

ENGINE

TABLE OF CONTENTS

page

2.0L SOHC ENGINE	1
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2.0L SOHC ENGINE

TABLE OF CONTENTS

page

page

DESCRIPTION AND OPERATION

2.0L SOHC ENGINE.....	2
CYLINDER BLOCK AND BEDPLATE	3
CRANKSHAFT	3
PISTON AND CONNECTING ROD	3
CYLINDER HEAD.....	4
CAMSHAFT	4
VALVE AND VALVE SPRING	5
INTAKE MANIFOLD	5
EXHAUST MANIFOLD	5
ENGINE LUBRICATION	5

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS—INTRODUCTION.....	7
ENGINE DIAGNOSIS—PERFORMANCE	7
ENGINE DIAGNOSIS—MECHANICAL	9
HYDROSTATIC LOCKED ENGINE	11
INTAKE MANIFOLD LEAKAGE DIAGNOSIS	11
CYLINDER COMPRESSION PRESSURE TEST ..	11
CYLINDER COMBUSTION PRESSURE LEAKAGE TEST	11
CYLINDER HEAD GASKET FAILURE DIAGNOSIS	12
LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS	12
ENGINE OIL LEAK INSPECTION	13
ENGINE OIL PRESSURE CHECKING.....	14

SERVICE PROCEDURES

ENGINE OIL LEVEL CHECKING.....	14
ENGINE OIL SERVICE	14
ENGINE OIL CHANGE	15
FORM-IN-PLACE GASKETS & SEALERS.....	15
ENGINE GASKET SURFACE PREPARATION...	16
REPAIR OF DAMAGED OR WORN THREADS...	17
CYLINDER BORE—HONING	17
CYLINDER BORE AND PISTON—SIZING.....	17
PISTON RING—FITTING	18
CONNECTING ROD AND BEARING—FITTING...	18

CRANKSHAFT MAIN BEARING—FITTING	19
CRANKSHAFT END PLAY	20
CAMSHAFT END PLAY	20

REMOVAL AND INSTALLATION

ENGINE MOUNTS—FRONT AND REAR.....	20
ENGINE MOUNT AND SUPPORT BRACKET— RIGHT.....	22
ENGINE MOUNT—LEFT	22
STRUCTURAL COLLAR.....	23
ENGINE ASSEMBLY.....	23
INTAKE MANIFOLD	25
EXHAUST MANIFOLD	27
CYLINDER HEAD COVER	28
SPARK PLUG TUBE SEALS.....	29
SPARK PLUG TUBE.....	29
CAMSHAFT	30
ROCKER ARM/HYDRAULIC LASH ADJUSTER...	31
VALVE SEAL AND SPRING—IN VEHICLE	32
CYLINDER HEAD.....	33
VALVE SERVICE WITH THE CYLINDER HEAD REMOVED	36
CRANKSHAFT DAMPER	39
TIMING BELT COVER	39
TIMING BELT.....	41
TIMING BELT TENSIONER.....	46
OIL PAN.....	46
CAMSHAFT OIL SEAL	47
CRANKSHAFT OIL SEAL—FRONT.....	48
CRANKSHAFT OIL SEAL—REAR.....	49
ENGINE CORE PLUGS	50
CRANKSHAFT	51
OIL FILTER ADAPTER	54
OIL FILTER	54
OIL PUMP	54
PISTON AND CONNECTING ROD	56

DISASSEMBLY AND ASSEMBLY

OIL PUMP	59
----------------	----

CLEANING AND INSPECTION

INTAKE MANIFOLD	59
EXHAUST MANIFOLD	60
CYLINDER HEAD	60
OIL PUMP	61
CYLINDER BLOCK	62

ADJUSTMENTS

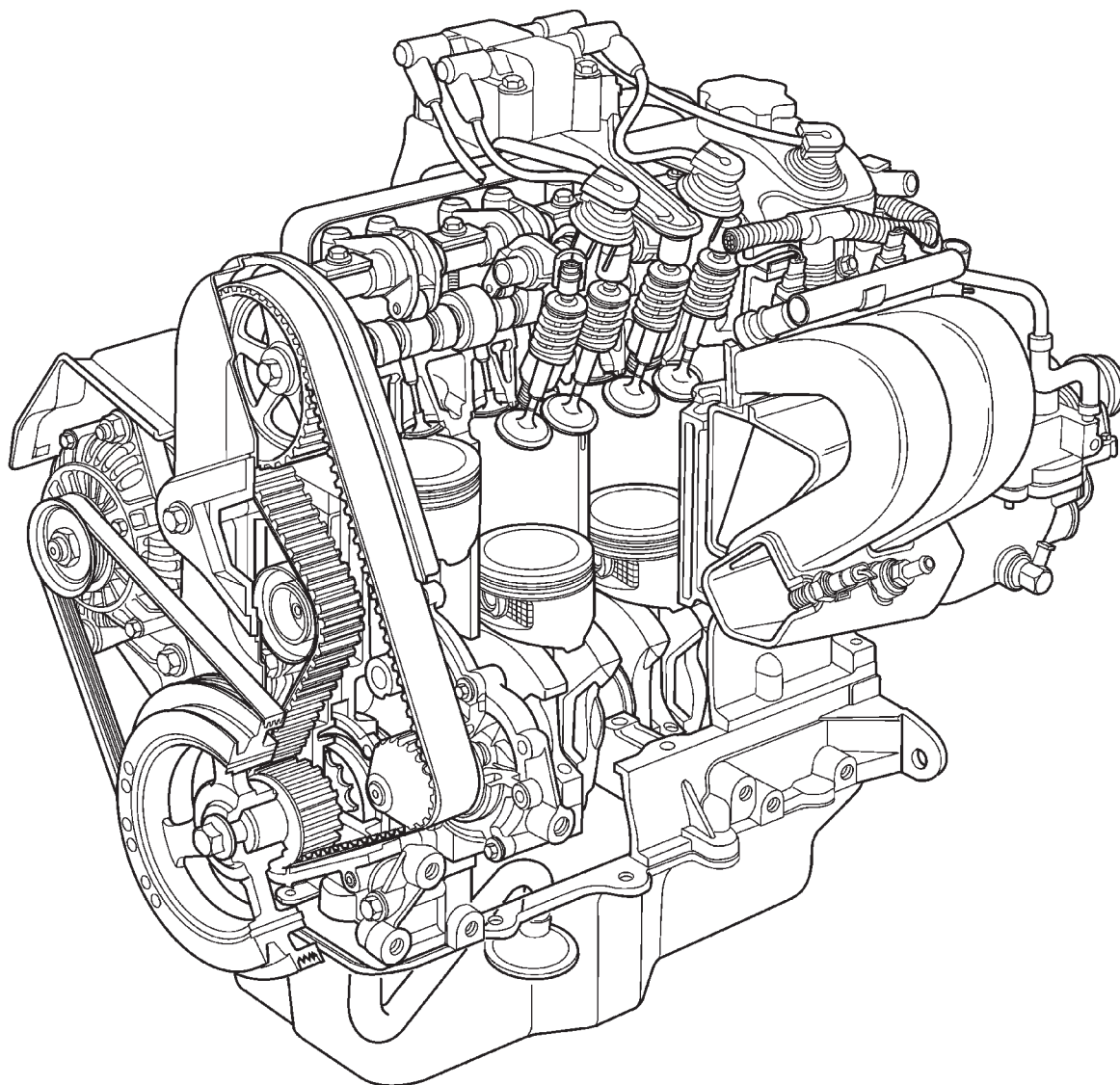
ENGINE SUPPORT ADJUSTMENT	62
---------------------------------	----

