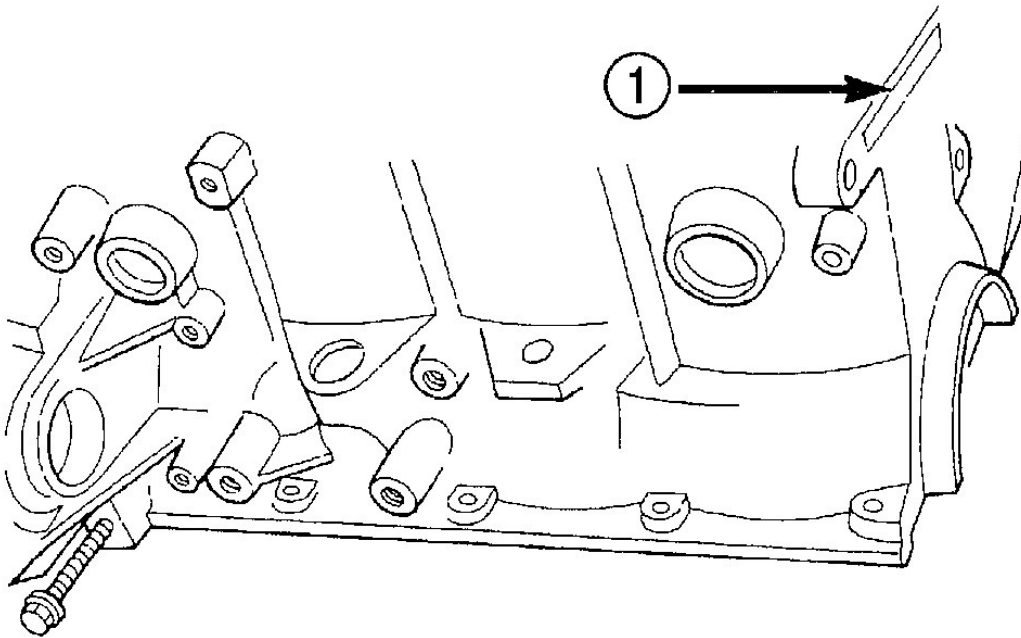


**2004 ENGINES****2.4L 4-Cylinder DOHC****ENGINE****DESCRIPTION**

The 2.4 Liter (148 cu. in.) in-line four cylinder engine is a double over head camshaft with hydraulic lash adjusters and four valve per cylinder design. The engine is free-wheeling; meaning it has provisions for piston-to-valve clearance. However valve-to-valve interference can occur, if camshafts are rotated independently.

The cylinders are numbered from front of the engine to the rear. The firing order is 1-3-4-2.

The engine identification number is located on the rear of the cylinder block.



1 - ENGINE IDENTIFICATION LOCATION

G01857670

**Fig. 1: Locating Engine Identification**  
**Courtesy of DAIMLERCHRYSLER CORP.**

## 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 the Engine Mechanical and the Engine Performance diagnostic charts, for possible causes and corrections of malfunctions see **ENGINE DIAGNOSIS - MECHANICAL** and **ENGINE DIAGNOSIS - PERFORMANCE**.

For fuel system diagnosis, see **FUEL SYSTEM** article.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not 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

### ENGINE DIAGNOSIS - PERFORMANCE

## 2004 Chrysler PT Cruiser GT

2004 ENGINES 2.4L 4-Cylinder DOHC

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery.	1. Test battery. Charge or replace as necessary. See CHARGING & STARTING SYSTEMS article.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals.
	3. Faulty starter.	3. Test starting system. See CHARGING & STARTING SYSTEMS article.
	4. Faulty coil(s) or control unit.	4. Test and replace as needed.
	5. Incorrect spark plug gap.	5. Set gap. See IGNITION CONTROL article.
	6. Contamination in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump.	7. Test fuel pump and replace as needed.
	8. Incorrect engine timing.	8. Check for a skipped timing belt/chain.
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low.	1. Test minimum air flow.
	2. Incorrect fuel mixture.	2. Refer to Appropriate Diagnostic Information.
	3. Intake manifold leakage.	3. Inspect intake manifold, manifold gasket, and vacuum hoses.
	4. Faulty ignition coil(s).	4. Test and replace as necessary.

G01857671

**Fig. 2: Diagnosing Engine - Performance (1 Of 2)**  
**Courtesy of DAIMLERCHRYSLER CORP.**

## 2004 Chrysler PT Cruiser GT

2004 ENGINES 2.4L 4-Cylinder DOHC

CONDITION	POSSIBLE CAUSE	CORRECTION
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 ignition coil(s).</li></ol>	<ol style="list-style-type: none"><li>1. Clean plugs and set gap.</li><li>2. Clean system and replace fuel filter.</li><li>3. Test and replace as necessary.</li><li>4. Correct valve timing.</li><li>5. Replace cylinder head gasket.</li><li>6. Test compression of each cylinder.</li><li>7. Replace valves.</li><li>8. Perform exhaust restriction test. See EXHAUST SYSTEM &amp; TURBOCHARGER article. Install new parts, as necessary.</li><li>9. Test and replace as necessary.</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 ignition coil(s).</li></ol>	<ol style="list-style-type: none"><li>1. Clean spark plugs and set gap.</li><li>2. Clean fuel system and replace fuel filter.</li><li>3. Replace valves.</li><li>4. Test and replace as necessary.</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 ignition coil(s).</li><li>3. Dirty fuel injector(s).</li><li>4. Contamination in fuel system.</li></ol>	<ol style="list-style-type: none"><li>1. Clean spark plugs and set gap.</li><li>2. Test and replace as necessary.</li><li>3. Test and replace as necessary.</li><li>4. Clean system and replace fuel filter.</li></ol>

G01857672

**Fig. 3: Diagnosing Engine - Performance (2 Of 2)**  
Courtesy of DAIMLERCHRYSLER CORP.

### ENGINE DIAGNOSIS - MECHANICAL



**2004 Chrysler PT Cruiser GT**

2004 ENGINES 2.4L 4-Cylinder DOHC

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 adjusters.</li><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>1. Check and correct engine oil level.</li><li>2. Change oil to correct viscosity.</li><li>3. (a) Change engine oil and filter. (b) Run engine to operating temperature. (c) Change engine oil and filter again.</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><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. Thin or diluted oil.</li><li>4. Thick oil</li><li>5. Excessive bearing clearance.</li><li>6. Connecting rod journal out-of-round.</li><li>7. 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.</li><li>4. (a) Change engine oil and filter. (b) Run engine to operating temperature. (c) Change engine oil and filter again.</li><li>5. Measure bearings for correct clearance. Repair as necessary.</li><li>6. Replace crankshaft or grind surface.</li><li>7. Replace bent connecting rods.</li></ol>

G01857673

**Fig. 4: Diagnosing Engine - Mechanical (1 Of 3)**  
**Courtesy of DAIMLERCHRYSLER CORP.**

**2004 Chrysler PT Cruiser GT**

2004 ENGINES 2.4L 4-Cylinder DOHC

CONDITION	POSSIBLE CAUSES	CORRECTION
MAIN BEARING NOISE	<ol style="list-style-type: none"><li>1. Insufficient oil supply.</li><li>2. Low oil pressure.</li><li>3. Thin or diluted oil.</li><li>4. Thick oil</li><li>5. Excessive bearing clearance.</li><li>6. Excessive end play.</li><li>7. Crankshaft journal out-of-round or worn.</li><li>8. 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.</li><li>4. (a) Change engine oil and filter. (b) Run engine to operating temperature. (c) Change engine oil and filter again.</li><li>5. Measure bearings for correct clearance. Repair as necessary.</li><li>6. Check thrust bearing for wear on flanges.</li><li>7. Replace crankshaft or grind journals.</li><li>8. Tighten to correct torque.</li></ol>
OIL PRESSURE DROP	<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><li>6. Thin or diluted oil.</li><li>7. Oil pump relief valve stuck.</li><li>8. Oil pump suction tube loose.</li><li>9. Oil pump cover warped or cracked.</li><li>10. Excessive bearing clearance.</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><li>6. Change oil to correct viscosity.</li><li>7. Remove valve and inspect, clean, or replace.</li><li>8. Remove oil pan and install new tube or clean, if necessary.</li><li>9. Install new oil pump.</li><li>10. Measure bearings for correct clearance.</li></ol>
OIL LEAKS	<ol style="list-style-type: none"><li>1. Misaligned or deteriorated gaskets.</li><li>2. Loose fastener, broken or porous metal part.</li><li>3. Misaligned or deteriorated cup or threaded plug.</li></ol>	<ol style="list-style-type: none"><li>1. Replace gasket(s).</li><li>2. Tighten, repair or replace the part.</li><li>3. Replace as necessary.</li></ol>

G01857674

**Fig. 5: Diagnosing Engine - Mechanical (2 Of 3)**  
**Courtesy of DAIMLERCHRYSLER CORP.**

## 2004 Chrysler PT Cruiser GT

2004 ENGINES 2.4L 4-Cylinder DOHC

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL CONSUMPTION OR SPARK PLUGS FOULED	1. PCV system malfunction.	1. Check system and repair as necessary. See EMISSIONS CONTROL article.
	2. Worn, scuffed or broken rings.	2. Hone cylinder bores. Install new rings.
	3. Carbon in oil ring slots.	3. Install new rings.
	4. Rings fitted too tightly in grooves.	4. Remove rings and check grooves. If groove is not proper width, replace piston.
	5. Worn valve guide(s).	5. Ream guide(s) and replace valve(s) with oversize valve(s) and seal(s).
	6. Valve stem seal(s) worn or damaged.	6. Replace seal(s).

G01857675

**Fig. 6: Diagnosing Engine - Mechanical (3 Of 3)**  
Courtesy of DAIMLERCHRYSLER CORP.

### 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.

### 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. 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.
4. Remove the Auto Shutdown (ASD) relay from the PDC.
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®. For Special Tool identification, see **SPECIAL TOOLS**.
7. Crank engine until maximum pressure is reached on gauge. 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.**

### 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 manual procedures.
  - If the leakage occurs at the crankshaft rear oil seal area, see **INSPECTION FOR REAR SEAL AREA LEAKS**.
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® 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.

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

4. If no leaks are detected, pressurize the crankcase as previously described.

**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.**

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.
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.

## **STANDARD PROCEDURE**

### **REPAIR OF DAMAGED OR WORN THREADS**

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

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.

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

### **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.

#### **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® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

**Mopar® 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® 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® 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® BED PLATE SEALANT** is a unique (green-in-color) anaerobic type gasket material that is specially made to seal the area between the bed plate 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® 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® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

#### **SEALER APPLICATION**

Mopar® 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® 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® 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.

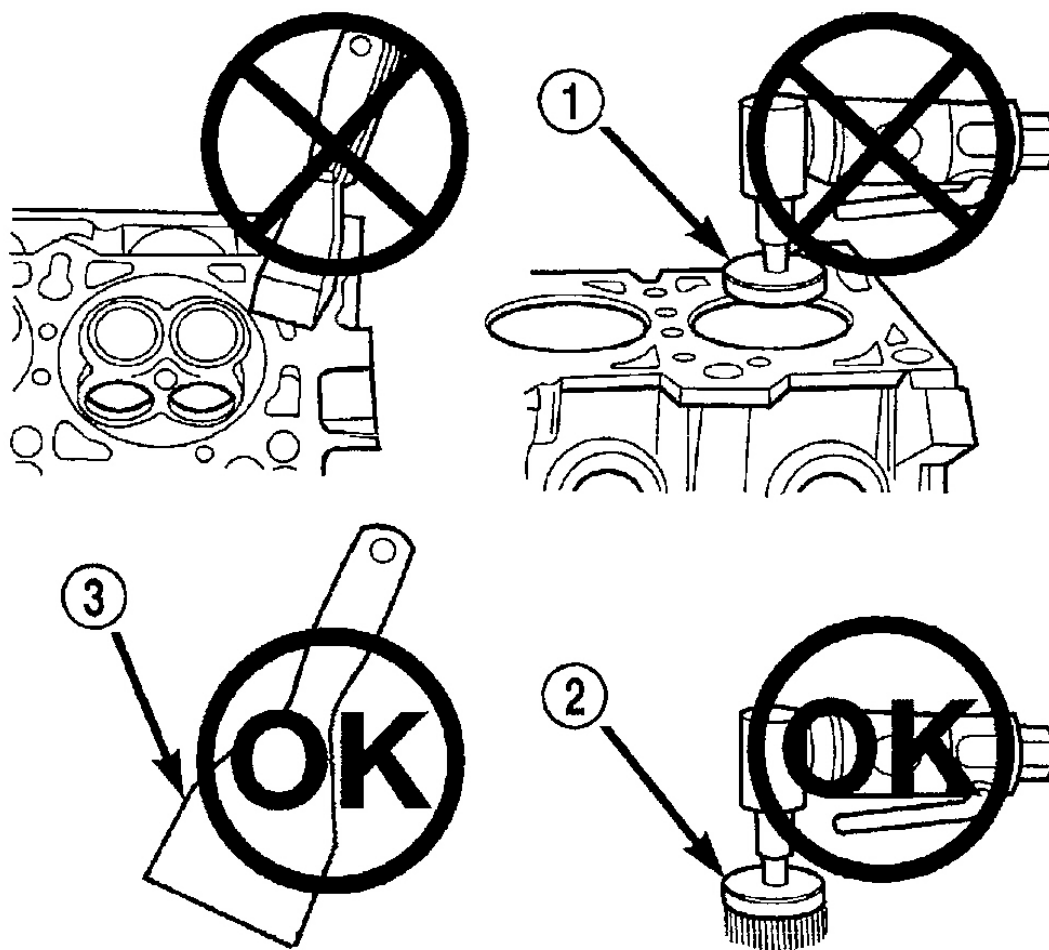
#### **ENGINE GASKET SURFACE PREPARATION**

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





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

G01857676

**Fig. 7: Identifying Proper Tool Usage For Surface Preparation**  
Courtesy of DAIMLERCHRYSLER CORP.

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

Only use the following for cleaning gasket surfaces:

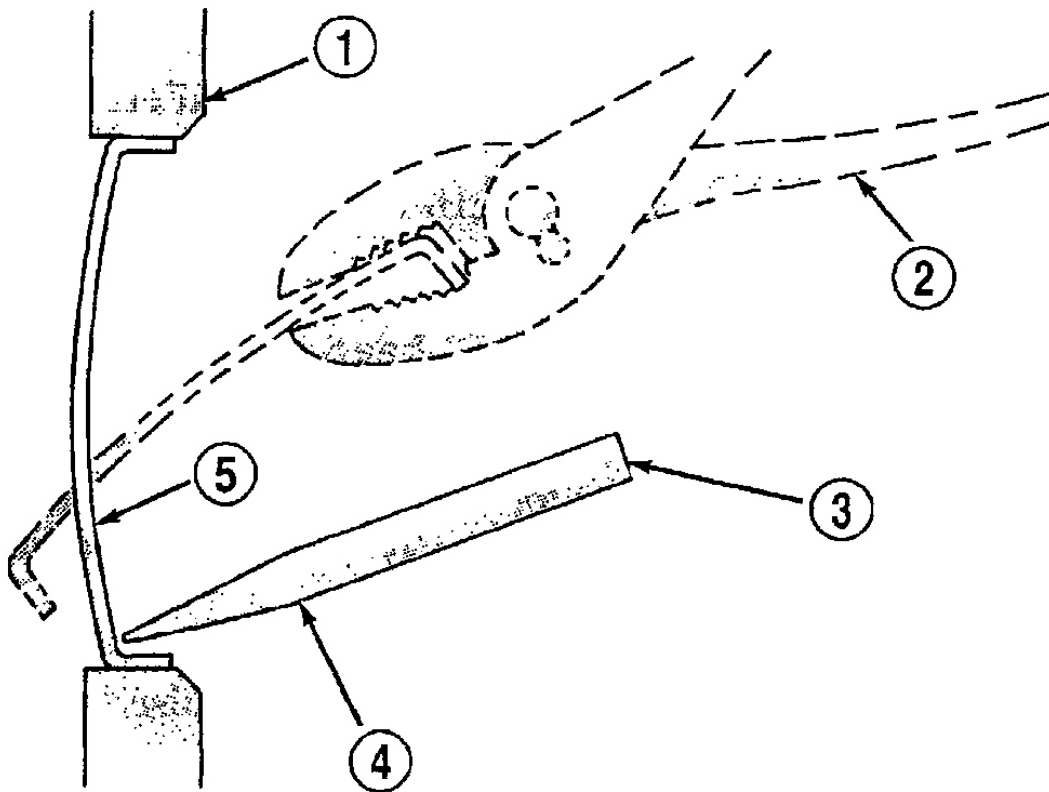
- Solvent or a commercially available gasket remover
- Plastic or wood scraper
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow)

**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.

#### ENGINE CORE AND OIL GALLERY PLUGS

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

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.



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

G01857677

**Fig. 8: Removing Core Hole Plug****Courtesy of DAIMLERCHRYSLER CORP.**

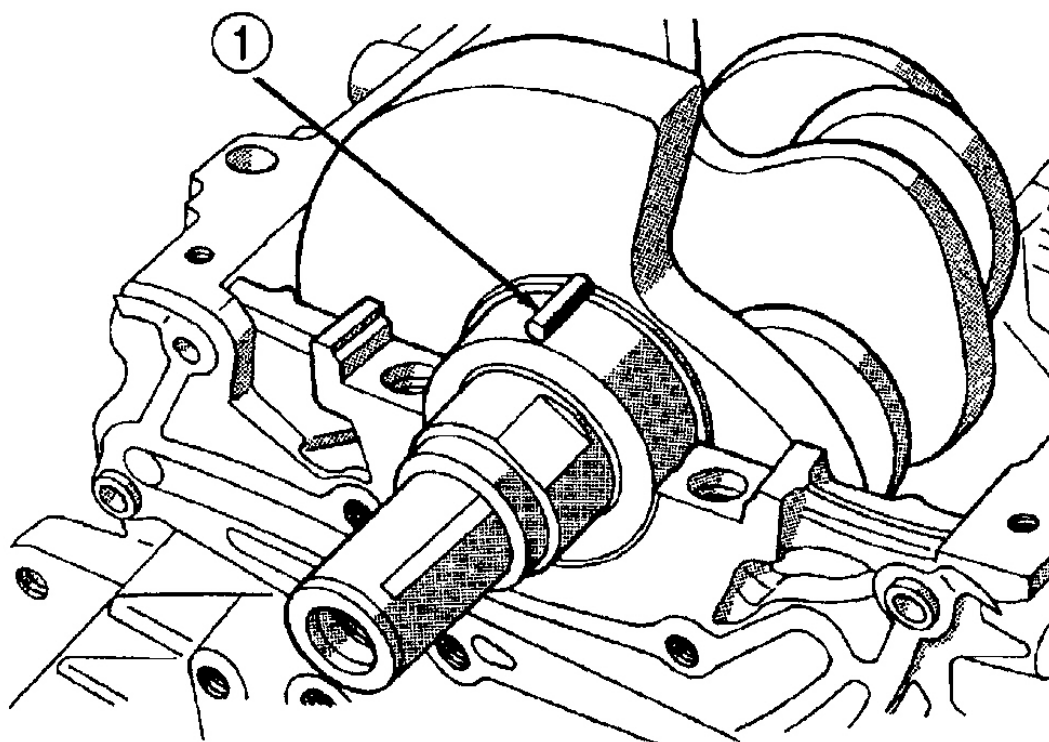
Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of 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.

**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. (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap/bed plate bolts of the bearing being checked to the proper specifications.



1 - PLASTIGAGE

G01857678

**Fig. 9: Identifying 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. See **SPECIFICATIONS**. Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.

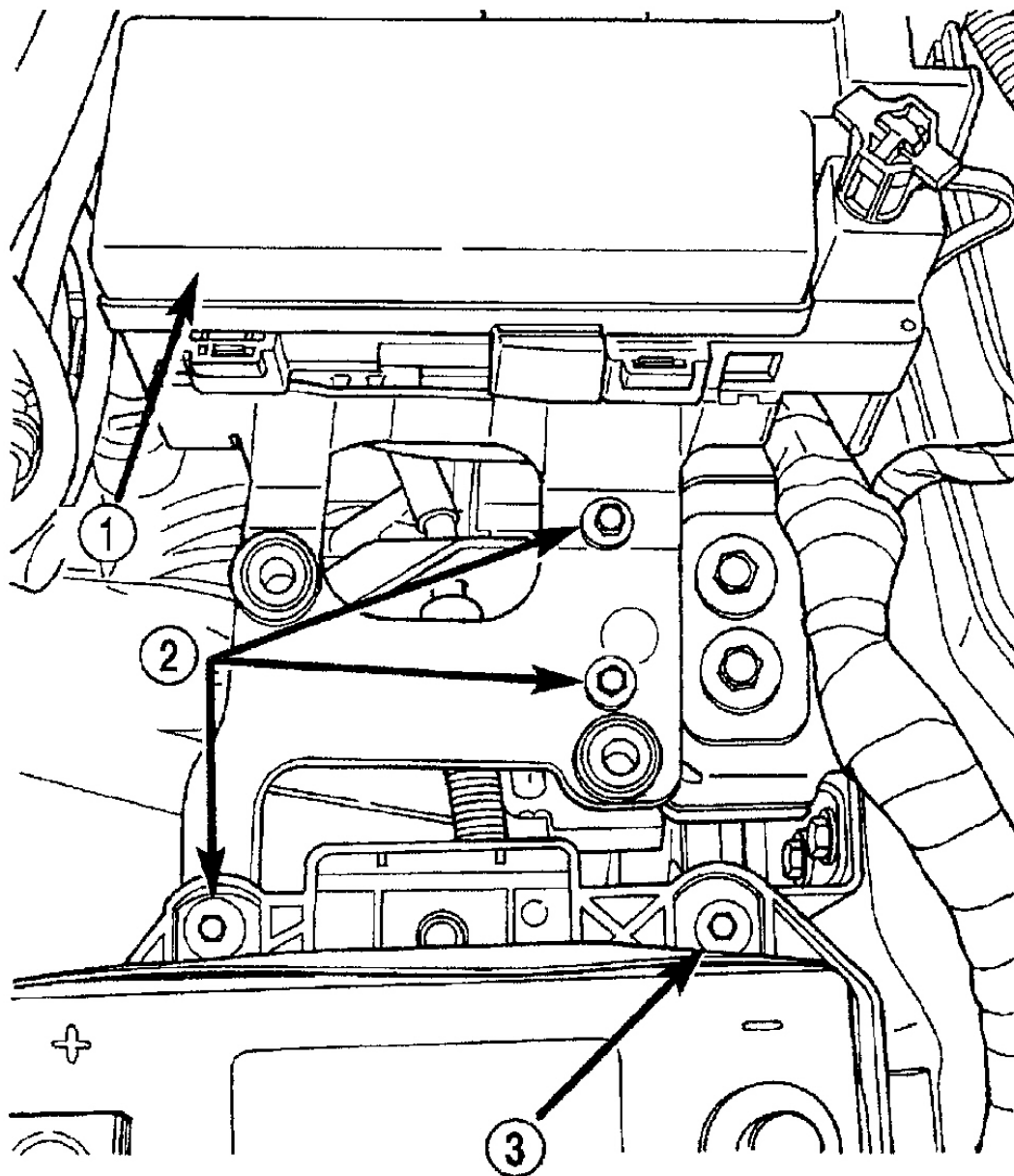
**NOTE:** Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

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

## REMOVAL - ENGINE ASSEMBLY

1. Perform fuel pressure release procedure, then disconnect and remove fuel line. See **FUEL SYSTEM** article.

2. Remove air cleaner housing assembly and clean air hose. See **AIR CLEANER HOUSING**.
3. Disconnect both cables from battery.
4. Remove battery and battery tray. See **CHARGING & STARTING SYSTEMS** article.
5. Drain cooling system. See **COOLING SYSTEM MECHANICAL** article.
6. Discharge air conditioning system, if equipped. See **MANUAL HVAC SYSTEM** article.
7. Disconnect throttle and speed control cables from throttle body.
8. Disconnect engine wiring harness at Powertrain Control Module (PCM).
9. Disconnect positive cable from Power Distribution Center (PDC) and ground wire from vehicle body. Remove bolts attaching PDC and set aside.



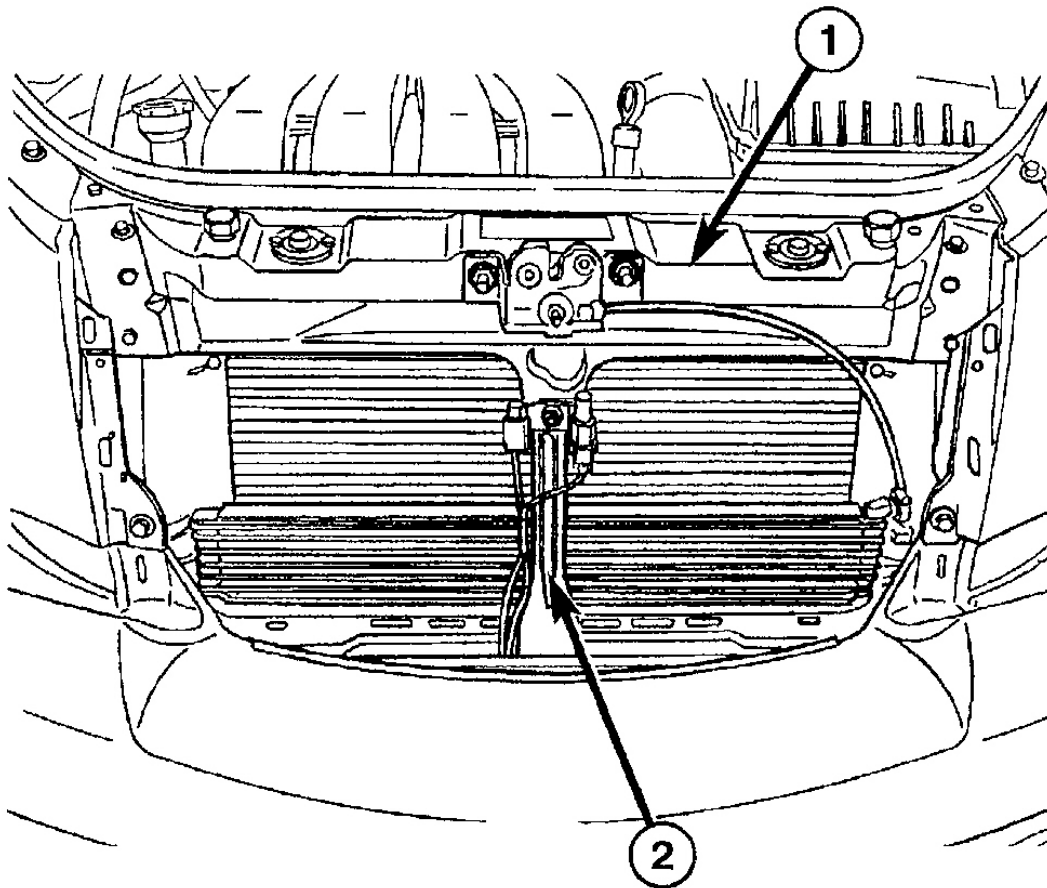
- 1 - PDC
- 2 - PDC BRACKET BOLTS
- 3 - BATTERY TRAY BOLT

G01857679

**Fig. 10: Removing PDC Bracket Attaching Bolts**  
Courtesy of DAIMLERCHRYSLER CORP.

10. Disconnect wiring connectors at lower battery tray support.

11. Disconnect ground wire from the vehicle body-to-engine at the right side strut tower.
12. Disconnect brake booster vacuum hose from intake manifold.
13. Disconnect the proportional purge hose from throttle body.
14. Disconnect coolant reserve/recovery hose from coolant outlet connector.
15. Disconnect heater hoses.
16. Remove grille. See **BODY** article.
17. Remove upper radiator closure panel and center brace. See **BODY** article.



1 - UPPER RADIATOR CLOSURE PANEL

2 - CENTER BRACE

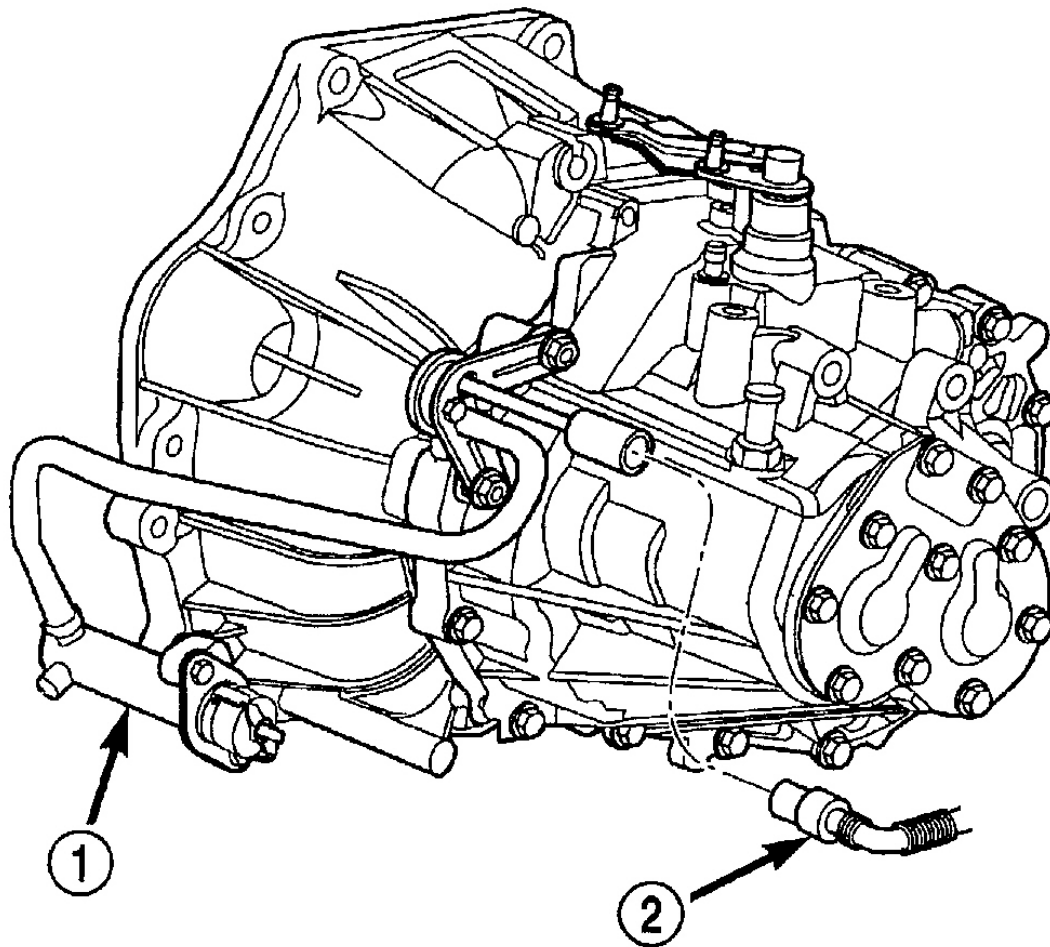
G01857680

**Fig. 11: Removing Upper Radiator Closure Panel & Center Brace**  
**Courtesy of DAIMLERCHRYSLER CORP.**

18. Remove upper radiator hose.

19. Remove lower radiator hose.
20. Disconnect upper A/C line from A/C condenser.
21. Disconnect A/C lines at junction near upper torque strut.
22. **Automatic Transmission equipped vehicles:**
  - a. Using a blade or suitable hose cutter, cut transaxle oil cooler lines off flush with transmission fittings. Plug lines and fitting to prevent debris from entering transaxle or cooler circuit. A service splice kit will be installed upon reassembly.
  - b. Disconnect transmission electrical connectors.
  - c. Disconnect transmission shift linkage.
23. **Manual Transmission equipped vehicles:**
  - a. Using Special Tool 6638A, disconnect clutch hydraulic line.

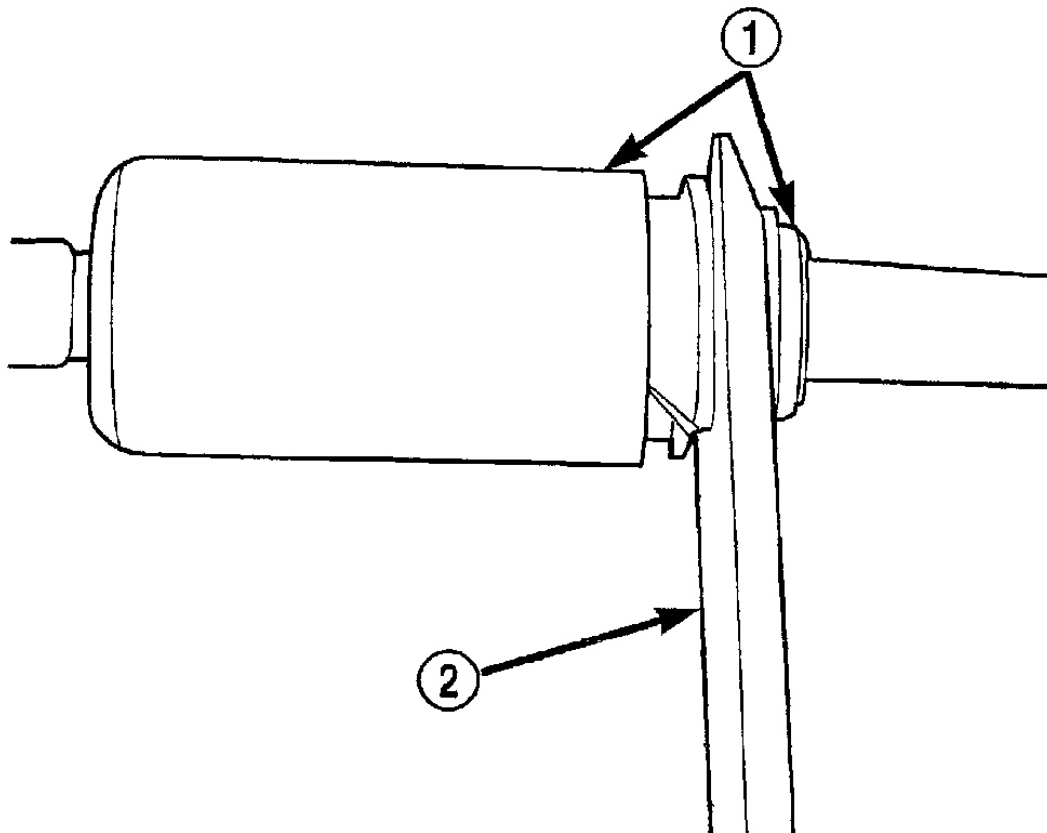




1 - SLAVE CYLINDER  
2 - HYDRAULIC TUBE

G01857681

**Fig. 12: Identifying Clutch Hydraulic Line To Slave Cylinder**  
Courtesy of DAIMLERCHRYSLER CORP.



1 - QUICK CONNECT FITTING

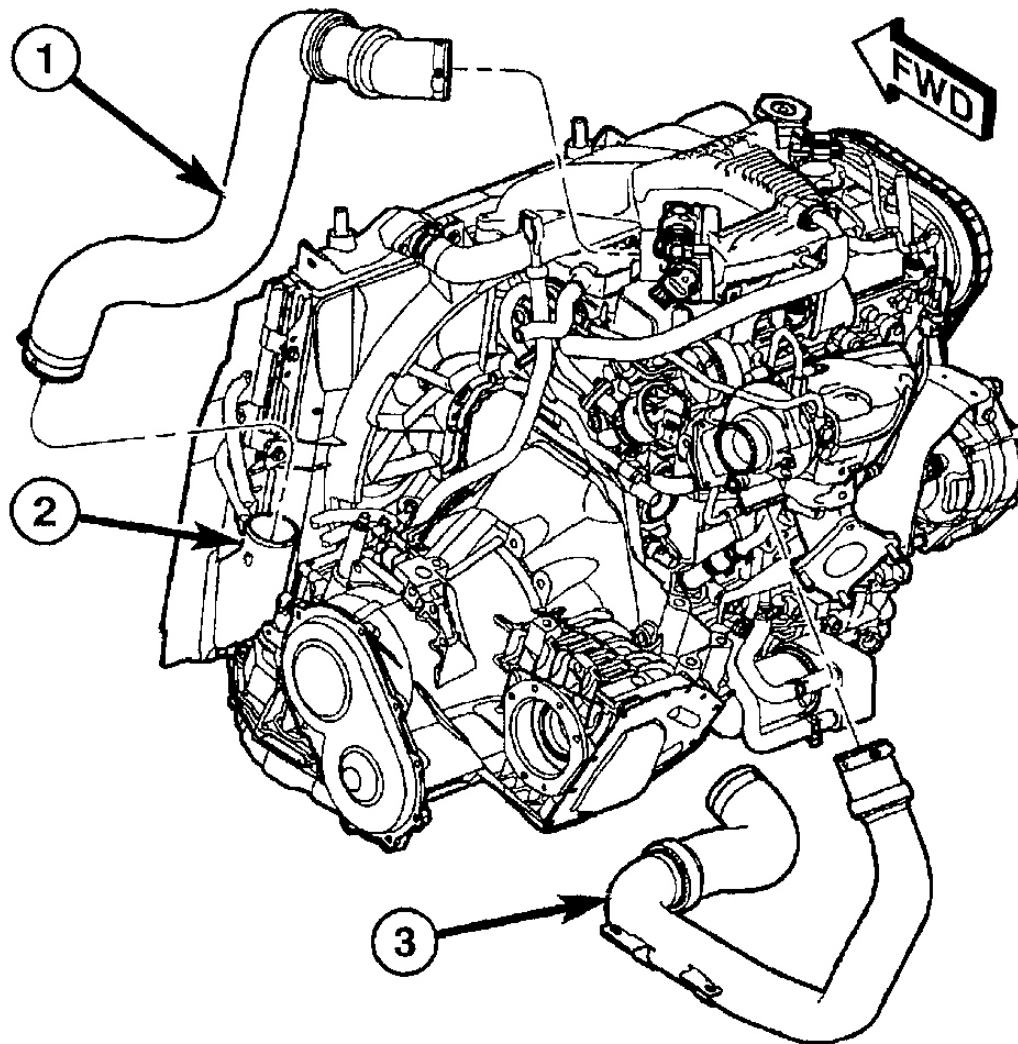
2 - TOOL 6638A

G01857682

**Fig. 13: Disconnecting Clutch Hydraulic Line**  
 Courtesy of DAIMLERCHRYSLER CORP.

- b. Disconnect transmission shift linkage.
- c. Disconnect transmission electrical connectors.
- 24. **Turbocharger equipped vehicles:** Disconnect power steering hoses from radiator.
- 25. Disconnect radiator fan electrical connector and remove cooling module assembly (fan, radiator, A/C condenser, transmission oil cooler).
- 26. Hoist vehicle and remove front wheels.
- 27. Remove right inner splash shield.
- 28. Remove axle shafts. See **AXLE SHAFTS** article.
- 29. Remove accessory drive belts. See **COOLING SYSTEM MECHANICAL** article.

30. Remove generator and support brackets.
31. **Turbocharger equipped vehicles:** Remove charge air cooler hoses.



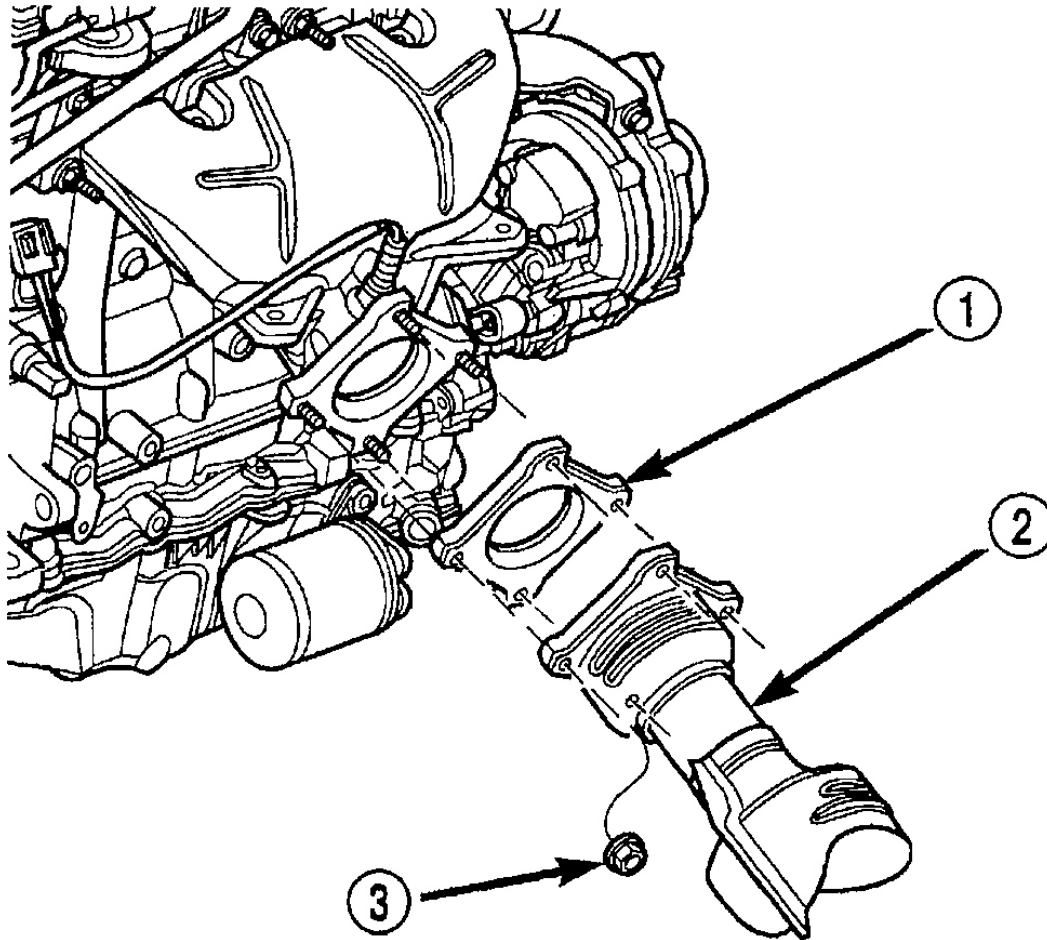
- 1 - HOSE - CHARGE AIR COOLER TO THROTTLE BODY  
2 - CHARGE AIR COOLER  
3 - HOSE - TURBOCHARGER TO CHARGE AIR COOLER

G01857683

**Fig. 14: Removing Charge Air Cooler Hoses**  
Courtesy of DAIMLERCHRYSLER CORP.

32. Drain engine oil.
33. Disconnect the downstream oxygen sensor connector.

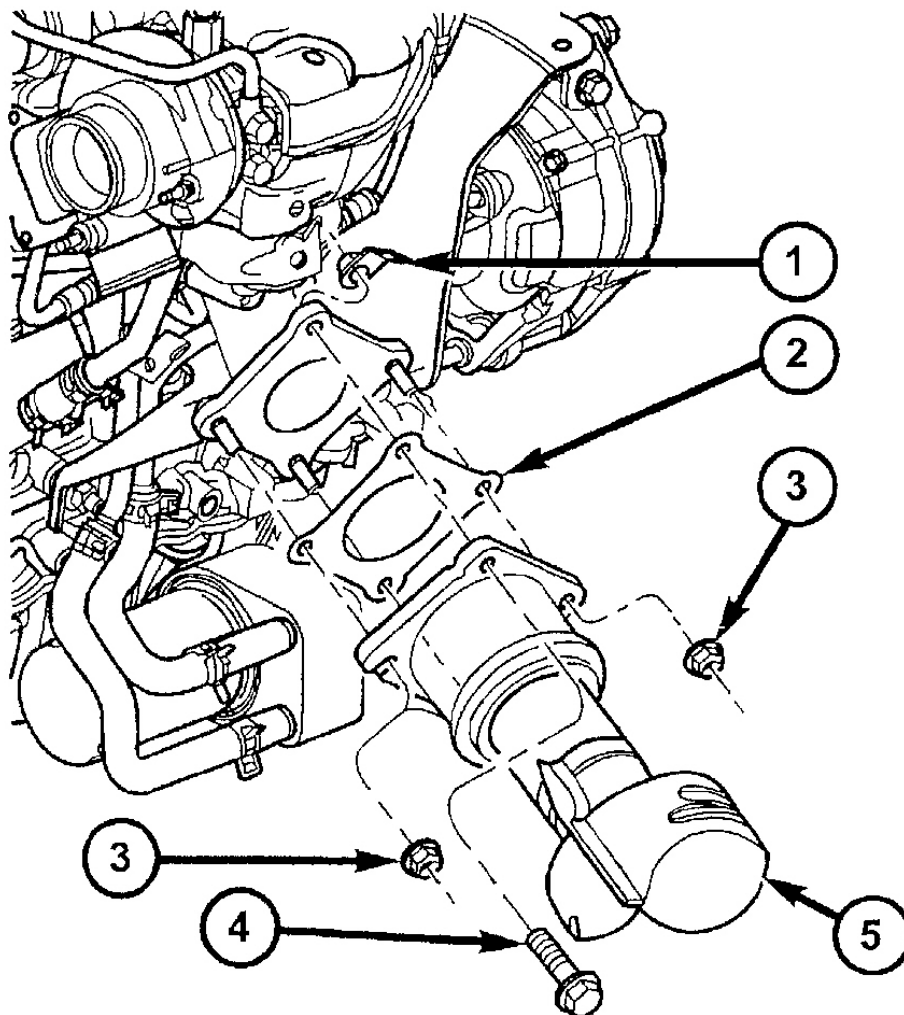
34. Disconnect exhaust system from manifold.



- 1 - GASKET
- 2 - CATALYTIC CONVERTER
- 3 - NUT

G01857684

**Fig. 15: Identifying Exhaust System To Manifold Connection**  
Courtesy of DAIMLERCHRYSLER CORP.

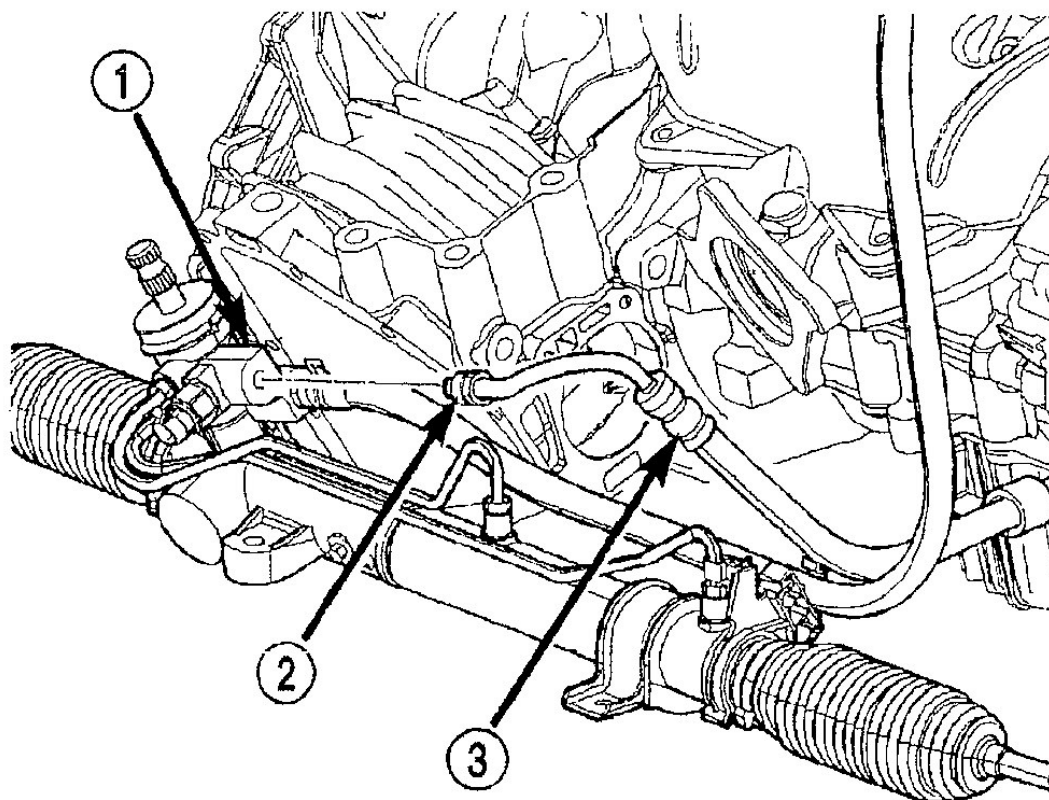


- 1 - FLAG NUT
- 2 - GASKET
- 3 - NUT
- 4 - BOLT
- 5 - CATALYTIC CONVERTER

G01857685

**Fig. 16: Identifying Converter To Exhaust Manifold Connection - 2.4L Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

35. **Non-Turbo equipped vehicles:** Disconnect power steering pressure hose from steering gear.

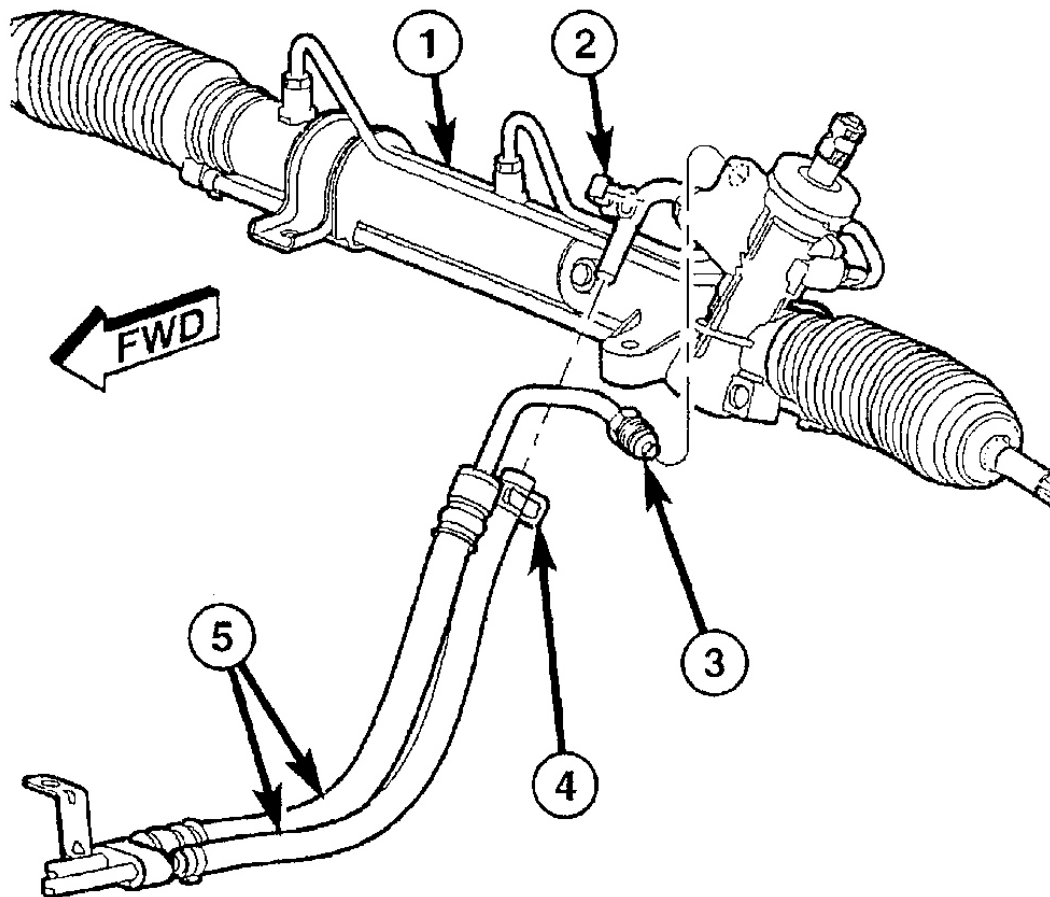


- 1 - STEERING GEAR
- 2 - FITTING
- 3 - POWER STEERING PRESSURE HOSE

G01857686

**Fig. 17: Identifying Power Steering Fluid Pressure Hose**  
Courtesy of DAIMLERCHRYSLER CORP.

36. **Turbocharger equipped vehicles:** Disconnect both power steering hoses from steering gear.

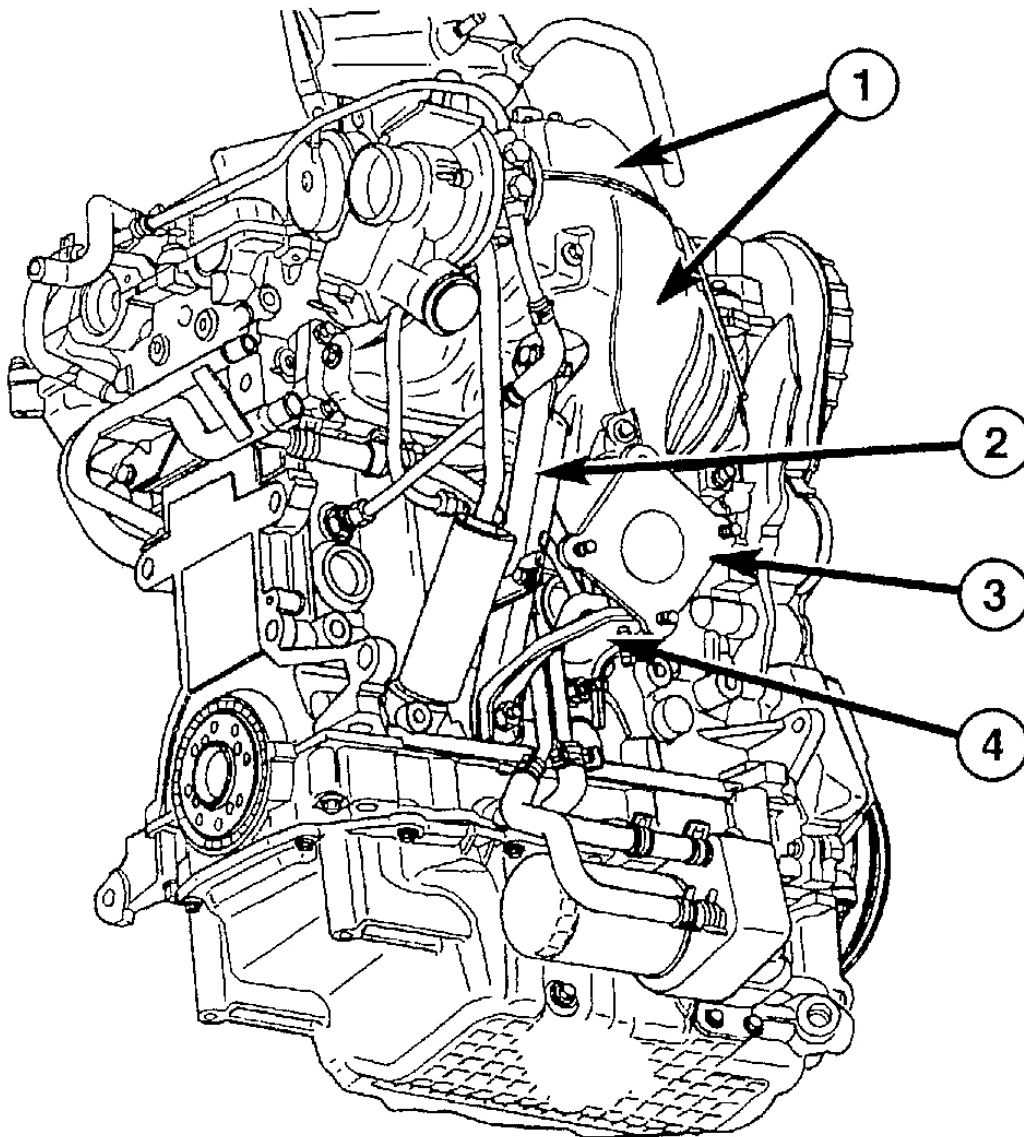


- 1 - POWER STEERING GEAR
- 2 - ROUTING CLIP
- 3 - PRESSURE HOSE TUBE NUT
- 4 - RETURN HOSE CLAMP
- 5 - PRESSURE/RETURN HOSE ASSEMBLY

G01857687

**Fig. 18: Identifying Hoses At Power Steering Gear - 2.4L Turbo**  
 Courtesy of DAIMLERCHRYSLER CORP.

37. **Turbocharger equipped vehicles:** Remove upper and lower heat shields, elbow support bracket, turbocharger support bracket, and elbow.



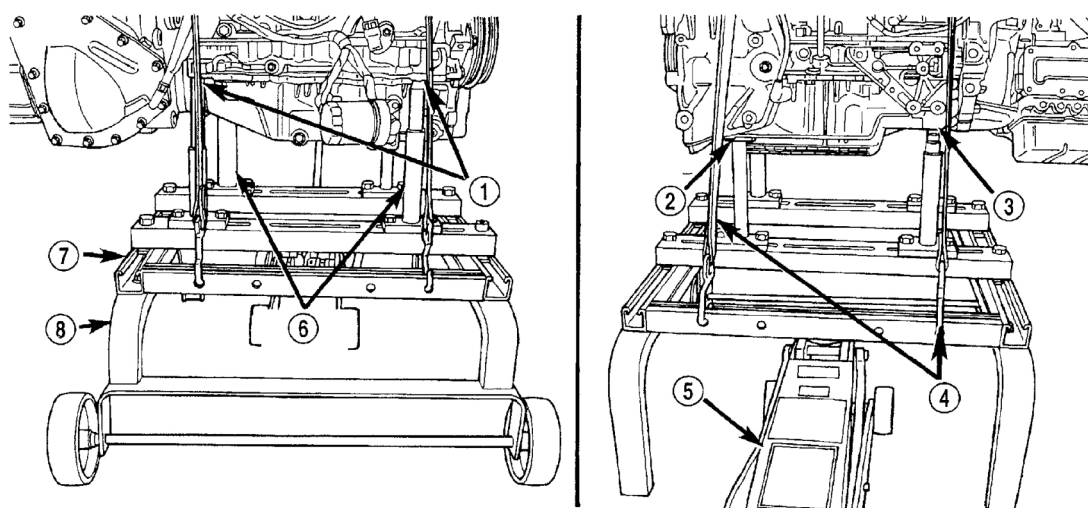
- 1 - UPPER/LOWER HEAT SHIELDS
- 2 - TURBOCHARGER SUPPORT BRACKET
- 3 - ELBOW
- 4 - ELBOW SUPPORT BRACKET

G01857688

**Fig. 19: Removing Turbocharger Brackets & Heat Shields**  
**Courtesy of DAIMLERCHRYSLER CORP.**



38. Remove structural collar. See **STRUCTURAL COLLAR**.
39. **Automatic Transmission equipped vehicles:**
  - a. Remove torque converter bolts and mark converter to flex plate orientation for reassembly.
40. **Manual Transmission equipped vehicles:**
  - a. Remove drive plate to clutch module bolts.
41. Remove lower engine torque strut. See **TORQUE STRUT**.
42. Lower vehicle and remove A/C compressor.
43. Disconnect power steering lines from power steering pump.
44. Remove power steering pump.
45. Raise vehicle enough to allow engine dolly, cradle, and posts, (Special Tools 6135, 6710, and 6848) to be installed under vehicle. For Special Tool identification, see **SPECIAL TOOLS**.
46. Loosen engine support posts to allow movement for positioning onto engine locating holes and flange on the engine bedplate. Lower vehicle and position cradle until the engine is resting on support posts. Tighten mounts to cradle frame. This will keep support posts from moving when removing or installing engine and transmission.



1 - POST LOCATING HOLES IN BLOCK  
 2 - POST POSITIONED UNDER BRACKET  
 3 - POST LOCATING HOLE IN STRUT  
 4 - SAFETY STRAPS

G01857691

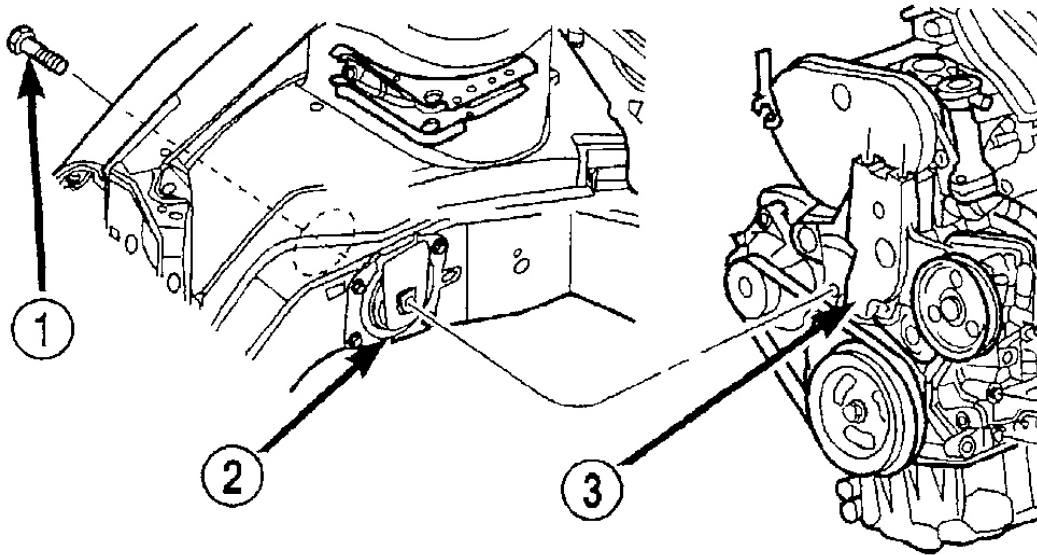
5 - FLOOR JACK  
 6 - SPECIAL TOOL 6848  
 7 - SPECIAL TOOL 6135  
 8 - SPECIAL TOOL 6710

**Fig. 20: Positioning Engine Cradle Support Post**  
 Courtesy of DAIMLERCHRYSLER CORP.

**WARNING: Safety straps MUST be used.**

47. Install safety straps around the engine to cradle. Tighten straps and lock them into position.

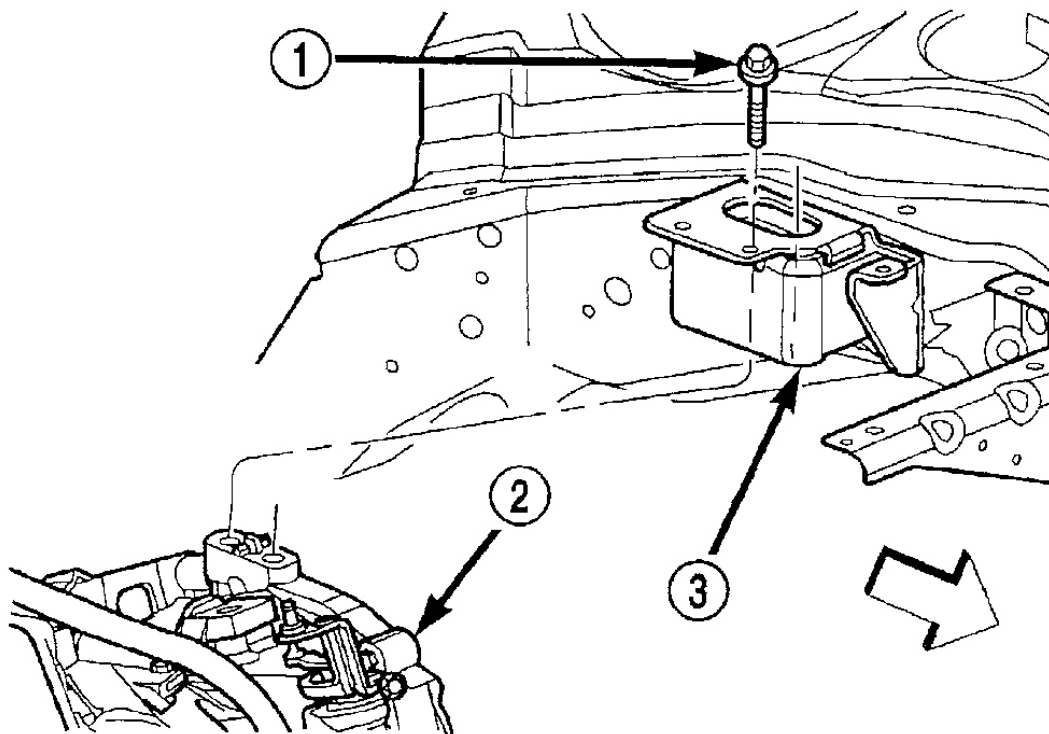
48. Raise vehicle enough to determine if straps are secure enough to hold cradle assembly to engine.
49. Lower vehicle so weight of the engine and transmission ONLY is on the cradle assembly.
50. Remove the upper engine torque strut.
51. Remove right mount through bolt and left mount attaching bolts.



- 1 - BOLT  
2 - RIGHT ENGINE MOUNT  
3 - ENGINE MOUNT BRACKET

G01857689

**Fig. 21: Locating Right Mount Through Bolt**  
Courtesy of DAIMLERCHRYSLER CORP.



- 1 - BOLT
- 2 - TRANSAXLE
- 3 - LEFT MOUNT

G01857690

**Fig. 22: Locating Left Mount Bolts**  
 Courtesy of DAIMLERCHRYSLER CORP.

52. Raise vehicle slowly until engine/transaxle assembly clears engine compartment. It may be necessary to move the engine/transmission assembly with the cradle to allow for removal around body flanges.

## INSTALLATION

1. Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine/transaxle assembly.
2. Continue lowering vehicle until engine/transaxle aligns to mounting locations. Install mounting bolts at the right and left engine/transaxle mounts. Tighten bolts to 118 N.m (87 ft. lbs.).
3. Install upper engine torque strut.
4. Remove safety straps from engine/transaxle assembly. Slowly raise vehicle enough to remove the engine dolly and cradle.

5. Install power steering pump.
  6. Connect power steering lines to power steering pump.
  7. Install A/C compressor.
  8. Install lower engine torque strut. See **TORQUE STRUT**.
  9. **Automatic Transmission equipped vehicles:**
    - a. Install torque converter bolts.
  10. **Manual Transmission equipped vehicles:**
    - a. Install drive plate to clutch module bolts.
  11. Install structural collar. See **STRUCTURAL COLLAR**.
  12. **Turbocharger equipped vehicles:** Install elbow, turbocharger support bracket, elbow support bracket, and upper and lower heat shields. See **Fig. 19**.
  13. **Non-Turbo equipped vehicles:** Connect power steering pressure hose to steering gear. See **Fig. 17**.
  14. **Turbocharger equipped vehicles:** Connect both power steering hoses to steering gear. See **Fig. 18**.
  15. Connect exhaust system to manifold. See **Fig. 15** and **Fig. 16**.
  16. Connect the downstream oxygen sensor.
  17. **Turbocharger equipped vehicles:** Install charge air cooler hoses. See **Fig. 14**.
  18. Install generator and mounting brackets.
  19. Install accessory drive belts. See **COOLING SYSTEM MECHANICAL** article.
  20. Install axle shafts. See **AXLE SHAFTS** article.
  21. Install right inner splash shield.
  22. Install wheels and lower vehicle.
  23. Install cooling module assembly (fan, radiator, A/C condenser, transmission oil cooler). Connect radiator fan electrical connector.
  24. **Turbocharger equipped vehicles:** Connect power steering hoses to radiator.
  25. **Manual Transmission equipped vehicles:**
    - a. Connect clutch hydraulic line. See **Fig. 12**.
    - b. Connect transmission shift linkage.
    - c. Connect transmission electrical connectors.
- NOTE:** It is not necessary to bleed the clutch hydraulic system. The quick-connect fittings close immediately after disconnection; allowing no fluid to escape.
26. **Automatic Transmission equipped vehicles:**
    - a. Connect transmission oil cooler lines using service splice kit. Refer to instructions provided with kit.
    - b. Connect transmission electrical connectors.
    - c. Connect transmission shift linkage.
  27. Connect A/C lines at junction near upper torque strut.

28. Connect upper A/C line to A/C condenser.
29. Install upper and lower radiator hoses.
30. Install upper radiator closure panel and center brace. See **Fig. 11**. See **BODY** article.
31. Install grille. See **BODY** article.
32. Connect fuel line and heater hoses.
33. Connect coolant reserve/recovery hose to coolant outlet connector.
34. Connect brake booster vacuum hose to intake manifold.
35. Connect the proportional purge hose to throttle body.
36. Install all ground straps and connect engine wiring harness.
37. Position PDC and install bolts. See **Fig. 10**. Connect positive battery cable to PDC and ground wire to vehicle body.
38. Connect engine wiring harness at Powertrain Control Module (PCM).
39. Connect throttle and speed control cables.
40. Install battery tray and battery. See **CHARGING & STARTING SYSTEMS** article.
41. Connect cables to battery.
42. Install air cleaner housing assembly and connect clean air hose. See **AIR CLEANER HOUSING**.
43. Install oil filter. Fill engine crankcase with proper oil to correct level.
44. Fill power steering system.
45. Fill cooling system. See **COOLING SYSTEM MECHANICAL** article.
46. Evacuate and recharge A/C system. See **MANUAL HVAC SYSTEM** article.
47. Start engine and run until operating temperature is reached.
48. Perform torque strut adjustment procedure. See **TORQUE STRUT**.
49. Adjust transmission linkage, if necessary.

## SPECIFICATIONS

### 2.4L ENGINE

#### Identifying General Engine Specifications

DESCRIPTION	SPECIFICATION	
Type	In-Line OHV, DOHC	
Number of Cylinders	4	
Firing Order	1-3-4-2	
Compression Ratio	Non-Turbo	9.5:1
	Turbo	8.1:1
Max. Variation Between Cylinders	25%	
	<b>Metric</b>	<b>Standard</b>
Displacement	2.4 Liters	148 cu. in.
Bore	87.5 mm	3.445 in.

**2004 Chrysler PT Cruiser GT**

2004 ENGINES 2.4L 4-Cylinder DOHC

Stroke	101.0 mm	3.976 in.
Compression Pressure	1172-1551 kPa	170-225 psi

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Cylinder Bore Diameter	87.4924- 87.5076 mm	3.4446-3.4452 in.
Out-of-Round (Max.)	0.051 mm	0.002 in.
Taper (Max.)	0.051 mm	0.002 in.

G01857693

**Fig. 23: Identifying Cylinder Block Specifications**  
Courtesy of DAIMLERCHRYSLER CORP.

## 2004 Chrysler PT Cruiser GT

2004 ENGINES 2.4L 4-Cylinder DOHC

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Diameter		
Non-Turbo	87.463-87.481 mm	3.4434-3.4441 in.
Turbo	87.436-87.454 mm	3.4424-3.4431 in.
Clearance @ 14 mm (0.551 in.) from bottom of skirt (Non-Turbo)	0.024-0.057 mm	0.0009-0.0022 in.
Clearance @ 22 mm (0.866 in.) from bottom of skirt (Turbo)	0.046-0.064 mm	0.0018-0.0025 in.
Weight	331-339 grams	11.67-11.95 oz.
Land Clearance (Diametrical)		
Non-Turbo	0.614-0.664 mm	0.024-0.026 in.
Turbo	0.556-0.674 mm	0.021-0.027 in.
Piston Length		
Non-Turbo	66.25 mm	2.608 in.
Turbo	61.43 mm	2.419 in.
Piston Ring Groove Depth No. 1		
Non-Turbo	4.640-4.784 mm	0.182-0.188 in.
Turbo	3.713-3.882 mm	0.146-0.153 in.
Piston Ring Groove Depth No. 2		
Non-Turbo	4.575-4.719 mm	0.180-0.185 in.
Turbo	4.118-4.297 mm	0.162-0.169 in.
Piston Ring Groove Depth No. 3		
Non-Turbo	4.097-4.236 mm	0.161-0.166 in.
Turbo	2.818-2.967 mm	0.110-0.116 in.

G01857694

**Fig. 24: Identifying Piston Specifications**  
**Courtesy of DAIMLERCHRYSLER CORP.**

# 2004 Chrysler PT Cruiser GT

2004 ENGINES 2.4L 4-Cylinder DOHC

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance in Piston		
Non-Turbo	0.005-0.018 mm	0.0002-0.0008 in.
Turbo	0.004-0.014 mm	0.0001-0.0005 in.
Clearance in Connecting Rod	Interference	
Non-Turbo		
Turbo	0.007-0.018 mm	0.0002-0.0007 in.
Diameter		
Non-Turbo	21.9982-22.003 mm	0.8660-0.8662 in.
Turbo	21.997-22.000 mm	0.8660-0.8661 in.
End Play	None	
Non-Turbo		
Turbo	0.34-1.44 mm	0.0133-0.0566 in.
Length		
Non-Turbo	72.75-73.25 mm	2.864-2.883 in.
Turbo	65.41-65.85 mm	2.575-2.592 in.

G01857695

**Fig. 25: Identifying Piston Pin Specifications**  
**Courtesy of DAIMLERCHRYSLER CORP.**



## 2004 Chrysler PT Cruiser GT

2004 ENGINES 2.4L 4-Cylinder DOHC

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap-Top Compression Ring		
Non-Turbo	0.25-0.51 mm	0.0098-0.020 in.
Turbo	0.20-0.40 mm	0.0078-0.0157 in.
Wear Limit	0.8 mm	0.031 in.
Ring Gap-2nd Compression Ring		
Non-Turbo	0.23-0.48 mm	0.009-0.018 in.
Turbo	0.20-0.40 mm	0.007-0.015 in.
Wear Limit	0.8 mm	0.031 in.
Ring Gap-Oil Control Steel Rails		
Non-Turbo	0.25-0.64 mm	0.009-0.025 in.
Turbo	0.15-0.66 mm	0.005-0.025 in.
Wear Limit	1.0 mm	0.039 in.
Ring Side Clearance- Compression Rings		
Non-Turbo	0.030-0.080 mm	0.0011-0.0031 in.
Turbo	0.035-0.085 mm	0.001-0.003 in.
Wear Limit	0.10 mm	0.004 in.
Ring Side Clearance-Oil Ring Pack		
Non-Turbo	0.012-0.178 mm	0.0004-0.0070 in.
Turbo	0.027-0.176 mm	0.001-0.006 in.
Ring Width- Compression Rings		
Non-Turbo	1.47-1.50 mm	0.057-0.059 in.
Turbo Top Ring	1.17-1.19 mm	0.0460-0.0468 in.
Turbo 2nd Ring	1.472-1.49 mm	0.057-0.058 in.
Ring Width-Oil Ring Pack		
Non-Turbo	2.72-2.88 mm	0.107-0.1133 in.
Turbo	2.64-2.89 mm	0.103-0.113 in.

G01857696

**Fig. 26: Identifying Piston Ring Specifications**  
Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.025-0.071 mm	0.0009-0.0027 in.
Wear Limit	0.075 mm	0.003 in.
Bore Diameter-Piston Pin		
Non-Turbo	20.96-20.98 mm	0.8252-0.8260 in.
Turbo	22.007-22.015 mm	0.8664-0.8667 in.
Bore Diameter-Crankshaft End		
Non-Turbo	52.993-53.007 mm	2.0863-2.0868 in.
Turbo	52.992-53.008 mm	2.0862-2.0869 in.
Side Clearance	0.13-0.38 mm	0.005-0.015 in.
Wear Limit	0.40 mm	0.016 in.
Weight-Total (Less Bearing)		
Non-Turbo	565.8 grams	19.96 oz.
Turbo	663.5 grams	23.4 oz.

G01857697

**Fig. 27: Identifying Connecting Rod Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Connecting Rod Journal Diameter	49.984-50.000 mm	1.968-1.9685 in.
Main Bearing Journal Diameter	59.992-60.008 mm	2.362-2.3625 in.
Journal Out-of-Round (Max.)	0.0035 mm	0.0003 in.
Journal Taper (Max.)	0.007 mm	0.0001 in.
End Play	0.09-0.24 mm	0.0035-0.0094 in.
Wear Limit	0.38 mm	0.015 in.
Main Bearing Diametrical Clearance	0.018-0.062 mm	0.0007-0.0024 in.

G01857698

**Fig. 28: Identifying Crankshaft Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Body Diameter	15.901-15.913 mm	0.626-0.6264 in.
Plunger Travel Minimum (Dry)	3.0 mm	0.118 in.

G01857699

**Fig. 29: Identifying Hydraulic Lash Adjuster Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Journals No.1 - 6	26.020 - 26.041 mm	1.024 - 1.025 in.

G01857700

**Fig. 30: Identifying Cylinder Head Camshaft Bearing Bore Diameter Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Journal Diameter No. 1-6	25.951-25.970 mm	1.021-1.022 in.
Bearing Clearance - Diametrical	0.069-0.071 mm	0.0027-0.003 in.
End Play	0.05-0.17 mm	0.0019-0.0066 in.
Lift (Zero Lash)		
Intake	8.25 mm	0.324 in.
Exhaust	6.60 mm	0.259 in.
Intake Valve Timing*		
Closes (ABDC)	51°	
Opens (BTDC)	1°	
Duration	232°	
Exhaust Valve Timing*		
Closes (ATDC)	7°	
Opens (BBDC)	47°	
Duration	234°	
Valve Overlap	8°	
* All reading in degrees. Timing points @4° from top of ramp.		

G01857701

**Fig. 31: Identifying Camshaft Specifications**  
Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Material	Cast Aluminum	
Gasket Thickness (Compressed)	0.71 mm	0.028 in.

G01857702

**Fig. 32: Identifying Cylinder Head Specifications**  
Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Angle	44.5 - 45°	
Seat Diameter - Intake	34.37-34.63 mm	1.353-1.363 in.
Seat Diameter - Exhaust	27.06-27.32 mm	1.065-1.075 in.
Runout (Max.)	0.05 mm	0.002 in.
Valve Seat Width - Intake and Exhaust	0.9-1.3 mm	0.035-0.051 in.
Service Limit - Intake	2.0 mm	0.079 in.
Service Limit - Exhaust	2.5 mm	0.098 in.

G01857703

**Fig. 33: Identifying Valve Seat Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter I.D.	5.975-6.000 mm	0.235-0.236 in.
Guide Bore Diameter	11.0-11.02 mm	0.4330-0.4338 in.
Guide Height (spring seat to guide tip)	13.25-13.75 mm	0.521-0.541 in.

G01857704

**Fig. 34: Identifying Valve Guide Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.



DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle - Intake and Exhaust	44.5 - 45°	
Head Diameter - Intake	34.67-34.93 mm	1.364-1.375 in.
Head Diameter - Exhaust	28.32-28.52 mm	1.114-1.122 in.
Valve Length (Overall)		
Intake	112.76-113.32 mm	4.439-4.461 in.
Exhaust	110.89-111.69 mm	4.365-4.397 in.
Valve Stem Diameter		
Intake	5.934-5.952 mm	0.2337-0.2344 in.
Exhaust	5.906-5.924 mm	0.2326-0.2333 in.

G01857705

**Fig. 35: Identifying Valve Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	1.2-1.7 mm	0.047-0.066 in.
Service Limit	0.95 mm	.0037 in.
Exhaust	0.985-1.315 mm	0.038-0.051 in.
Service Limit	1.05 mm	.039 in.

G01857706

**Fig. 36: Identifying Valve Margin Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	48.04 mm	1.891 in.
Exhaust	47.99 mm	1.889 in.

G01857707

**Fig. 37: Identifying Valve Stem Tip Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	0.048-0.066 mm	0.0018-0.0025 in.
Max. Allowable	0.076 mm	0.003 in.
Service Limit	0.25 mm	0.010 in.
Exhaust	0.0736-0.094 mm	0.0029-0.0037 in.
Max. Allowable	0.101 mm	0.004 in.
Service Limit	0.25 mm	0.010 in.

G01857708

**Fig. 38: Identifying Valve Stem To Guide Clearance Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length (Approx.)	49.2 mm	1.937 in.
Nominal Force (Valve Closed)	334 N @ 38.0 mm	75 lbs. @ 1.496 in.
Nominal Force (Valve Open)	598 N @ 29.75 mm	134 lbs. @ 1.172 in.
Installed Height	38.00 mm	1.496 in.
Number of Coils	6.9	
Wire Diameter	3.61 mm	0.142 in

G01857709

**Fig. 39: Identifying Valve Springs Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors (Max.)	0.10 mm	0.004 in.
Cover Out-of-Flat (Max.)	0.025 mm	0.001 in.
Inner Rotor Thickness (Min.)	9.40 mm	0.370 in.
Outer Rotor Thickness (Min.)	9.40 mm	0.370 in.
Outer Rotor Clearance (Max.)	0.039 mm	0.015 in.
Outer Rotor Diameter (Min.)	79.95 mm	3.148 in.
Tip Clearance Between Rotors (Max.)	0.20 mm	0.008 in.

G01857710

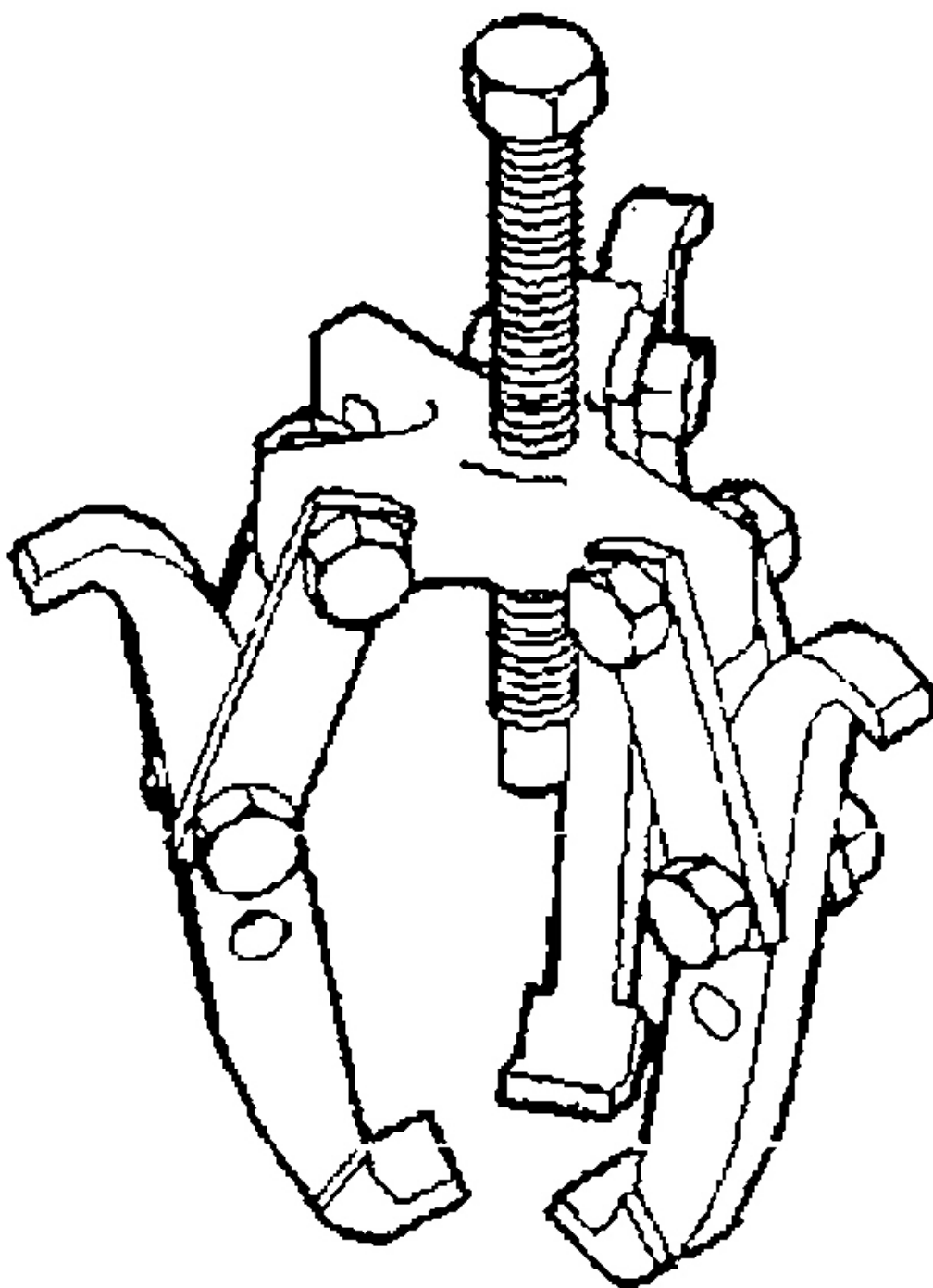
**Fig. 40: Identifying Oil Pump Specifications**  
 Courtesy of DAIMLERCHRYSLER CORP.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed*	25 kPa	4 psi
At 3000 rpm	170-550 kPa	25-80 psi
CAUTION: *If pressure is ZERO at curb idle, DO NOT run engine at 3000 rpm.		

G01857711

**Fig. 41: Identifying Oil Pressure Specifications**  
Courtesy of DAIMLERCHRYSLER CORP.

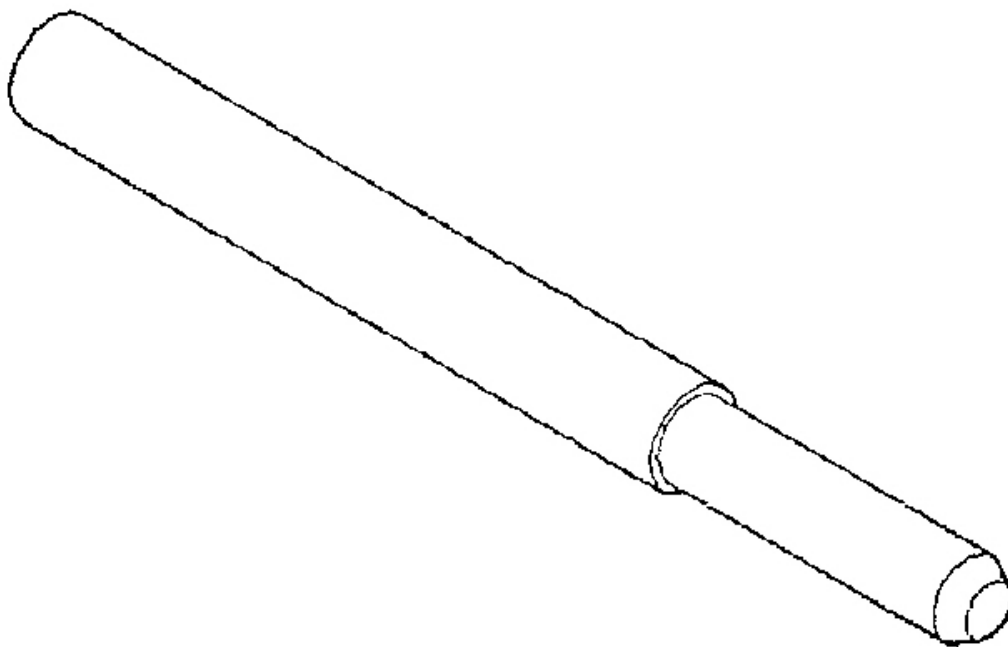
#### SPECIAL TOOLS



G01857713

**Fig. 42: Identifying Puller 1026**

Courtesy of DAIMLERCHRYSLER CORP.

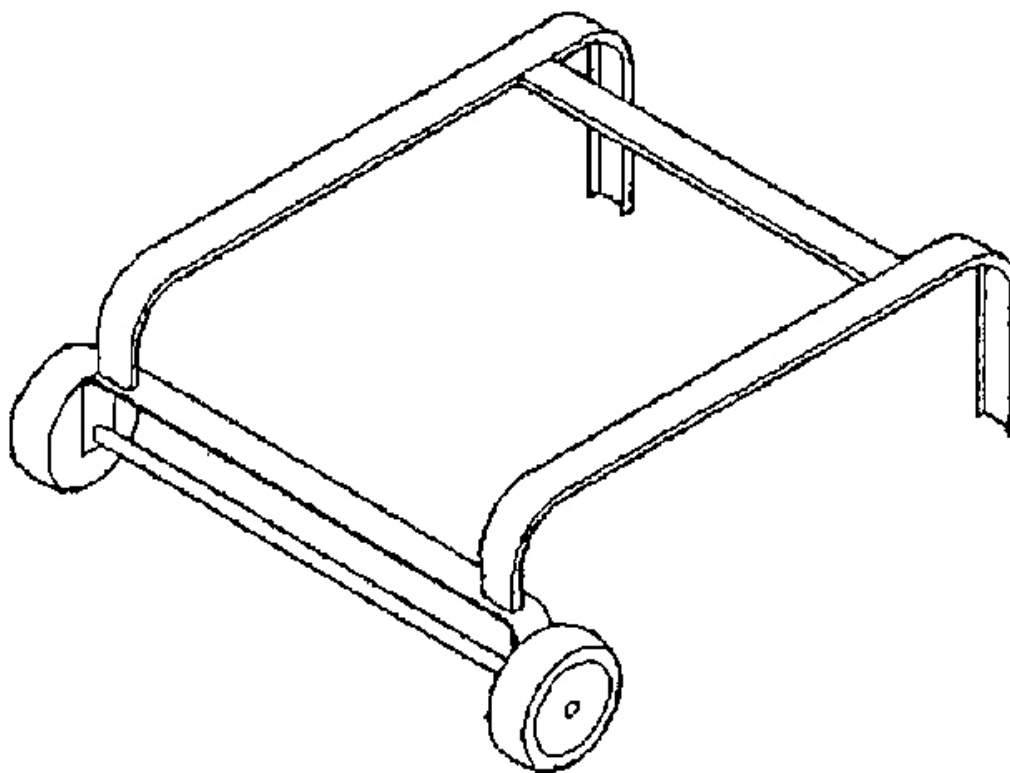


**G01857714**

**Fig. 43: Identifying Crankshaft Damper Removal Insert 6827A**

Courtesy of DAIMLERCHRYSLER CORP.

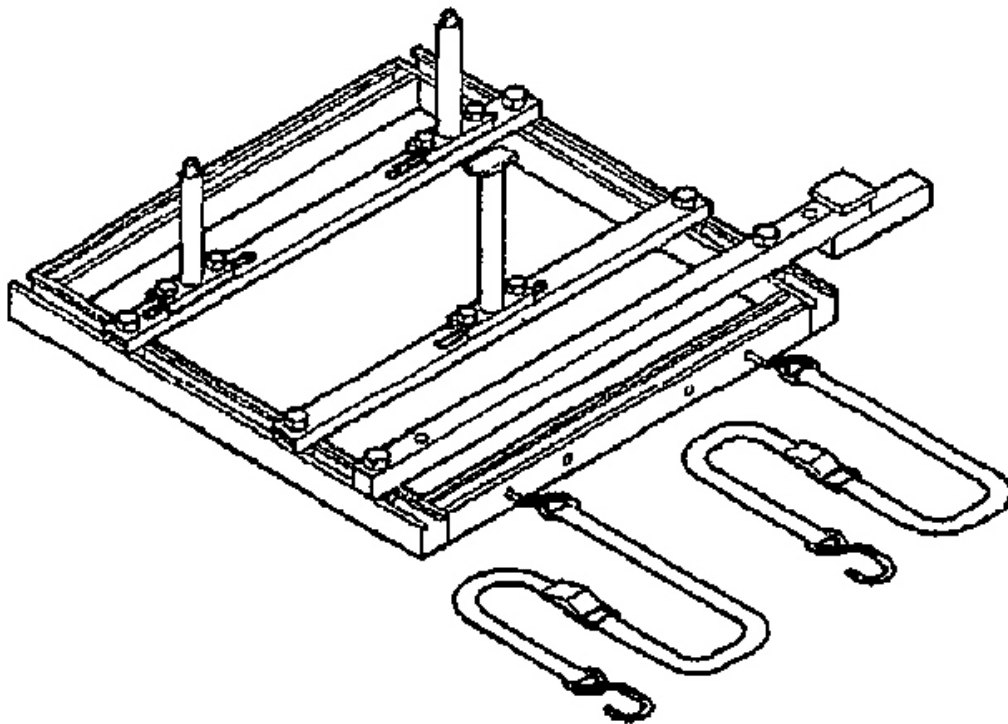




**G01857715**

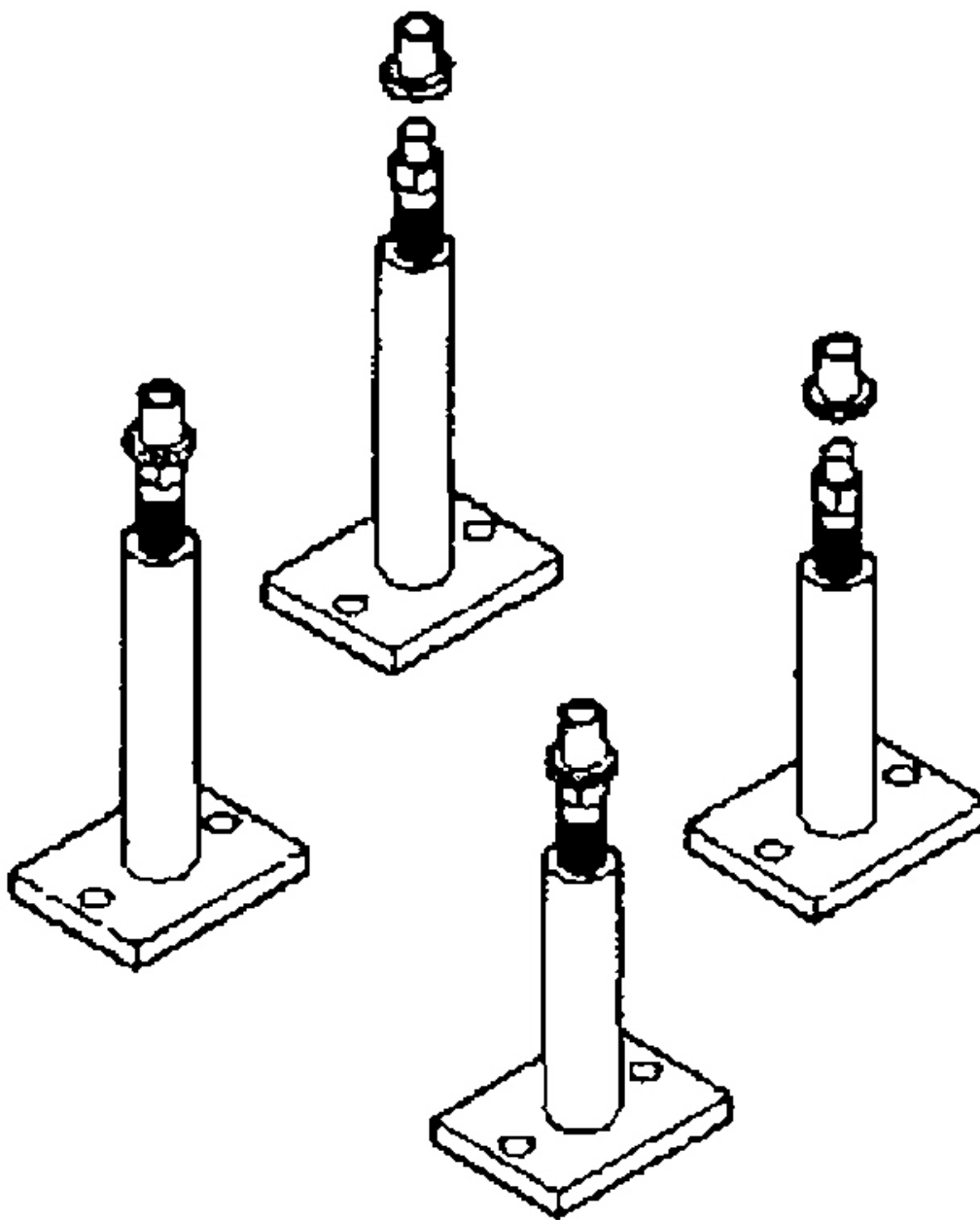
**Fig. 44: Identifying Dolly 6135**

**Courtesy of DAIMLERCHRYSLER CORP.**



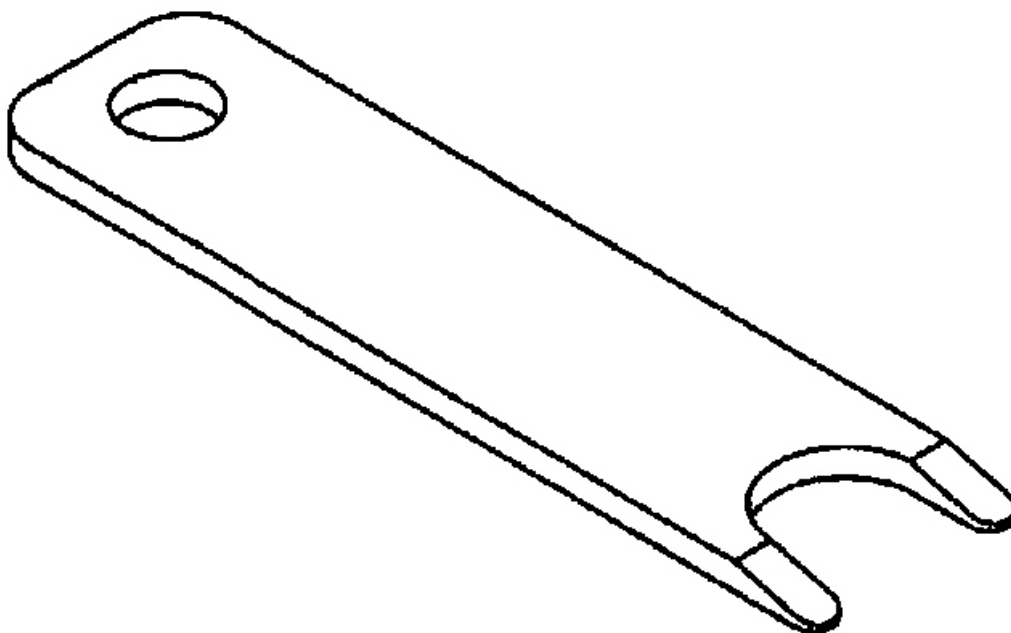
G01857716

**Fig. 45: Identifying Cradle 6710**  
Courtesy of DAIMLERCHRYSLER CORP.



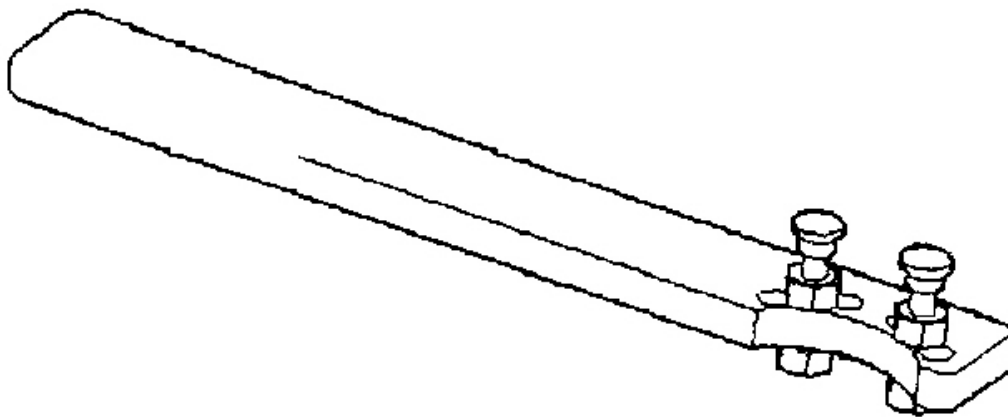
G01857717

**Fig. 46: Identifying Post Kit Engine Cradle 6848**  
Courtesy of DAIMLERCHRYSLER CORP.



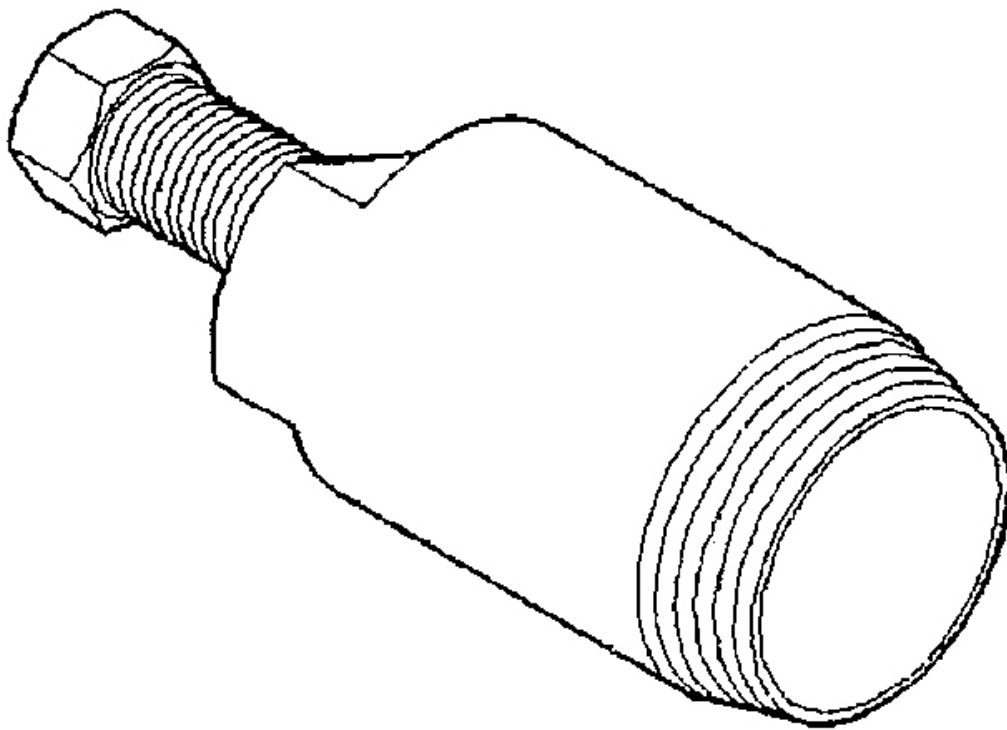
**G01857718**

**Fig. 47: Identifying Clutch Line Disconnect 6638A**  
**Courtesy of DAIMLERCHRYSLER CORP.**



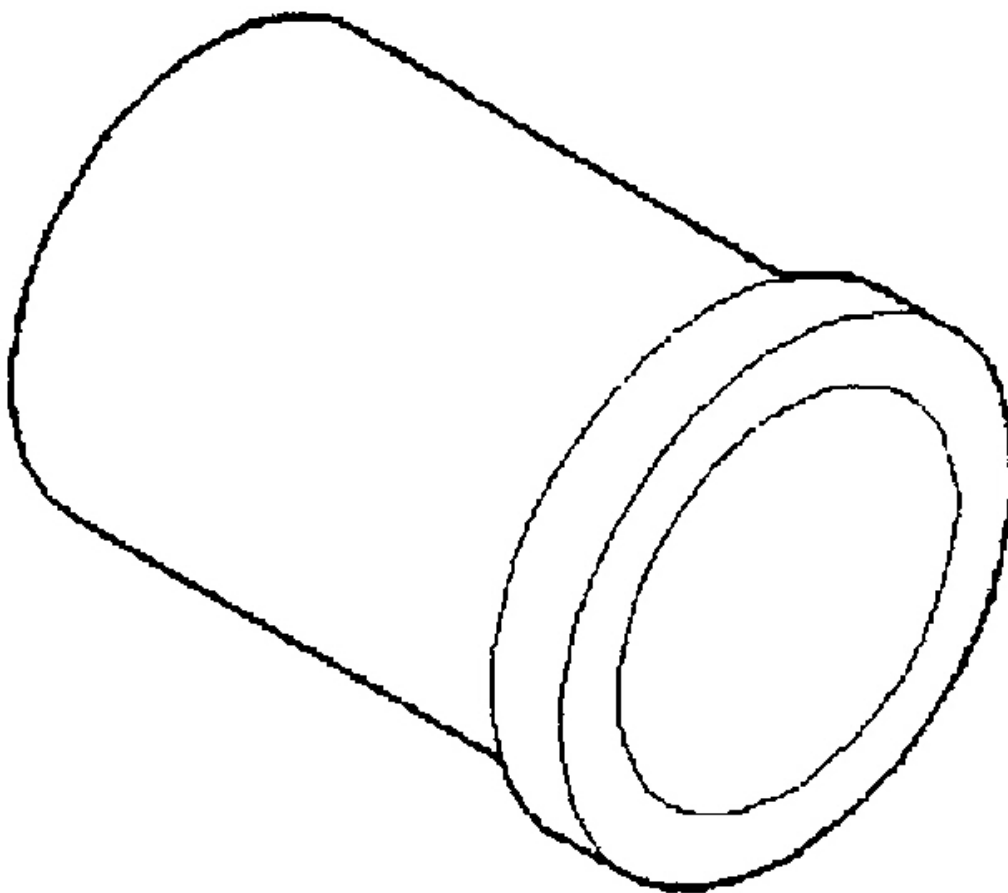
**G01857719**

**Fig. 48: Identifying Camshaft Sprocket Holder 6847**  
**Courtesy of DAIMLERCHRYSLER CORP.**



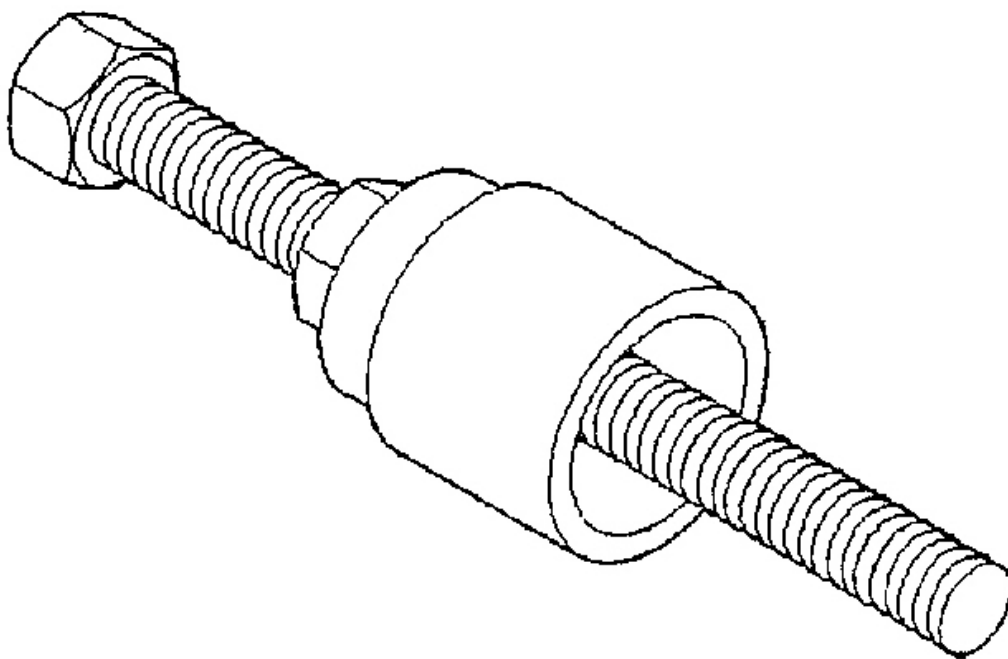
**G01857720**

**Fig. 49: Identifying Camshaft Seal Remover C-4679-A**  
**Courtesy of DAIMLERCHRYSLER CORP.**



**G01857721**

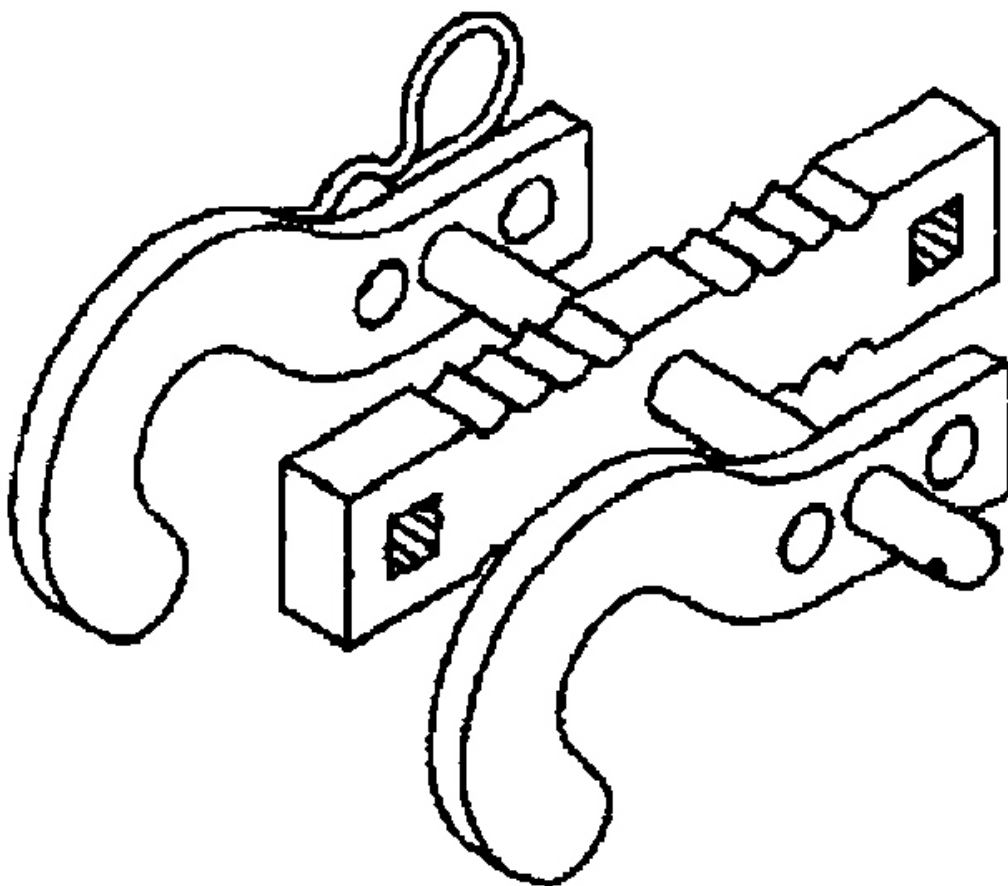
**Fig. 50: Identifying Camshaft Seal Installer MD-998306**  
**Courtesy of DAIMLERCHRYSLER CORP.**



**G01857722**

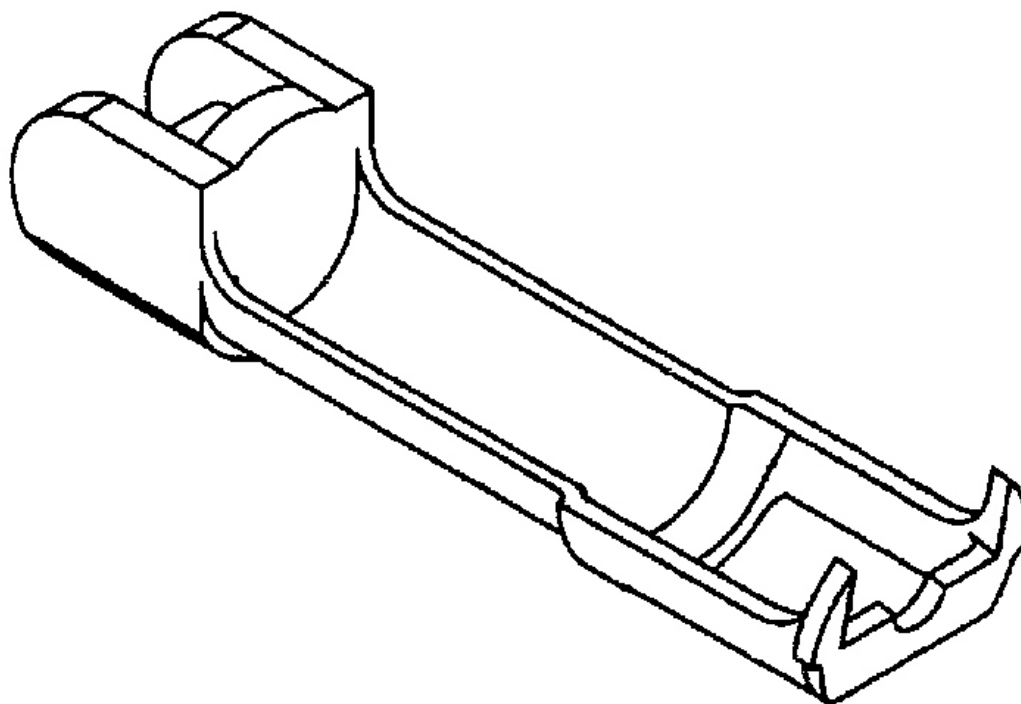
**Fig. 51: Identifying Crankshaft Damper/Sprocket Installer 6792**  
**Courtesy of DAIMLERCHRYSLER CORP.**





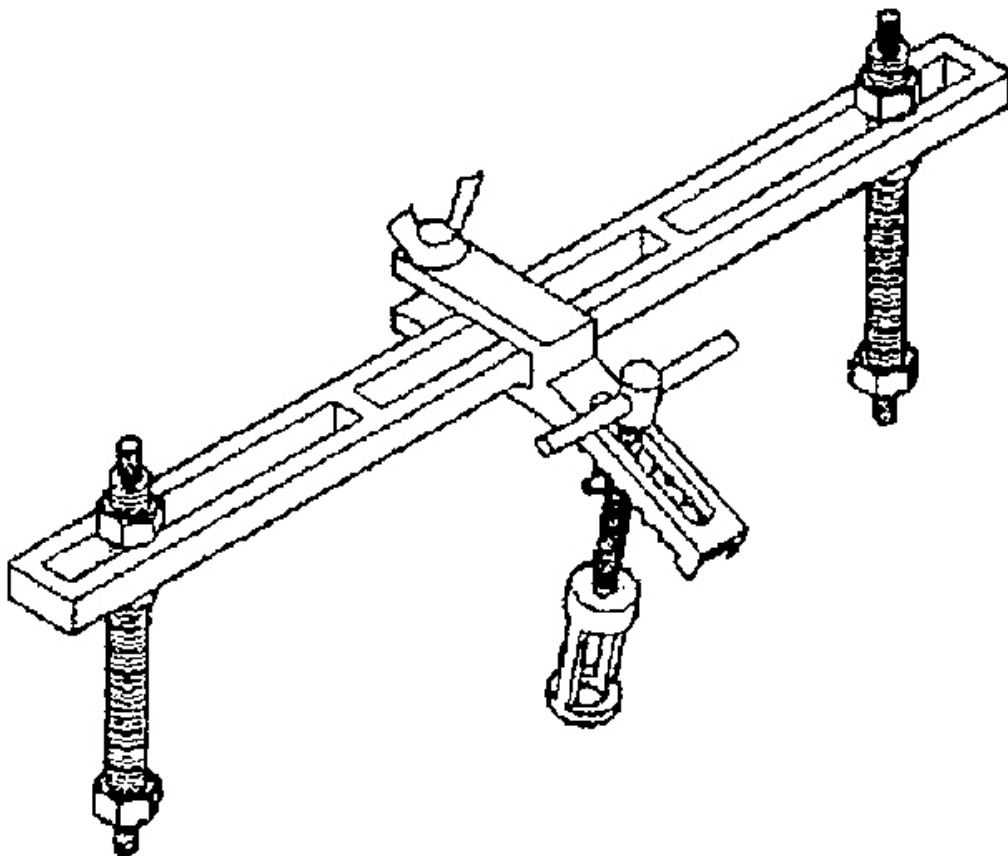
G01857723

**Fig. 52: Identifying Valve Spring Compressor 8215-A**  
Courtesy of DAIMLERCHRYSLER CORP.



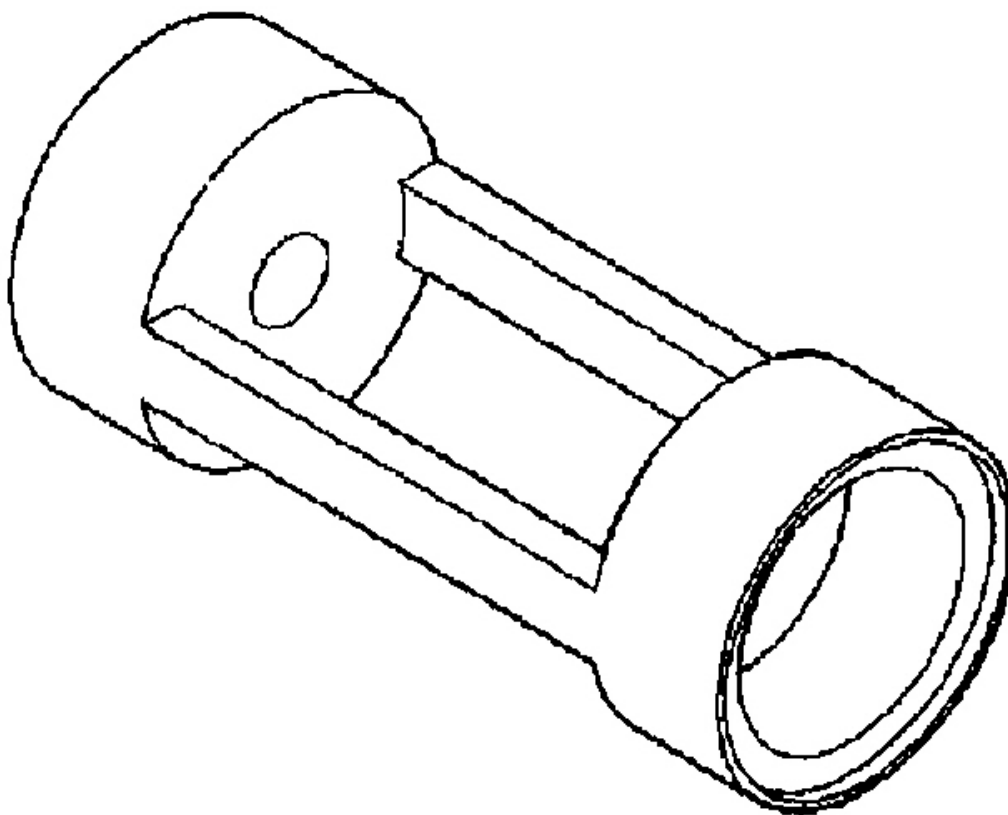
**G01857724**

**Fig. 53: Identifying Adaptor 8436**  
**Courtesy of DAIMLERCHRYSLER CORP.**



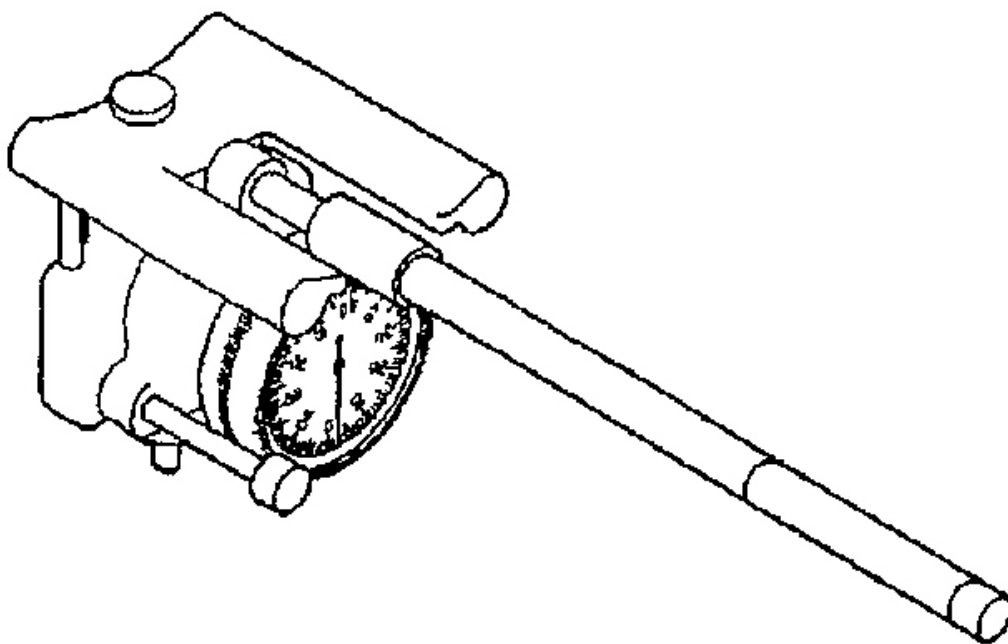
G01857725

**Fig. 54: Identifying Value Spring Compressor MD-998772-A**  
Courtesy of DAIMLERCHRYSLER CORP.



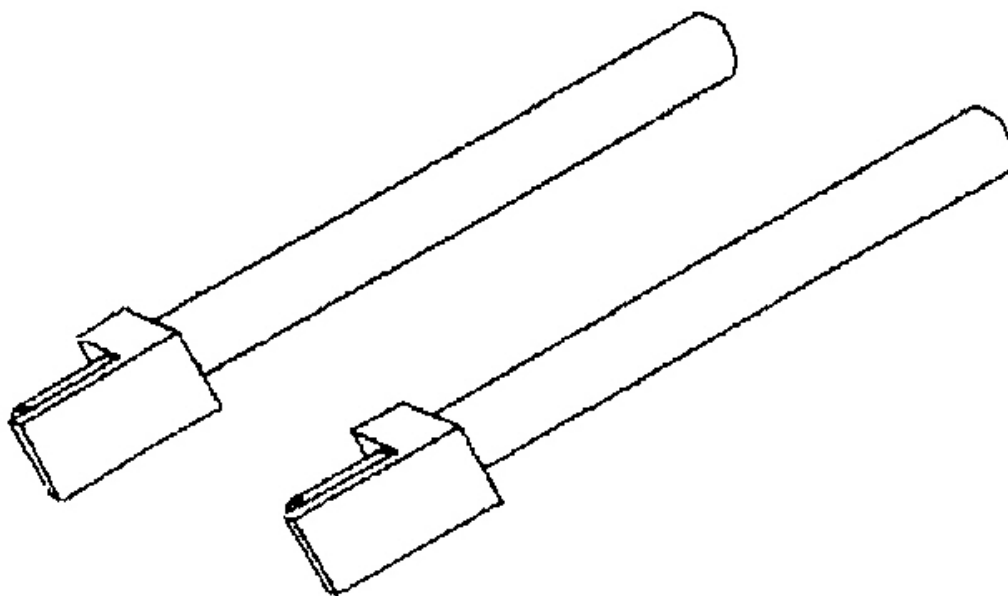
**G01857726**

**Fig. 55: Identifying Valve Spring Compressor Adapter 6779**  
**Courtesy of DAIMLERCHRYSLER CORP.**



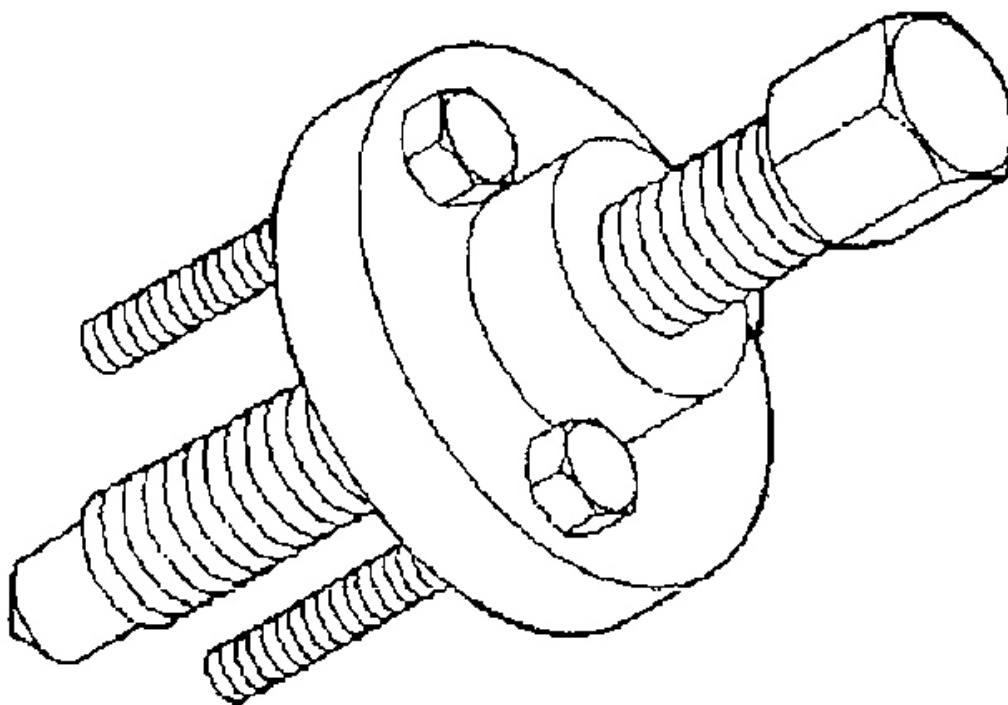
G01857727

**Fig. 56: Identifying Cylinder Bore Gage C-119**  
Courtesy of DAIMLERCHRYSLER CORP.



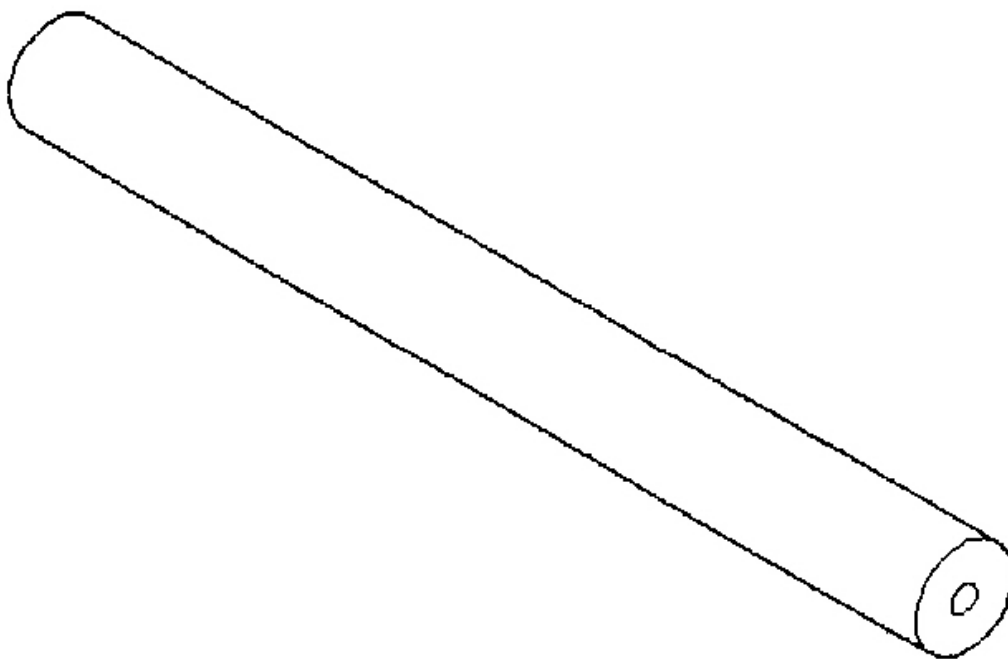
**G01857728**

**Fig. 57: Identifying Connecting Rod Guides 8189**  
**Courtesy of DAIMLERCHRYSLER CORP.**



**G01857729**

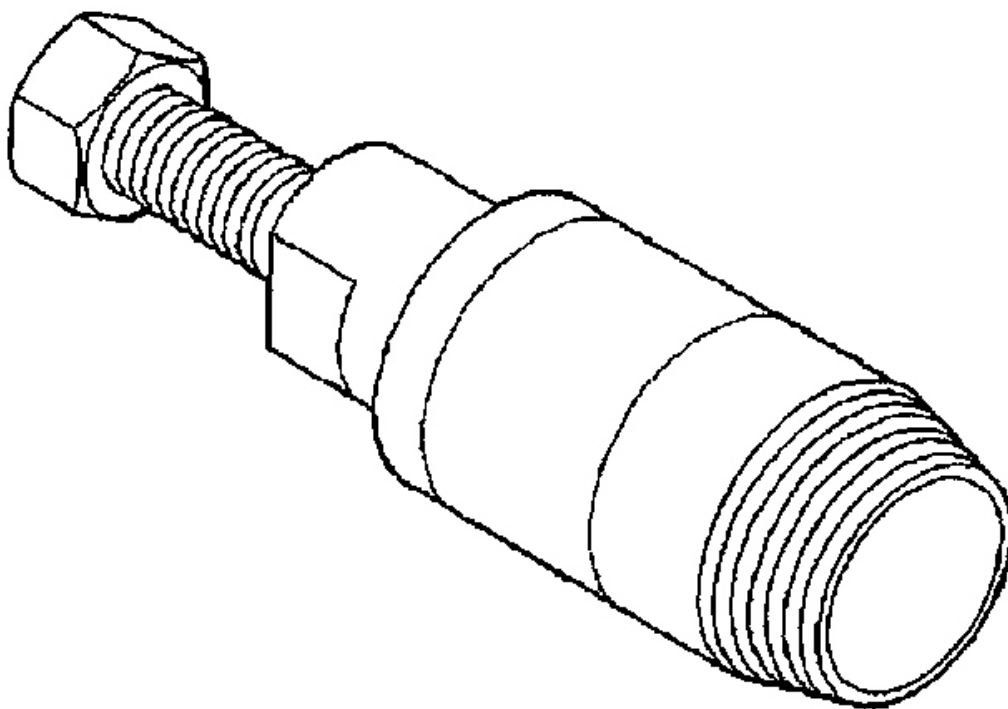
**Fig. 58: Identifying Crankshaft Sprocket Remover 6793**  
**Courtesy of DAIMLERCHRYSLER CORP.**



**G01857730**

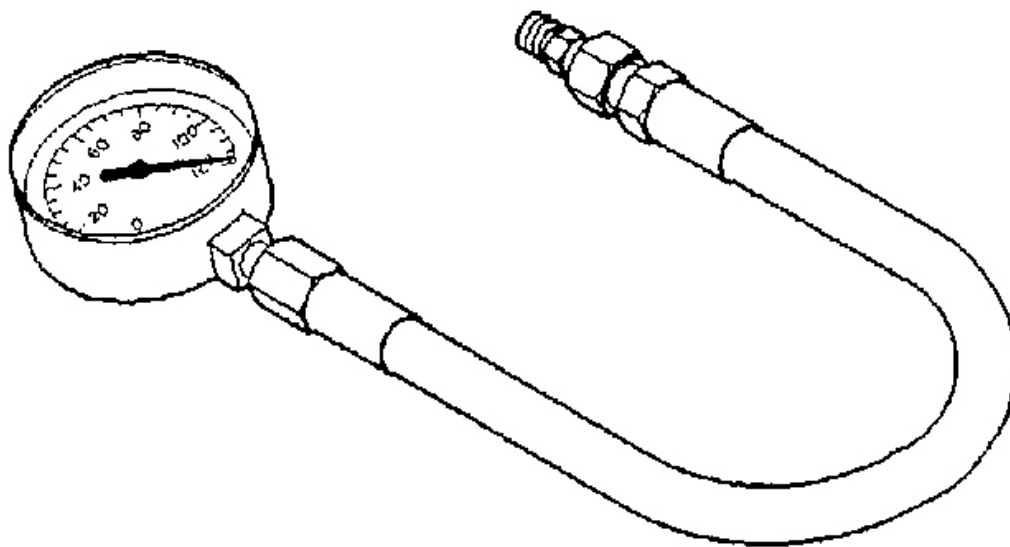
**Fig. 59: Identifying Crankshaft Sprocket Remover Insert C-4685-C2**  
**Courtesy of DAIMLERCHRYSLER CORP.**





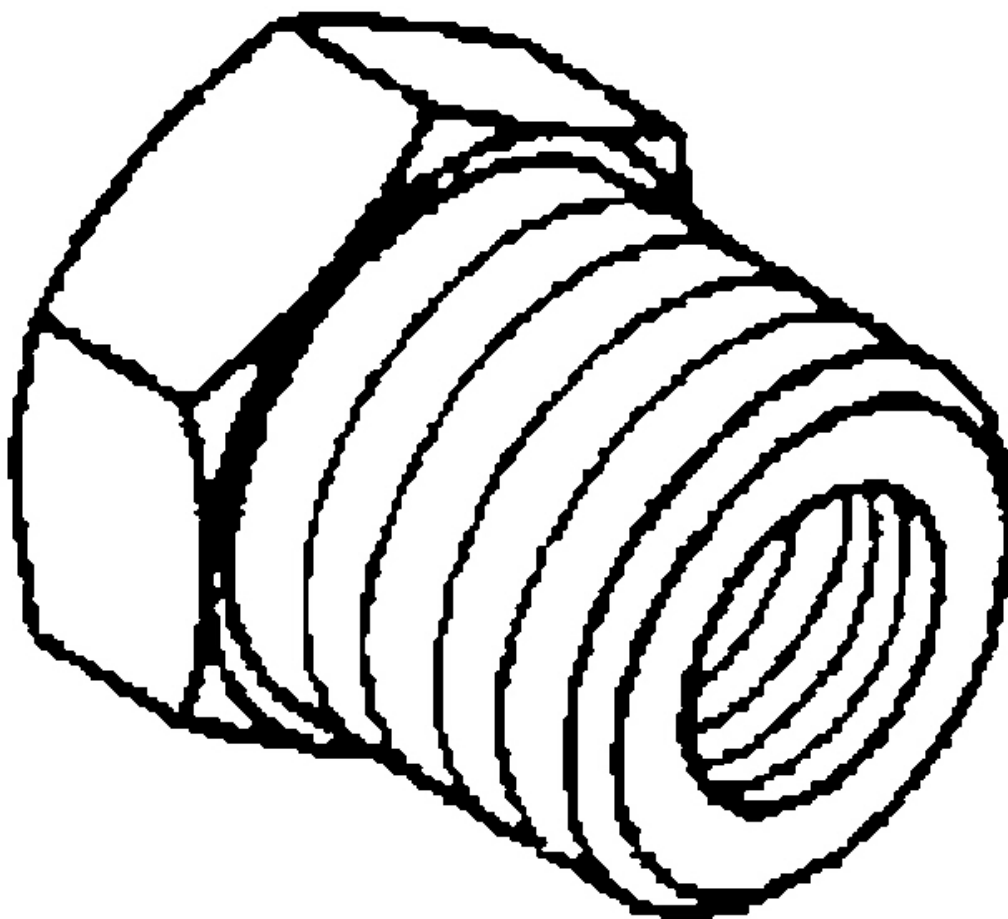
**G01857731**

**Fig. 60: Identifying Crankshaft Front Seal Remover 6771**  
**Courtesy of DAIMLERCHRYSLER CORP.**



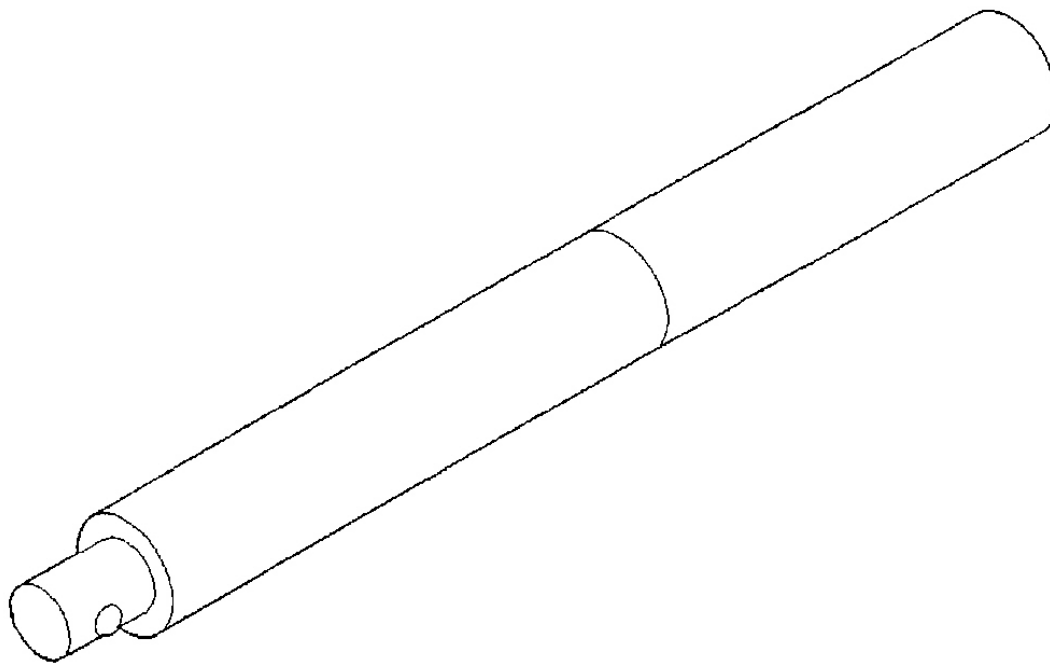
**G01857732**

**Fig. 61: Identifying Oil Pressure Gage C-3292**  
**Courtesy of DAIMLERCHRYSLER CORP.**



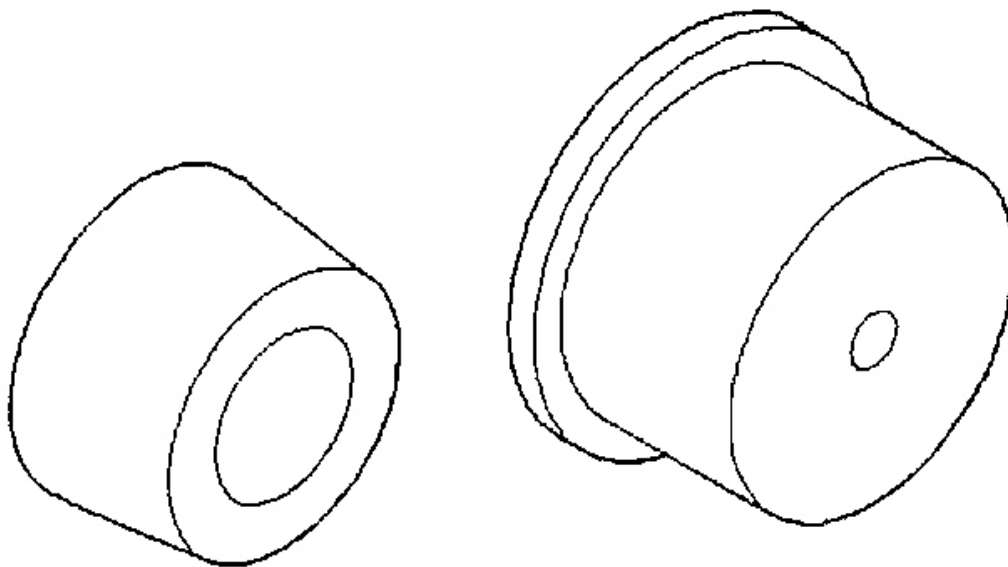
G01857733

**Fig. 62: Identifying Adaptor 8406**  
Courtesy of DAIMLERCHRYSLER CORP.



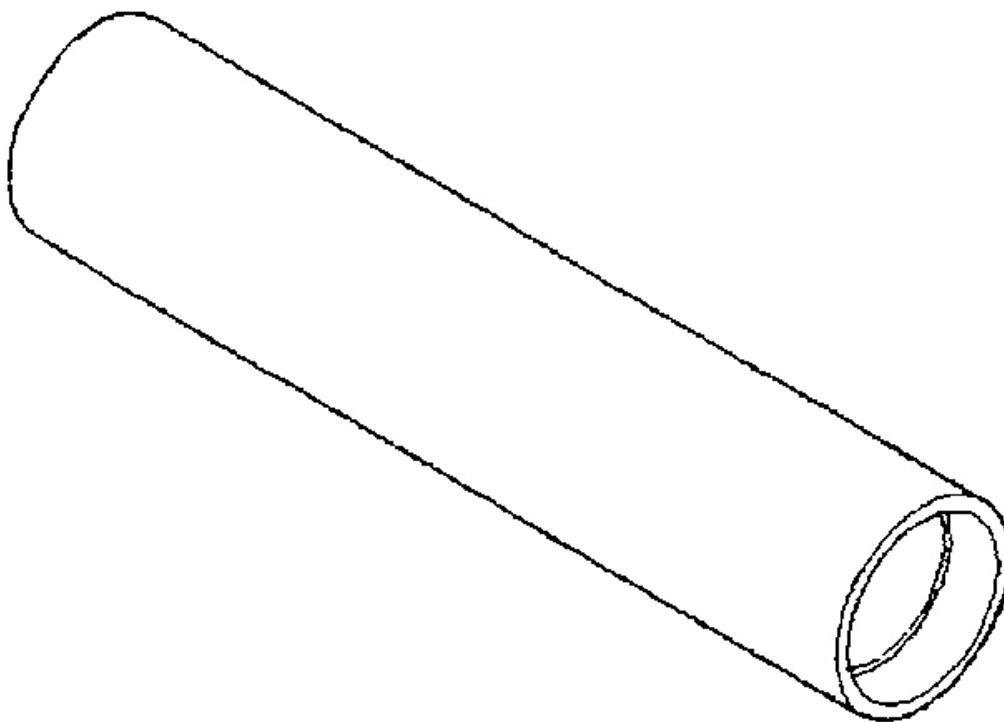
G01857734

**Fig. 63: Identifying Driver Handle C-4171**  
**Courtesy of DAIMLERCHRYSLER CORP.**



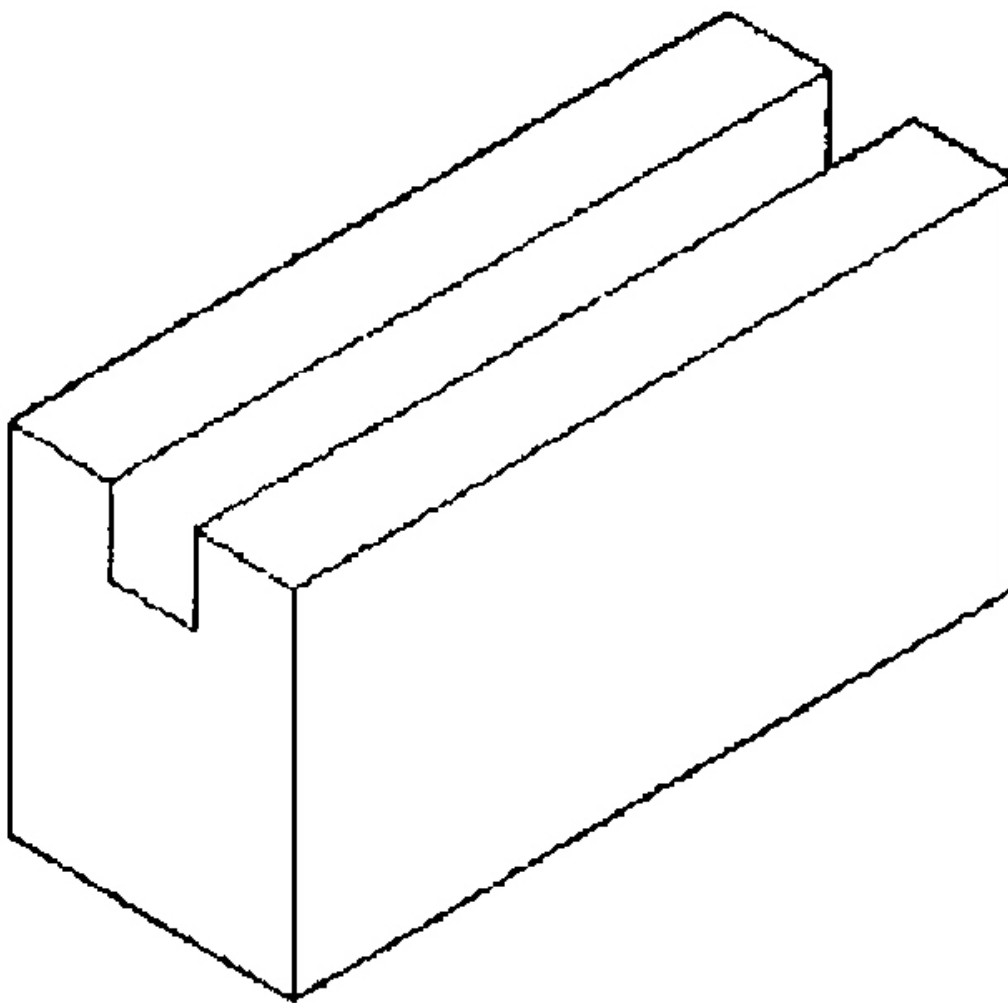
**G01857735**

**Fig. 64: Identifying Rear Crankshaft Seal Guide & Installer 6926-1 & 6926-2**  
Courtesy of DAIMLERCHRYSLER CORP.



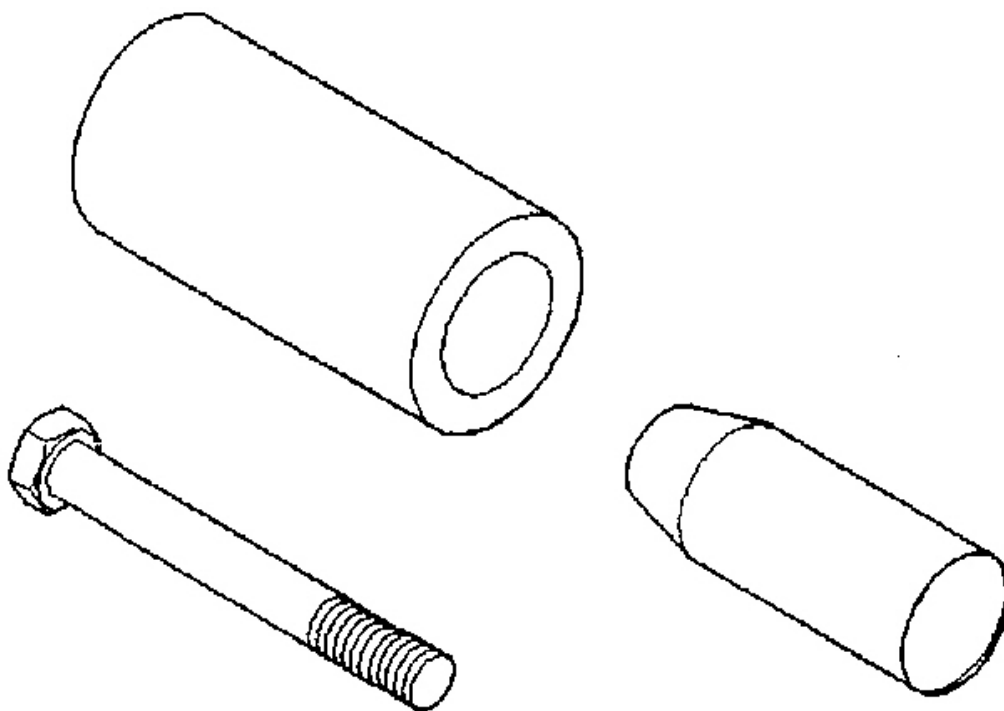
**G01857736**

**Fig. 65: Identifying Balance Shaft Sprocket Installer 6052**  
**Courtesy of DAIMLERCHRYSLER CORP.**



**G01857737**

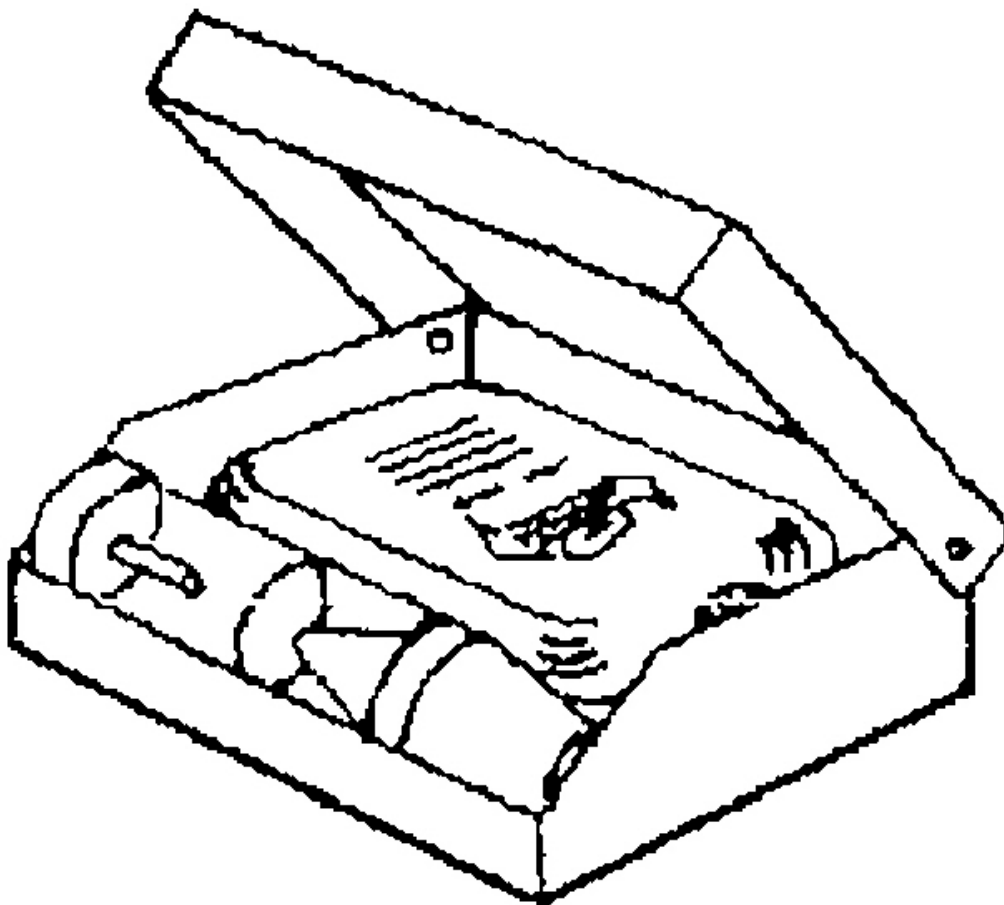
**Fig. 66: Identifying Post Adapter 8130**  
**Courtesy of DAIMLERCHRYSLER CORP.**



**G01857738**

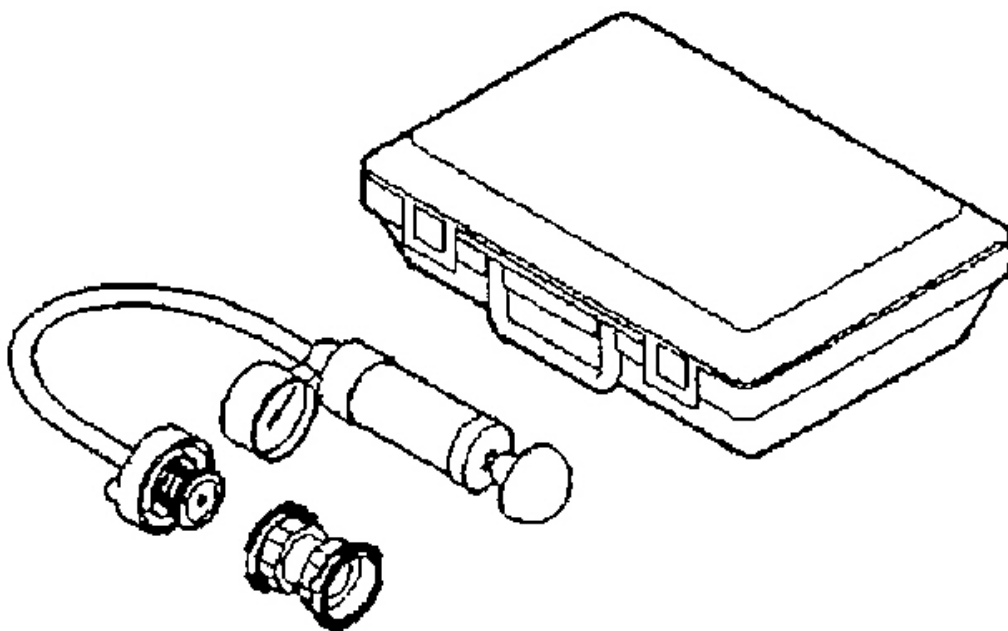
**Fig. 67: Identifying Front Crankshaft Oil Seal Installer 6780**  
**Courtesy of DAIMLERCHRYSLER CORP.**





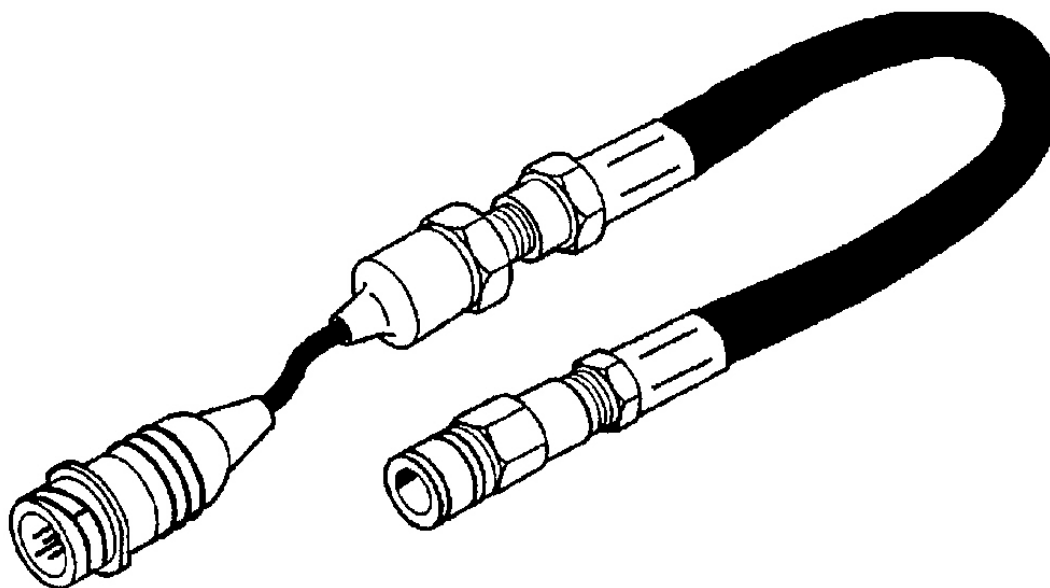
G01857739

**Fig. 68: Identifying Combustion Leak Tester C-3685-A**  
Courtesy of DAIMLERCHRYSLER CORP.



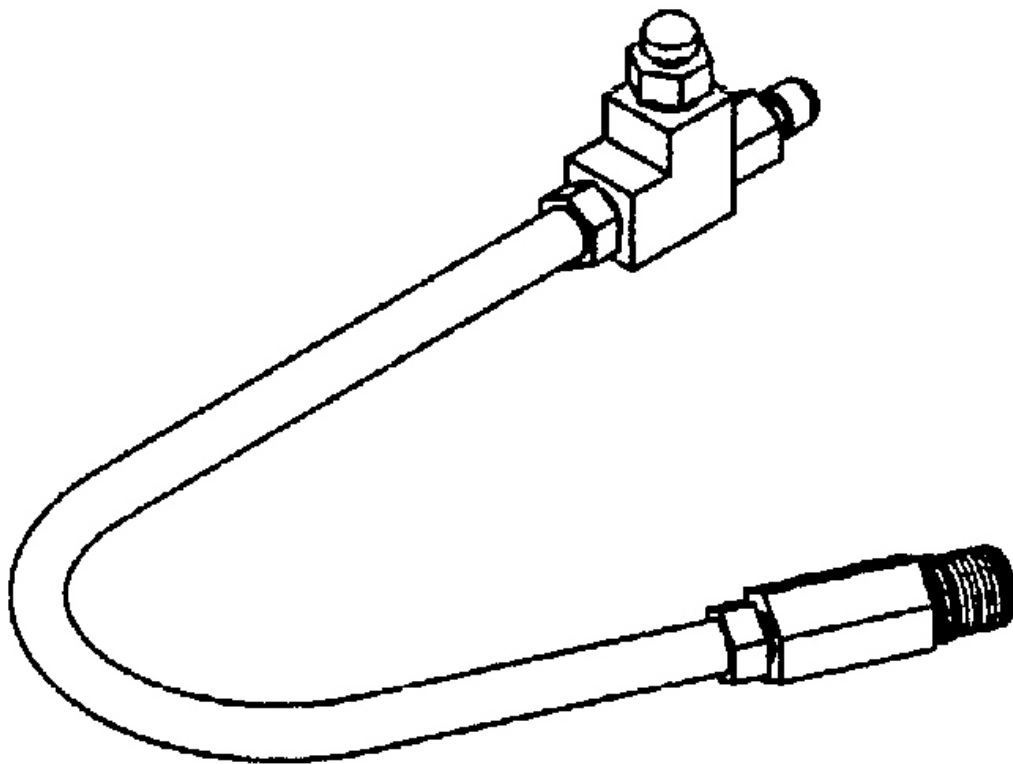
**G01857740**

**Fig. 69: Identifying Cooling System Tester 7700**  
**Courtesy of DAIMLERCHRYSLER CORP.**



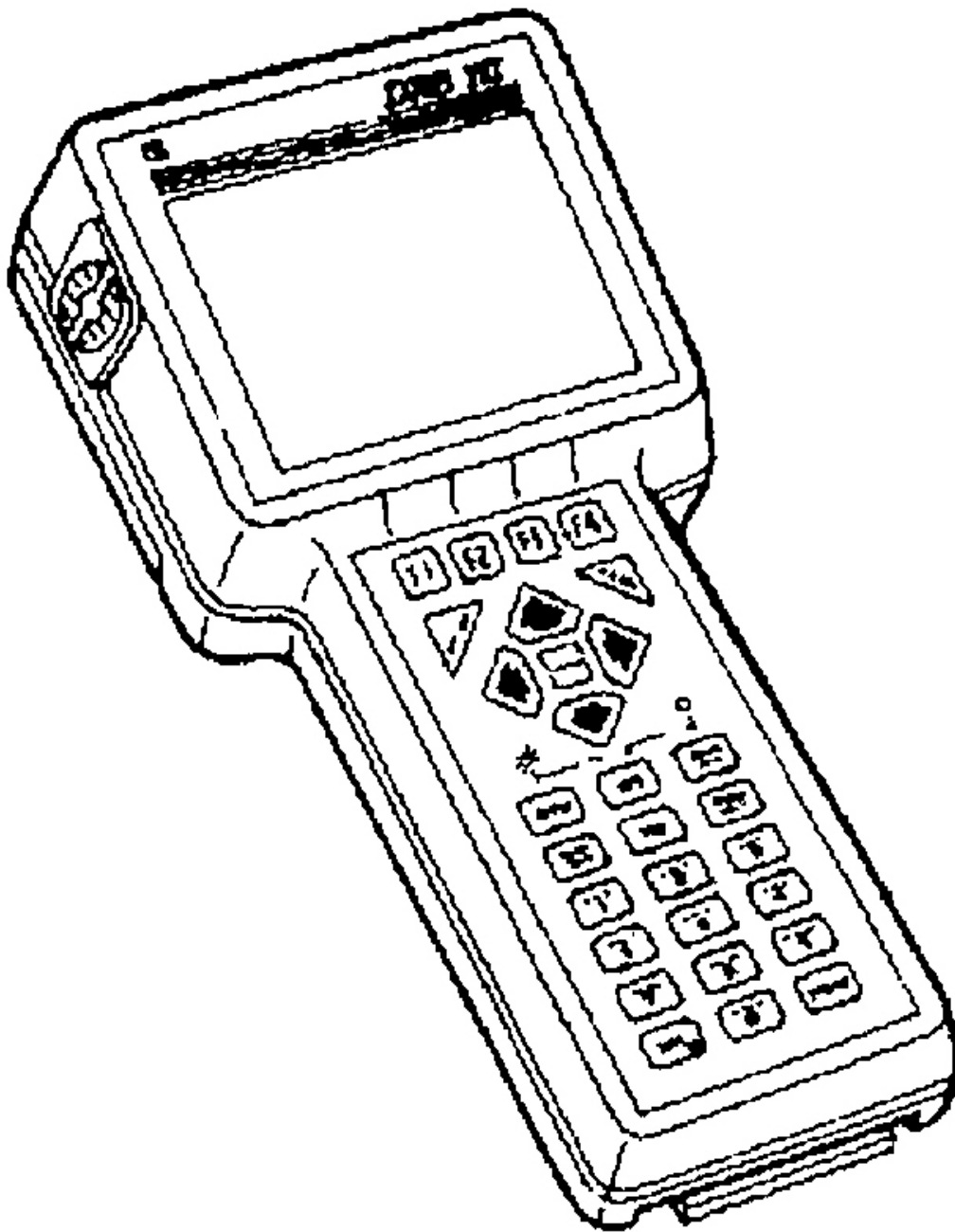
G01857741

**Fig. 70: Identifying Pressure Transducer CH7059**  
Courtesy of DAIMLERCHRYSLER CORP.



G01857742

**Fig. 71: Identifying Cylinder Compression Pressure Adaptor 8116**  
Courtesy of DAIMLERCHRYSLER CORP.



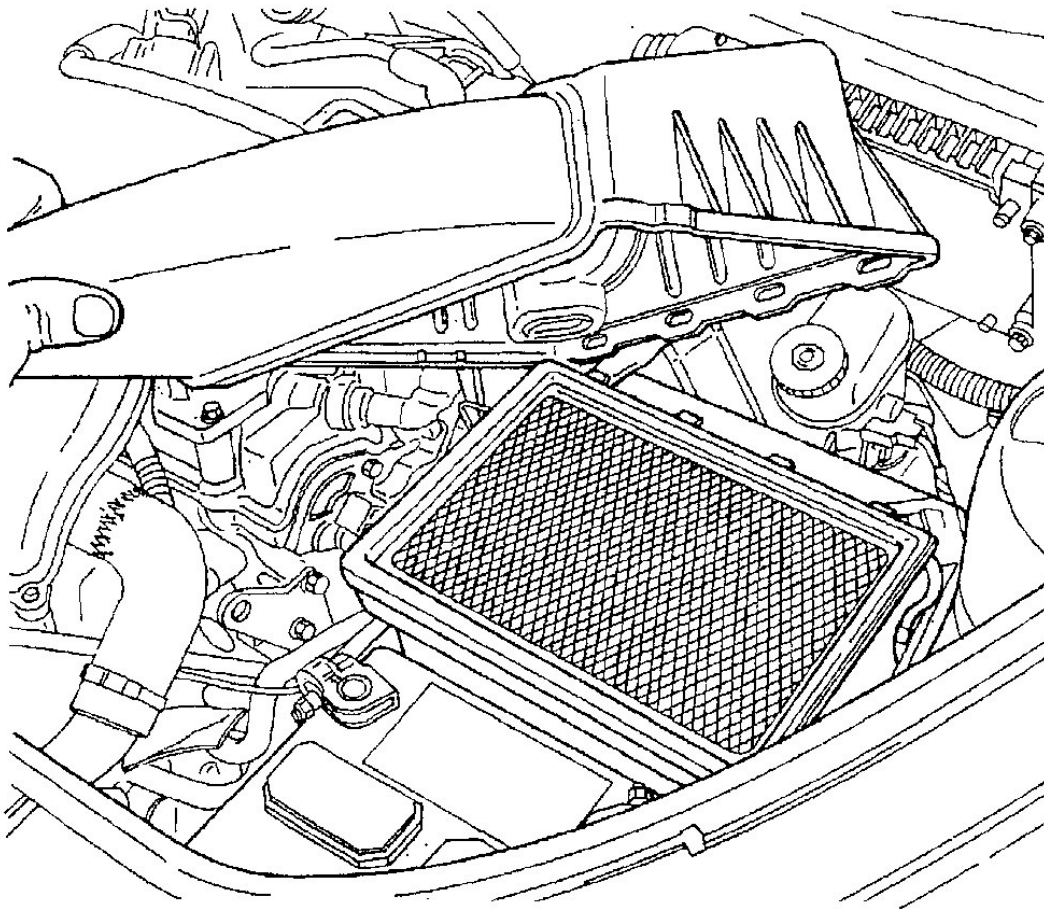
G01857743

**Fig. 72: Identifying DRB III® With PEP Module OT-CH6010A**  
Courtesy of DAIMLERCHRYSLER CORP.

## AIR CLEANER ELEMENT

### REMOVAL

1. Unfasten clasps on sides of air cleaner housing cover. Lift cover off air cleaner housing.



G01857744

**Fig. 73: Removing Air Cleaner Cover**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Remove filter element.
3. If necessary, clean the inside of the air cleaner housing.

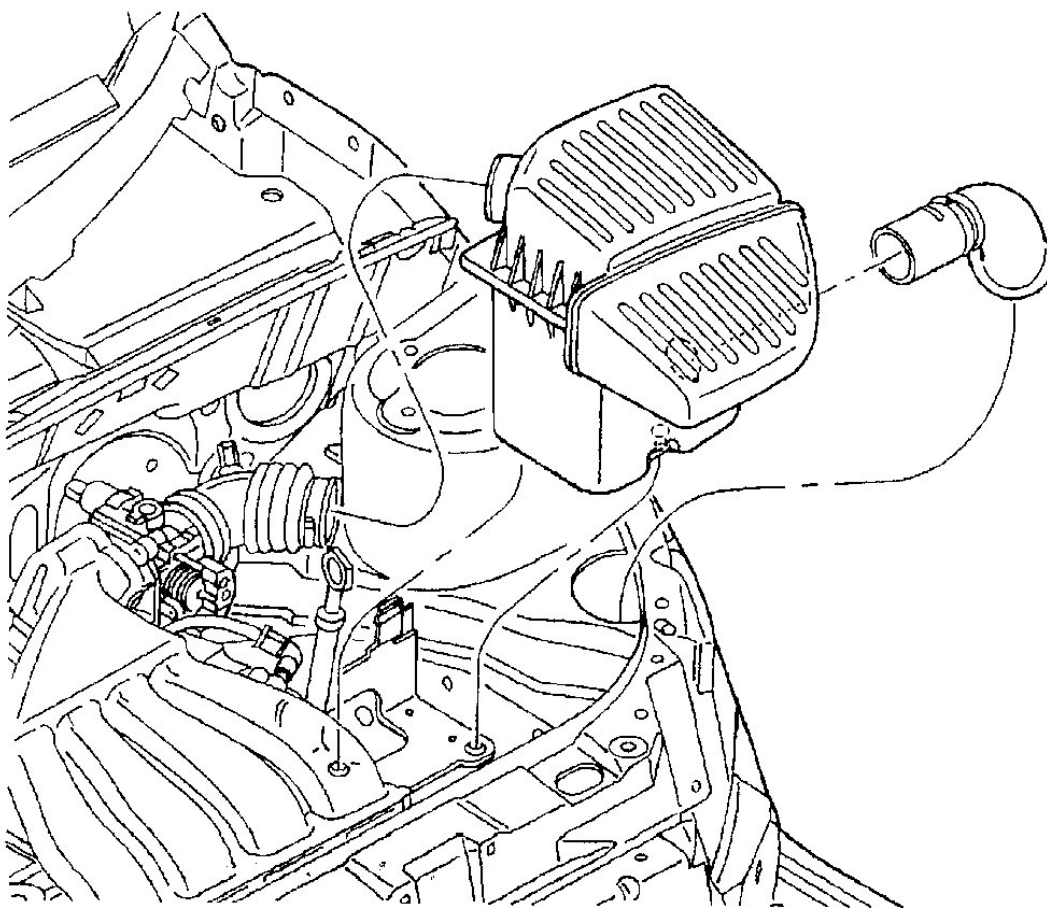
### INSTALLATION

1. Install new filter element.
2. Place cover over air cleaner housing. Snap clasps in place.

## AIR CLEANER HOUSING

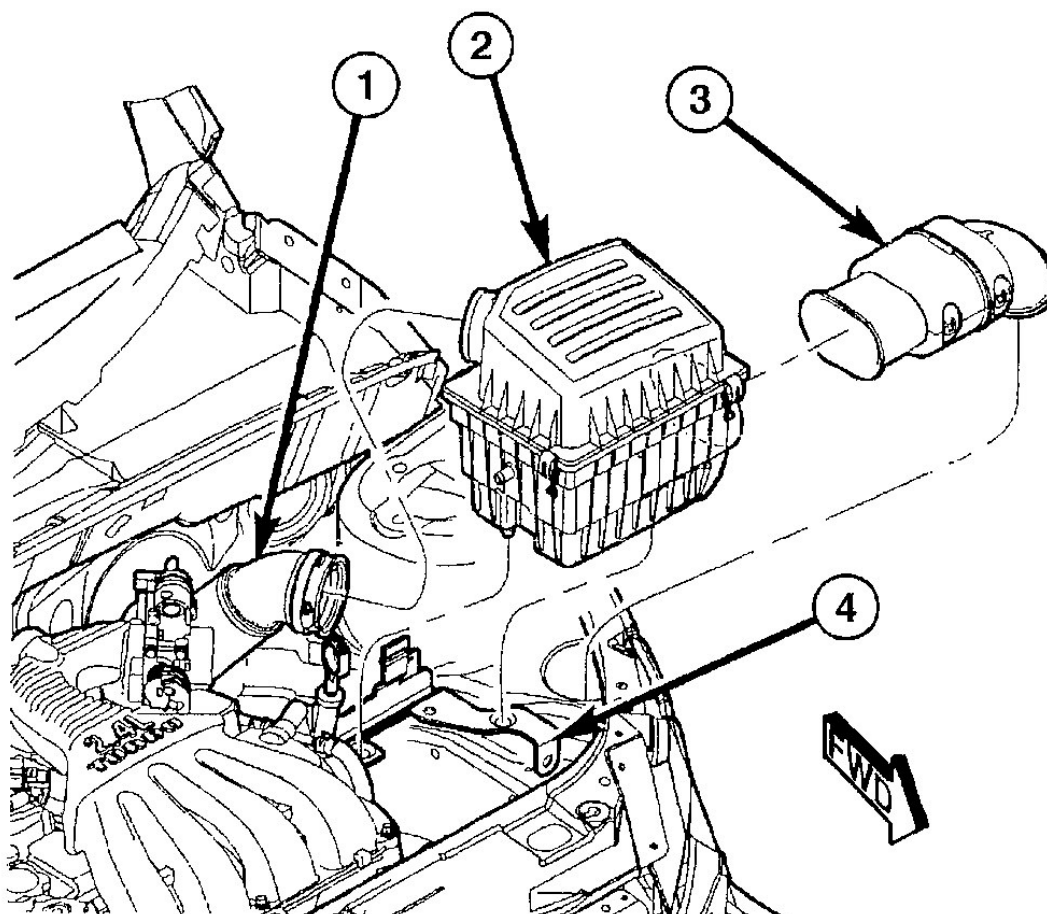
### REMOVAL

1. Disconnect the throttle body air inlet hose/clean air hose from the air cleaner housing.



G01857745

**Fig. 74: Disconnecting Air Inlet System**  
Courtesy of DAIMLERCHRYSLER CORP.

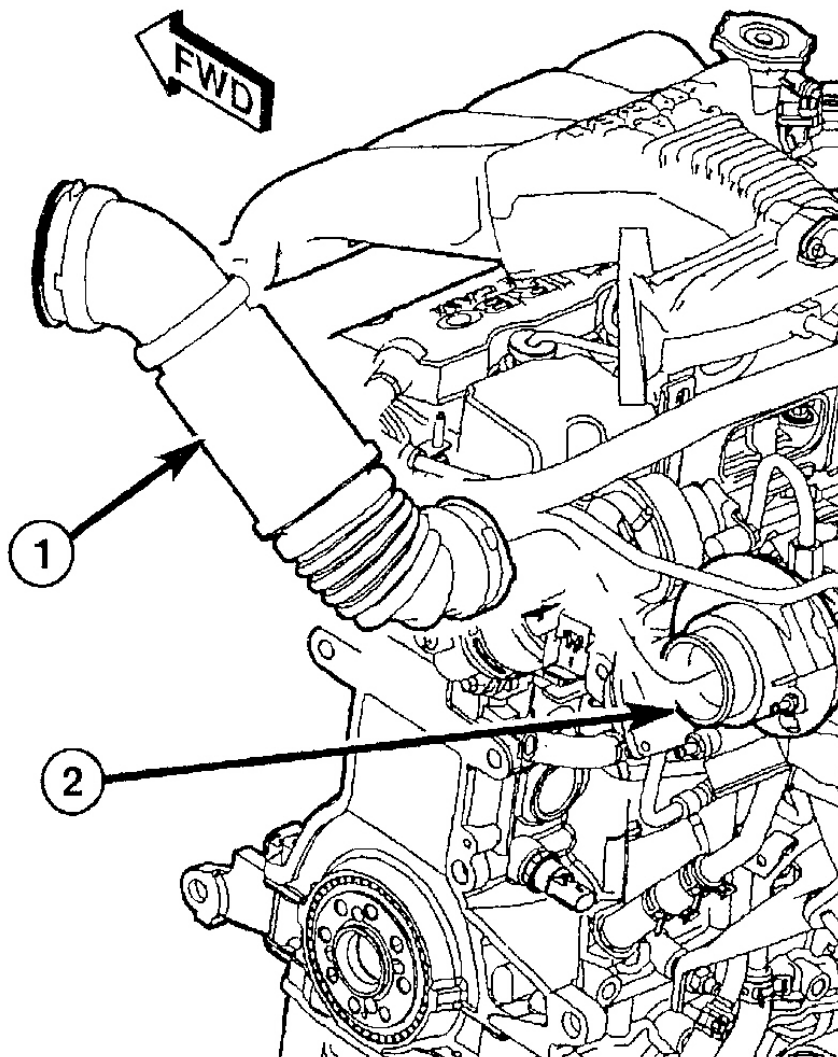


- 1 - CLEAN AIR HOSE
- 2 - AIR CLEANER HOUSING
- 3 - FRESH AIR INLET DUCT
- 4 - PDC MOUNTING BRACKET

G01857746

**Fig. 75: Disconnecting Air Inlet System - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.





1 - CLEAN AIR HOSE

2 - TURBOCHARGER

G01857747

**Fig. 76: Disconnecting Clean Air Hose - Turbo**  
**Courtesy of DAIMLERCHRYSLER CORP.**

2. Pull air cleaner housing straight up to remove.
3. Remove the inlet duct from the air cleaner housing.

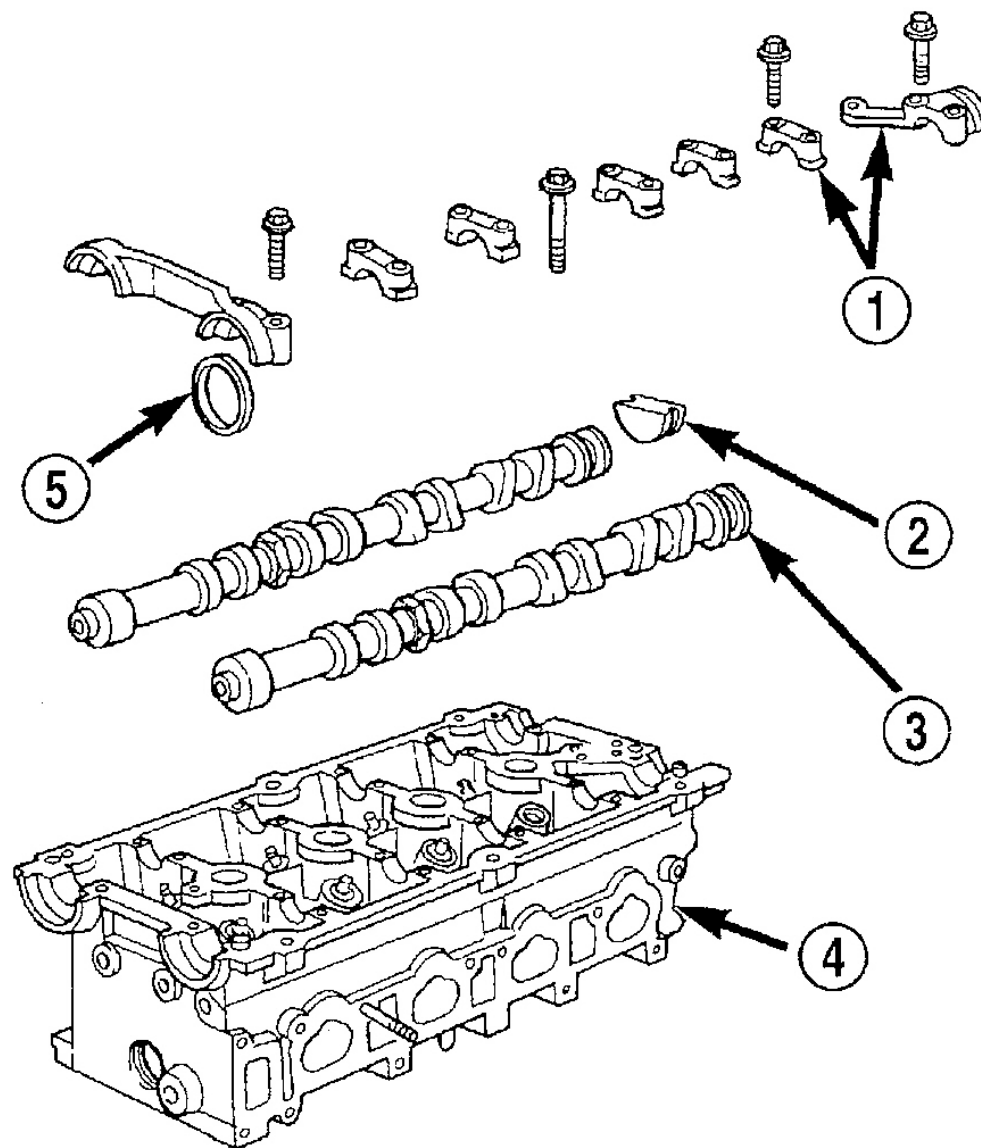
## INSTALLATION

1. Install inlet duct to the air cleaner housing.
2. Make sure the rubber grommets, for the air cleaner housing lower pins, are in place when reinstalling the air cleaner housing. The rubber grommets mount to the PDC bracket. See **Fig. 74** or **Fig. 75**.
3. Push air cleaner housing down while aligning pins into the grommets.
4. Connect the throttle body air inlet hose/clean air hose to the air cleaner housing. See **Fig. 74-Fig. 76**.

## CYLINDER HEAD

### DESCRIPTION

The cross flow designed, aluminum cylinder head contains dual over-head camshafts with four valves per cylinder. The valves are arranged in two in-line banks. The intake valves face toward the front of the vehicle. The exhaust valves face the dash panel. The cylinder head incorporates powdered metal valve guides and seats. The cylinder head is sealed to the block using a multi-layer steel head gasket and retaining bolts.



- 1 - CAMSHAFT BEARING CAPS
- 2 - PLUG
- 3 - CAMSHAFT
- 4 - CYLINDER HEAD
- 5 - CAMSHAFT OIL SEAL

G01857748

**Fig. 77: Identifying Cylinder Heat & Camshafts****Courtesy of DAIMLERCHRYSLER CORP.**

Integral oil galleries provide lubrication passages to the hydraulic lash adjusters, camshafts, and valve mechanisms.

**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**. 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).**

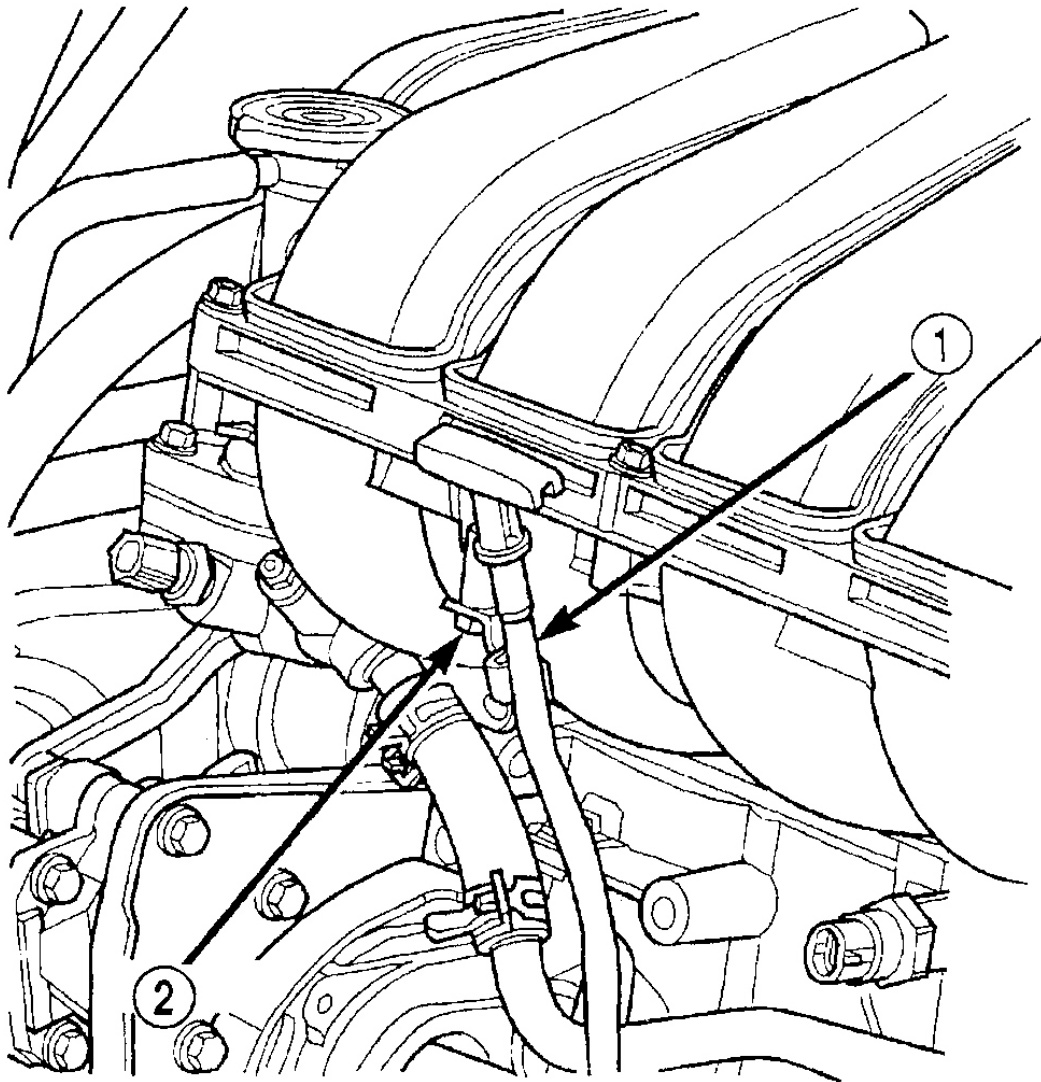
Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

**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 system pressure release procedure **before attempting any repairs** . See **FUEL SYSTEM** article.
2. Remove clean air hose and air cleaner housing. See **AIR CLEANER HOUSING**.
3. Disconnect negative cable from battery.
4. Drain cooling system. See **COOLING SYSTEM MECHANICAL** article.
5. Remove upper intake manifold. See **INTAKE MANIFOLD**.
6. Remove fastener attaching dipstick tube to lower intake manifold.

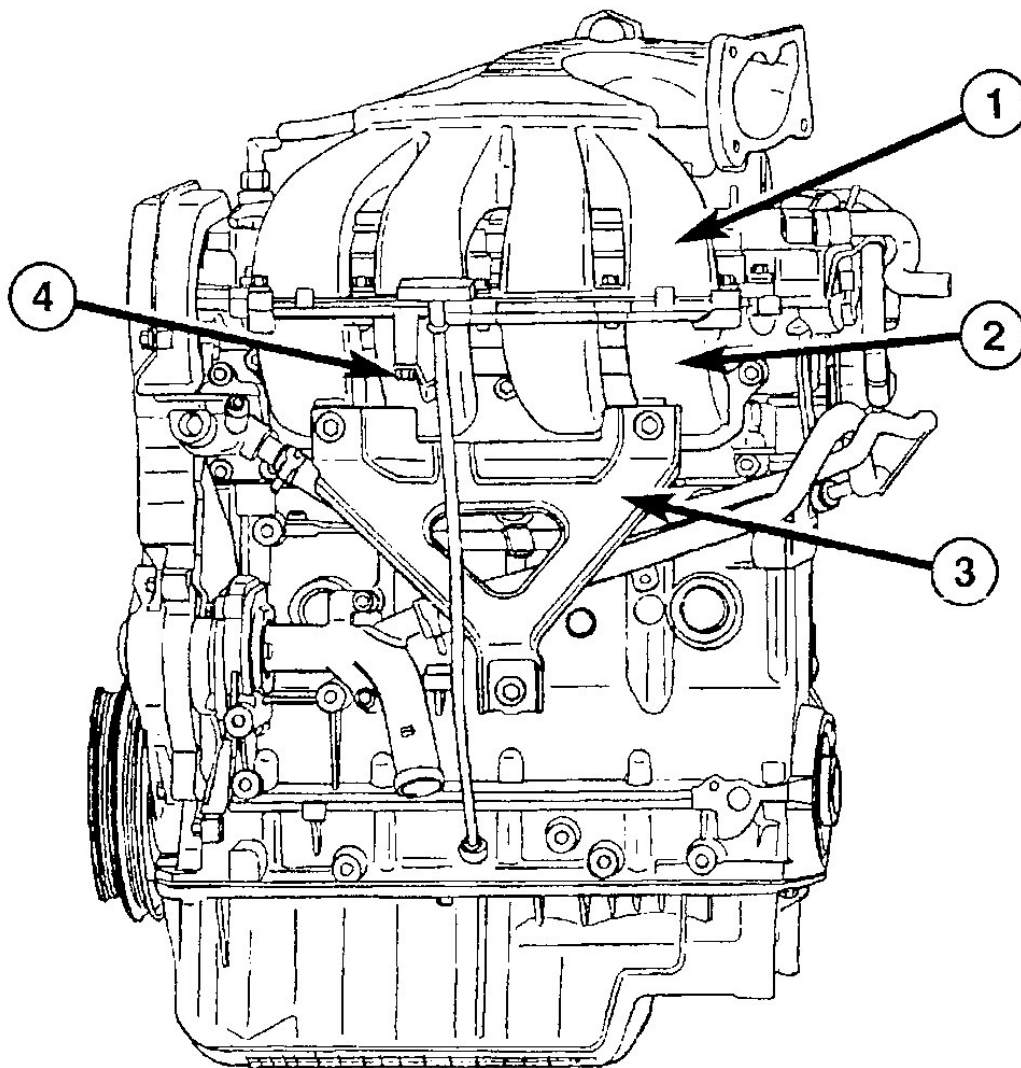


1 - DIPSTICK TUBE

2 - SCREW

G01857749

**Fig. 78: Removing Dipstick Tube**  
Courtesy of DAIMLERCHRYSLER CORP.



- 1 - UPPER INTAKE MANIFOLD
- 2 - LOWER INTAKE MANIFOLD
- 3 - SUPPORT BRACKET
- 4 - DIPSTICK TUBE SCREW

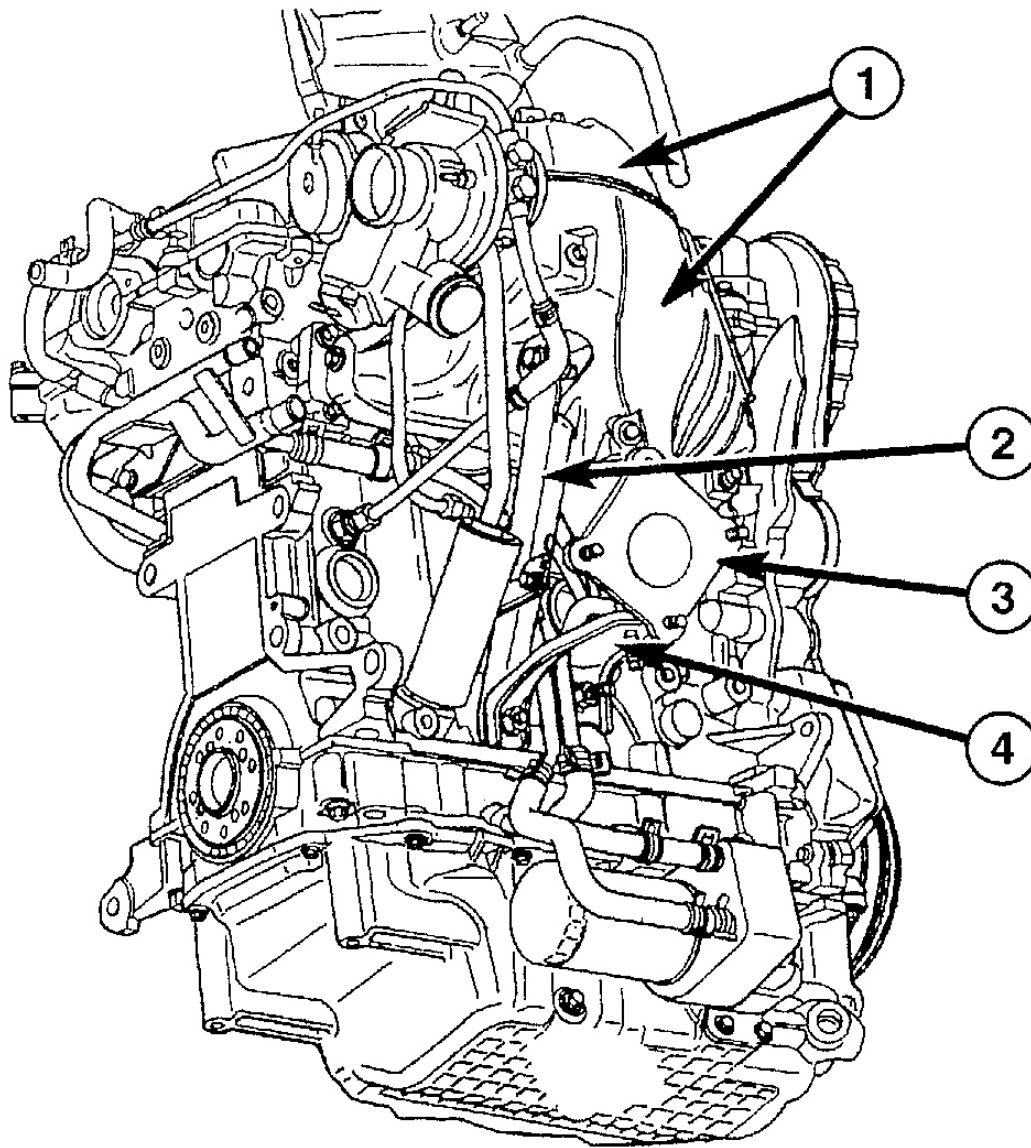
G01857750

**Fig. 79: Removing Lower Intake Manifold Support Bracket - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

- 7. **Turbocharger equipped vehicles:** Remove lower intake manifold support bracket.
- 8. Disconnect the fuel supply line quick-connect at the fuel rail assembly. See **FUEL SYSTEM** article.

9. Remove heater tube support bracket from cylinder head.
10. Remove upper radiator hose. Disconnect heater hoses from thermostat housing.
11. Disconnect engine coolant temperature sensor connector.
12. Remove accessory drive belts. See **COOLING SYSTEM MECHANICAL** article.
13. Disconnect exhaust pipe from manifold.
14. **Turbocharger equipped vehicles:**
  - Remove turbocharger heat shields
  - Remove elbow support bracket
  - Remove turbocharger support bracket
  - Remove elbow





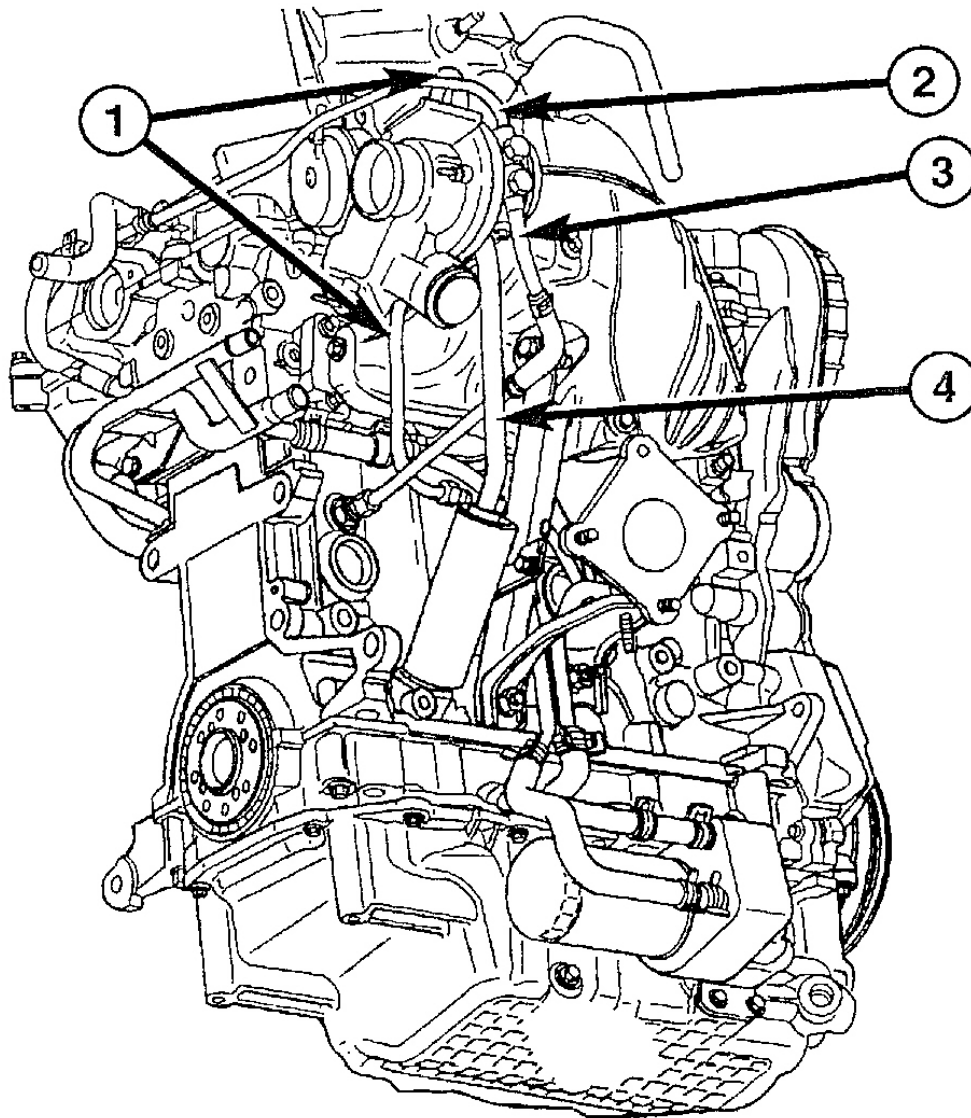
- 1 - UPPER/LOWER HEAT SHIELDS
- 2 - TURBOCHARGER SUPPORT BRACKET
- 3 - ELBOW
- 4 - ELBOW SUPPORT BRACKET

G01857751

**Fig. 80: Removing Turbocharger Brackets & Heat Shields**  
Courtesy of DAIMLERCHRYSLER CORP.

**15. Turbocharger equipped vehicles: See EXHAUST SYSTEM & TURBO CHARGER .**

- Remove oil return tube
- Remove oil supply line
- Remove coolant supply line
- Remove coolant return line



- 1 - OIL SUPPLY LINE
- 2 - COOLANT RETURN LINE
- 3 - COOLANT SUPPLY LINE
- 4 - OIL RETURN TUBE

G01857752

**Fig. 81: Identifying Turbocharger Lines & Hoses**  
Courtesy of DAIMLERCHRYSLER CORP.

- 16. Disconnect ignition coil wiring connector. Remove ignition coil and plug wires from engine.
- 17. Disconnect camshaft position sensor wiring connector.