SPECIFICATIONS

2.0L SOHC ENGINE	63
TORQUE	66

SPECIAL TOOLS

2.0L SOHC ENGINE	67
------------------------	----

DESCRIPTION AND OPERATION**2.0L SOHC ENGINE**

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Fig. 1 2.0L SOHC Engine**DESCRIPTION**

The 2.0 Liter (122 cu. in.) in-line four cylinder engine is a single over head camshaft with hydraulic lifters and four valves per cylinder design (Fig. 1). The engine does not have provisions for a free wheeling valve train.

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 stamped onto a machined pad located on the left rear of the cylinder block bedplate (Fig. 2).

DESCRIPTION AND OPERATION (Continued)

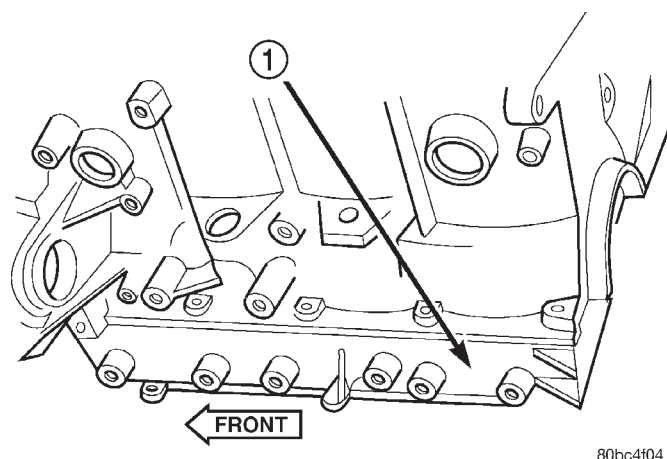


Fig. 2 Engine Identification—2.0L

1 – ENGINE IDENTIFICATION LOCATION

CYLINDER BLOCK AND BEDPLATE

DESCRIPTION

The cast iron cylinder block is a two-piece assembly, encompassing the cylinder block and bedplate. The bedplate 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 bedplate and block are serviced as an assembly.

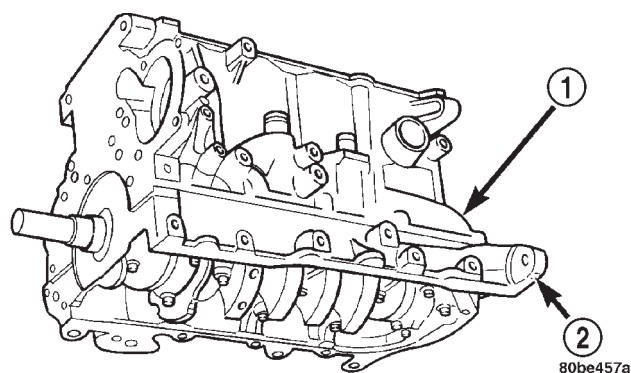


Fig. 3 Cylinder Block and Bedplate

1 – CYLINDER BLOCK
2 – BEDPLATE

CRANKSHAFT

DESCRIPTION

The crankshaft is made of nodular cast iron and includes five main bearing journals and four connecting rod journals (Fig. 4). The number three journal is the location for the thrust bearing. The mains and connecting rod journals have undercut fillet radiuses

that are rolled for added strength. To optimize bearing loading, eight counterweights are used.

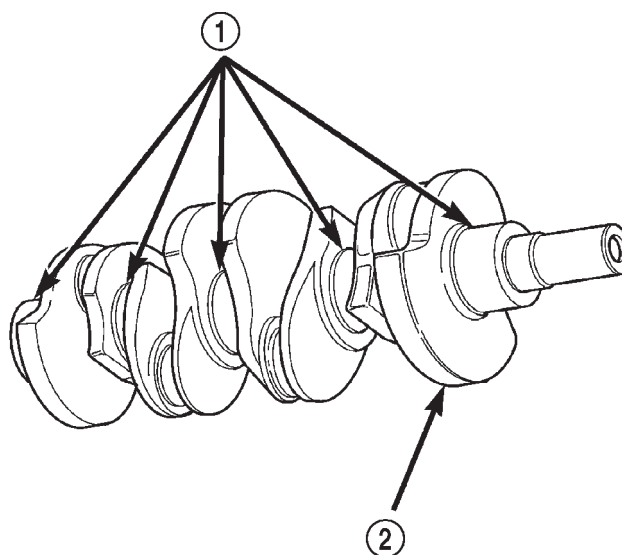


Fig. 4 Crankshaft

1 – MAIN BEARING JOURNALS
2 – COUNTER BALANCE WEIGHTS

OPERATION

The crankshaft transfers force generated by combustion within the cylinder to the flywheel or flexplate.

PISTON AND CONNECTING ROD

DESCRIPTION

NOTE: The engine DOES NOT have provisions for a free wheeling valve train. Non free wheeling valve train means, in the event of a broken timing belt, pistons will contact the valves.

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

OPERATION

The piston and connecting rod is the link between the combustion force to the crankshaft.

DESCRIPTION AND OPERATION (Continued)

CYLINDER HEAD

DESCRIPTION

The cross flow designed, aluminum cylinder head contains a single over head camshaft with four valves per cylinder (Fig. 5). 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 head gasket and retaining bolts.

The rocker arm shafts mount directly to the cylinder head. The rocker arms shafts are hollow, providing lubrication passages to the hydraulic lash adjusters, camshaft, and valve mechanisms.

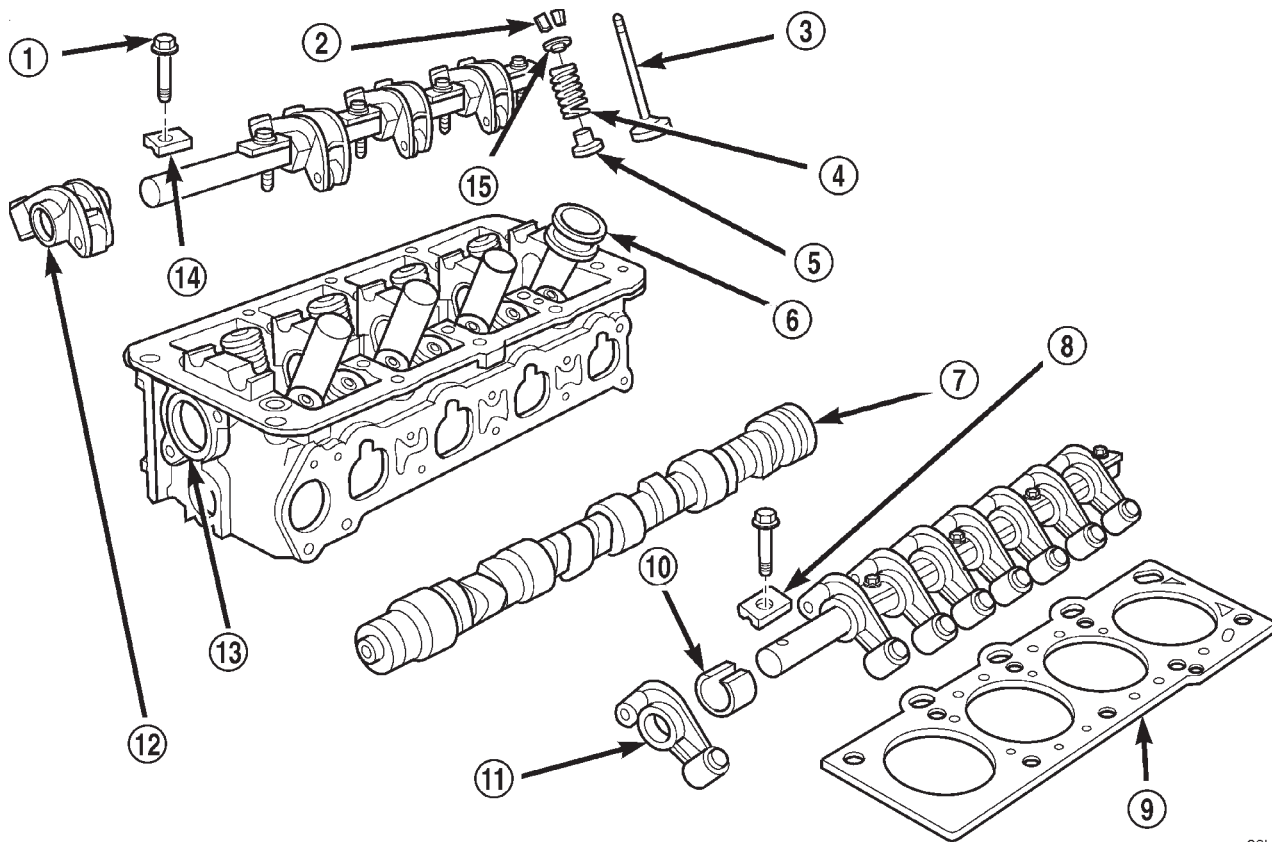
OPERATION

The cylinder head closes the combustion chamber, allowing the pistons to compress the air/fuel mixture for ignition. The valves are actuated by the lobe profiles on the camshaft to open and close at specified duration to either allow clean air in the combustion chamber or the exhaust gases out; depending on the stroke of the engine.

CAMSHAFT

DESCRIPTION

The camshaft is made of nodular iron with five bearing journal surfaces and three cam lobes per cylinder. Provision for a cam position sensor is provided on the rear of the camshaft. The camshaft position sensor bolts to the rear of the cylinder head and also



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Fig. 5 Cylinder Head Assembly

- | | |
|---|--|
| 1 - ROCKER SHAFT RETAINING BOLT | 10 - SPACER |
| 2 - VALVE RETAINING LOCKS | 11 - INTAKE ROCKER ARM/HYDRAULIC LASH ADJUSTER ASSEMBLY |
| 3 - VALVE | 12 - EXHAUST ROCKER ARM/HYDRAULIC LASH ADJUSTER ASSEMBLY |
| 4 - VALVE SPRING | 13 - CAMSHAFT SEAL |
| 5 - VALVE SEAL AND VALVE SPRING SEAT ASSEMBLY | 14 - RETAINER SPACER |
| 6 - SPARK PLUG TUBE SEAL | 15 - VALVE SPRING RETAINER |
| 7 - CAMSHAFT | |
| 8 - ROCKER ARM SHAFT RETAINER SPACER | |
| 9 - GASKET | |

DESCRIPTION AND OPERATION (Continued)

controls camshaft thrust. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

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.

VALVE AND VALVE SPRING**DESCRIPTION**

The four valves per cylinder are opened by using roller rocker arms with hydraulic lash adjusters which pivot on the rocker shafts. The valves have chrome plated valve stems. Viton rubber valve stem seals are integral with the spring seats.

The valve springs, spring retainers, and locks are the conventional design.

INTAKE MANIFOLD**DESCRIPTION**

The intake manifold is a molded plastic composition, attached to the cylinder head with fasteners. The manifold is a long branch design to enhance low and mid-range torque.

OPERATION

The intake manifold meters and delivers air to the combustion chambers. This air allows the fuel delivered by the fuel injectors to ignite, thus producing power.

EXHAUST MANIFOLD**DESCRIPTION**

The exhaust manifold is made of nodular cast iron for strength and high temperatures. The manifold attaches to the cylinder head.