18. Remove timing belt and camshaft sprockets. See **TIMING BELT AND SPROCKETS**.
19. Remove timing belt idler pulley and rear timing belt cover. See **TIMING BELT COVER(S)**.
20. **Non-Turbo equipped vehicles:** Remove fasteners securing power steering pump fluid reservoir/bracket to cylinder head.
21. Remove cylinder head cover. See **CYLINDER HEAD COVER**.
22. Remove camshafts. See **CAMSHAFT(S)**.
23. Remove rocker arms.
24. Remove cylinder head bolts in the reverse sequence of tightening. See **Fig. 87**.
25. Remove cylinder head from engine block.
26. Inspect and clean cylinder head and block sealing surfaces. Refer to **CLEANING** and **INSPECTION**.

**NOTE:**        **Ensure cylinder head bolt holes in the block are clean, dry (free of residual oil or coolant), and threads are not damaged.**

## **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.

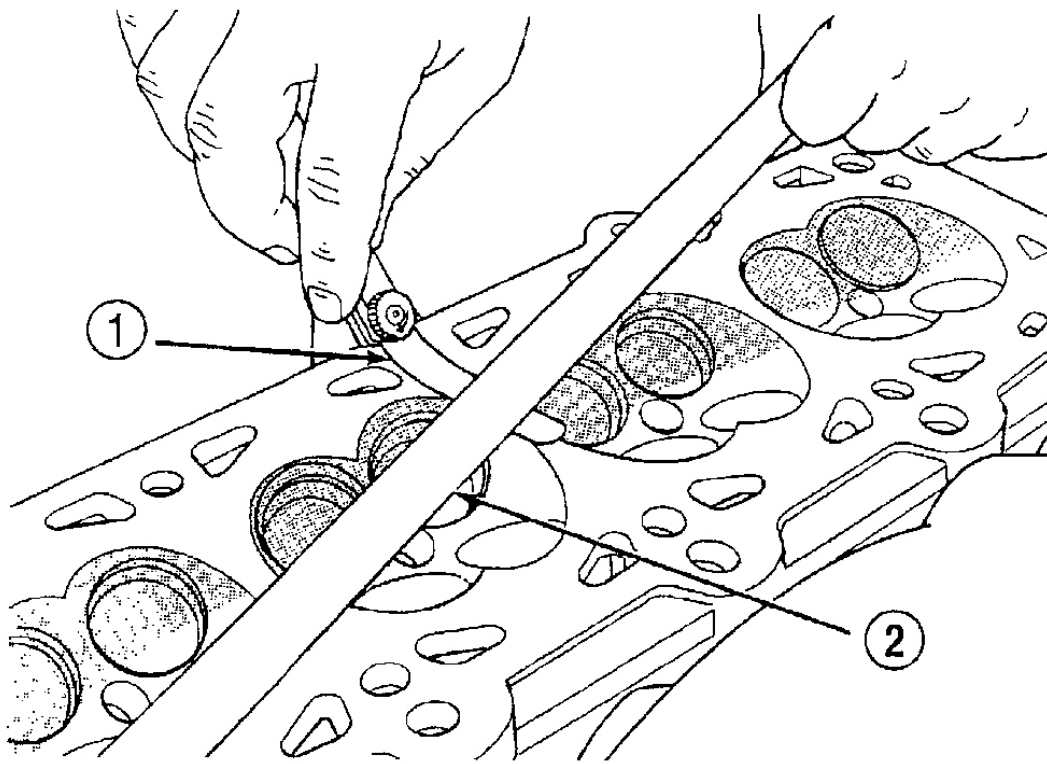
**NOTE:**        **Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.**

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

Clean all engine oil passages.

## **INSPECTION**

1. Cylinder head must be flat within 0.1 mm (0.004 in.).

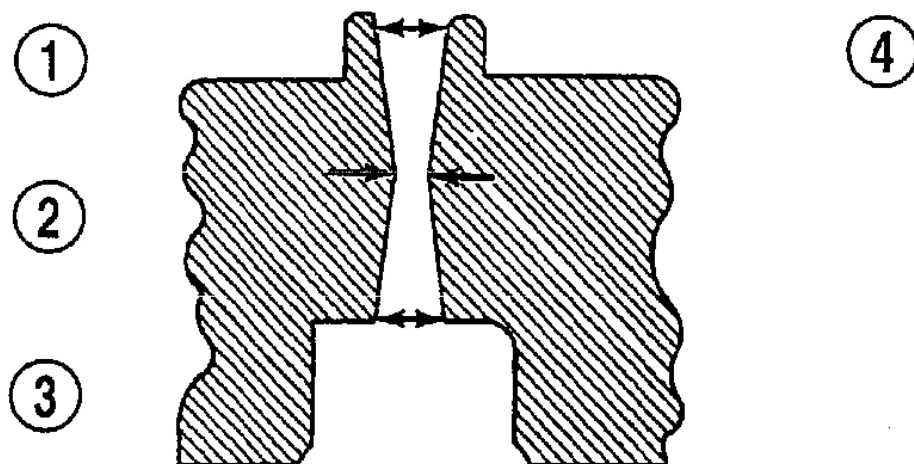


1 - FEELER GAUGE  
2 - STRAIGHT EDGE

G01857753

**Fig. 82: Checking Cylinder Head Flatness**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Inspect camshaft bearing journals for scoring.
3. Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
4. Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom. See **SPECIFICATIONS**. Replace guides if they are not within specification.



1 - TOP

2 - MIDDLE

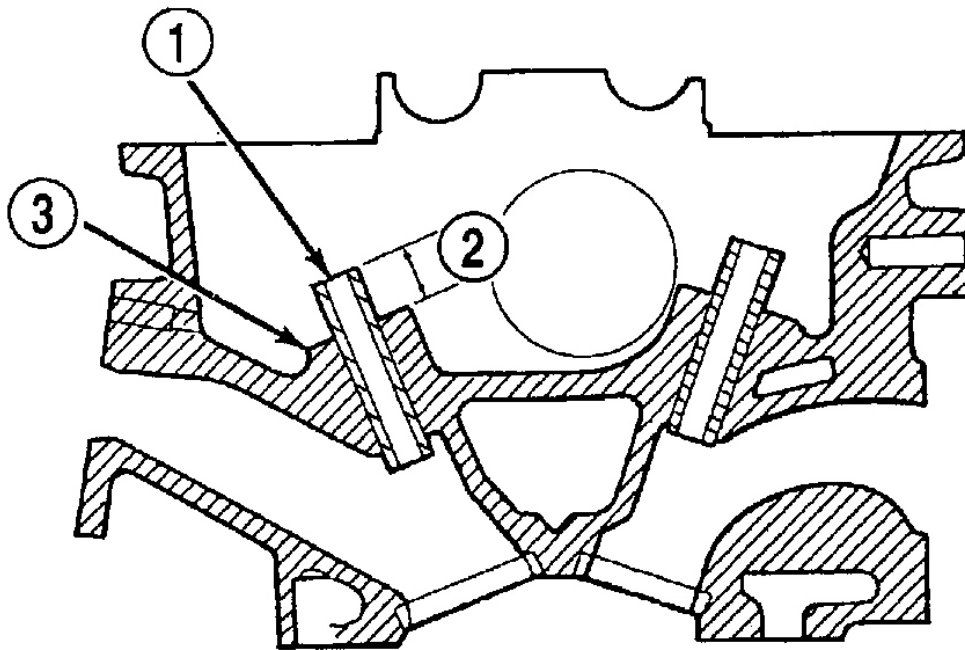
3 - BOTTOM

4 - CUT AWAY VIEW OF VALVE GUIDE MEASUREMENT  
LOCATIONS

G01857754

**Fig. 83: Checking Wear on Valve Guide - Typical**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Check valve guide height.



1 - VALVE GUIDE

2 - 13.25 - 13.75 MM (0.521 - 0.541 IN.)

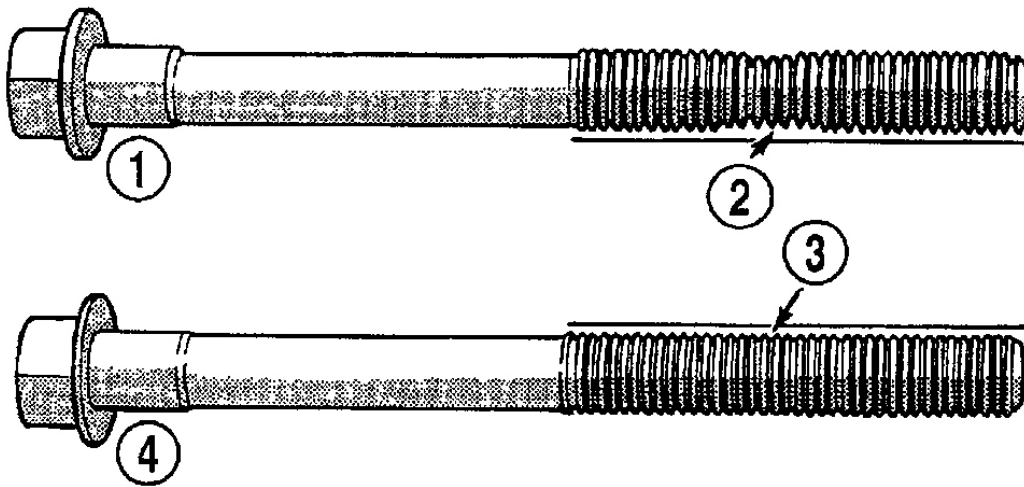
3 - SPRING SEAT

G01857755

**Fig. 84: Checking Valve Guide Height**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

**NOTE:** The Cylinder head bolts should be examined **BEFORE** reuse. If the threads are necked down, the bolts should be replaced.



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

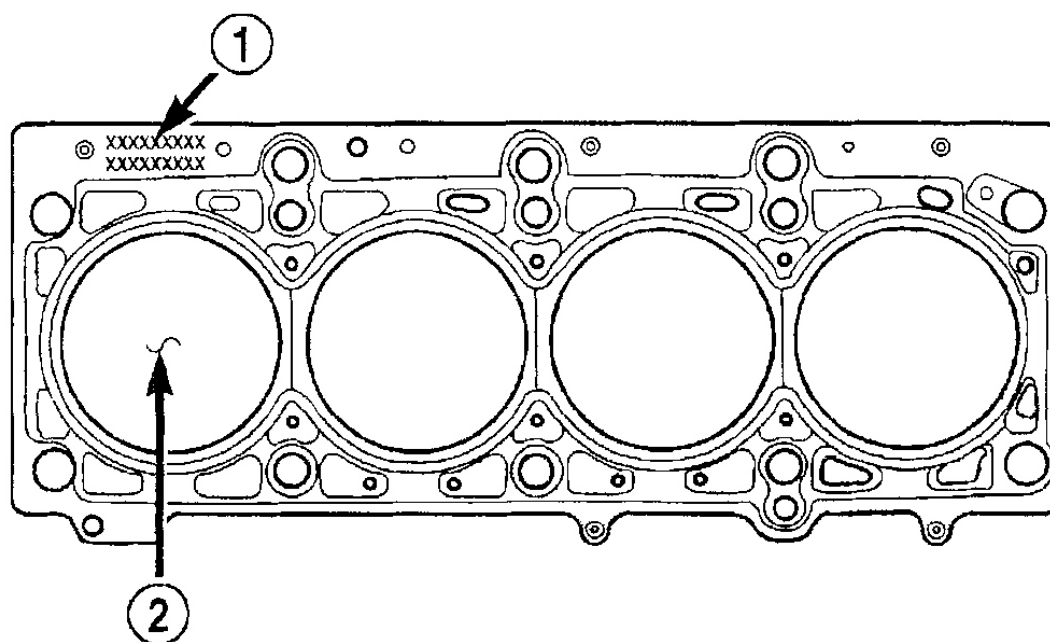
G01857756

**Fig. 85: 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 should be replaced.





1 - PART NUMBER FACES UP

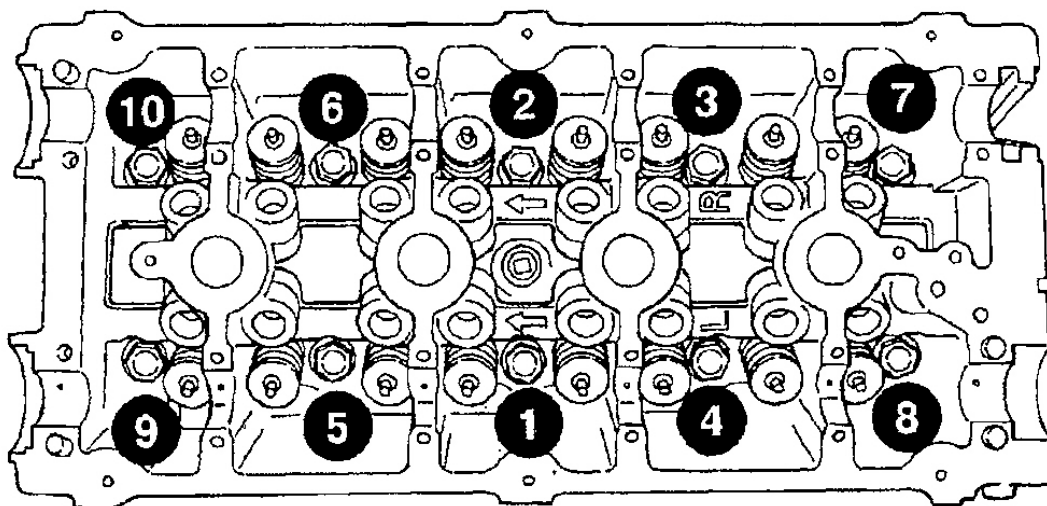
2 - NO. 1 CYLINDER

G01857757

**Fig. 86: Positioning Cylinder Head Gasket**  
Courtesy of DAIMLERCHRYSLER CORP.

**NOTE:** Head gaskets for Non-Turbo and Turbo applications are NOT interchangeable.

1. Position the new cylinder head gasket on engine block with the part number facing up. Ensure gasket is seated over the locating dowels in block.
2. Position cylinder head onto engine block.
3. Before installing the bolts, the threads should be lightly coated with engine oil.
4. Tighten the cylinder head bolts in the sequence shown. Using the 4 step torque-turn method, tighten according to the following values:



G01857758

**Fig. 87: Identifying Cylinder Head Tightening Sequence**  
 Courtesy of DAIMLERCHRYSLER CORP.

**NOTE:** Following torque specifications were changed per TSB No. 09-001-05 REV. A.

- First: All to 34 N.m (25 ft. lbs.)
- Second: All to 82 N.m (60 ft. lbs.)
- Third: All to 82 N.m (60 ft. lbs.)

**CAUTION:** Do not use a torque wrench for the Fourth step.

- **Fourth: Turn all bolts an additional 1/4 Turn**

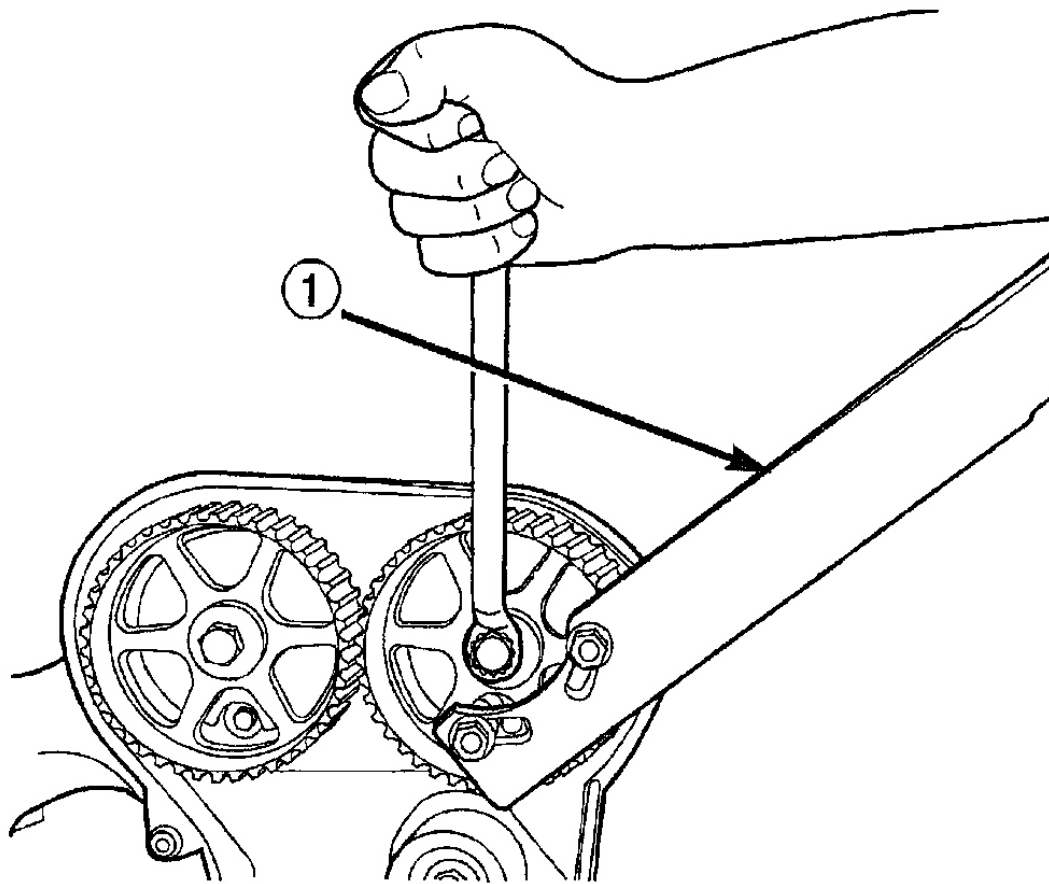
5. Install rocker arms and camshafts. See CAMSHAFT(S).
6. Install cylinder head cover. See CYLINDER HEAD COVER.
7. Install rear timing belt cover and timing belt idler pulley. See TIMING BELT COVER(S).
8. Install camshaft sprockets and timing belt. See TIMING BELT AND SPROCKETS.
9. Connect cam sensor wiring connector.
10. Install ignition coil and plug wires. Connect ignition coil wiring connector.
11. **Non-Turbo equipped vehicles:** Install power steering pump reservoir/bracket to cylinder head.
12. **Turbocharger equipped vehicles:** See EXHAUST SYSTEM & TURBO CHARGER article. See **Fig. 81**.
  - Install coolant return line

- Install coolant supply line
  - Install oil supply line
  - Install oil return tube
13. **Turbocharger equipped vehicles:** See **Fig. 80**.
- Install elbow
  - Install turbocharger support bracket
  - Install elbow support bracket
  - Install turbocharger heat shields
14. Install exhaust pipe to manifold. Tighten fasteners to 28 N.m (20 ft. lbs.).
15. Install accessory drive belts. See **COOLING SYSTEM MECHANICAL** article.
16. Connect engine coolant temperature sensor connector.
17. Connect upper radiator hose. Connect heater hoses to thermostat housing.
18. Install heater tube support bracket to cylinder head.
19. **Turbocharger equipped vehicles:** Install lower intake manifold support bracket. See **Fig. 79**.
20. Install fastener attaching dipstick tube to lower intake manifold. See **Fig. 78** and **Fig. 79**.
21. Connect fuel supply line quick-connect at the fuel rail assembly. See **FUEL SYSTEM** article.
22. Install upper intake manifold. See **INTAKE MANIFOLD**.
23. Fill cooling system. See **COOLING SYSTEM MECHANICAL** article.
24. Connect negative cable to battery.
25. Install clean air hose and air cleaner housing. See **AIR CLEANER HOUSING**.

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

### **REMOVAL**

1. Remove timing belt. See **TIMING BELT AND SPROCKETS**.
2. Hold each camshaft sprocket with Special Tool 6847 while removing center bolt.



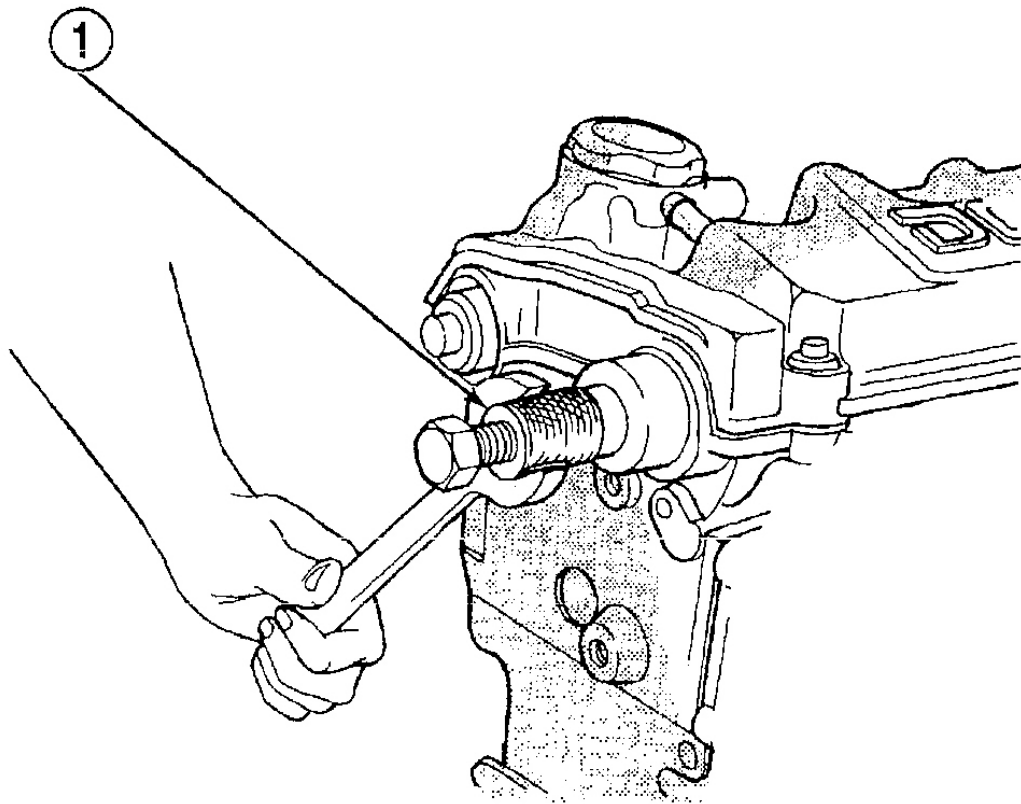
1 - SPECIAL TOOL 6847

G01857759

**Fig. 88: Removing & Installing Camshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Remove camshaft sprockets.
4. Remove rear timing belt cover. See **TIMING BELT COVER(S)**.

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



1 - SPECIAL TOOL C-4679

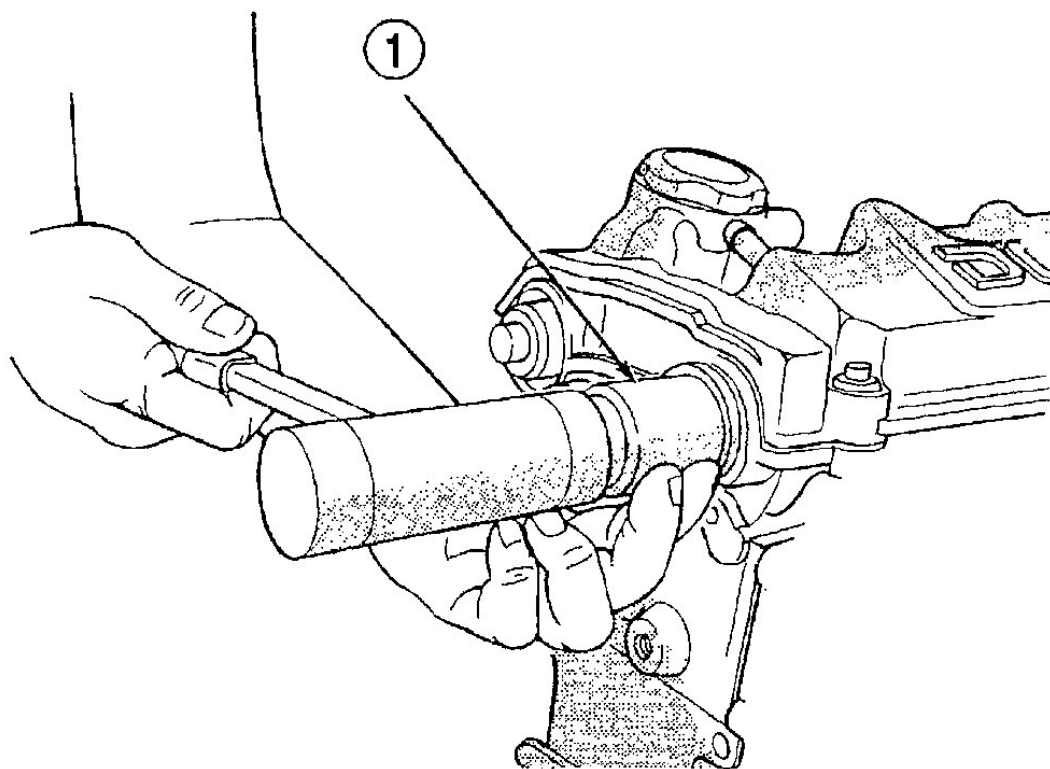
G01857760

**Fig. 89: Removing Camshaft Oil Seal With C-4679A**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Remove camshaft seal using Special Tool C-4679A.

## INSTALLATION

1. Shaft seal surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.
2. Install camshaft seals into cylinder head using Special Tool MD-998306 until flush with head.



1 - SPECIAL TOOL MD-998306

G01857761

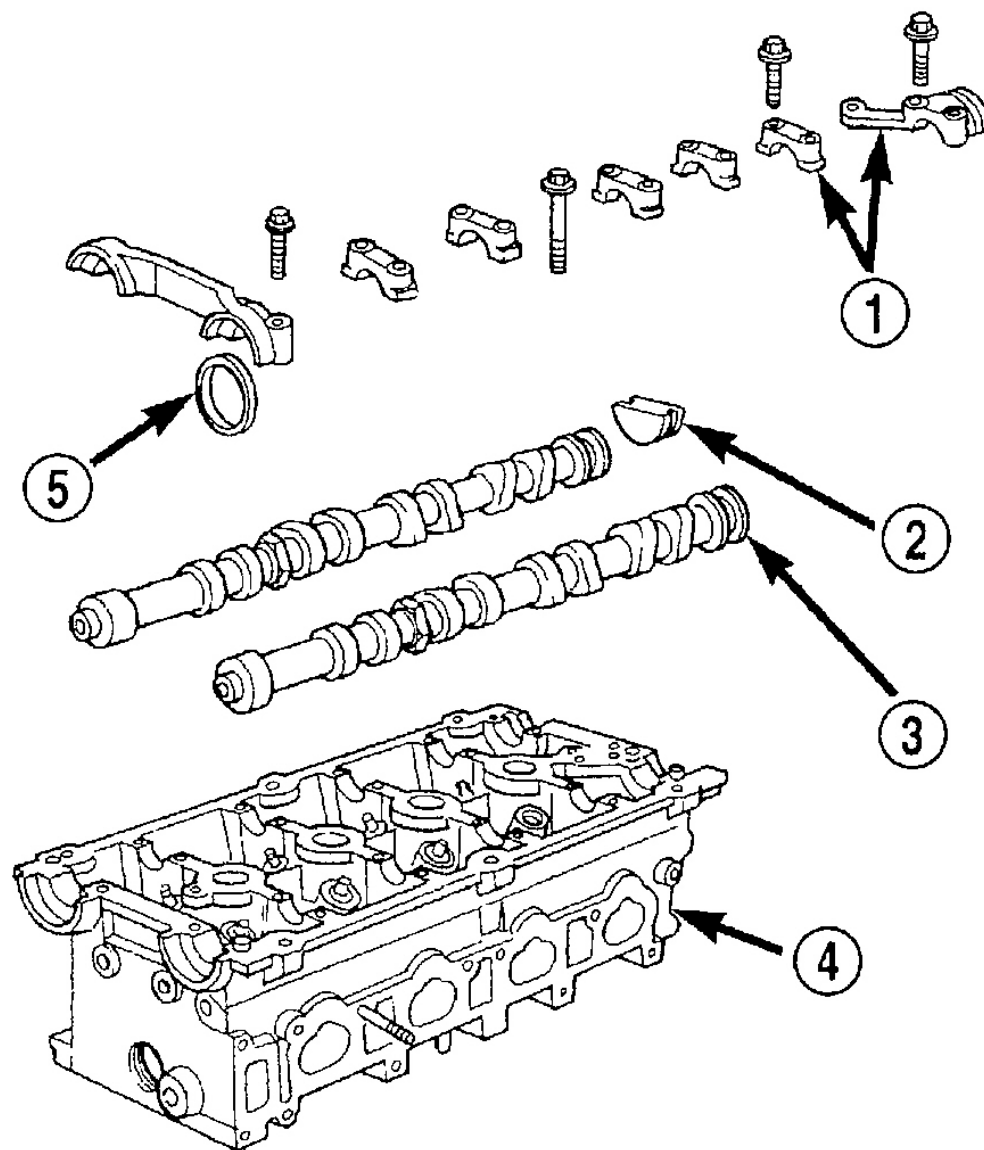
**Fig. 90: Installing Camshaft Seal**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install timing belt rear cover. See **TIMING BELT COVER(S)**.
4. Install camshaft sprockets. Hold each sprocket with Special Tool 6847 and tighten center bolt to 115 N.m (85 ft. lbs.). See **Fig. 88**.
5. Install timing belt and front covers. See **TIMING BELT COVER(S)** and **TIMING BELT AND SPROCKETS**.

## CAMSHAFT(S)

### DESCRIPTION

Both camshafts have six bearing journal surfaces and two cam lobes per cylinder. Flanges at the rear journals control camshaft end play. Provision for a cam position sensor is located on the intake camshaft on the rear of the cylinder head. A hydrodynamic oil seal is used for oil control at the front of the camshaft.



- 1 - CAMSHAFT BEARING CAPS
- 2 - PLUG
- 3 - CAMSHAFT
- 4 - CYLINDER HEAD
- 5 - CAMSHAFT OIL SEAL

G01857762

**Fig. 91: Identifying Camshafts**

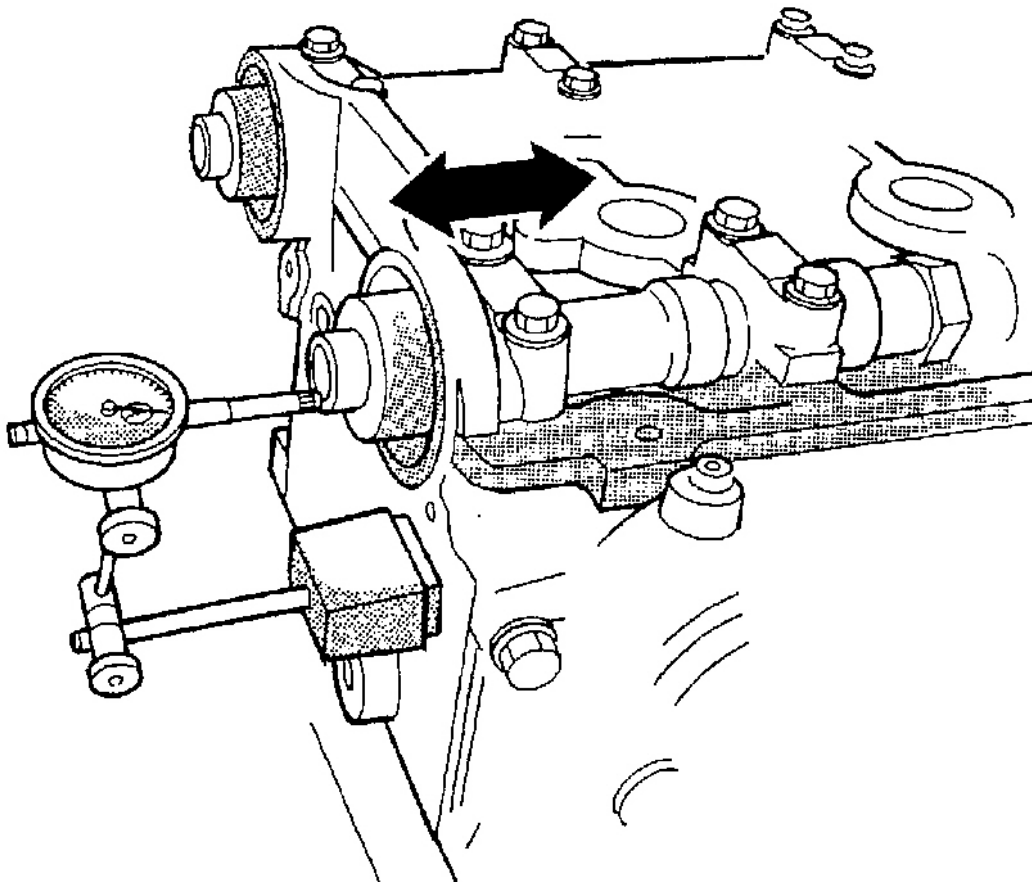
Courtesy of DAIMLERCHRYSLER CORP.

**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.



G01857763

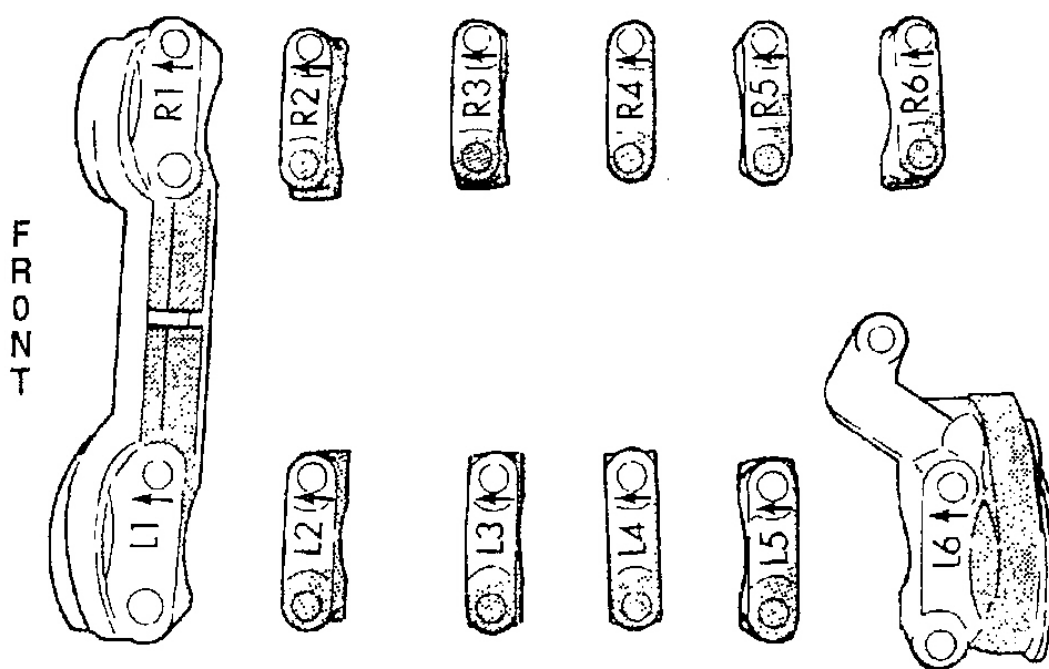


**Fig. 92: Measuring Camshaft End Play - Typical**  
 Courtesy of DAIMLERCHRYSLER CORP.

4. Move camshaft as far forward as it will go.
5. Record reading on dial indicator. For end play specification, see **SPECIFICATIONS**.
6. If end play is excessive, check cylinder head and camshaft for wear; replace as necessary.

## REMOVAL

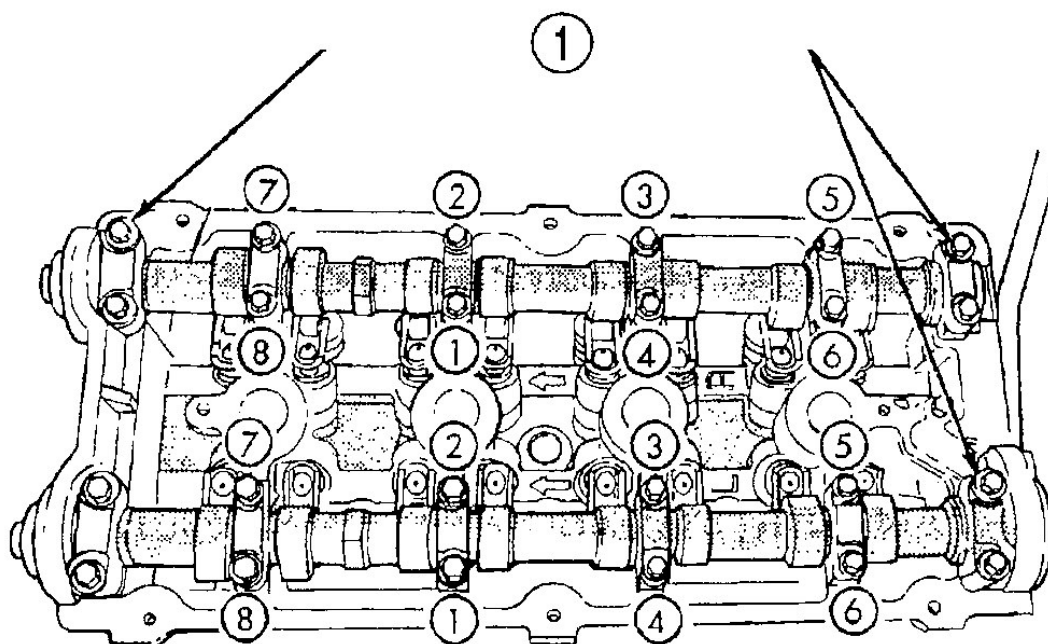
1. Remove cylinder head cover. See **CYLINDER HEAD COVER**.
2. Remove camshaft position sensor and camshaft target magnet. See **CHARGING & STARTING SYSTEMS** article.
3. Remove timing belt. See **TIMING BELT AND SPROCKETS**.
4. Remove camshaft sprockets and timing belt rear cover. See **TIMING BELT COVER(S)**.
5. Bearing caps are identified for location. Remove the outside bearing caps first.



G01857764

**Fig. 93: Identifying Camshaft Bearing Caps**  
 Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Camshafts are not interchangeable. The intake cam number 6 thrust bearing face spacing is wider.



1 - REMOVE OUTSIDE BEARING CAPS FIRST

G01857765

**Fig. 94: Removing Camshaft Bearing Cap**  
Courtesy of DAIMLERCHRYSLER CORP.

6. Loosen the camshaft bearing cap attaching fasteners in sequence shown one camshaft at a time.
7. Identify the camshafts before removing from the head. The camshafts are not interchangeable.
8. Remove camshafts from cylinder head.

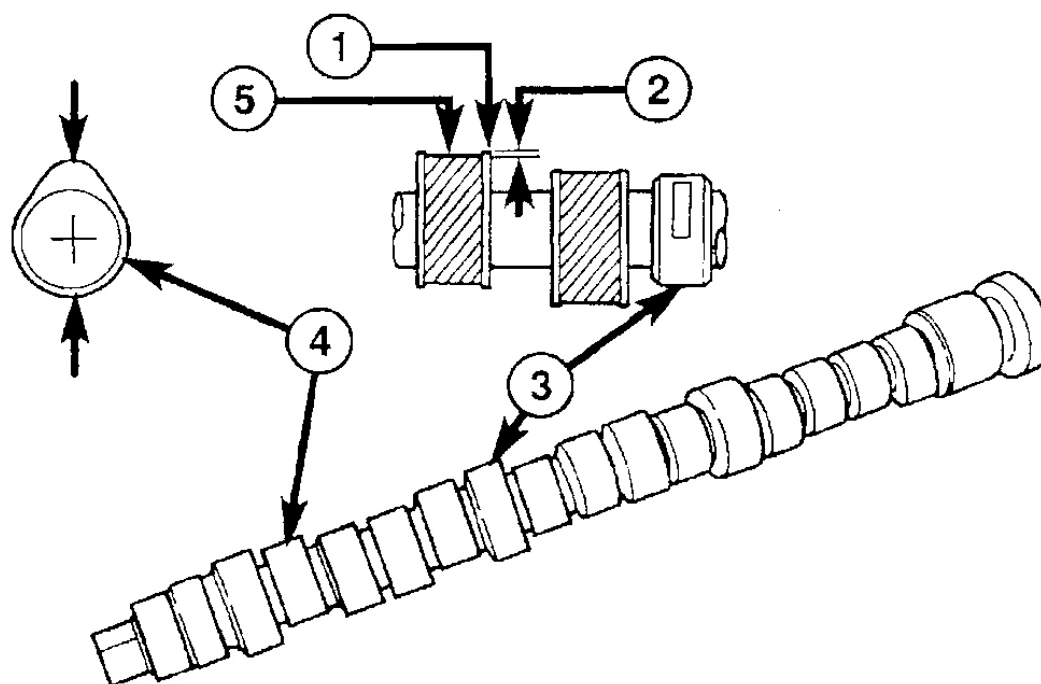
**NOTE:** If removing rocker arms, identify for reinstallation in the original position.

## CLEANING

Clean camshaft with a suitable solvent.

## INSPECTION

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



- 1 - UNWORN AREA
- 2 - ACTUAL WEAR
- 3 - BEARING JOURNAL
- 4 - LOBE
- 5 - WEAR ZONE

G01857766

**Fig. 95: Checking Camshaft(s) For Wear**  
 Courtesy of DAIMLERCHRYSLER CORP.

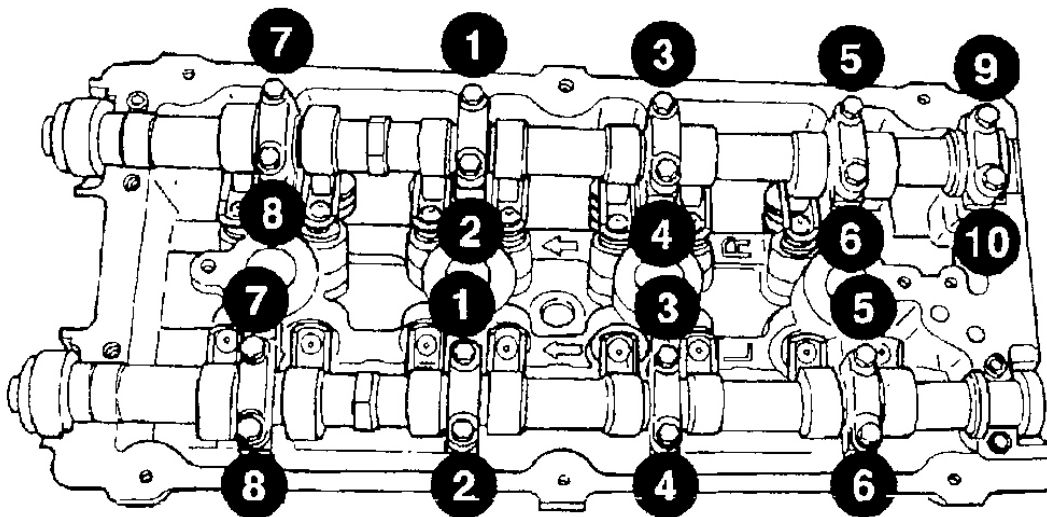
**NOTE:** If camshaft is replaced due to lobe wear or damage, always replace the rocker arms.

2. Check the cam lobe and bearing surfaces for abnormal wear and damage. Replace camshaft if defective.
3. Measure the lobe actual wear (unworn area - wear zone = actual wear) 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.).

## INSTALLATION

**CAUTION:** Ensure that **NONE** of the pistons are at top dead center when installing the camshafts.

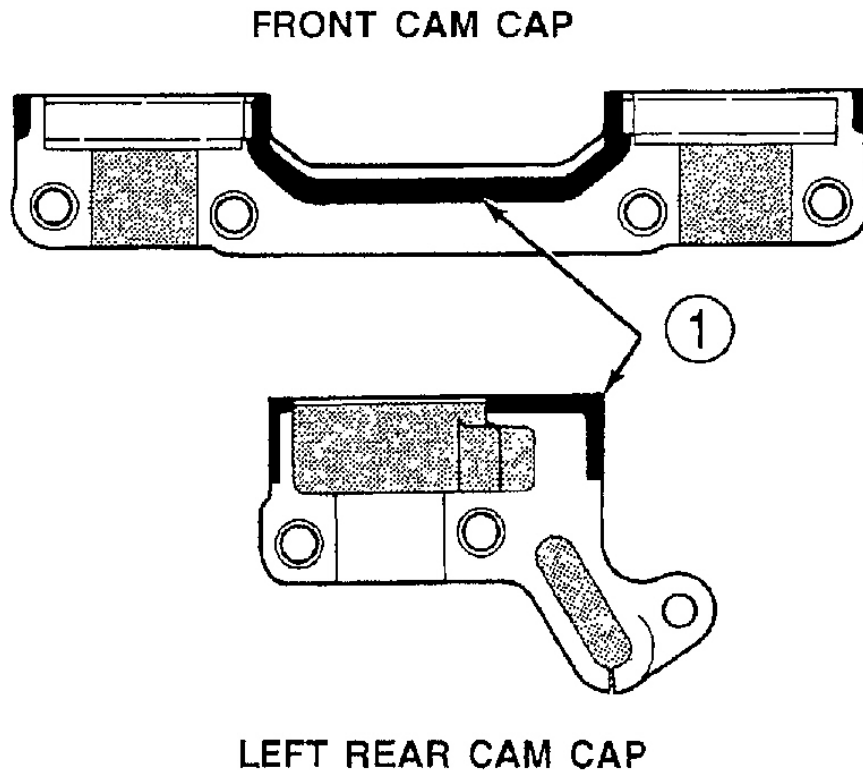
1. Lubricate all camshaft bearing journals, rocker arms and camshaft lobes.
2. Install all rocker arms in original positions, if reused.
3. Position camshafts on cylinder head bearing journals. Install right and left camshaft bearing caps No. 2 - 5 and right No. 6. Tighten M6 fasteners to 12 N.m (105 in. lbs.) in sequence shown.



G01857767

**Fig. 96: Identifying Camshaft Bearing Cap Tightening Sequence**  
Courtesy of DAIMLERCHRYSLER CORP.

**NOTE:** Bearing end caps must be installed before seals can be installed.



1 - 1.5 mm (.060 in.) DIAMETER BEAD OF MOPAR GASKET MAKER

G01857768

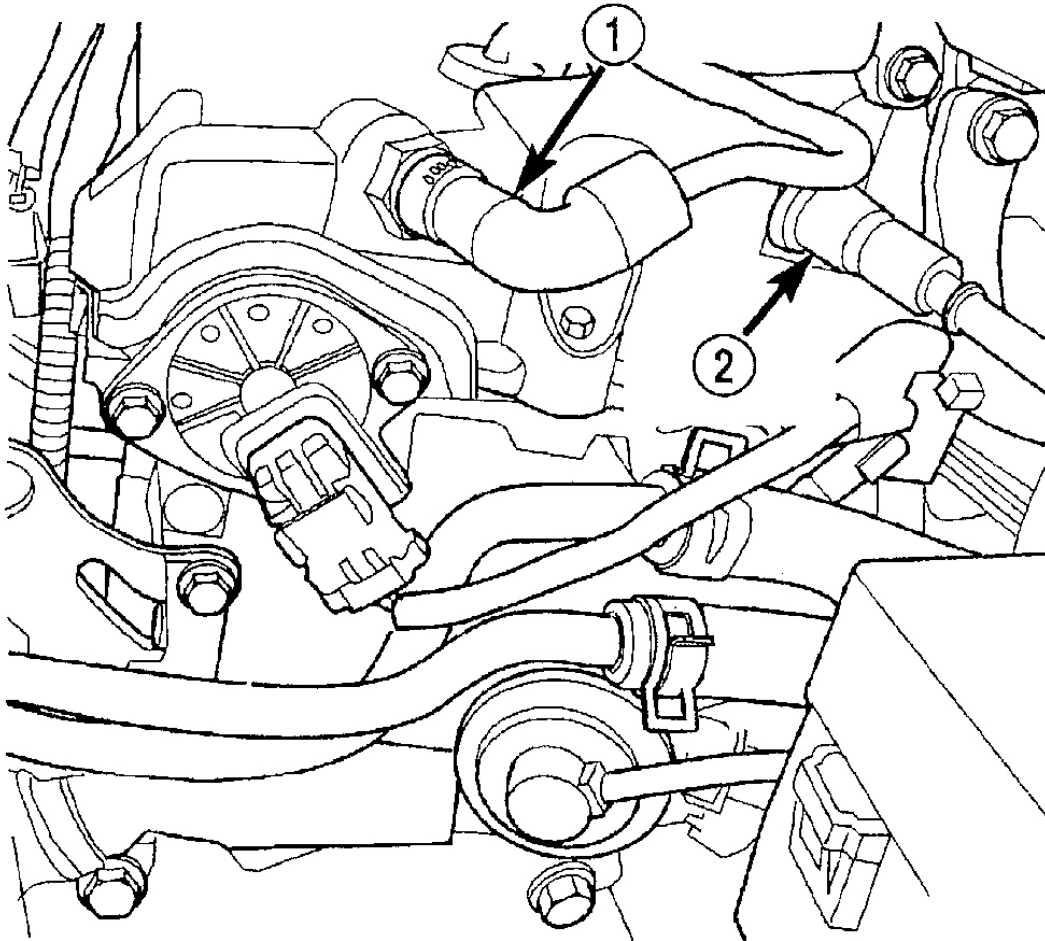
**Fig. 97: Sealing Camshaft Bearing Caps**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Apply Mopar® Gasket Maker to No. 1 and No. 6 bearing caps. Install bearing caps and tighten M8 fasteners to 28 N.m (250 in. lbs.).
5. Install camshaft oil seals. See CAMSHAFT OIL SEAL(S).
6. Install camshaft target magnet and camshaft position sensor.
7. Install cylinder head cover. See CYLINDER HEAD COVER.
8. Install timing belt rear cover and camshaft sprockets. See TIMING BELT COVER(S).
9. Install timing belt. See TIMING BELT AND SPROCKETS.

## CYLINDER HEAD COVER

### REMOVAL

1. Remove upper intake manifold. See **INTAKE MANIFOLD**.
2. Remove ignition coil and spark plug wires.
3. Disconnect PCV and make-up air hoses from cylinder head cover.



- 1 - PCV HOSE  
2 - MAKE-UP AIR HOSE

G01857769

**Fig. 98: Disconnecting PCM & Make-Up Air Hoses**  
Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** When removing cylinder head cover bolts, be careful not to interchange the two (2) center bolts with the seven (7) perimeter

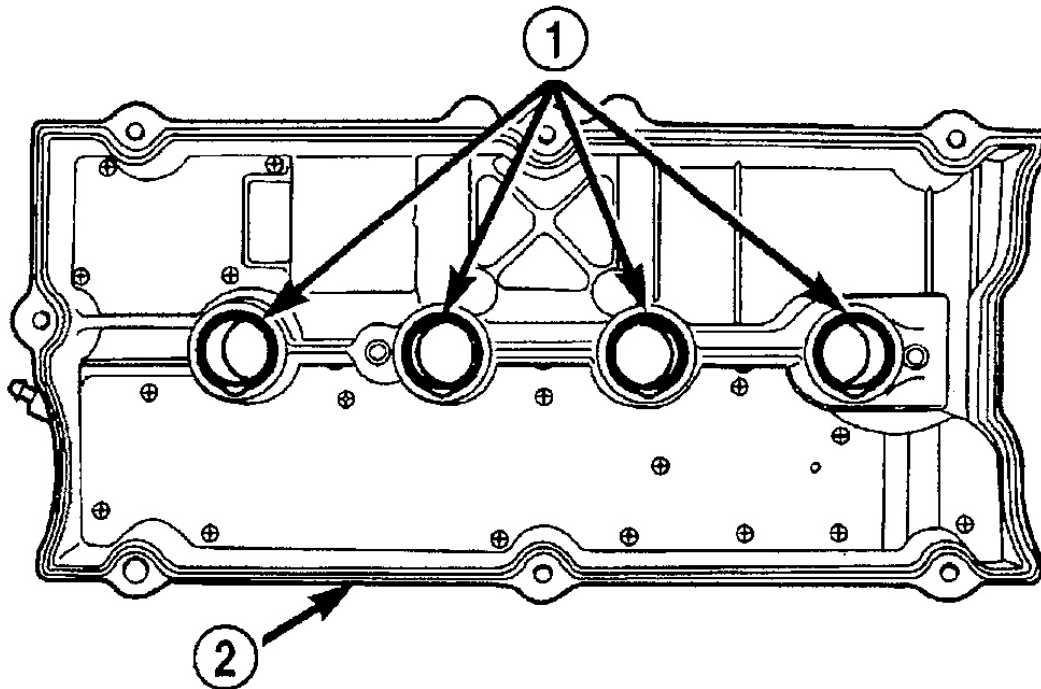
bolts. The two (2) center bolts contain an aluminum washer between the bolt head and torque limiter for sealing purposes.

4. Remove cylinder head cover bolts.
5. Remove cylinder head cover from cylinder head.

## INSTALLATION

**NOTE:** Replace spark plug well seals and bolt seals when installing a new cylinder head cover gasket.

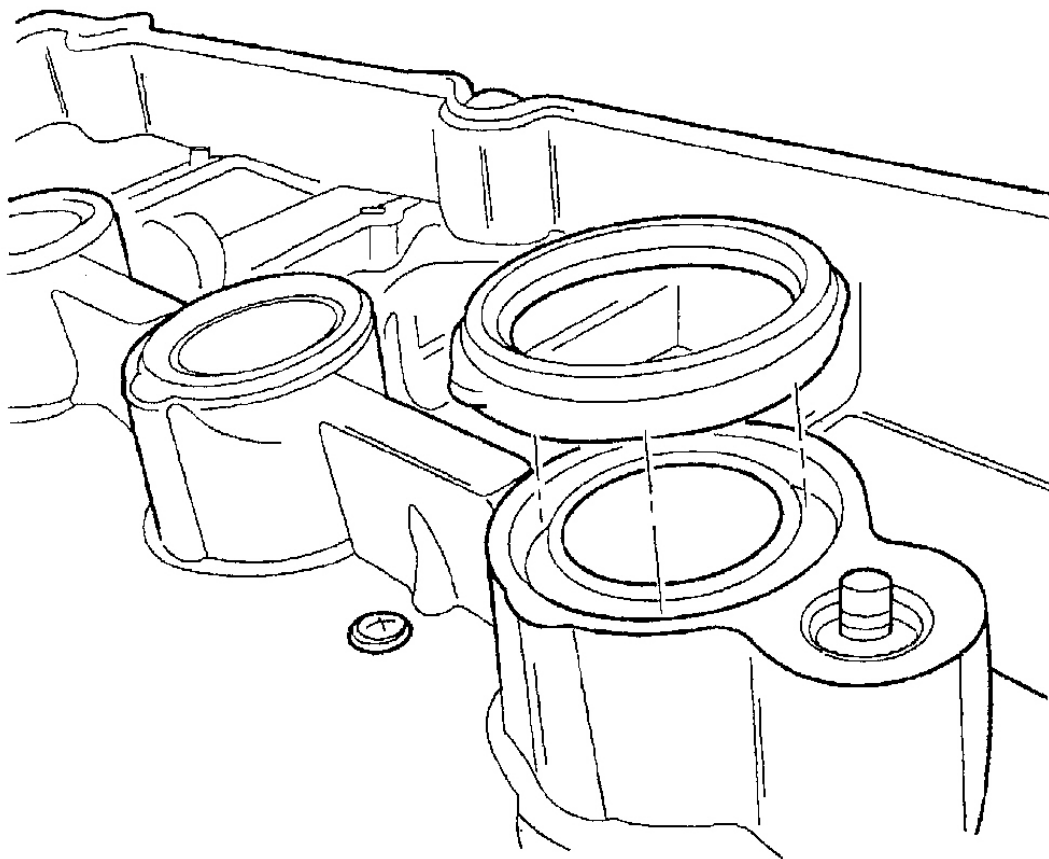
1. Install new cylinder head cover gaskets and spark plug well seals.



1 - SPARK PLUG WELL SEALS  
2 - GASKET

G01857770

**Fig. 99: Installing Cylinder Head Cover Gasket & Spark Plug Well Seals**  
Courtesy of DAIMLERCHRYSLER CORP.

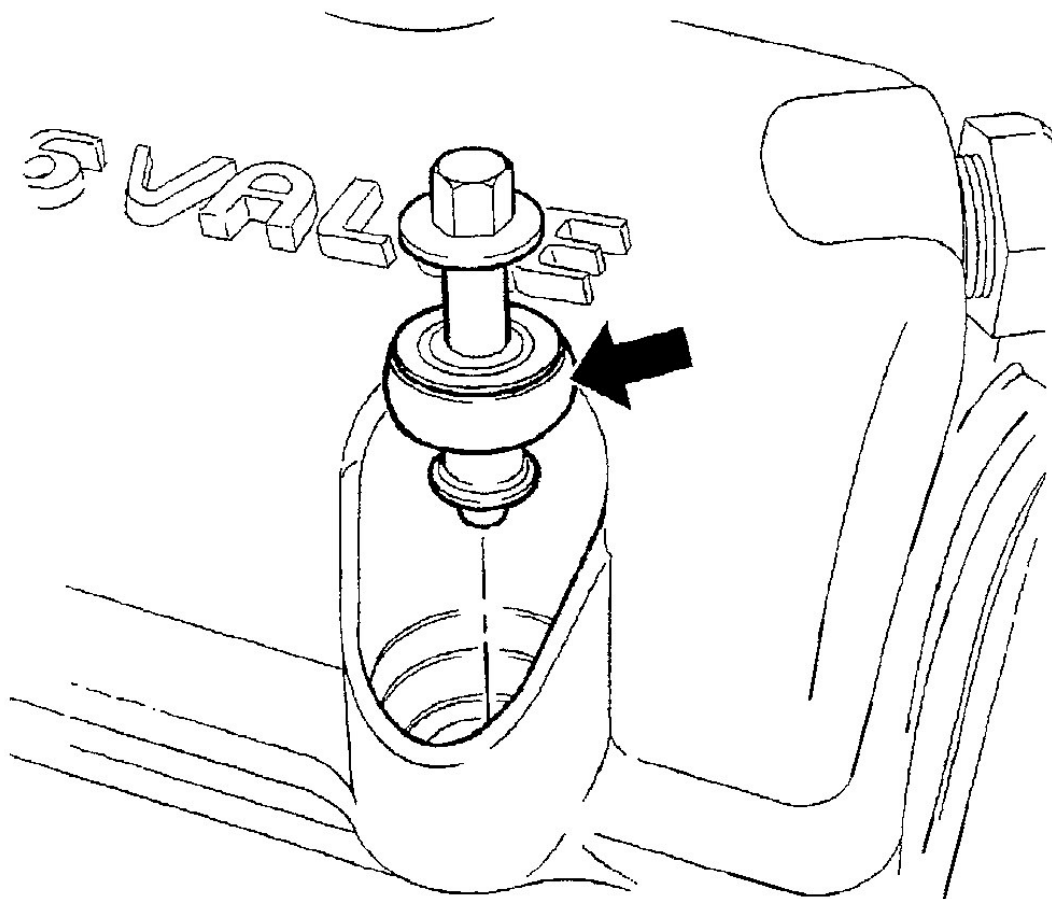


G01857771

**Fig. 100: Identifying Spark Plug Well Seals**  
**Courtesy of DAIMLERCHRYSLER CORP.**

2. Replace cylinder head cover bolt seals.

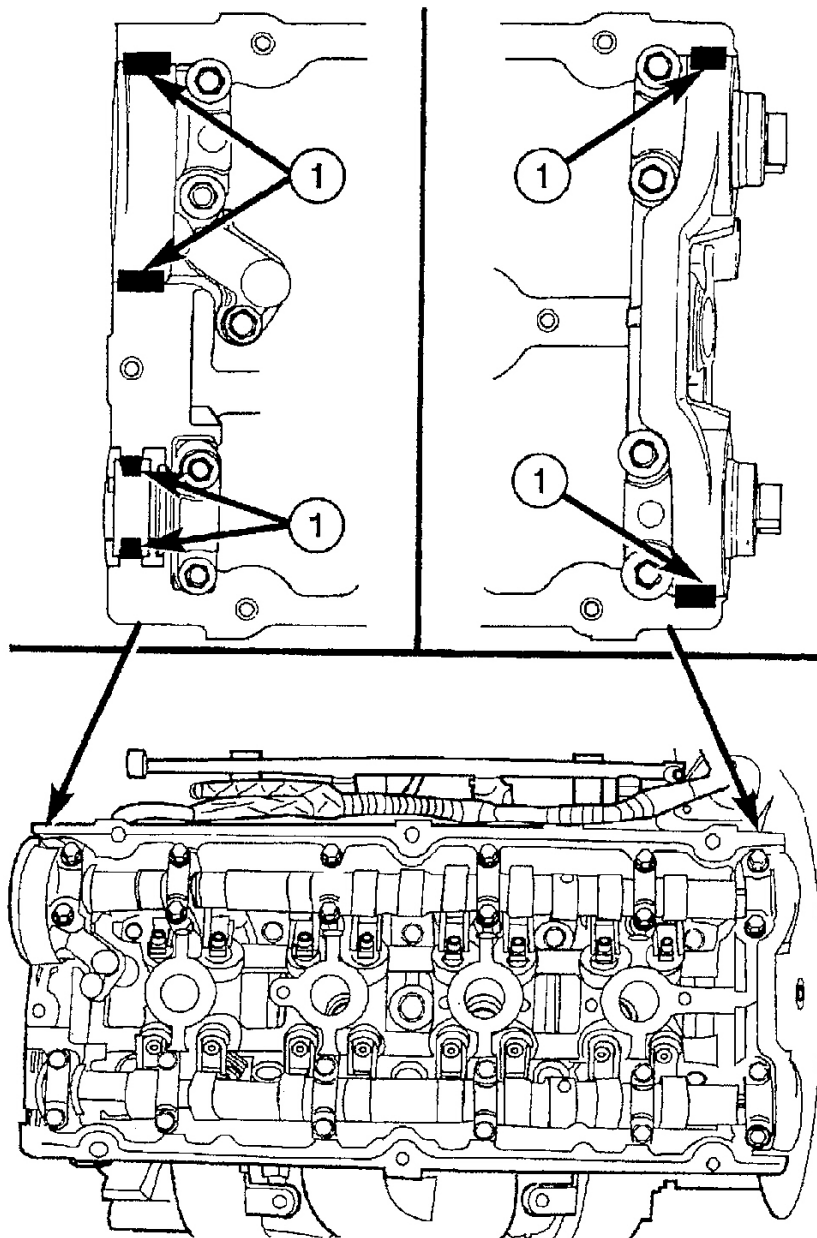




G01857772

**Fig. 101: Identifying Cylinder Head Cover Bolt Assembly**  
Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.



1 – SEALER LOCATION

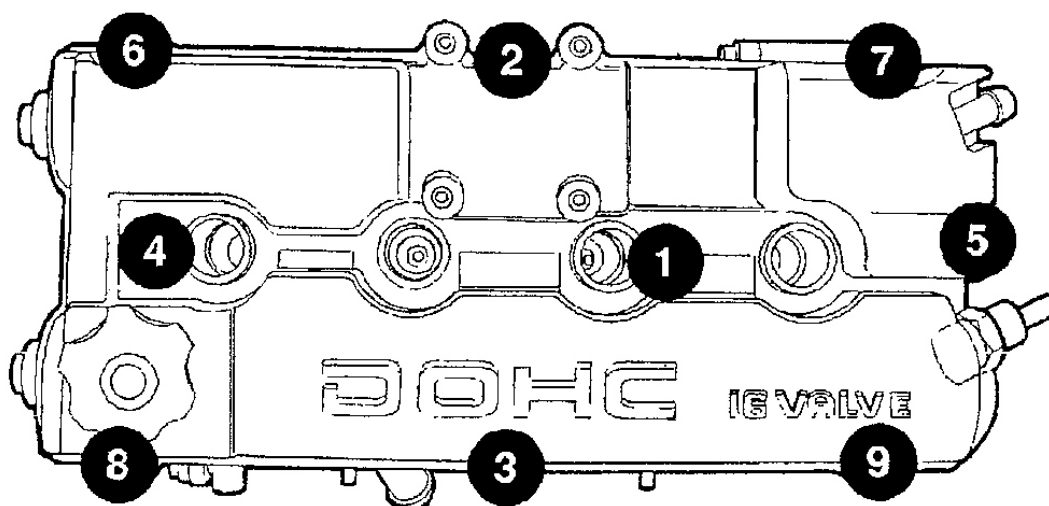
G01857773

**Fig. 102: Locating Sealers**

Courtesy of DAIMLERCHRYSLER CORP.

3. Apply Mopar® Engine RTV GEN II at the camshaft cap corners and at the top edges of the 1/2 round seal.

**CAUTION:** When installing cylinder head cover bolts, be careful not to interchange the two (2) center bolts with the seven (7) perimeter bolts. The two (2) center bolts contain an aluminum washer between the bolt head and torque limiter for sealing purposes.



G01857774

**Fig. 103: Identifying Cylinder Head Cover Tightening Sequence (Typical Cover Shown)**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Install cylinder head cover assembly to cylinder head. Install all bolts, ensuring the two (2) bolts containing the sealing washer are located in the center locations of cover. Tighten bolts in sequence shown. Using a 3 step torque method as follow:
  - a. Tighten all bolts to 4.5 N.m (40 in. lbs.).
  - b. Tighten all bolts to 9.0 N.m (80 in. lbs.).
  - c. Tighten all bolts to 12 N.m (105 in. lbs.).
5. Install ignition coil and spark plug wires. Tighten fasteners to 12 N.m (105 in. lbs.).
6. If the PCV valve was removed, apply Mopar® thread Sealant with Teflon to threads and install valve to cylinder head cover. Tighten PCV valve to 8 N.m (70 in. lbs.).
7. Connect PCV and make-up air hoses to cylinder head cover. See **Fig. 98**.
8. Install upper intake manifold. See **INTAKE MANIFOLD**.

## HYDRAULIC LASH ADJUSTERS

### DIAGNOSIS AND TESTING

#### HYDRAULIC LASH ADJUSTER NOISE DIAGNOSIS

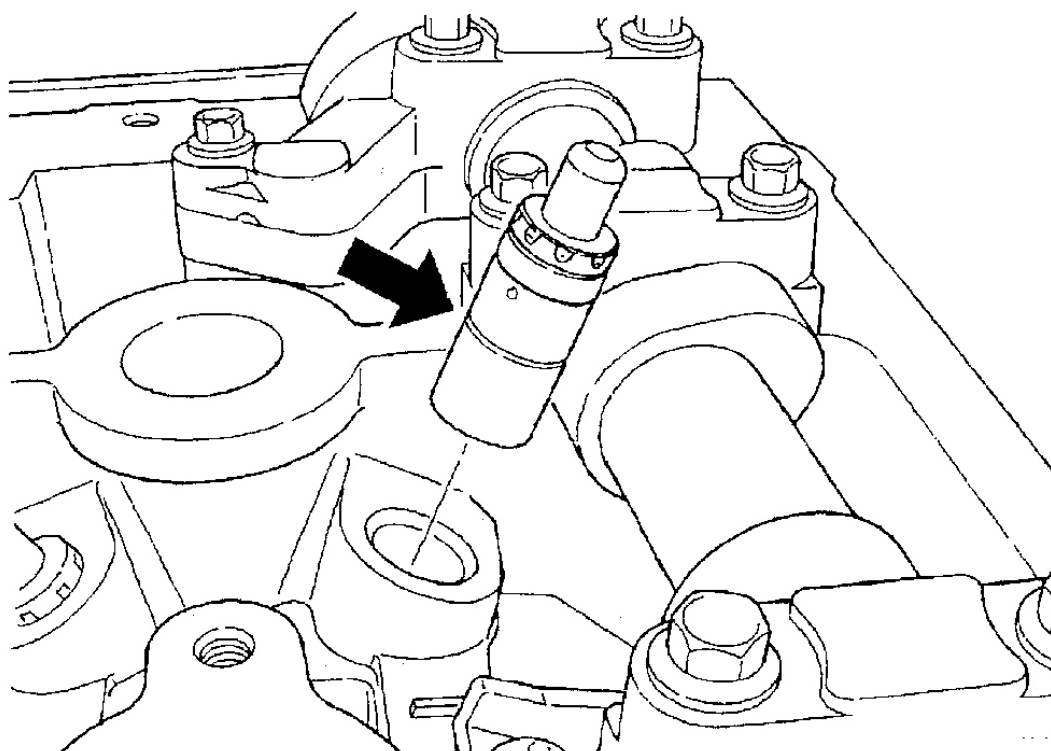
A tappet-like noise may be produce from several items. Check the following items.

1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. 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.
4. Low oil pressure.
5. The oil restrictor (integral to the cylinder head gasket) in the vertical oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Faulty lash adjuster.
  - Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.
  - Remove suspected lash adjusters, and replace as necessary.

## REMOVAL

**NOTE:**      **This procedure is for in-vehicle service with camshafts installed.**

1. Remove cylinder head cover. See **CYLINDER HEAD COVER**.
2. Remove rocker arm. See **ROCKER ARMS**.
3. Remove hydraulic lash adjuster.



G01857775

**Fig. 104: Identifying Hydraulic Lash Adjuster**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Repeat removal procedure for each hydraulic lash adjuster.
5. If reusing, mark each hydraulic lash adjuster for reassembly in original position. Lash adjusters are serviced as an assembly.

## INSTALLATION

1. Install hydraulic lash adjuster. Ensure the lash adjusters are at least partially full of engine oil. This is indicated by little or no plunger travel when the lifter is depressed.
2. Install rocker arm. See **ROCKER ARMS**.
3. Repeat installation procedure for each hydraulic lash adjuster.
4. Install cylinder head cover. See **CYLINDER HEAD COVER**.

## INTAKE/EXHAUST VALVES & SEATS

### DESCRIPTION

The valves are made of heat resistant steel. They have chrome plated stems to prevent scuffing. Viton rubber valve stem seals are integral with the spring seats. The valve have three-bead lock keepers to retain springs and to promote valve rotation.

## **OPERATION**

The four valves per cylinder (two intake and two exhaust) are opened by using roller rocker arms which pivot on hydraulic lash adjusters.

## **CLEANING**

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

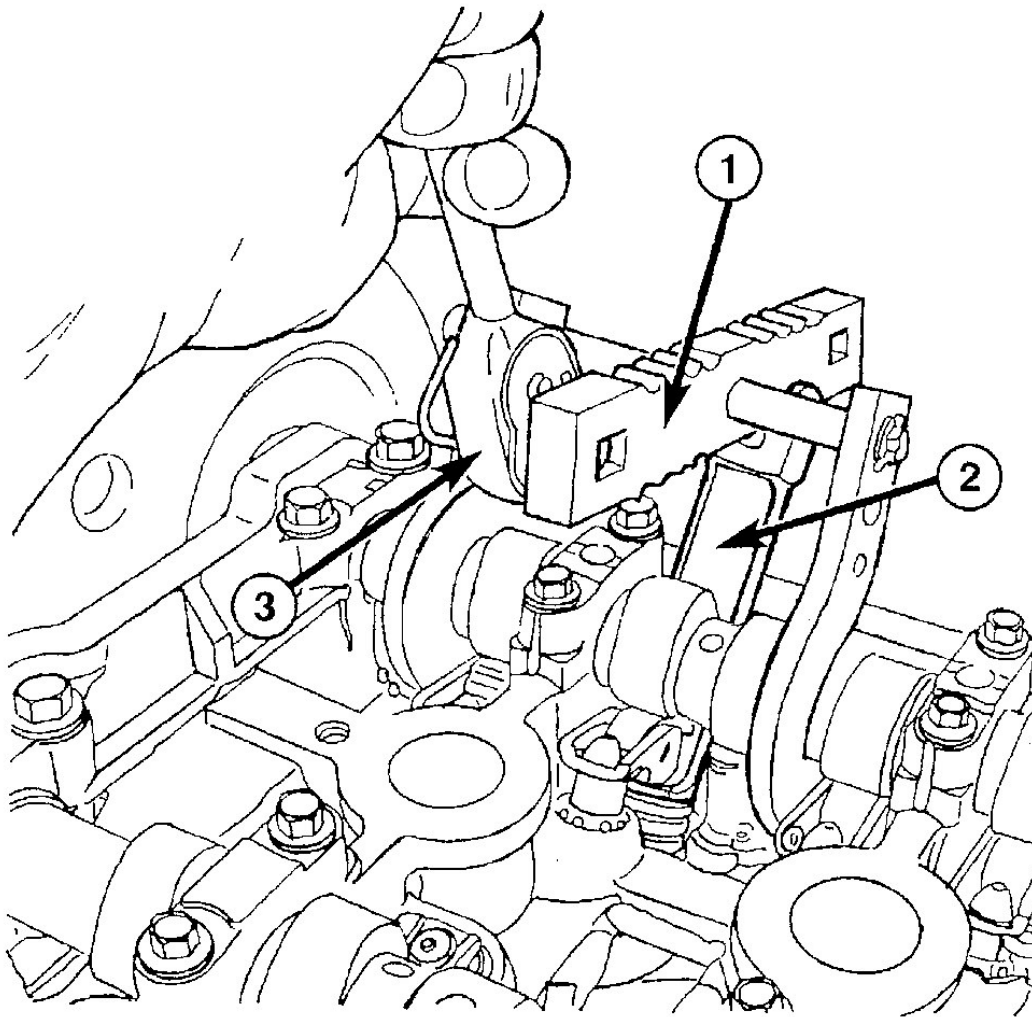
## **ROCKER ARMS**

### **REMOVAL**

**NOTE:** This procedure is for in-vehicle service with camshafts installed.

1. Remove cylinder head cover. See **CYLINDER HEAD COVER**.
2. Remove spark plugs.
3. Rotate engine until the camshaft lobe, on the follower being removed, is positioned on its base circle (heel). Also, the piston should be a minimum of 6.3 mm (0.25 in) below TDC position.

**CAUTION:** If cam follower assemblies are to be reused, always mark position for reassembly in their original positions.



1 - SPECIAL TOOL 8215A

2 - SPECIAL TOOL 8436

3 - 3/8" DRIVE RACHET

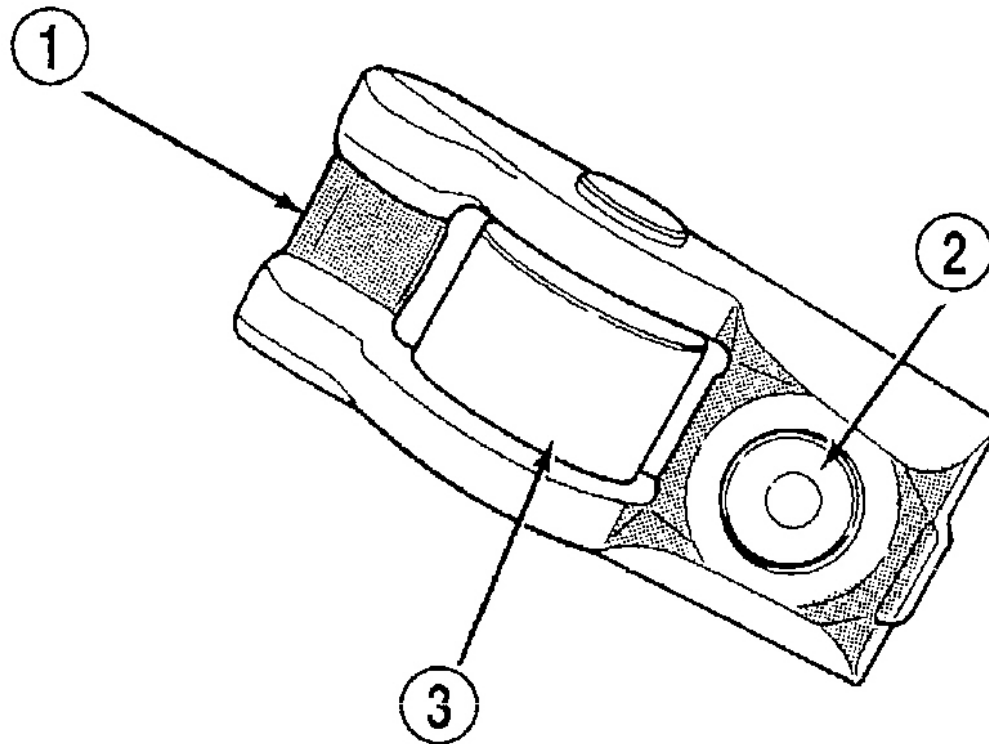
G01857776

**Fig. 105: Removing & Installing Rocker Arm**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Using Special Tools 8215A and 8436 slowly depress valve assembly until rocker arm can be removed.
5. Repeat removal procedure for each rocker arm.

## INSPECTION

Inspect the rocker arm for wear or damage. Replace as necessary.



- 1 - TIP
- 2 - LASH ADJUSTER POCKET
- 3 - ROLLER

G01857777

**Fig. 106: Inspecting Rocker Arm**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. Lubricate rocker arm with clean engine oil.
2. Using Special Tools 8215A and 8436 slowly depress valve assembly until rocker arm can be installed on the hydraulic lifter and valve stem.
3. Repeat installation procedure for each rocker arm.



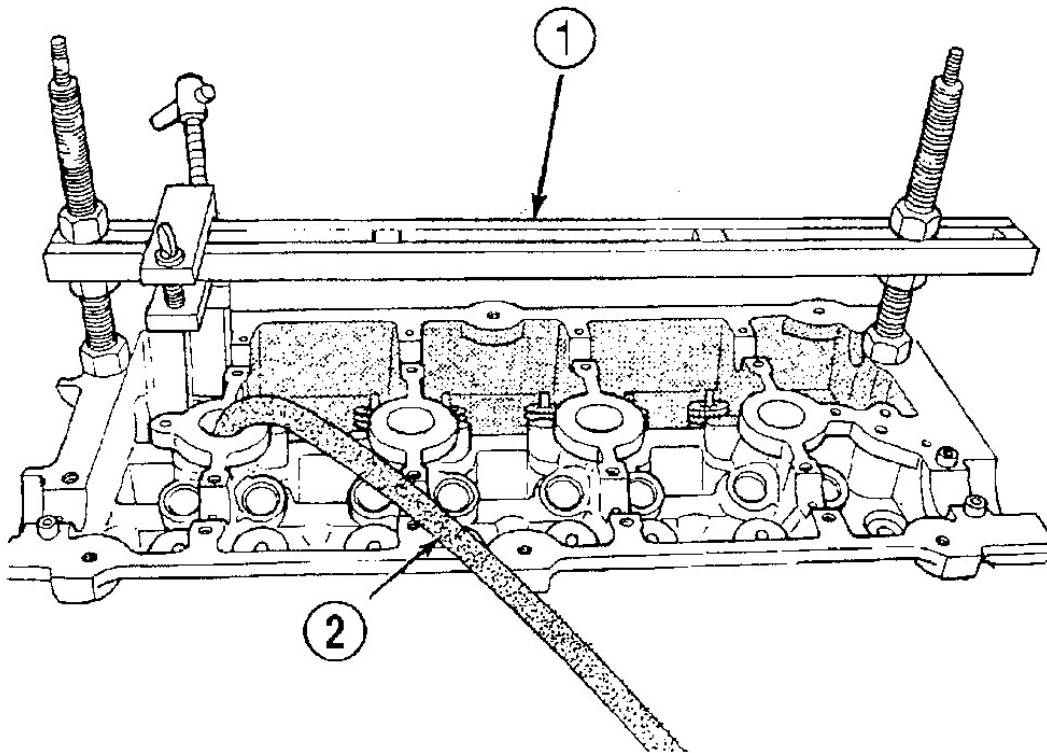
4. Install spark plugs.
5. Install cylinder head cover. See CYLINDER HEAD COVER.

## VALVE SPRINGS & SEALS

### REMOVAL

#### REMOVAL - CYLINDER HEAD ON

1. Remove cylinder head cover. See CYLINDER HEAD COVER.
2. Remove camshafts. See CAMSHAFT(S).
3. Rotate crankshaft until piston is at TDC on compression.
4. With air hose attached to adapter tool installed in spark plug hole, apply 90-120 psi air pressure.
5. Using Special Tool MD-998772-A with adapter 6779, compress valve springs and remove valve locks.



1 - VALVE SPRING COMPRESSOR MD 998772A

2 - AIR HOSE

G01857778

**Fig. 107: Removing & Installing Valve Spring**  
**Courtesy of DAIMLERCHRYSLER CORP.**

6. Remove valve spring(s).
7. Remove valve stem seal(s) by using valve stem seal tool. See **Fig. 109**.

**REMOVAL - CYLINDER HEAD OFF**

1. With cylinder head removed from cylinder block, compress valve springs using a universal valve spring compressor.
2. Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.
3. Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides**. Identify valves, locks and retainers to insure installation in original location.
4. Inspect the valves. See **INSPECTION**.

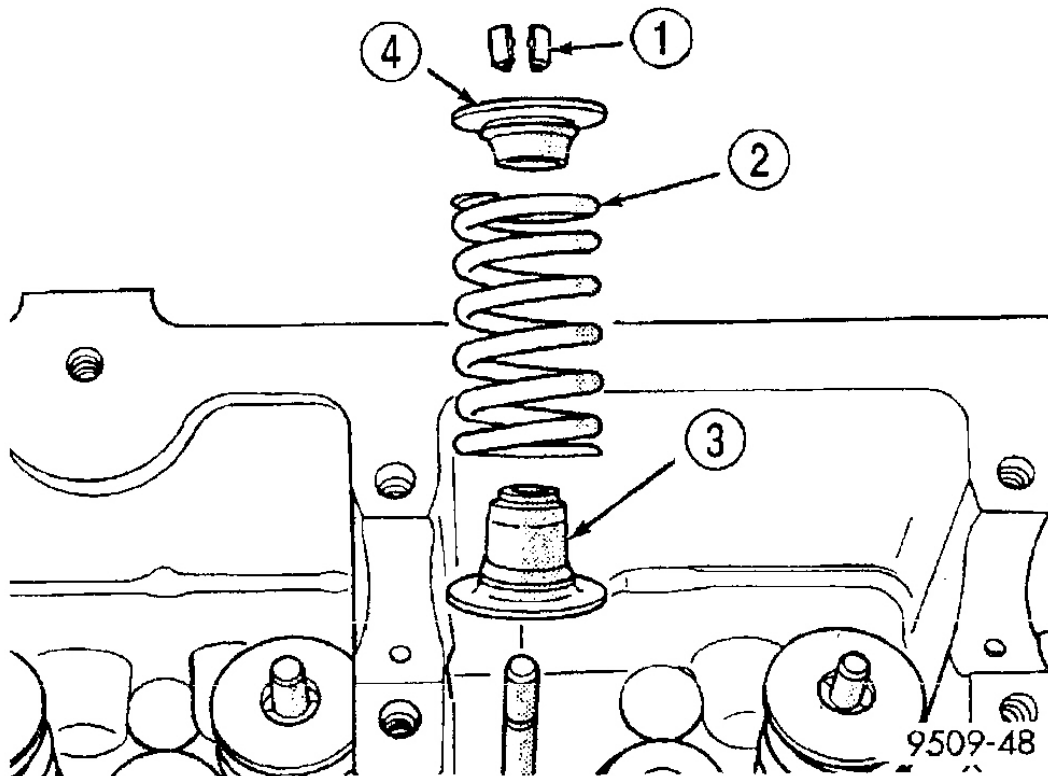
**INSPECTION**

1. Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested for correct tension. Discard the springs that do not meet specifications. The following specifications apply to both intake and exhaust valves springs:
  - Valve Closed Nominal Tension-76 lbs. @ 38.0 mm (1.50 in.)
  - Valve Open Nominal Tension-136 lbs. @ 29.75 mm (1.17 in.)
2. Inspect each valve spring for squareness with a steel square and surface plate, test springs from both ends. If the spring is more than 1.5 mm (1/16 inch) out of square, install a new spring.

**INSTALLATION**

**INSTALLATION - CYLINDER HEAD ON**

1. Install valve seal/valve spring seat assembly. Push the assembly down to seat it onto the valve guide.



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

G01857779

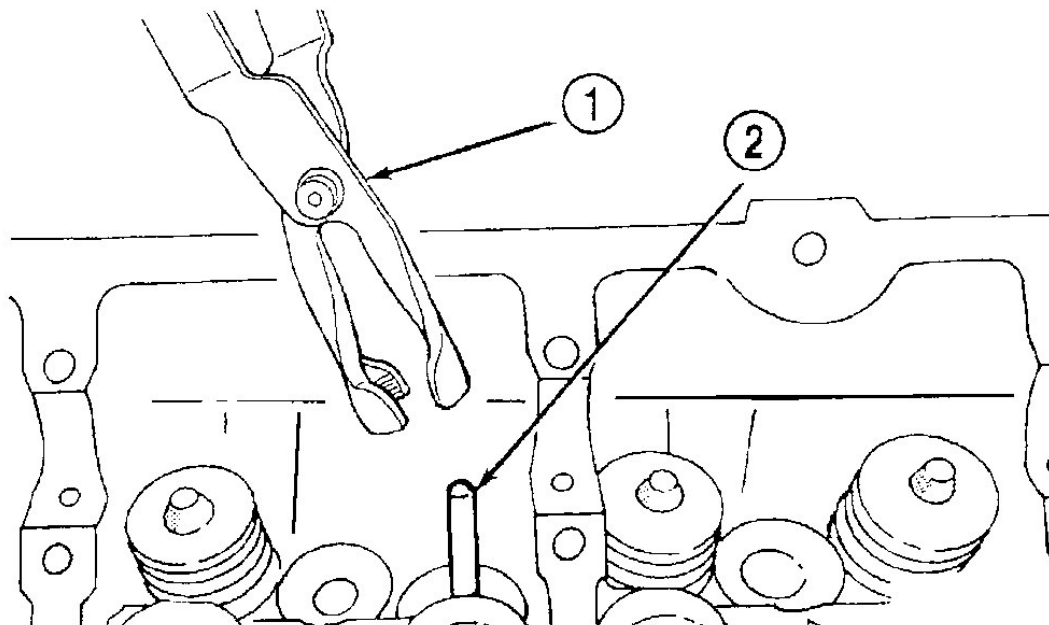
**Fig. 108: Installing Valve Stem Seal/Valve Spring Seat**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Install valve spring and retainer, use Special Tool MD-998772-A with adapter 6779 to compress valve springs only enough to install locks. See **Fig. 107**. Correct alignment of tool is necessary to avoid nicking valve stems.
3. Remove air hose and install spark plugs.
4. Install camshafts. See **CAMSHAFT(S)**.
5. Install cylinder head cover. See **CYLINDER HEAD COVER**.

**INSTALLATION - CYLINDER HEAD OFF**

1. Coat valve stems with clean engine oil and insert in cylinder head.

**CAUTION:** When oversize valves are used, the corresponding oversize valve seal must also be used. Excessive guide wear may result if oversize seals are not used with oversize valves.



1 - VALVE SEAL TOOL

2 - VALVE STEM

G01857780

**Fig. 109: Identifying Valve Stem Oil Seal Tool**

Courtesy of DAIMLERCHRYSLER CORP.

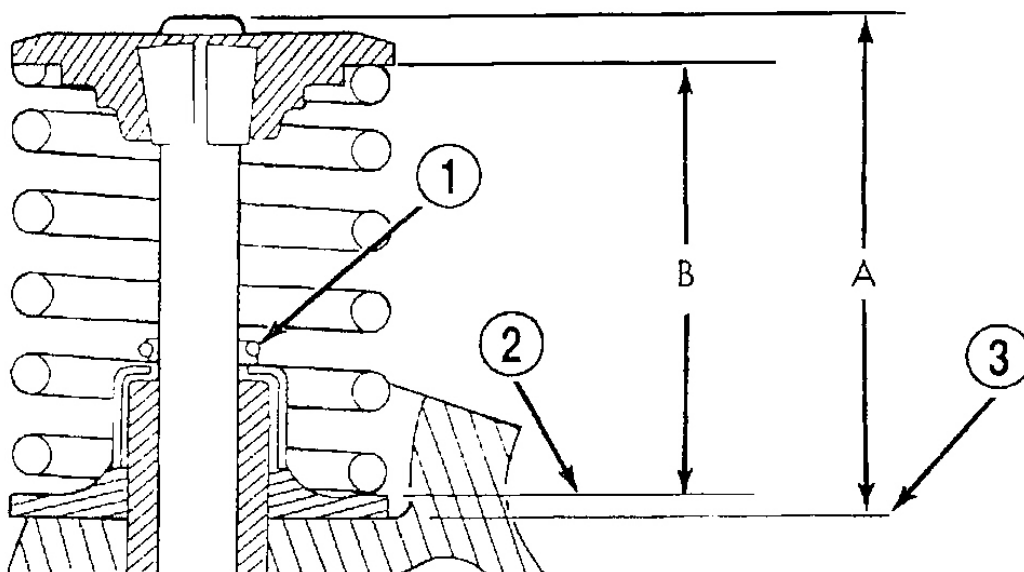
2. Install new valve stem seals on all valves using a valve stem seal tool. The valve stem seals should be pushed firmly and squarely over valve guide.

**CAUTION:** When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Ensure both locks are in the correct location after removing tool.

3. Install valve springs and retainers. Compress valve spring only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may result from misalignment of the valve

spring compressor.

4. Check the valve spring installed height B after refacing the valve and seat. 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 (1.525 in.), install a 0.762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.



- 1 - GARTER SPRING
- 2 - VALVE SPRING SEAT
- 3 - CYLINDER HEAD SURFACE

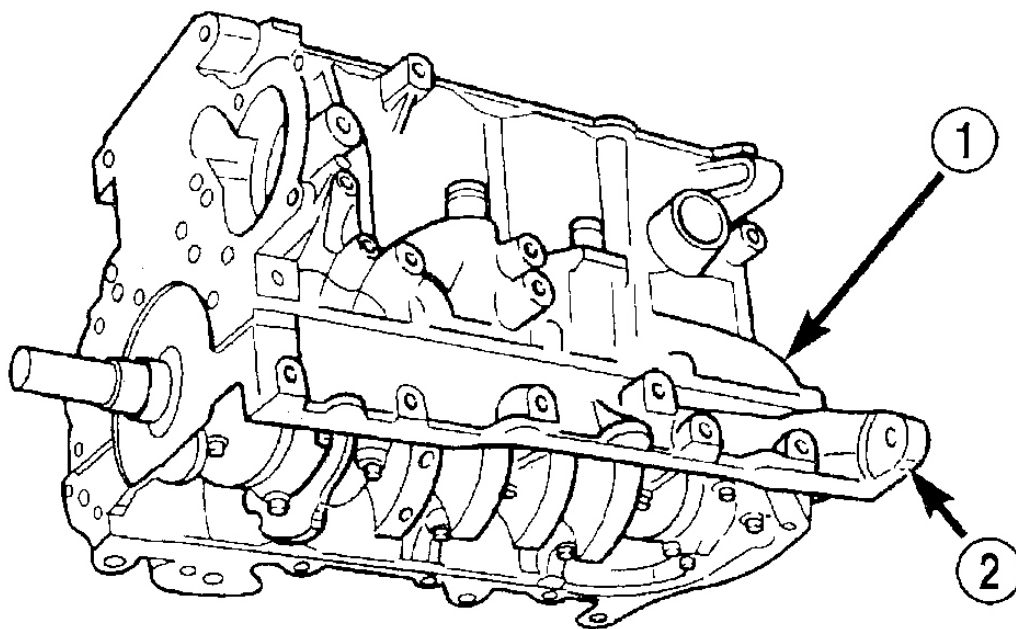
G01857781

**Fig. 110: Checking Spring Installed Height and Valve Tip Height Dimensions**  
Courtesy of DAIMLERCHRYSLER CORP.

## ENGINE BLOCK

### DESCRIPTION

The cast iron cylinder block is a two-piece assembly, consisting of the cylinder block and bed plate. The bed plate incorporates the main bearing caps and bolts to the cylinder block. This design offers a much stronger lower end and increased cylinder block rigidity. The rear oil seal retainer is integral with the block. The bed plate and block are serviced as an assembly.



1 - CYLINDER BLOCK

2 - BED PLATE

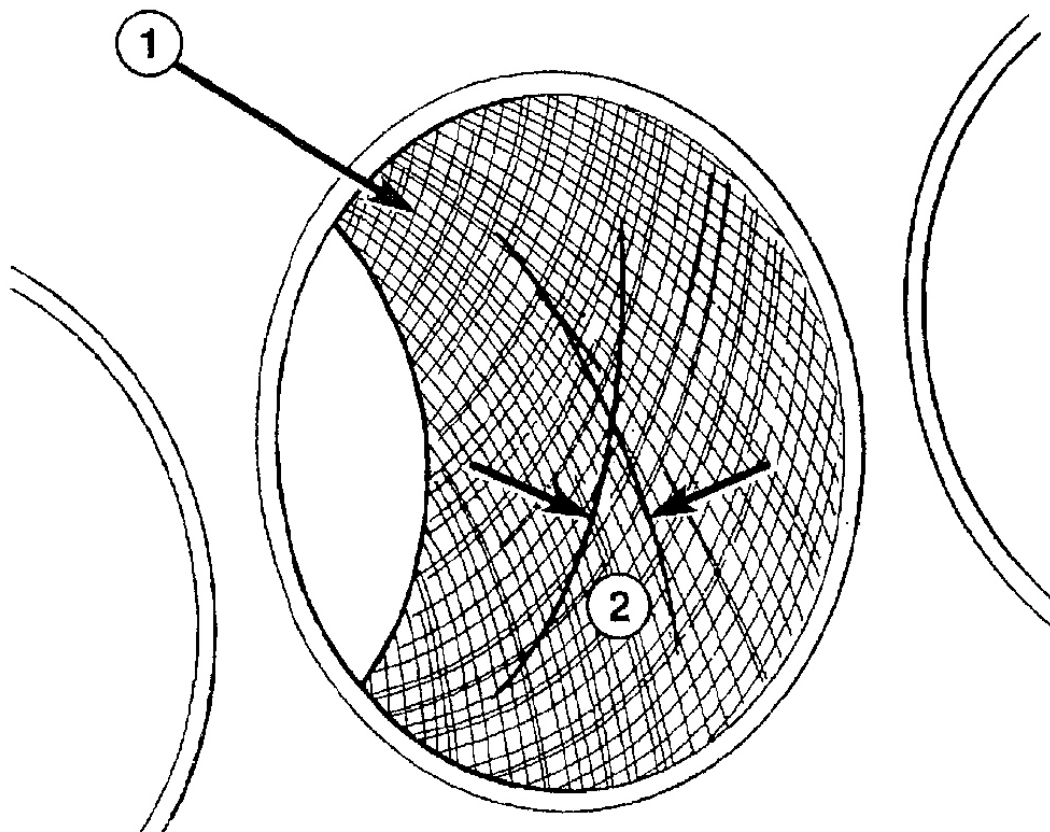
G01857782

**Fig. 111: Identifying Cylinder Block and Bed plate**

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.



1 - CROSS-HATCH PATTERN

2 - 40°–60°

G01857783

**Fig. 112: Identifying 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.

**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.

5. After honing, it is necessary that the block be cleaned again to remove all traces of abrasive.

## **CLEANING**

Clean cylinder block thoroughly using a suitable cleaning solvent.