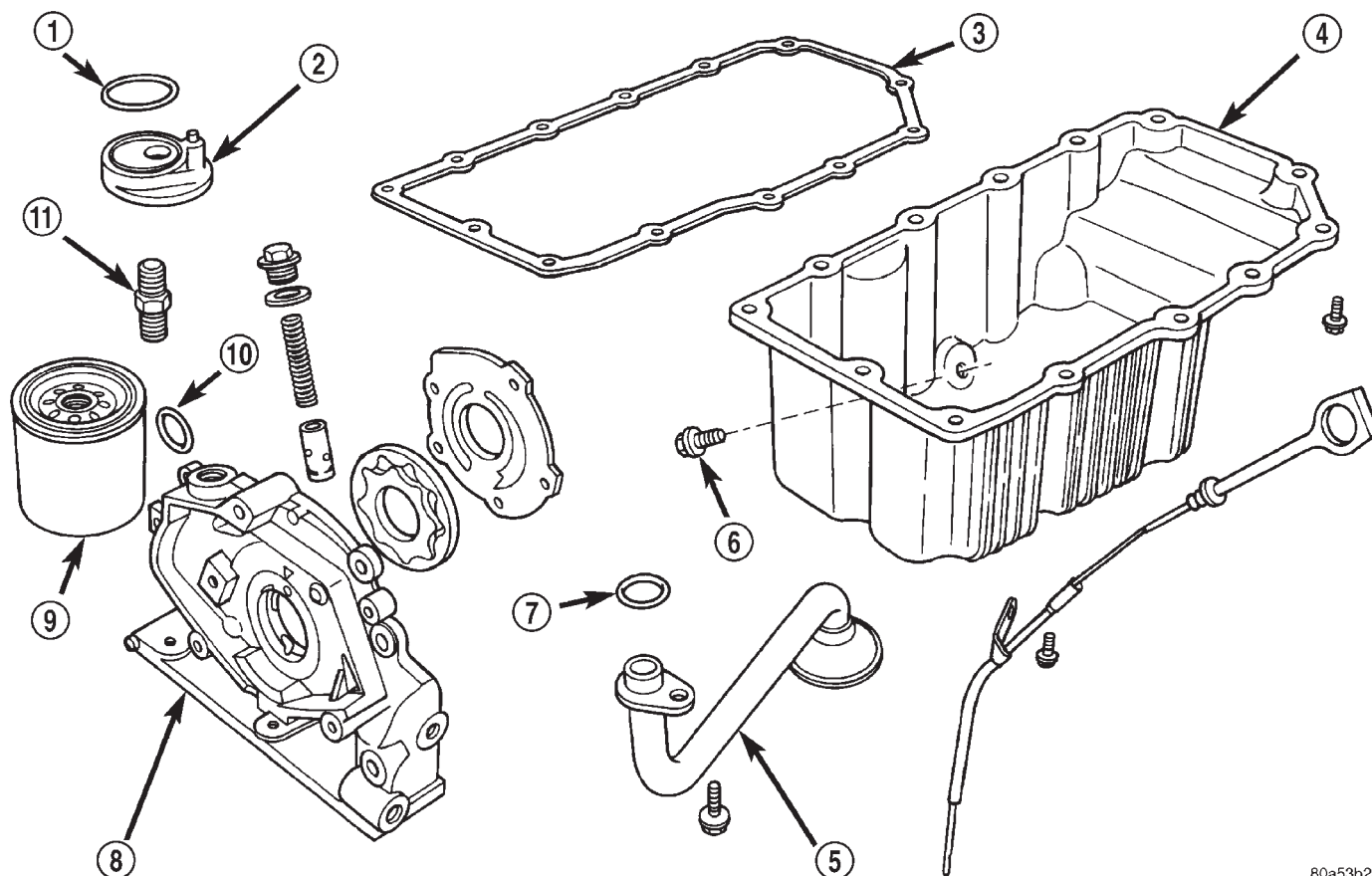
OPERATION

The exhaust manifold collects the exhaust gasses exiting the combustion chambers. Then it channels the exhaust gasses to the exhaust pipe attached to the manifold.

ENGINE LUBRICATION**DESCRIPTION**

The lubrication system is a full-flow filtration, pressure feed type. The oil pump (Fig. 6) is mounted in the front engine cover and driven by the crankshaft.

DESCRIPTION AND OPERATION (Continued)

**Fig. 6 Oil Pump**

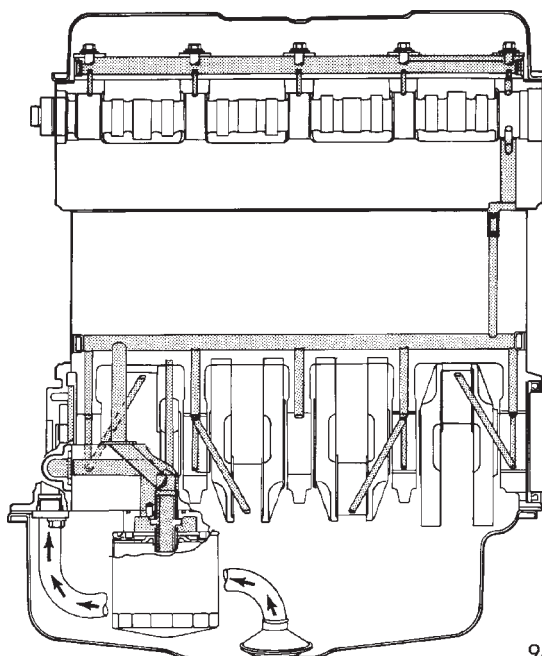
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- 1 - O-RING
- 2 - OIL FILTER ADAPTER
- 3 - OIL PAN GASKET
- 4 - OIL PAN
- 5 - OIL PICK-UP TUBE
- 6 - DRAIN PLUG

- 7 - O-RING
- 8 - OIL PUMP BODY
- 9 - FILTER
- 10 - O-RING
- 11 - NIPPLE

OPERATION

Refer to (Fig. 7) for lubrication system flow. Engine oil is 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 the main bearing journals to the connecting rod journals. A vertical hole at the number five bulkhead routes pressurized oil through a restrictor up into the cylinder head. The restrictor that is integral to the cylinder head gasket, provides increased oil flow to the main gallery. The rocker shafts route oil to the rocker arms/hydraulic lash adjusters. Oil returning to the oil pan from the pressurized components supplies lubrication to the valve stems. The cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collar.

**Fig. 7 Engine Lubrication System**

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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 Service Diagnosis—Mechanical Chart and the Service Diagnosis—Performance Chart, for possible causes and corrections of malfunctions. Refer to FUEL SYSTEM for the fuel system diagnosis.