## **INSPECTION**

### **ENGINE BLOCK**

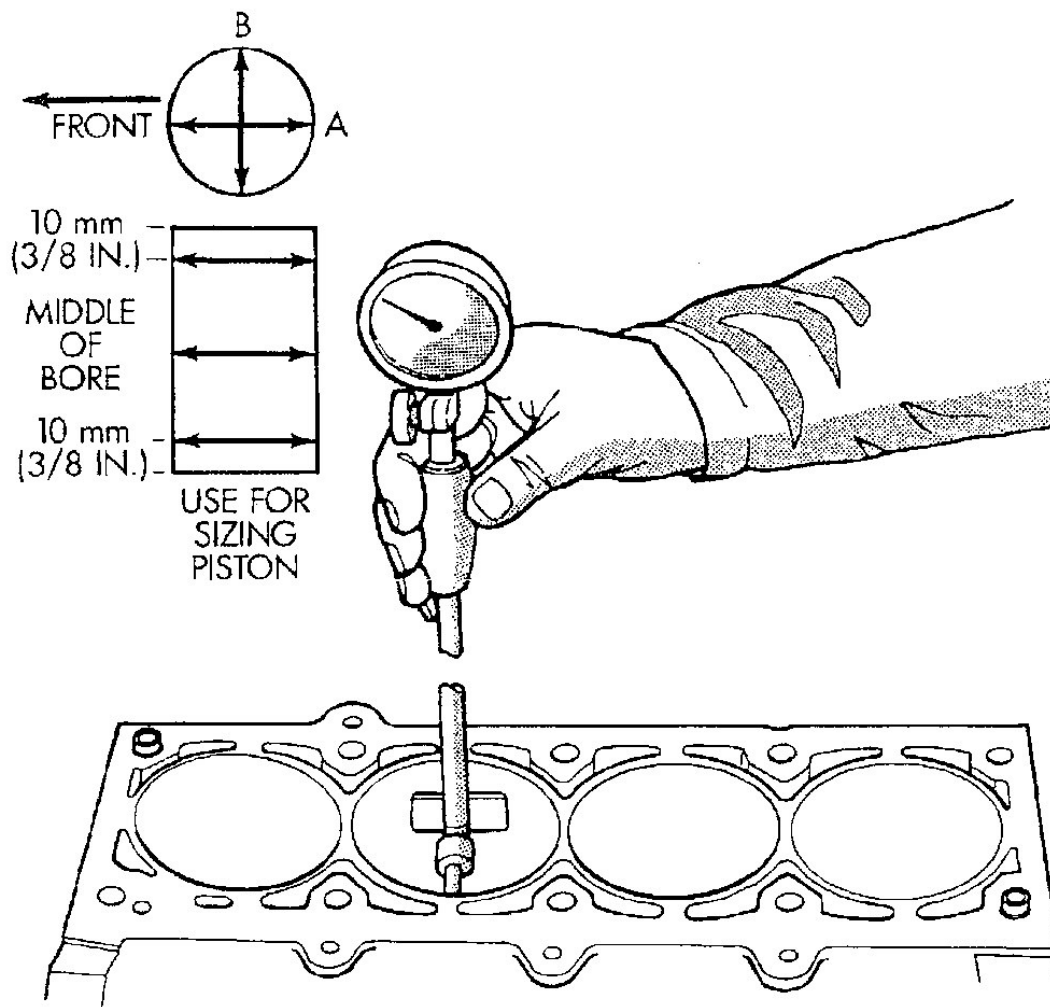
1. Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.
2. If new core plugs are to be installed. See **STANDARD PROCEDURE**.
3. Examine block and cylinder bores for cracks or fractures.
4. Check block deck surfaces for flatness. Deck surface must be within service limit 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. See **SPECIFICATIONS**. If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.





G01857784

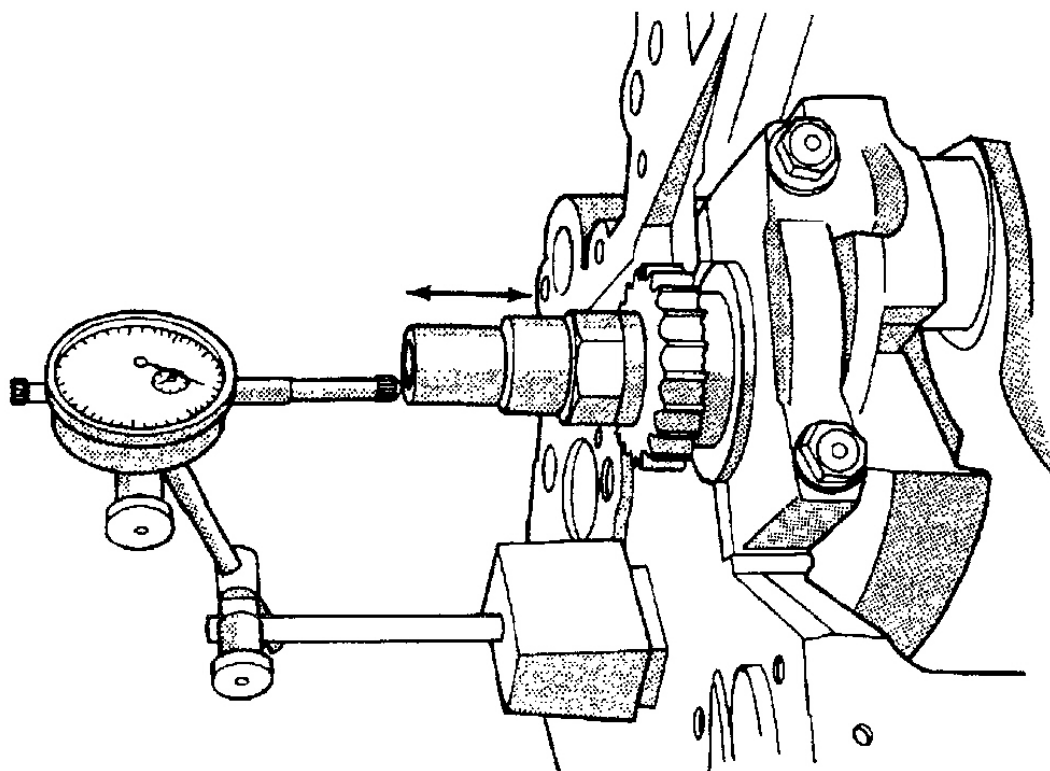
**Fig. 113: Checking Cylinder Bore Size**  
 Courtesy of DAIMLERCHRYSLER CORP.

Measure the cylinder bore at three levels in directions A and B. 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. See **SPECIFICATIONS**.

## CRANKSHAFT

### STANDARD PROCEDURE - MEASURING CRANKSHAFT END PLAY

1. Mount a dial indicator to front of engine with the locating probe on nose of crankshaft.



G01857785

**Fig. 114: Checking Crankshaft End Play - Typical**  
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. See **SPECIFICATIONS** for end play specification.

## REMOVAL - CRANKSHAFT

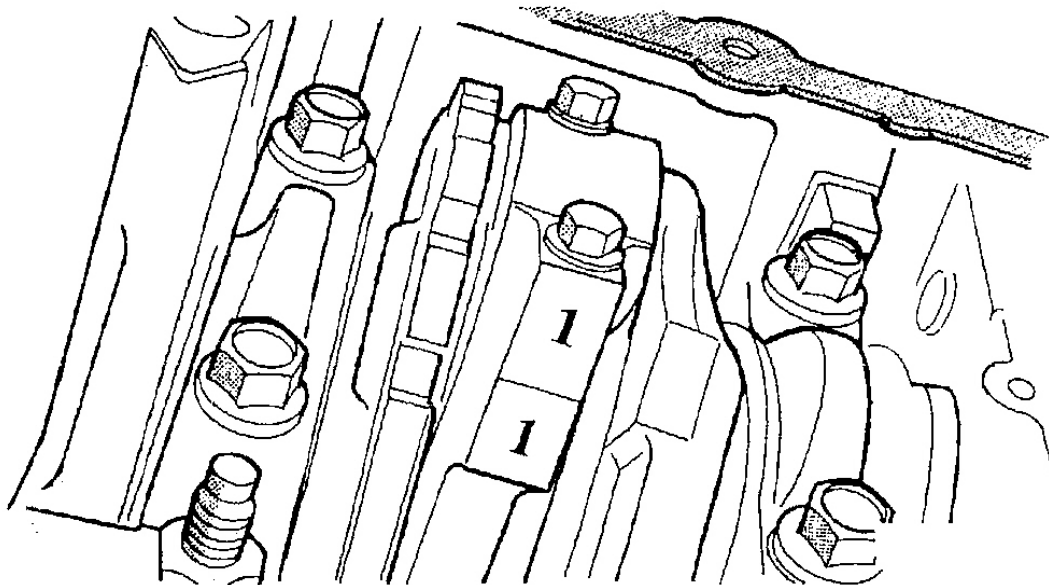
**NOTE:** Crankshaft can not be removed when engine is in vehicle.

1. Remove engine assembly from vehicle. See **ENGINE**.
2. Separate transaxle from engine.
3. Remove drive plate/flex plate.
4. Remove crankshaft rear oil seal. See **CRANKSHAFT OIL SEAL - REAR**.
5. Mount engine on a suitable repair stand.
6. Drain engine oil and remove oil filter.

7. Remove crankshaft vibration damper. See **VIBRATION DAMPER**.
8. Remove engine mount support bracket.
9. Remove front timing belt covers. See **TIMING BELT COVER(S)**.
10. Remove the timing belt. See **TIMING BELT AND SPROCKETS**.
11. Remove the rear timing belt cover. See **TIMING BELT COVER(S)**.
12. Remove the oil pan. See **OIL PAN**.
13. Remove oil pump pick-up tube.
14. Remove the crankshaft sprocket and oil pump. See **OIL PUMP**.
15. Remove balance shafts and housing assembly. See **BALANCE SHAFTS AND CARRIER ASSEMBLY**.
16. Remove crankshaft position sensor.

**CAUTION: DO NOT** use a number stamp or a punch to mark connecting rods. Damage to connecting rod could occur.

**NOTE:** If piston/connecting rod replacement is necessary, remove cylinder head. See **CYLINDER HEAD**.



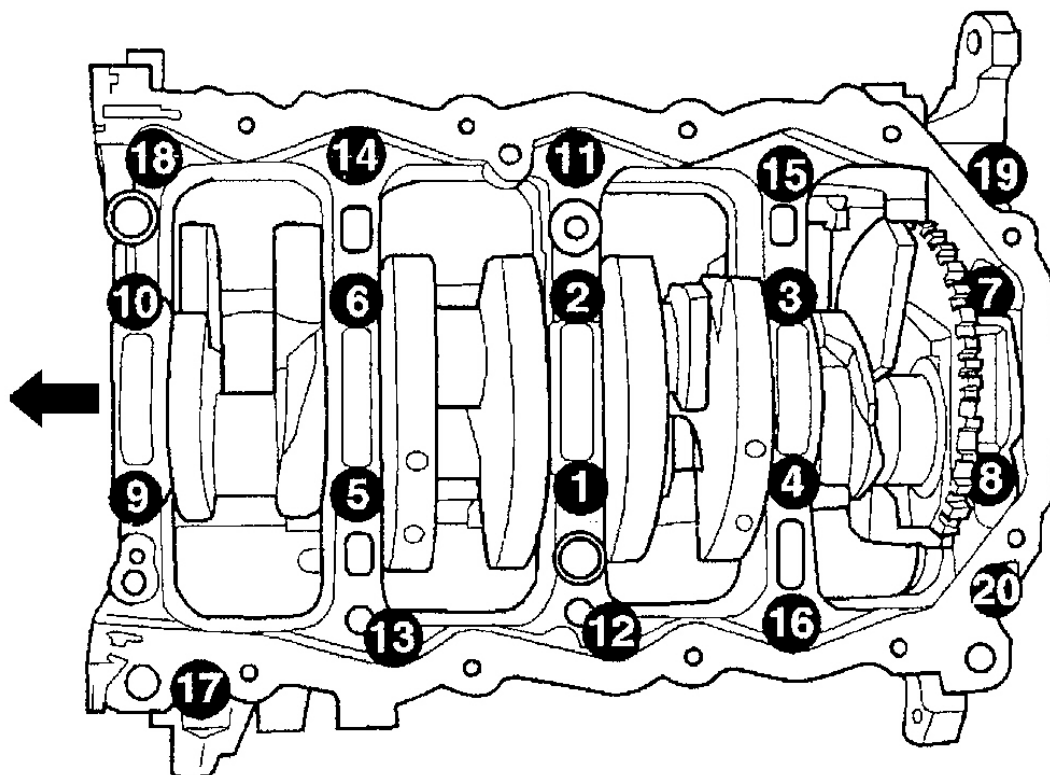
G01857786

**Fig. 115: Identifying Connecting Rod to Cylinder - Typical**  
Courtesy of DAIMLERCHRYSLER CORP.

17. Using a permanent ink or paint marker, identify cylinder number on each connecting rod cap.

**NOTE:** Do not reuse connecting rod bolts.

18. Remove all connecting rod bolts and caps. Care should be taken not to damage the fracture rod and cap surfaces.
19. Remove all bed plate bolts from the engine block.



G01857787

**Fig. 116: Identifying Bed Plate Bolt Removal Sequence**  
Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** Do not pry up on one side of the bed plate. Damage may occur to cylinder block to bed plate alignment and thrust bearing.

20. Using a mallet gently tap the bedplate loose from the engine block dowel pins.
21. Bed plate should be removed evenly from the cylinder block dowel pins to prevent damage to the dowel pins and thrust bearing.

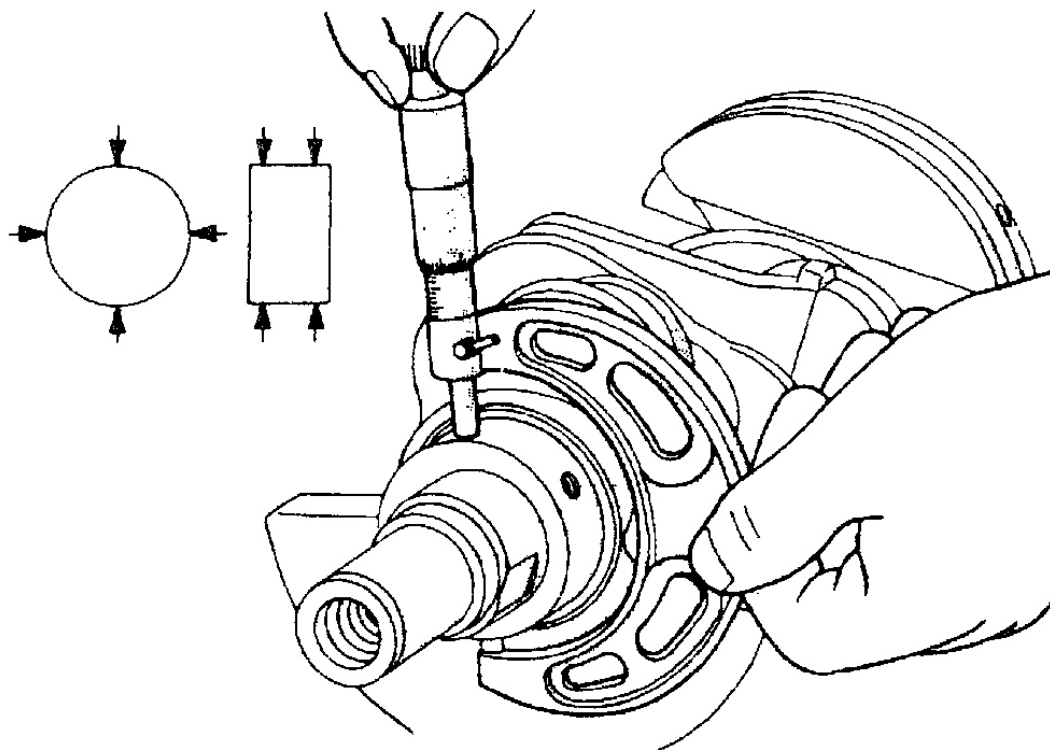
**CAUTION:** Use extreme care when handling crankshaft. Tone wheel damage can occur if crankshaft is mis-handled.

22. Lift out crankshaft from cylinder block. Do not damage the main bearings or journals when removing the crankshaft.
23. Remove the target ring mounting screws and discard.
24. Remove the target ring from the crankshaft.

## INSPECTION

**CAUTION:** With the nodular cast iron crankshafts, it is important that the final paper or cloth polish be in the same direction as normal rotation in the engine.

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 0.025 mm (0.001 in.). Journal grinding should not exceed 0.305 mm (0.012 in.) under the standard journal diameter. DO NOT grind thrust faces of No. 3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.



G01857788

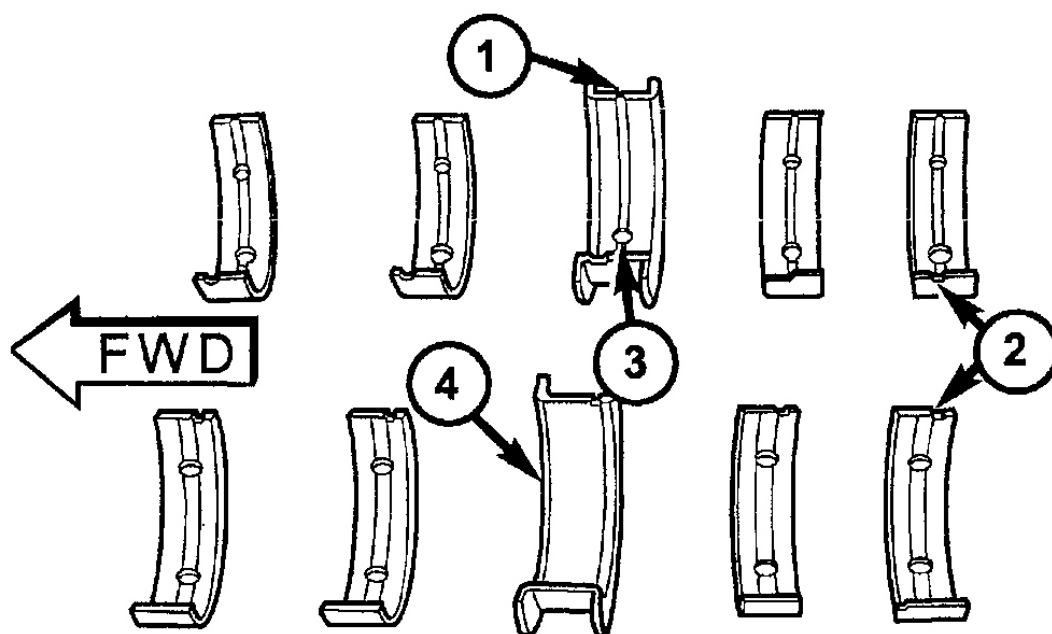
**Fig. 117: Identifying Crankshaft Journal Measurements - Typical**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION - CRANKSHAFT

## CRANKSHAFT MAIN BEARING LOCATION

**CAUTION:** The upper and lower thrust bearing halves are NOT interchangeable. Make certain the bearing half with the oil groove and hole is installed in the engine block.

The crankshaft is supported in five main bearings. All upper bearing shells in the crankcase have oil grooves and holes. All lower bearing shells **except** for the thrust bearing half have oil grooves and holes. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal.



1 - OIL GROOVE

2 - MAIN BEARINGS

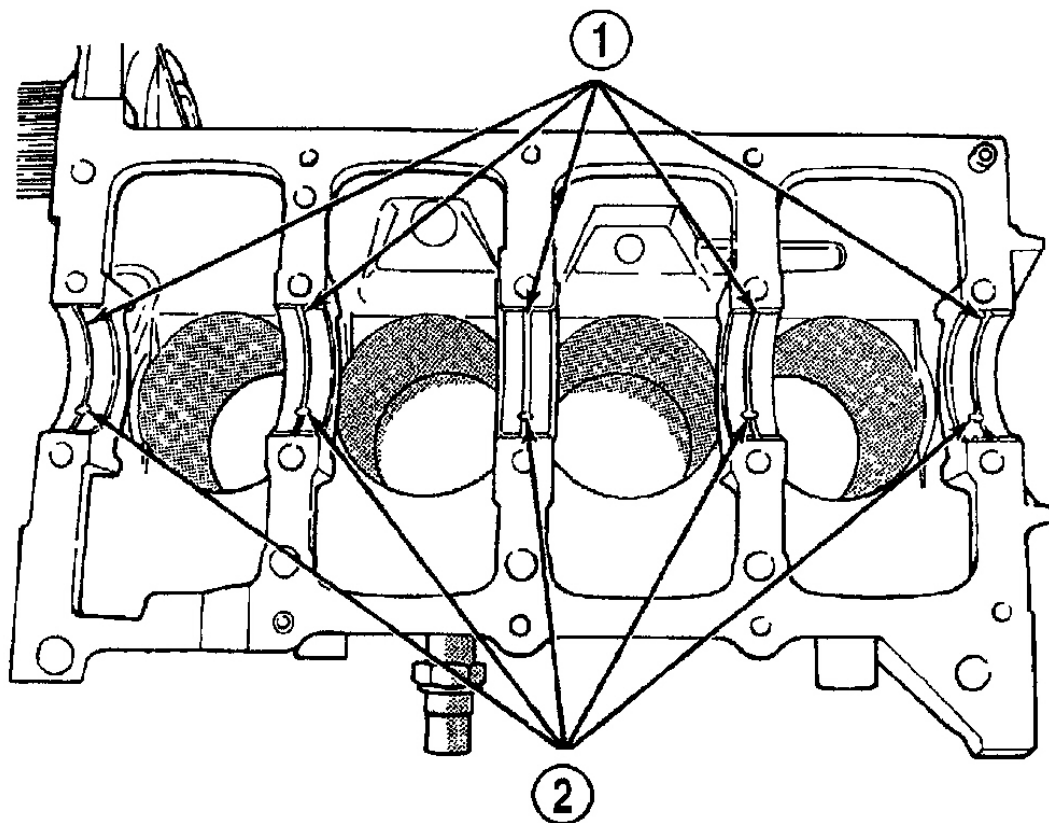
3 - OIL HOLE

4 - LOWER THRUST BEARING PLAIN (NO OIL HOLE OR GROOVE)

G01857789

**Fig. 118: Identifying Main Bearing**  
Courtesy of DAIMLERCHRYSLER CORP.

1. Install the main bearing upper shells with the lubrication groove and oil hole in the engine block.



- 1 - LUBRICATION GROOVES  
2 - OIL HOLES

G01857790

**Fig. 119: Installing Main Bearing Upper Shell**  
Courtesy of DAIMLERCHRYSLER CORP.

**NOTE:** If the crankshaft is sent out for machine work, it must be balanced as an assembly with the target ring installed.

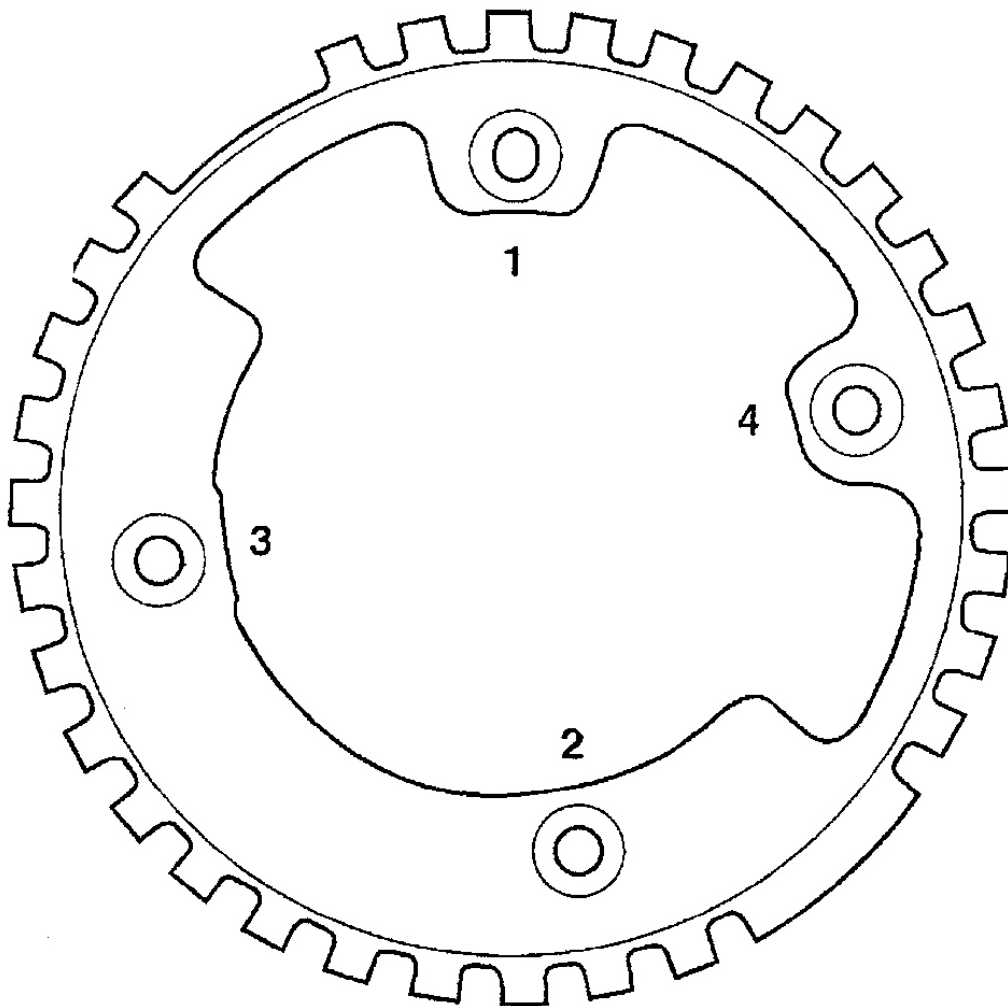
2. Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

**CAUTION:** Do not get oil on the bed plate mating surface. It will affect the ability of the sealer to seal the bed plate to cylinder block.

3. Clean crankshaft and target ring with Mopar® Brake Parts cleaner and dry with compressed air to ensure that the crankshaft mating surface and target ring mounting holes are free from oil and lock patch debris.

**NOTE:** Always use **NEW** mounting screws whether installing original or new target ring.

4. Install **NEW** mounting screws finger tight starting with the #1 location. Make sure engagement occurs with the shoulder of the screws and mounting hole before starting all other screws.
5. Torque all mounting screws with T30 torx bit to 13 Nm (110 in-lbs) following the torque sequence.



1 - TARGET RING

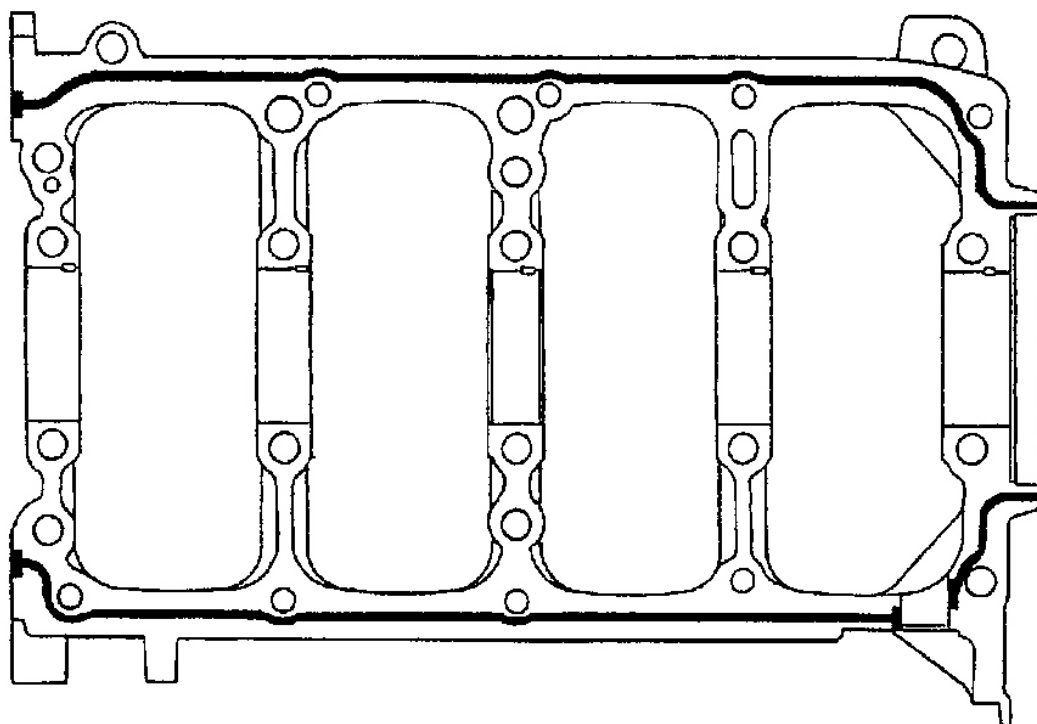
G01857791

**Fig. 120: Identifying Target Ring**  
Courtesy of DAIMLERCHRYSLER CORP.



6. Oil the bearings and journals. Install crankshaft in engine block.

**CAUTION:** Use only the specified anaerobic sealer on the bed plate or damage may occur to the engine.

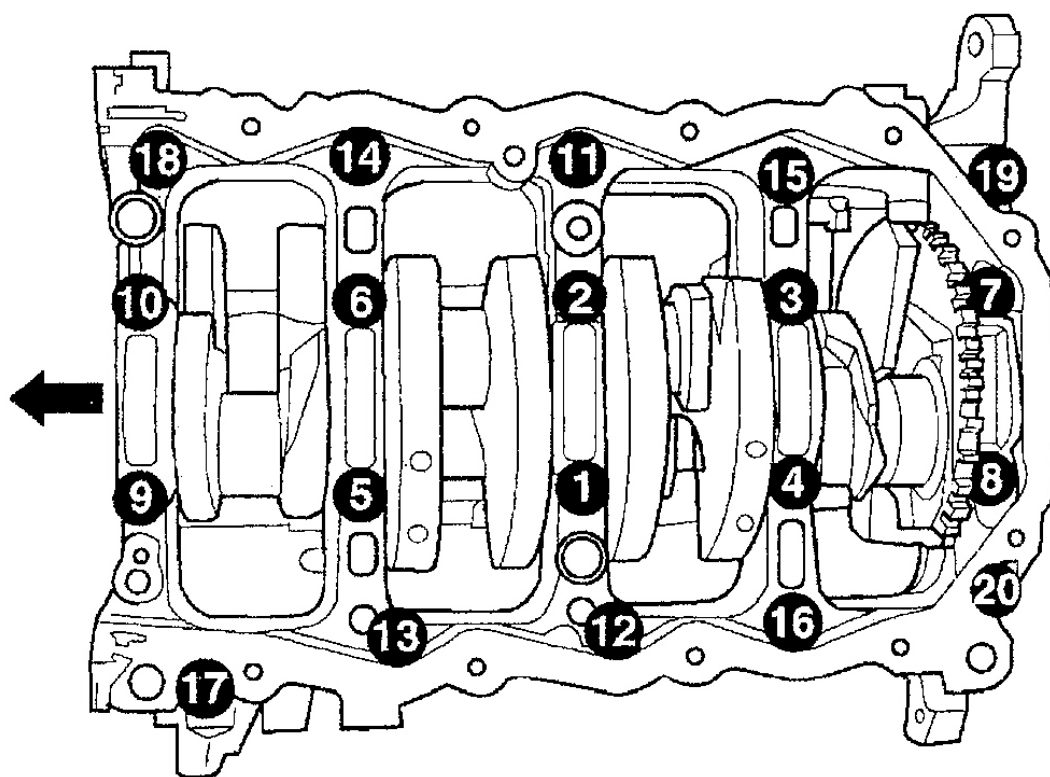


G01857792

**Fig. 121: Sealing Bed Plate**

Courtesy of DAIMLERCHRYSLER CORP.

7. Apply a 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar® Bed Plate Sealant to bed plate as shown.
8. Install lower main bearings into main bearing cap/bed plate. Make certain the bearing tabs are seated into the bed plate slots. Install the main bearing/bed plate into engine block.
9. Before installing the bolts the threads should be oiled with clean engine oil, wipe off any excess oil.
10. Install main bearing cap/bed plate to engine block bolts 11, 17, and 20 finger tight. Tighten these bolts down together until the bed plate contacts the cylinder block.



G01857793

**Fig. 122: Identifying Main Bearing Caps/Bed Plate Bolt Torque Sequence**  
 Courtesy of DAIMLERCHRYSLER CORP.

11. To ensure correct thrust bearing alignment, perform the following steps:
  - Step 1: Rotate crankshaft until number 4 piston is at TDC.
  - Step 2: Move crankshaft rearward to limits of travel.
  - Step 3: Then, move crankshaft forward to limits of travel.
  - Step 4: Wedge an appropriate tool between the rear of the cylinder block (**NOT BED PLATE**) and the rear crankshaft counterweight. This will hold the crankshaft in it's furthest forward position.
  - Step 5: Install and tighten bolts (1-10) in sequence shown to 41 N.m (30 ft. lbs.). See **Fig. 122**.
  - Step 6: Remove wedge tool used to hold crankshaft.
12. Tighten bolts (1-10) again to 41 N.m (30 ft. lbs.) in sequence shown. See **Fig. 122**.
13. Install main bearing bed plate to engine block bolts (11-20), and torque each bolt to 28 N.m (250 in. lbs.) in sequence shown. See **Fig. 122**.
14. Tighten bolts (1-10) to 75 N.m (55 ft. lbs.) in sequence shown. See **Fig. 122**.
15. Tighten bolts (11-20) again to 28 N.m (250 in. lbs.) in sequence shown. See **Fig. 122**.
16. After the main bearing bed plate is installed, check the crankshaft turning torque. The turning torque

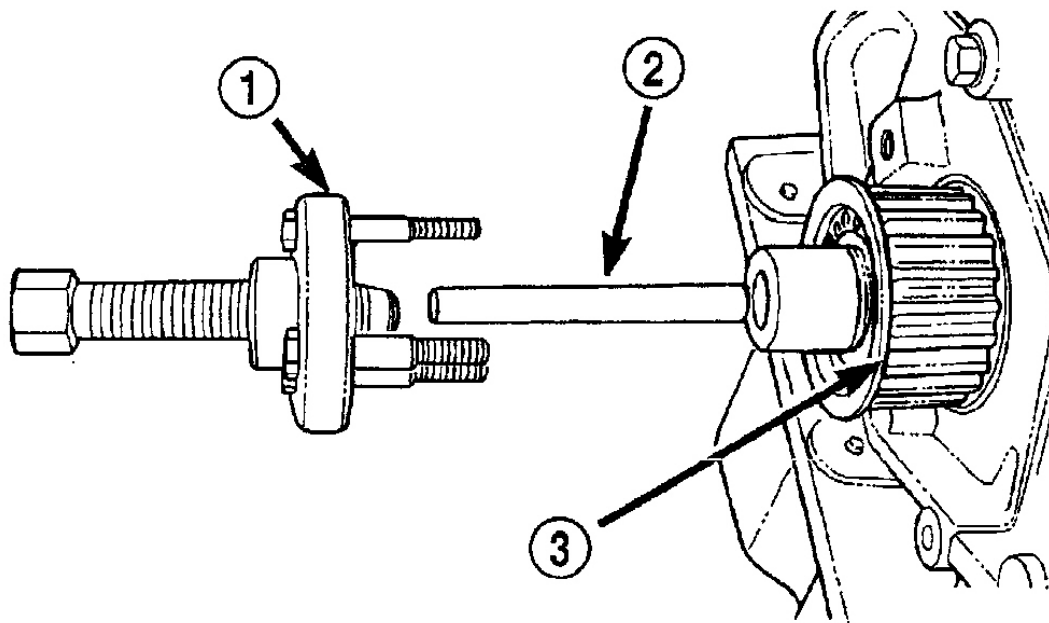
should not exceed 5.6 N.m (50 in. lbs.).

17. Check crankshaft end play. See **STANDARD PROCEDURE - MEASURING CRANKSHAFT END PLAY**.
18. Install connecting rod bearings and caps. **Do Not Reuse Connecting Rod Bolts.** Torque connecting rod bolts to 27 N.m (20 ft. lbs.) plus 1/4 turn.
19. Install balance shafts and housing assembly. See **BALANCE SHAFTS AND CARRIER ASSEMBLY**.
20. Install the oil pump. See **OIL PUMP**.
21. Install oil pump pick-up tube. Torque fastener to 23 N.m (200 in. lbs.).
22. Install the oil pan. See **OIL PAN**.
23. Install crankshaft position sensor.
24. Install cylinder head if it was removed. See **CYLINDER HEAD**.
25. Install the timing belt rear cover. See **TIMING BELT COVER(S)**.
26. Install front crankshaft oil seal and crankshaft sprocket. See **CRANKSHAFT OIL SEAL - FRONT**.
27. Install the timing belt. See **TIMING BELT AND SPROCKETS**.
28. Install the timing belt front covers. See **TIMING BELT COVER(S)**.
29. Install engine mount support bracket.
30. Install crankshaft vibration damper. See **VIBRATION DAMPER**.
31. Install **NEW** oil filter.
32. Remove engine from repair stand and position on Special Tools 6135 and 6710 Engine Dolly and Cradle. Install safety straps around the engine to cradle and tighten and lock them into position.
33. Install crankshaft rear oil seal. See **CRANKSHAFT OIL SEAL - REAR**.
34. Install drive plate/flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten to 95 N.m (70 ft. lbs.).
35. Attach transaxle to engine. Tighten attaching bolts to 101 N.m (75 ft. lbs.).
36. Install the engine assembly. See **ENGINE**.

## **CRANKSHAFT OIL SEAL - FRONT**

### **REMOVAL**

1. Remove the crankshaft vibration damper. See **VIBRATION DAMPER**.
2. Remove timing belt. See **TIMING BELT AND SPROCKETS**.
3. Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2.

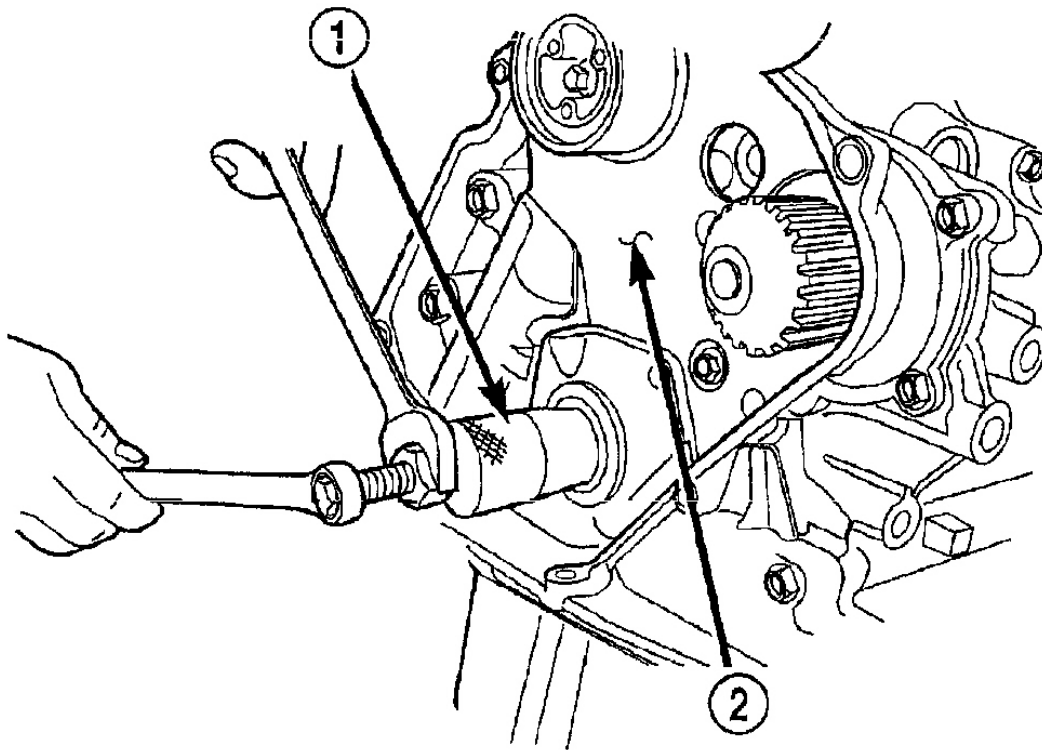


- 1 - SPECIAL TOOL 6793
- 2 - SPECIAL TOOL C-4685-C2
- 3 - CRANKSHAFT SPROCKET

G01857794

**Fig. 123: Removing Crankshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

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



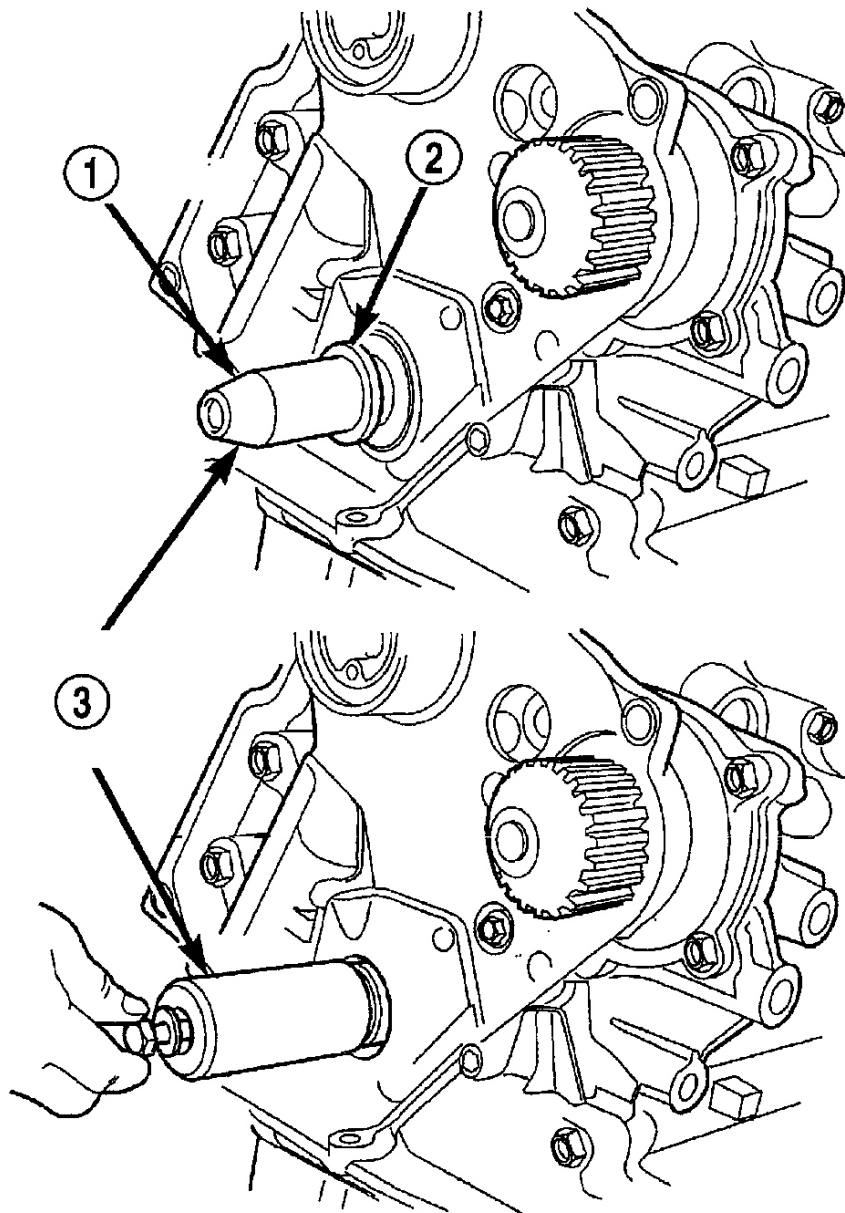
- 1 - SPECIAL TOOL 6771  
2 - REAR TIMING BELT COVER  
G01857795

**Fig. 124: Removing Front Crankshaft Oil Seal**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Using Tool 6771 to remove front crankshaft oil seal. Be careful not to damage the seal surface of cover.

## INSTALLATION

1. Install new seal by using Special Tool 6780.

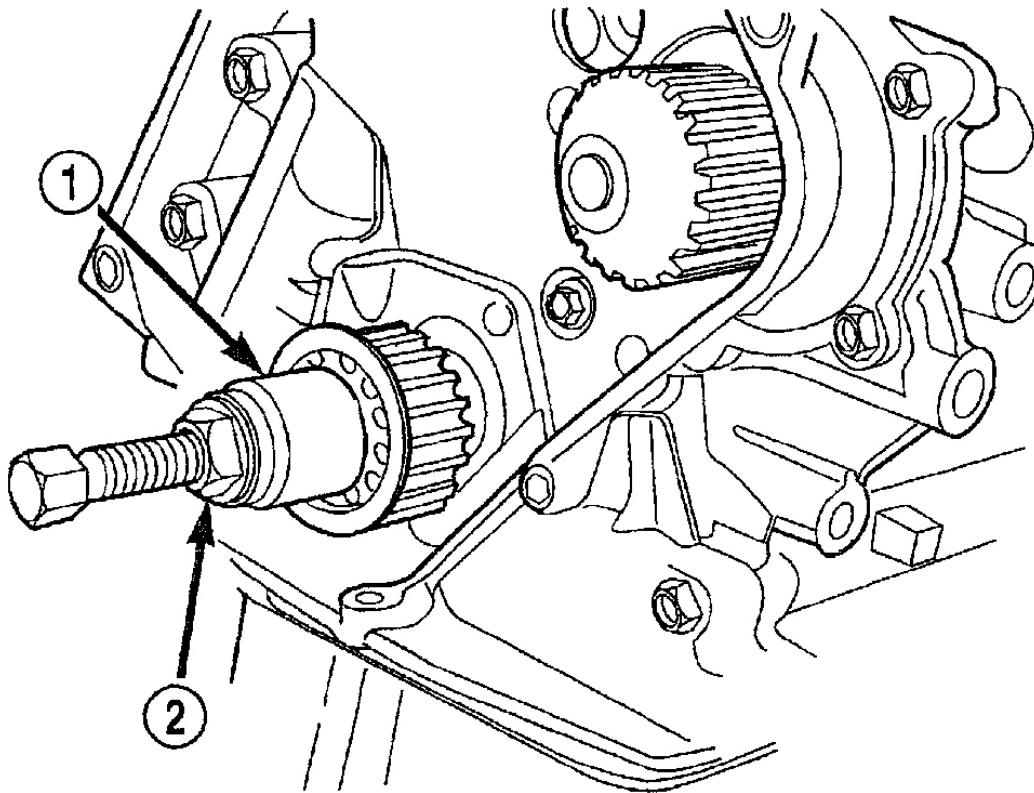


- 1 - PROTECTOR
- 2 - SEAL
- 3 - SPECIAL TOOL 6780

G01857796

**Fig. 125: Installing Crankshaft Front Oil Seal**  
Courtesy of DAIMLERCHRYSLER CORP.

- 2. Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.
- 3. Install crankshaft sprocket using Special Tool 1972.



- 1 - SPECIAL TOOL 6792  
2 - TIGHTEN NUT TO INSTALL  
G01857797

**Fig. 126: Installing Crankshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Install timing belt. See **TIMING BELT AND SPROCKETS**.
5. Install crankshaft vibration damper. See **VIBRATION DAMPER**.

## CRANKSHAFT OIL SEAL - REAR

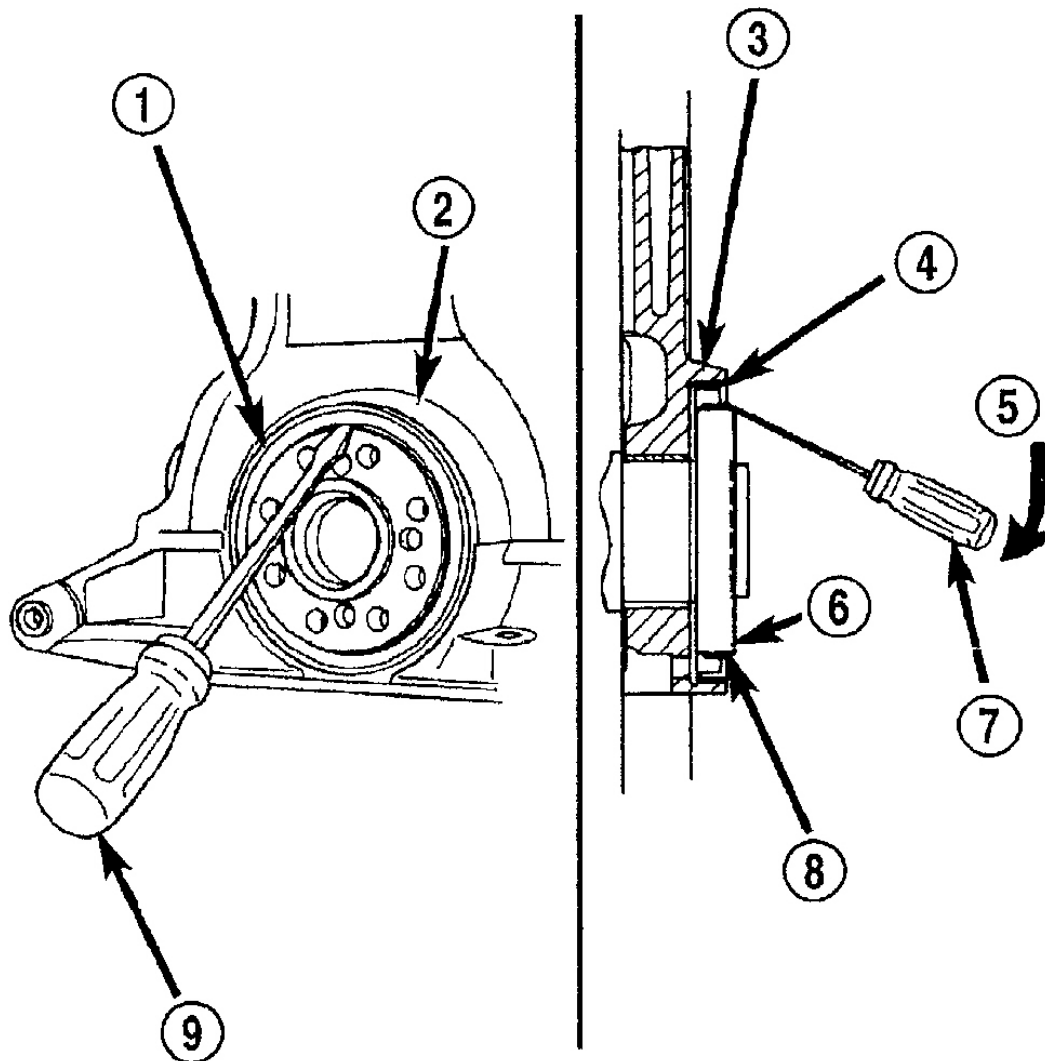
### REMOVAL

1. Remove transaxle. See appropriate TRANSMISSIONS article.
2. Remove flex plate.

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

**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

G01857798

**Fig. 127: Removing Rear Crankshaft Oil Seal**  
**Courtesy of DAIMLERCHRYSLER CORP.**

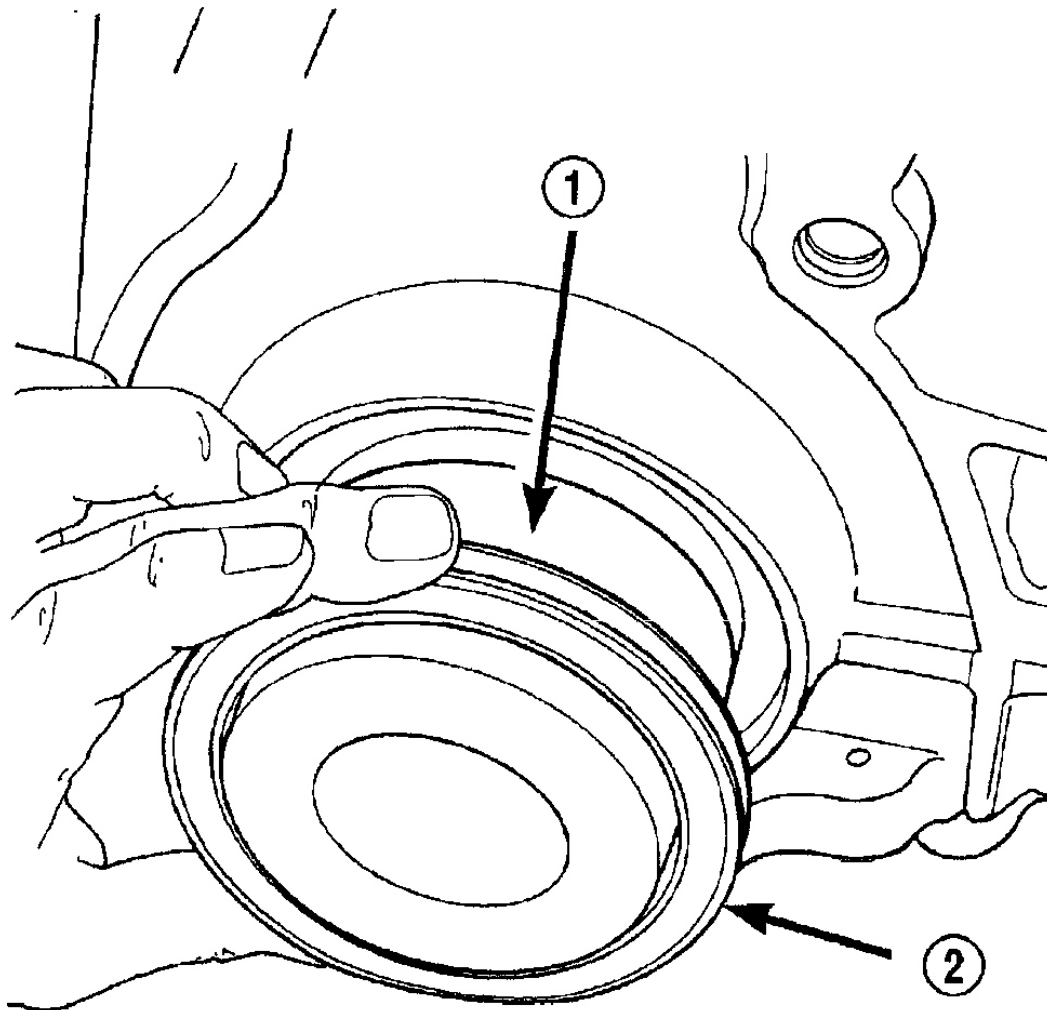
3. Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver through the dust lip against metal case of the seal. Pry out seal.

## **INSTALLATION**

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

**NOTE:** When installing seal, no lube on seal is needed.

1. Place Special Tool 6926-1 Seal Guide on crankshaft.



1 - SPECIAL TOOL 6926-1 PILOT

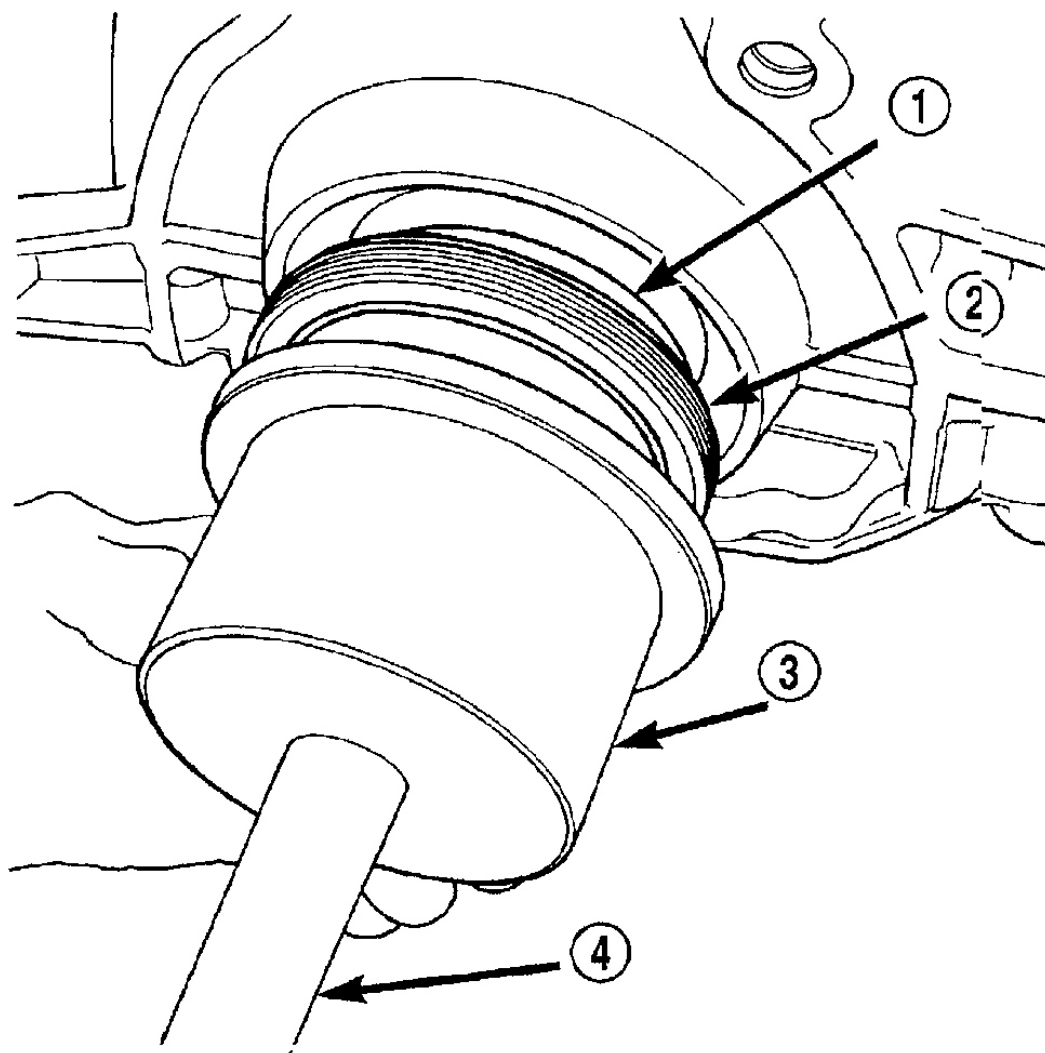
2 - SEAL

G01857799

**Fig. 128: Identifying Rear Crankshaft Seal & Special Tool 6926-1**  
**Courtesy of DAIMLERCHRYSLER CORP.**

2. Position seal over guide tool. Guide tool should remain on crankshaft during installation of seal. Ensure that the lip of the seal is facing towards the crankcase during installation.

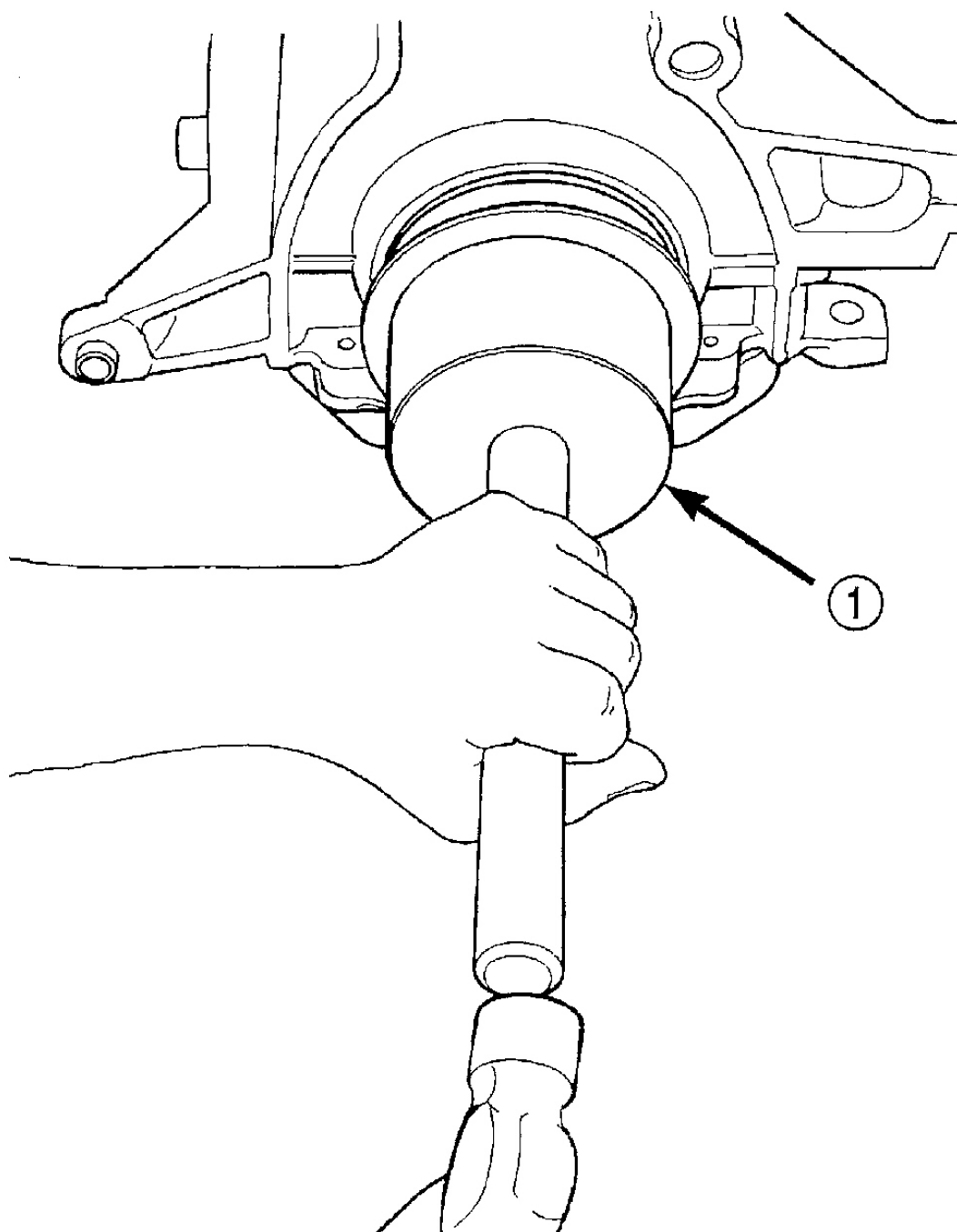
**CAUTION: If the seal is driven into the block past flush, this may cause an oil leak.**



- 1 - SPECIAL TOOL 6926-1 PILOT
- 2 - SEAL
- 3 - SPECIAL TOOL 6926-2 INSTALLER
- 4 - SPECIAL TOOL C-4171

G01857800

**Fig. 129: Identifying Crankshaft Seal & Special Tools 6926-2 & C-4171**  
Courtesy of DAIMLERCHRYSLER CORP.



1 - SPECIAL TOOL 6926-2 INSTALLER  
G01857801

**Fig. 130: Installing Rear Crankshaft Seal**  
**Courtesy of DAIMLERCHRYSLER CORP.**

3. Drive the seal into the block using Special Tool 6926-2 and handle C-4171 until the tool bottoms out against the block.
4. Install flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten bolts to 95 N.m (70 ft. lbs.).
5. Install transaxle. See appropriate TRANSMISSIONS article.

## **PISTON & CONNECTING ROD**

### **DESCRIPTION**

#### **Non-Turbo**

The pistons are made of a cast aluminum alloy. The pistons have pressed-in pins attached to forged powdered metal connecting rods. The pistons pin is offset 1 mm (0.0394 in.) towards the thrust side of the piston. The connecting rods are a cracked cap design and are not repairable. Hex head cap screws are used to provide alignment and durability in the assembly. The pistons and connecting rods are serviced as an assembly.

#### **Turbo**

The pistons are made of a cast aluminum alloy. The pistons have full floating pins attached to forged steel connecting rods. The pistons pin is offset 1 mm (0.0394 in.) towards the thrust side of the piston. The connecting rods are a cracked cap design and are not repairable. Hex head cap screws are used to provide alignment and durability in the assembly. The connecting rod has an oil squirt hole to provide extra cylinder wall lubrication. The pistons and connecting rods are serviced as an assembly.

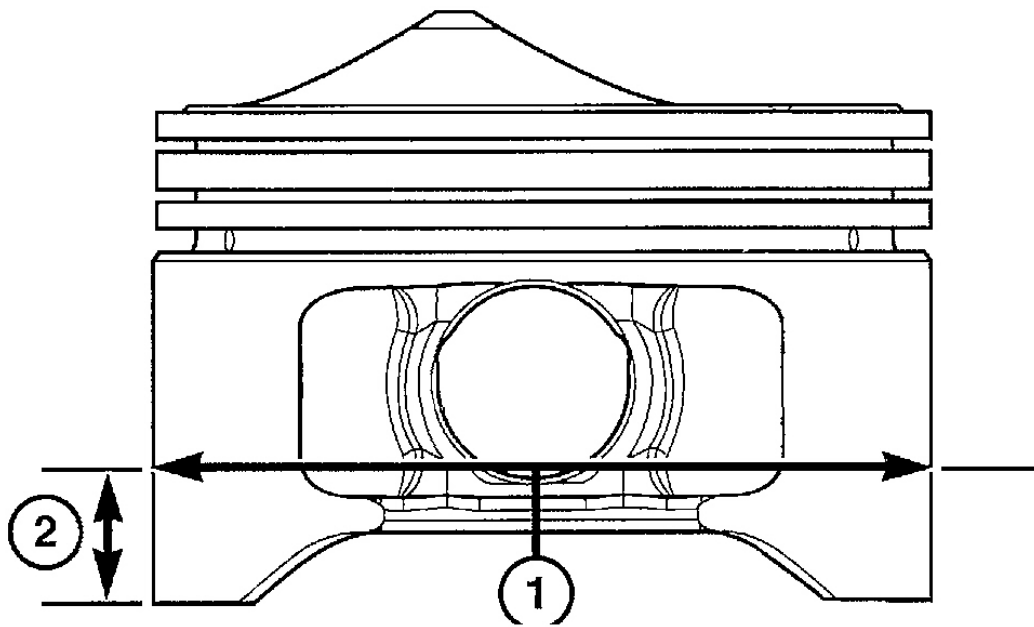
### **STANDARD PROCEDURE - PISTON TO CYLINDER BORE FITTING**

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

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin.

#### **Non-Turbo:**

- Measurement should be taken approximately 14 mm (0.551 in.) from the bottom of the skirt as shown.



1 - PISTON DIAMETER

2 - 14 mm (0.551 in.)

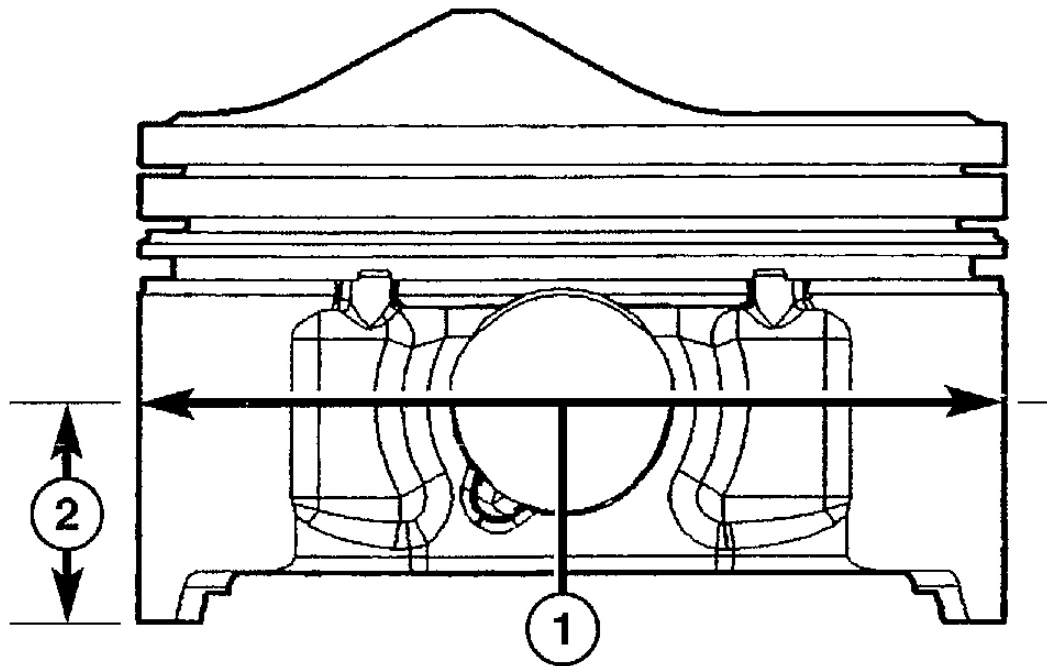
G01857802

**Fig. 131: Measuring Piston**

Courtesy of DAIMLERCHRYSLER CORP.

**Turbo:**

- Measurement should be taken approximately 22 mm (0.866 in.) from the bottom of the skirt as shown.



1 - PISTON DIAMETER

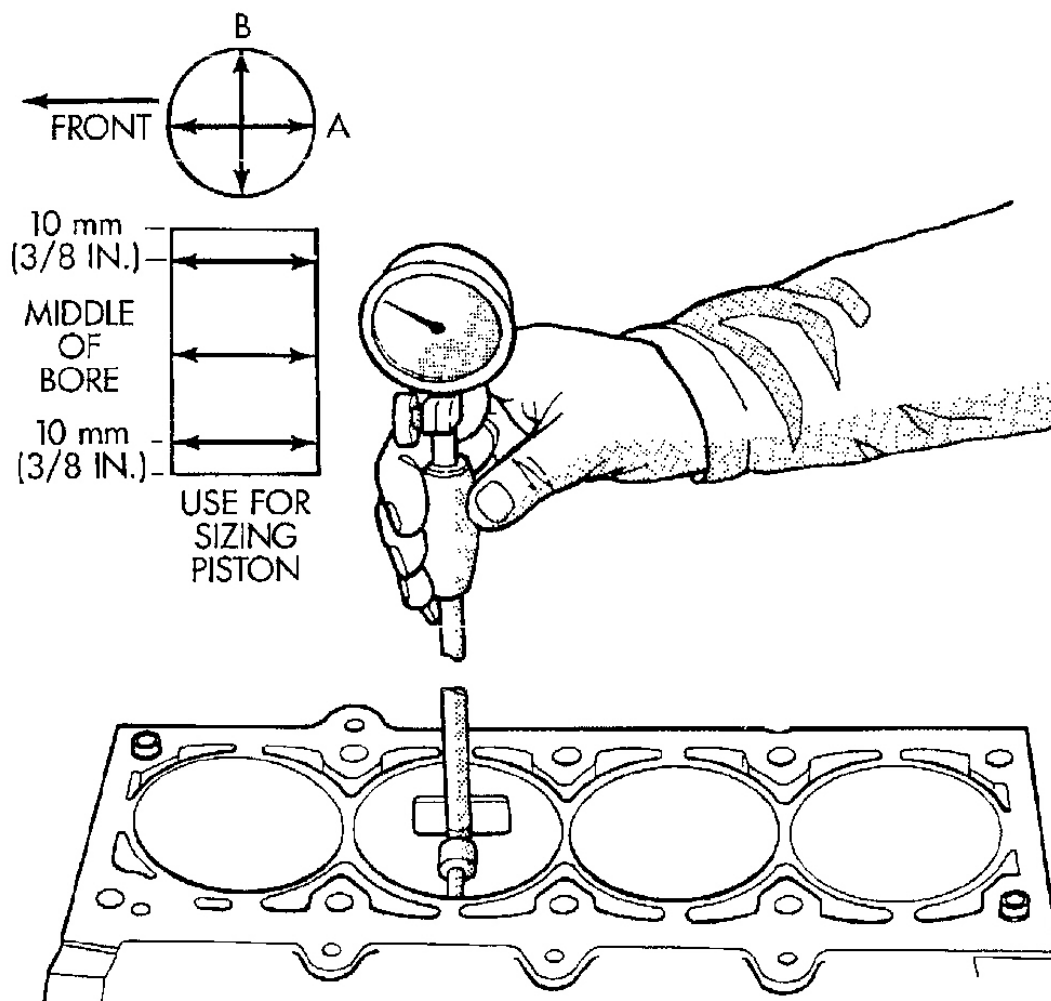
2 - 22 mm ( 0.866 in.)

G01857803

**Fig. 132: Measuring Piston - Turbo**  
**Courtesy of DAIMLERCHRYSLER CORP.**

Cylinder bores should be measured halfway down the cylinder bore and transverse (measurement location B) to the engine crankshaft center line shown. Refer to **SPECIFICATIONS** for Engine Specifications. Correct piston to bore clearance must be established in order to assure quiet and economical operation.



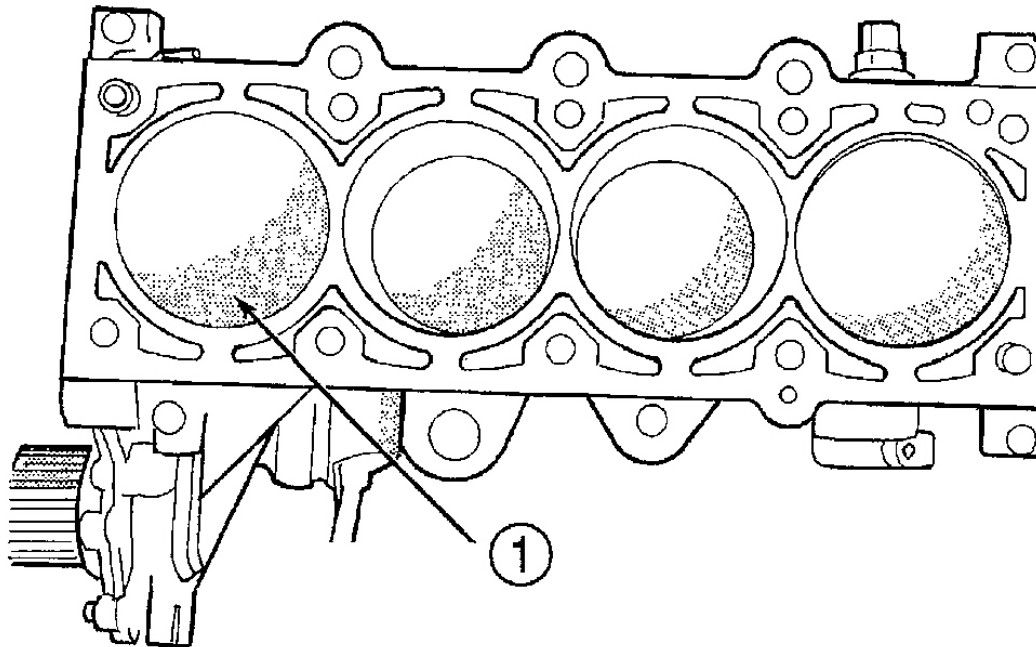


G01857804

**Fig. 133: Checking Cylinder Bore**  
Courtesy of DAIMLERCHRYSLER CORP.

## REMOVAL

1. Remove cylinder head. See **CYLINDER HEAD**.
2. Remove oil pan. See **OIL PAN**.
3. Remove Balance Shaft Carrier Assembly. See **BALANCE SHAFTS AND CARRIER ASSEMBLY**.
4. 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.**
5. Pistons have a directional stamping in the front half of the piston facing towards the **front** of engine.



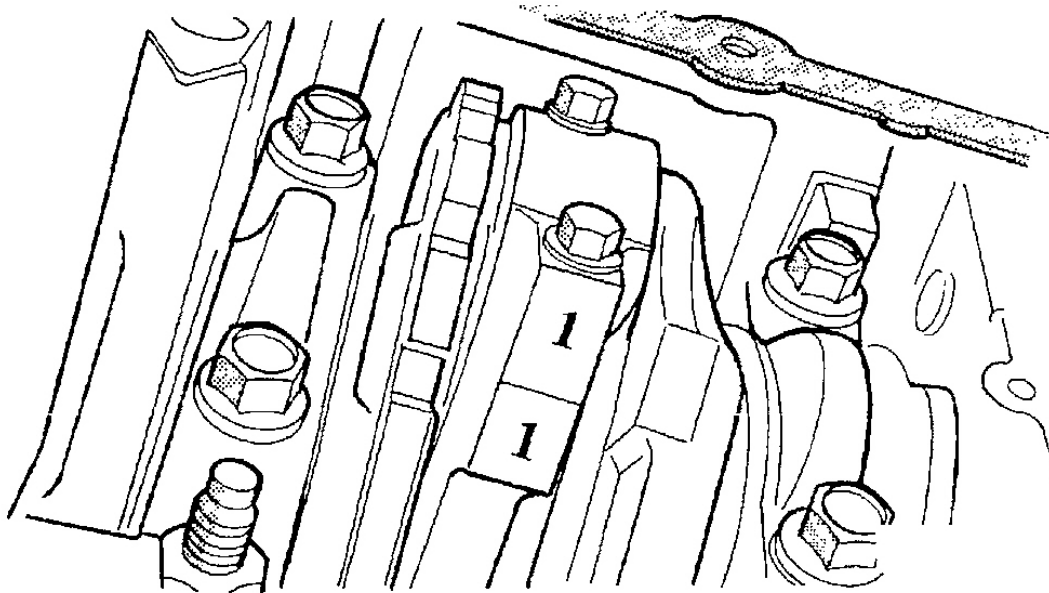
1 - DIRECTIONAL ARROW WILL BE IMPRINTED IN THIS AREA

G01857805

**Fig. 134: Identifying Piston Markings**  
Courtesy of DAIMLERCHRYSLER CORP.

6. Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

**CAUTION: DO NOT use a number stamp or a punch to mark connecting rods.**  
**Damage to connecting rod could occur.**



G01857806

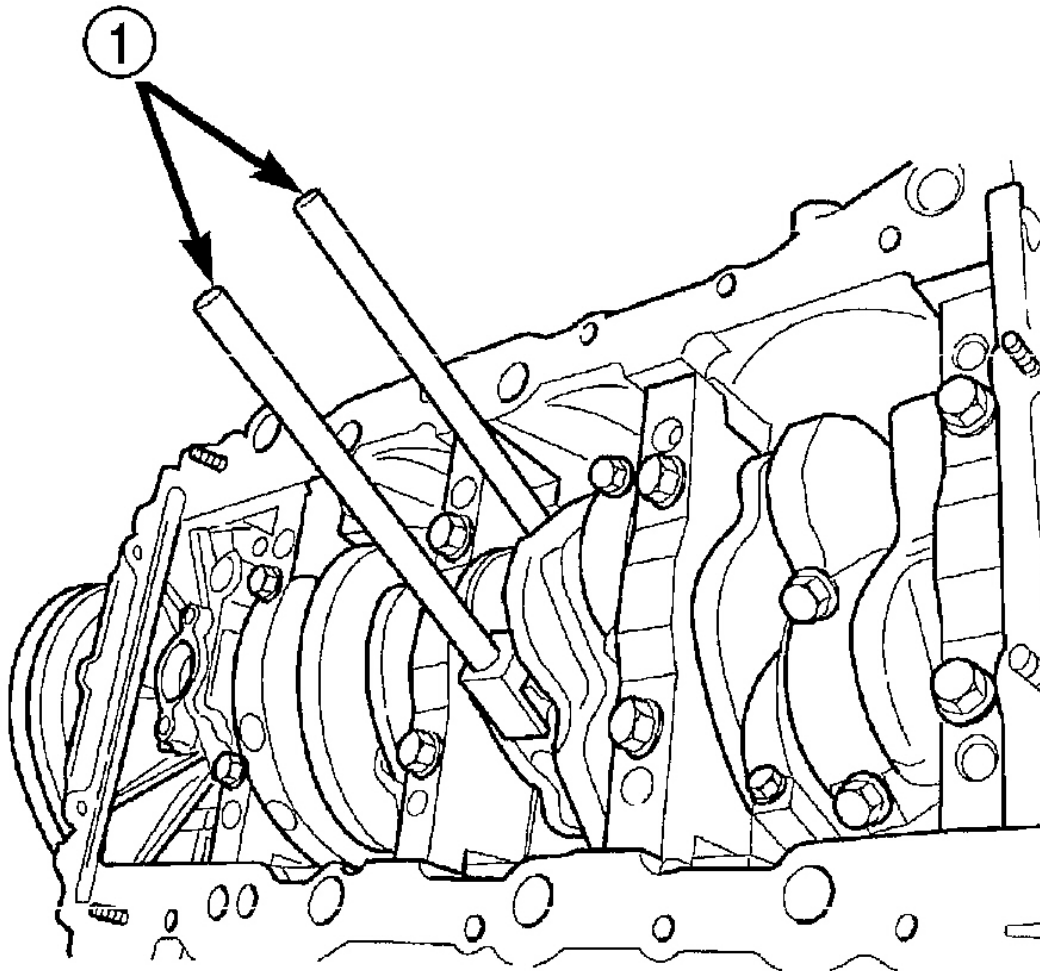
**Fig. 135: Identifying Connecting Rod to Cylinder - Typical**  
Courtesy of DAIMLERCHRYSLER CORP.

7. Using a permanent ink or paint marker, identify cylinder number on each connecting rod cap.

**NOTE:** Do not reuse connecting rod bolts.

8. Remove connecting rod bolts and cap. Care should be taken not to damage the fracture rod and cap surfaces.

**CAUTION:** Care must be taken not to damage the fractured rod and cap joint surfaces, as engine damage may occur.



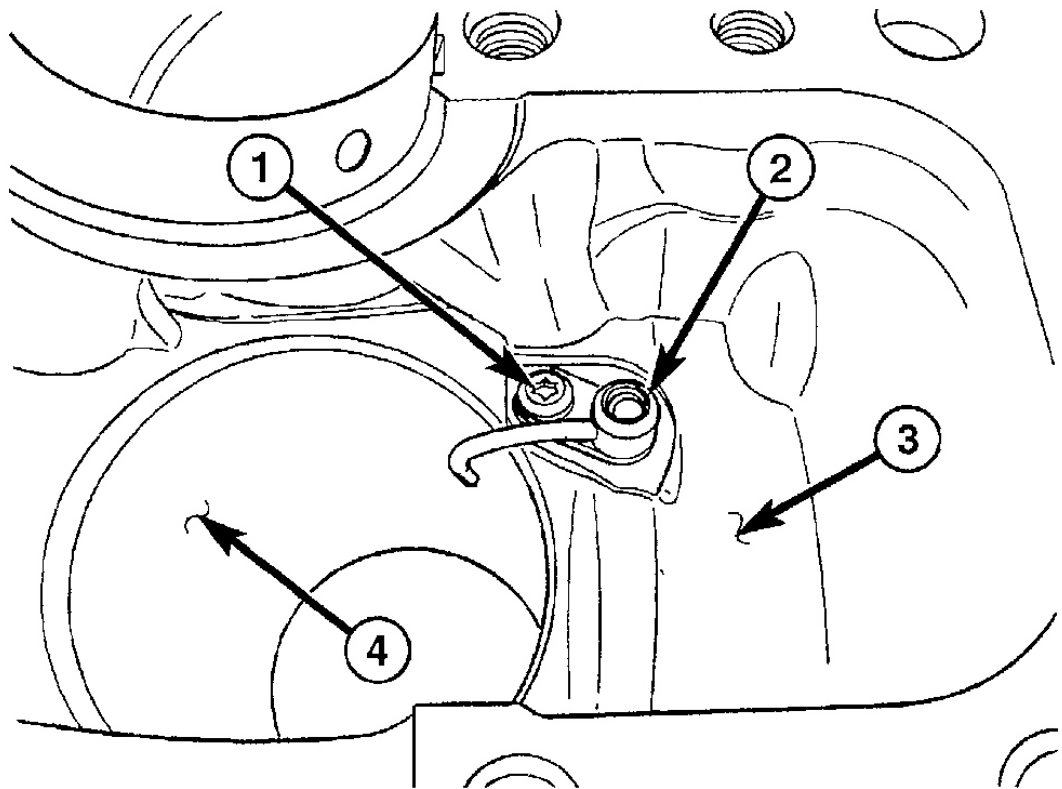
# 1 - SPECIAL TOOL 8189 CONNECTING ROD GUIDES

G01857807

**Fig. 136: Identifying Connecting Rod Guides - Typical**  
Courtesy of DAIMLERCHRYSLER CORP.

9. To protect crankshaft journal and fractured rod surfaces, install Special Tool 8189, connecting rod guides onto connecting rod. Carefully push each piston and rod assembly out of cylinder bore.

**NOTE:** On Turbocharger equipped engines, be careful not to damage the oil jet assembly when removing piston/connecting rod.



1 - FASTENER - 12 N·m (105 in. lbs.)

2 - OIL JET

3 - ENGINE BLOCK

4 - CYLINDER WALL

G01857808

**Fig. 137: Identifying Oil Jet Fastener - Turbo**  
**Courtesy of DAIMLERCHRYSLER CORP.**

10. Remove Special Tool 8189, connecting rod guides and re-install bearing cap on the mating rod.

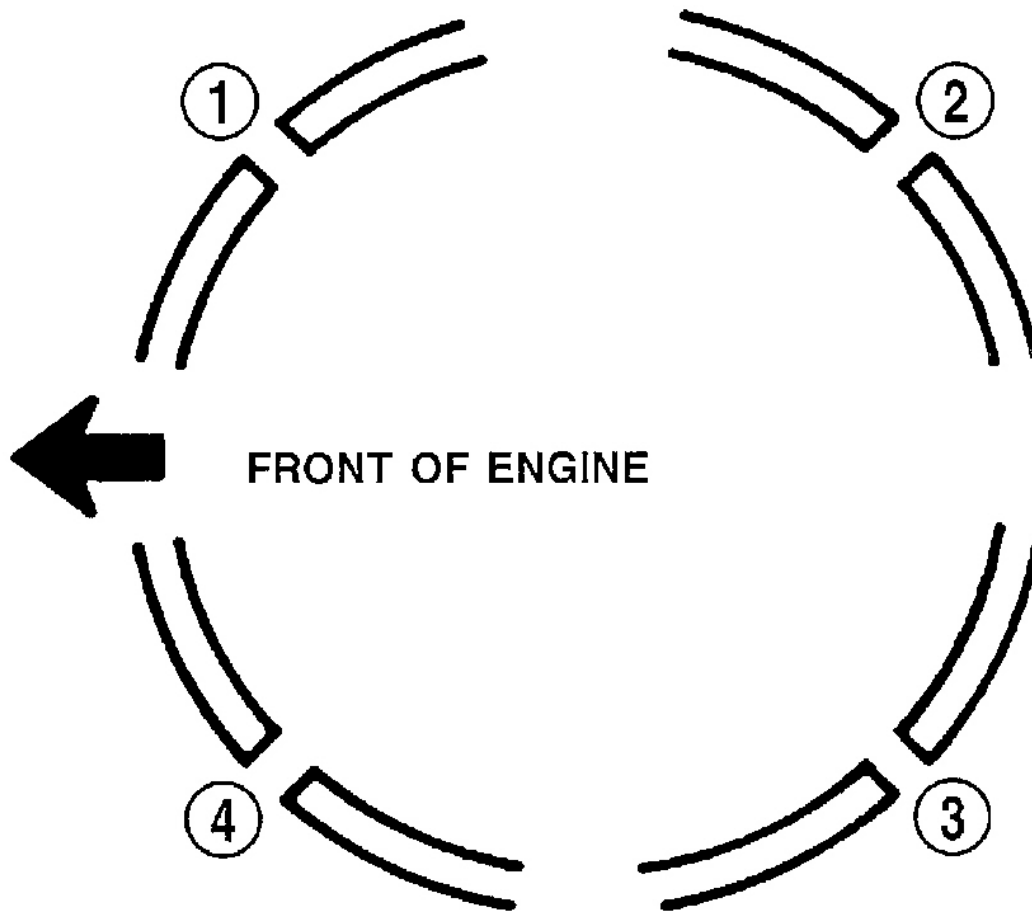
**NOTE:**      **Piston and rods are serviced as an assembly.**

11. Repeat procedure for each piston and connecting rod assembly.
12. Remove piston rings. See **PISTON RINGS**.

## INSTALLATION

1. Install piston rings on piston). See **PISTON RINGS**.

2. Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.



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

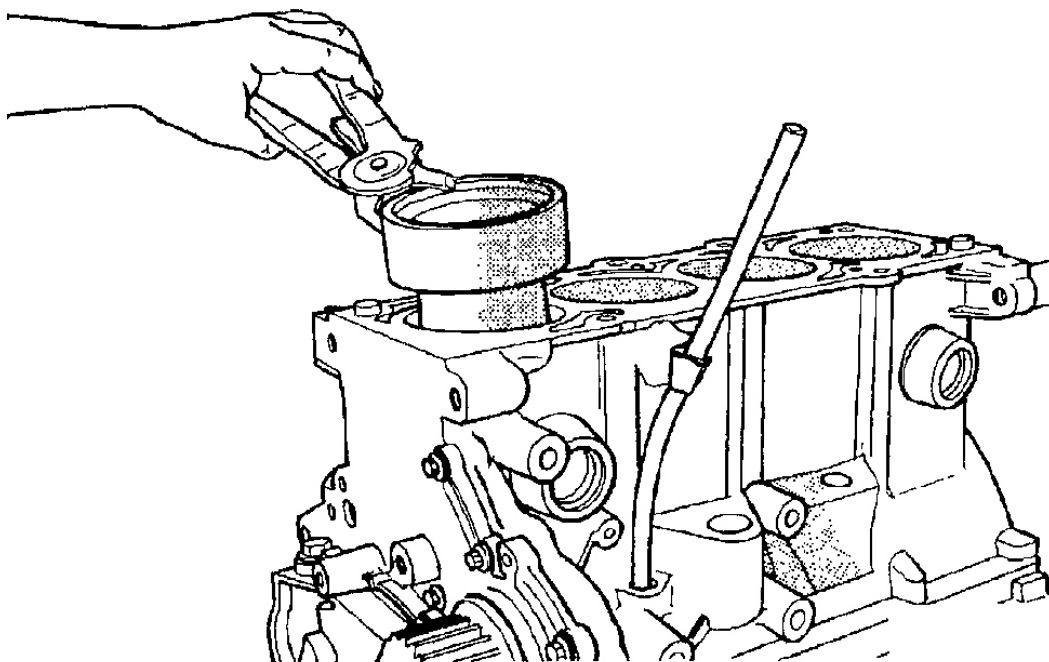
G01857809

**Fig. 138: Identifying Piston Ring End Gap Position**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps

located as shown. As viewed from top.

4. Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston. **Be sure position of rings does not change during this operation.**



G01857810

**Fig. 139: Installing Piston**

Courtesy of DAIMLERCHRYSLER CORP.

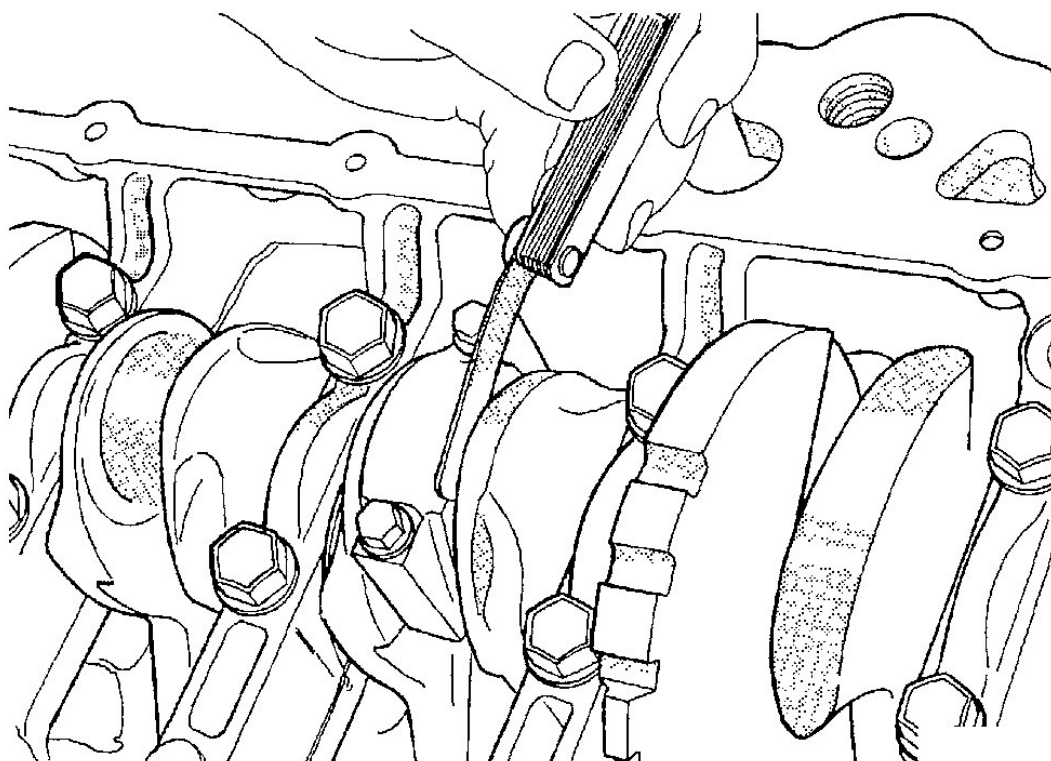
5. The directional stamp on the piston should face toward the front of the engine. See **Fig. 134**.
6. Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Lubricate connecting rod journal with clean engine oil.
7. Install connecting rod upper bearing half into connecting rod. Install Special Tool 8189, connecting rod guides onto connecting rod. See **Fig. 136**.
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. Remove Special Tool 8189, connecting rod guides.

**NOTE:** The connecting rod cap bolts should not be reused.

10. Before installing the **NEW** bolts, the threads should be coated with clean engine oil.
11. Install connecting rod lower bearing half into connecting rod cap. Install connecting rod cap.
12. Install each bolt finger tight then alternately torque each bolt to assemble the cap properly.

**CAUTION:** Do not use a torque wrench for the second step.

13. Tighten the connecting rod bolts using the 2 step torque-turn method. Tighten according to the following values:
  1. Tighten the bolts to 27 N.m (20 ft. lbs.).
  2. Tighten the connecting rod bolts an additional **1/4 TURN**.
14. Using a feeler gauge, check connecting rod side clearance. See **SPECIFICATIONS** for connecting rod side clearance.



G01857811

**Fig. 140: Checking Connecting Rod Side Clearance - Typical**  
Courtesy of DAIMLERCHRYSLER CORP.

15. Install Balance Shaft Carrier Assembly. See **BALANCE SHAFTS AND CARRIER ASSEMBLY**.
16. Install oil pan. See **OIL PAN**.
17. Install cylinder head. See **CYLINDER HEAD**.

## CONNECTING ROD BEARINGS



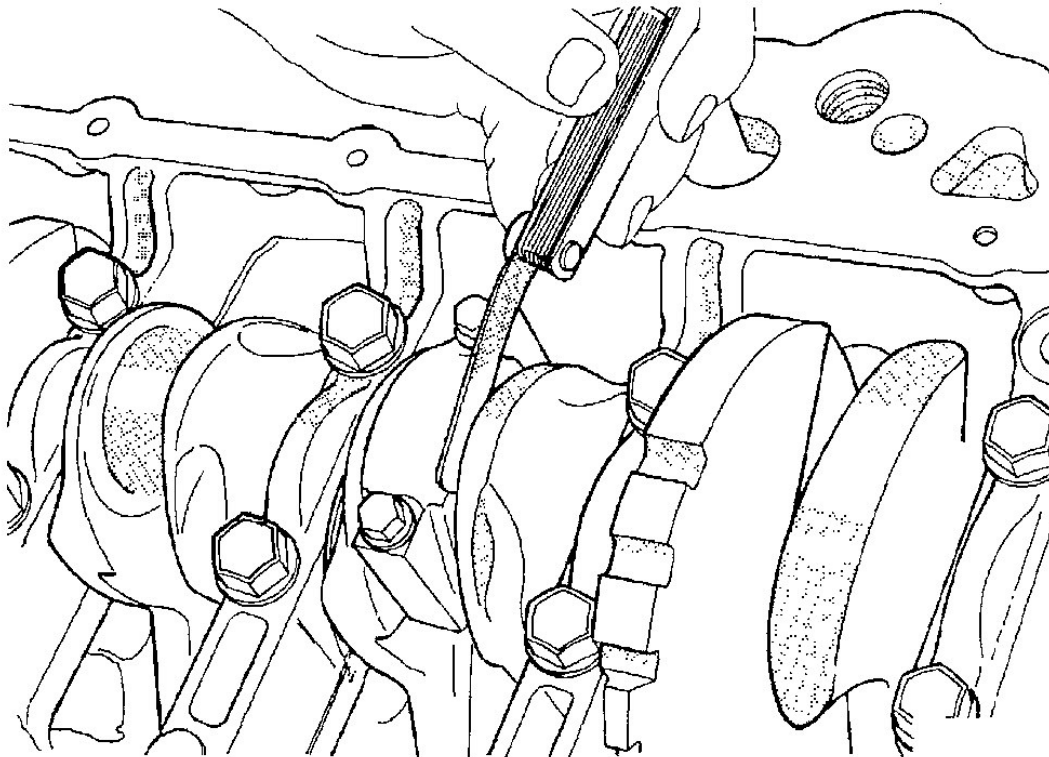
**STANDARD PROCEDURE****CONNECTING ROD - FITTING**

**NOTE:**        **The rod bearing bolts should not be reused.**

1. For measuring connecting rod bearing clearance procedure and use of Plastigage. See **STANDARD PROCEDURE**. For bearing clearance refer to **SPECIFICATIONS**.
2. Before installing the **NEW** bolts the threads should be oiled with clean engine oil.
3. Install each bolt finger tight then alternately torque each bolt to assemble the cap properly.