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

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

ENGINE DIAGNOSIS—PERFORMANCE

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

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped plugs. 2. Contamination in fuel system. 3. Faulty fuel pump. 4. Incorrect valve timing. 5. Leaking cylinder head gasket. 6. Low compression. 7. Burned, warped, or pitted valves. 8. Plugged or restricted exhaust system. 9. Faulty coil(s).	1. Clean plugs and set gap. Refer to IGNITION SYSTEM. 2. Clean system and replace fuel filter. 3. Test and replace as necessary. Refer to FUEL SYSTEM. 4. Correct valve timing. 5. Replace cylinder head gasket. 6. Test compression of each cylinder. 7. Replace valves. 8. Install new parts, as necessary. 9. Test and replace as necessary. Refer to IGNITION SYSTEM.
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs. 2. Contamination in Fuel System. 3. Burned, warped, or pitted valves. 4. Faulty coil(s).	1. Clean spark plugs and set gap. Refer to IGNITION SYSTEM. 2. Clean fuel system and replace fuel filter. 3. Replace valves. 4. Test and replace as necessary. Refer to IGNITION SYSTEM.
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrect spark plug gap. 2. Faulty coil(s). 3. Dirty fuel injector(s). 4. Contamination in fuel system.	1. Clean spark plugs and set gap. Refer to IGNITION SYSTEM. 2. Test and replace as necessary. Refer to IGNITION SYSTEM. - Test and replace as necessary. Refer to FUEL SYSTEM. 4. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase. 2. Thin or diluted oil. 3. Low oil pressure. 4. Dirt in tappets/lash adjusters. 5. Worn rocker arms. 6. Worn tappets/lash adjusters. 7. Worn valve guides. 8. Excessive runout of valve seats on valve faces. 9. Missing adjuster pivot.	1. Check and correct engine oil level. 2. Change oil to correct viscosity. 3. Check and correct engine oil level. 4. Replace rocker arm/hydraulic lash adjuster assembly. 5. Inspect oil supply to rocker arms. 6. Install new rocker arm/hydraulic lash adjuster assembly. 7. Ream guides and install new valves with oversize stems. 8. Grind valve seats and valves. 9. Replace rocker arm/hydraulic lash adjuster assembly.
CONNECTING ROD NOISE	1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Excessive bearing clearance. 5. Connecting rod journal out-of-round. 6. Misaligned connecting rods.	1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. 4. Measure bearings for correct clearance. Repair as necessary. 5. Replace crankshaft or grind surface. 6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Excessive bearing clearance. 5. Excessive end play. 6. Crankshaft journal out-of-round or worn. 7. Loose flywheel or torque converter.	1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. 4. Measure bearings for correct clearance. Repair as necessary. 5. Check thrust bearing for wear on flanges. 6. Replace crankshaft or grind journals. 7. Tighten to correct torque.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL PRESSURE DROP	1. Low oil level. 2. Faulty oil pressure sending unit. 3. Low oil pressure. 4. Clogged oil filter. 5. Worn parts in oil pump. 6. Thin or diluted oil. 7. Oil pump relief valve stuck. 8. Oil pump suction tube loose. 9. Oil pump cover warped or cracked. 10. Excessive bearing clearance.	1. Check engine oil level. 2. Install new sending unit. 3. Check sending unit and main bearing oil clearance. 4. Install new oil filter. 5. Replace worn parts or pump. 6. Change oil to correct viscosity. 7. Remove valve and inspect, clean, or replace. 8. Remove oil pan and install new tube or clean, if necessary. 9. Install new oil pump. 10. Measure bearings for correct clearance.
OIL LEAKS	1. Misaligned or deteriorated gaskets. 2. Loose fastener, broken or porous metal part. 3. Misaligned or deteriorated cup or threaded plug.	1. Replace gasket(s). 2. Tighten, repair or replace the part. 3. Replace as necessary.
OIL CONSUMPTION OR SPARK PLUGS FOULED	1. PCV system malfunction. 2. Worn, scuffed or broken rings. 3. Carbon in oil ring slots. 4. Rings fitted too tightly in grooves. 5. Worn valve guide(s). 6. Valve stem seal(s) worn or damaged.	1. Check system and repair as necessary. Refer to EMISSION CONTROL SYSTEMS. 2. Hone cylinder bores. Install new rings. 3. Install new rings. 4. Remove rings and check grooves. If groove is not proper width, replace piston. 5. Ream guide(s) and replace valve(s) with oversize valve(s) and seal(s). 6. Replace seal(s).

DIAGNOSIS AND TESTING (Continued)

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) Fill engine with specified amount of approved oil and install new oil filter.

(11) Connect negative battery cable.

(12) Start engine and check for any leaks.

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

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.

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) Disconnect coil wire from distributor and secure to good ground to prevent a spark from starting a fire (Conventional Ignition System). For Direct Ignition System DIS disconnect the coil connector.

(5) Be sure throttle blade is fully open during the compression check.

(6) Insert compression gage adaptor Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0-500 psi (Blue) pressure transducer with cable adaptors to the DRBIII®.

(7) Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.

(8) Repeat the previous step for all remaining cylinders.

(9) Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.

(10) If one or more cylinders have abnormally low compression pressures, repeat the compression test.

(11) If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

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).

DIAGNOSIS AND TESTING (Continued)

- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

WARNING: DO NOT REMOVE THE RADIATOR 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 radiator 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 radiator 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 HEAD GASKET FAILURE DIAGNOSIS

A leaking engine cylinder head gasket usually results in loss of power, loss of coolant, and engine misfiring.

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

- An engine cylinder head gasket leaking between adjacent cylinders is indicated by a loss of power and/or engine misfire.
- An engine cylinder head gasket leaking between a cylinder and an adjacent water jacket is indicated by coolant foaming or overheating and loss of coolant.

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. 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.

Remove the radiator cap.

Start the engine and allow it to warm up until the engine thermostat opens.

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

If bubbles are not visible, perform either of the following procedures:

PRESSURE TEST

- Install cooling system tester Special Tool 7700 or equivalent, and pressurize the coolant system.

- If a cylinder is leaking combustion pressure into the water jacket, the tester pointer will pulsate with every combustion stroke of the cylinder.

CHEMICAL TEST

- This procedure involves using Bloc-Chek Test Kit, Special Tool C-3685-A or the equivalent. Perform test procedure following the instructions included with the test kit.

LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS

A tappet-like noise may be produced 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 pressed into 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.

a. 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.

DIAGNOSIS AND TESTING (Continued)

b. Remove suspected lash adjusters, and replace as necessary.

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 per service manual instructions.

(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, refer to the section, Inspection for Rear Seal Area Leak.

(6) If no leaks are detected, turn off the air supply. Remove the air hose, all plugs, and caps. Install the PCV valve and fresh air hose (make-up air). Proceed to next step.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

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

INSPECTION FOR REAR SEAL AREA LEAKS

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

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

(1) Disconnect the battery.

(2) Raise the vehicle.

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

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.

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

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

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

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

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

(7) After the oil leak root cause and appropriate corrective action have been identified, refer to Crankshaft Oil Seal—Rear for proper replacement procedures.

DIAGNOSIS AND TESTING (Continued)

ENGINE OIL PRESSURE CHECKING

- (1) Remove oil pressure switch and install gauge assembly C-3292 with adaptor.
- (2) Run engine until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not perform the 3000 RPM test in the next step.

(3) Oil Pressure: **Curb Idle** 25 kPa (4 psi) minimum **3000 RPM** 170-550 kPa (25-80 psi).

(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.

SERVICE PROCEDURES

ENGINE OIL LEVEL CHECKING

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

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Remove dipstick (Fig. 8), and observe oil level. Add oil only when the level is at or below the ADD mark (Fig. 9).