**CAUTION: Do not use a torque wrench for the second step.**

4. Tighten the connecting rod bolts using the 2 step torque-turn method. Tighten according to the following values:
  1. Tighten the bolts to 27 N.m (20 ft. lbs.).
  2. Tighten the connecting rod bolts an additional **1/4 TURN**.
5. Using a feeler gauge, check connecting rod side clearance. Refer to clearance specifications in **SPECIFICATIONS**.



G01857812

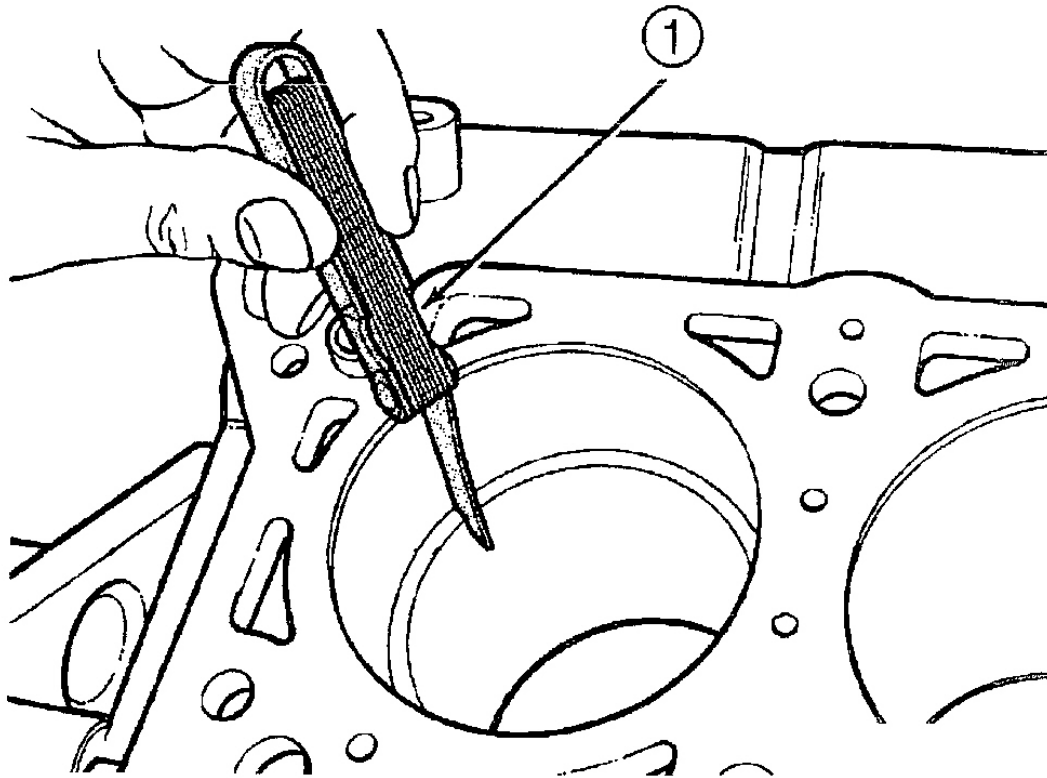
**Fig. 141: Checking Connecting Rod Side Clearance - Typical**  
Courtesy of DAIMLERCHRYSLER CORP.

## 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 inch) from bottom of cylinder bore. Check gap with feeler gauge. See **SPECIFICATIONS**.

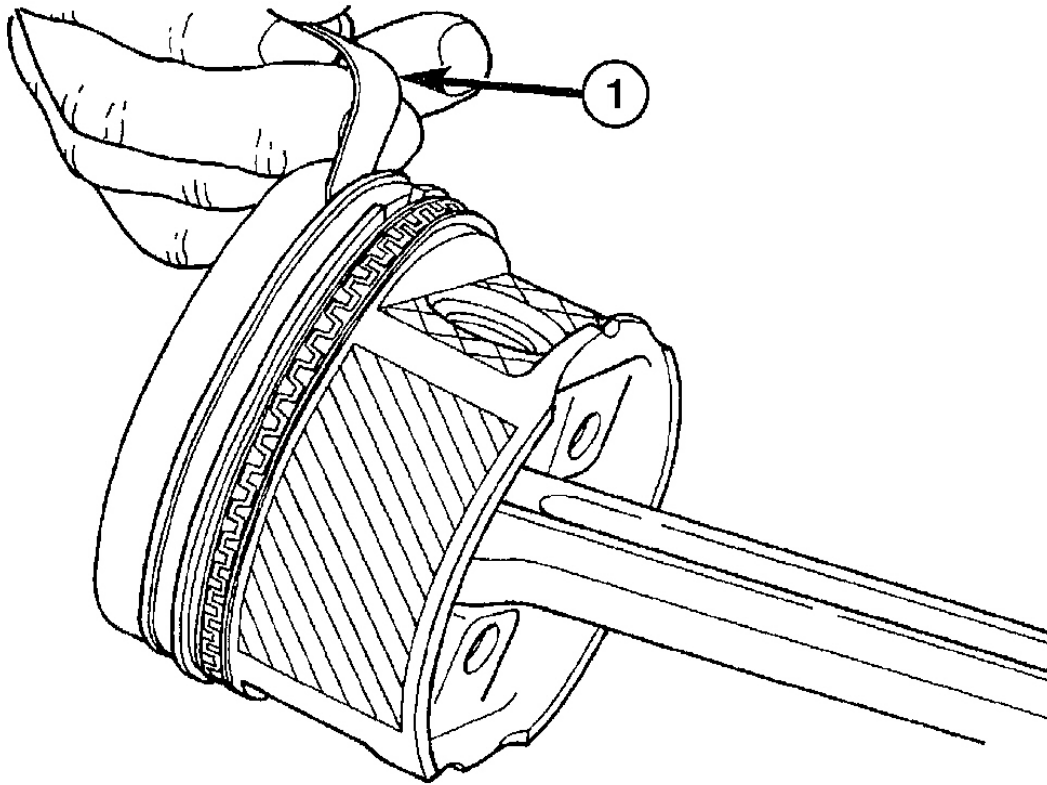


1 - FEELER GAUGE

G01857813

**Fig. 142: Checking Piston Ring Gap**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Check piston ring to groove side clearance. See SPECIFICATIONS.



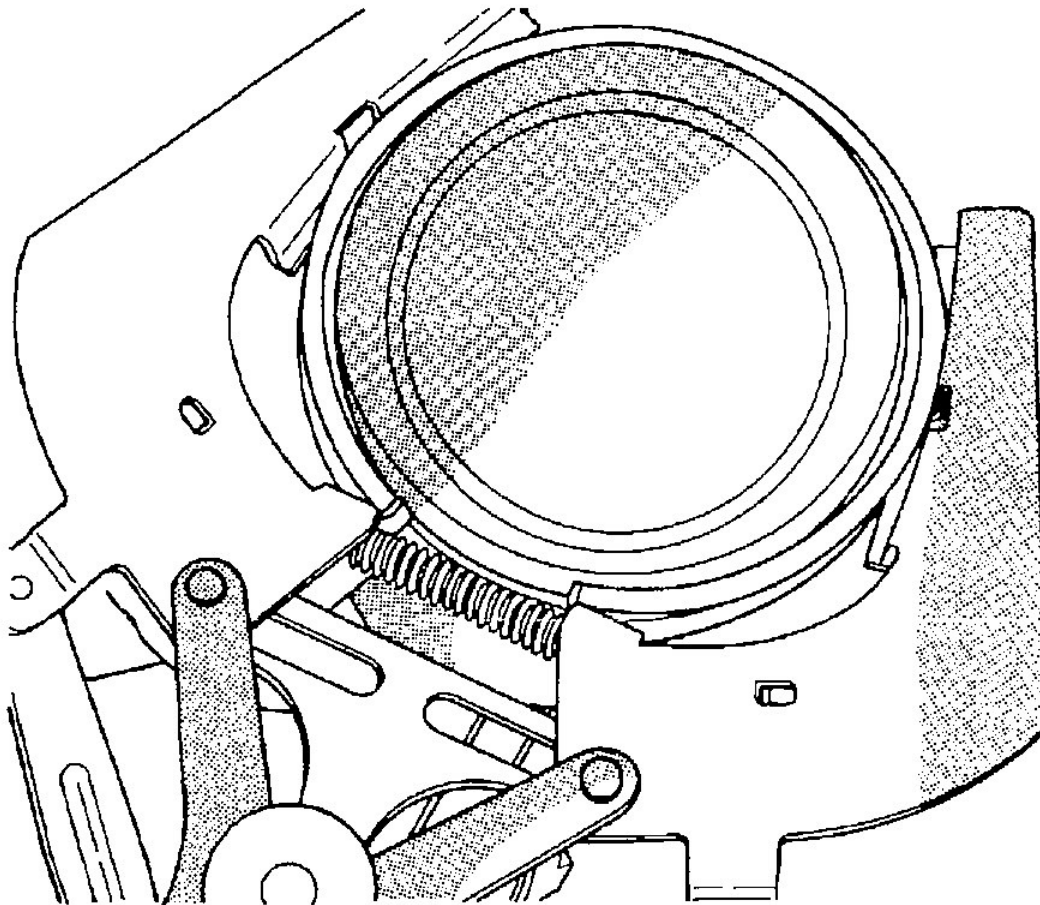
1 - FEELER GAUGE

G01857814

**Fig. 143: Checking Piston Ring Side Clearance**  
Courtesy of DAIMLERCHRYSLER CORP.

## REMOVAL

1. Using a suitable ring expander, remove upper and intermediate piston rings.



G01857815

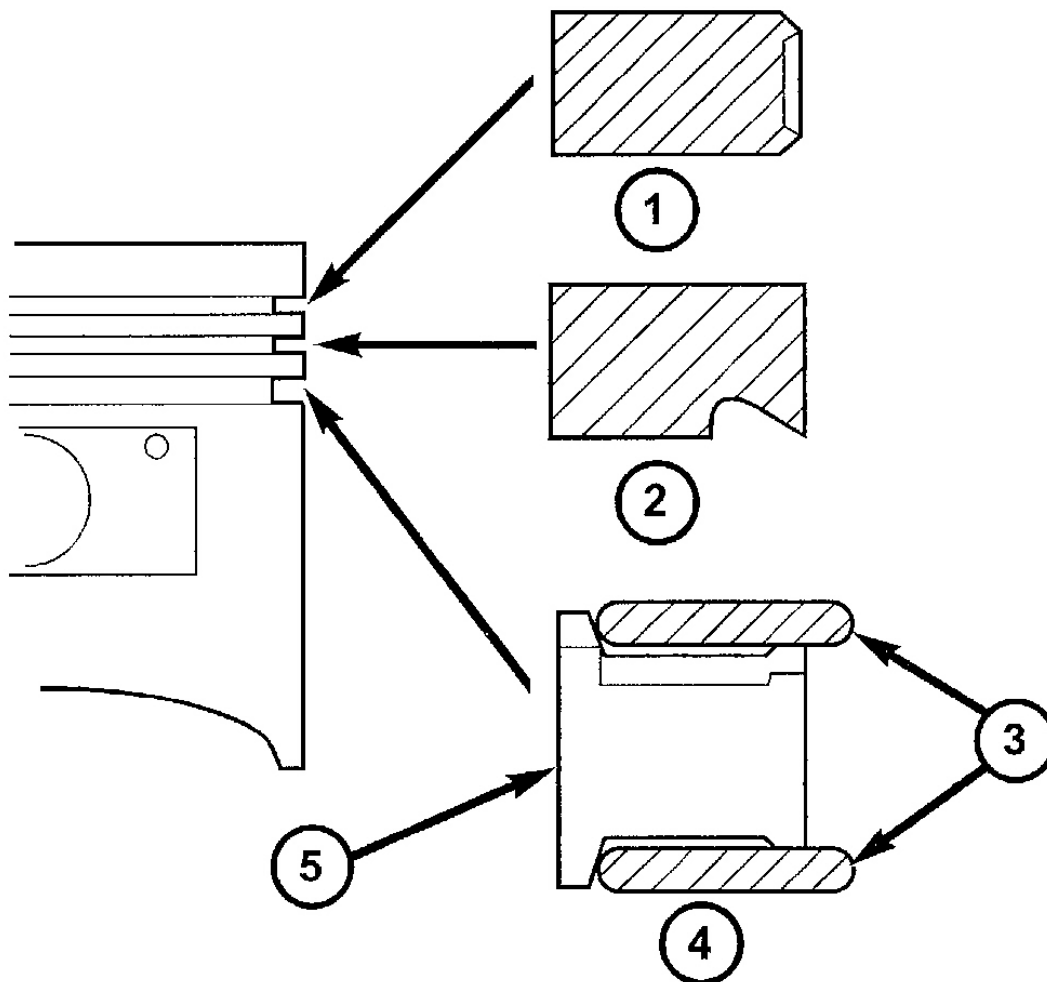
**Fig. 144: Removing & Installing Piston Rings**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.
3. Clean ring grooves of any carbon deposits.

## INSTALLATION

**NOTE:** The identification mark on face of upper and intermediate piston rings must point toward top of piston.

Install rings with manufacturers identification mark facing up, to the top of the piston.



- 1 - NO. 1 PISTON RING
- 2 - NO. 2 PISTON RING
- 3 - SIDE RAIL
- 4 - OIL RING
- 5 - SPACER EXPANDER

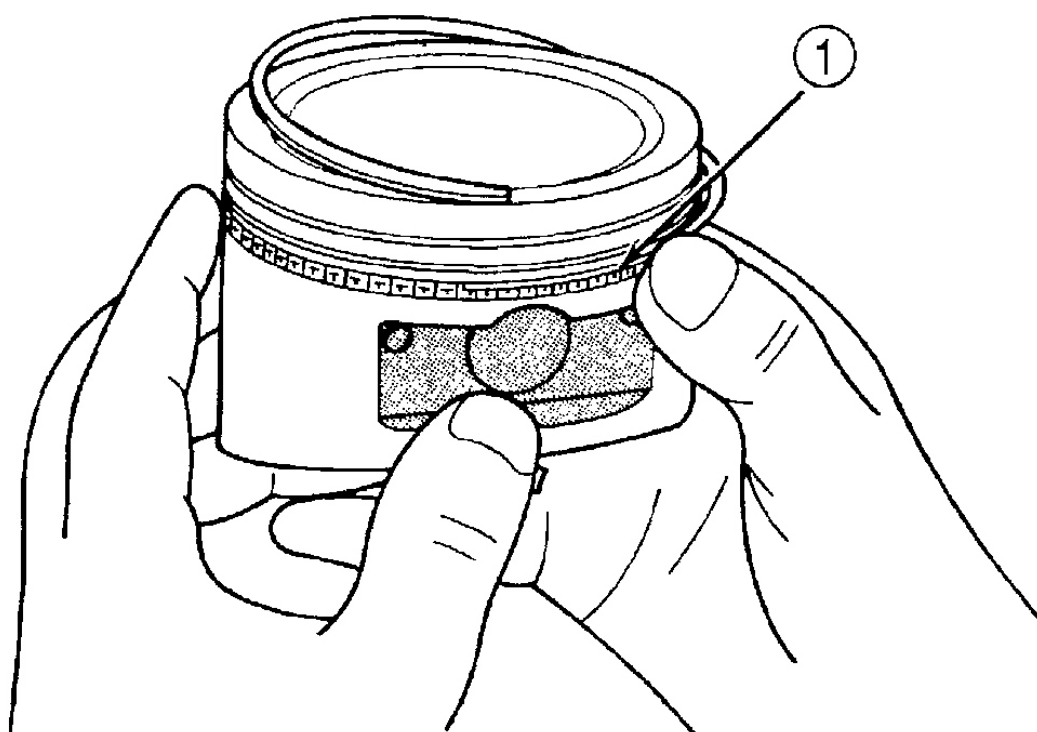
G01857816

**Fig. 145: Installing Piston Ring**  
 Courtesy of DAIMLERCHRYSLER CORP.

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

1. Oil ring expander.

2. Upper oil ring side rail.
3. Lower oil ring side rail.
4. No. 2 Intermediate piston ring.
5. No. 1 Upper piston ring.
  1. Install oil ring expander. See **Fig. 145**.
  2. Install upper side rail first and then the lower side rail. Install the side rails by placing one end between the piston ring groove and the oil ring 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.**

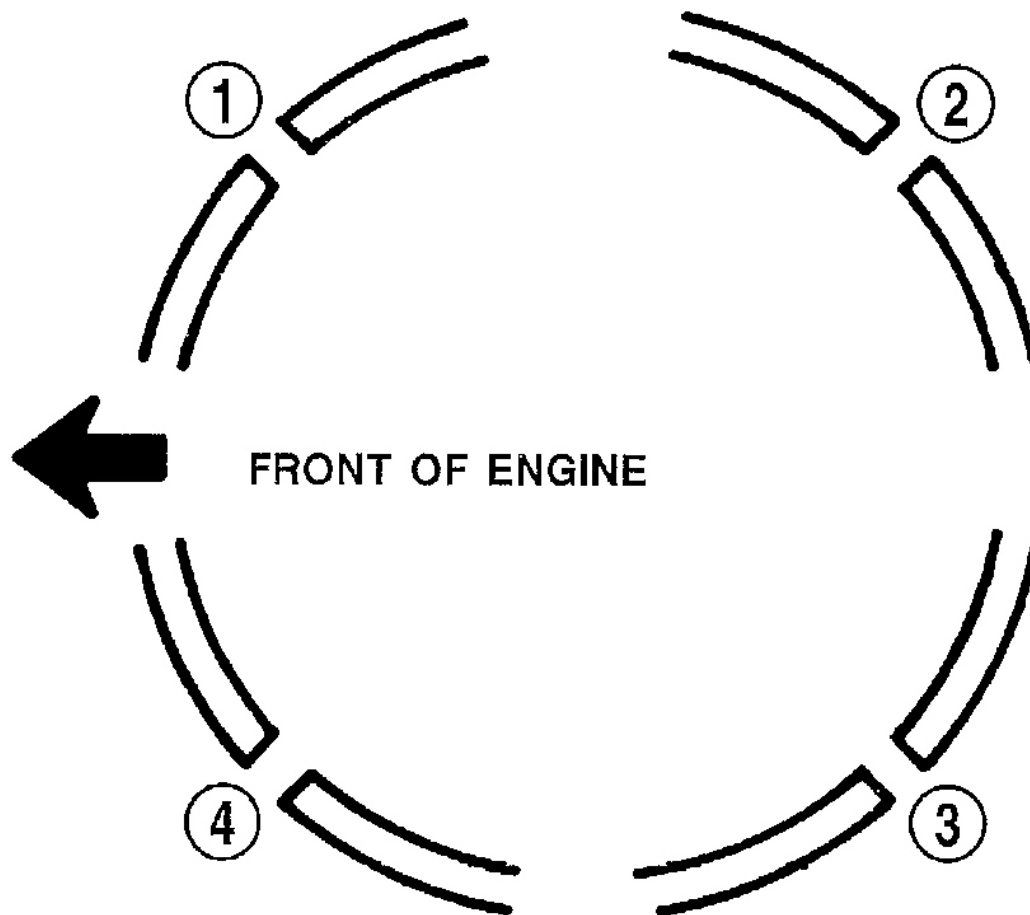


1 - SIDE RAIL END

G01857817

**Fig. 146: Installing Side Rail**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install No. 2 piston ring and then No. 1 piston ring. See **Fig. 145**.
4. Position piston ring end gaps as shown.



1 - GAP OF LOWER SIDE RAIL

2 - NO. 1 RING GAP

3 - GAP OF UPPER SIDE RAIL

4 - NO. 2 RING GAP AND SPACER EXPANDER GAP

G01857818

**Fig. 147: Positioning Piston Ring End Gap**  
Courtesy of DAIMLERCHRYSLER CORP.

5. 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.

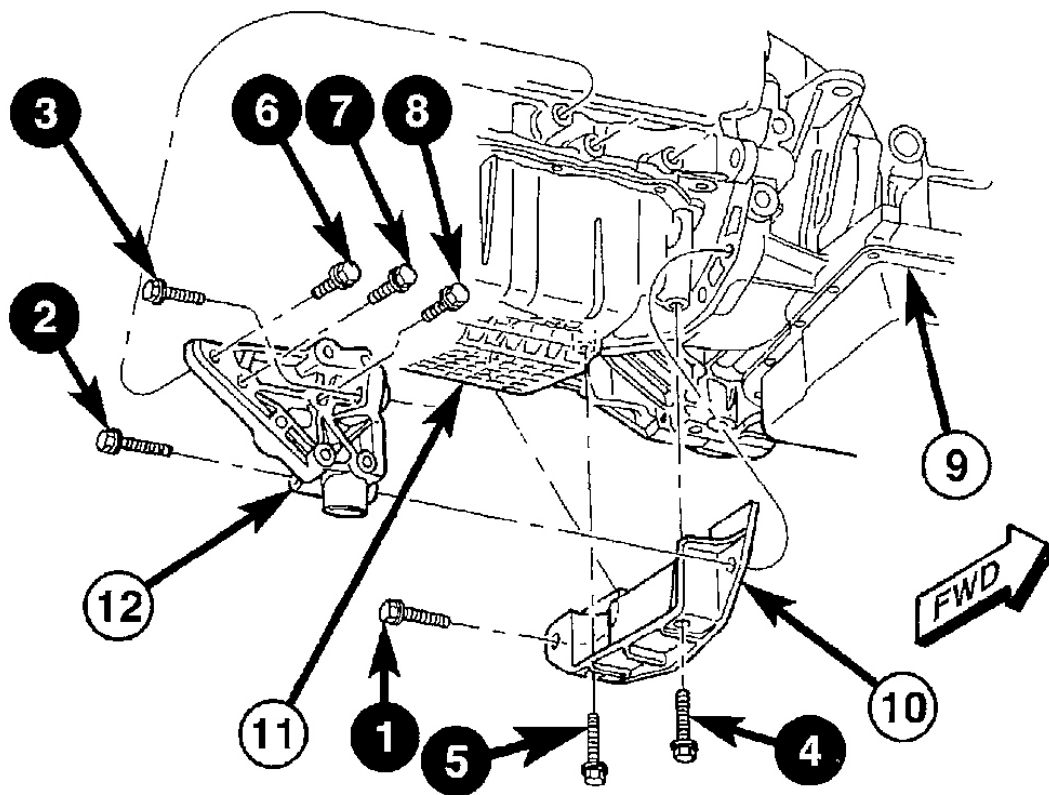


## STRUCTURAL COLLAR

### REMOVAL

#### STRUCTURAL COLLAR-AUTOMATIC TRANSAXLE EQUIPPED

1. Raise vehicle on hoist.
2. Remove bolts attaching bending strut to engine and transaxle.



1-8 – BOLT TIGHTENING SEQUENCE

9 – TRANSAXLE

10 – COLLAR

11 – OIL PAN

12 – STRUT

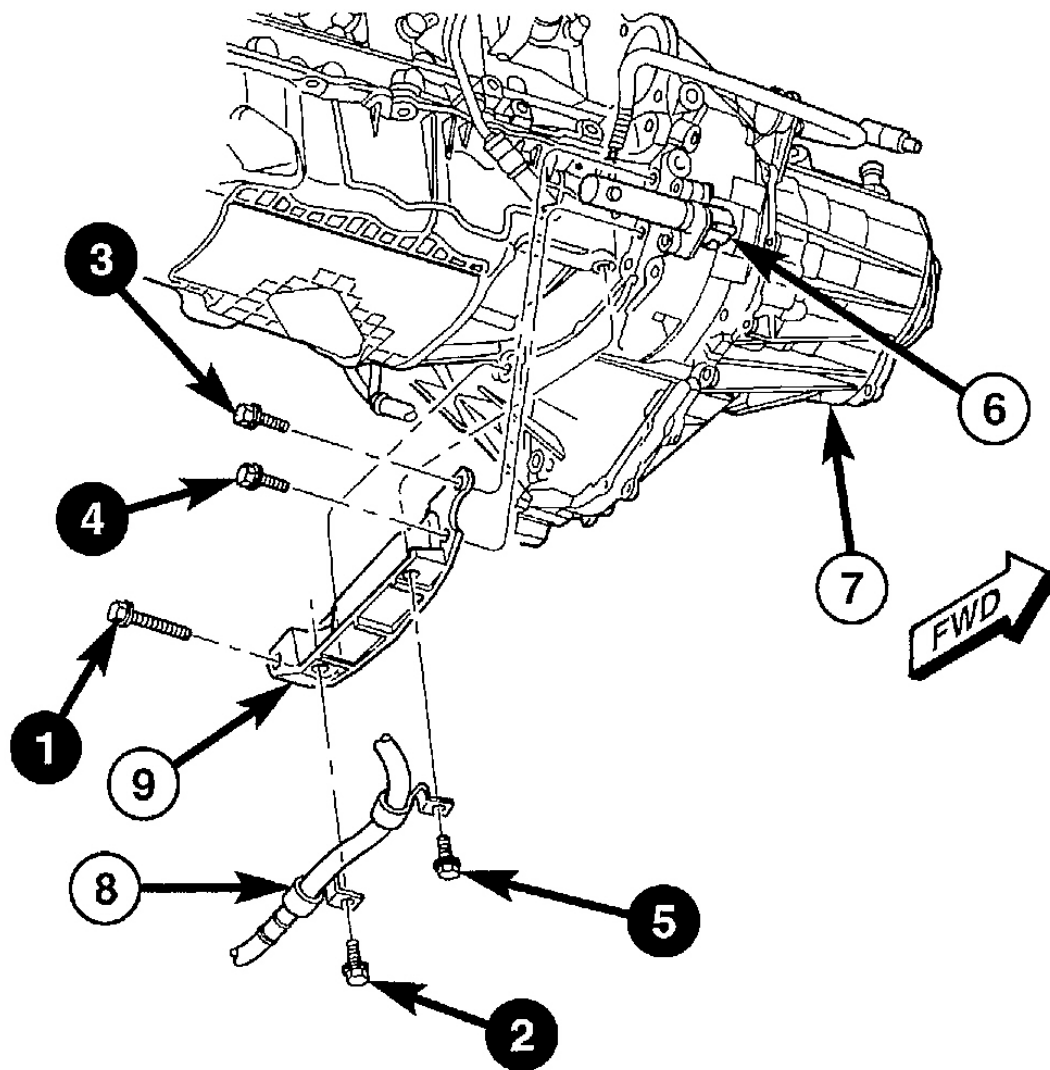
G01857819

**Fig. 148: Removing Structural Collar & Bearing Strut - (Automatic Transaxle Equipped)**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Remove bolts attaching collar and strut to engine, oil pan, and transaxle. Remove strut and collar.

**STRUCTURAL COLLAR-MANUAL TRANSAXLE EQUIPPED**

1. Raise vehicle on hoist.
2. Remove bolts attaching bending strut to engine and transaxle. Remove strut.



- 1-5 – BOLT TIGHTENING SEQUENCE
- 6 – HYDRAULIC CLUTCH SLAVE CYLINDER
- 7 – TRANSAXLE
- 3 – POWER STEERING HOSE
- 9 – COLLAR

G01857820

**Fig. 149: Removing Structural Collar and Bending Strut - (Manual Transaxle Equipped)**  
 Courtesy of DAIMLERCHRYSLER CORP.

3. Remove bolts attaching collar and clutch slave cylinder to transaxle.

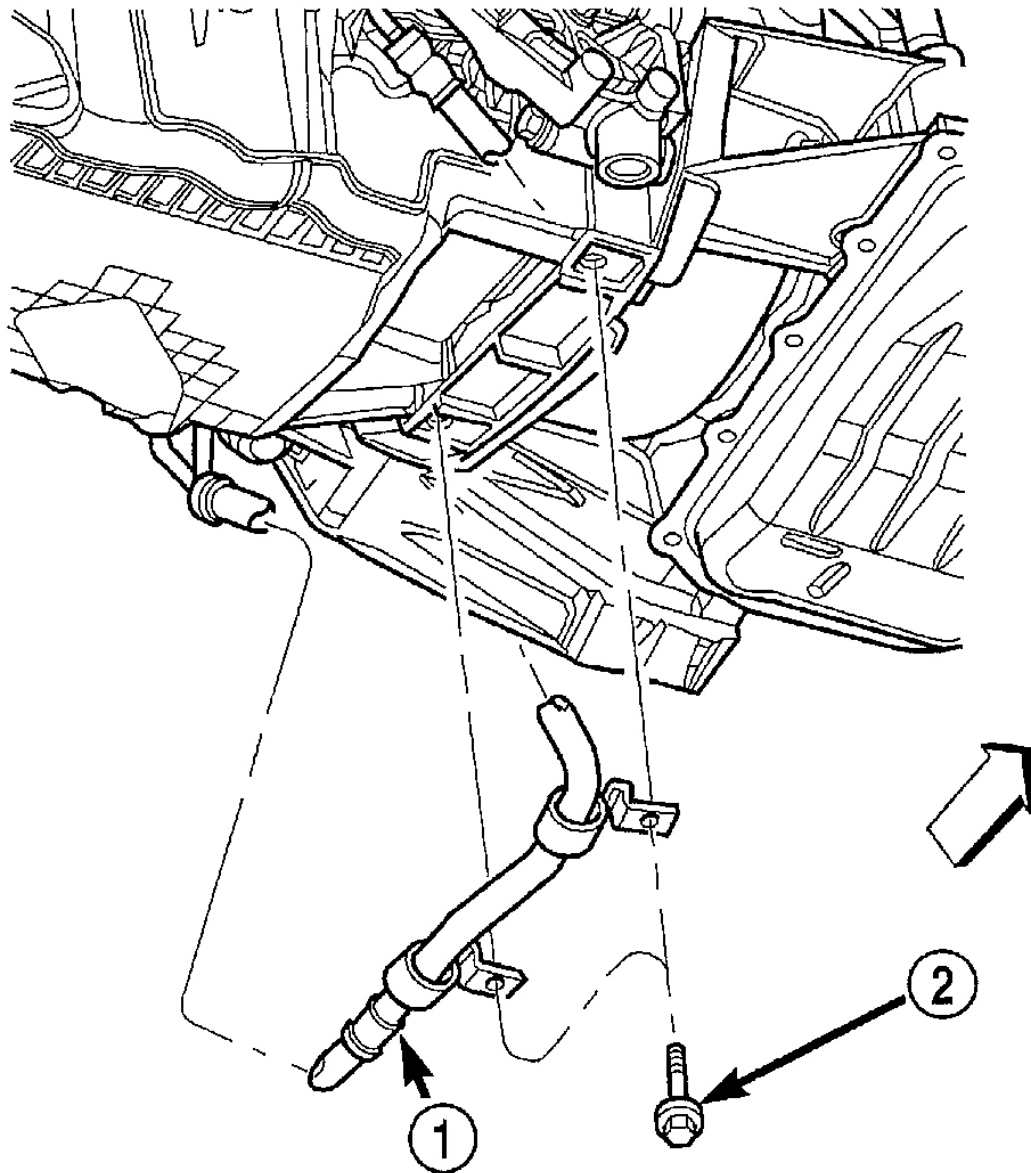
4. Remove remaining bolts attaching collar to oil pan and transaxle. Remove collar.

## INSTALLATION

### STRUCTURAL COLLAR-AUTOMATIC TRANSAXLE EQUIPPED

**CAUTION:** Torque procedure for the structural collar and bending strut must be followed or damage could occur to oil pan, collar, and/or bending strut.

1. Perform the following steps for installing structural collar and bending strut. Refer to **Fig. 148**:
  - Step 1: Place collar into position between transaxle and oil pan. Install collar to transaxle bolt (1), **hand start only**.
  - Step 2: Position power steering hose support bracket and install collar to oil pan bolt (4), **hand tight only**.



1 - POWER STEERING HOSE

2 - BOLT

G01857821

**Fig. 150: Connecting Power Steering Hose To Structural Collar**  
Courtesy of DAIMLERCHRYSLER CORP.

- Step 3: Position bending strut in place and **hand start only** bolt (3) into the upper transaxle hole.

- Step 4: Install bolt (2), through strut and collar, **hand start only**.
- Step 5: Install bolt (6), strut to cylinder block, **hand tight only**.
- Step 6: Position power steering hose support bracket and install the remaining collar to oil pan bolt (5), **hand tight only**.
- Step 7: Final torque collar to transaxle bolts (1-3), to 101 N.m (75 ft. lbs.)
- Step 8: Install bolts (7) and (8), through strut and into cylinder block.
- Step 9: Final torque bolts (4-8) to 61 N.m (45 ft. lbs.).

2. Lower vehicle.

#### STRUCTURAL COLLAR-MANUAL TRANSAXLE EQUIPPED

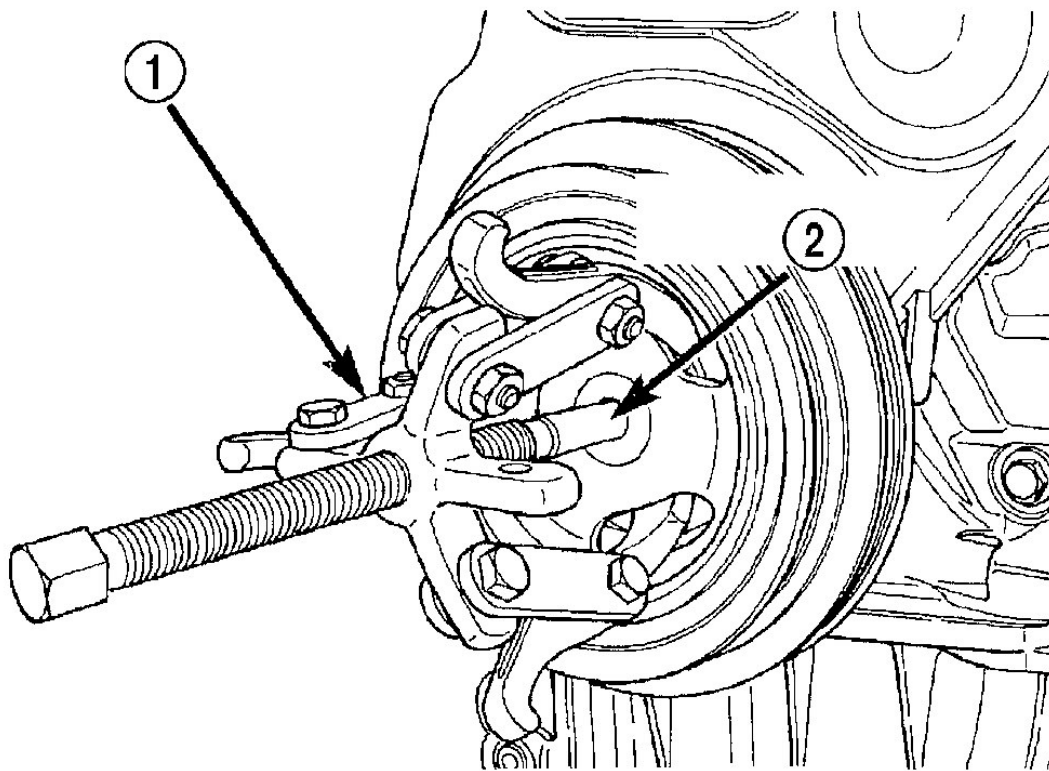
**CAUTION:** Torque procedure for the structural collar and bending strut must be followed or damage could occur to oil pan, collar, and/or bending strut.

1. Perform the following steps for installing structural collar and bending strut. Refer to **Fig. 149**:
  - Step 1: Place collar into position between transaxle and oil pan. Install collar to transaxle bolt (1), **hand start only**.
  - Step 2: Position power steering hose support bracket and install collar to oil pan bolt (2), **hand tight only**.
  - Step 3: Position clutch slave cylinder into mounting position and install bolts (3) and (4) **hand tight only**.
  - Step 4: Position power steering hose support bracket and install the remaining collar to oil pan bolt (5) **hand tight only**.
  - Step 5: Final torque all bolts in sequence shown in **Fig. 149** to the following torque values:
    - Bolt (1) to 101 N.m (75 ft. lbs.)
    - Bolts (2) and (5) to 61 N.m (45 ft. lbs.)
    - Bolts (3) and (4) to 28 N.m (20 ft. lbs.)
2. Lower vehicle.

## VIBRATION DAMPER

### REMOVAL

1. Remove accessory drive belts. See **COOLING SYSTEM MECHANICAL** article.
2. Remove crankshaft damper bolt.
3. Remove damper by using Special Tool 1026 and Insert 6827A.



1 - SPECIAL TOOL 1026 3 - JAW PULLER

2 - SPECIAL TOOL 6827A INSERT

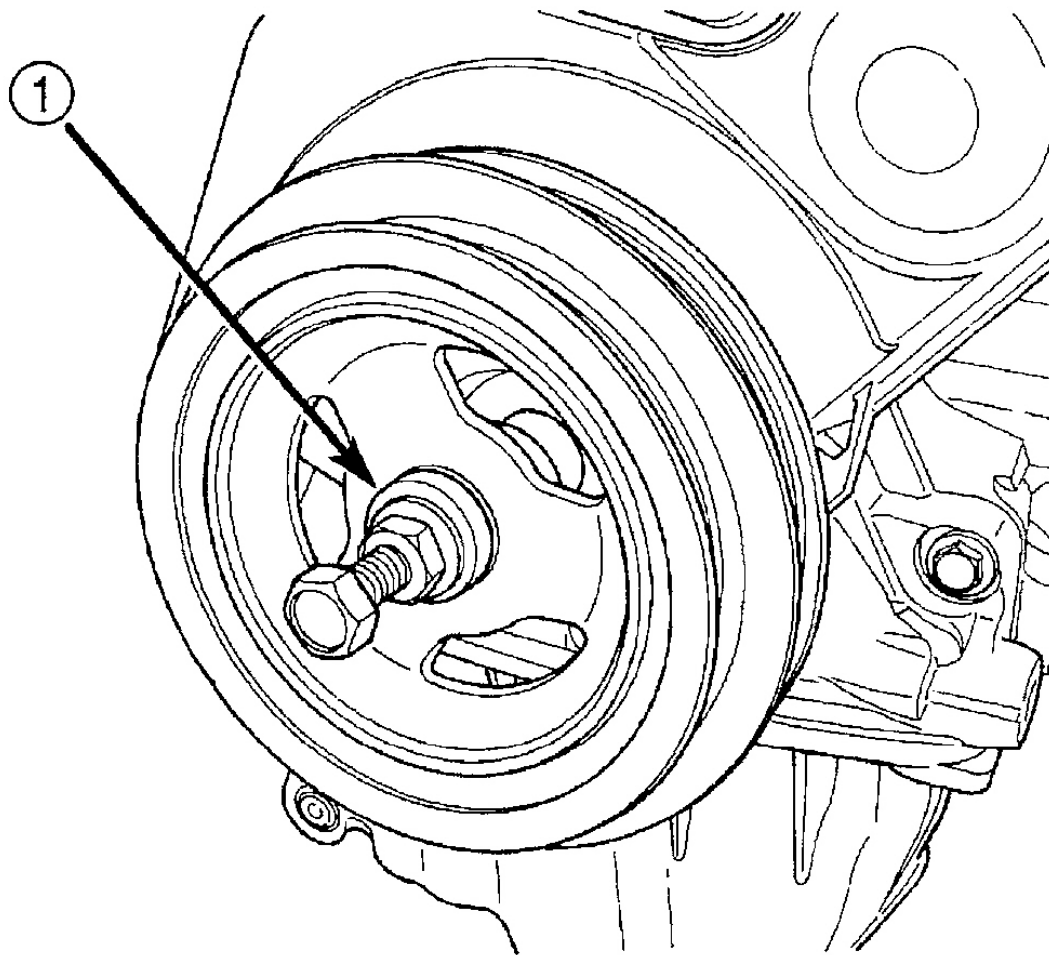
G01857822

**Fig. 151: Removing Crankshaft Damper**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

**NOTE:** Lubricate the threads of the M12 1.75 x 150 mm bolt using Mopar® Nickel Anti-seize Compound or equivalent, before beginning to press the damper on.

1. Install crankshaft damper using Special Tool 6792 (M12 1.75 x 150 mm bolt, washer, thrust bearing and nut).
2. Apply Mopar® Lock & Seal Adhesive (Medium Strength Threadlocker) to crankshaft damper bolt and tighten to 136 N.m (100 ft. lbs.).



1 - SPECIAL TOOL 6792

G01857823

**Fig. 152: Installing Crankshaft Damper**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Install accessory drive belts. See COOLING SYSTEM MECHANICAL article.

## ENGINE MOUNTING

### DESCRIPTION

The engine mounting system consists of a four-point system utilizing two load-carrying mounts and two torque struts. See **Fig. 154** and **Fig. 156**. The load-carrying mounts are located on each frame rail. The right mount is a hydro-elastic mount and left mount is a conventional elastomeric isolator. The two torque controlling struts are



attached at the front of the engine, straddling the right side load-carrying mount. The upper strut connects to the suspension strut tower and the lower to the suspension cross-member.

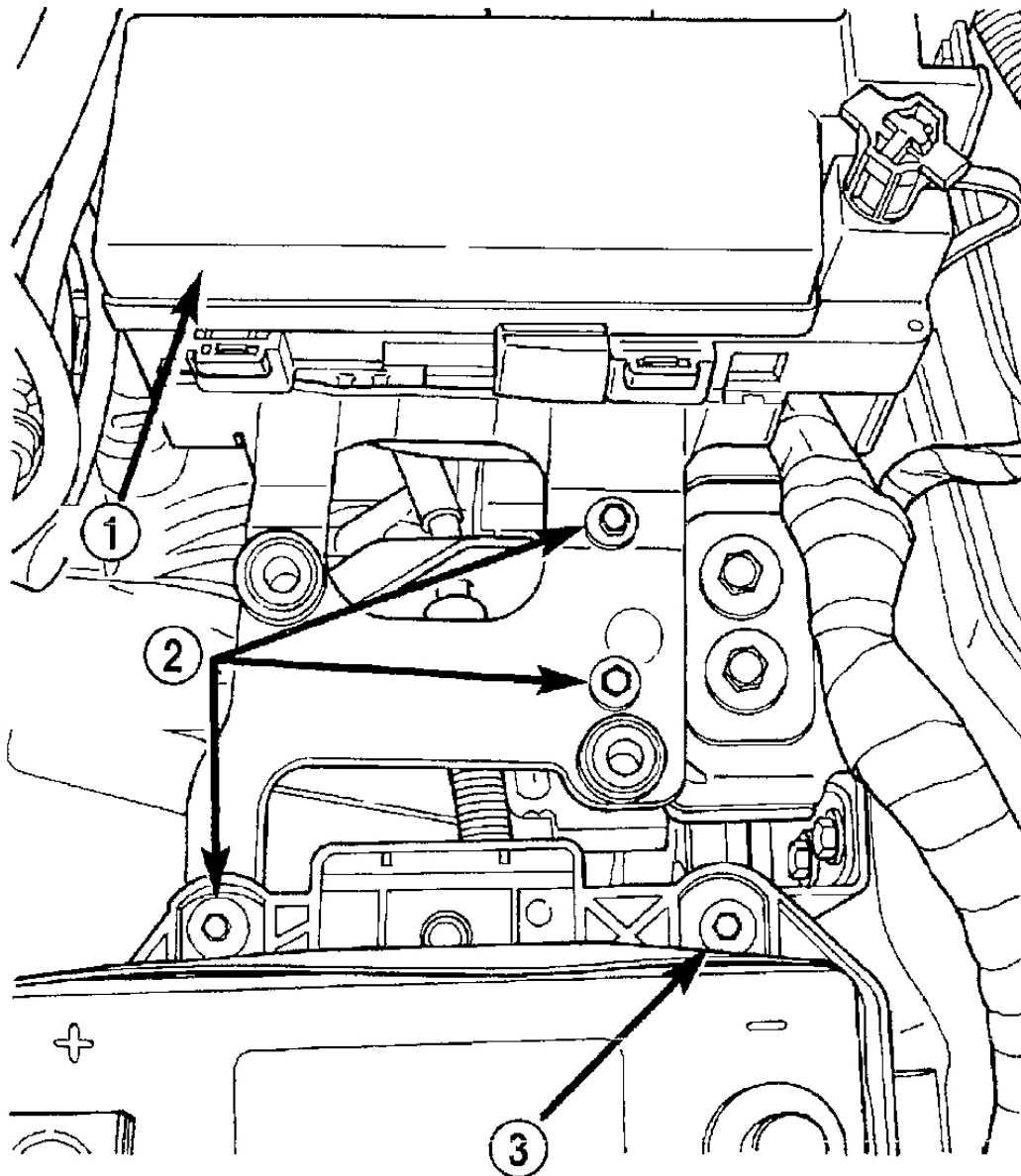
## **OPERATION**

The four-point engine mounting system minimizes the transmission of structure-borne engine noise to the passenger compartment. The load-carrying right and left mounts dampen and isolate vertical motion and vibration. The two struts absorb torque reaction forces and torsional vibrations.

## **LEFT MOUNT**

### **REMOVAL**

1. Remove air cleaner assembly.
2. Disconnect negative cable from battery.
3. Remove bolts attaching the power distribution center (PDC) bracket to left mount and battery tray.



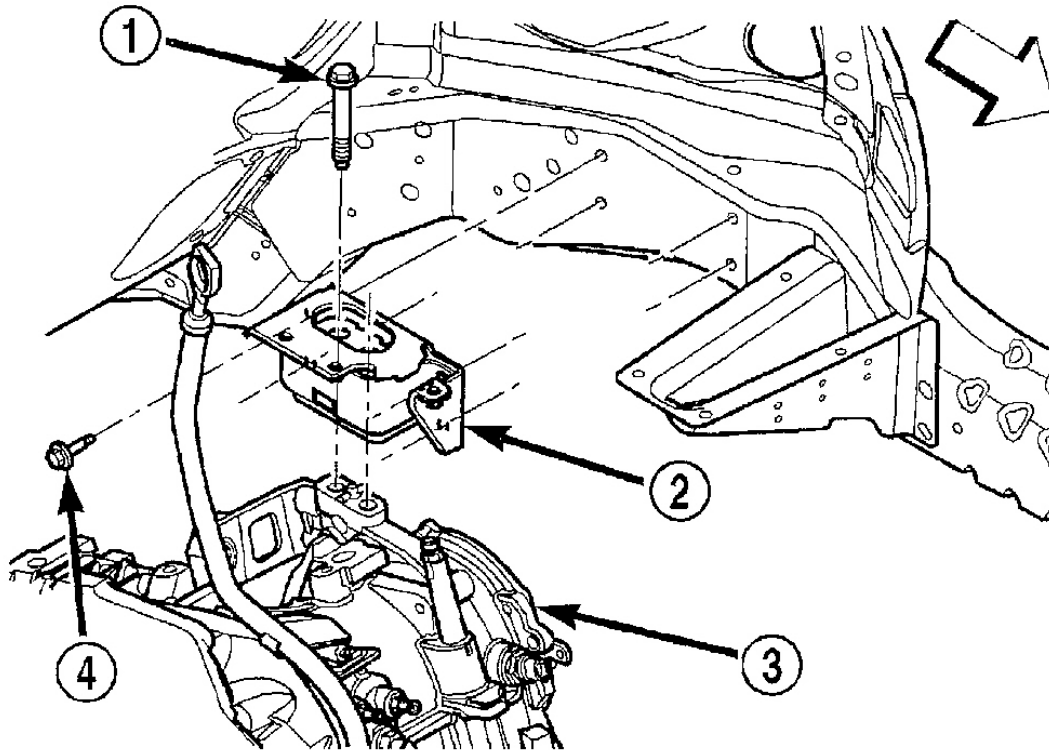
- 1 - PDC
- 2 - PDC BRACKET BOLTS
- 3 - BATTERY TRAY BOLT

G01857824

**Fig. 153: Removing PDC Bracket Attaching Bolts**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Support transaxle with a suitable jack.

5. Remove mount to transaxle bolts.



- 1 - BOLT
- 2 - LEFT MOUNT
- 3 - TRANSAXLE
- 4 - BOLT

G01857825

**Fig. 154: Removing Left Mount**  
Courtesy of DAIMLERCHRYSLER CORP.

6. Remove left mount bracket to body frame rail fasteners.
7. Remove mount.

## INSTALLATION

1. Install engine mount bracket to body frame rail and tighten fasteners to 28 N.m (250 in. lbs.).
2. Position engine/transaxle for installation of mount to transaxle bolts. Install and tighten bolts to 68 N.m (50 ft. lbs.).
3. Remove jack from under transaxle.

4. Install bolts attaching the power distribution center (PDC) bracket to left mount and battery tray. See **Fig. 153**.
5. Connect negative cable to battery.
6. Install air cleaner assembly.

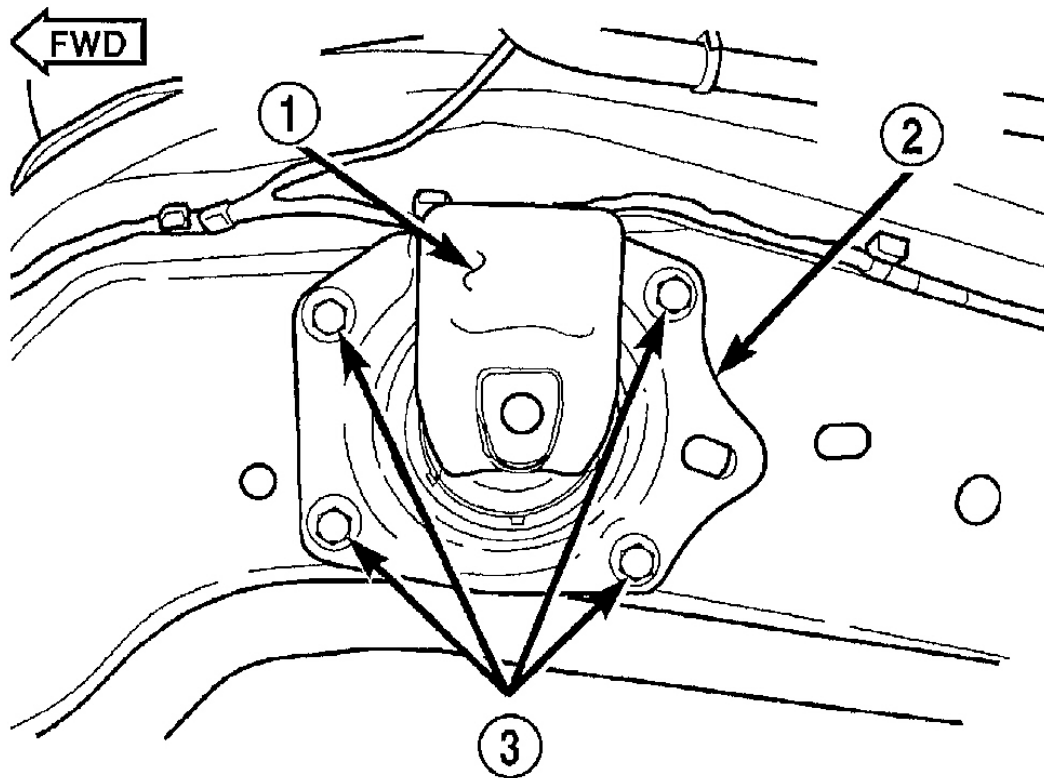
## **RIGHT MOUNT**

### **REMOVAL**

1. Remove the engine assembly for the required clearance to access the engine mount. See **ENGINE**.

**NOTE:**        **The right engine mount attaching holes are slightly oversize to compensate for manufacturing tolerances. The mount has been set at the manufacturing plant for proper powertrain alignment. Therefore, it is necessary to mark the position of the mount before the attaching bolts are loosened.**

2. Using a permanent ink marker or equivalent, mark the position of engine mount to the body frame rail.
3. Remove bolts attaching mount to body.



- 1 - SNUBBER PAD
- 2 - RIGHT ENGINE MOUNT
- 3 - BOLTS

G01857826

**Fig. 155: Removing Right Engine Mount**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Remove mount.

## INSTALLATION

**NOTE:** Engine mount must be installed in the original position on body frame rail. If mount was not marked or frame rail was replaced, perform the following procedure.

1. Position mount into the original position on body frame rail.
2. Perform the following procedure if the mount position was not previously marked, or the frame rail was

replaced.

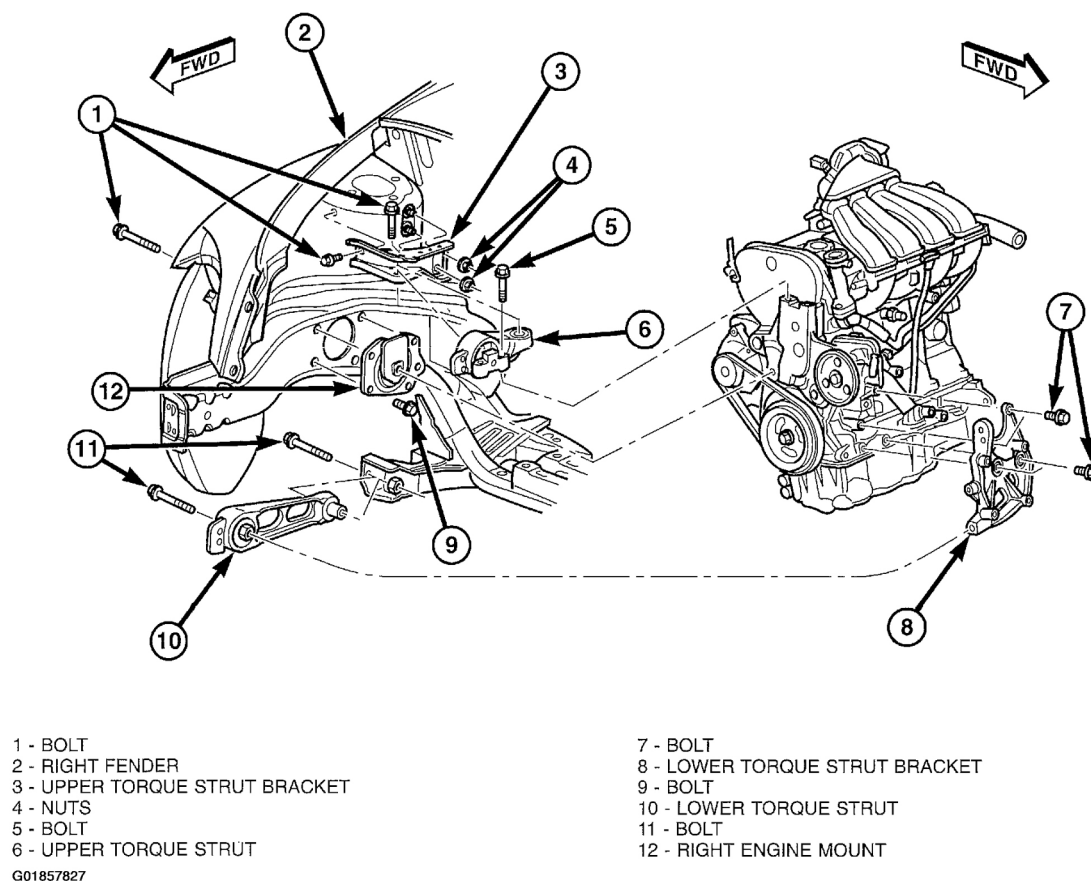
- a. Insert new mount loosely in frame rail.
  - b. Align the four holes in the mount with the mating holes in the rail such that the holes are concentric (frame rail holes centered in the mount holes).
  - c. Using a permanent ink marker or equivalent, mark the position of engine mount to the body frame rail while maintaining mounting hole concentricity.
3. Ensure the mount maintains originally marked position and install mount bolts. Tighten bolts to 28 N.m (250 in. lbs.).
  4. Install the engine assembly. See **ENGINE**.

## TORQUE STRUT

### REMOVAL

#### REMOVAL - UPPER

1. Remove bolts attaching upper torque strut to shock tower bracket and engine mount bracket.



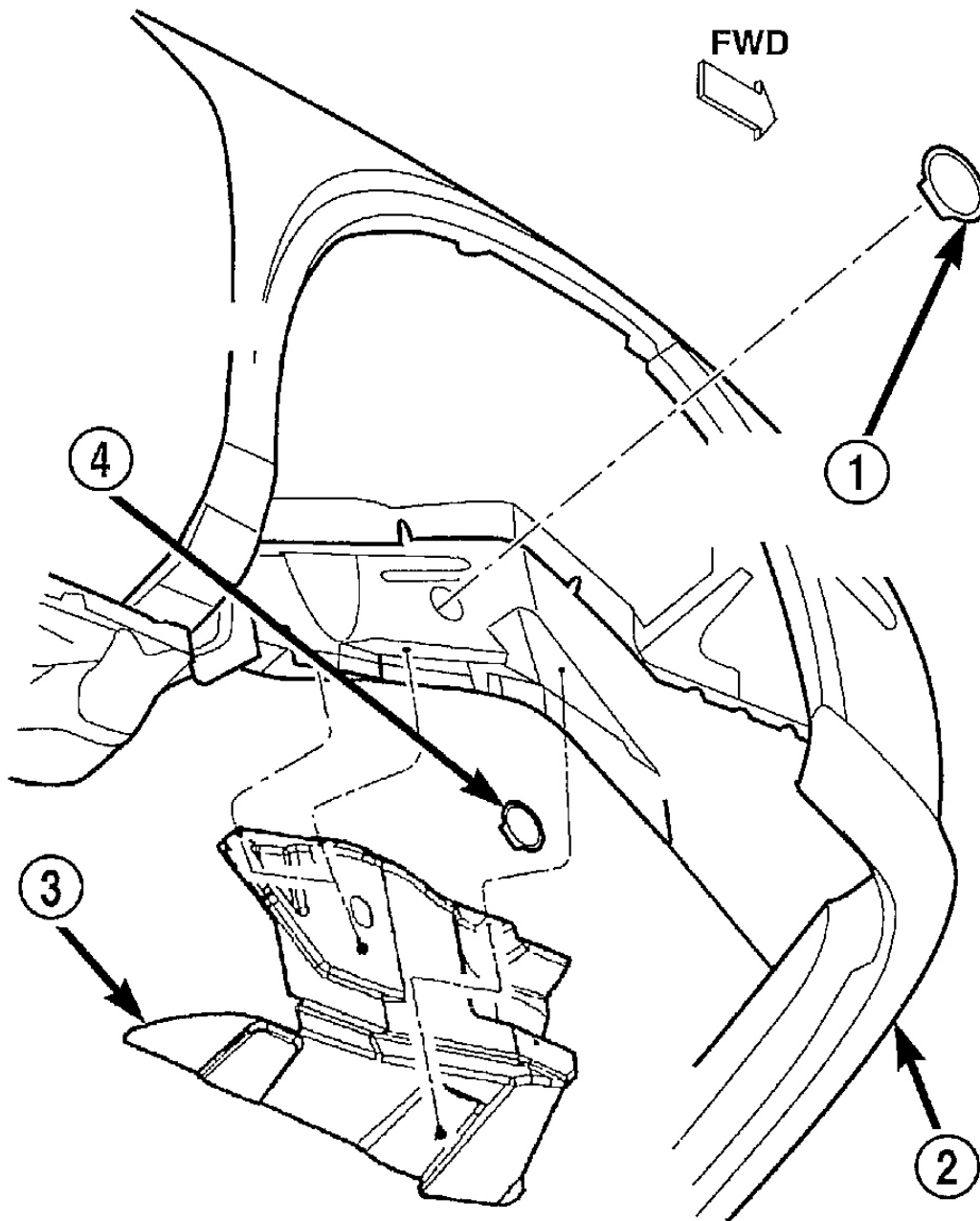
**Fig. 156: Identifying Engine Mounting - Right Side**

**Courtesy of DAIMLERCHRYSLER CORP.**

2. Remove timing belt front upper cover (if A/C equipped).
3. Remove the upper torque strut.

**REMOVAL - LOWER**

1. Raise vehicle on hoist.
2. Remove accessory drive belt splash shield.



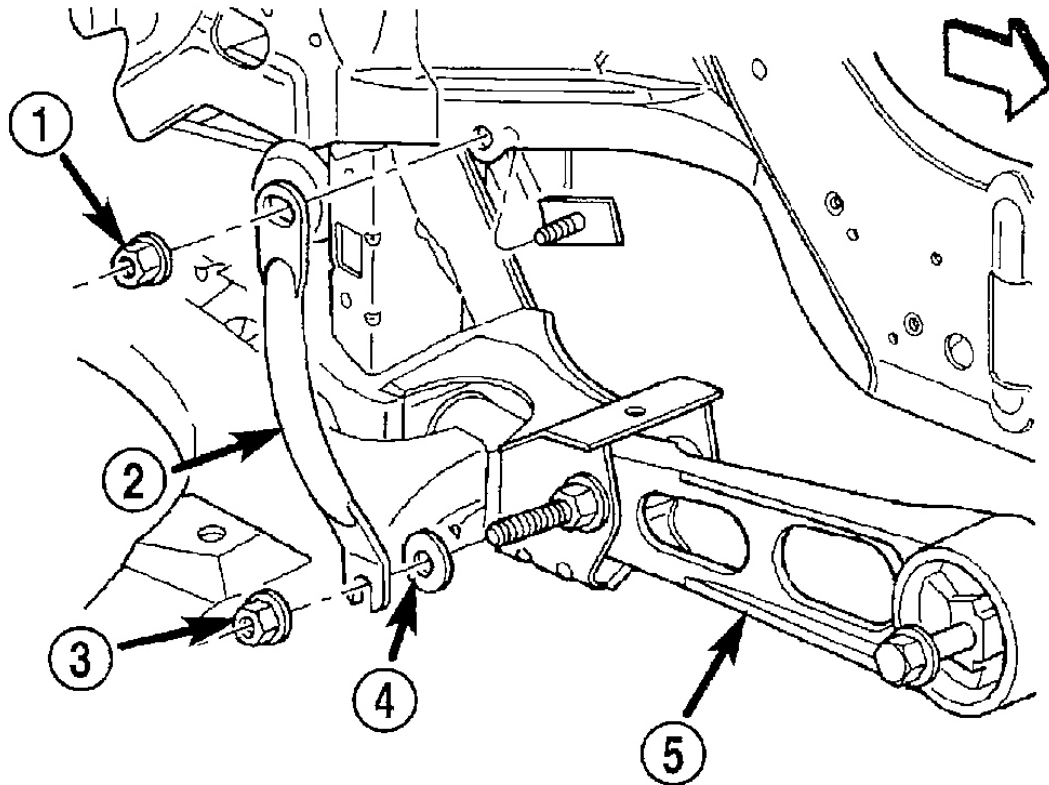
- 1 - RIGHT MOUNT BOLT ACCESS PLUG
- 2 - FASCIA
- 3 - SPLASH SHIELD
- 4 - CRANKSHAFT BOLT ACCESS PLUG

G01857828



**Fig. 157: Removing & Installing Splash Shield**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Remove pencil strut.



- 1 - NUT  
2 - PENCIL STRUT  
3 - NUT  
4 - FLAT WASHER  
5 - LOWER TORQUE STRUT

G01857829

**Fig. 158: Removing & Installing Pencil Strut**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Remove bolts attaching lower torque strut to crossmember and strut bracket. See **Fig. 156**.
5. Remove lower torque strut.

## INSTALLATION

**INSTALLATION - UPPER**

1. Position the upper torque strut into mounting location. See **Fig. 156**.
2. Move torque strut aside (towards right fender) and install timing belt front upper cover (if A/C equipped).
3. Install the torque strut mounting bolts and perform the torque strut adjustment procedure. See **ADJUSTMENTS**.

**INSTALLATION - LOWER**

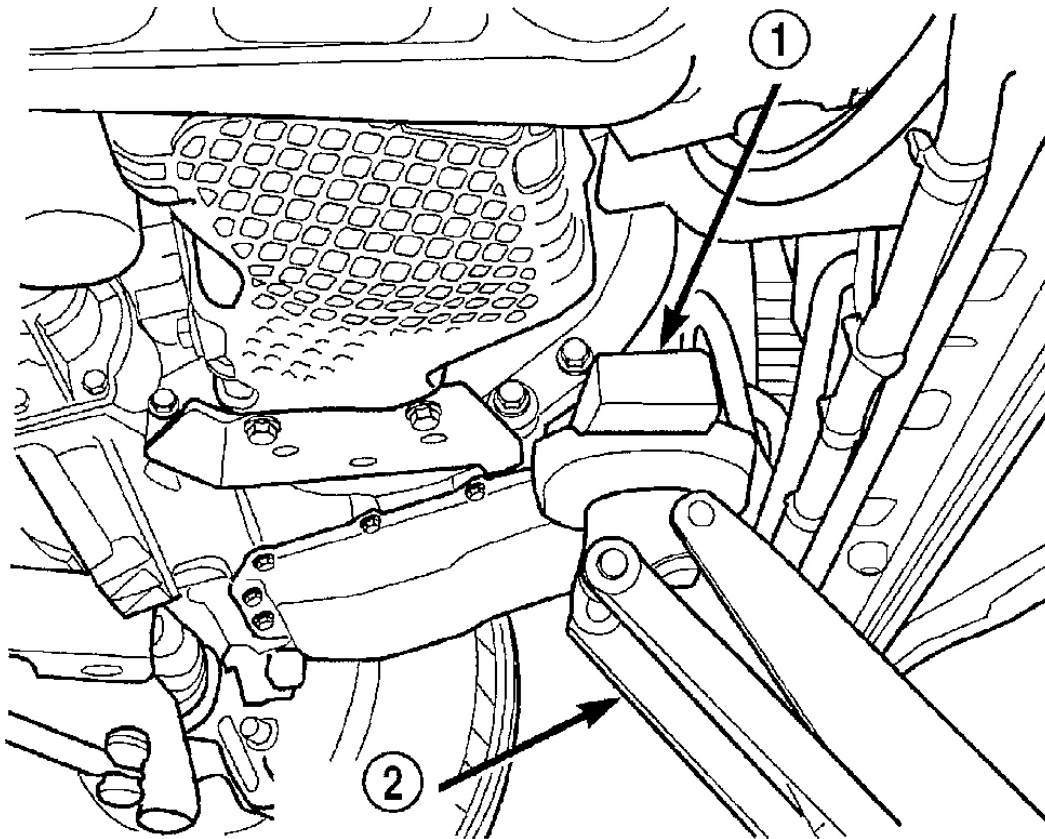
1. Position lower torque strut into mounting locations.
2. Install mounting bolts and perform torque strut adjustment procedure. See **ADJUSTMENTS**.
3. Install pencil strut and tighten nuts to 58 N.m (43 ft. lbs.). See **Fig. 158**.
4. Install accessory belt splash shield and lower vehicle. See **Fig. 157**.

**ADJUSTMENTS****ENGINE TORQUE STRUT ADJUSTMENT**

The upper and lower torque struts need to be adjusted together to assure proper engine positioning and engine mount loading. Whenever a torque strut bolt(s) is loosened, this procedure must be performed.

1. Remove accessory drive belt splash shield. See **Fig. 157**.
2. Remove pencil strut. See **Fig. 158**.
3. Loosen the upper and lower torque strut attaching bolt at the suspension crossmember and shock tower bracket. See **Fig. 156**.

**NOTE:**        **The floor jack must be positioned as shown to prevent minimal upward lifting of the engine.**



1 - WOOD BLOCK

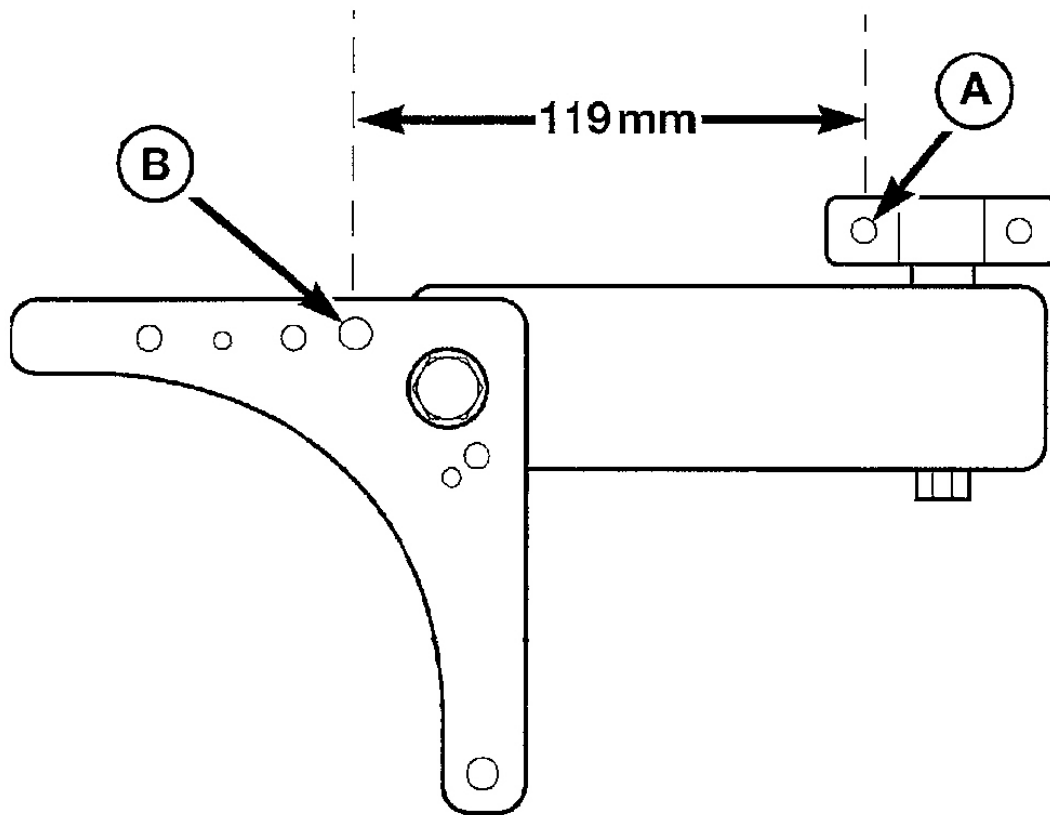
2 - FLOOR JACK

G01857830

**Fig. 159: Positioning Floor Jack**

Courtesy of DAIMLERCHRYSLER CORP.

4. The engine position may now be adjusted by positioning a suitable floor jack on the forward edge of the transmission bell housing.
5. With the engine supported, remove the upper and lower torque strut attachment bolt(s) at shock tower bracket and suspension crossmember. See **Fig. 156**. Verify that the torque struts are free to move within the shock tower bracket and crossmember. Reinstall the torque strut bolt(s), but do not tighten.
6. Carefully apply upward force, allowing the upper engine to rotate rearward until the distance between the center of the rearmost attaching bolt on the engine mount bracket (point "A") and the center of the hole on the shock tower bracket (point "By") is 119 mm (4.70 in.).



G01857831

**Fig. 160: Identifying Engine Position Measurement**  
Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION:** The engine must be held in position with jack until both the upper and lower torque strut bolts are tightened.

7. With the engine held at the proper position, tighten both the upper and lower torque strut bolts to 115 N.m (85 ft. lbs.). See **Fig. 156**.
8. Remove the floor jack.
9. Install pencil strut and tighten nuts to 58 N.m (43 ft. lbs.). See **Fig. 158**.
10. Install accessory drive belt splash shield. See **Fig. 157**.

## LUBRICATION

### DESCRIPTION

The lubrication system is a full-flow filtration, pressure feed type. The oil pump is mounted in the front engine

cover and driven by the crankshaft.

## OPERATION

Engine oil drawn up through the pickup tube and is pressurized by the oil pump and routed through the full-flow filter to the main oil gallery running the length of the cylinder block. A diagonal hole in each bulkhead feeds oil to each main bearing. Drilled passages within the crankshaft route oil from main bearing journals to connecting rod journals. Balance shaft lubrication is provided through an oil passage from the number one main bearing cap through the balance shaft carrier support leg. This passage directly supplies oil to the front bearings and internal machined passages in the shafts that routes oil from front to the rear shaft bearing journals. A vertical hole at the number five bulkhead routes pressurized oil through a restrictor (integral to the cylinder head gasket) up past a cylinder head bolt to an oil gallery running the length of the cylinder head. The camshaft journals are partially slotted to allow a predetermined amount of pressurized oil to pass into the bearing cap cavities. Lubrication of the camshaft lobes are provided by small holes in the camshaft bearing caps that are directed towards each lobe. Oil returning to the pan from pressurized components supplies lubrication to the valve stems. Cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collars.

## DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE

1. Disconnect and remove oil pressure switch. See **OIL PRESSURE SENSOR/SWITCH**.
2. Install Special Tools C-3292 Gauge with 8406 Adaptor fitting.
3. Start engine and record oil pressure. Refer to Specifications for correct oil pressure requirements. See **SPECIFICATIONS**.

**CAUTION: If oil pressure is 0 at idle, do not perform the 3000 RPM test**

4. If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open, a clogged oil pick-up screen or a damaged oil pick-up tube O-ring.
5. After test is complete, remove test gauge and fitting.
6. Install oil pressure switch and connector. See **OIL PRESSURE SENSOR/SWITCH**.

## OIL

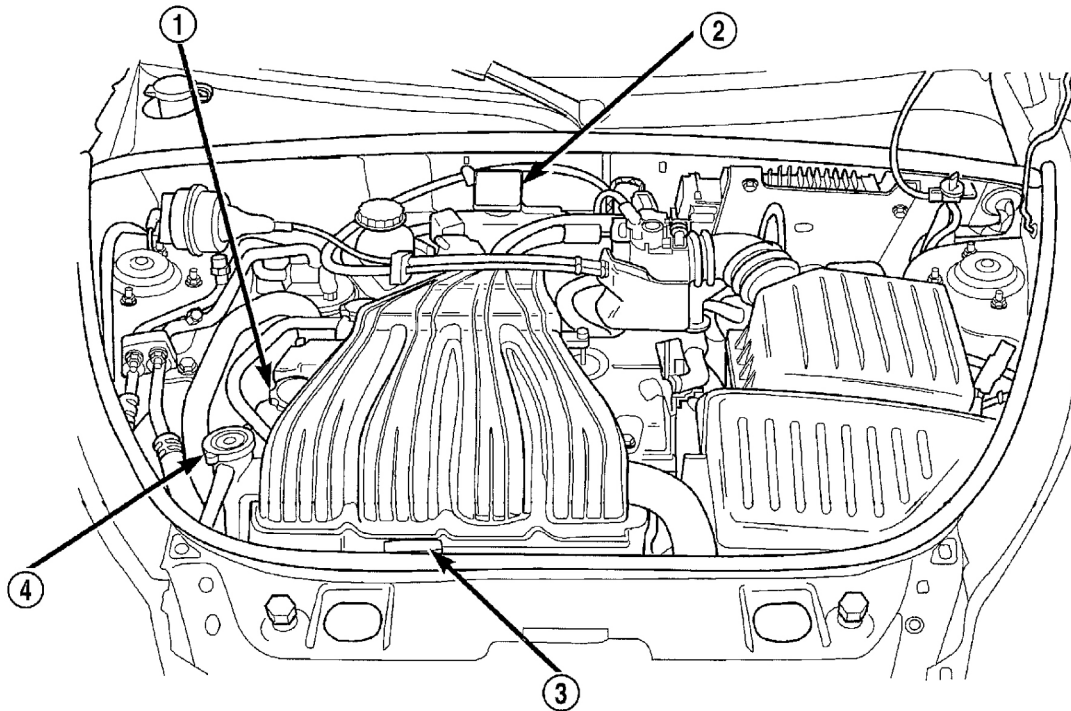
### STANDARD PROCEDURE

#### ENGINE OIL LEVEL CHECK

**CAUTION: Do not operate engine if the oil level is above the MAX mark on the dipstick. Excessive oil volume can cause oil aeration which can lead to engine failure due to loss of oil pressure or increase in oil temperature.**

The best time to check engine oil level is after the vehicle 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. Remove dipstick and observe oil level. Add oil only when the level is at or below the MIN mark.

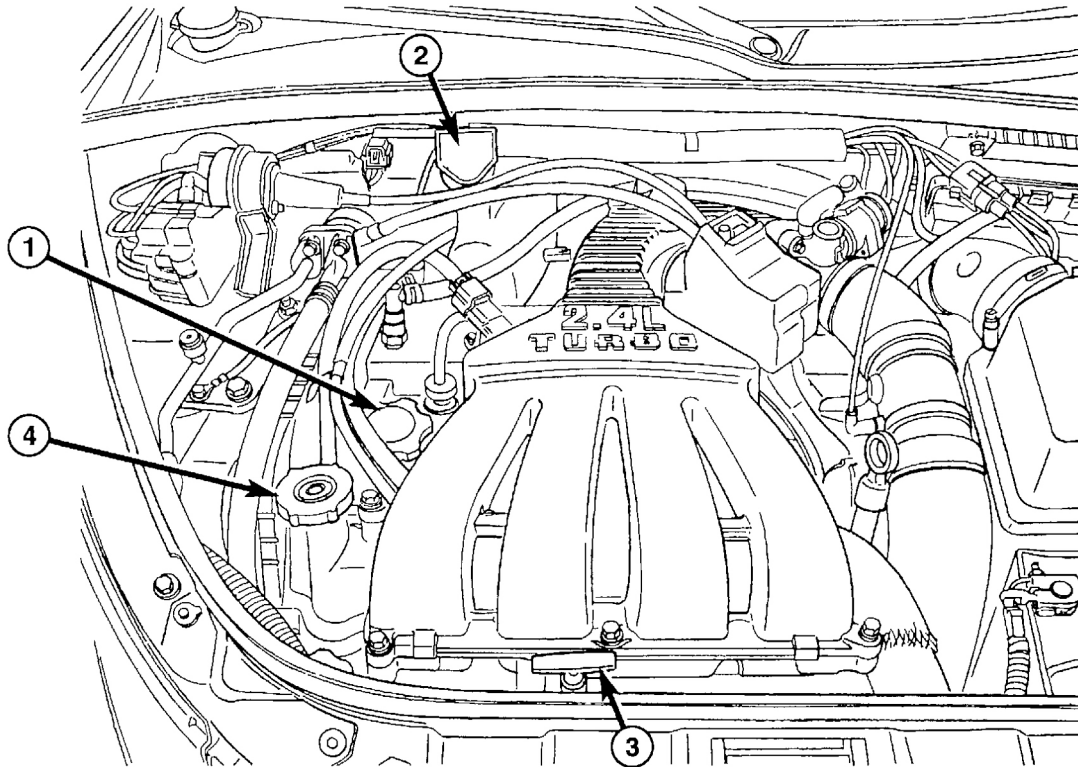


1 - ENGINE OIL FILL  
2 - COOLANT RECOVERY CONTAINER

3 - ENGINE OIL DIPSTICK  
4 - COOLANT PRESSURE CAP

G01857832

**Fig. 161: Identifying Engine Oil Dipstick & Fill Locations**  
Courtesy of DAIMLERCHRYSLER CORP.

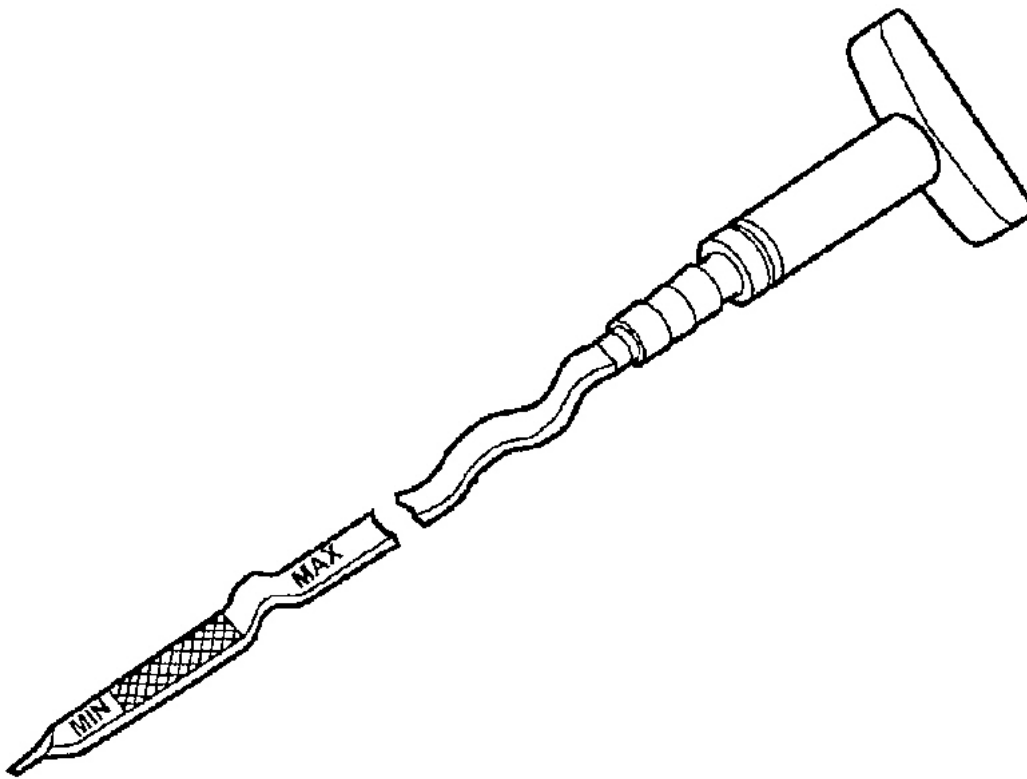


1 - ENGINE OIL FILL  
2 - COOLANT RECOVERY CONTAINER

3 - ENGINE OIL DIPSTICK  
4 - COOLANT PRESSURE CAP

G01857833

**Fig. 162: Identifying Engine Oil Dipstick & Fill Locations - Turbo**  
**Courtesy of DAIMLERCHRYSLER CORP.**



G01857834

**Fig. 163: Identifying Engine Oil Dipstick**  
Courtesy of DAIMLERCHRYSLER CORP.

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

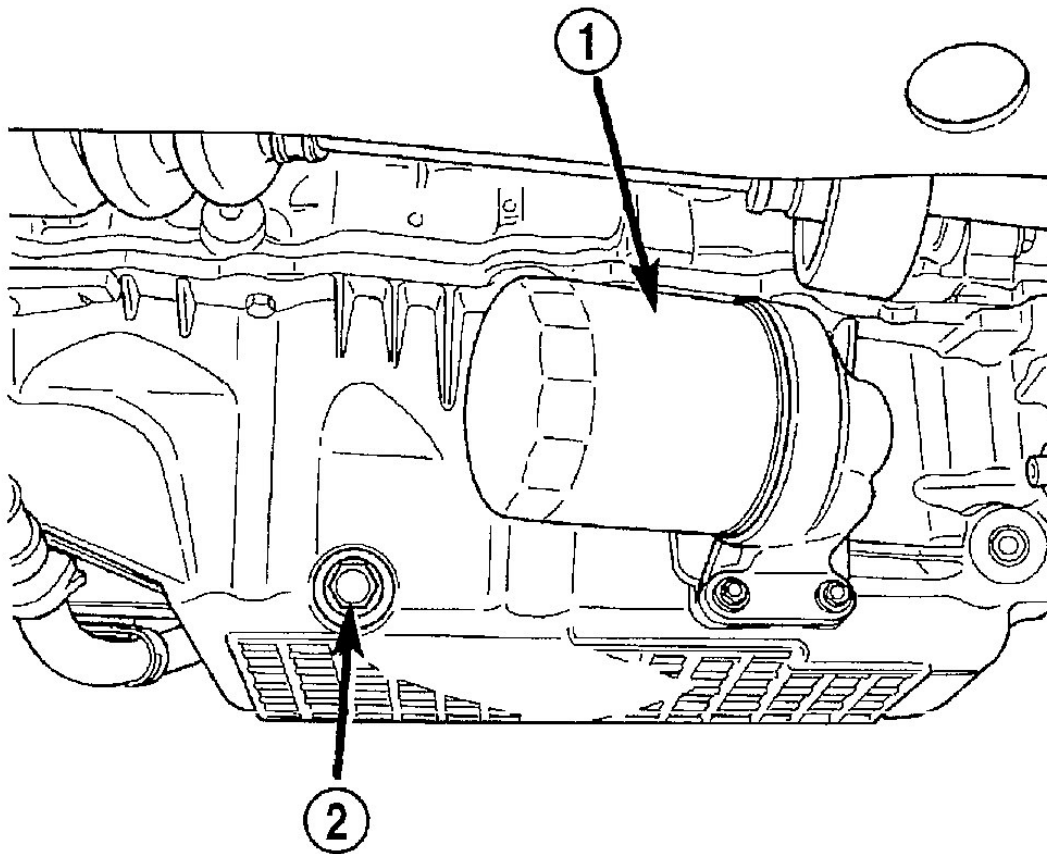
**WARNING:** NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, 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.

Change engine oil at mileage and time intervals described in the Maintenance Schedule.

1. Run engine until achieving normal operating temperature.



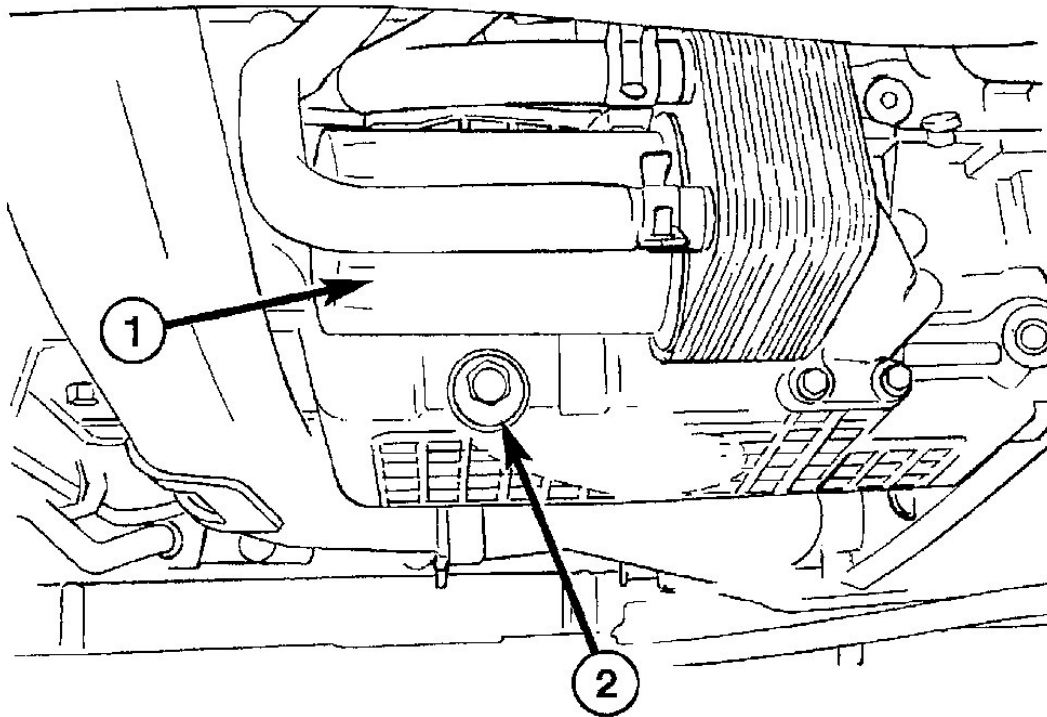
2. Position the vehicle on a level surface and turn engine off.
3. Remove oil fill cap.
4. Raise vehicle on hoist.
5. Place a suitable oil collecting container under oil pan drain plug.
6. Remove oil pan drain plug and allow oil to drain into collecting container. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.



1 - OIL FILTER  
2 - DRAIN PLUG

G01857835

**Fig. 164: Removing Oil Filter & Drain Plug**  
**Courtesy of DAIMLERCHRYSLER CORP.**



1 - OIL FILTER  
2 - DRAIN PLUG

G01857836

**Fig. 165: Removing Oil Filter & Drain Plug - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

7. Remove oil filter. See **OIL FILTER**.
8. Install oil pan drain plug. Torque drain plug to 28 N.m (20 ft. lbs.).
9. Install new oil filter. See **OIL FILTER**.
10. Lower vehicle and fill crankcase with specified type and amount of engine oil.
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. Replace oil filter with a Mopar® or the equivalent.

#### USED ENGINE OIL DISPOSAL

**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.**

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine.

## **OIL FILTER**

### **REMOVAL**

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

1. Using a suitable filter wrench, turn oil filter counterclockwise to remove.

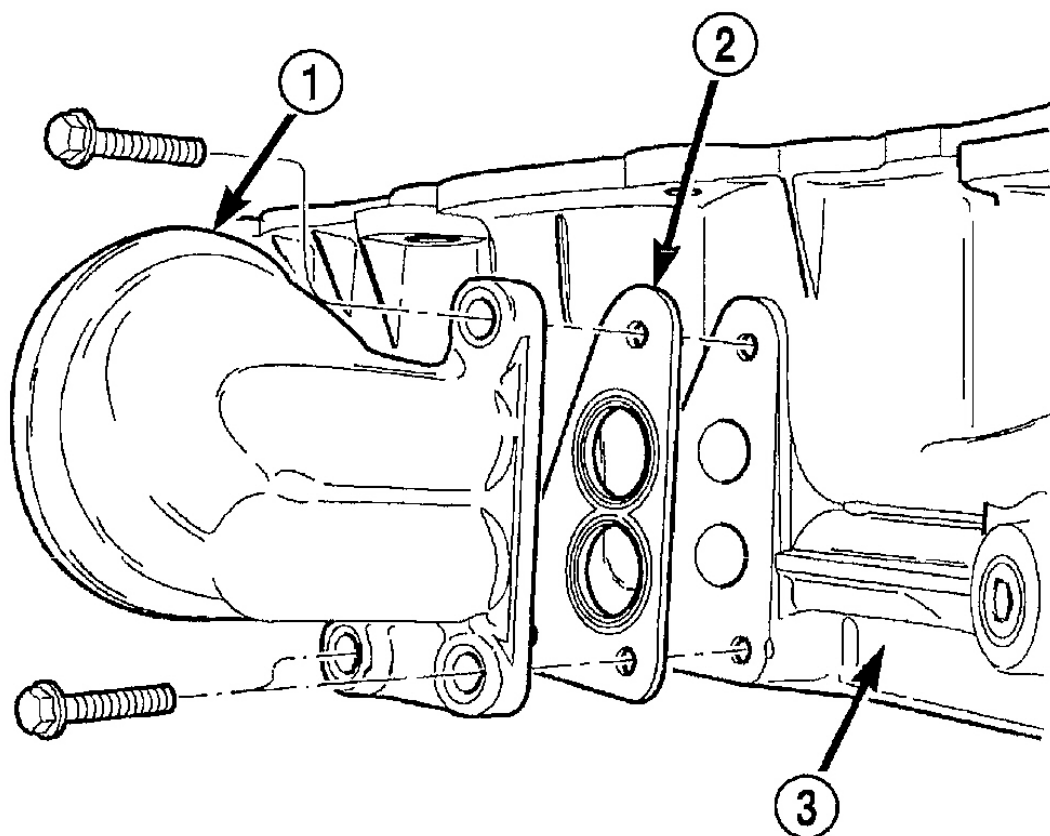
### **INSTALLATION**

1. Clean and check filter mounting surface. The surface must be smooth, flat and free of debris or pieces of gasket.
2. Lubricate new oil filter gasket.
3. Screw oil filter on until the gasket contacts base. Tighten to 21 N.m (15 ft. lbs.).

## **OIL FILTER ADAPTER**

### **REMOVAL**

1. Raise vehicle on hoist.
2. Place a suitable oil collecting container under oil filter.
3. Remove oil filter. See **OIL FILTER**.
4. **Turbocharger Equipped Vehicles:** Remove oil cooler connector bolt. **DO NOT** disconnect coolant lines from oil cooler. Reposition oil cooler.
5. Remove filter adapter attaching bolts.



- 1 - OIL FILTER ADAPTER
- 2 - GASKET
- 3 - OIL PAN

G01857837

**Fig. 166: Removing Oil Filter Adaptor**  
 Courtesy of DAIMLERCHRYSLER CORP.

6. Remove filter adaptor and gasket.

## INSTALLATION

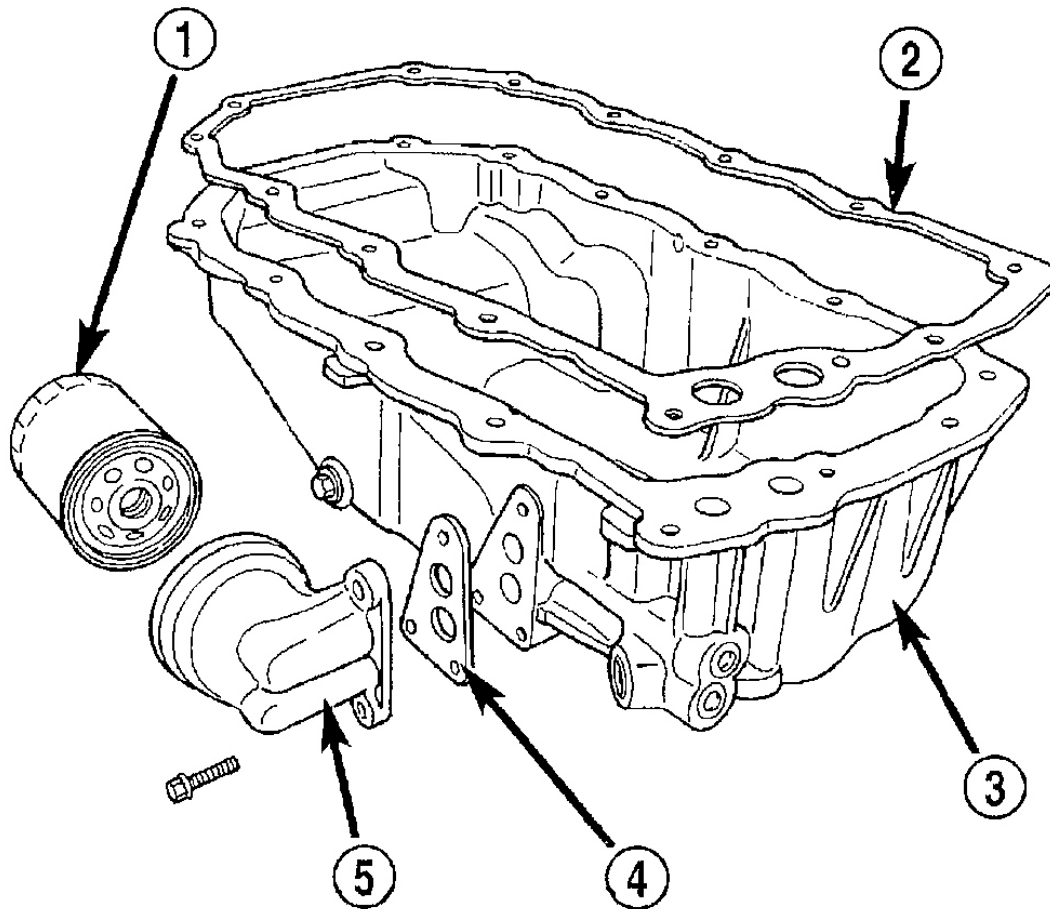
1. Clean all gasket sealing surfaces
2. Install gasket and filter adaptor to oil pan. Tighten bolts to 12 N.m (105 in. lbs.).
3. **Turbocharger Equipped Vehicles:**
  - Replace oil cooler seal
  - Lubricate seal and position oil cooler to oil filter adapter, aligning notch to tab
  - Install oil cooler connector bolt. Torque connector bolt to 55 N.m (41 ft. lbs.).

4. Install oil filter. See **OIL FILTER**.
5. Lower vehicle and check engine oil level. Adjust level as necessary.

## **OIL PAN**

### **REMOVAL**

1. Raise vehicle on hoist.
2. Drain engine oil and remove oil filter.
3. Remove accessory drive belt splash shield.
4. **Turbocharger Equipped Vehicles:** Remove turbocharger to charge air cooler hose assembly. See **EXHAUST SYSTEM & TURBO CHARGER** article.
5. **Turbocharger Equipped Vehicles:** Remove oil cooler connector bolt. **DO NOT** disconnect coolant lines from oil cooler. Reposition oil cooler.
6. Remove structural collar. See **STRUCTURAL COLLAR**.
7. Remove lower torque strut. See **TORQUE STRUT**.
8. Remove oil filter adapter and gasket.