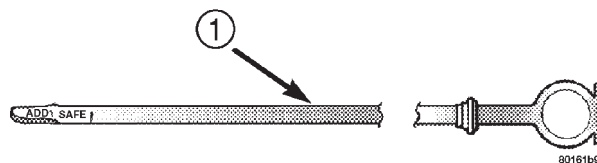


Fig. 9 Oil Level

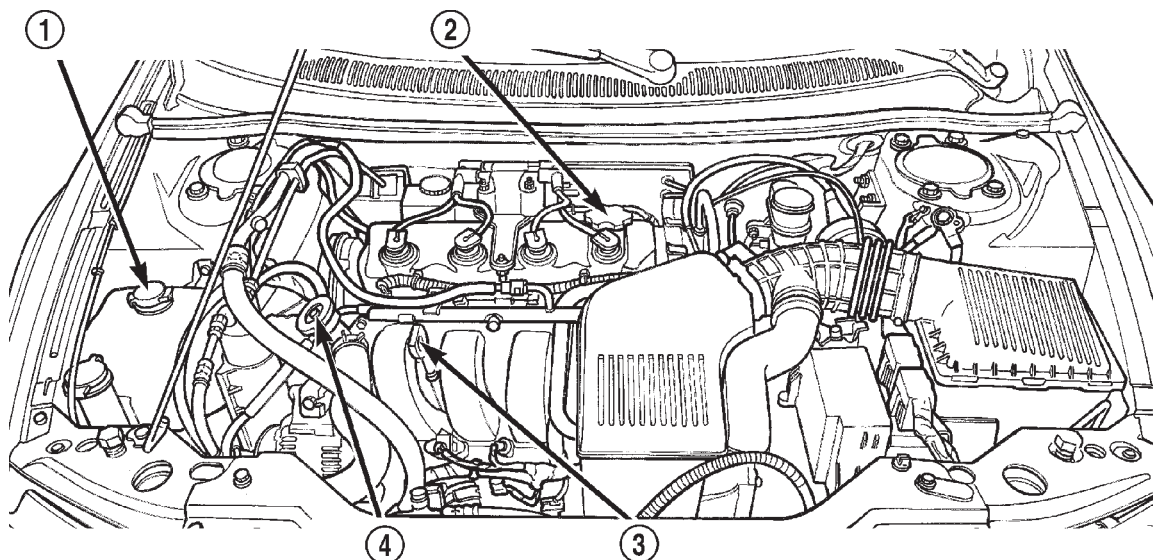
1 – ENGINE OIL LEVEL DIPSTICK

ENGINE OIL SERVICE

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.

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Service Grade Certified. MOPAR® provides engine oils that conform to this service grade.



80b3c684

Fig. 8 Dipstick and Engine Oil Fill Locations—2.0L

1 – COOLANT RECOVERY CONTAINER
2 – ENGINE OIL FILL

3 – ENGINE OIL DIPSTICK
4 – COOLANT PRESSURE CAP

SERVICE PROCEDURES (Continued)

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 10).

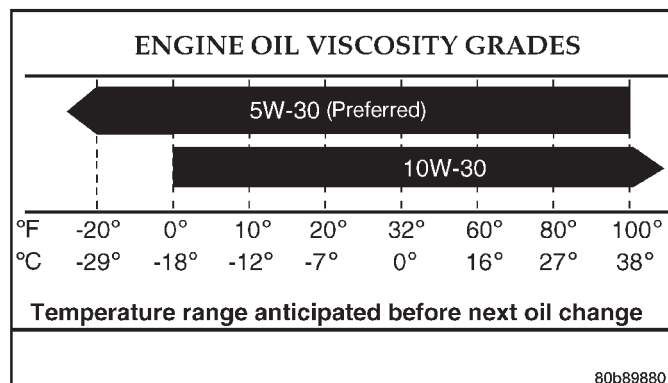


Fig. 10 Temperature/Engine Oil Viscosity

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 11).



9400-9

Fig. 11 Engine Oil Container Standard Notations

ENGINE OIL CHANGE

CHANGING ENGINE OIL

Change engine oil at mileage and time intervals described in the Maintenance Schedule. Refer to Group 0, Lubrication and Maintenance.

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.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations.

(3) Remove oil fill cap. Refer to (Fig. 8).

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

ENGINE OIL FILTER CHANGE

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.

OIL FILTER REMOVAL

Refer to Removal and Installation Section in Group 9, Engine for procedure.

USED ENGINE OIL DISPOSAL

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

FORM-IN-PLACE GASKETS & 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

SERVICE PROCEDURES (Continued)

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

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

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

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

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

MOPAR® GASKET SEALANT

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 multi-layer 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.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier than using pre-cut gaskets.

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 (Fig. 12)

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

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (Fig. 12)
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (Fig. 12)

SERVICE PROCEDURES (Continued)

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.

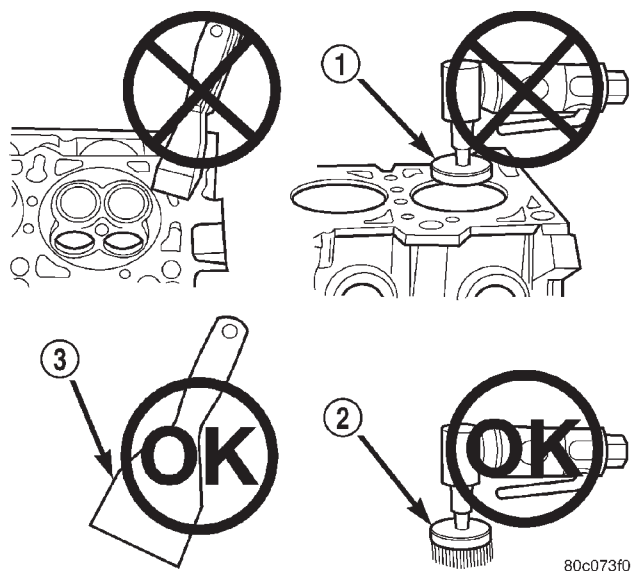


Fig. 12 Proper Tool Usage For Surface Preparation

REPAIR OF DAMAGED OR WORN THREADS

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

CAUTION: Be sure that the tapped holes maintain the original centerline.

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

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. Inspect cyl-

inder walls after each 20 strokes, using a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.**

(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 50–60 degrees, the cross hatch angle is most satisfactory for proper seating of rings (Fig. 13).

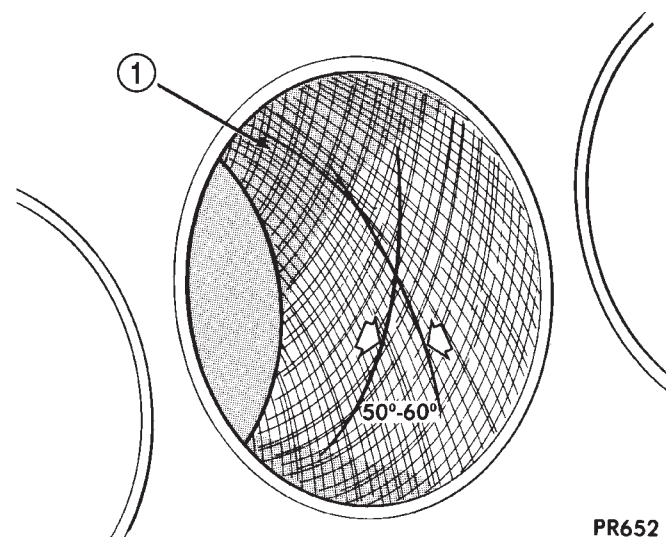


Fig. 13 Cylinder Bore Cross-Hatch Pattern

1 – CROSS-HATCH PATTERN

(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 50–60 degree angle. Faster up and down strokes increase the cross-hatch angle.

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

CAUTION: Ensure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and hot water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil the bores after cleaning to prevent rusting.

CYLINDER BORE AND PISTON—SIZING

The cylinder walls should be checked for out-of-round and taper with Tool C-119 (Fig. 14). Refer to Engine Specifications for cylinder bore out-of-round and cylinder bore taper specifications. If the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely

SERVICE PROCEDURES (Continued)

coordinated with the fitting of pistons and rings in order that specified clearances may be maintained. **Refer to Honing Cylinder Bores outlined in the Standard Service Procedures for specification and procedures.**

Measure the cylinder bore at three levels in directions A and B (Fig. 14). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore. Refer to Engine Specifications.