- 1 - OIL FILTER
- 2 - OIL PAN GASKET
- 3 - OIL PAN
- 4 - ADAPTER GASKET
- 5 - OIL FILTER ADAPTER

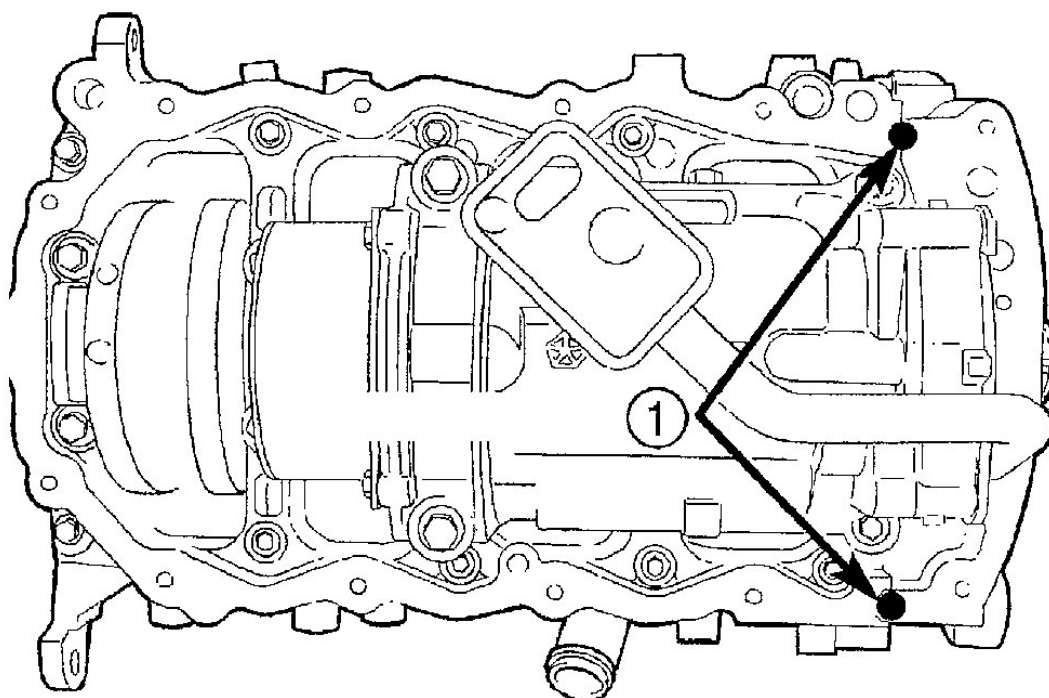
G01857838

**Fig. 167: Removing Oil Pan**  
 Courtesy of DAIMLERCHRYSLER CORP.

- 9. Remove oil pan and gasket.
- 10. Clean oil pan and all gasket surfaces.

## INSTALLATION

- 1. Apply Mopar® Engine RTV GEN II at the oil pump to engine block parting lines.



#### 1 - SEALER LOCATIONS

G01857839

#### **Fig. 168: Sealing Oil Pan**

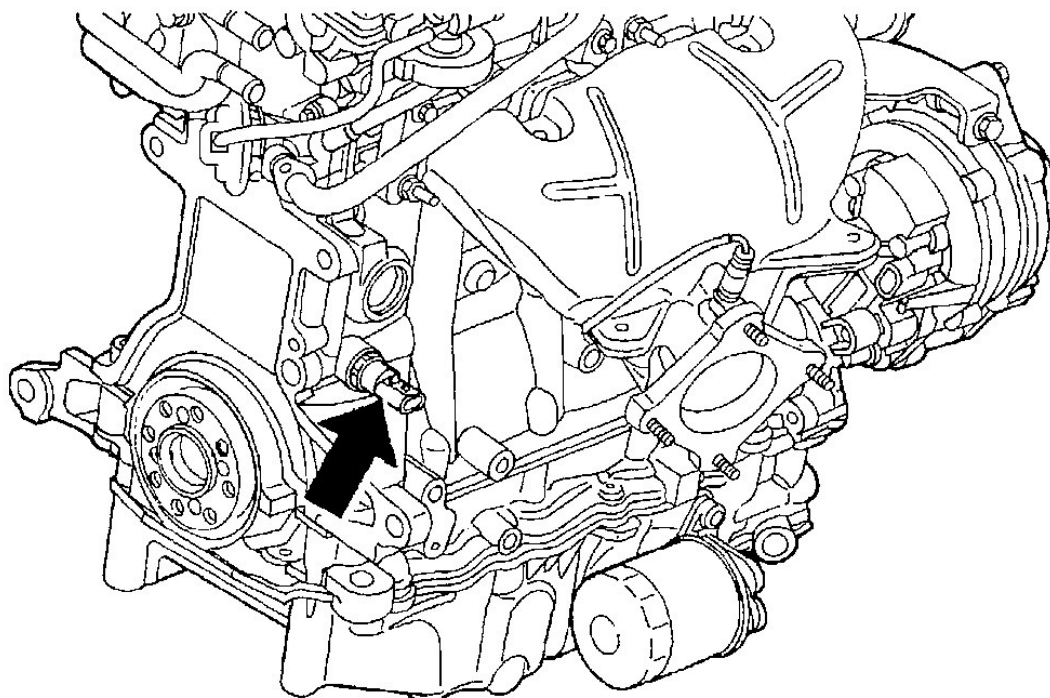
Courtesy of DAIMLERCHRYSLER CORP.

2. Install oil pan gasket to the block.
3. Install pan gasket and pan. Tighten screws to 12 N.m (105 in. lbs.).
4. Install oil filter adapter and gasket. Tighten screws to 12 N.m (105 in. lbs.).
5. **Turbocharger Equipped Vehicles:**
  - Replace oil cooler seal
  - Lubricate seal and position oil cooler to oil filter adapter, aligning notch to tab
  - Install oil cooler connector bolt. Torque connector bolt to 55 N.m (41 ft. lbs.)
6. Install oil drain plug and oil filter.
7. Install structural collar. See **STRUCTURAL COLLAR**.
8. Install lower torque strut. See **TORQUE STRUT**.
9. **Turbocharger Equipped Vehicles:** Install turbocharger to charge air cooler hose assembly. See **EXHAUST SYSTEM & TURBO CHARGER** article.
10. Lower vehicle and fill engine crankcase with proper oil to correct level.

## OIL PRESSURE SENSOR/SWITCH

### DESCRIPTION

The oil pressure switch is located on the right rear side of the engine block. The oil pressure switch is a pressure sensitive switch that is activated by the engine's oil pressure (in the main oil gallery). The switch is a two terminal device (one terminal is provided to the wiring harness and the other terminal is the switch's metal housing that screws into the engine block).



G01857840

**Fig. 169: Locating Engine Oil Pressure Switch**  
Courtesy of DAIMLERCHRYSLER CORP.

### OPERATION

The oil pressure switch is normally "Closed." The switch changes from a "Closed" circuit to an "Open" circuit, on increasing pressure of 7 psi. The oil pressure switch changes from an "Open" circuit to a "Closed" circuit, on decreasing pressure, between 2 psi and 4 psi.

### REMOVAL

1. Raise vehicle.
2. Position oil collecting container under pressure switch location.



3. Disconnect oil pressure switch electrical connector and remove switch.

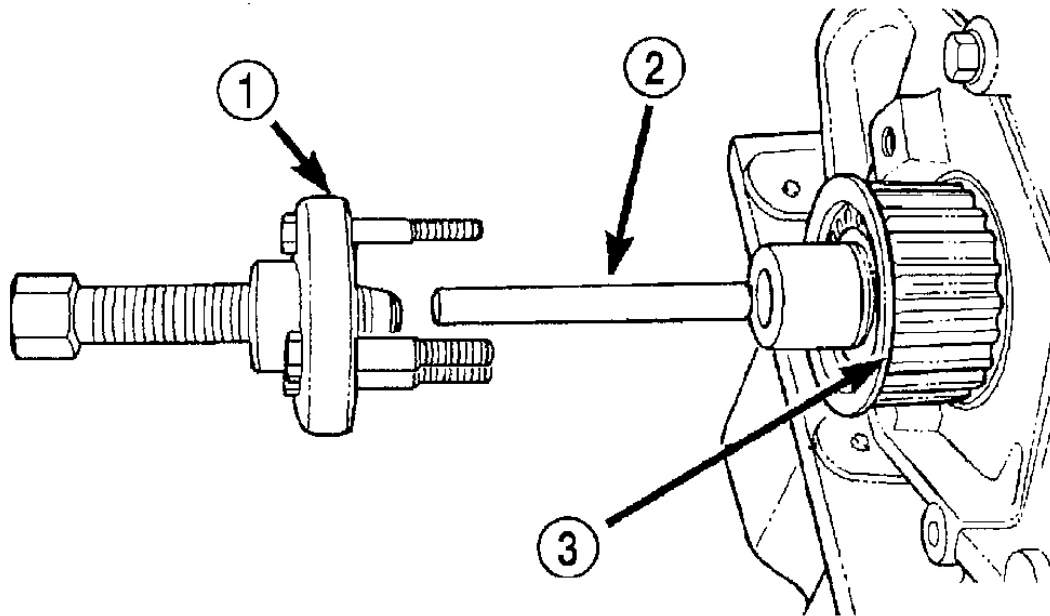
## INSTALLATION

1. Install oil pressure switch and connect electrical connector.
2. Lower vehicle.
3. Start engine and allow to run a minimum of 2 minutes.
4. Shut engine off and check engine oil level. Adjust level as necessary.

## OIL PUMP

### REMOVAL

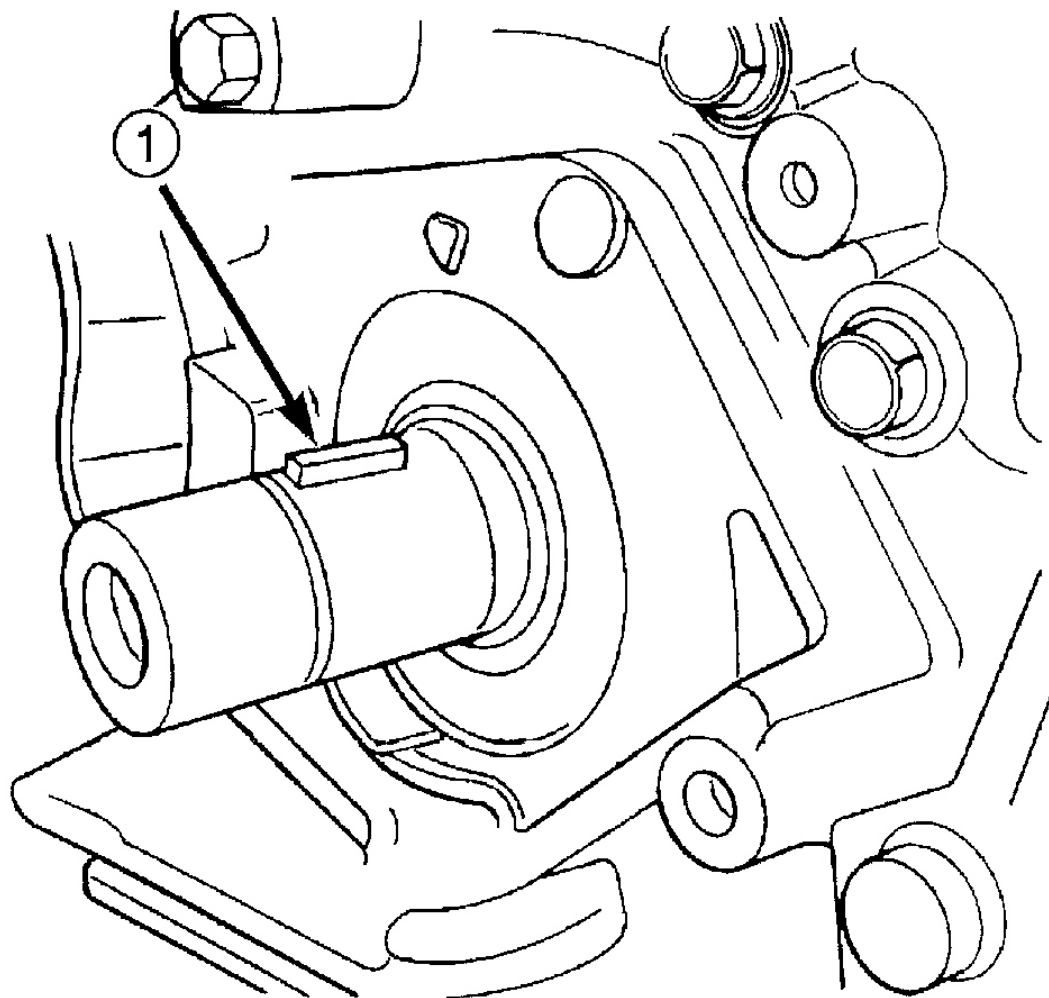
1. Disconnect negative cable from battery.
2. Remove timing belt. See **TIMING BELT AND SPROCKETS**.
3. Remove timing belt rear cover. See **TIMING BELT COVER(S)**.
4. Remove oil pan. See **OIL PAN**.
5. Remove crankshaft sprocket using Special Tools 6793 and C-4685-C2.



- 1 - SPECIAL TOOL 6793  
2 - SPECIAL TOOL C-4685-C2  
3 - CRANKSHAFT SPROCKET  
G01857841

**Fig. 170: Removing Crankshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

6. Remove crankshaft key.

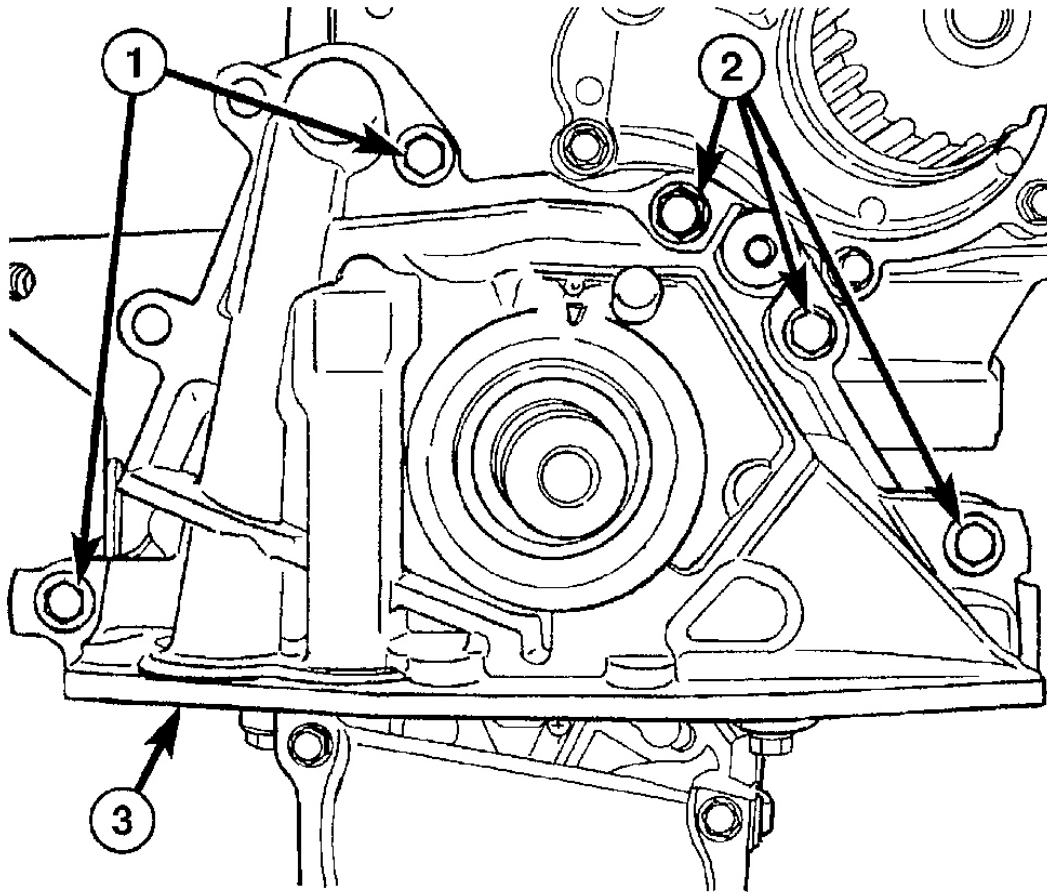


1 - CRANKSHAFT KEY

G01857842

**Fig. 171: Removing & Installing Crankshaft Key**  
**Courtesy of DAIMLERCHRYSLER CORP.**

7. Remove oil pick-up tube.
8. Remove oil pump and front crankshaft seal.



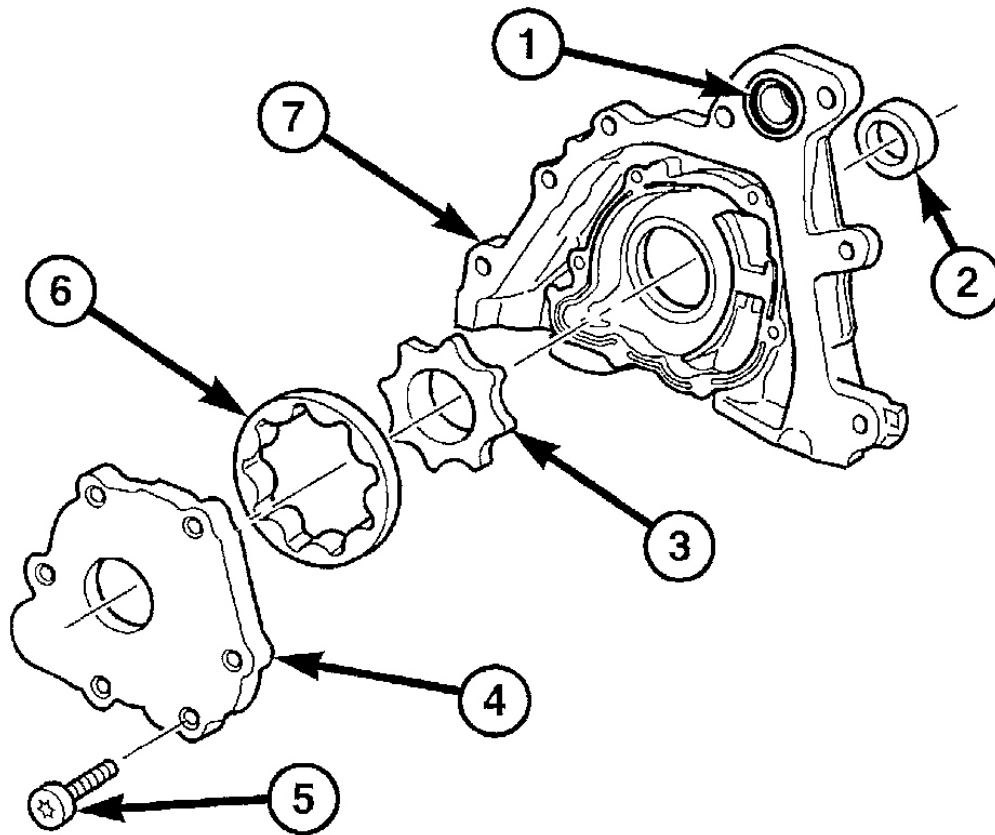
- 1 - BOLTS
- 2 - BOLTS
- 3 - OIL PUMP

G01857843

**Fig. 172: Removing Oil Pump**  
Courtesy of DAIMLERCHRYSLER CORP.

#### DISASSEMBLY

1. Remove oil pump cover fasteners, and lift off cover.



- 1 - O-RING
- 2 - FRONT CRANKSHAFT SEAL
- 3 - INNER ROTOR
- 4 - OIL PUMP COVER
- 5 - FASTENER
- 6 - OUTER ROTOR
- 7 - OIL PUMP BODY

G01857844

**Fig. 173: Disassembling Oil Pump**  
Courtesy of DAIMLERCHRYSLER CORP.

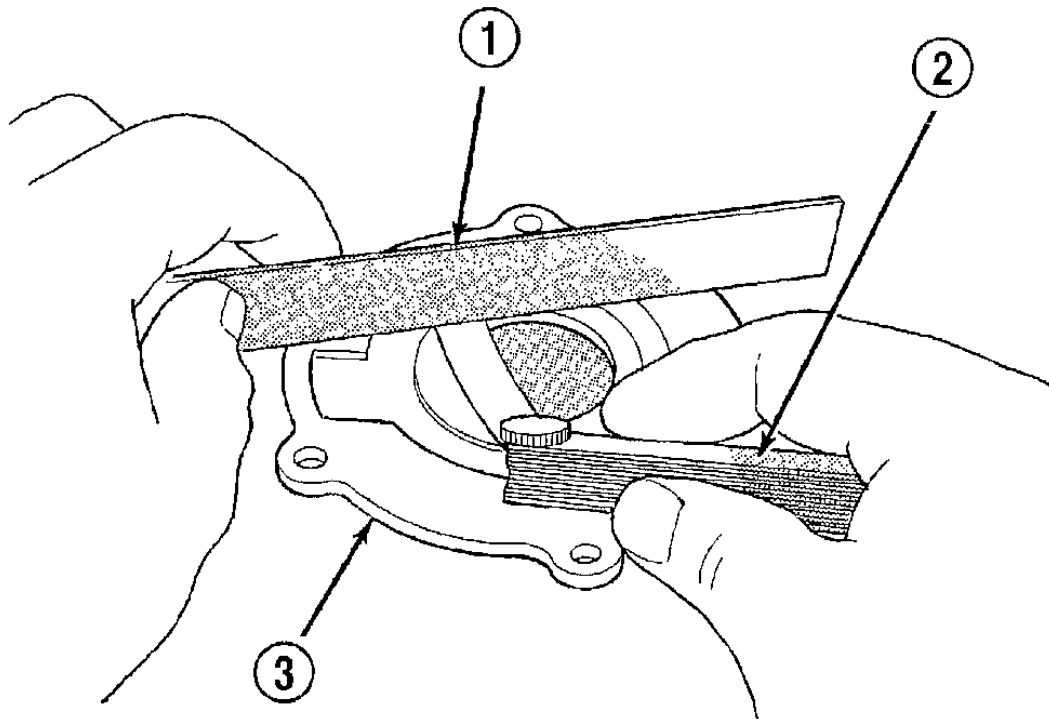
- 2. Remove pump rotors.
- 3. Wash all parts in a suitable solvent and inspect carefully for damage or wear.

## CLEANING

Clean all parts thoroughly.

**INSPECTION**

1. Inspect the mating surface of the oil pump. Surface should be smooth. Replace pump cover if scratched or grooved.
2. Lay a straightedge across the pump cover surface. If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

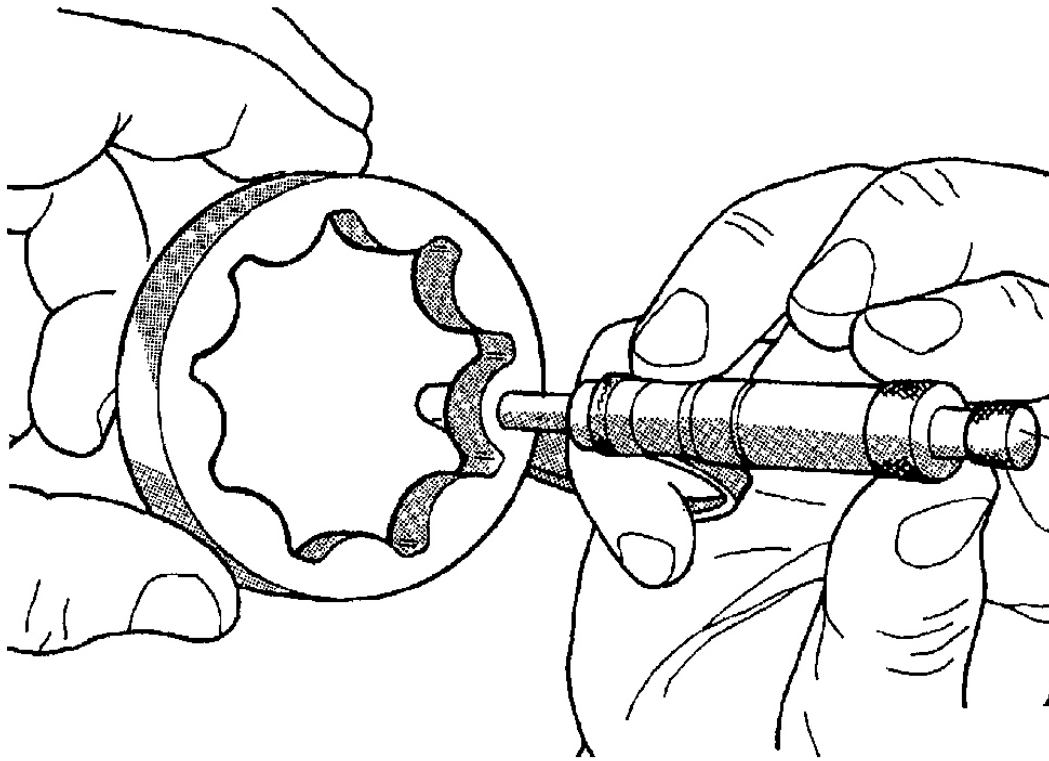


- 1 - STRAIGHT EDGE  
2 - FEELER GAUGE  
3 - OIL PUMP COVER

G01857845

**Fig. 174: Checking Oil Pump Cover Flatness**  
**Courtesy of DAIMLERCHRYSLER CORP.**

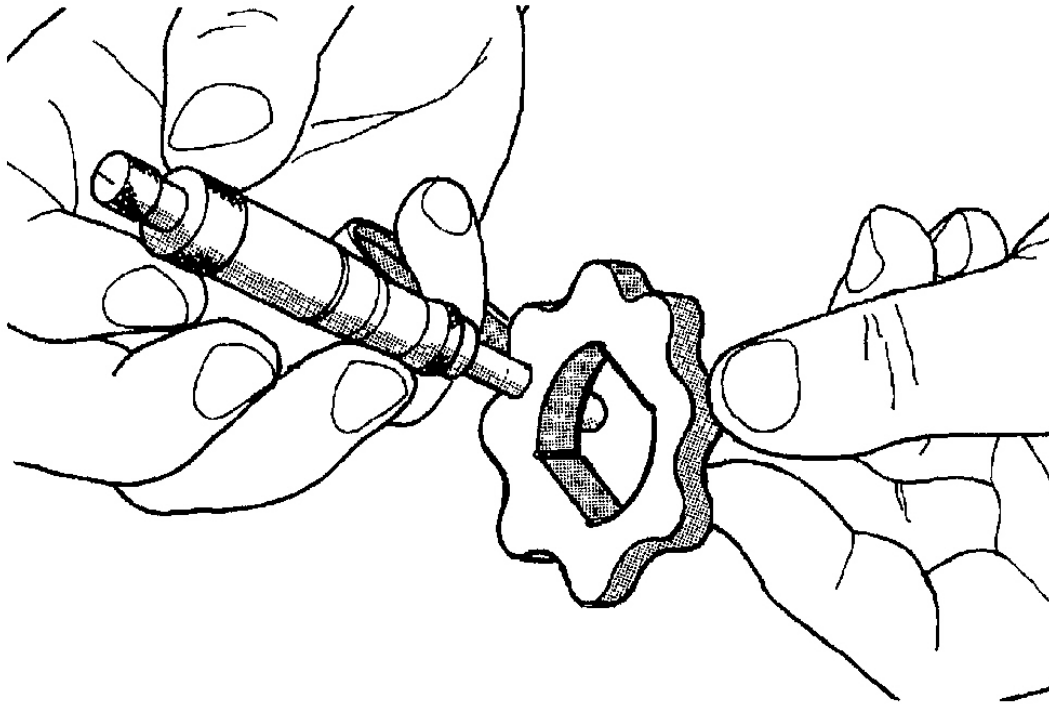
3. Measure thickness and diameter of outer rotor. If outer rotor thickness measures 10.699 mm (0.421 in.) or less, or if the diameter is 85.924 mm (3.383 in.) or less, replace outer rotor.



G01857846

**Fig. 175: Measuring Outer Rotor Thickness**  
**Courtesy of DAIMLERCHRYSLER CORP.**

4. If inner rotor measures 10.699 mm (0.421 in.) or less replace inner rotor.



G01857847

**Fig. 176: Measuring Inner Rotor Thickness**  
Courtesy of DAIMLERCHRYSLER CORP.

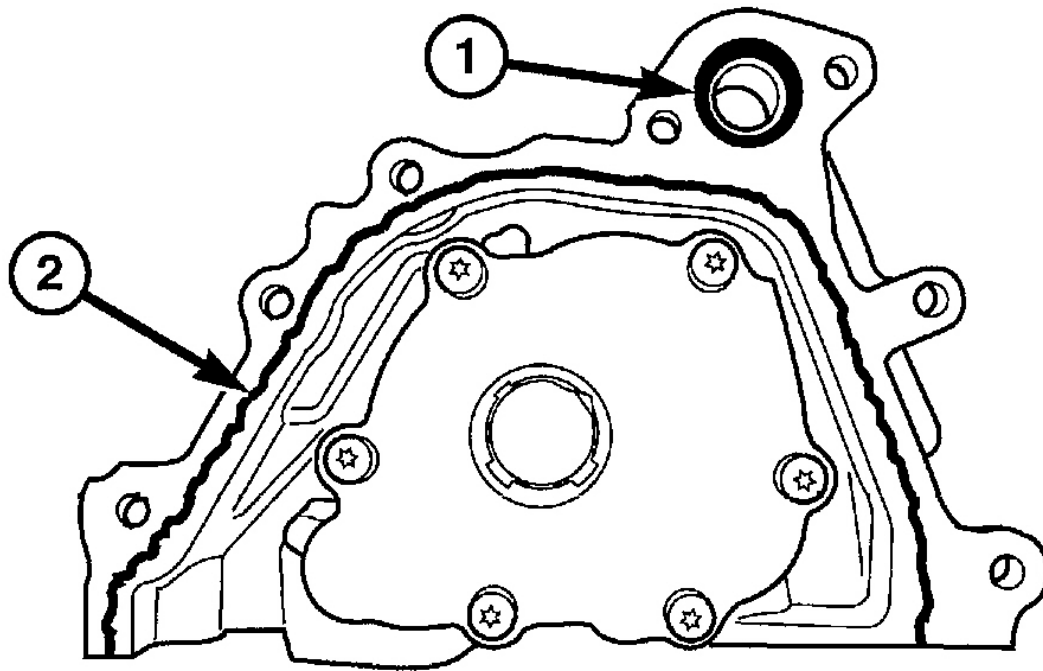
## ASSEMBLY

1. Assemble pump, using new parts as required. **Install the inner rotor with chamfer facing the cast iron oil pump cover.**
2. Prime oil pump before installation by filling rotor cavity with engine oil.
3. Install cover and tighten fasteners to 13 N.m (118 in. lbs.). See **Fig. 173**.

## INSTALLATION

1. Make sure all surfaces are clean and free of oil and dirt.
2. Apply Mopar® Gasket Maker to oil pump as shown. Install O-ring into oil pump body discharge passage.





1 - O-RING

2 - SEALER LOCATION

G01857848

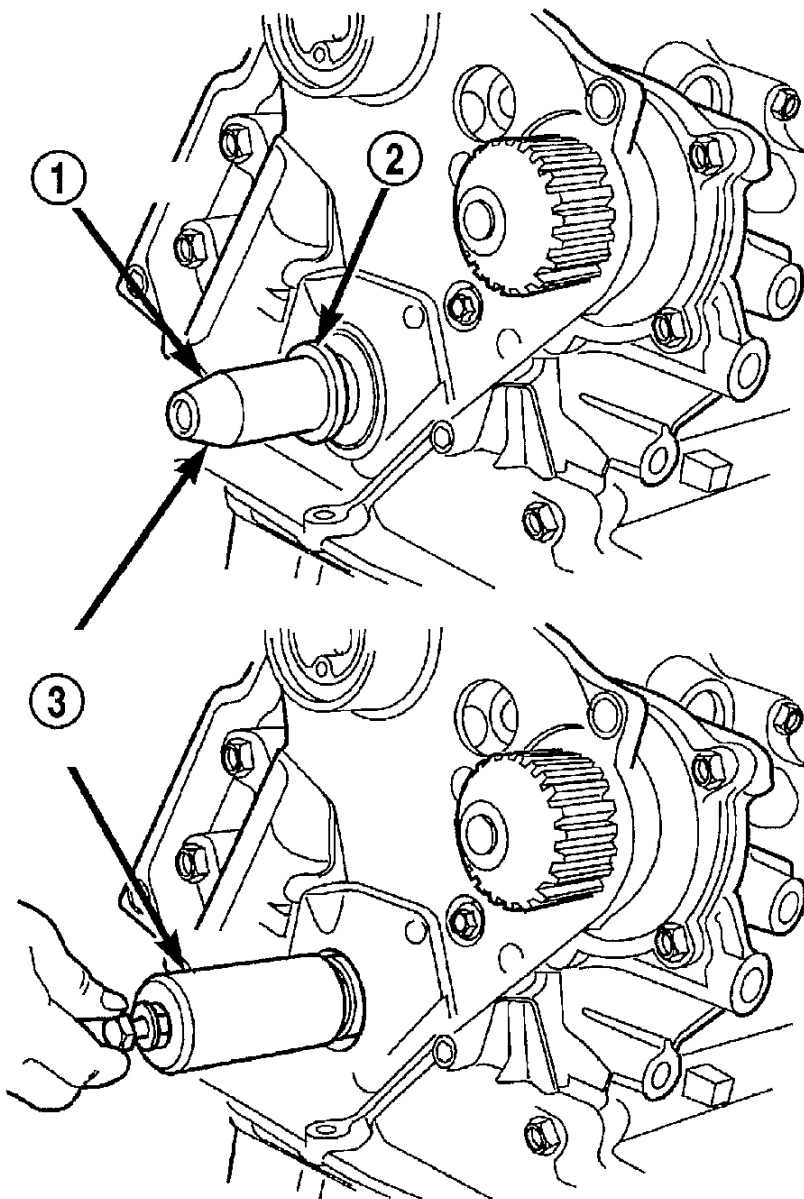
**Fig. 177: Sealing Oil Pump**

Courtesy of DAIMLERCHRYSLER CORP.

3. Prime oil pump with engine oil before installation.

**CAUTION:** To align, the front crankshaft seal **MUST** be out of pump, or damage may result.

4. Align oil pump rotor flats with flats on crankshaft. Install the oil pump to the block. See **Fig. 172**.
5. Install new front crankshaft seal using Special Tool 6780.



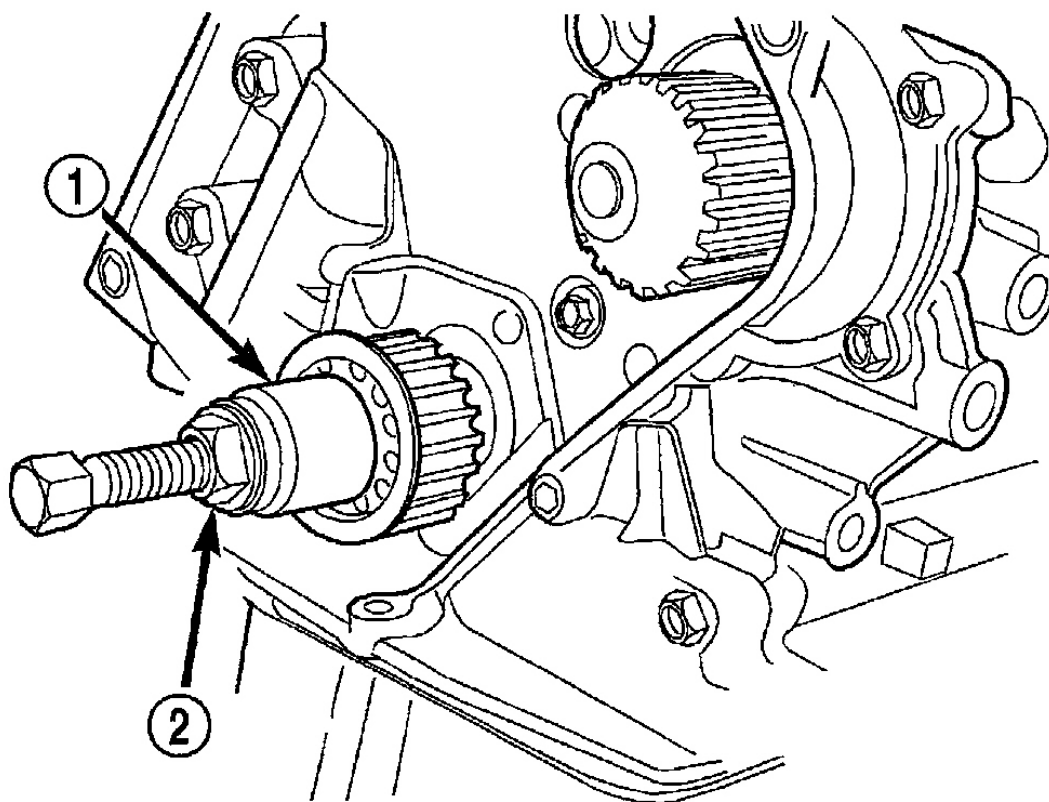
- 1 - PROTECTOR
- 2 - SEAL
- 3 - SPECIAL TOOL 6780

G01857849

**Fig. 178: Installing Front Crankshaft Seal**  
Courtesy of DAIMLERCHRYSLER CORP.

6. Install crankshaft key. See **Fig. 171**.

**CAUTION:** The crankshaft sprocket is set to a predetermined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.



- 1 - SPECIAL TOOL 6792  
2 - TIGHTEN NUT TO INSTALL

G01857850

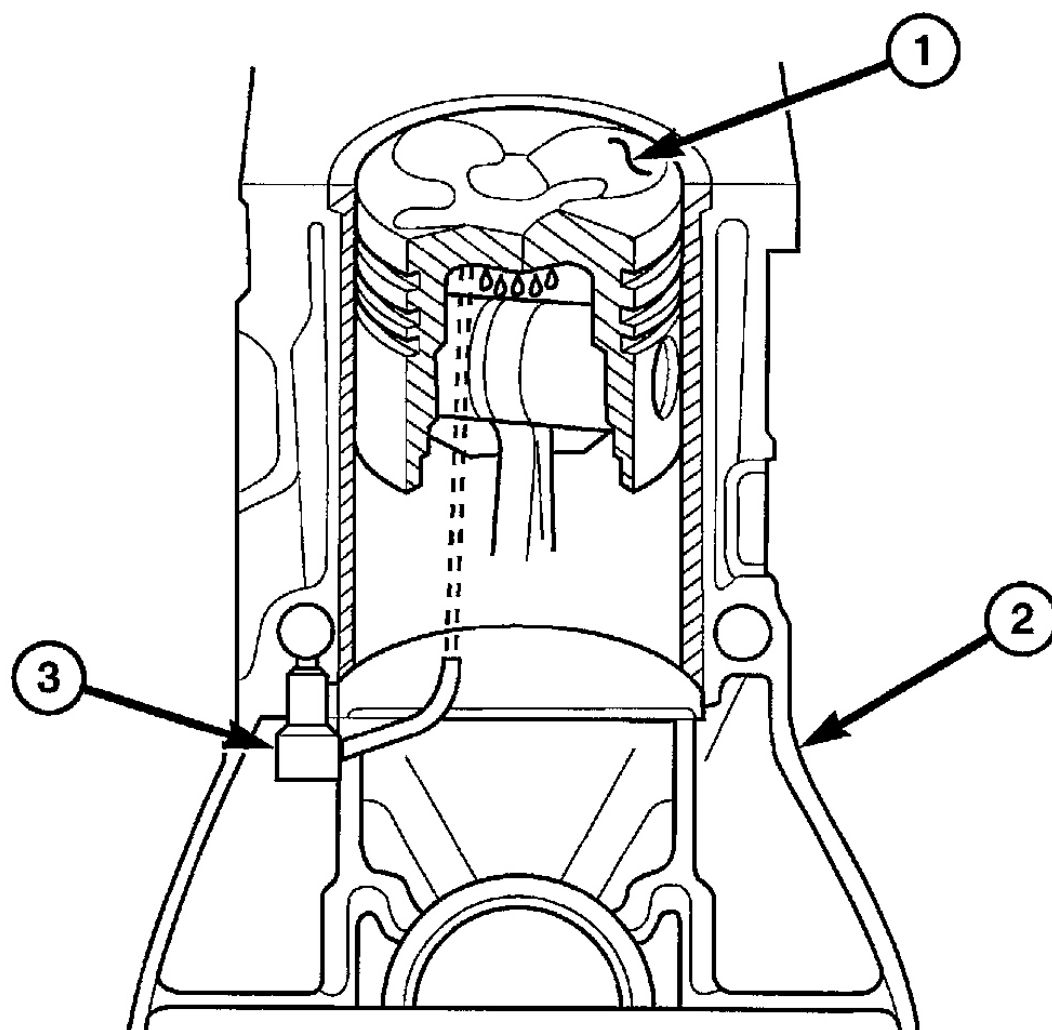
**Fig. 179: Installing Crankshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

7. Install crankshaft sprocket using Special Tool 6792.
8. Install oil pump pick-up tube.
9. Install oil pan. See **OIL PAN**.
10. Install timing belt rear cover. See **TIMING BELT COVER(S)**.
11. Install timing belt. See **TIMING BELT AND SPROCKETS**.

## **OIL JET - 2.4L TURBO**

### **DESCRIPTION**

The 2.4L Turbocharged engines are equipped with four oil jets installed in the engine block. The oil jets are provided engine oil pressure from the main oil gallery. The oil jets are used to cool the pistons. An integral check ball controls the flow of oil through the oil jet.



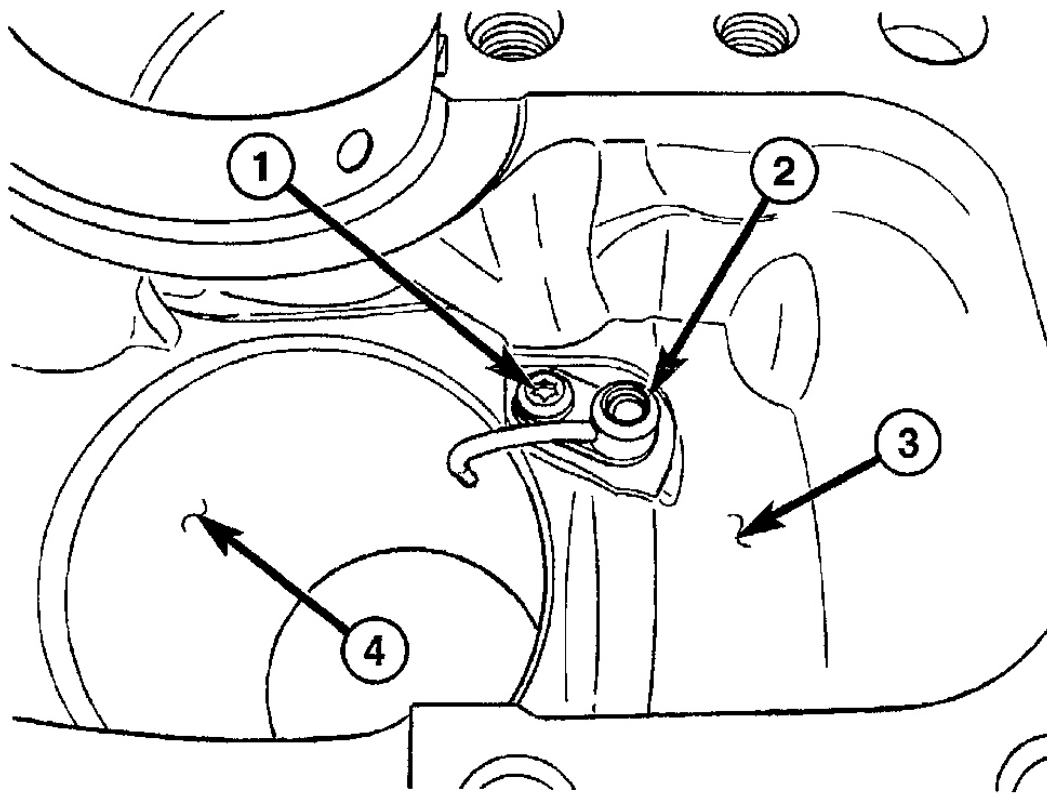
- 1 - PISTON ASSEMBLY
- 2 - ENGINE BLOCK
- 3 - OIL JET

G01857851

**Fig. 180: Identifying Oil Jet - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

## REMOVAL

1. Remove crankshaft. See CRANKSHAFT.
2. Remove oil jet fastener.



1 - FASTENER - 12 N·m (105 in. lbs.)

2 - OIL JET

3 - ENGINE BLOCK

4 - CYLINDER WALL

G01857852

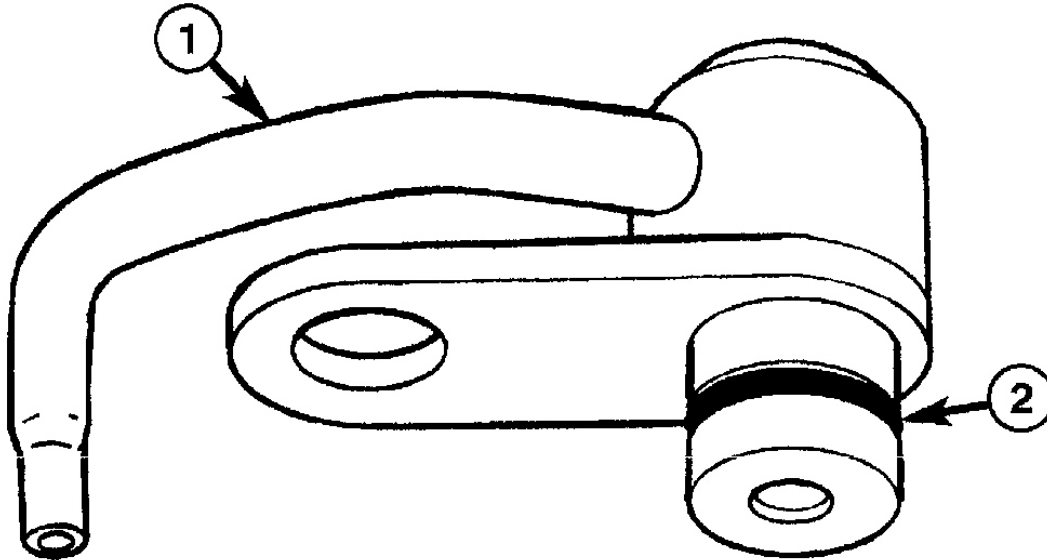
**Fig. 181: Removing & Installing Oil Jet Fasteners - Turbo**  
 Courtesy of DAIMLERCHRYSLER CORP.

**CAUTION: Do Not Pull on Oil Jet Tube**

3. Using pliers or other similar tool, pull oil jet from engine block.

## INSTALLATION

1. Inspect oil jet o-ring.



1 - OIL JET  
2 - O-RING

G01857853

**Fig. 182: Inspecting Oil Jet O-Ring**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Lightly coat o-ring with clean engine oil.
3. Push oil jet into engine block until it is fully seated.

**CAUTION:** Ensure oil jet is fully seated in engine block before installing fastener. Do Not use the oil jet fastener to draw the oil jet into the engine block. Damage to oil jet may occur.

4. Install oil jet fastener. Torque fastener to 12 N.m (105 in. lbs.). See **Fig. 181**.
5. Install crankshaft. See **CRANKSHAFT**.

## OIL COOLER & LINES - 2.4L TURBO

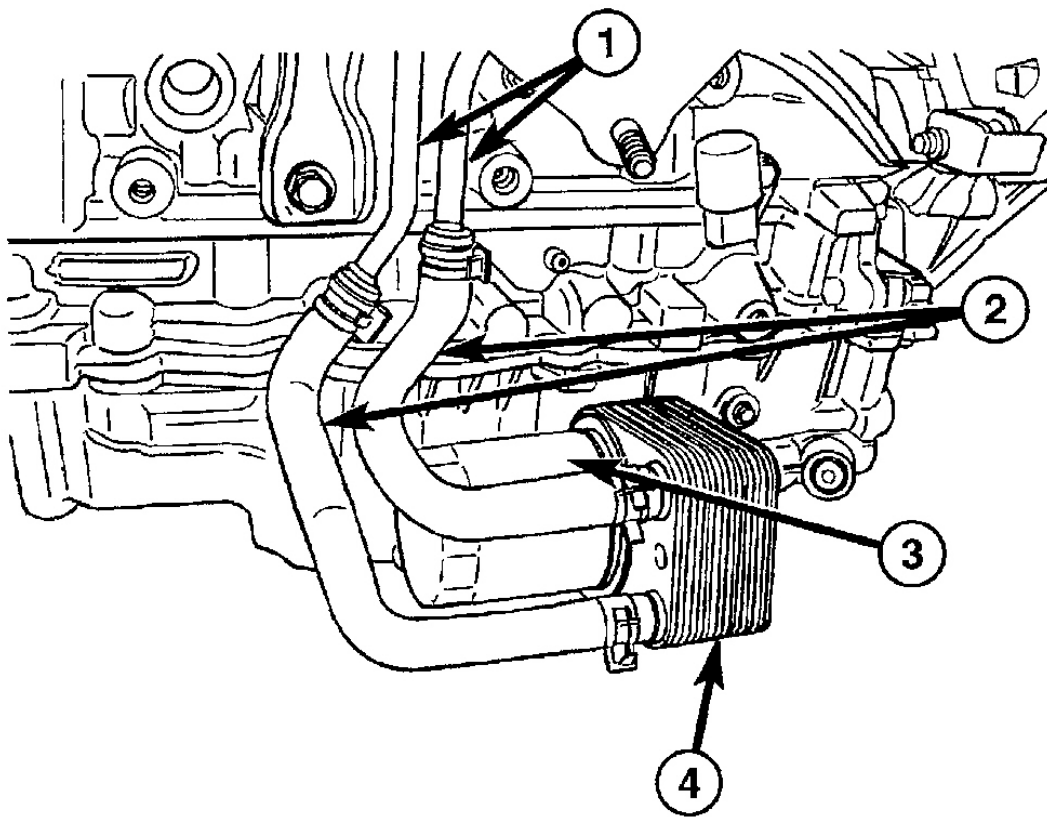
### DESCRIPTION

An engine oil cooler is used on the 2.4L Turbocharged engine. The cooler is a coolant-to-oil type and mounted

between the oil filter and oil filter adapter.

## REMOVAL

1. Raise vehicle on hoist.
2. Drain cooling system. See **COOLING SYSTEM MECHANICAL** article.
3. Disconnect oil cooler coolant hoses.



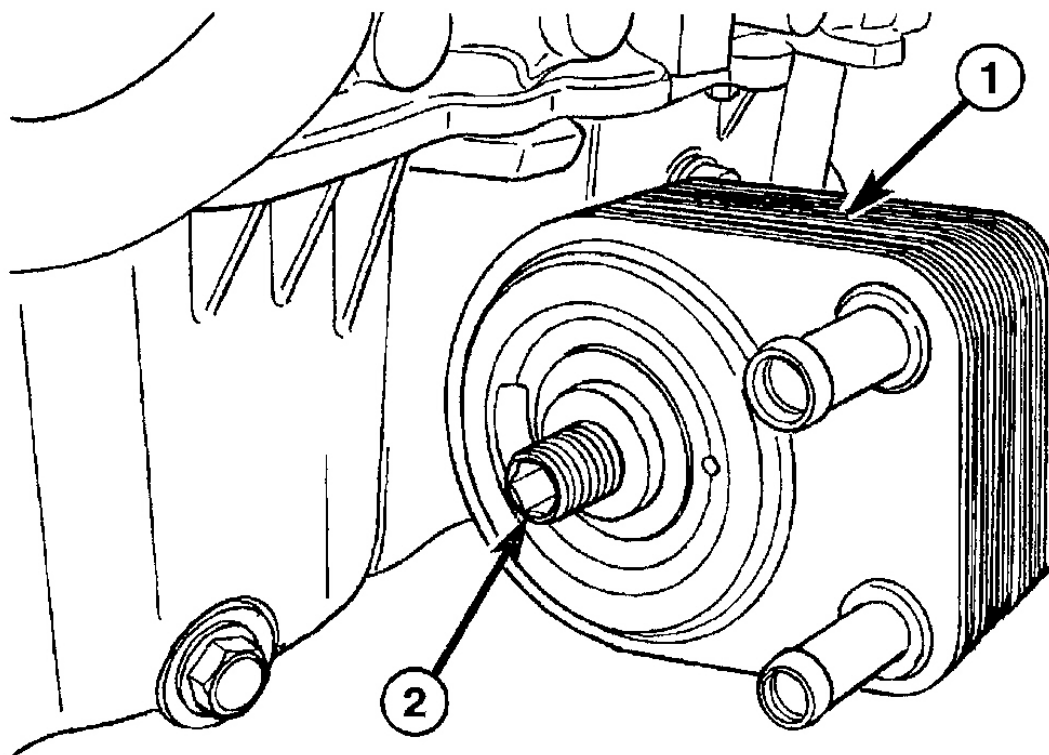
- 1 - COOLANT TUBES
- 2 - COOLANT HOSES
- 3 - OIL FILTER
- 4 - OIL COOLER

G01857854

**Fig. 183: Identifying Oil Cooler & Lines**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Remove oil filter.
5. Remove oil cooler connector bolt.





- 1 - OIL COOLER
- 2 - CONNECTOR BOLT

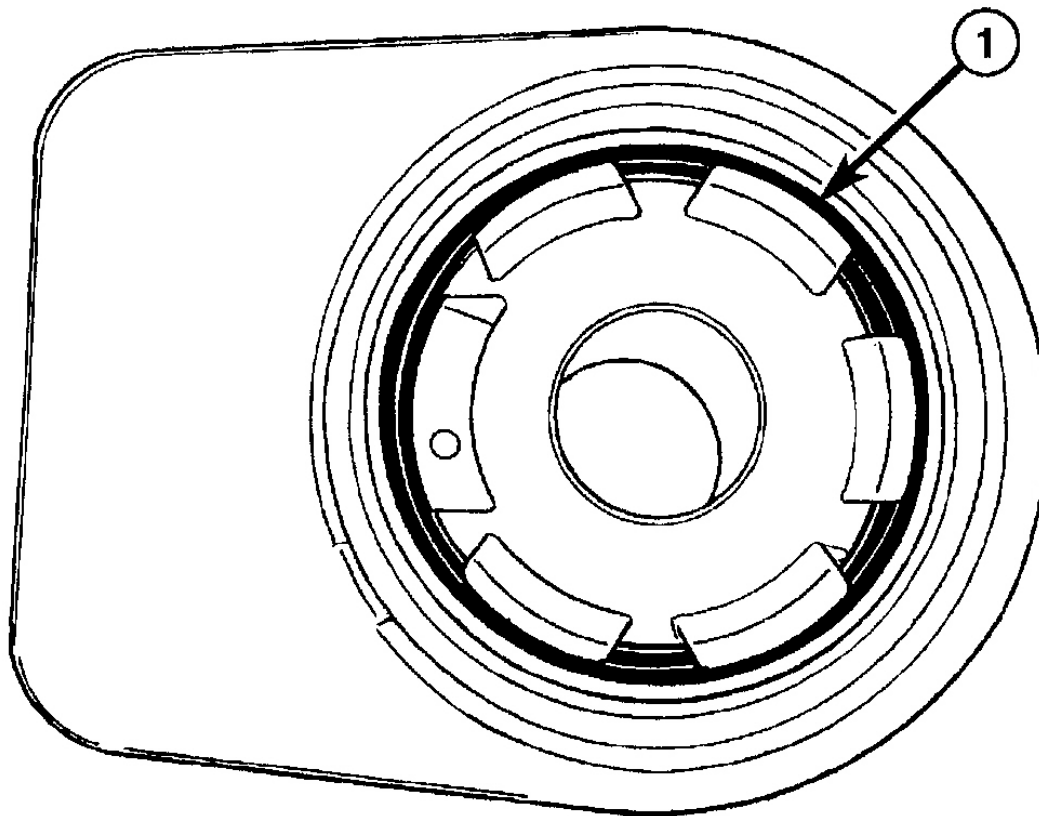
G01857855

**Fig. 184: Locating Oil Cooler Connector Bolt**  
Courtesy of DAIMLERCHRYSLER CORP.

6. Remove oil cooler.

## INSTALLATION

1. Replace oil cooler seal.

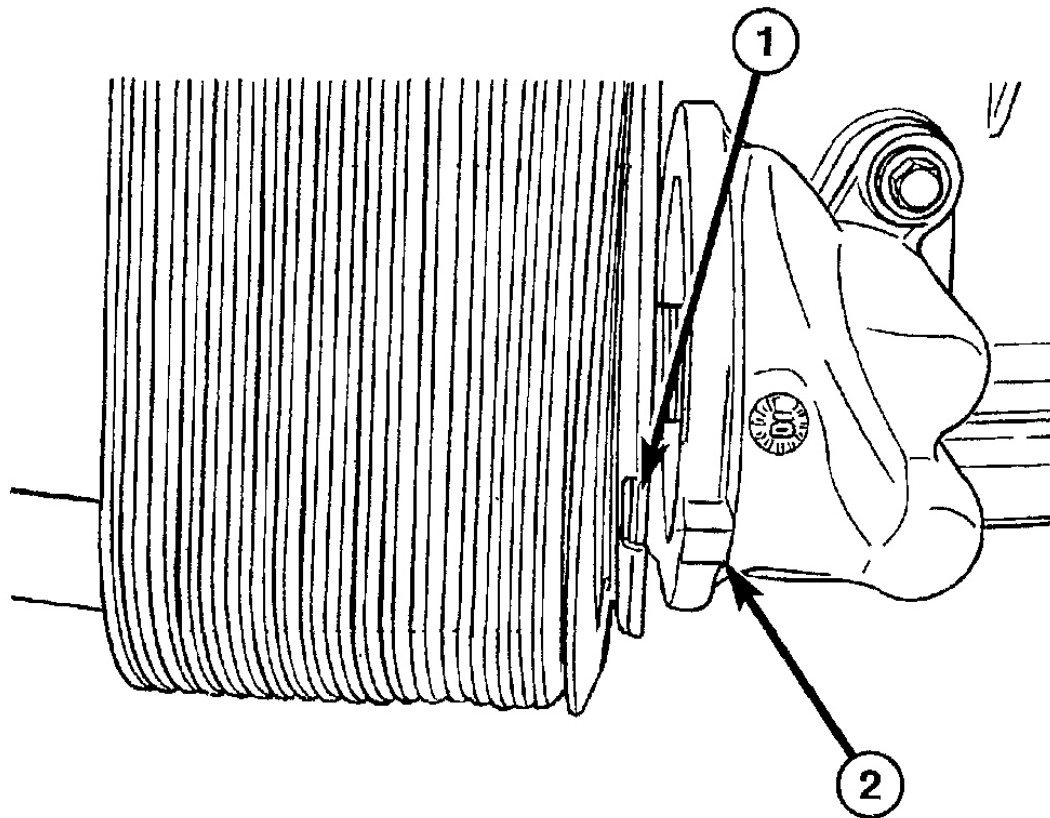


1 - OIL COOLER SEAL

G01857856

**Fig. 185: Installing Oil Cooler Seal**  
**Courtesy of DAIMLERCHRYSLER CORP.**

2. Lubricate seal and position oil cooler to oil filter adapter, aligning notch to tab.



1 - NOTCH

2 - TAB

G01857857

**Fig. 186: Aligning Oil Cooler**

Courtesy of DAIMLERCHRYSLER CORP.

3. Install oil cooler connector bolt. Torque connector bolt to 55 N.m (41 ft. lbs.). See **Fig. 184**.
4. Install oil filter.
5. Connect oil cooler coolant hoses. See **Fig. 183**.
6. Lower vehicle.
7. Fill cooling system. See **COOLING SYSTEM MECHANICAL** article.

## INTAKE MANIFOLD

### 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.**

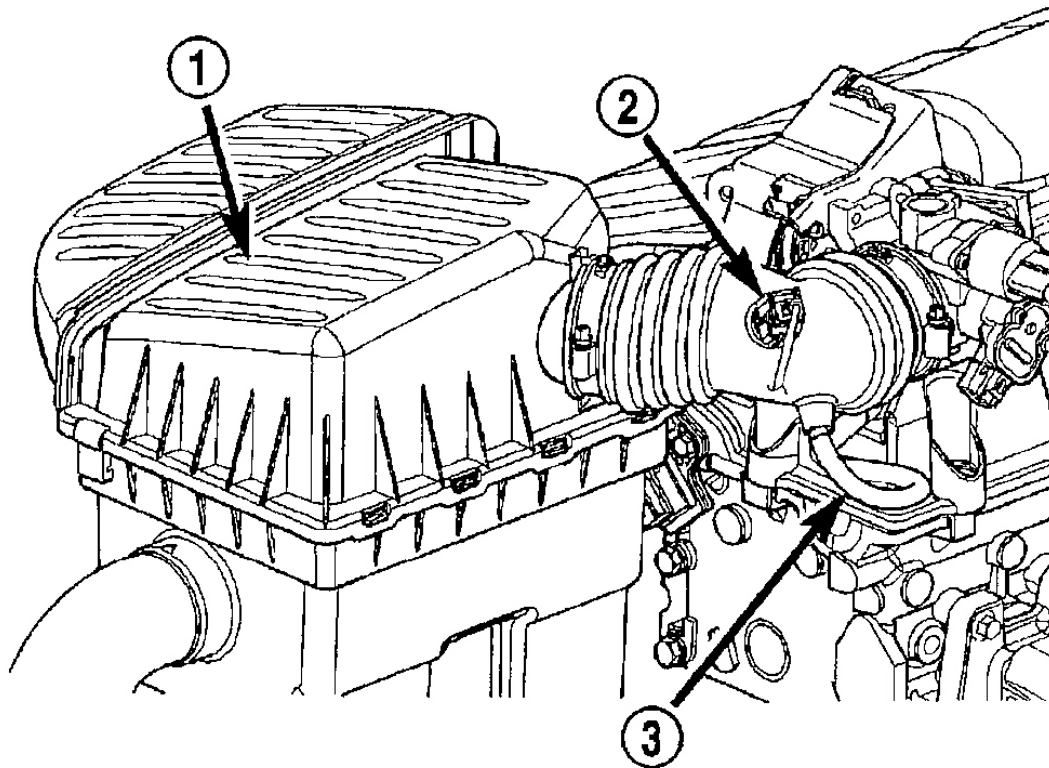
1. Start the engine.
2. Spray a small stream of water (Spray Bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.
4. Repair as required.

## **REMOVAL**

### **REMOVAL - UPPER INTAKE MANIFOLD**

#### **Non-Turbo**

1. Disconnect inlet air temperature sensor and make-up air hose from clean air hose.

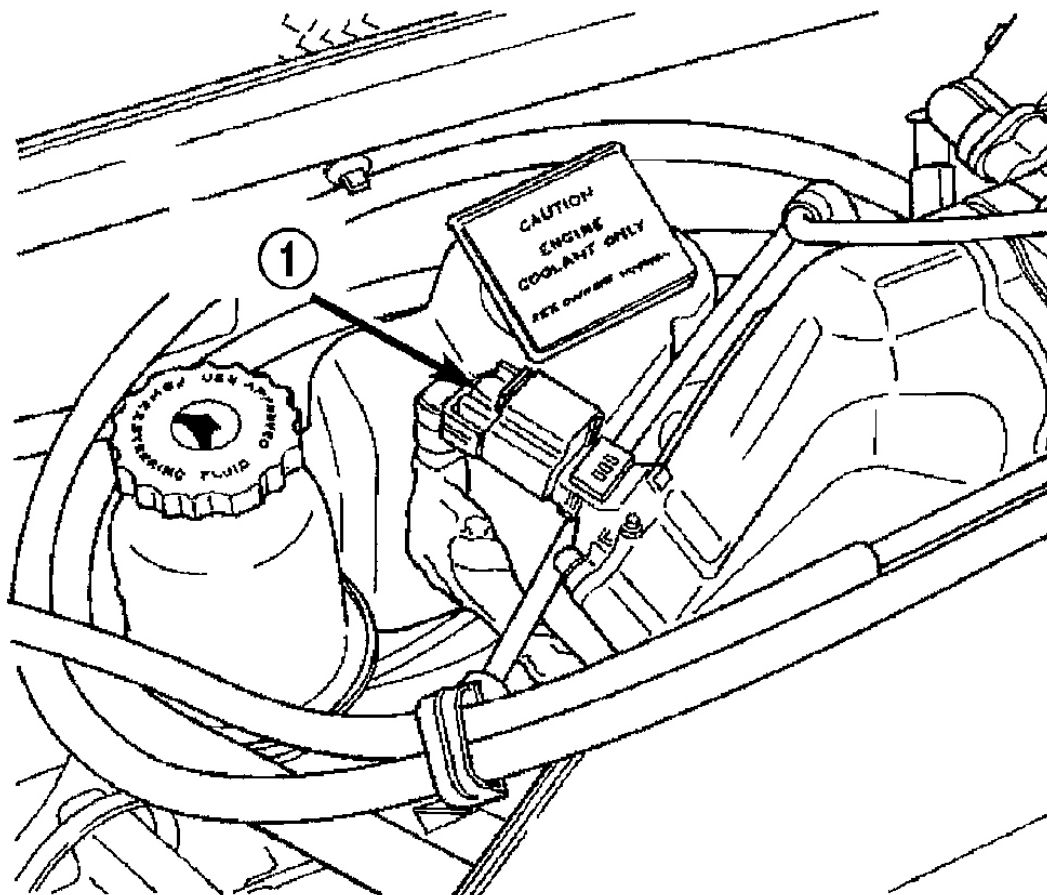


- 1 - AIR CLEANER HOUSING
- 2 - INLET AIR TEMPERATURE SENSOR
- 3 - MAKE-UP AIR HOSE

G01857858

**Fig. 187: Identifying Clean Air Hoses**  
**Courtesy of DAIMLERCHRYSLER CORP.**

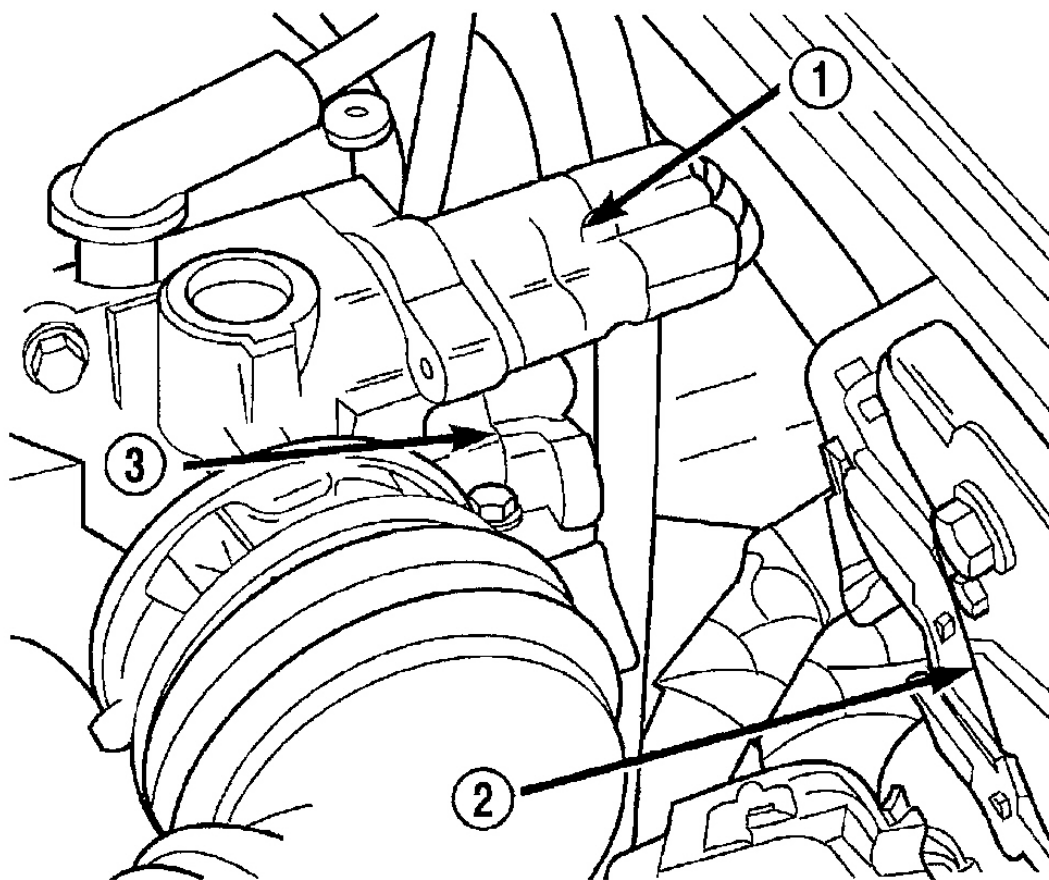
2. Remove air cleaner housing and clean air hose assembly.
3. Disconnect negative cable from battery.
4. Remove throttle and speed control cables from throttle lever and bracket.
5. Disconnect manifold absolute pressure (MAP) sensor, idle air control (IAC) motor and throttle position sensor (TPS) wiring connectors.



1 - MAP SENSOR

G01857859

**Fig. 188: Locating MAP Sensor**  
Courtesy of DAIMLERCHRYSLER CORP.



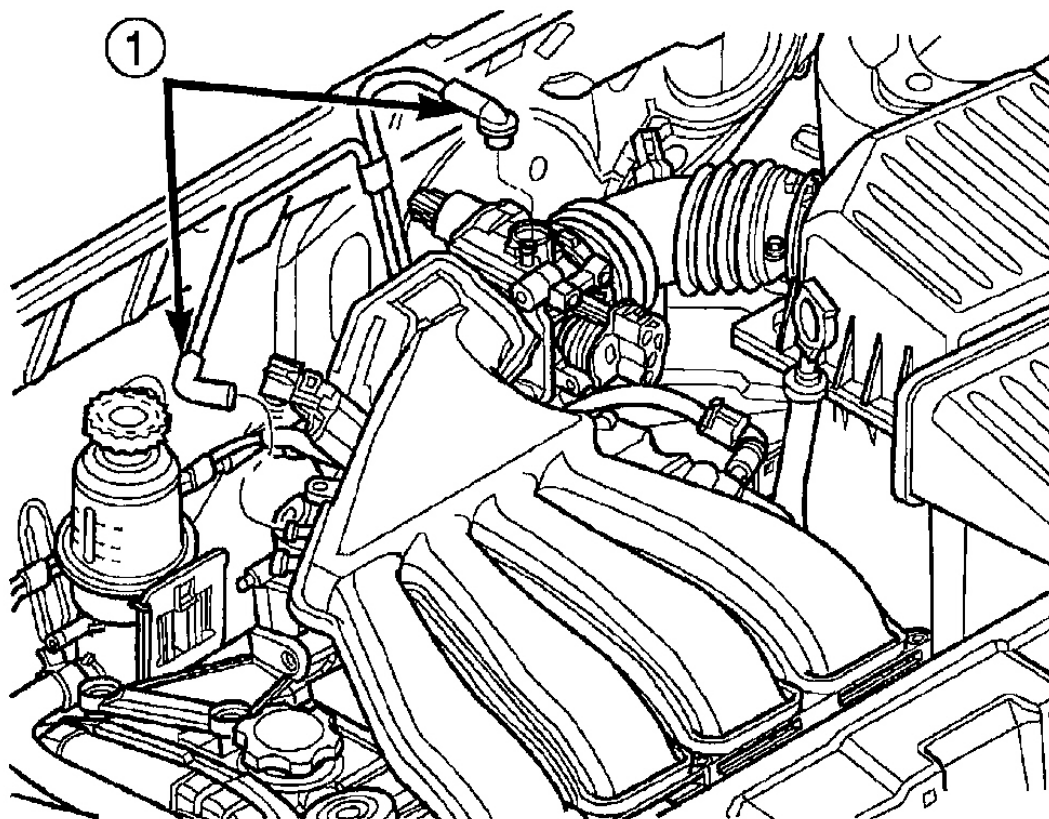
- 1 - IAC
- 2 - PCM
- 3 - TPS

G01857860

**Fig. 189: Locating Idle Air Control (IAC) Motor and Throttle Position Sensor (TPS) Wiring Connectors**

**Courtesy of DAIMLERCHRYSLER CORP.**

6. Disconnect proportional purge hoses.



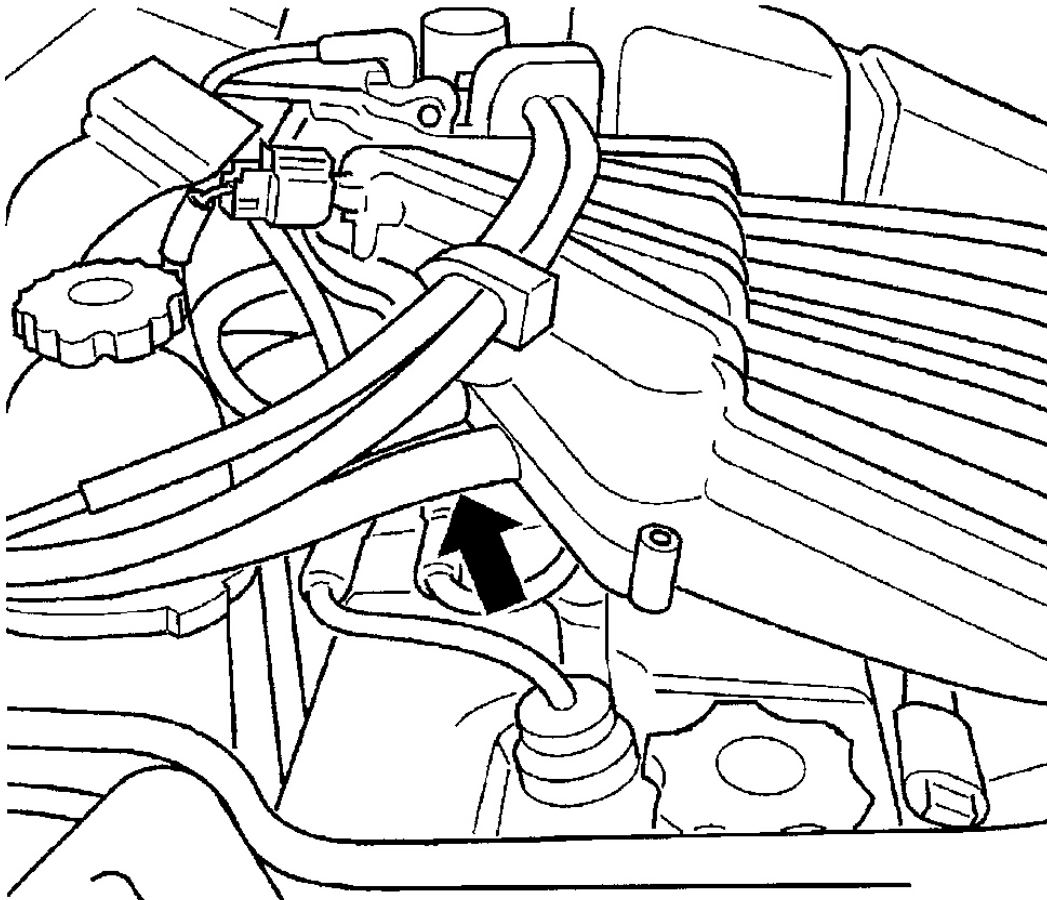
1 - PROPORTIONAL PURGE HOSES

G01857861

**Fig. 190: Disconnecting Proportional Purge Hoses**  
Courtesy of DAIMLERCHRYSLER CORP.

7. Disconnect brake booster hose.

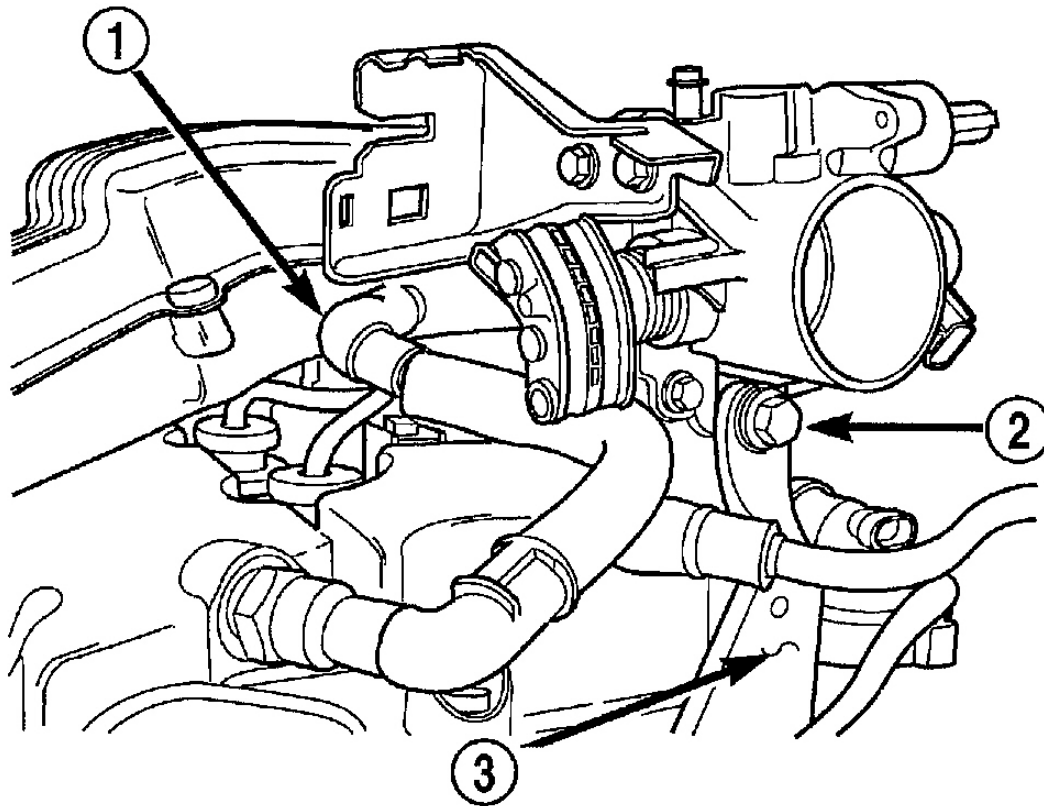




G01857862

**Fig. 191: Disconnecting Brake Booster Hose**  
Courtesy of DAIMLERCHRYSLER CORP.

8. Disconnect PCV hose from intake manifold.

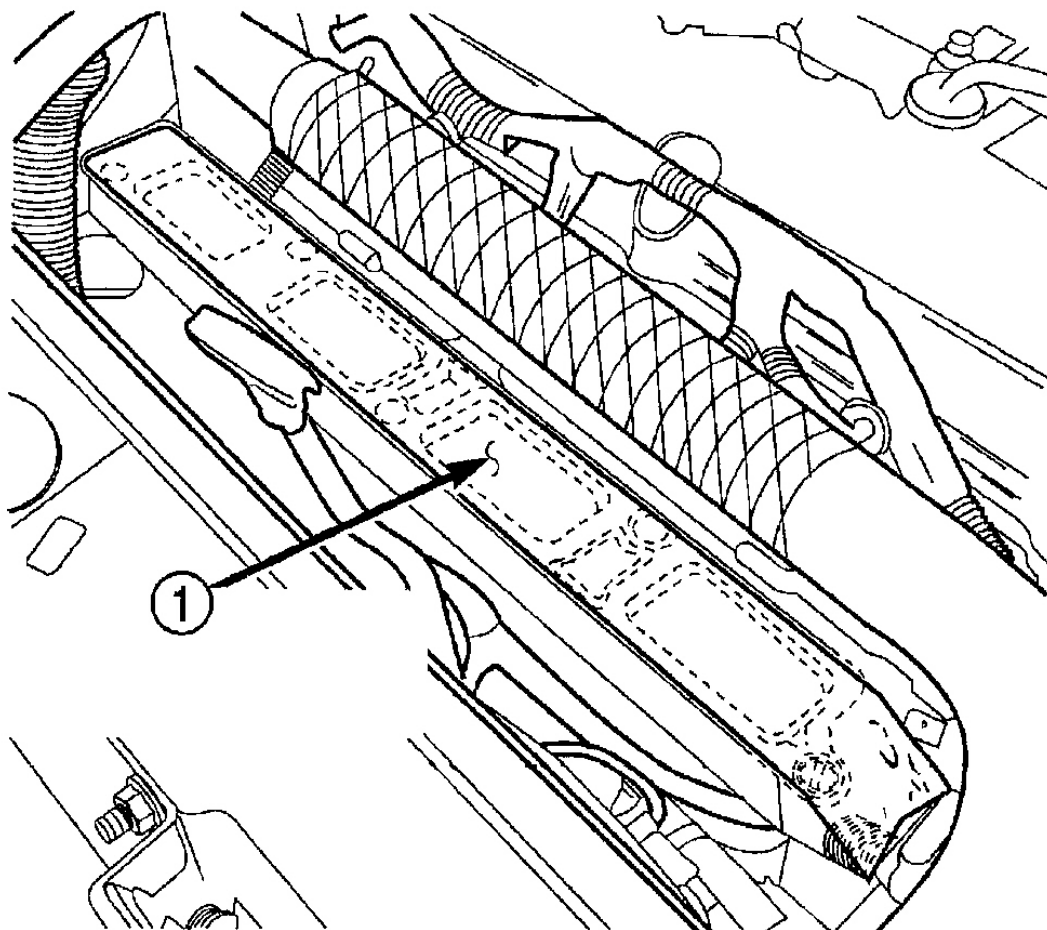


- 1 - PCV HOSE
- 2 - BOLT
- 3 - SUPPORT BRACKET

G01857863

**Fig. 192: Disconnecting Throttle Body Support Bracket & PCV Hose**  
Courtesy of DAIMLERCHRYSLER CORP.

9. Remove throttle body support bracket bolt at the throttle body.
10. Remove upper intake manifold fasteners. See **Fig. 204**.
11. Remove upper intake manifold.
12. If further service is required, cover the lower intake manifold openings to prevent foreign materials from entering the engine.



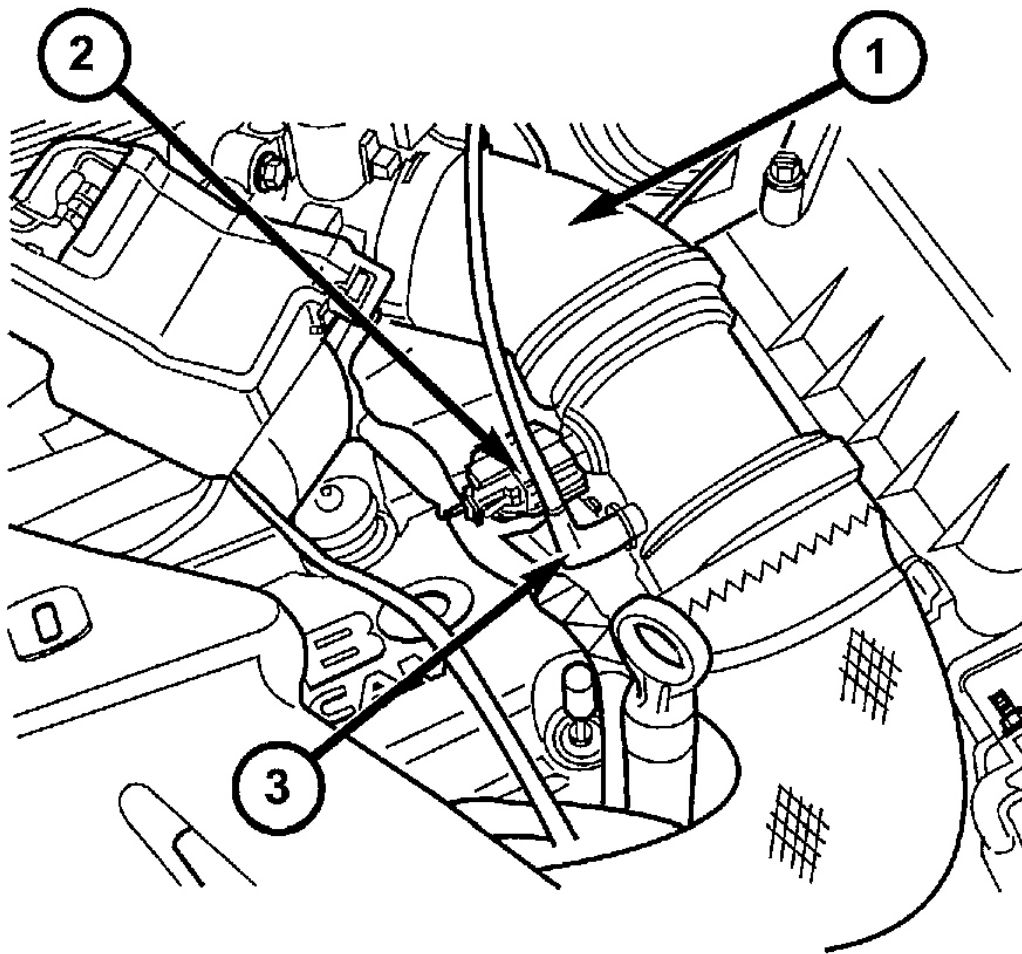
1 - INTAKE MANIFOLD MUST BE COVERED DURING SERVICE

G01857864

**Fig. 193: Covering Lower Intake Manifold Openings**  
Courtesy of DAIMLERCHRYSLER CORP.

**Turbo**

1. Disconnect negative battery cable.
2. Disconnect the inlet air temperature (IAT) sensor connector.

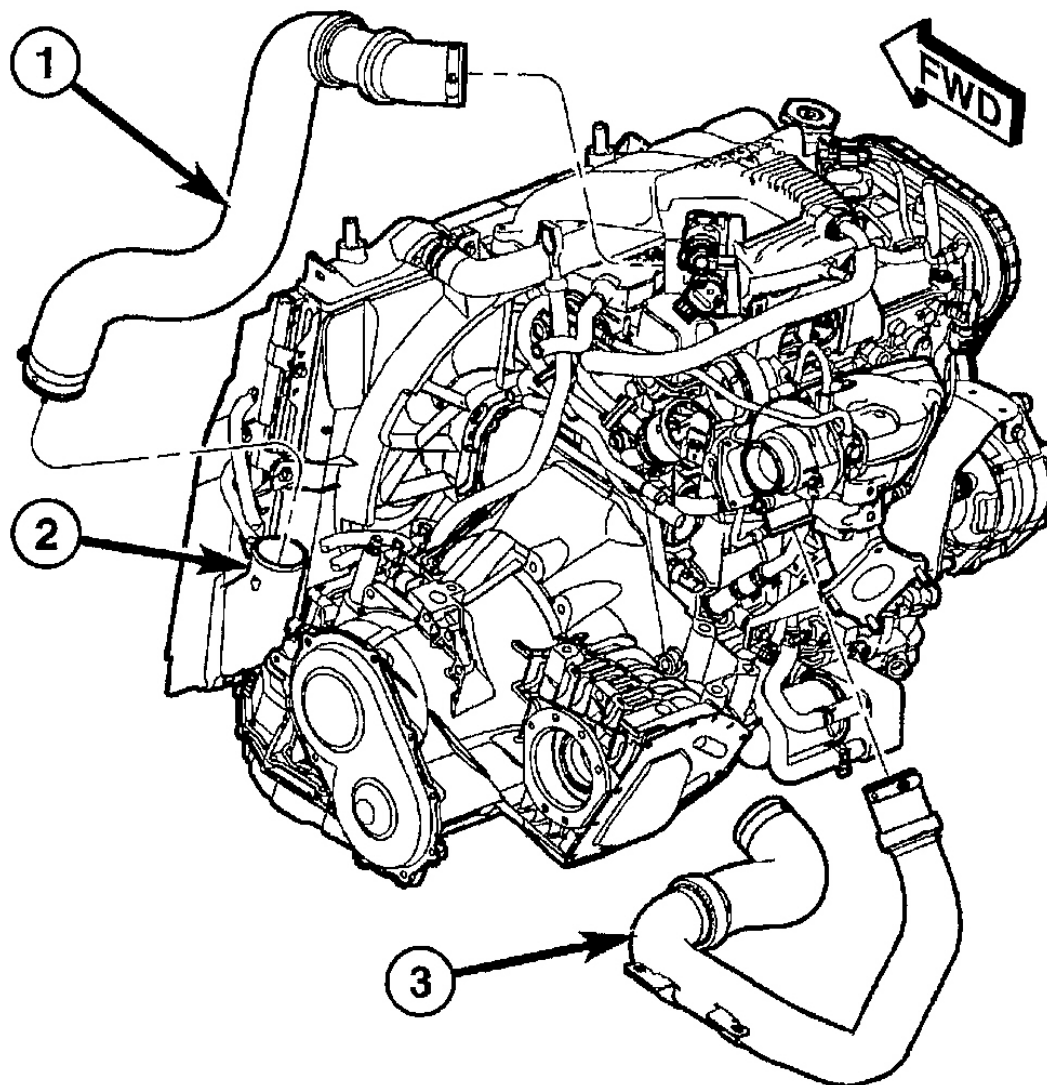


- 1 - HOSE - CHARGE AIR COOLER TO THROTTLE BODY  
2 - IAT SENSOR  
3 - TIP HOSE

G01857865

**Fig. 194: Disconnecting IAT Sensor - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Disconnect the throttle inlet pressure (TIP) hose.
4. Disconnect charge air cooler hose at throttle body.

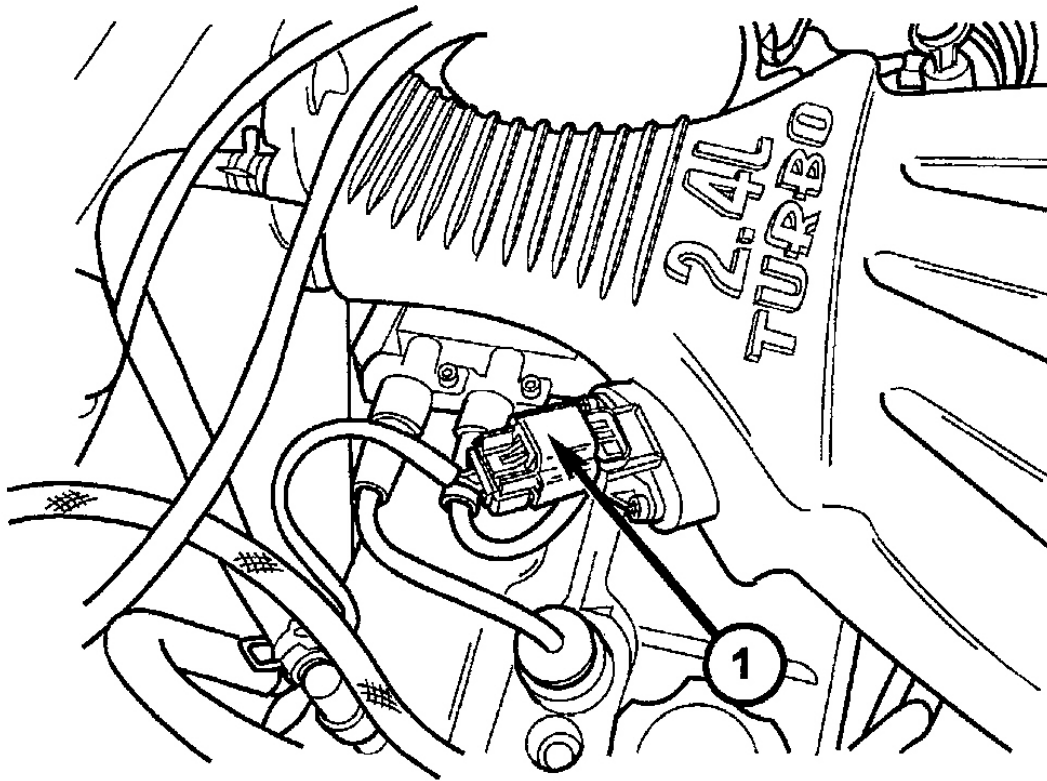


- 1 - HOSE - CHARGE AIR COOLER TO THROTTLE BODY
- 2 - CHARGE AIR COOLER
- 3 - HOSE - TURBOCHARGER TO CHARGE AIR COOLER

G01857866

**Fig. 195: Identifying Charge Air Cooler Hoses**  
Courtesy of DAIMLERCHRYSLER CORP.

- 5. Disconnect idle air control (IAC) motor and throttle position sensor connectors.
- 6. Disconnect the MAP sensor connector.

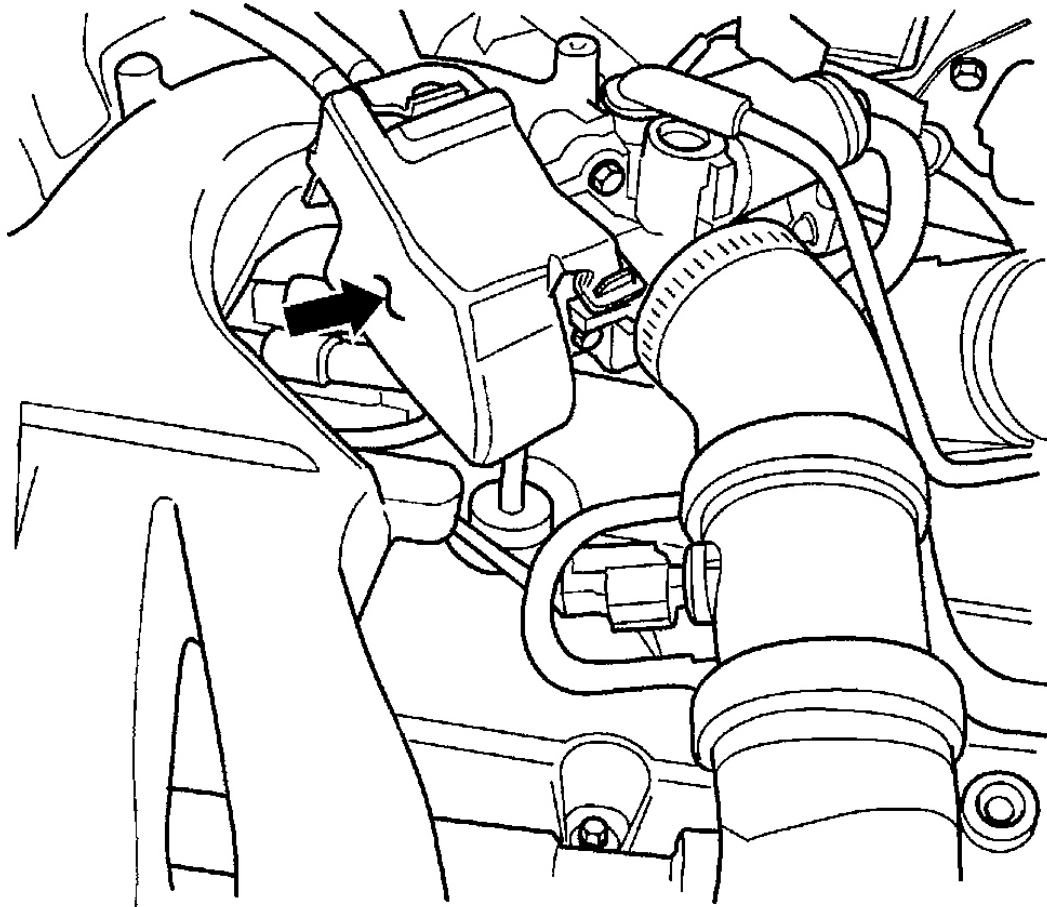


1 - MAP SENSOR

G01857867

**Fig. 196: Disconnecting MAP Sensor - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

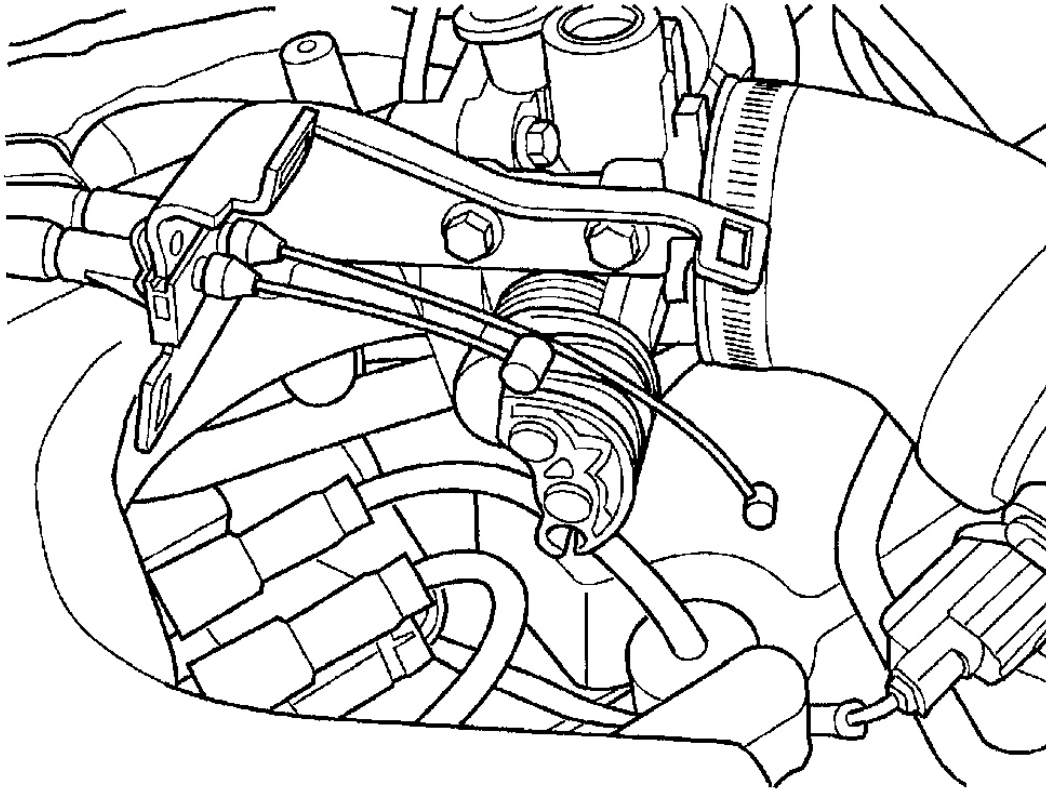
7. Remove the throttle control shield.