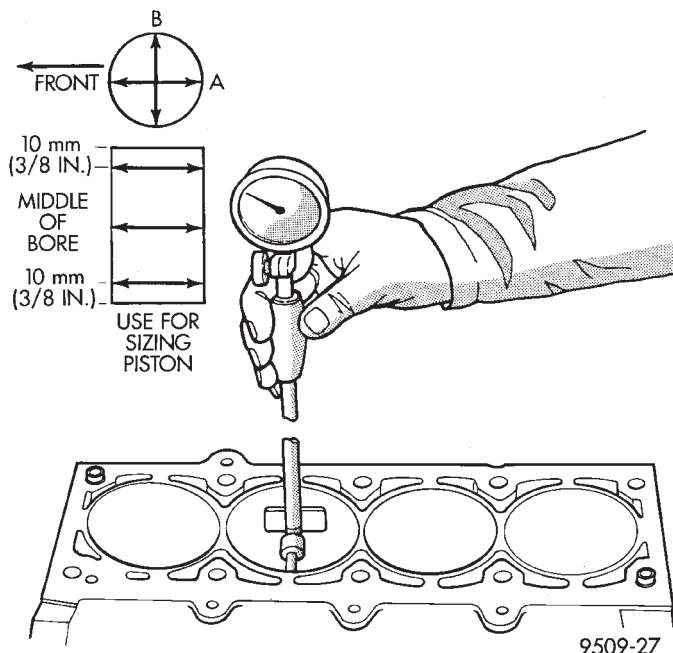


Fig. 14 Checking Cylinder Bore Size

SIZING PISTONS

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin about 17.5 mm (11/16 inch) from the bottom of the skirt as shown in (Fig. 15). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 14). Refer to Engine Specifications. Correct piston to bore clearance must be established in order to assure quiet and economical operation.

DaimlerChrysler engines use pistons designed specifically for each engine model. Clearance and sizing locations vary with respect to engine model.

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

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 positioned below normal ring travel in the cylinder

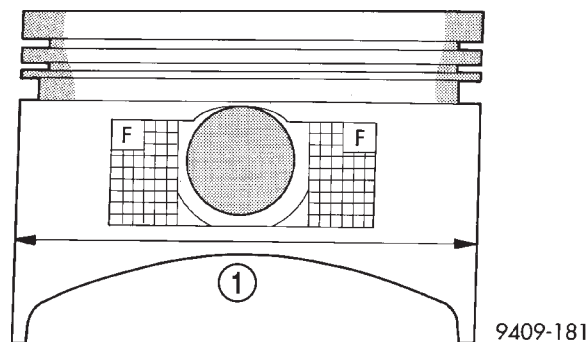


Fig. 15 Piston Measurements

1 – PISTON O.D. MEASUREMENT LOCATION

bore. Check gap with feeler gauge (Fig. 16). Refer to Engine Specifications in this section for piston ring specifications.

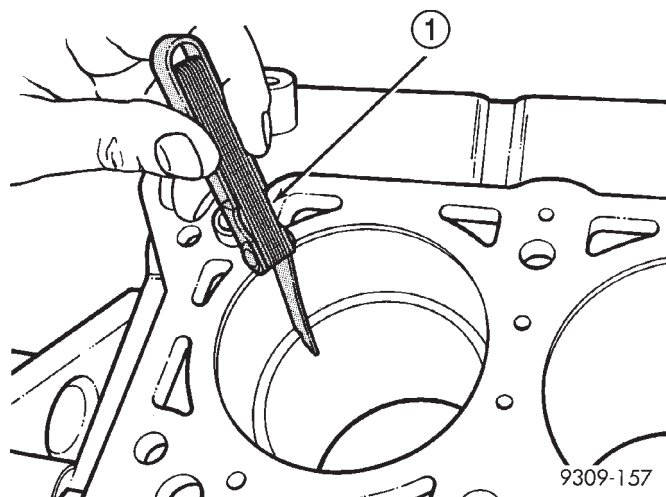


Fig. 16 Piston Ring Gap

1 – FEELER GAUGE

(2) Check piston ring to groove side clearance (Fig. 17). Refer to Engine Specifications in this section for piston ring specifications.

CONNECTING ROD AND BEARING—FITTING

CONNECTING ROD BEARING CLEARANCE

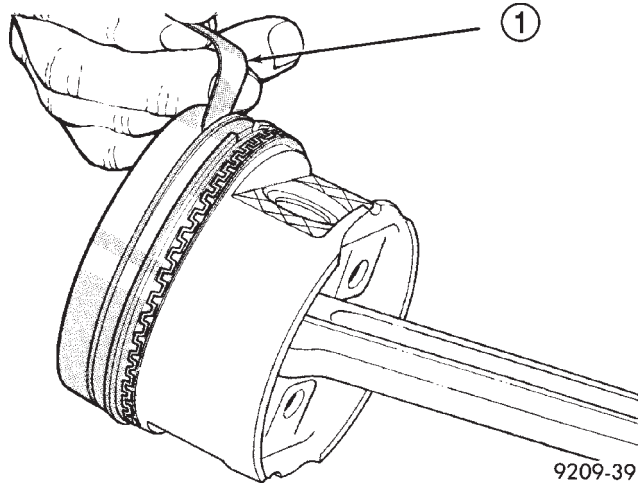
Engine connecting rod bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

(1) Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.

(2) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(3) Place a piece of Plastigage across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 in.) off center and away from

SERVICE PROCEDURES (Continued)

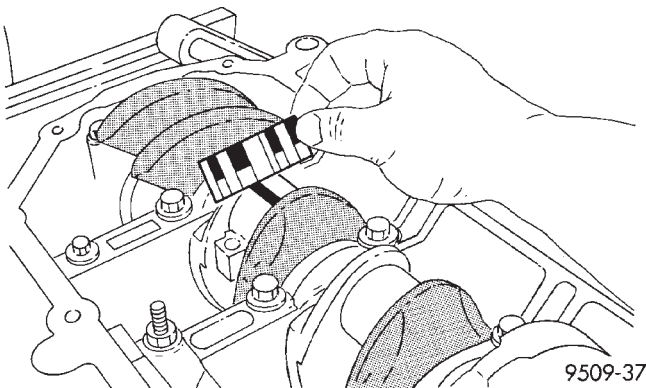
**Fig. 17 Piston Ring Side Clearance**

1 - FEELER GAUGE

the oil hole. In addition, suspect areas can be checked by placing plastigage in that area.