G01857868

**Fig. 197: Removing Throttle Control Shield - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

8. Remove the throttle cable from the throttle body lever.

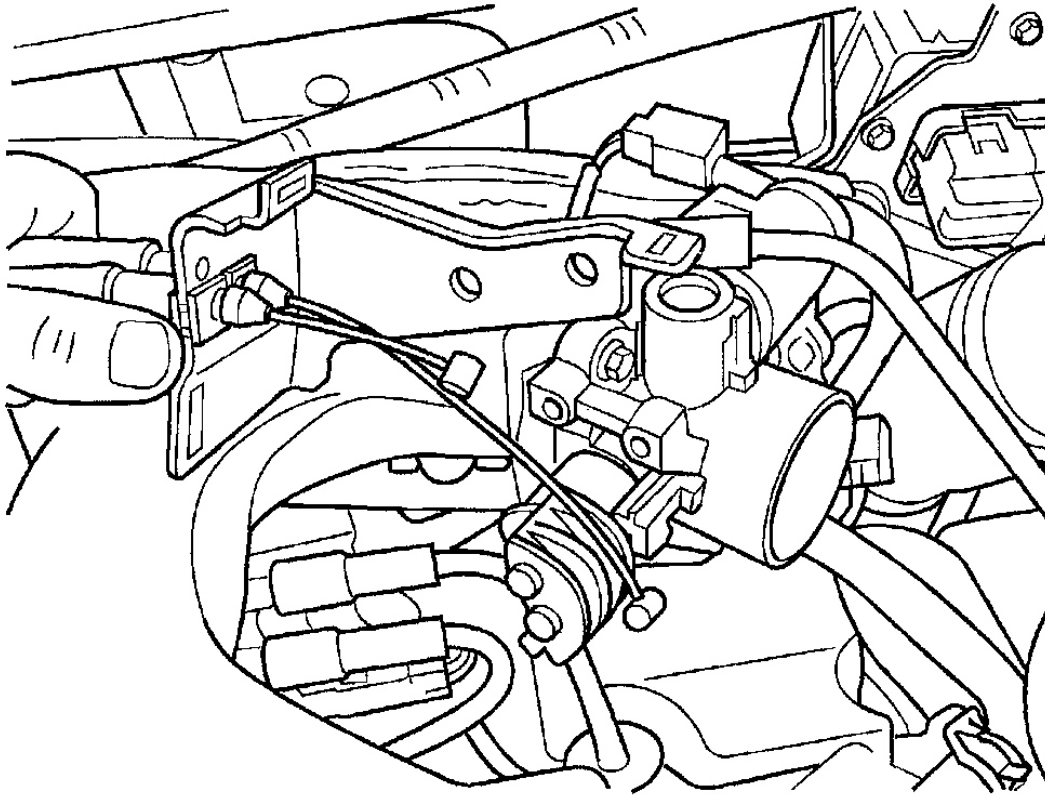


G01857869

**Fig. 198: Removing Throttle Cables - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

9. If equipped with speed control, remove speed control cable from the throttle lever by sliding clasp out hole used for throttle cable.
10. Remove the 2 screws for the throttle cable bracket.
11. Reposition throttle cable bracket.

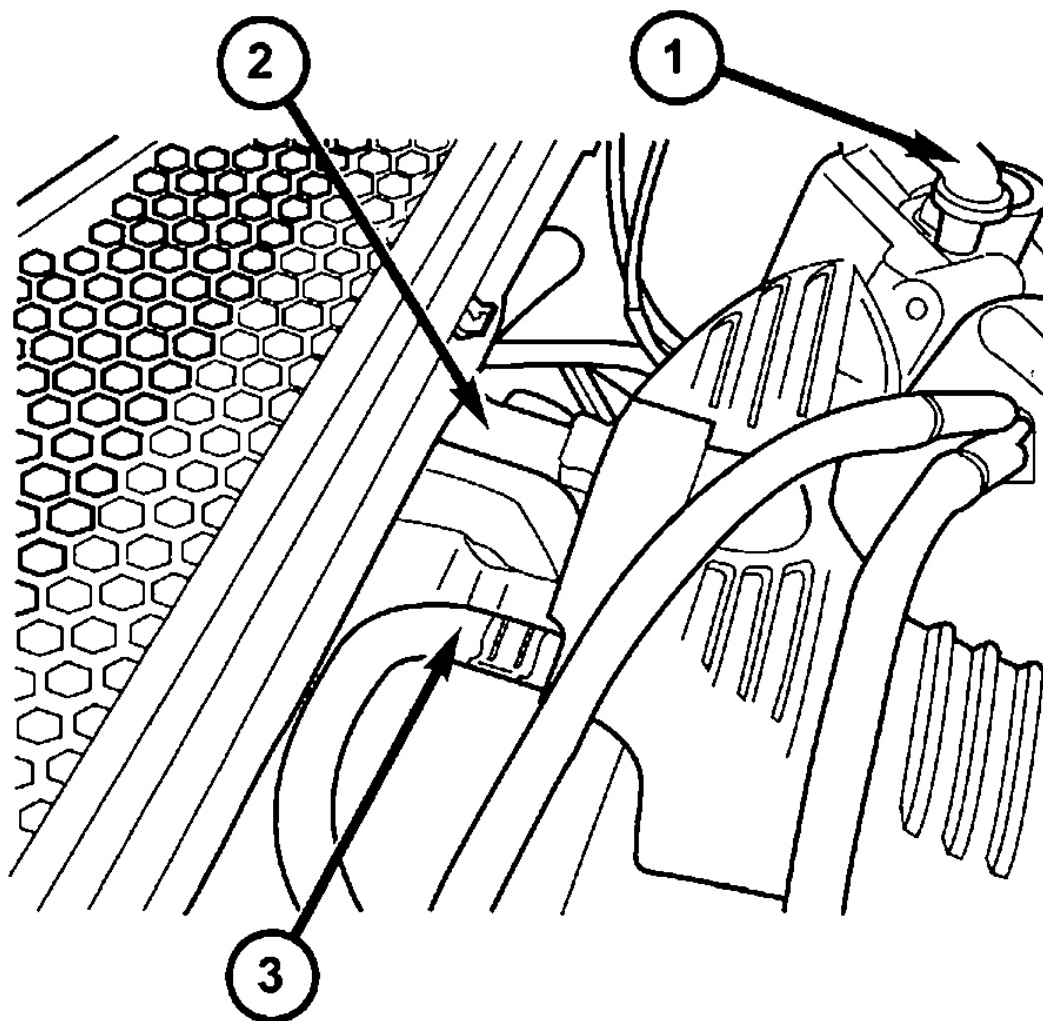




G01857870

**Fig. 199: Repositioning Throttle Cable Bracket - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

12. Disconnect brake booster hose and PCV hose from intake manifold.



1 - PURGE SOLENOID HOSE

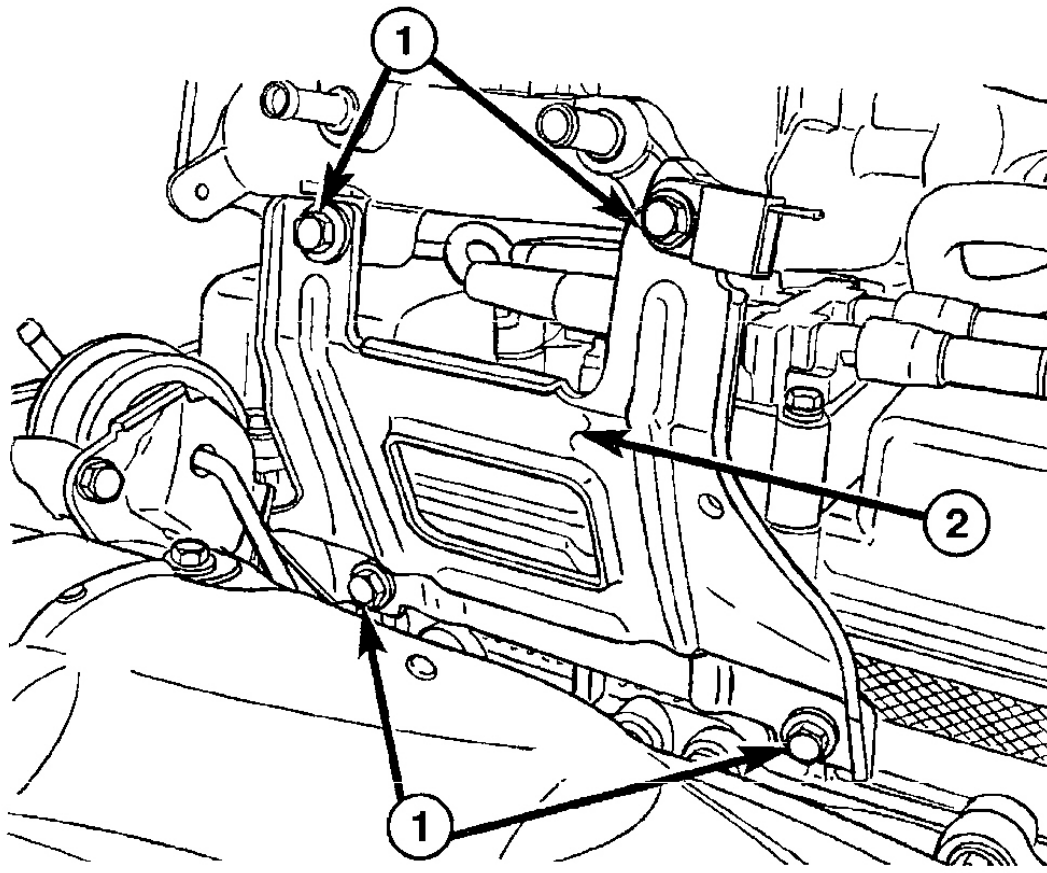
2 - BRAKE BOOSTER HOSE

3 - PCV HOSE

G01857871

**Fig. 200: Disconnecting Vacuum Hoses - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

13. Disconnect purge solenoid hose from throttle body.
14. Remove upper intake manifold support bracket.



1 - FASTENERS

2 - UPPER INTAKE MANIFOLD SUPPORT BRACKET

G01857872

**Fig. 201: Removing Support Bracket**  
Courtesy of DAIMLERCHRYSLER CORP.

15. Remove upper intake manifold fasteners. See **Fig. 205**.
16. Remove upper intake manifold.
17. If further service is required, cover the lower intake manifold openings to prevent foreign materials from entering the engine. See **Fig. 193**.

#### REMOVAL - LOWER INTAKE MANIFOLD

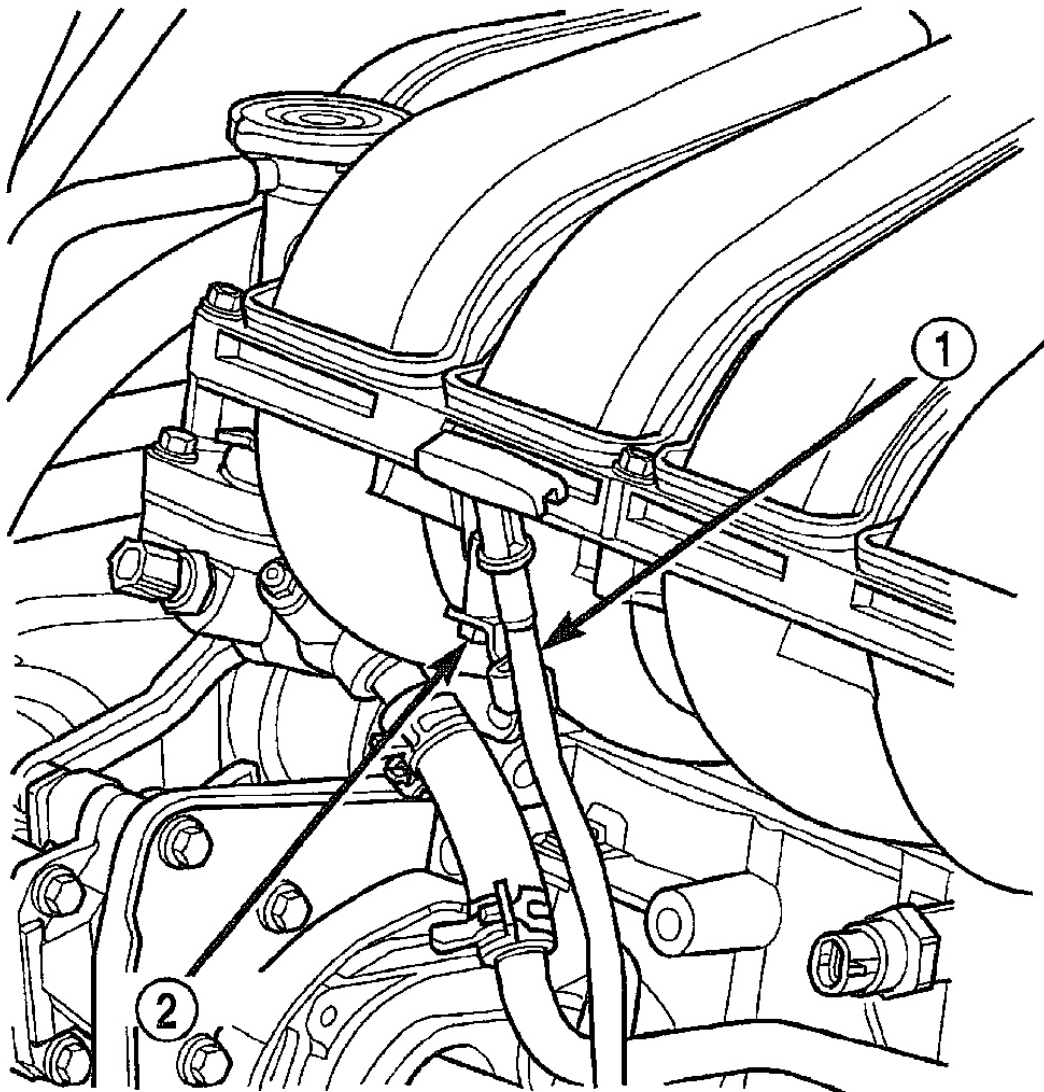
**WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING SYSTEM**

**COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.**

1. Perform fuel system pressure release procedure **before attempting any repairs**. See **FUEL SYSTEM** article.
2. Disconnect negative battery cable.
3. Remove upper intake manifold. See **REMOVAL - UPPER INTAKE MANIFOLD**.
4. Partially drain cooling system below thermostat level. See **COOLING SYSTEM MECHANICAL** article.
5. Remove upper radiator hose.
6. Remove coolant outlet connector and thermostat. See **COOLING SYSTEM MECHANICAL** article.

**WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.**

7. Disconnect the fuel supply line quick connect at the fuel rail assembly. See **FUEL SYSTEM** article.
8. Disconnect fuel injector wiring harness.
9. Remove screw attaching the oil dipstick tube to lower intake manifold.

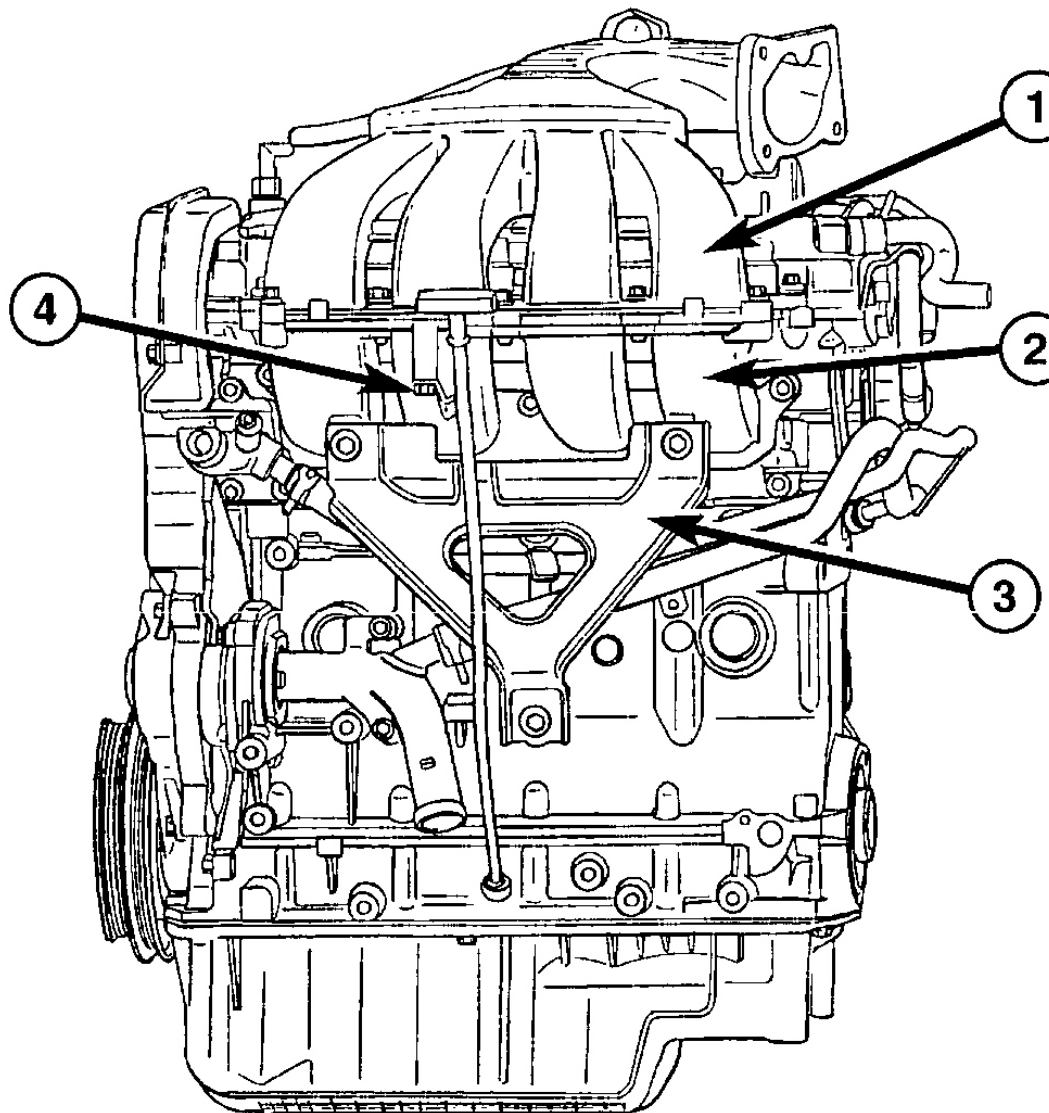


1 - DIPSTICK TUBE

2 - SCREW

G01857873

**Fig. 202: Removing Dipstick Tube**  
Courtesy of DAIMLERCHRYSLER CORP.



- 1 - UPPER INTAKE MANIFOLD
- 2 - LOWER INTAKE MANIFOLD
- 3 - SUPPORT BRACKET
- 4 - DIPSTICK TUBE SCREW

G01857874

**Fig. 203: Removing & Installing Lower Intake Manifold Support Bracket - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

10. **Turbocharger Equipped Engine:** Remove fasteners for lower intake manifold support bracket.

11. Remove lower intake manifold fasteners. See **Fig. 207**.
12. Remove lower intake manifold.

## **CLEANING**

1. Discard gasket(s).
2. Clean all sealing surfaces.

## **INSPECTION**

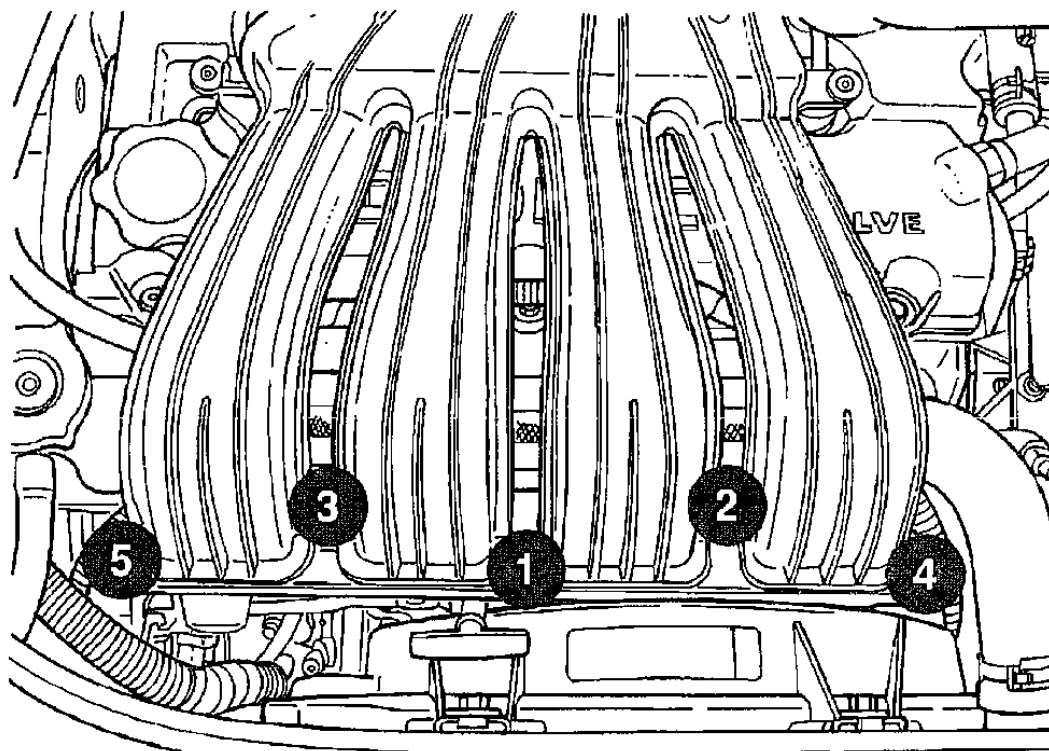
1. Inspect manifold for cracks or distortion. Replace manifold if necessary.
2. Inspect manifold for gasket surface damage or warpage. Replace manifold if necessary.

## **INSTALLATION**

### **INSTALLATION - UPPER INTAKE MANIFOLD**

#### **Non-Turbo**

1. If lower intake manifold was covered during service, remove cover. See **Fig. 193**.
2. Clean all sealing surfaces. Replace seals as necessary.
3. Position new seals on manifold, if replaced.
4. Position upper intake manifold on lower intake manifold. Tighten upper intake manifold fasteners to 12 N.m (105 in. lbs.) in sequence shown.



G01857875

**Fig. 204: Identifying Intake Manifold Tightening Sequence**  
 Courtesy of DAIMLERCHRYSLER CORP.

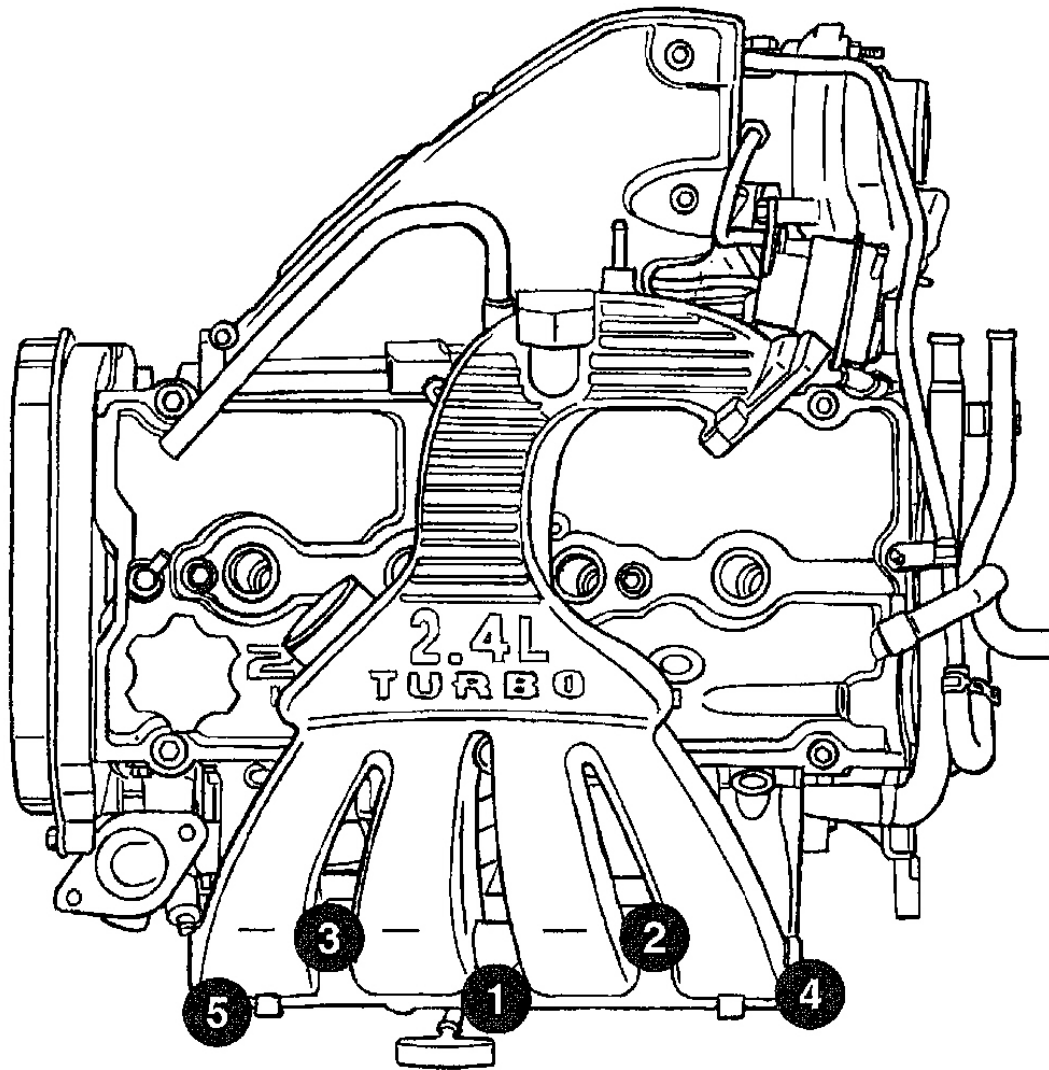
5. Install throttle body support bracket bolt at throttle body. See **Fig. 192**. Tighten bolt to 28 N.m (20 ft. lbs.).
6. Connect PCV hose to intake manifold. See **Fig. 192**.
7. Connect manifold absolute pressure (MAP) electrical connector. See **Fig. 188**.
8. Connect proportional purge hoses. See **Fig. 190**.
9. Connect brake booster hose. See **Fig. 191**.
10. Connect Idle Air Control (IAC) motor and Throttle Position Sensor (TPS) wiring connectors. See **Fig. 189**.
11. Install throttle and speed control cables to bracket. Connect cables to the throttle lever.
12. Connect negative cable to battery.
13. Install air cleaner housing and clean air hose. Tighten clean air hose clamp to 1.7 N.m (15 in. lbs.).
14. Connect make-up air hose and inlet air temperature sensor. See **Fig. 187**.

#### Turbo

1. If lower intake manifold was covered during service, remove cover. See **Fig. 193**.



2. Clean all sealing surfaces. Replace upper intake manifold gasket.
3. Position upper intake manifold on lower intake manifold. Tighten upper intake manifold fasteners to 28 N.m (250 in. lbs.). in sequence shown.



G01857876

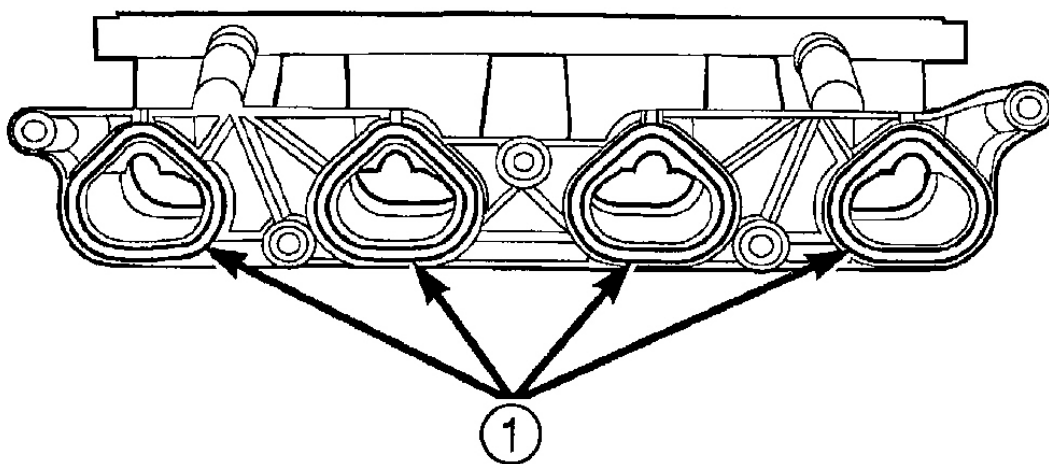
**Fig. 205: Identifying Intake Manifold Tightening Sequence - Turbo**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Install upper intake manifold support bracket. Torque fasteners to 28 N.m (250 in. lbs.).
5. Connect purge solenoid hose to throttle body.
6. Connect brake booster vacuum hose and PCV hose to intake manifold.
7. Install the 2 screws for the throttle cable bracket and tighten to 12 N.m (105 in. lbs.).

8. If equipped with speed control, install speed control cable to the throttle lever by sliding clasp in the hole used for throttle cable.
9. Install the throttle cable to the throttle body lever.
10. Install the throttle control shield.
11. Connect idle air control (IAC) motor and throttle position sensor connectors.
12. Connect the MAP sensor connector.
13. Connect charge air cooler hose to throttle body. Tighten hose clamp to 1.7 N.m (15 in. lbs.).
14. Connect negative battery cable.

#### INSTALLATION - LOWER INTAKE MANIFOLD

1. Clean all gasket surfaces.
2. **Naturally Aspirated Engine:** Position new seals on lower intake manifold, if replaced.

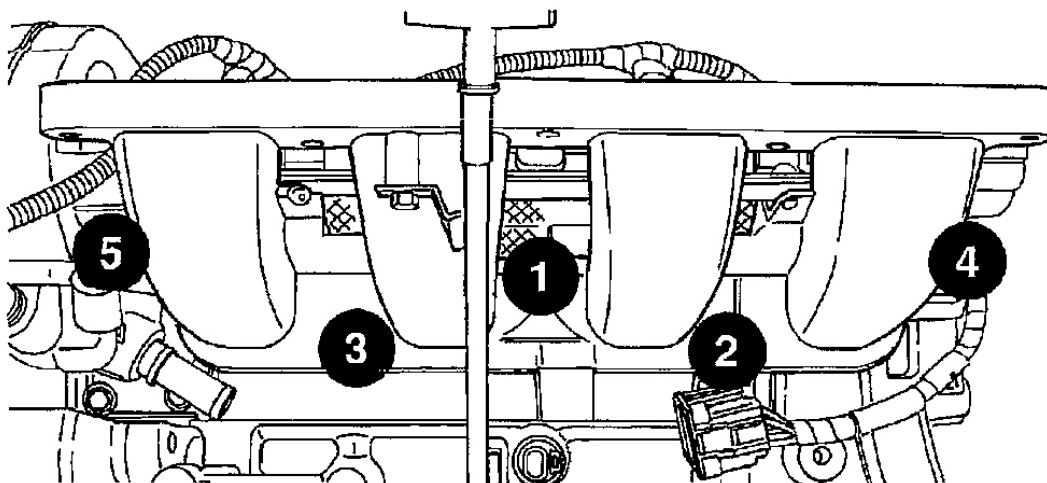


#### 1 - SEALS

G01857877

**Fig. 206: Positioning Lower Intake Manifold Seals - Naturally Aspirated Engine**  
Courtesy of DAIMLERCHRYSLER CORP.

3. **Naturally Aspirated Engine:** Install lower intake manifold. Tighten fasteners to 12 N.m (105 in. lbs.) in sequence shown.



G01857878

**Fig. 207: Identifying Lower Intake Manifold Tightening Sequence**  
 Courtesy of DAIMLERCHRYSLER CORP.

4. **Turbocharged Engine:** Replace lower intake manifold gasket.
5. **Turbocharged Engine:** Install lower intake manifold. Tighten fasteners to 28 N.m (250 in. lbs.) in sequence shown. See **Fig. 207**.
6. **Turbocharger Equipped Engine:** Install fasteners for lower intake manifold support bracket. See **Fig. 203**. Torque fasteners to 54 N.m (40 ft. lbs.).
7. If removed, install the fuel rail assembly to intake manifold. Tighten screws to 23 N.m (200 in. lbs.).
8. Connect fuel injector wiring harness.
9. Inspect quick connect fittings for damage, replace if necessary. See **FUEL SYSTEM** article. Lubricate tube with clean engine oil. Connect fuel supply hose to fuel rail assembly. Check connection by pulling on connector to insure it locked into position.
10. Install the screw attaching the oil dipstick tube to lower intake manifold. See **Fig. 202** and **Fig. 203**.
11. Install coolant outlet connector and thermostat. See **COOLING SYSTEM MECHANICAL** article.
12. Install radiator upper hose.
13. Install upper intake manifold. See **INSTALLATION - UPPER INTAKE MANIFOLD**.
14. Connect negative cable to battery.
15. Fill the cooling system. See **COOLING SYSTEM MECHANICAL** article.

**CAUTION:** When using the ASD Fuel System Test, the Auto Shutdown (ASD) relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

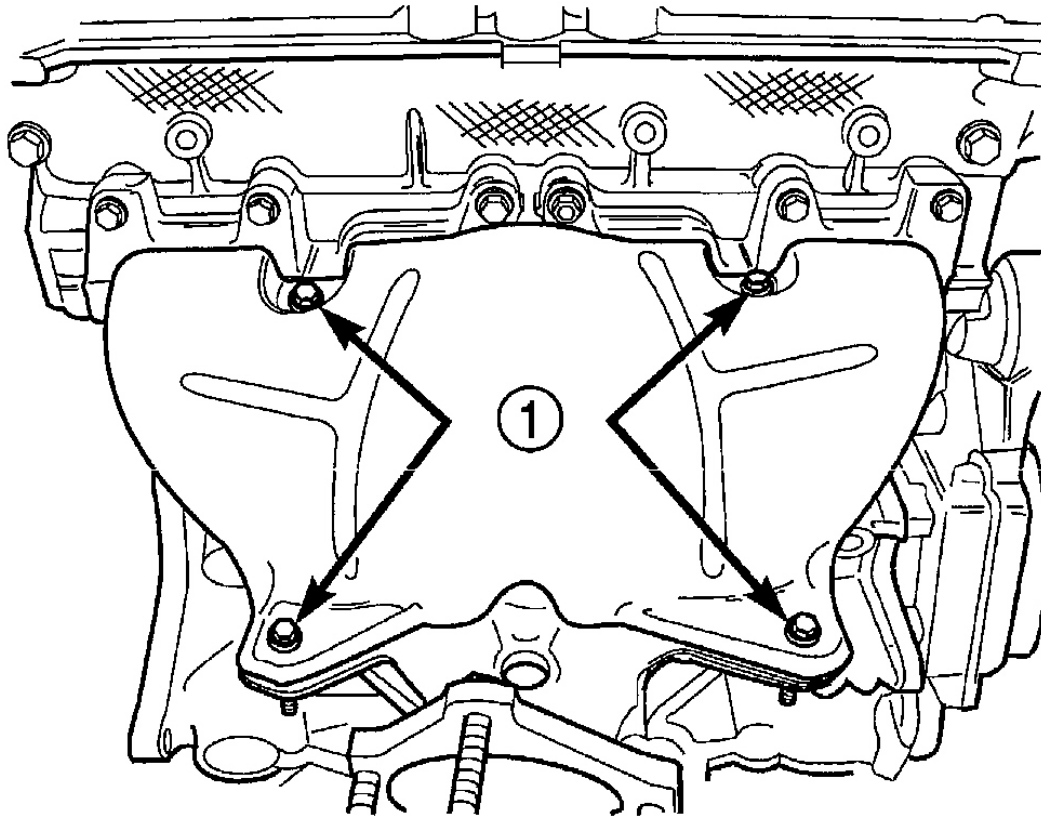
16. With the DRBIII® scan tool use ASD Fuel System Test to pressurize system to check for leaks.

## EXHAUST MANIFOLD

### REMOVAL

**NOTE:** The exhaust manifold on Turbocharged equipped vehicles is serviced as an assembly with the Turbocharger. See EXHAUST SYSTEM & TURBO CHARGER article.

1. Remove clean air hose and air cleaner housing.
2. Disconnect negative cable from battery.
3. Disconnect throttle and speed control cables from the throttle lever and bracket.
4. Disconnect MAP sensor electrical connector.
5. Remove fasteners securing power steering fluid reservoir to cylinder head.
6. Remove coolant recovery container. See COOLING SYSTEM MECHANICAL article.
7. Remove bolts attaching upper heat shield.

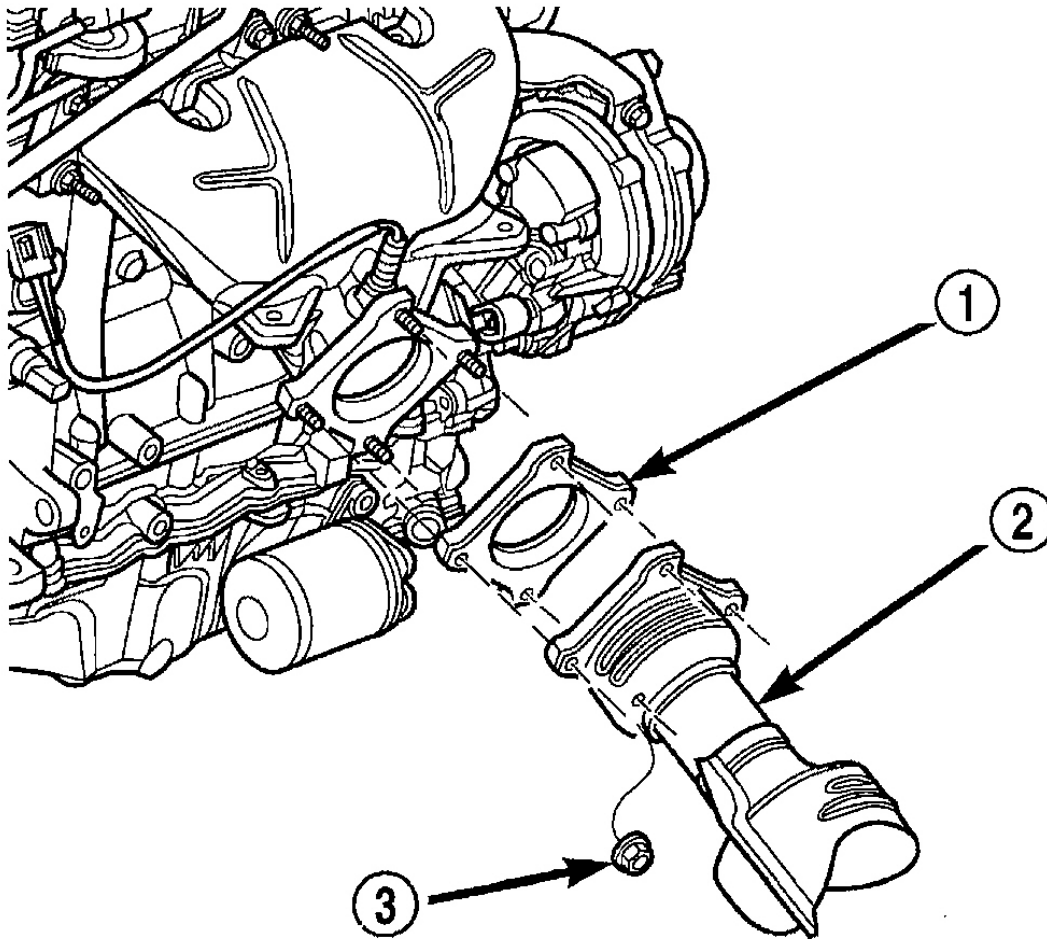


1 - BOLTS

G01857879

**Fig. 208: Removing Exhaust Manifold Heat Shield Bolts**  
Courtesy of DAIMLERCHRYSLER CORP.

8. Remove upper heat shield.
9. Raise vehicle.
10. Disconnect exhaust pipe from manifold.

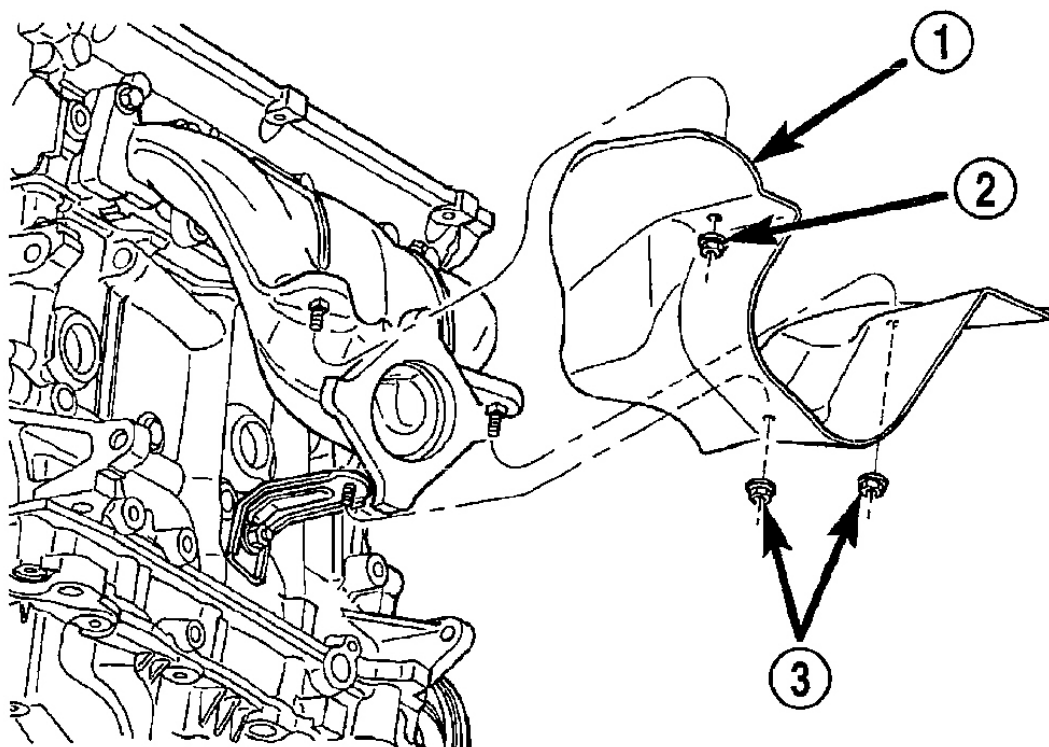


- 1 - GASKET
- 2 - CATALYTIC CONVERTER
- 3 - NUT

G01857880

**Fig. 209: Disconnecting Exhaust Manifold To Pipe Connection**  
Courtesy of DAIMLERCHRYSLER CORP.

11. Remove engine wiring heat shield.



1 - HEAT SHIELD

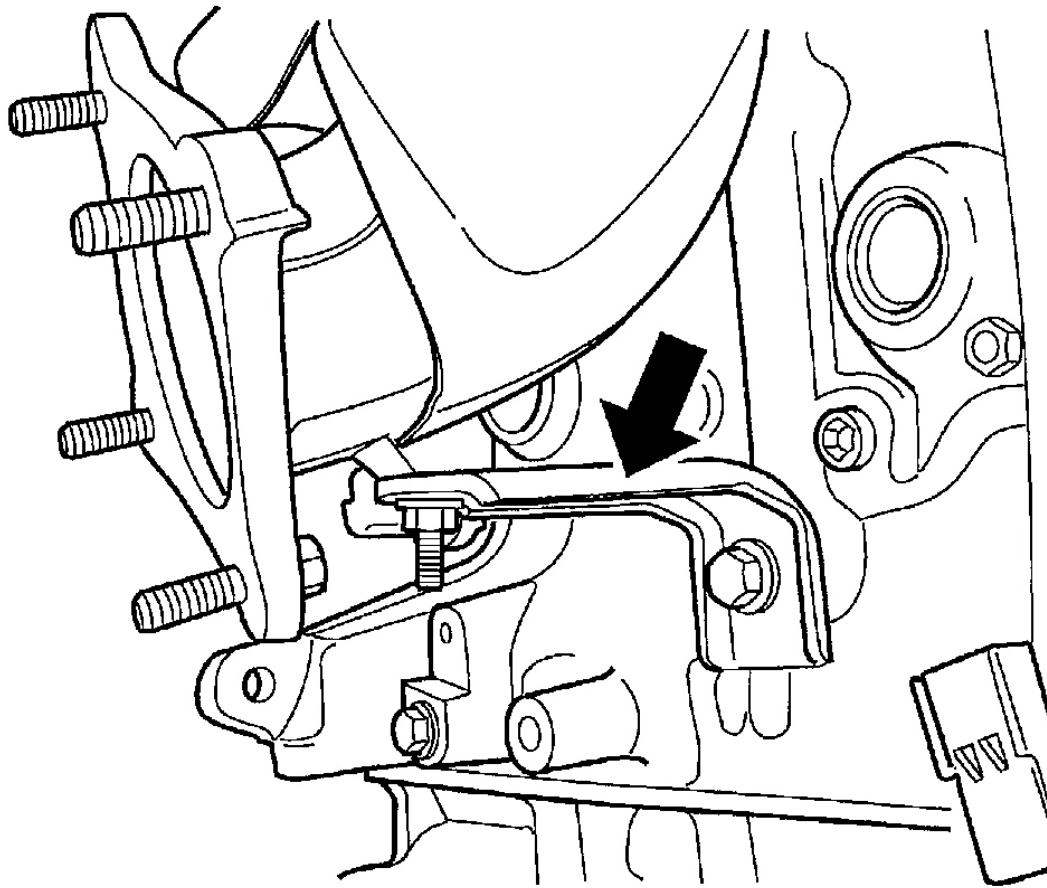
2 - NUT

3 - NUT

G01857881

**Fig. 210: Removing Heat Shield-Engine Wiring**  
Courtesy of DAIMLERCHRYSLER CORP.

12. Remove manifold support bracket.

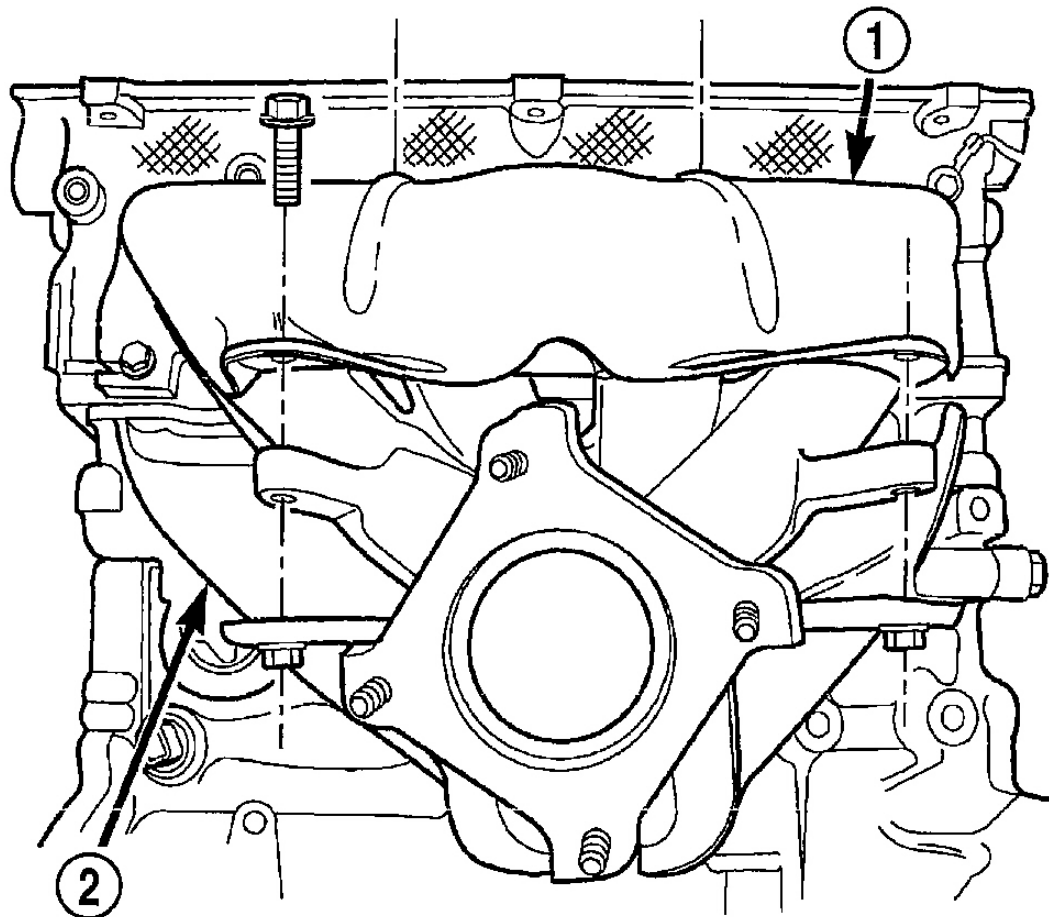


G01857882

**Fig. 211: Removing Exhaust Manifold Support Bracket**  
Courtesy of DAIMLERCHRYSLER CORP.

13. Remove lower exhaust manifold heat shield.





1 - UPPER HEAT SHIELD  
2 - LOWER HEAT SHIELD

G01857883

**Fig. 212: Removing Exhaust Manifold Heat Shield**  
Courtesy of DAIMLERCHRYSLER CORP.

14. Disconnect oxygen sensor electrical connector.
15. Remove exhaust manifold lower retaining fasteners.
16. Lower vehicle and remove the upper exhaust manifold retaining fasteners.
17. Remove exhaust manifold from above/between the engine and cowl panel. See **Fig. 213**.
18. Remove and discard manifold gasket.

## CLEANING

1. Discard gasket (if equipped) and clean all surfaces of manifold and cylinder head.

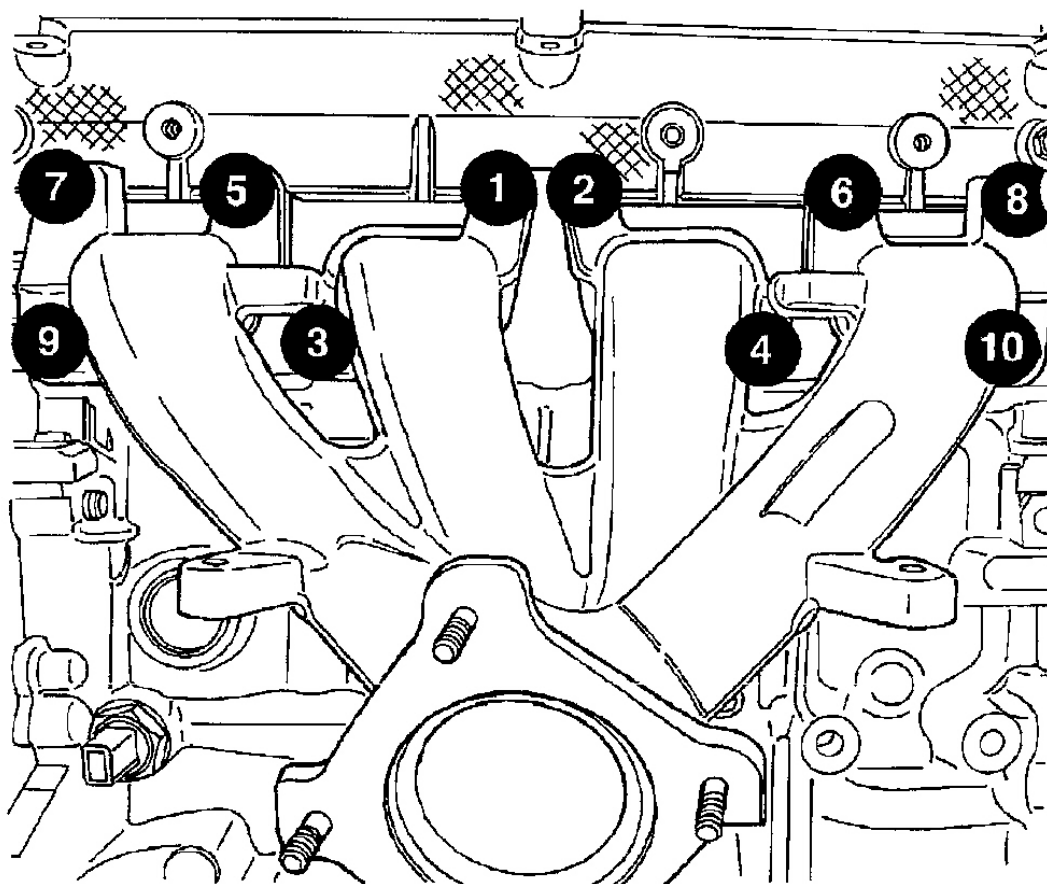
## INSPECTION

1. Inspect manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.
2. Inspect manifolds for cracks or distortion. Replace manifold as necessary.

## INSTALLATION

**NOTE:** The exhaust manifold on Turbocharged equipped vehicles is serviced as an assembly with the Turbocharger. See EXHAUST SYSTEM & TURBO CHARGER .

1. Install a new exhaust manifold gasket. **DO NOT APPLY SEALER.**
2. Position exhaust manifold in place. Tighten fasteners, starting at center and progressing outward in both directions to 23 N.m (200 in. lbs.). Raise and lower vehicle for fastener access as necessary. Repeat tightening procedure until all fasteners are at specified torque.



G01857884

**Fig. 213: Identifying Exhaust Manifold Tightening Sequence**  
**Courtesy of DAIMLERCHRYSLER CORP.**

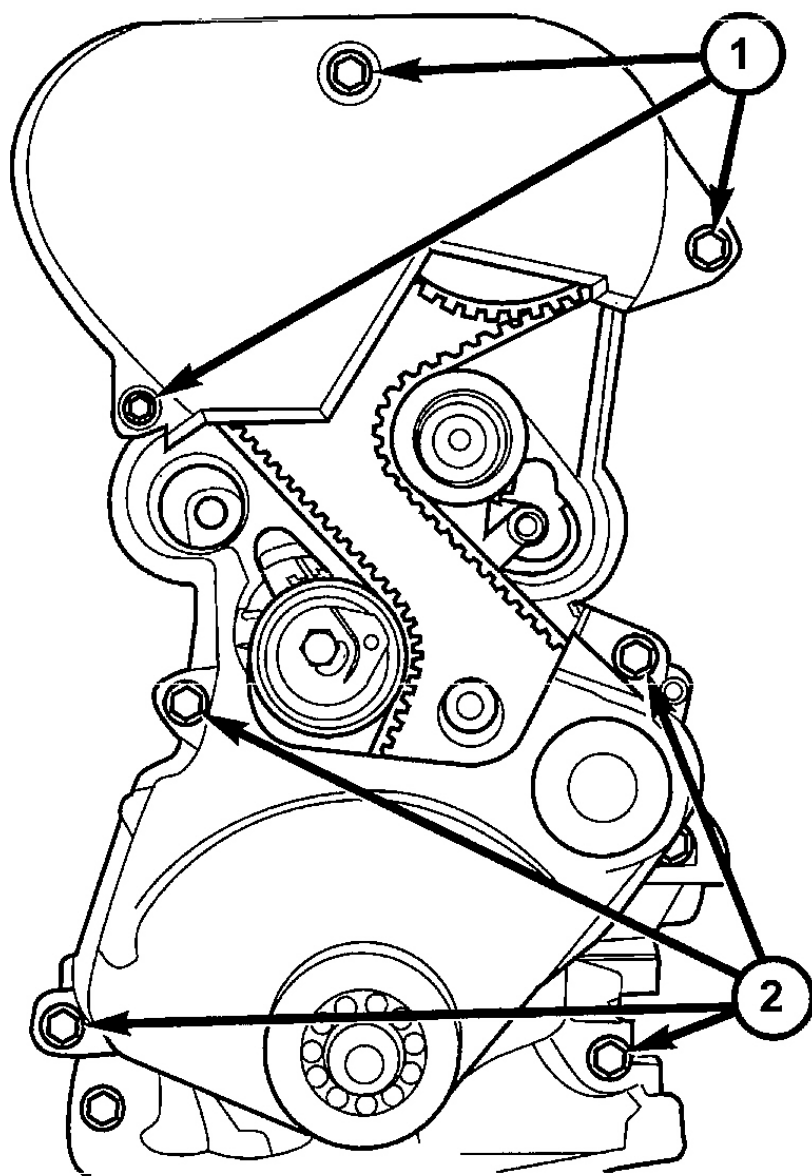
3. Install exhaust manifold heat shields. See **Fig. 212**. Tighten bolts to 12 N.m (105 in. lbs.). See **Fig. 208**.
4. Install exhaust manifold support bracket. See **Fig. 211**.
5. Install engine wiring heat shield. See **Fig. 210**.
6. Connect oxygen sensor electrical connector.
7. Install exhaust pipe to manifold. See **Fig. 209**. Tighten fasteners to 28 N.m (250 in. lbs.).
8. Install coolant recovery container. See **COOLING SYSTEM MECHANICAL** article.
9. Install fasteners securing power steering fluid reservoir to cylinder head.
10. Connect MAP sensor electrical connector.
11. Connect throttle and speed control cables to the throttle lever and bracket.
12. Connect negative cable to battery.
13. Install clean air hose and air cleaner housing.

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

### **REMOVAL**

#### **FRONT COVER-UPPER**

1. Remove upper torque strut attaching bolts and set strut aside. See **TORQUE STRUT**.
2. **Turbocharger equipped vehicles:**
  - Discharge and evacuate and air conditioning system. See **MANUAL HVAC SYSTEM** article.
  - Disconnect air conditioning lines at junction block near upper timing belt cover.
3. Remove upper timing belt cover fasteners and remove cover.



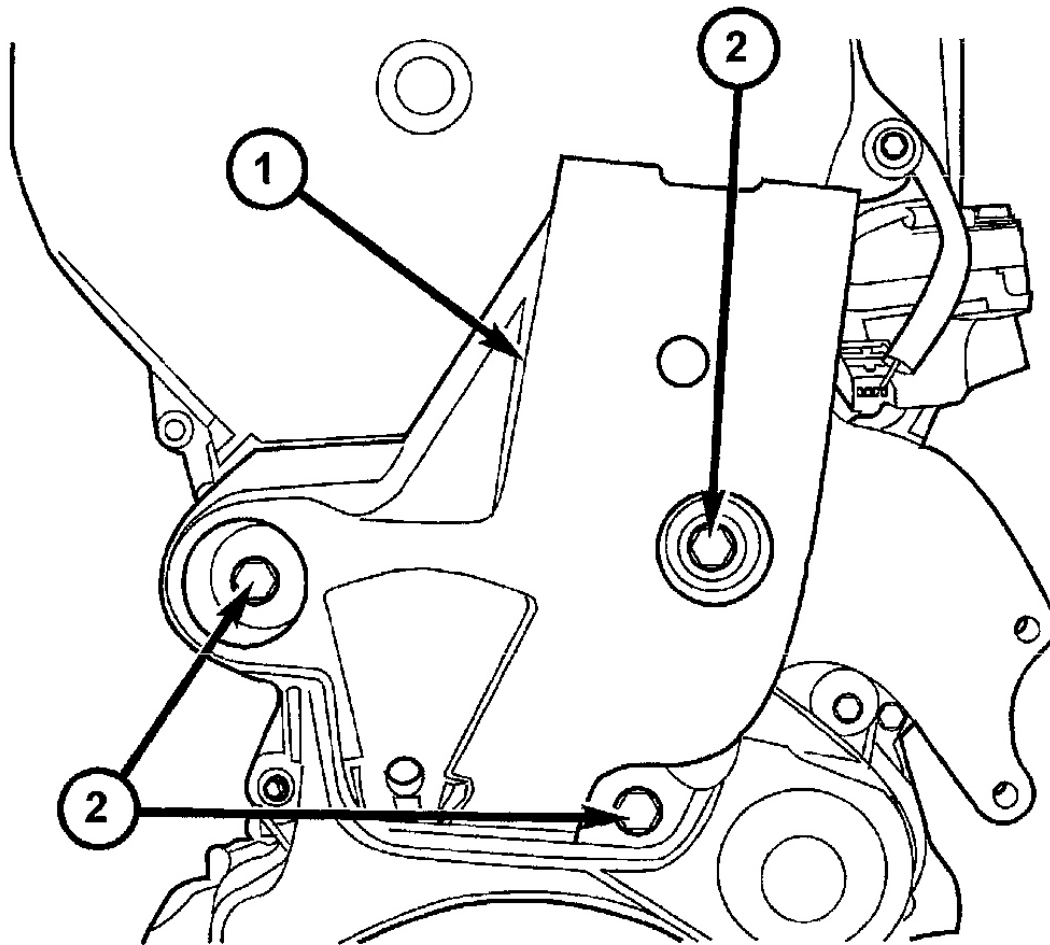
- 1 - UPPER COVER FASTENERS
- 2 - LOWER COVER FASTENERS

G01857885

**Fig. 214: Removing Front Timing Belt Covers**  
Courtesy of DAIMLERCHRYSLER CORP.

FRONT COVER-LOWER

1. Disconnect negative battery cable.
2. Raise vehicle on hoist. Remove right front wheel.
3. Remove the right splash shield.
4. Remove accessory drive belts. See **COOLING SYSTEM MECHANICAL** article.
5. Remove crankshaft damper. See **VIBRATION DAMPER**.
6. Remove the lower torque strut. See **TORQUE STRUT**.
7. Disconnect exhaust system from manifold.
8. Disconnect A/C pressure switch at rear of compressor housing.
9. Lower vehicle and support engine with a jack.
10. Discharge A/C system and disconnect A/C lines at coupling block. See **MANUAL HVAC SYSTEM** article.
11. Remove upper torque strut. See **TORQUE STRUT**.
12. Remove screw attaching ground strap to strut bracket.
13. Remove torque strut bracket from strut tower.
14. Remove upper radiator closure panel. See **BODY** article.
15. Remove power steering pump and bracket. Set pump aside. **Do not disconnect lines from pump.**
16. With engine properly supported, remove right engine mount through bolt.
17. Raise engine with jack until engine support bracket bolts are accessible.



- 1 - ENGINE SUPPORT BRACKET
- 2 - BOLTS - 61 N·m (45 ft. lbs.)

G01857886

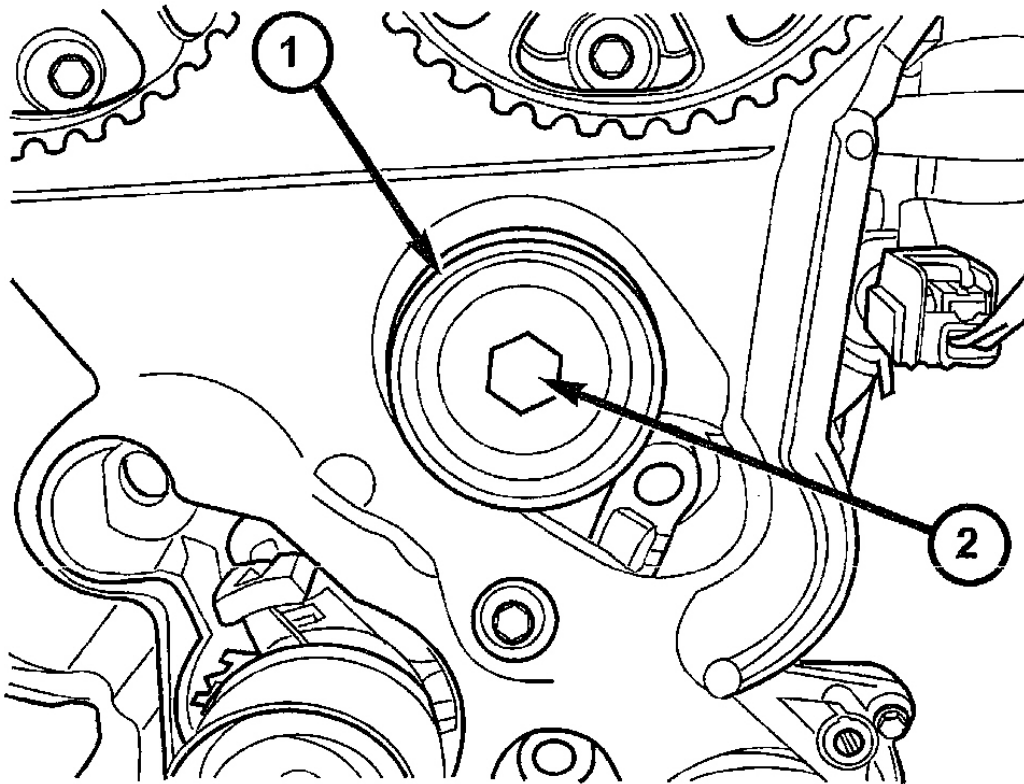
**Fig. 215: Removing Engine Support Bracket**  
 Courtesy of DAIMLERCHRYSLER CORP.

18. Remove engine support bracket.
19. Remove timing belt cover fasteners and remove cover. See **Fig. 214**.

#### REAR COVER

1. Remove front timing belt covers. Refer to above procedures.

2. Remove timing belt. See **TIMING BELT AND SPROCKETS**.
3. Remove timing belt idler pulley.

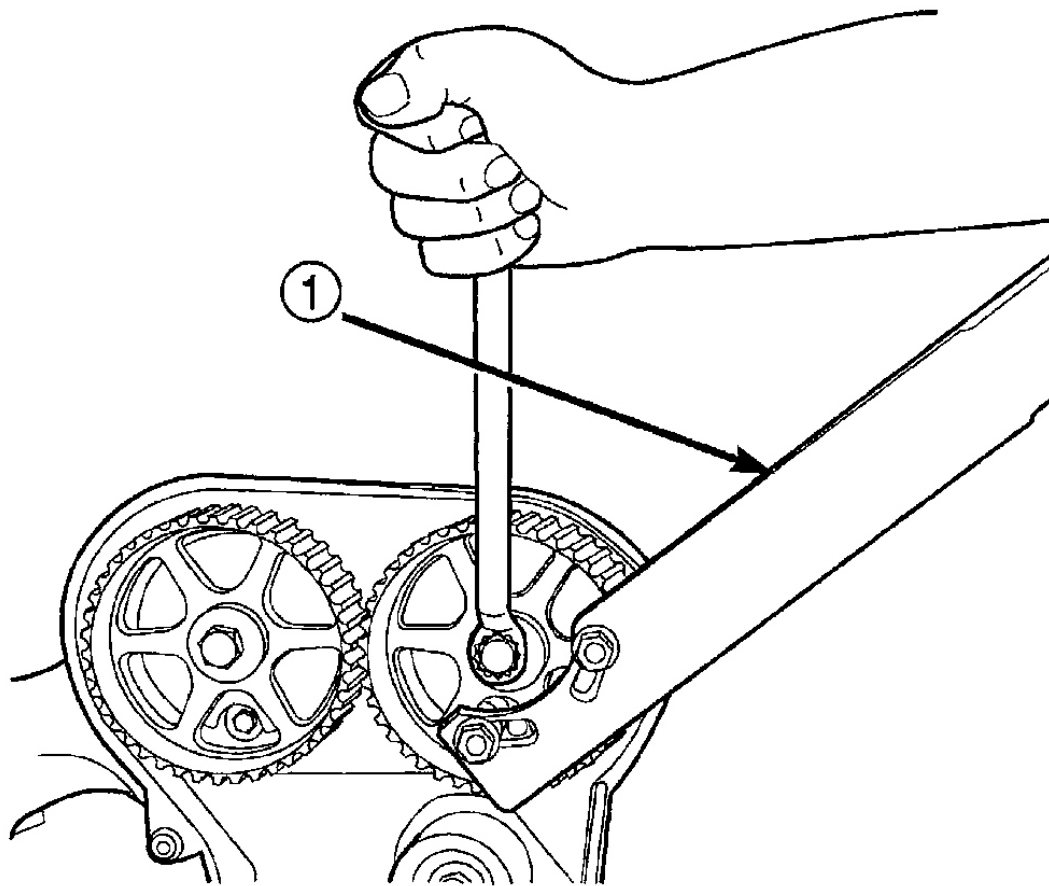


1 - IDLER PULLEY  
2 - BOLT

G01857887

**Fig. 216: Removing Timing Belt Idler Pulley**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Remove camshaft sprockets. Use Special Tool 6847 to hold camshaft sprockets while removing the sprocket bolts.



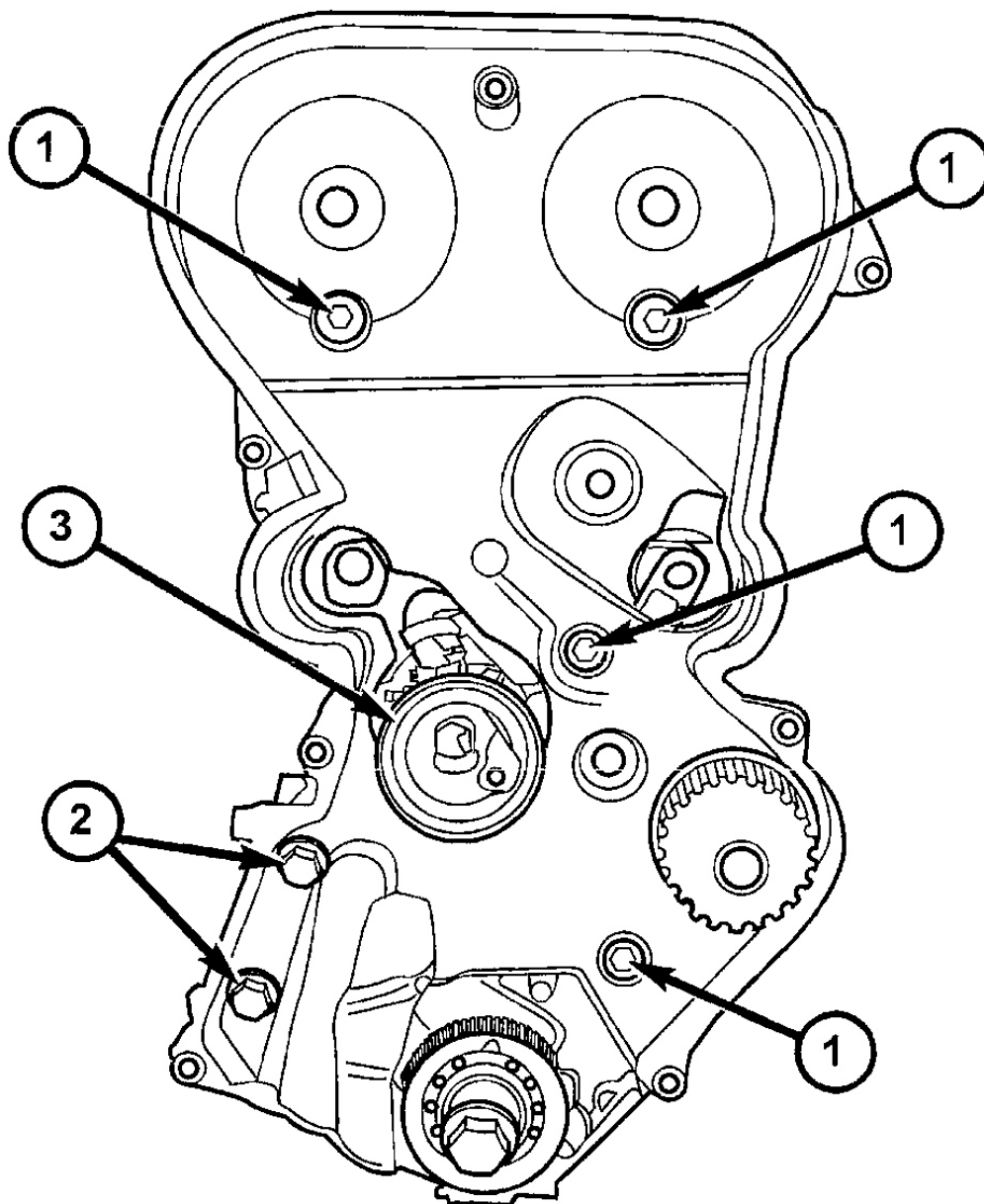
1 - SPECIAL TOOL 6847

G01857888

**Fig. 217: Removing & Installing Camshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Remove rear timing belt cover fasteners and remove cover from engine.





1 - M6 BOLTS - 12 N·m (105 in. lbs.)

2 - M8 BOLTS - 28 N·m (250 in. lbs.)

3 - TIMING BELT TENSIONER

G01857889

**Fig. 218: Removing Rear Timing Belt Cover Fasteners**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

**FRONT COVER-UPPER**

1. Install timing belt cover and tighten fasteners to 6 N.m (50 in. lbs.). See **Fig. 214**.
2. Install upper torque strut. See **TORQUE STRUT**.
3. **Turbocharger equipped vehicles:**
  - Connect air conditioning lines at junction block near upper timing belt cover.
  - Recharge air conditioning system. See **MANUAL HVAC SYSTEM** article.
4. Perform torque strut adjustment procedure. See **TORQUE STRUT**.

**FRONT COVER-LOWER**

1. Install lower timing belt cover and tighten fasteners to 6 N.m (50 in. lbs.). See **Fig. 214**.
2. Install right engine support bracket. See **Fig. 215**. Ensure the power steering pump is properly located in mounting location on bracket. Tighten mount bracket bolts to 61 N.m (45 ft. lbs.).
3. Lower engine into mounting position and install right engine mount through bolt. Tighten bolt to 118 N.m (87 ft. lbs.).
4. Install power steering pump and bracket.
5. Install upper radiator closure panel. See **BODY** article.
6. Install torque strut bracket to strut tower.
7. Connect ground strap to bracket.
8. Install upper torque strut.
9. Connect A/C lines and charge A/C system. See **MANUAL HVAC SYSTEM** article.
10. Raise vehicle.
11. Connect exhaust system to manifold.
12. Connect A/C pressure switch connector.
13. Install crankshaft damper. See **VIBRATION DAMPER**.
14. Install accessory drive belts. See **COOLING SYSTEM MECHANICAL** article.
15. Install lower torque strut. See **TORQUE STRUT**.
16. Perform torque strut adjustment procedure. See **TORQUE STRUT**.
17. Install right splash shield.
18. Install right front wheel.
19. Connect negative cable to battery.

**REAR COVER**

1. Install rear timing belt cover and fasteners. Torque fasteners to values specified. See **Fig. 218**.
2. Install timing belt idler pulley. See **Fig. 216**. Torque timing belt idler pulley fastener to 61 N.m (45 ft. lbs.).

**CAUTION: Do not use an impact wrench to tighten camshaft sprocket bolts.  
Damage to the camshaft-to-sprocket locating dowel pin may occur.**

3. Install camshaft sprockets. Hold sprockets with Special Tool 6847 while tightening center bolt to 115 N.m (85 ft. lbs.). See **Fig. 217**.
4. Install timing belt. See **TIMING BELT AND SPROCKETS**.
5. Install front timing belt covers. Refer to above procedures.

## **TIMING BELT AND SPROCKETS**

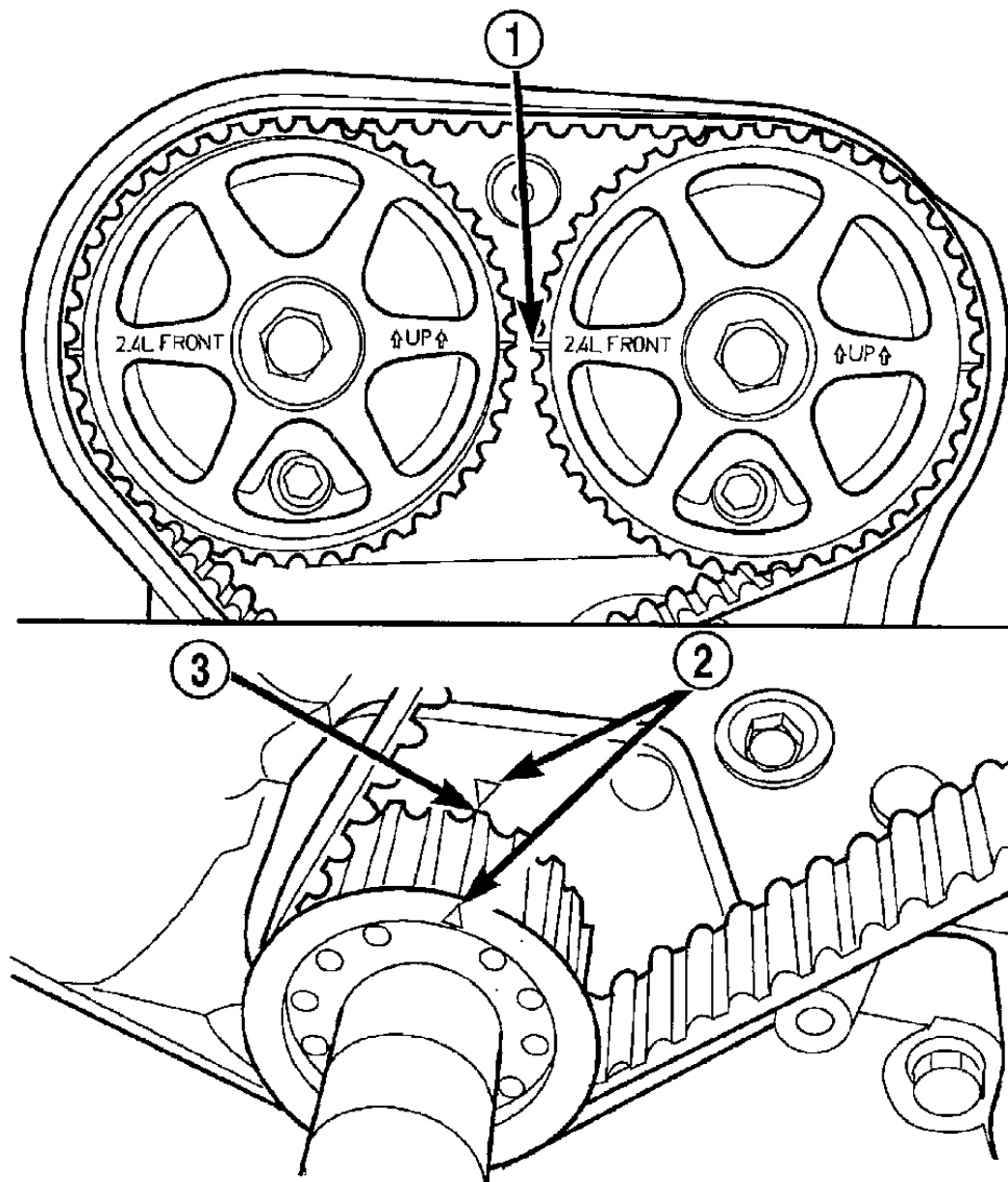
### **REMOVAL**

#### **REMOVAL - TIMING BELT**

1. Disconnect negative battery cable.
2. Remove upper and lower front timing belt covers. See **Fig. 214**. See **TIMING BELT COVER(S)**.

**CAUTION:** When aligning crankshaft and camshaft timing marks always rotate engine from crankshaft. Camshaft should not be rotated after timing belt is removed. Damage to valve components may occur. Always align timing marks before removing timing belt.

**NOTE:** The crankshaft sprocket TDC mark is located on the trailing edge of the sprocket tooth. Failure to align trailing edge of sprocket tooth to TDC mark on oil pump housing will cause the camshaft timing marks to be misaligned.

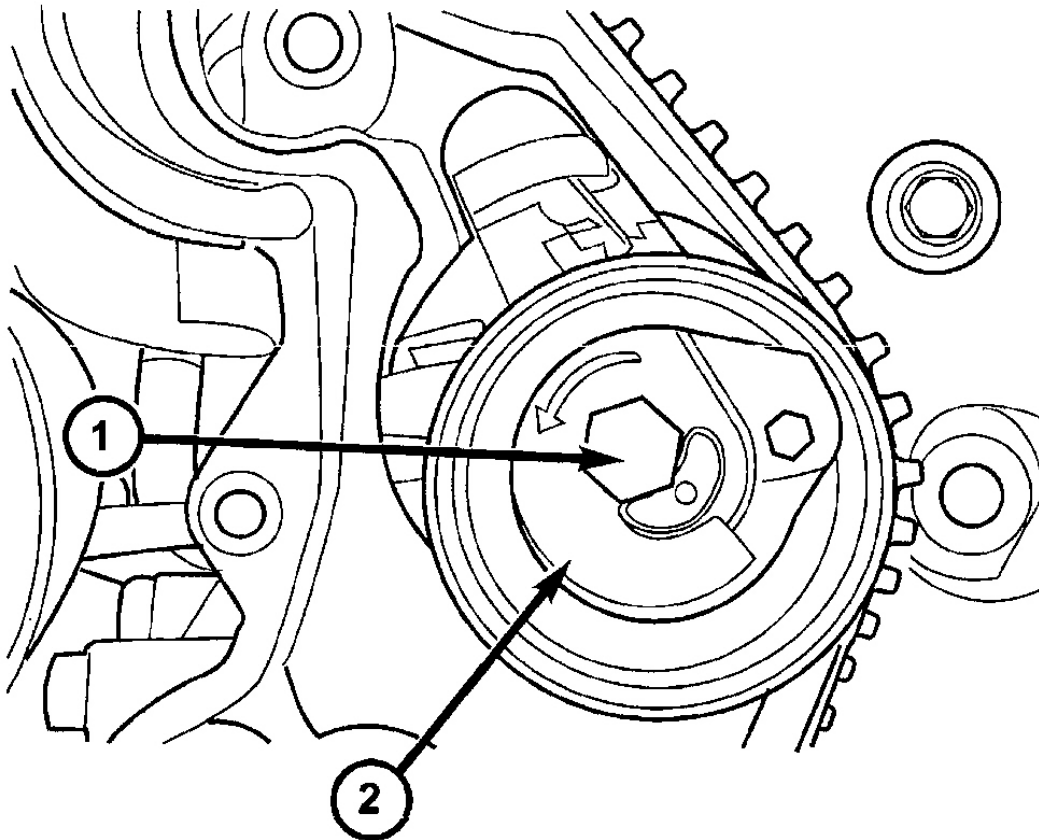


- 1 - CAMSHAFT TIMING MARKS
- 2 - CRANKSHAFT TDC MARKS
- 3 - TRAILING EDGE OF SPROCKET TOOTH

G01857890

**Fig. 219: Marking Crankshaft & Camshaft Timing**  
Courtesy of DAIMLERCHRYSLER CORP.

3. Before the removal of the timing belt, rotate crankshaft until the TDC mark on oil pump housing aligns with the TDC mark on crankshaft sprocket (trailing edge of sprocket tooth).
4. Loosen timing belt tensioner lock bolt.



1 - LOCK BOLT  
2 - TOP PLATE

G01857891

**Fig. 220: Loosening Timing Belt Tensioner Lock Bolt**  
Courtesy of DAIMLERCHRYSLER CORP.

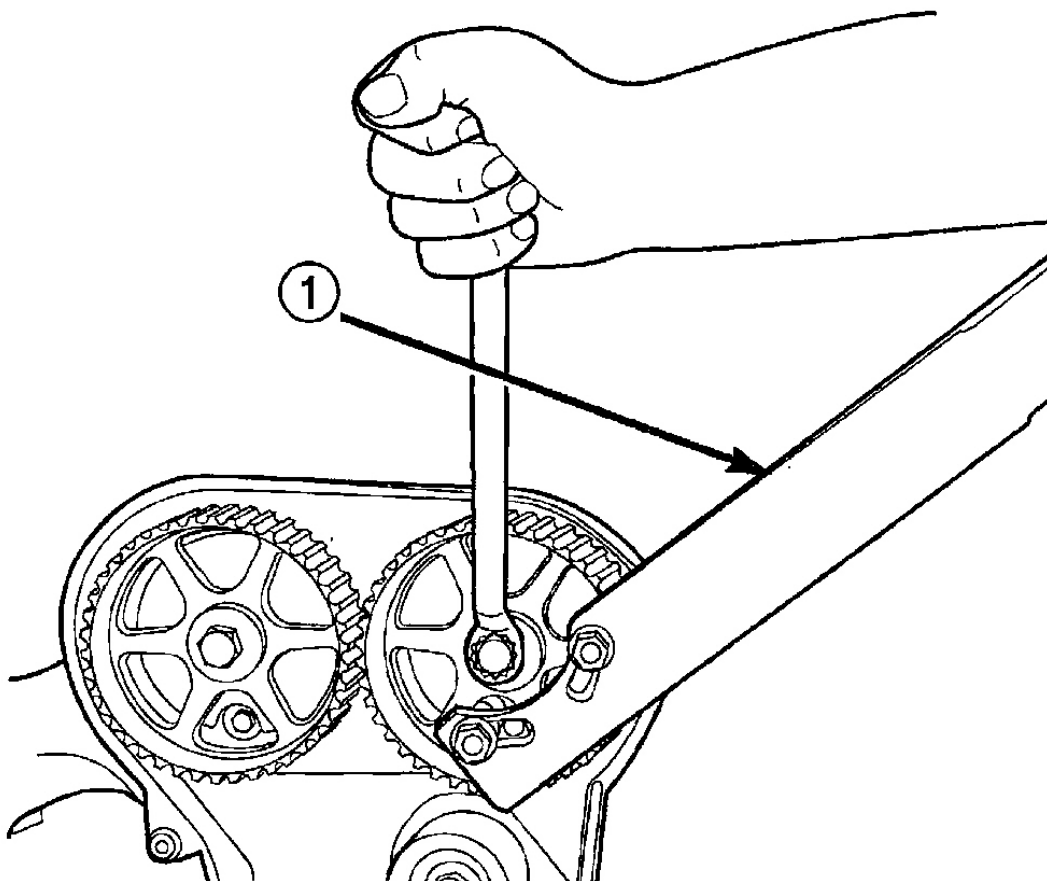
5. Insert a 6 mm Allen wrench into the hexagon opening located on the top plate of the belt tensioner pulley. Rotate the top plate **CLOCKWISE** until there is enough slack in timing belt to allow for removal.
6. Remove timing belt.

**CAUTION:** If timing belt was damaged due to incorrect tracking (alignment), the belt

**tensioner pulley and bracket must be replaced as an assembly. See TIMING BELT TENSIONER & PULLEY.**

#### REMOVAL - CAMSHAFT SPROCKET(S)

1. Remove upper and lower front timing belt covers. See TIMING BELT COVER(S).
2. Remove timing belt. See REMOVAL - TIMING BELT.
3. Use Special Tool 6847 to hold camshaft sprockets while removing the sprocket bolt(s). Remove camshaft sprocket(s).



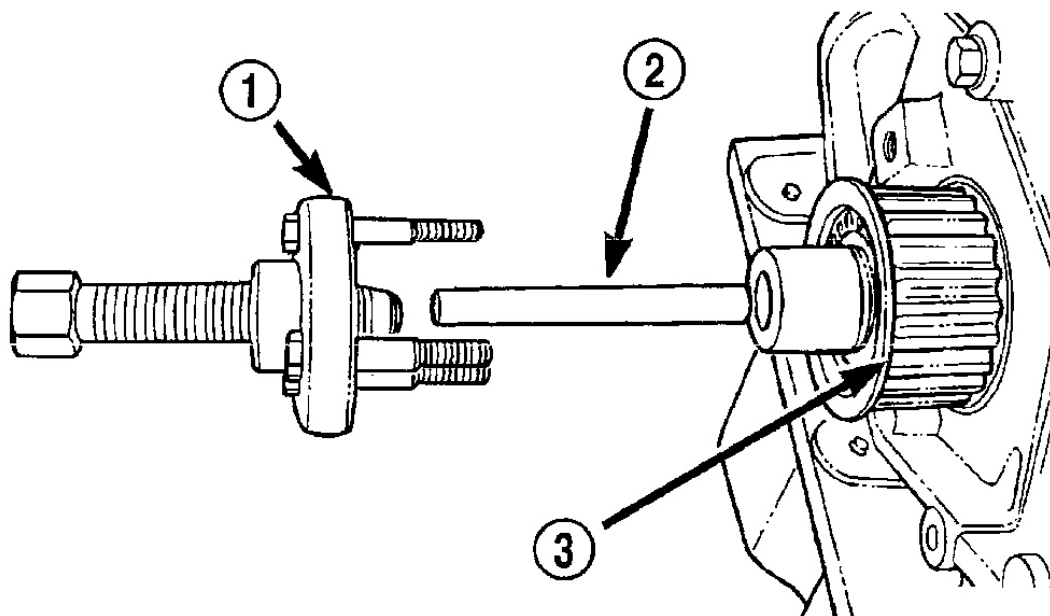
1 - SPECIAL TOOL 6847

G01857892

**Fig. 221: Removing & Installing Camshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

#### REMOVAL - CRANKSHAFT SPROCKET

1. Remove upper and lower front timing belt covers. See **TIMING BELT COVER(S)**.
2. Remove timing belt. See **REMOVAL - TIMING BELT**.
3. Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2.



- 1 - SPECIAL TOOL 6793  
2 - SPECIAL TOOL C-4685-C2  
3 - CRANKSHAFT SPROCKET

G01857893

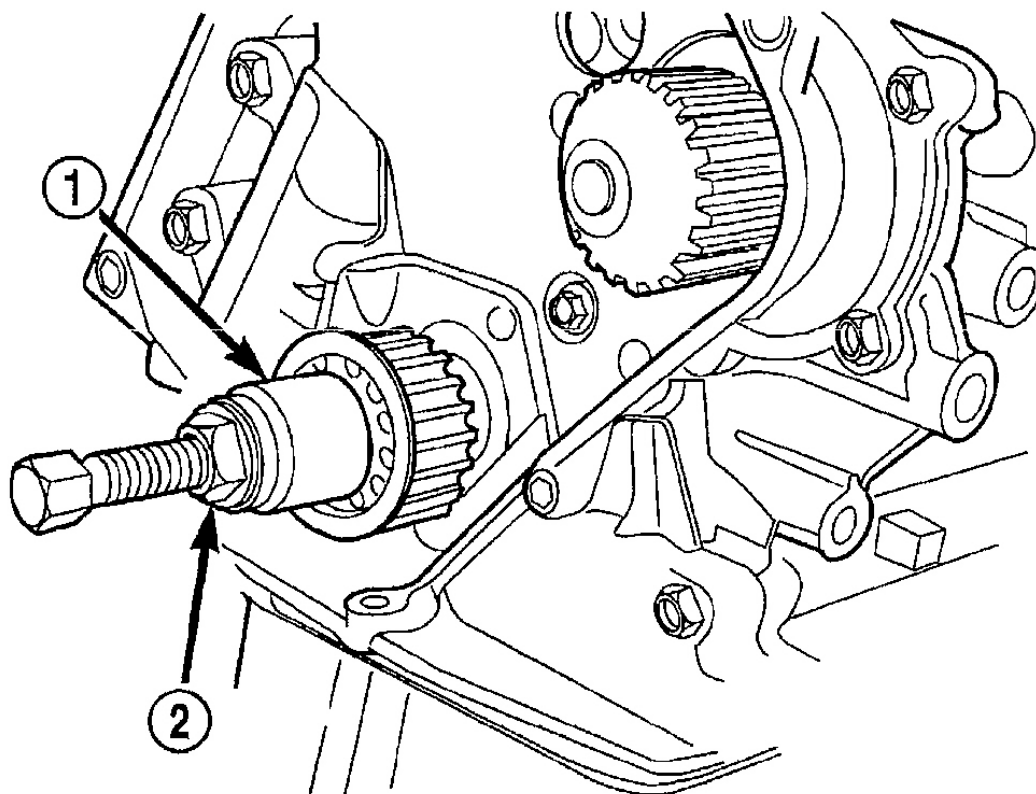
**Fig. 222: Removing Crankshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

### INSTALLATION - CRANKSHAFT SPROCKET

**CAUTION:** The crankshaft sprocket is set to a predetermined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.

1. Install crankshaft sprocket using Special Tool 679.



- 1 - SPECIAL TOOL 6792  
2 - TIGHTEN NUT TO INSTALL

G01857894

**Fig. 223: Installing Crankshaft Sprocket**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Install timing belt. See **INSTALLATION - TIMING BELT**.
3. Install upper and lower front timing belt covers. See **TIMING BELT COVER(S)**.

#### INSTALLATION - CAMSHAFT SPROCKET(S)

**CAUTION:** Do not use an impact wrench to tighten camshaft sprocket bolts. Damage to the camshaft-to-sprocket locating dowel pin may occur.

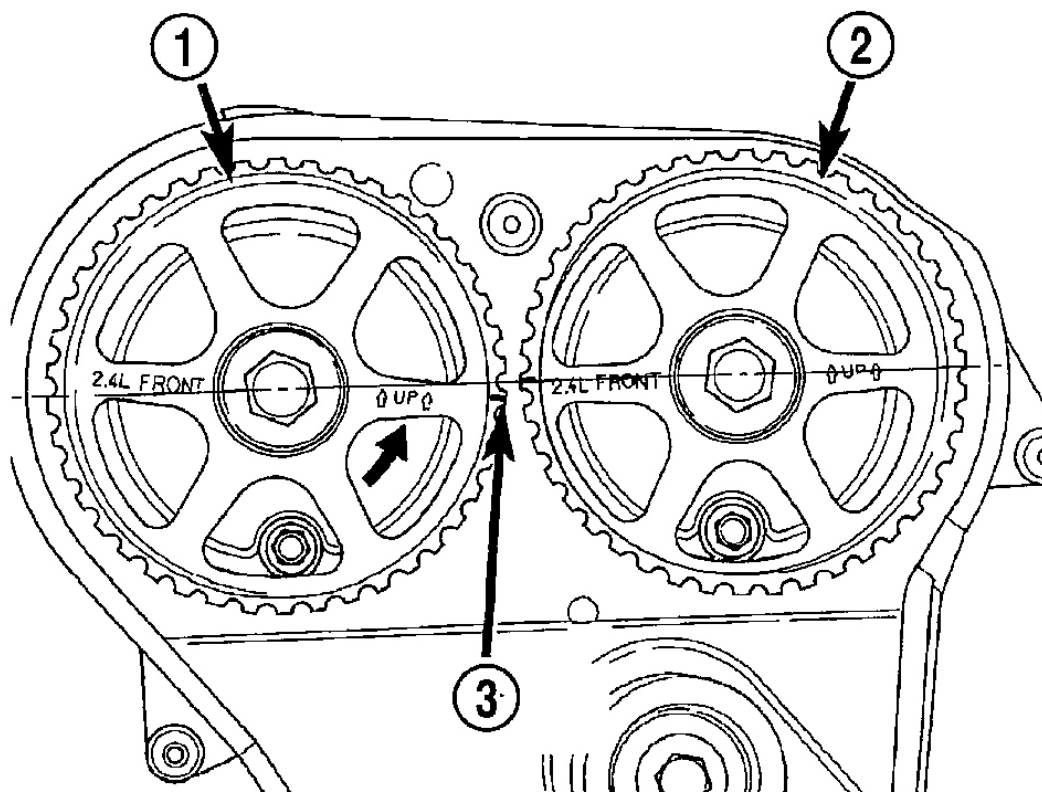
1. Install camshaft sprockets. Hold sprockets with Special Tool 6847 while tightening center bolt to 115 N.m (85 ft. lbs.). See **Fig. 221**.
2. Install timing belt. See **INSTALLATION - TIMING BELT**.
3. Install upper and lower front timing belt covers. See **TIMING BELT COVER(S)**.



## INSTALLATION - TIMING BELT

1. Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing.

**CAUTION:** Ensure that the arrows on both camshaft sprockets are facing up.

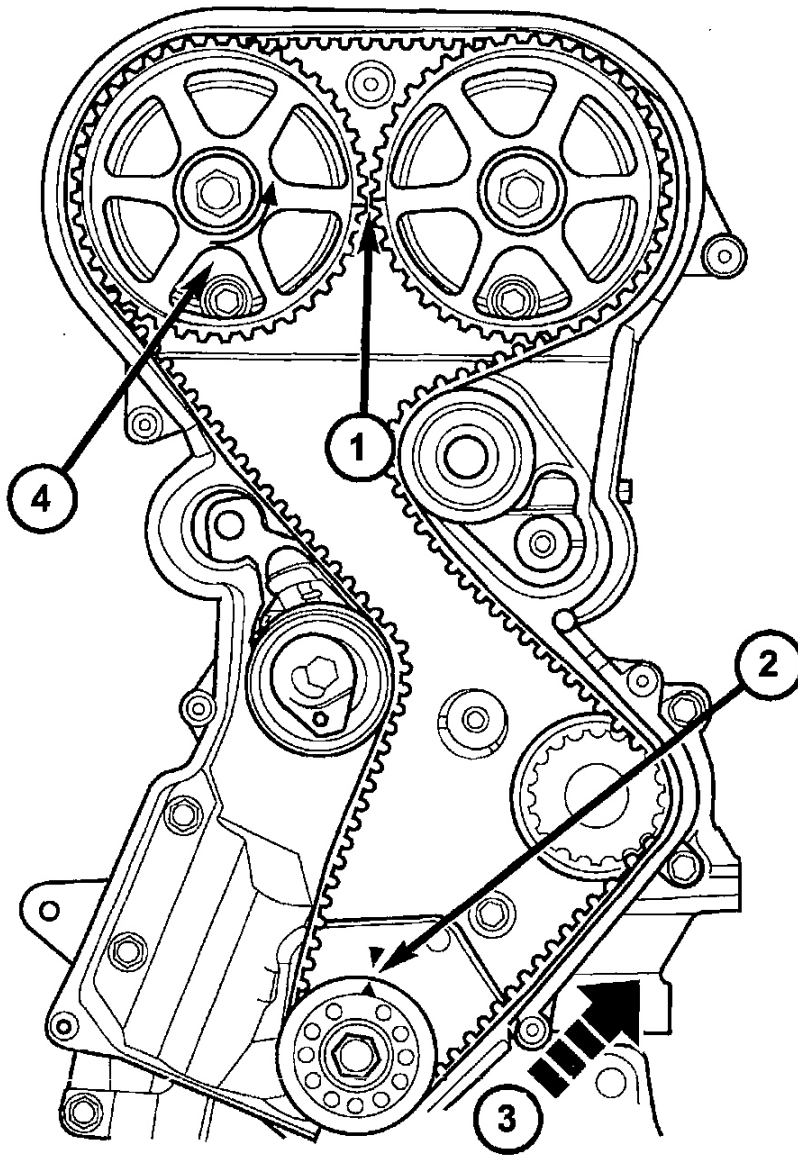


- 1 - CAMSHAFT SPROCKET-EXHAUST
- 2 - CAMSHAFT SPROCKET-INTAKE
- 3 - 1/2 NOTCH LOCATION

G01857895

**Fig. 224: Identifying Camshaft Sprocket Alignment For Timing Belt**  
Courtesy of DAIMLERCHRYSLER CORP.

2. Set camshafts timing marks so that the exhaust camshaft sprocket is a 1/2 notch below the intake camshaft sprocket.
3. Install timing belt. Starting at the crankshaft, go around the water pump sprocket, idler pulley, camshaft sprockets and then around the tensioner.



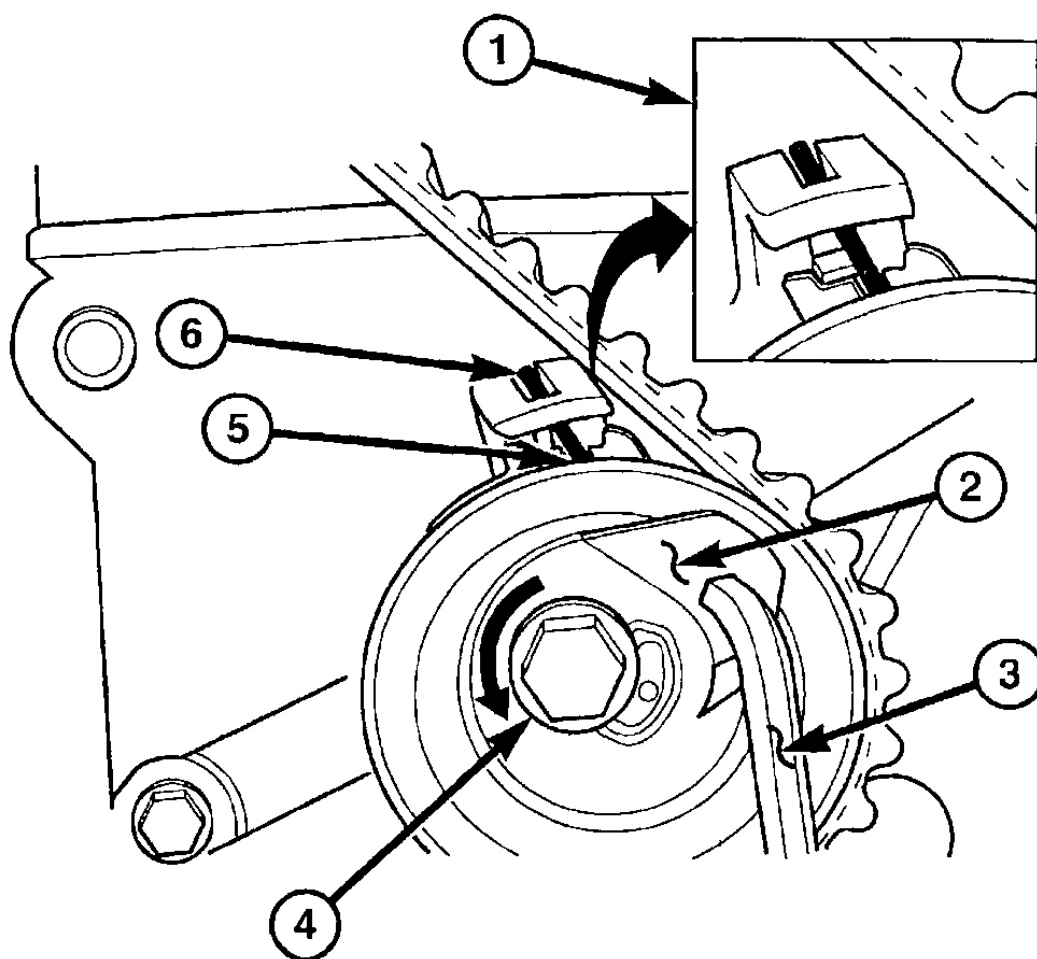
- 1 - CAMSHAFT TIMING MARKS 1/2 NOTCH LOCATION
- 2 - CRANKSHAFT AT TDC
- 3 - INSTALL BELT IN THIS DIRECTION
- 4 - ROTATE CAMSHAFT SPROCKET TO TAKE UP BELT SLACK

G01857896

**Fig. 225: Installing Timing Belt**  
Courtesy of DAIMLERCHRYSLER CORP.

- 4. Move the exhaust camshaft sprocket counterclockwise to align marks and take up belt slack.
- 5. Insert a 6 mm Allen wrench into the hexagon opening located on the top plate of the belt tensioner pulley.

Rotate the top plate **COUNTERCLOCKWISE** . The tensioner pulley will move against the belt and the tensioner setting notch will eventually start to move clockwise. Watching the movement of the setting notch, continue rotating the top plate counterclockwise until the setting notch is aligned with the spring tang. Using the allen wrench to prevent the top plate from moving, torque the tensioner lock bolt to 25 N.m (220 in. lbs.). Setting notch and spring tang should remain aligned after lock bolt is torqued.



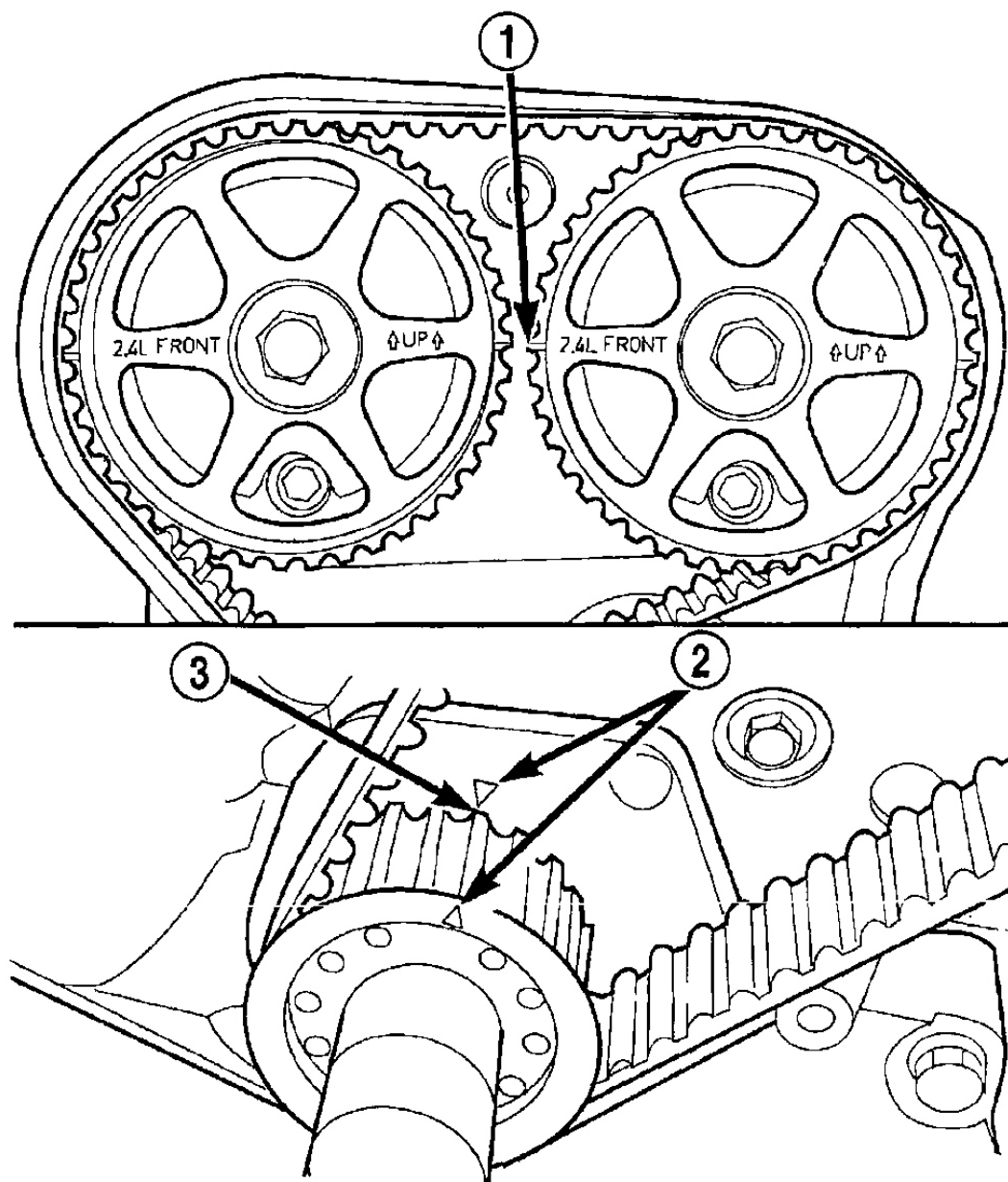
- 1 - ALIGN SETTING NOTCH WITH SPRING TANG
- 2 - TOP PLATE
- 3 - 6mm ALLEN WRENCH
- 4 - LOCK BOLT
- 5 - SETTING NOTCH
- 6 - SPRING TANG

G01857897

**Fig. 226: Adjusting Timing Belt Tension**  
**Courtesy of DAIMLERCHRYSLER CORP.**

6. Remove allen wrench and torque wrench.

**NOTE:** Repositioning the crankshaft to the TDC position must be done only during the **CLOCKWISE** rotation movement. If TDC is missed, rotate a further two revolutions until TDC is achieved. **DO NOT** rotate crankshaft counterclockwise as this will make verification of proper tensioner setting impossible.

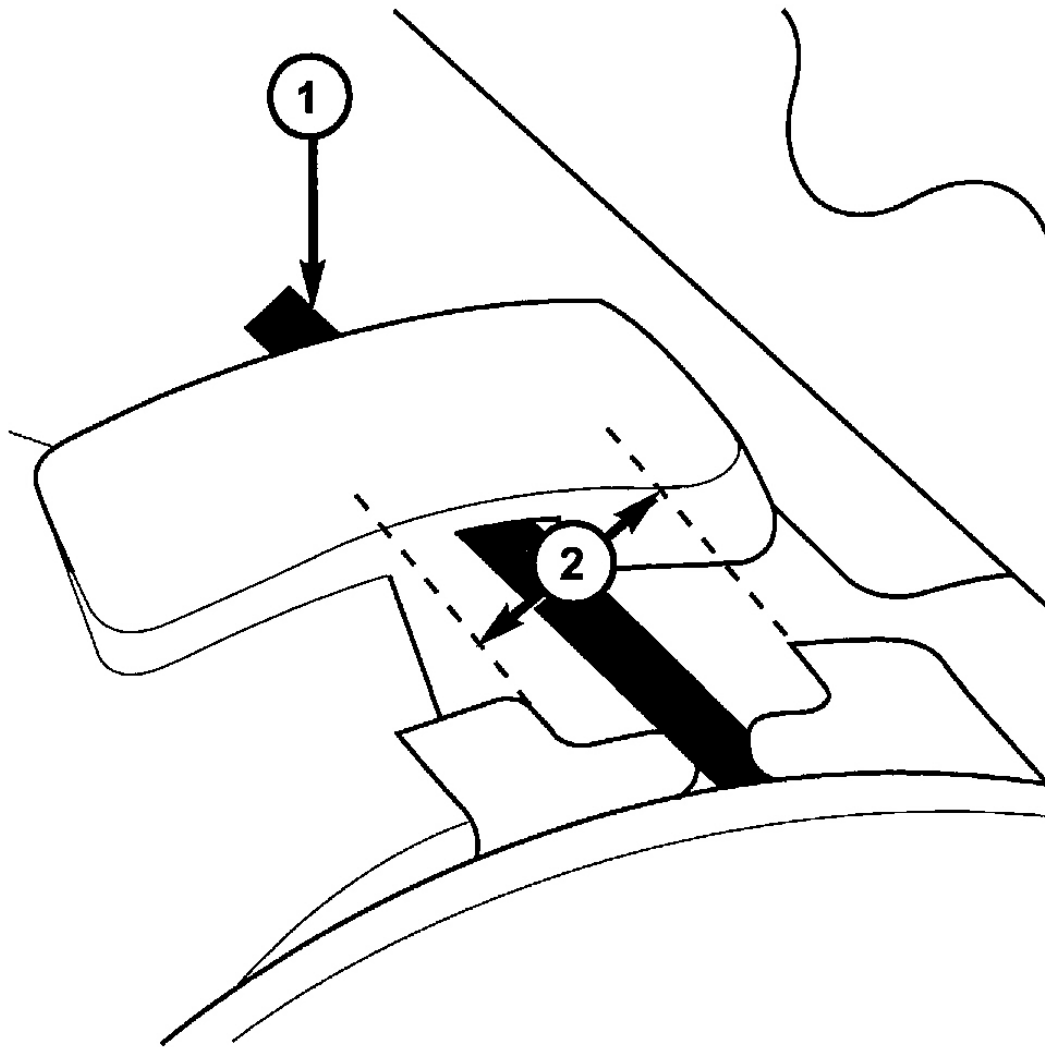


- 1 - CAMSHAFT TIMING MARKS
- 2 - CRANKSHAFT TDC MARKS
- 3 - TRAILING EDGE OF SPROCKET TOOTH

G01857898

**Fig. 227: Aligning Crankshaft & Camshaft Timing**  
 Courtesy of DAIMLERCHRYSLER CORP.

7. Rotate the crankshaft **CLOCKWISE** two complete revolutions manually for seating of the belt, until the crankshaft is repositioned at the TDC position. Verify that the camshaft and crankshaft timing marks are in proper position.
8. Check if the spring tang is within the tolerance window. If the spring tang is within the tolerance window, the installation process is complete and nothing further is required. If the spring tang is not within the tolerance window, repeat Steps 5 through 7.



1 - SPRING TANG  
2 - TOLERANCE WINDOW

G01857899

**Fig. 228: Verifying Timing Belt Tension**

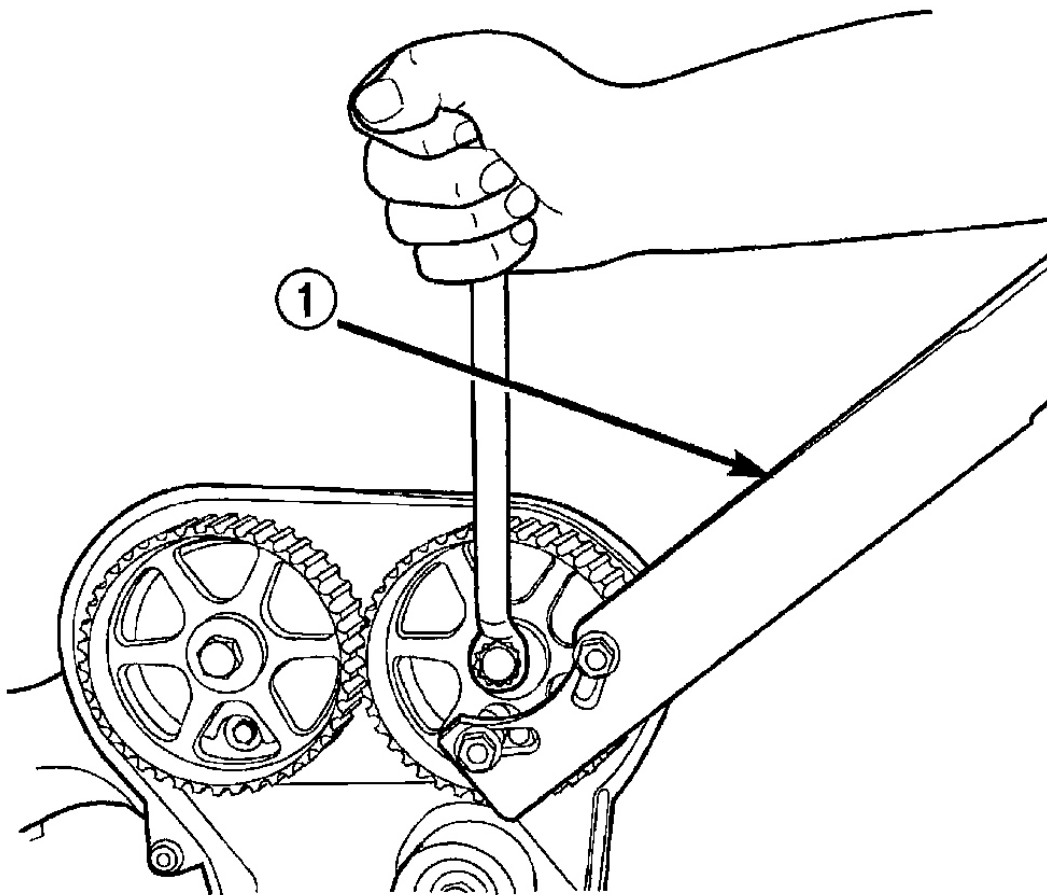
**Courtesy of DAIMLERCHRYSLER CORP.**

9. Install upper and lower front timing belt covers. See **Fig. 214**. See **TIMING BELT COVER(S)**.
10. Connect negative cable to battery.

## **TIMING BELT TENSIONER & PULLEY**

### **REMOVAL**

1. Remove timing belt. See **TIMING BELT AND SPROCKETS**.
2. Remove timing belt idler pulley.
3. Hold camshaft sprocket with Special Tool 6847 while removing bolt. Remove both camshaft sprockets.



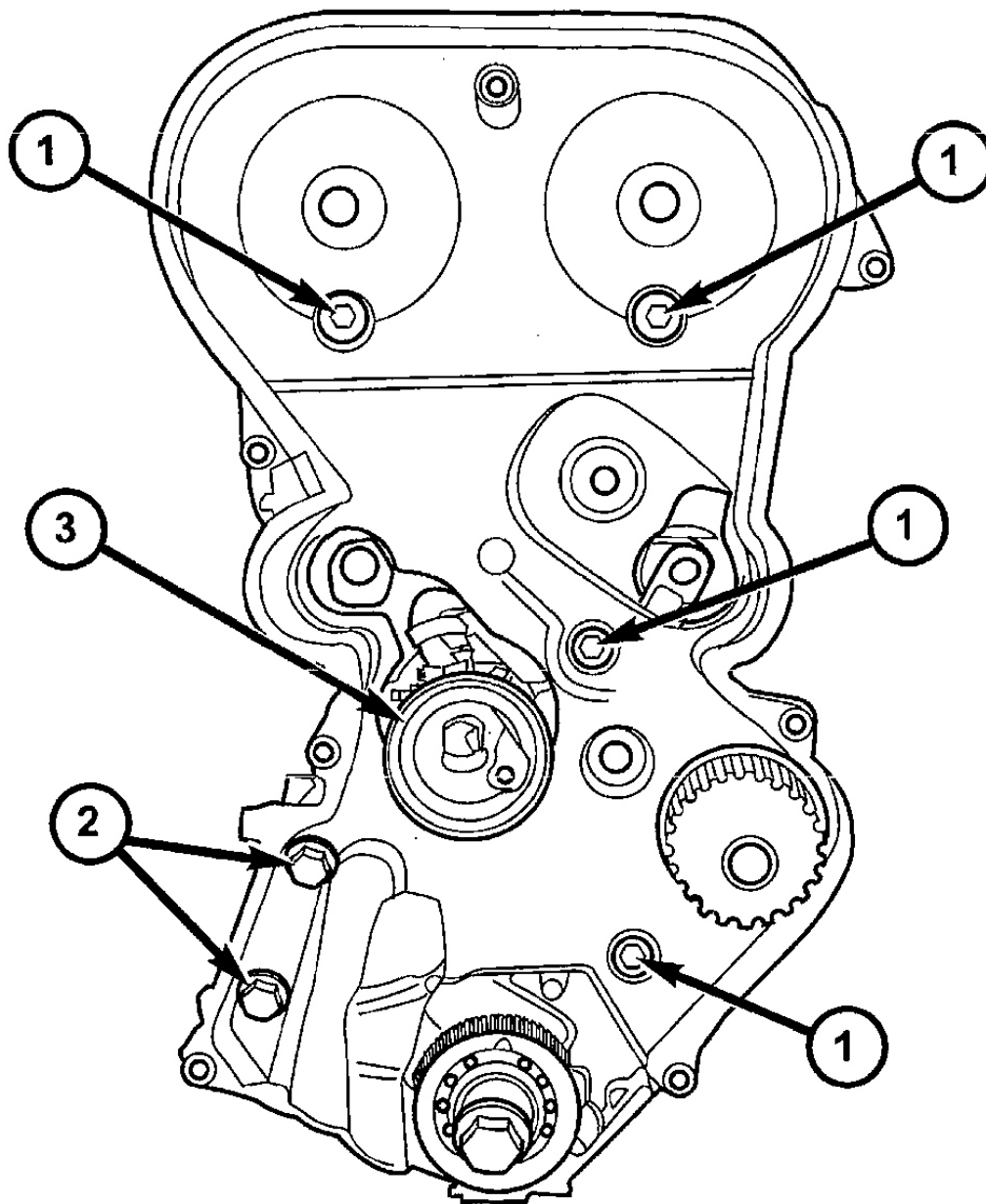
1 - SPECIAL TOOL 6847

G01857900

**Fig. 229: Removing Camshaft Sprockets**  
Courtesy of DAIMLERCHRYSLER CORP.

4. Remove rear timing belt cover fasteners and remove cover from engine.





1 - M6 BOLTS - 12 N·m (105 in. lbs.)

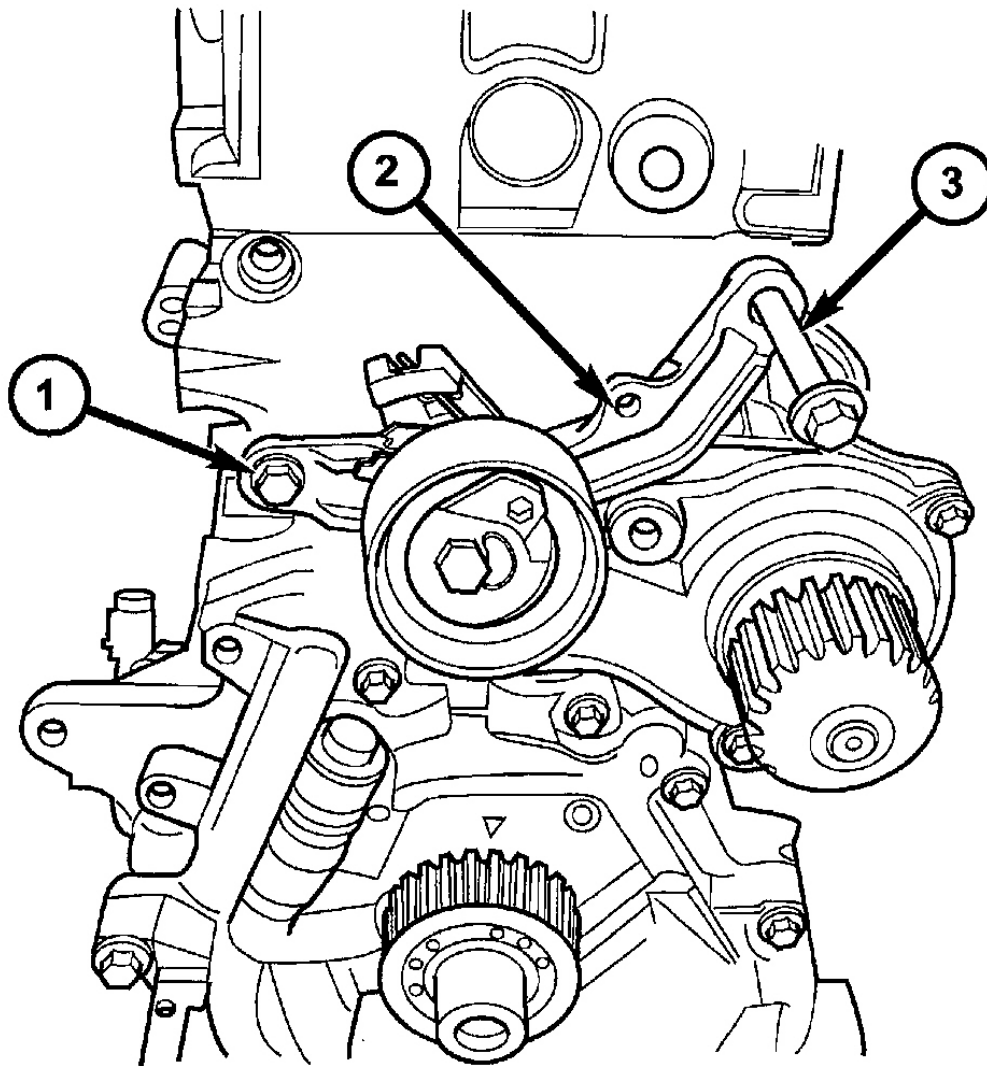
2 - M8 BOLTS - 28 N·m (250 in. lbs.)

3 - TIMING BELT TENSIONER

G01857901

**Fig. 230: Removing Rear Timing Belt Cover Fasteners**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Remove lower bolt attaching timing belt tensioner assembly to engine and remove tensioner **as an assembly** .



- 1 - BOLT  
2 - TENSIONER ASSEMBLY  
3 - BOLT-INSTALL FOR PROPER ALIGNMENT

G01857902

**Fig. 231: Removing Timing Belt Tensioner/Bracket Assembly**  
Courtesy of DAIMLERCHRYSLER CORP.

## INSTALLATION

1. Align timing belt tensioner assembly to engine and install lower mounting bolt **but do not tighten**. To properly align tensioner assembly to engine; temporarily install one of the engine bracket mounting bolts (M10) 5-7 turns into the tensioner assembly upper mounting location.
2. Torque the tensioner's lower mounting bolt to 61 N.m (45 ft. lbs.). Remove the upper bolt used for tensioner alignment.
3. Install rear timing belt cover and fasteners.
4. Install timing belt idler pulley and torque mounting bolt to 61 N.m (45 ft. lbs.).

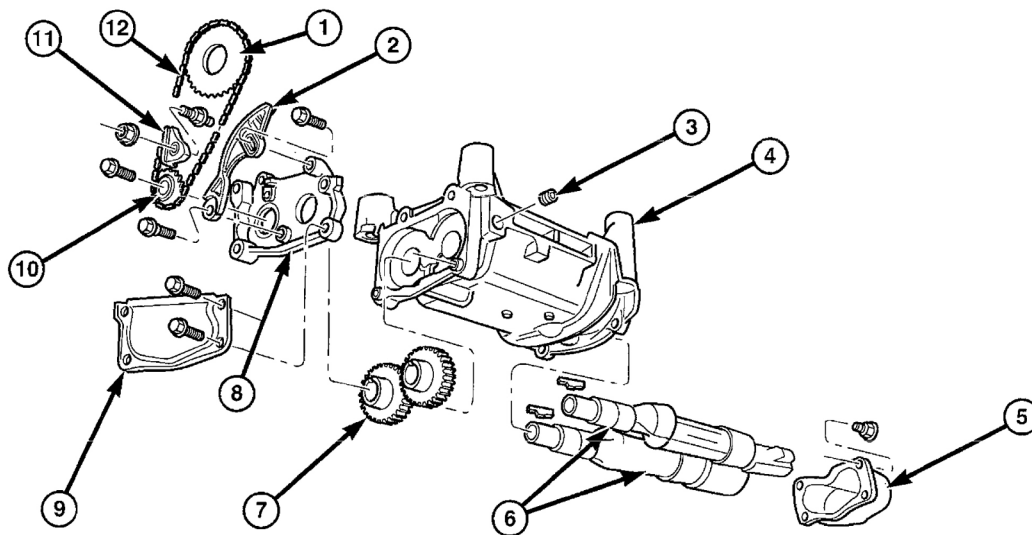
**CAUTION: Do not use an impact wrench to tighten camshaft sprocket bolts.  
Damage to the camshaft-to-sprocket locating dowel pin may occur.**

5. Install camshaft sprockets. Use Special Tool 6847 to hold sprockets and tighten bolts to 115 N.m (85 ft. lbs.).
6. Install timing belt. See **TIMING BELT AND SPROCKETS**.

## BALANCE SHAFTS AND CARRIER ASSEMBLY

### DESCRIPTION

The 2.4L engine is equipped with two nodular cast iron balance shafts installed in a cast aluminum carrier attached to the lower cylinder block.



1 - SPROCKET  
2 - TENSIONER  
3 - PLUG  
4 - CARRIER  
5 - REAR COVER  
6 - BALANCE SHAFTS

7 - GEARS  
8 - GEAR COVER  
9 - CHAIN COVER  
10 - SPROCKET  
11 - GUIDE  
12 - CHAIN

G01857903

**Fig. 232: Identifying Balance Shafts & Carrier Assembly**

Courtesy of DAIMLERCHRYSLER CORP.

## OPERATION

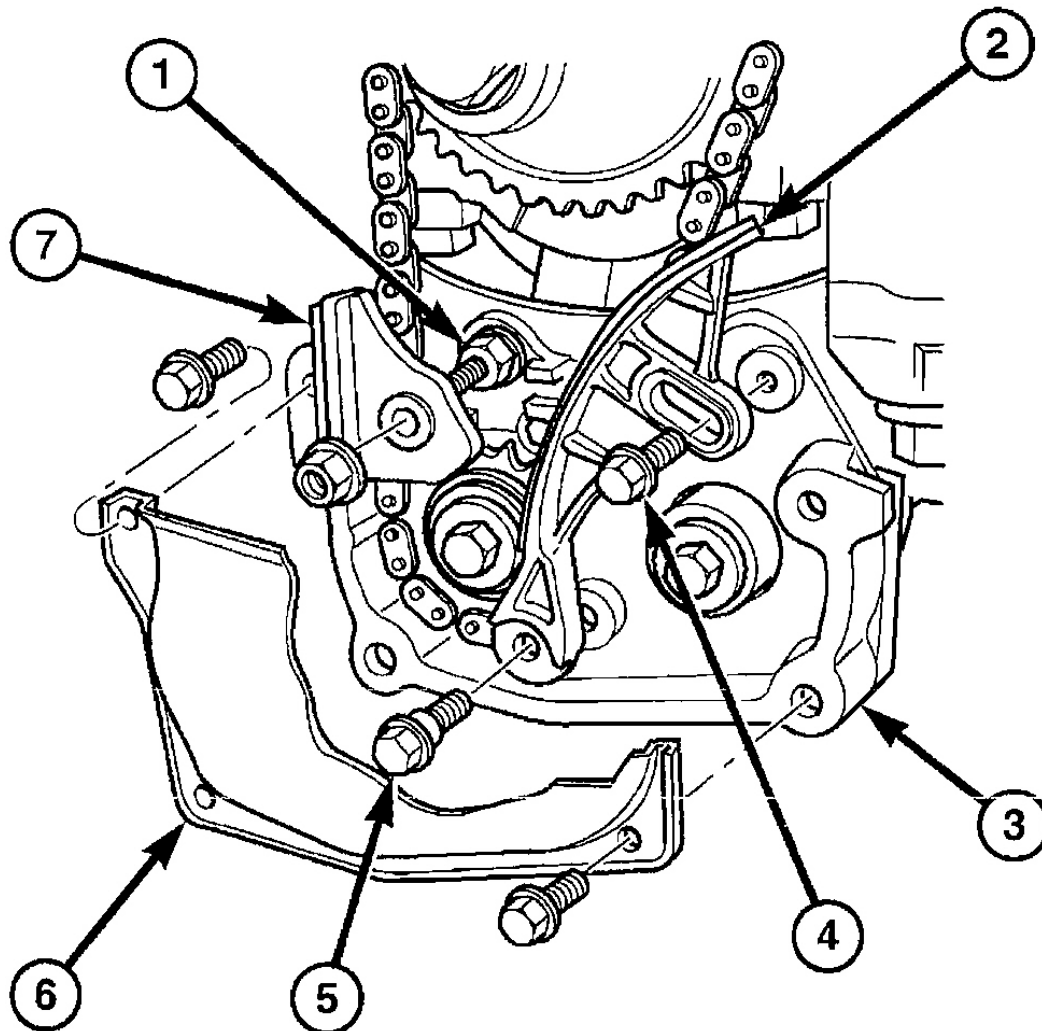
The balance shafts are driven by the crankshaft via a roller chain and sprockets. The balance shafts are connected by helical gears. The dual counter rotating shafts decrease second order vertical shaking forces caused by component movement.

## REMOVAL

### BALANCE SHAFTS/CHAIN/SPROCKETS

**NOTE:** For service procedures requiring only temporary relocation of carrier assembly refer to **BALANCE SHAFT CARRIER** procedure below.

1. Drain engine oil.
2. Remove the oil pan and pick-up tube. See **OIL PAN**.
3. If replacing crankshaft sprocket, remove oil pump. See **OIL PUMP**.
4. Remove chain cover, guide and tensioner. Discard pivot screw and adjuster screw.

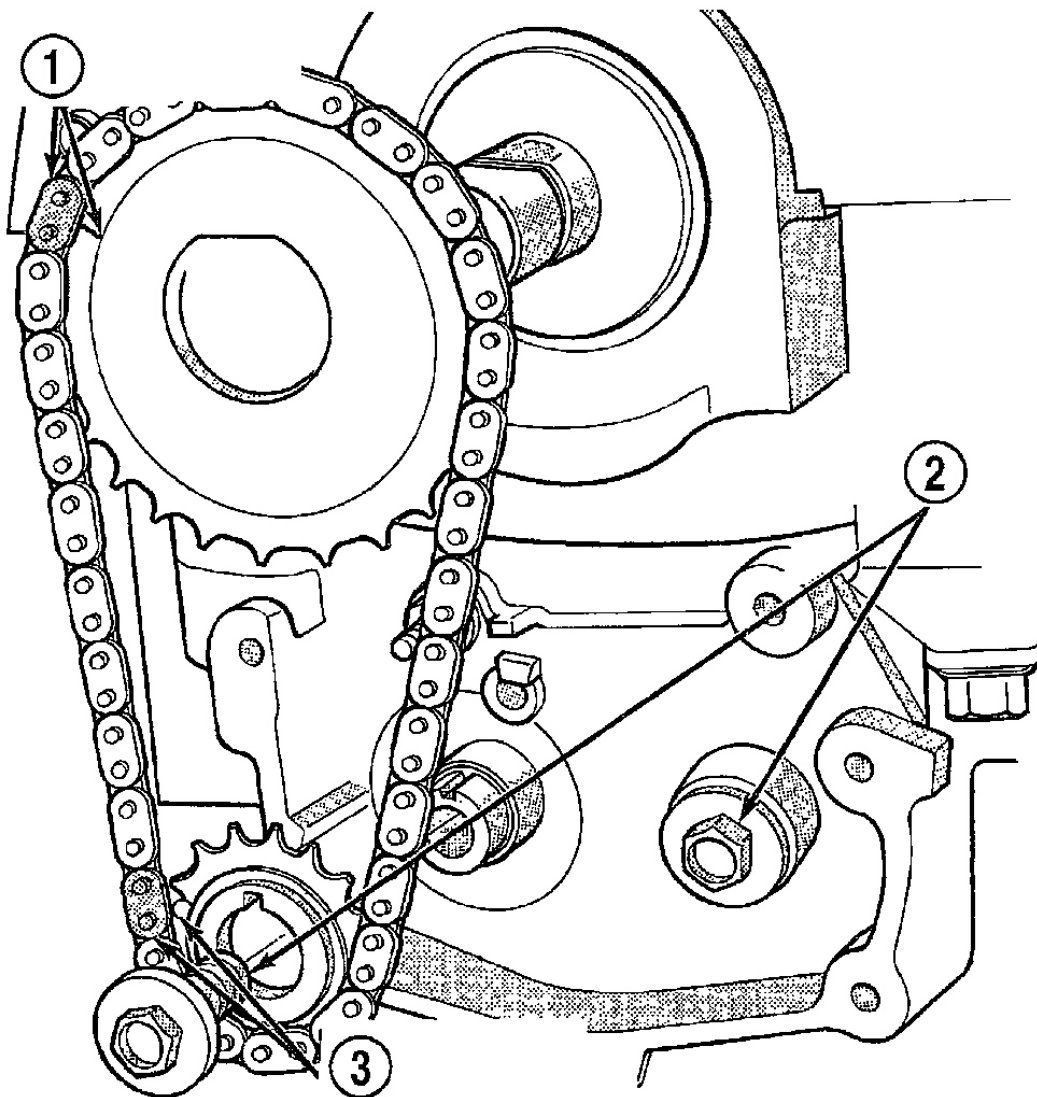


- 1 - STUD
- 2 - TENSIONER (ADJUSTER)
- 3 - GEAR COVER
- 4 - ADJUSTER SCREW
- 5 - SHOULDERED PIVOT SCREW
- 6 - CHAIN COVER (CUTAWAY)
- 7 - GUIDE

G01857904

**Fig. 233: Removing Chain Cover, Guide & Tensioner**  
 Courtesy of DAIMLERCHRYSLER CORP.

5. Remove screw retaining balance shaft drive sprocket. Remove chain and sprocket.

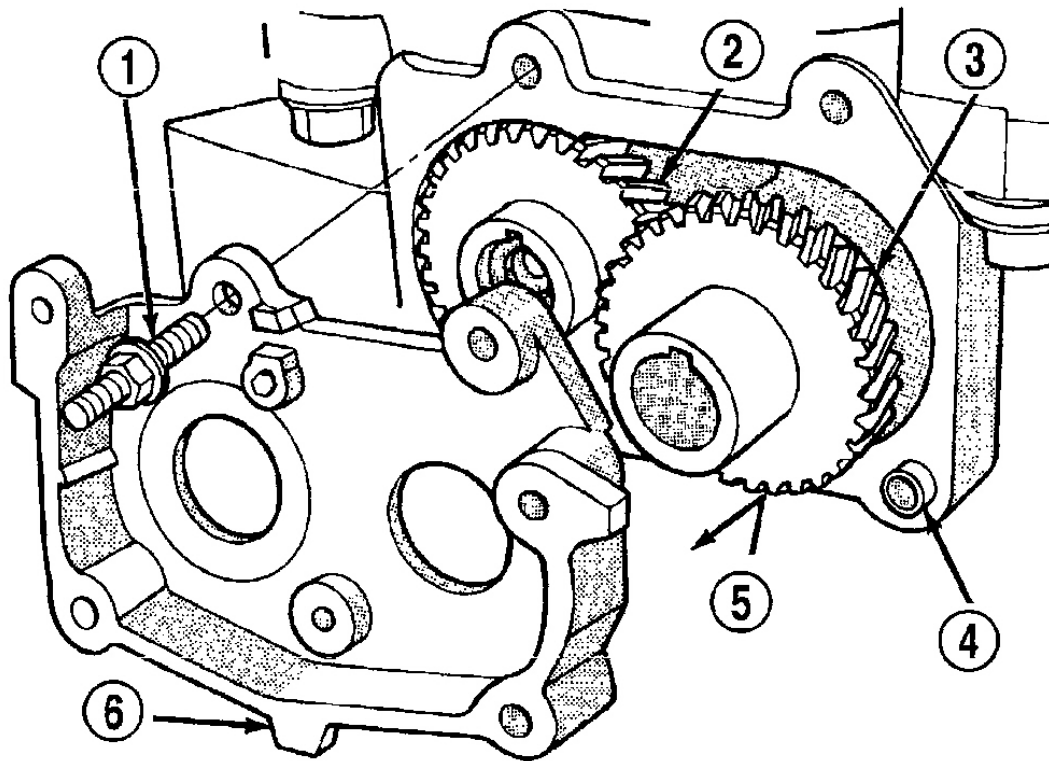


- 1 - NICKEL PLATED LINK AND MARK
- 2 - GEAR/SPROCKET SCREWS
- 3 - NICKEL PLATED LINK AND DOT

G01857905

**Fig. 234: Removing Drive Chain & Sprockets**  
 Courtesy of DAIMLERCHRYSLER CORP.

6. Using two, wide pry bars, work the crankshaft sprocket back and forth until it is off the crankshaftshaft.
7. Remove gear cover retaining stud (double ended to also retain chain guide). Remove cover and balance shaft gears.

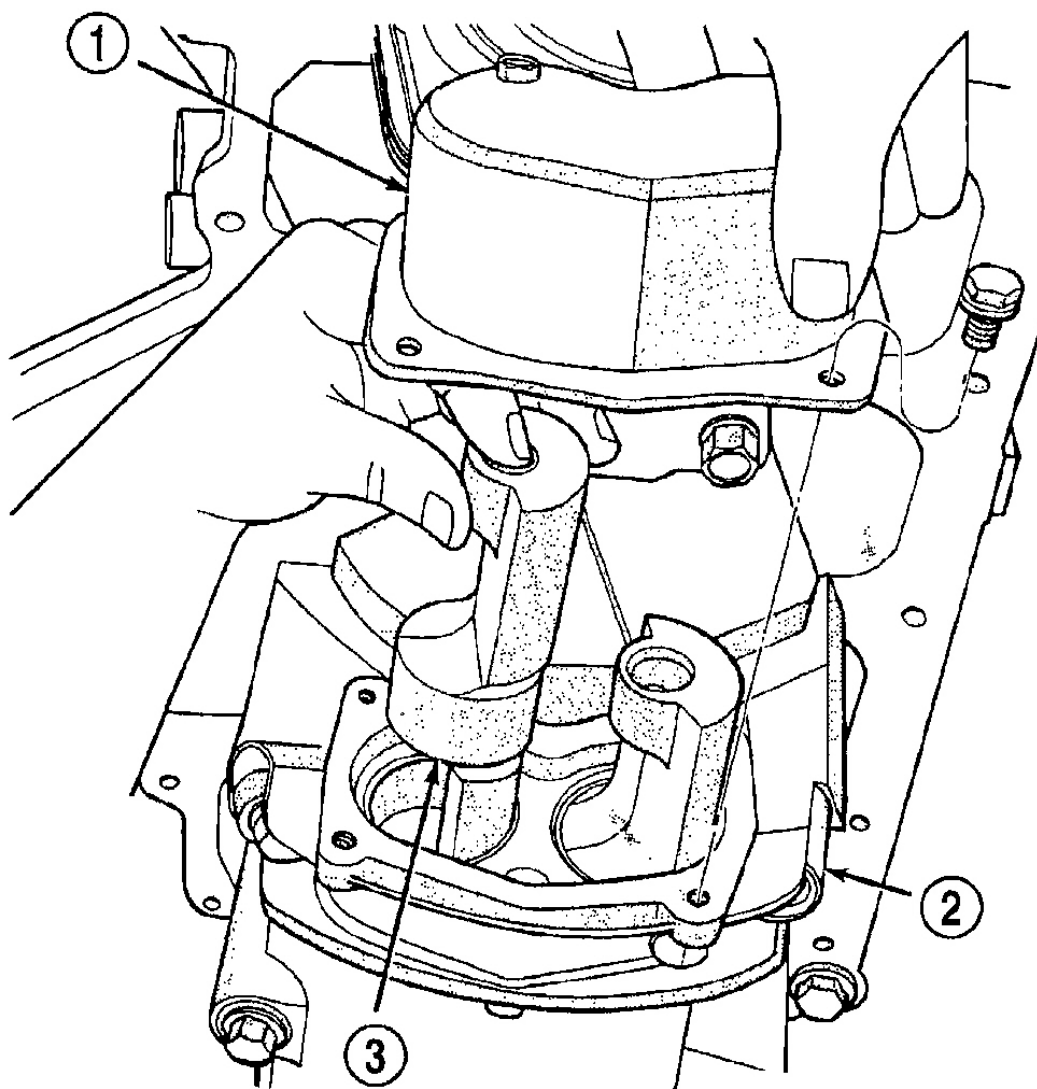


- 1 - STUD (DOUBLE ENDED)
- 2 - DRIVE GEAR
- 3 - DRIVEN GEAR
- 4 - CARRIER DOWEL
- 5 - GEAR(S)
- 6 - GEAR COVER

G01857906

**Fig. 235: Removing Gear Cover & Gears**  
 Courtesy of DAIMLERCHRYSLER CORP.

- 8. Remove rear cover and balance shafts.



- 1 - REAR COVER
- 2 - CARRIER
- 3 - BALANCE SHAFT

G01857907

**Fig. 236: Removing & Installing Balance Shaft**  
 Courtesy of DAIMLERCHRYSLER CORP.

9. Remove four carrier to crankcase attaching bolts to separate carrier from engine bedplate.

#### BALANCE SHAFT CARRIER



The following components will remain intact during carrier removal: Gear cover, gears, balance shafts and the rear cover. See **Fig. 232**.

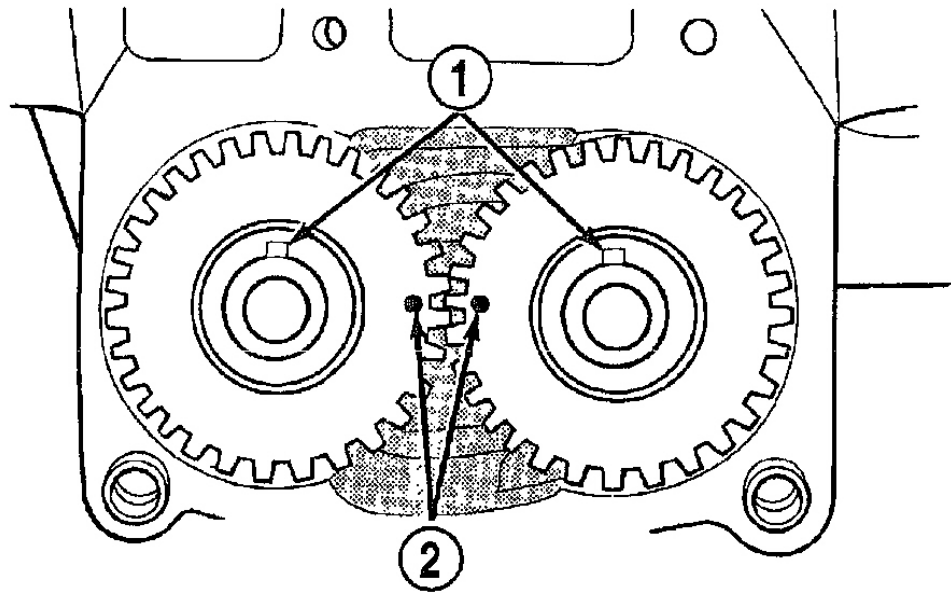
1. Drain engine oil.
2. Remove the oil pan and pick-up tube. See **OIL PAN**.
3. Remove chain cover, guide and tensioner. See **Fig. 233**.
4. Remove screw retaining balance shaft drive sprocket. See **Fig. 234**.
5. Move balance shaft inboard through drive chain sprocket. Sprocket will hang in lower chain loop.
6. Remove carrier to crankcase attaching bolts to remove carrier.

## INSTALLATION

### BALANCE SHAFT INSTALLATION/TIMING

Balance shaft and carrier assembly installation is the reverse of the removal procedure. **During installation crankshaft-to-balance shaft timing must be established.**

1. With balance shafts installed in carrier position carrier on crankcase and install four attaching bolts and tighten to 54 N.m (40 ft. lbs.). See **Fig. 232**.
2. Turn balance shafts until both shaft key ways are up, parallel to vertical centerline of engine. Install short hub drive gear on sprocket driven shaft and long hub gear on gear driven shaft. After installation gear and balance shaft keyways must be up with gear timing marks meshed as shown.



1 - KEYWAYS UP

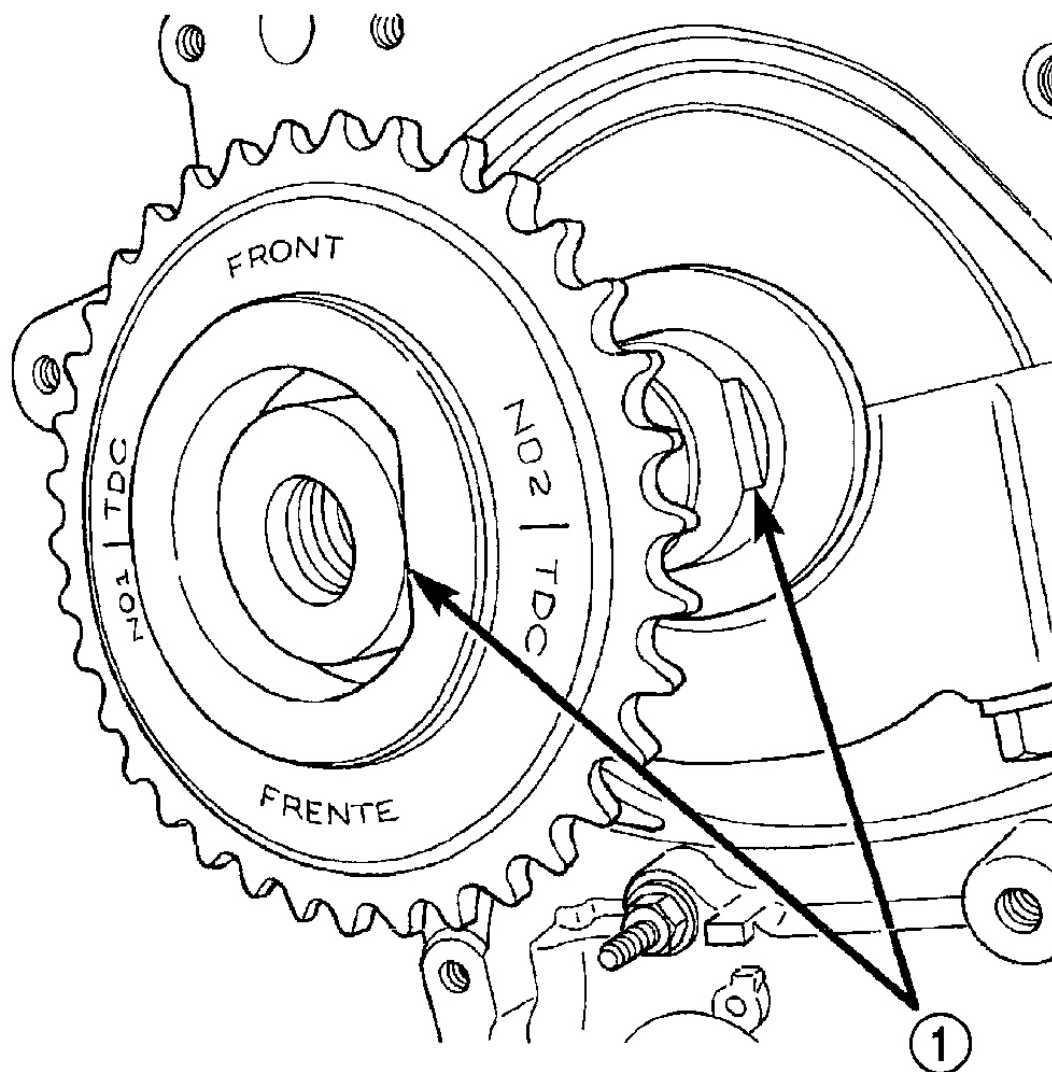
2 - GEAR ALIGNMENT DOTS

G01857908

**Fig. 237: Aligning Timing Gear**

Courtesy of DAIMLERCHRYSLER CORP.

3. Install gear cover and tighten double ended stud/washer fastener to 12 N.m (105 in. lbs.).
4. Align flat on balance shaft drive sprocket to the flat on crankshaft.

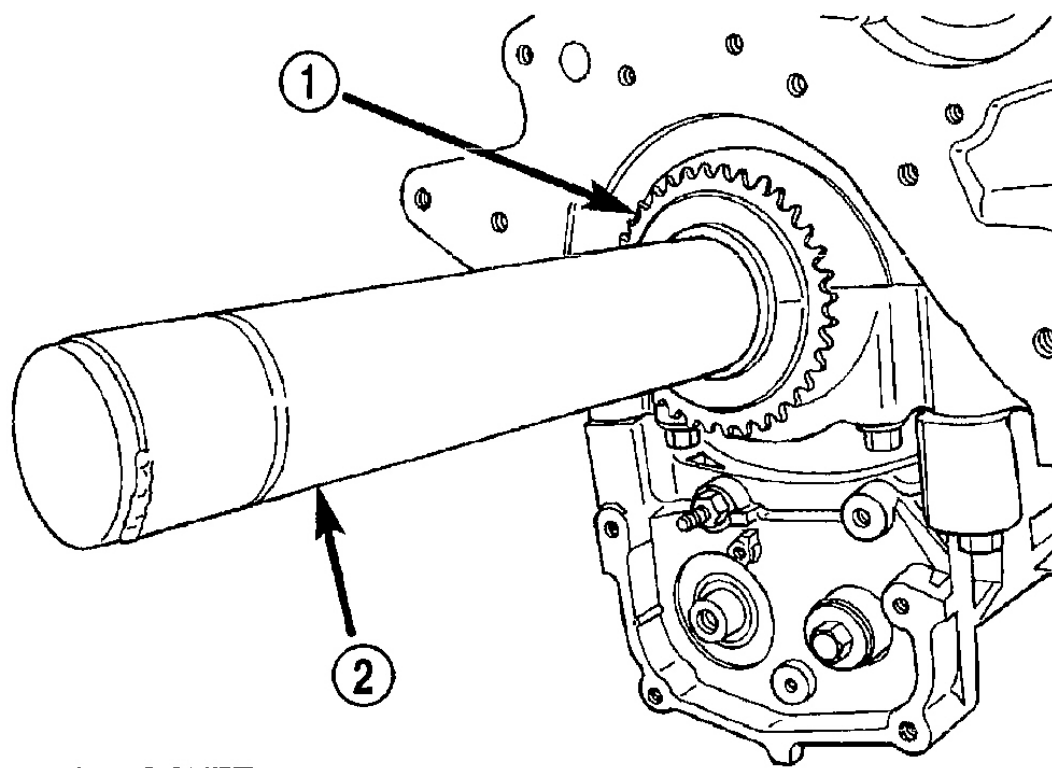


1 - ALIGN FLATS

G01857909

**Fig. 238: Aligning Balance Shaft Sprocket To Crankshaft**  
Courtesy of DAIMLERCHRYSLER CORP.

5. Install balance shaft drive sprocket on crankshaft using Special Tool 6052.

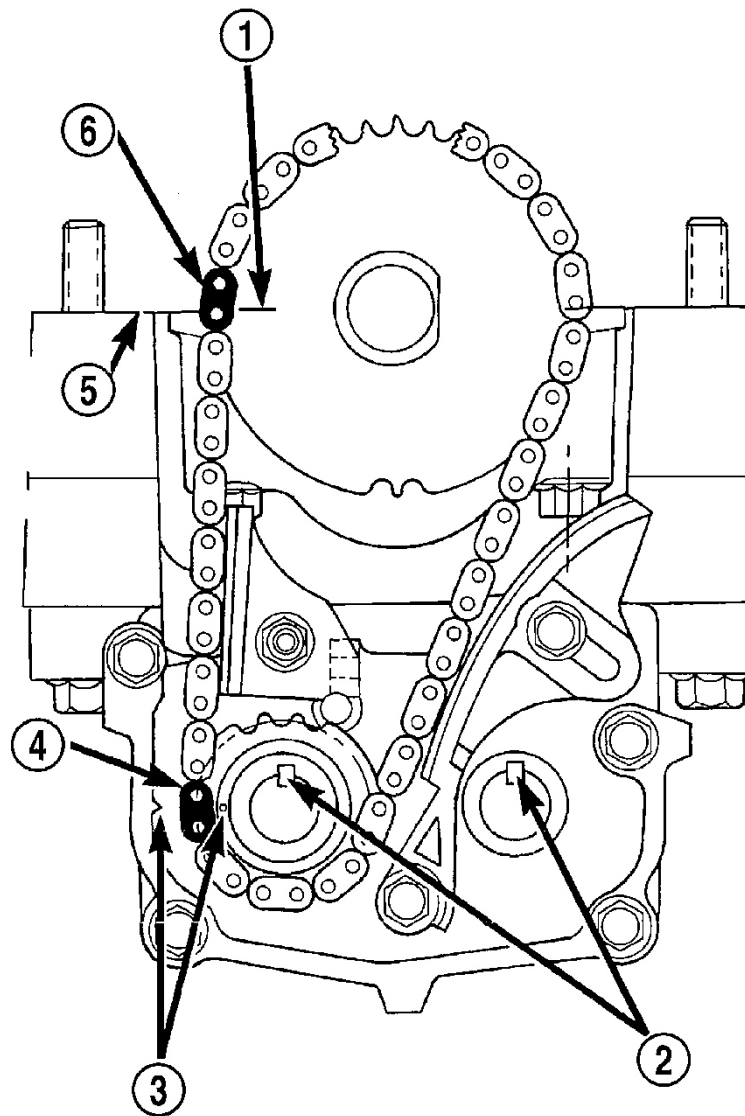


- 1 - SPROCKET
- 2 - SPECIAL TOOL 6052

G01857910

**Fig. 239: Identifying Balance Shaft Drive**  
**Courtesy of DAIMLERCHRYSLER CORP.**

6. Turn crankshaft until number 1 cylinder is at top dead center (TDC). The timing marks on the chain sprocket should line up with the parting line on the left side of number one main bearing cap.



- 1 - MARK ON SPROCKET
- 2 - KEYWAYS UP
- 3 - ALIGN MARKS
- 4 - PLATED LINK
- 5 - PARTING LINE (BEDPLATE TO BLOCK)
- 6 - PLATED LINK

G01857911

**Fig. 240: Adjusting Balance Shaft Timing**  
 Courtesy of DAIMLERCHRYSLER CORP.

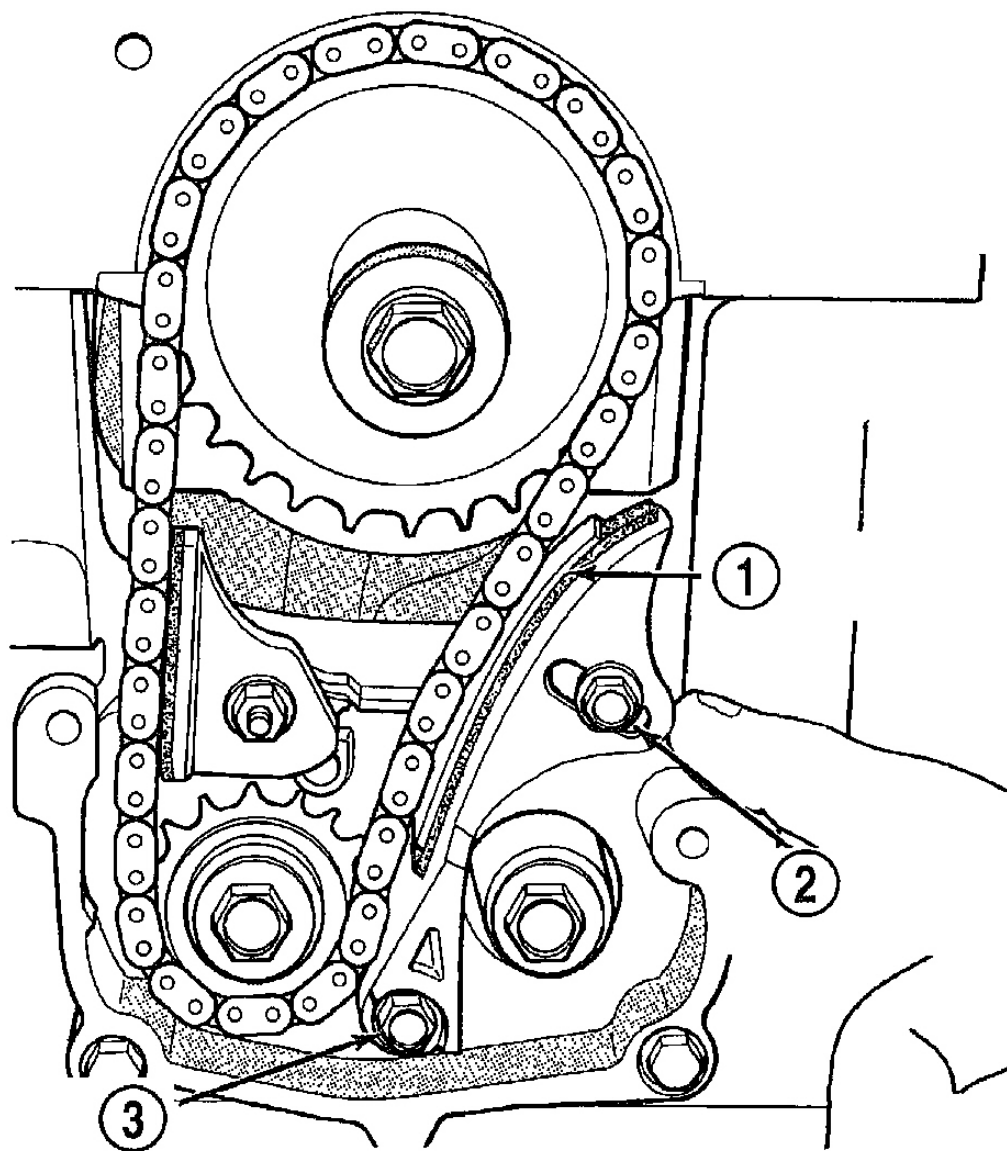
7. Place chain over crankshaft sprocket so that the plated link of the chain is over the number 1 cylinder timing mark on the balance shaft crankshaft sprocket.

**NOTE:**        **The lower plated link is 8 links from the upper link.**

8. Place balance shaft sprocket into the timing chain and align the timing mark on the sprocket (dot) with the (lower) plated link on the chain.

**NOTE:**        **THE TIMING MARK ON THE SPROCKET, THE (LOWER) NICKEL PLATED LINK, AND THE ARROW ON THE SIDE OF THE GEAR COVER SHOULD LINE UP WHEN THE BALANCE SHAFTS ARE TIMED CORRECTLY.**

9. With balance shaft keyways pointing up (12 o'clock) slide the balance shaft sprocket onto the nose of the balance shaft. The balance shaft may have to be pushed in slightly to allow for clearance
10. If the sprockets are timed correctly, install the balance shaft bolts and tighten to 28 N.m (250 in. lbs.). A wood block placed between crankcase and crankshaft counterbalance will prevent crankshaft and gear rotation.
11. **CHAIN TENSIONING:**
  - a. Install chain tensioner loosely assembled with **new** adjuster screw and shouldered pivot screw.
  - b. Position guide on double ended stud making sure tab on the guide fits into slot on the gear cover. Install and tighten nut/washer assembly to 12 N.m (105 in. lbs.).
  - c. Place a shim 1 mm (0.039 in.) thick x 70 mm (2.75 in.) long between tensioner and chain. Push tensioner and shim up against the chain. **Apply firm pressure 2.5-3 Kg (5.5-6.6 lbs.) directly behind the adjustment slot to take up all slack.** Chain must have shoe radius contact as shown.



- 1 - 1MM (0.039 IN.) SHIM
  - 2 - TENSIONER (ADJUSTER) BOLT
  - 3 - SHOULDERED PIVOT BOLT
- G01857912

**Fig. 241: Adjusting Chain Tension**  
Courtesy of DAIMLERCHRYSLER CORP.

- d. With the load applied, tighten top tensioner adjuster bolt first, then bottom shouldered pivot bolt. Tighten bolts to 12 N.m (105 in. lbs.). Remove shim.
- e. Install carrier covers and tighten screws to 12 N.m (105 in. lbs.).
12. If removed, install oil pump. See **OIL PUMP**.
13. Install pick-up tube and oil pan. See **OIL PAN**.
14. Fill engine crankcase with proper oil to correct level.

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS

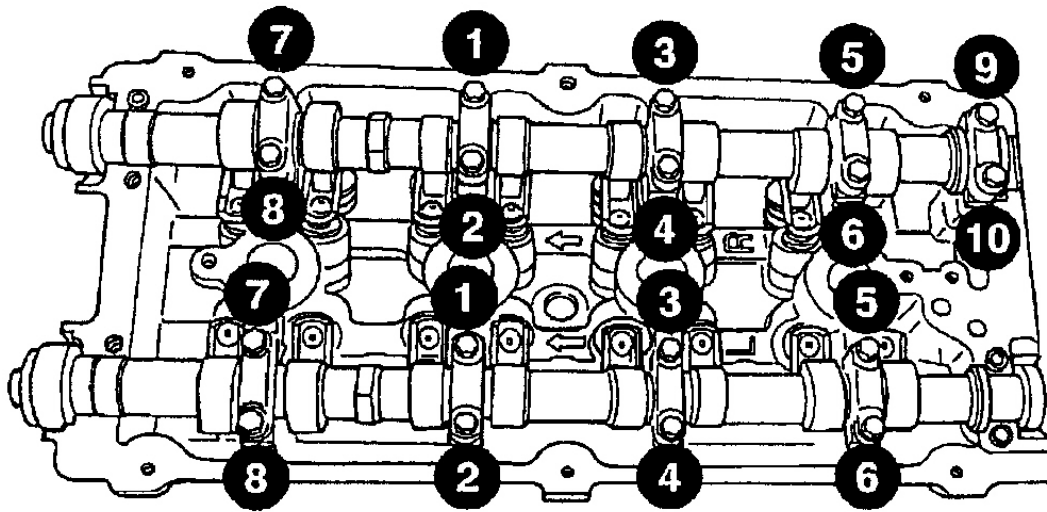
Application	Ft. Lbs (N.m)
Balance Shaft Carrier-To-Crankshaft Bolts	40 (54)
Balance Shaft Sprocket Bolt	21 (28)
Camshaft Bearing Cap M8 Bolts <sup>(1)</sup>	21 (28)
Camshaft Sprocket Bolt	85 (115)
Connecting Rod Bolts	20 (27)
Crankshaft Damper Pulley Bolt	100 (136)
Crankshaft Main Bearing Cap/Bedplate <sup>(3)</sup>	
Bedplate M8 Bolts	21 (28)
Main Cap M11 Bolts	55 (75)
Cylinder Head Bolts	
1st Step	25 (34)
2nd Step	50 (68)
3rd Step (Repeat Step 2)	50 (68)
4th Step <sup>(5)</sup>	Tighten Additional 1/4 Turn
Engine Mount Through Bolts (Front & Rear)	45 (61)
Engine Support Bracket Bolts	45 (61)
Exhaust Manifold-To-Cylinder Head Bolts	17 (23)
Exhaust Pipe-To-Manifold Bolts	21 (28)
Flexplate Bolts	70 (95)
Intake Manifold Bolts	21 (28)
Oil Pan Drain Plug	21 (28)
Oil Pump Pick-Up Tube Screw	17 (23)
Oil Pump Relief Valve Retaining Plug	30 (41)
Oil Pump-To-Block Bolts	21 (28)
Spark Plugs	13 (18)
Structural Collar	<sup>(6)</sup>
Thermostat Housing Bolts	17 (23)



**2004 Chrysler PT Cruiser GT**

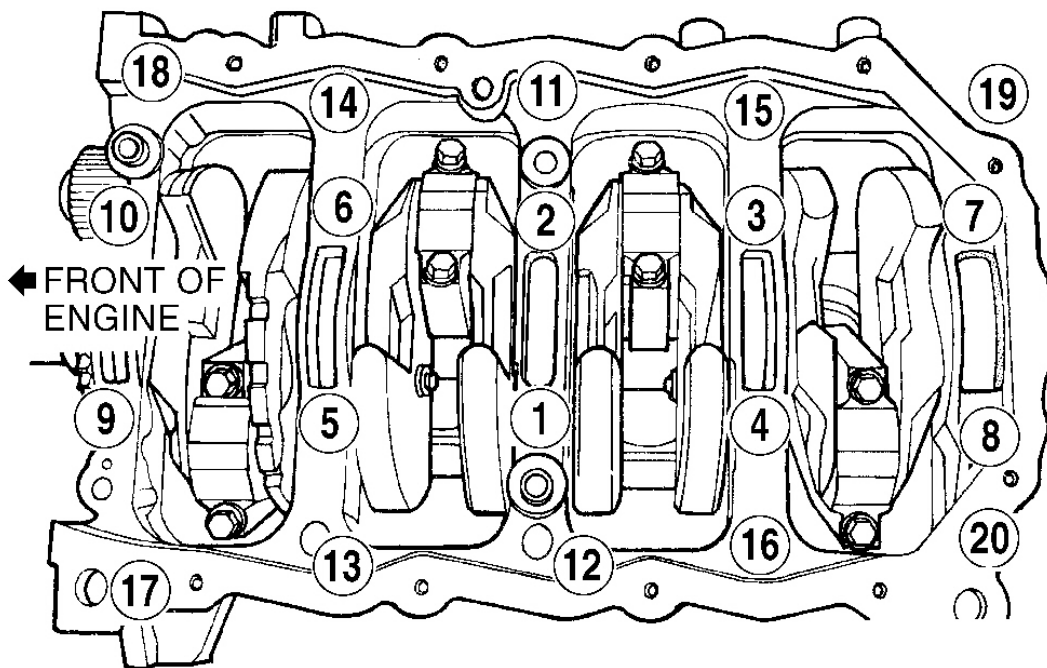
2004 ENGINES 2.4L 4-Cylinder DOHC

Timing Belt Cover M8 Bolts (Rear)	21 (28)
Timing Belt Idler Pulley Bolt	45 (61)
Timing Belt Tensioner Lock Bolt	18 (25)
Timing Belt Tensioner Assembly Bolts	45 (61)
<b>INCH Lbs. (N.m)</b>	
Balance Shaft Carrier Cover Screws	106 (12)
Balance Shaft Gear Cover Double Ended Stud/Washer	106 (12)
Balance Shaft Timing Chain Tensioner Lower/Upper Mounting Bolt	106 (12)
Camshaft Cover Bolts <b>Fig. 246</b>	
Step 1	40 (4.5)
Step 2	80 (9.0)
Step 3	106 (12)
Camshaft Bearing Cap M6 Bolts	106 (12)
Camshaft Sensor Pick-Up Bolts	114 (12.9)
Exhaust Manifold Heat Shield Bolts	106 (12)
Oil Filter	97 (11)
Oil Pan Bolts	106 (12)
Oil Pump Cover Screws	106 (12)
Timing Belt Cover M6 Bolts (Front)	106 (12)
Water Pump Body-To-Block Bolts	106 (12)
<p>(1) Tighten bolts to specification in sequence. See <b>Fig. 242</b>.</p> <p>(2) Tighten bolts to specification, then add 1/4 turn.</p> <p>(3) Tighten bolts to specification in sequence. See <b>Fig. 243</b>.</p> <p>(4) Tighten bolts to specification in sequence. See <b>Fig. 244</b>.</p> <p>(5) DO NOT use a torque wrench for 4th step.</p> <p>(6) Tighten bolts to specification in sequence using the 7 step procedure. See <b>STRUCTURAL COLLAR</b>. See <b>Fig. 245</b>.</p> <p>(7) Tighten bolts to specification. See <b>Fig. 246</b>.</p>	



G00183566

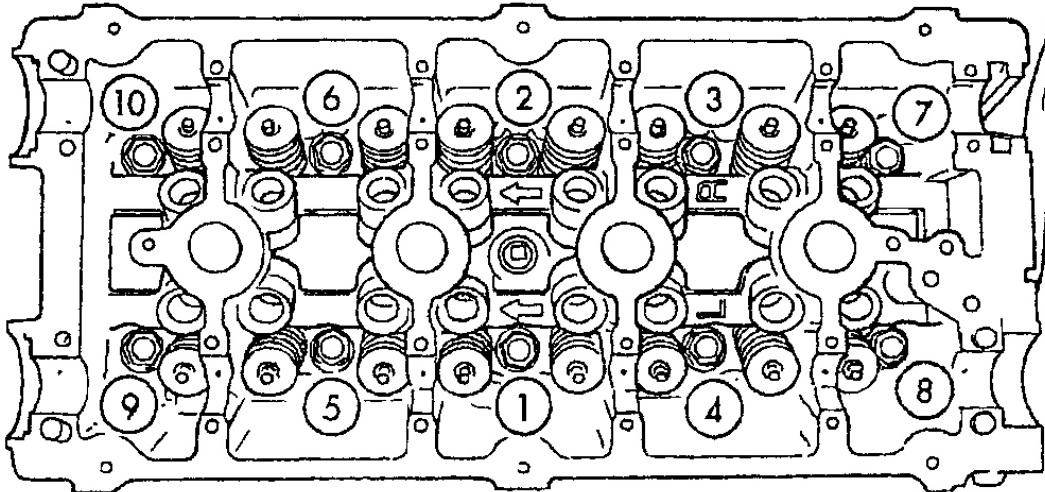
**Fig. 242: Tightening Sequence Of Camshaft Bearing Cap Bolts**  
Courtesy of CHRYSLER CORP.



G95H14784

**Fig. 243: Installing Main Bearing Bolts**

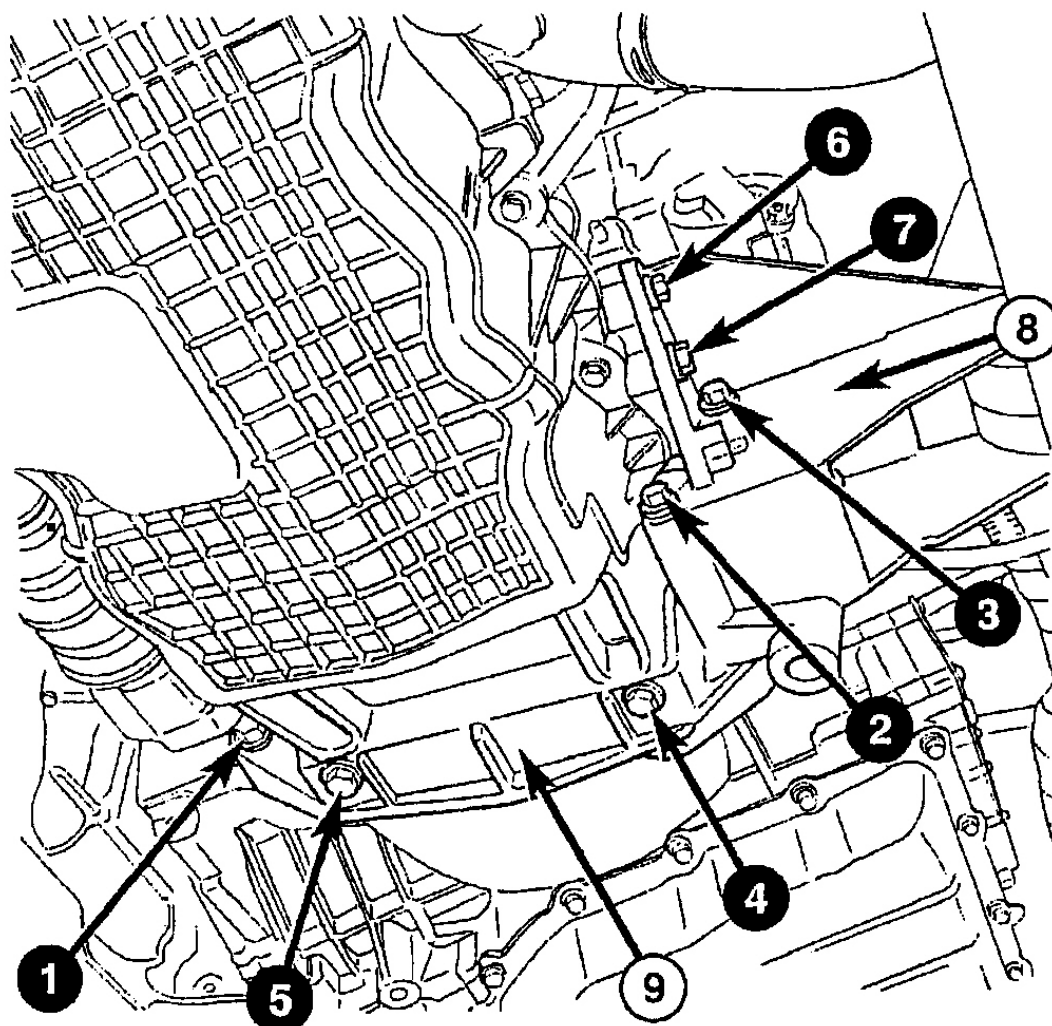
Courtesy of CHRYSLER CORP.



G00183547

**Fig. 244: Tightening Sequence Of Cylinder Head Bolts**

Courtesy of CHRYSLER CORP.



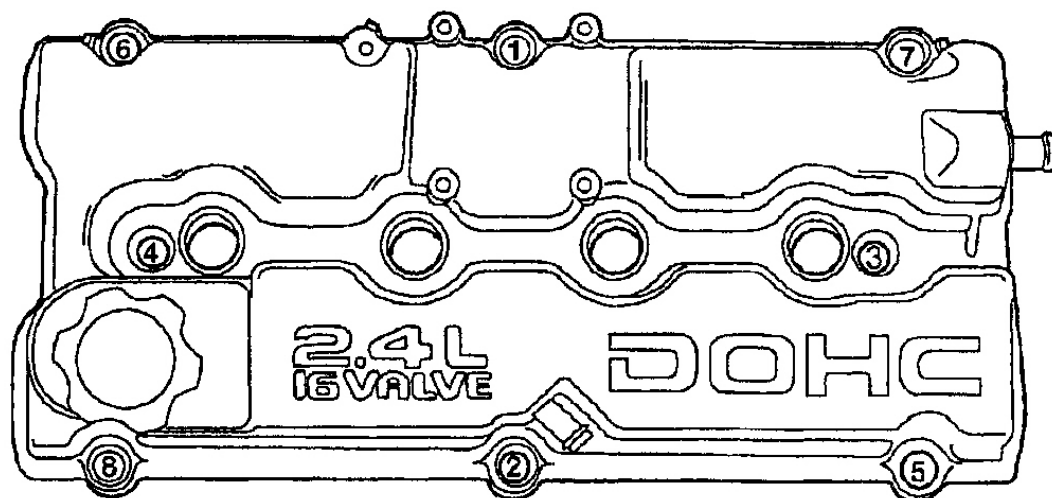
1-7 - BOLT TIGHTENING SEQUENCE

8 - TORQUE REACTION BRACKET

9 - STRUCTURAL COLLAR

G00191975

**Fig. 245: Removing/Installing Structural Collar & Torque Reaction Bracket Bolts**  
Courtesy of CHRYSLER CORP.



G00183542

**Fig. 246: Tightening Sequence Of Camshaft Cover Bolts**  
 Courtesy of CHRYSLER CORP.

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS (TURBO)

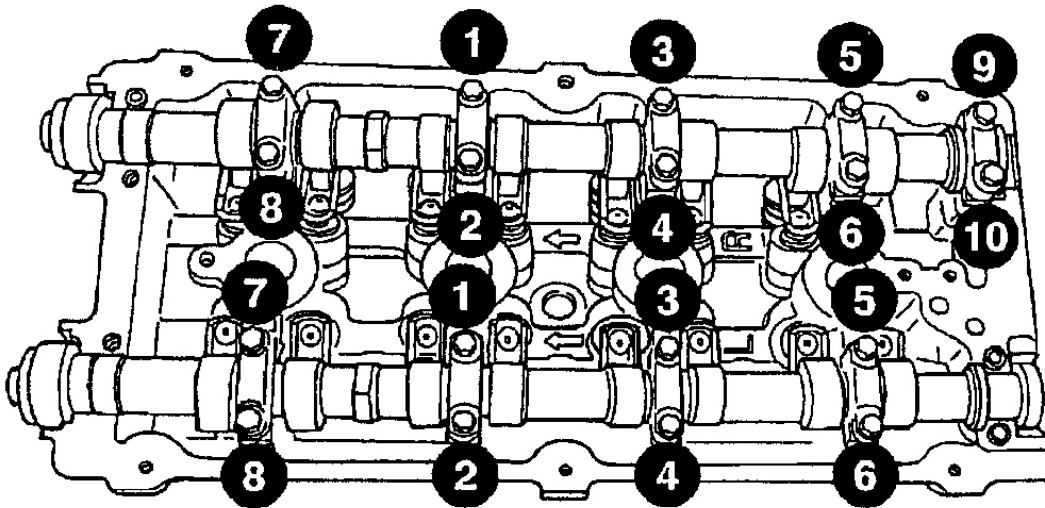
Application	Ft. Lbs. (N.m)
Balance Shaft Carrier-To-Block Bolt	40 (54)
Balance Shaft Sprocket Bolt	21 (28)
Camshaft Bearing Cap	
M6 Bolts	(1)
M8 Bolts	21 (28)
Camshaft Sprocket Bolt	85 (115)
Connecting Rod Bolts	
Step 1	20 (27)
Step 2	Plus 1/4 Turn
Crankshaft Damper Pulley Bolt	100 (136)
Crankshaft Main Bearing Cap/Bedplate <sup>(2)</sup>	
Bedplate M8 Bolts	21 (28)
Main Bearing Cap M11 Bolts	55 (75)
Cylinder Head Bolts <sup>(3)</sup>	
Step 1	25 (34)
Step 2	60 (82)
Step 3 (Repeat Step 2)	60 (82)
Step 4	Plus 1/4 Turn

## 2004 Chrysler PT Cruiser GT

2004 ENGINES 2.4L 4-Cylinder DOHC

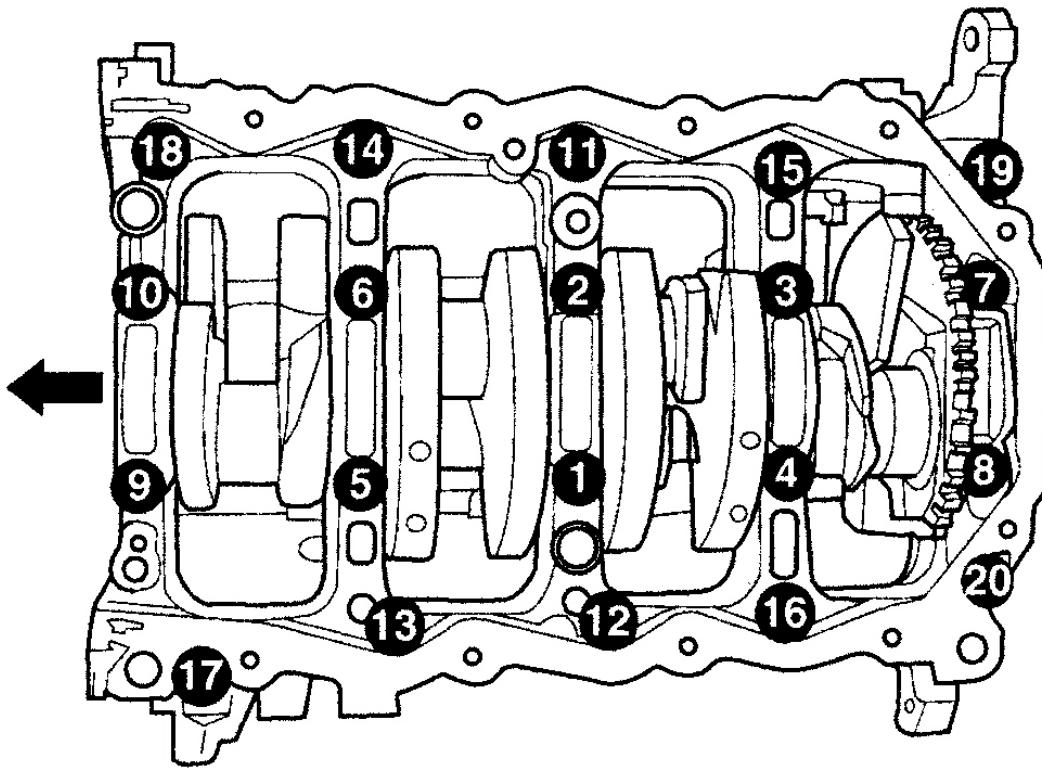
Engine Support Bracket Bolts	45 (61)
Exhaust Manifold-To-Cylinder Head Bolts	17 (23)
Flexplate Bolts	70 (95)
Intake Manifold Bolts	
Lower (4)	21 (28)
Upper (5)	21 (28)
Oil Cooler Connector Bolt	41 (55)
Oil Filter	10 (14)
Oil Pan Drain Plug	21 (28)
Oil Pump Pick-Up Tube Screw	17 (23)
Oil Pump Relief Valve Retaining Plug	30 (41)
Oil Pump-To-Block Bolts	21 (28)
Spark Plugs	13 (18)
Timing Belt Cover (Rear)	
M6 Bolts	(6)
M8 Bolts	21 (28)
Timing Belt Idler Pulley Bolt	45 (61)
Timing Belt Tensioner Assembly Bolts	45 (61)
Timing Belt Tensioner Lock Bolt	18 (25)
<b>INCH Lbs. (N.m)</b>	
Balance Shaft Carrier Cover Bolt	106 (12)
Balance Shaft Gear Cover Double Ended Stud/Washer	106 (12)
Balance Shaft Timing Chain Tensioner Lower/Upper Mounting Bolt	106 (12)
Cylinder Head Cover Bolts <sup>(7)</sup>	
Step 1	40 (4.5)
Step 2	80 (9.0)
Step 3	106 (12)
Exhaust Manifold Heat Shield Bolts	106 (12)
Oil Filter Adapter Bolt	106 (12)
Oil Jet Fastener Bolt	106 (12)
Oil Pan Bolts	106 (12)
Oil Pump Cover Screws	115 (13)
Timing Belt Cover (Front) M6 Bolts	106 (12)
<p>(1) Tighten bolts to 106 INCH lbs. (12 N.m) in sequence. See <b>Fig. 247</b>.</p> <p>(2) Tighten bolts to specification in sequence. See <b>Fig. 248</b>.</p> <p>(3) Tighten bolts to specification in sequence. See <b>Fig. 249</b>.</p> <p>    Tighten bolts to specification in sequence. See <b>Fig. 250</b>.</p>	

- (4)
- (5) Tighten bolts to specification in sequence. See **Fig. 251**.
- (6) Tighten bolts to 106 INCH lbs. (12 N.m)
- (7) Tighten bolts to specification. See **Fig. 252**.



G00183566

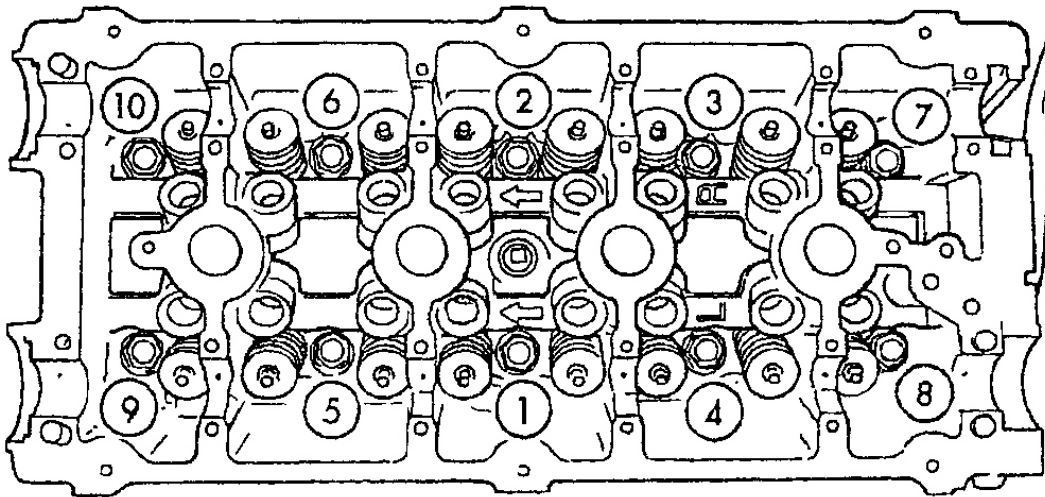
**Fig. 247: Camshaft Bearing Cap Bolt Tightening Sequence**  
Courtesy of CHRYSLER CORP.



G00351826

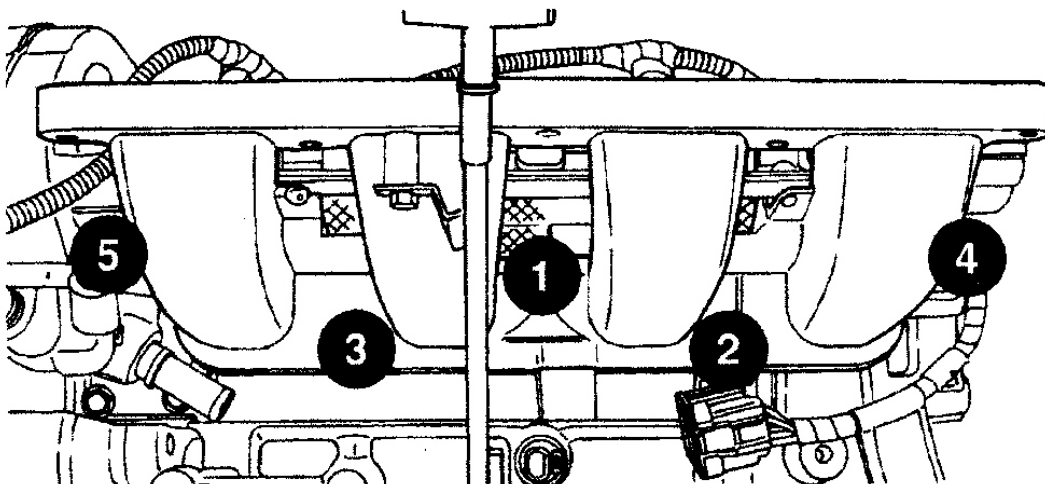
**Fig. 248: Crankshaft Main Bearing Cap/Bedplate Bolt Tightening Sequence**  
Courtesy of DAIMLERCHRYSLER CORPORATION





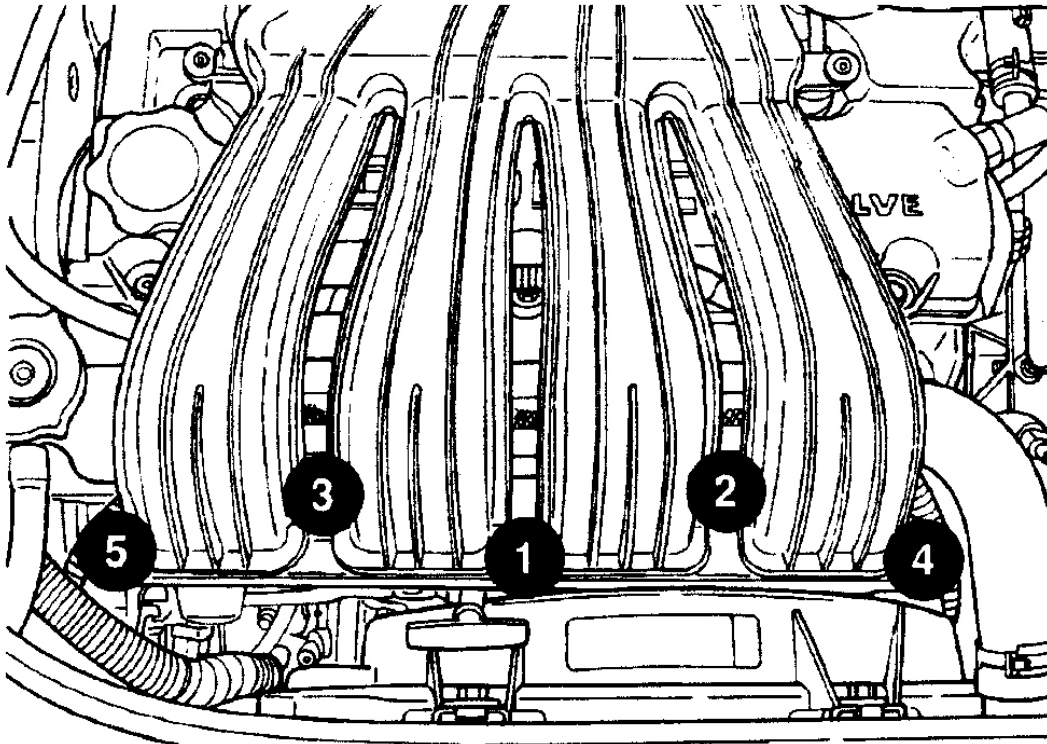
G00183547

**Fig. 249: Cylinder Head Bolt Tightening Sequence**  
Courtesy of CHRYSLER CORP.



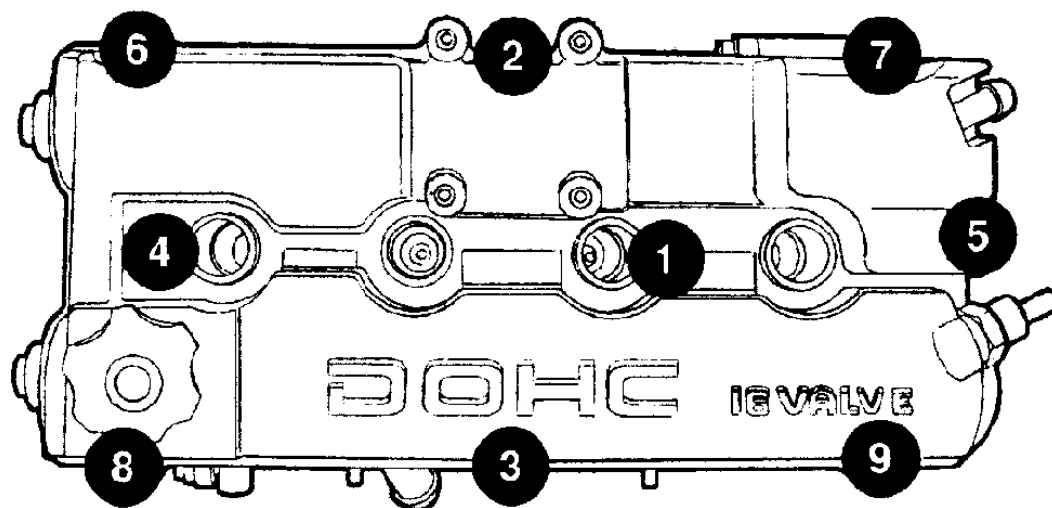
G00351828

**Fig. 250: Intake Manifold Bolt (Lower) Tightening Sequence**  
Courtesy of DAIMLERCHRYSLER CORPORATION



G00351829

**Fig. 251: Intake Manifold Bolt (Upper) Tightening Sequence**  
Courtesy of DAIMLERCHRYSLER CORPORATION



G00351827

**Fig. 252: Cylinder Head Cover Bolt Tightening Sequence**  
Courtesy of DAIMLERCHRYSLER CORPORATION