(4) Assemble the rod cap with Plastigage in place. Tighten the rod cap to the specified torque. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**

(5) Remove the bearing cap and compare the width of the flattened Plastigage with the scale provided on the package (Fig. 18). Locate the band closest to the same width. This band indicates the amount of oil clearance. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale. If the bearing clearance exceeds wear limit specification, replace the bearing.**

**Fig. 18 Connecting Rod Bearing Clearance—Typical**

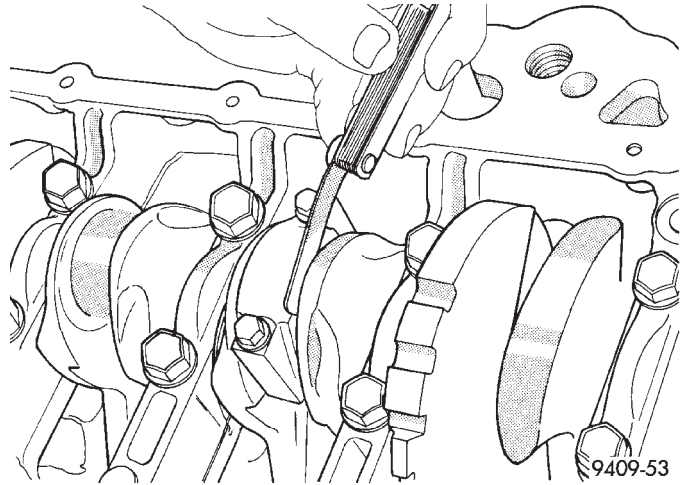
NOTE: The rod bearing bolts should not be reused.

(1) Before installing the **NEW** bolts the threads should be oiled with clean engine oil.

(2) Install each bolt finger tight then alternately torque each bolt to assemble the cap properly.

(3) Tighten the bolts to 27 N·m PLUS 1/4 turn (20 ft. lbs. PLUS 1/4 turn) **Do not use a torque wrench for last step.**

(4) Using a feeler gauge, check connecting rod side clearance (Fig. 19). Refer to Engine Specifications in this section for connecting rod specifications.

**Fig. 19 Connecting Rod Side Clearance****CRANKSHAFT MAIN BEARING—FITTING****PLASTIGAGE PROCEDURE**

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

(1) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(2) Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes (Fig. 20). (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.

(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. Refer to Engine 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.

SERVICE PROCEDURES (Continued)

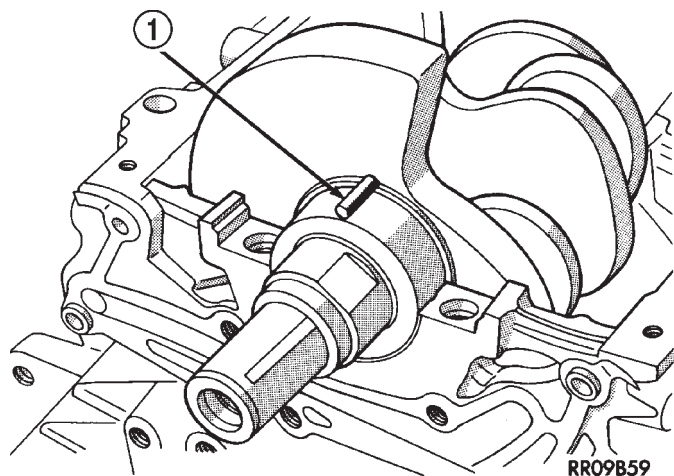


Fig. 20 Plastigage Placed in Lower Shell—Typical

1 - PLASTIC GAUGE

(4) Install the proper crankshaft main bearings to achieve the specified bearing clearances. Refer to Crankshaft, Removal and Installation procedure.

CRANKSHAFT END PLAY

DIAL INDICATOR METHOD

(1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 21).

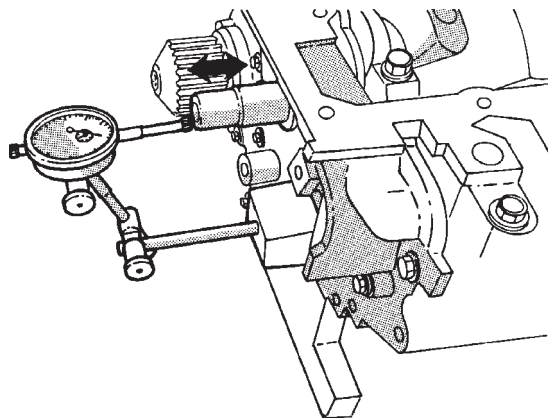


Fig. 21 Checking Crankshaft End Play—Dial Indicator

(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 of its travel and read the dial indicator. Refer to Engine Specifications in this section for crankshaft specifications.

FEELER GAGE METHOD

(1) Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek, using care not to damage any bearing surface. Do **not** loosen main bearing cap.

(2) Use a feeler gauge between number three thrust bearing and machined crankshaft surface to determine end play.

CAMSHAFT END PLAY

(1) Oil camshaft journals and remove rocker arm assemblies. Cam sensor installed and fastener tighten to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 22).

(4) Move camshaft as far forward as it will go.

(5) Refer to Engine Specification for camshaft end play specifications.

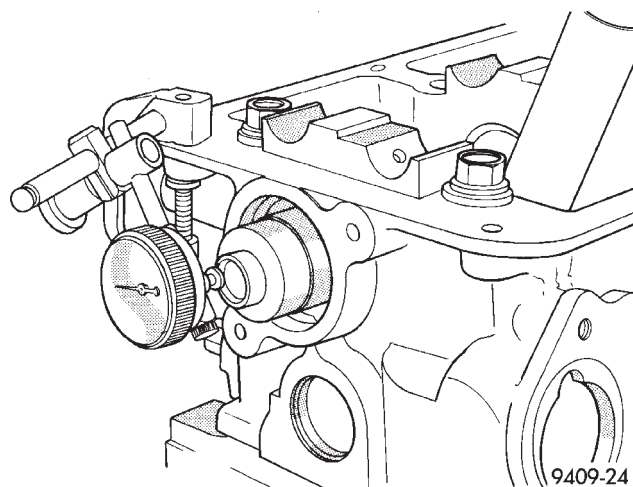


Fig. 22 Camshaft End Play

REMOVAL AND INSTALLATION

ENGINE MOUNTS—FRONT AND REAR

REMOVAL

FRONT MOUNT

(1) Raise vehicle on hoist.

(2) Remove through bolt at front mount (Fig. 25).

(3) Remove attaching bolts from mount to lower radiator support.

NOTE: It may be necessary to tilt engine for front mount removal clearance.

(4) Remove front mount.

REMOVAL AND INSTALLATION (Continued)

REAR MOUNT

- (1) Raise vehicle on hoist.
- (2) Remove through bolt from rear engine mount and bracket (Fig. 26).
- (3) Remove rear strut bracket and support bracket (Fig. 23).
- (4) Remove bending strut from rear mount to engine (Fig. 24).
- (5) Remove bolts attaching rear mount to suspension crossmember.

NOTE: It may be necessary to tilt engine for rear mount removal clearance.

- (6) Remove rear mount.

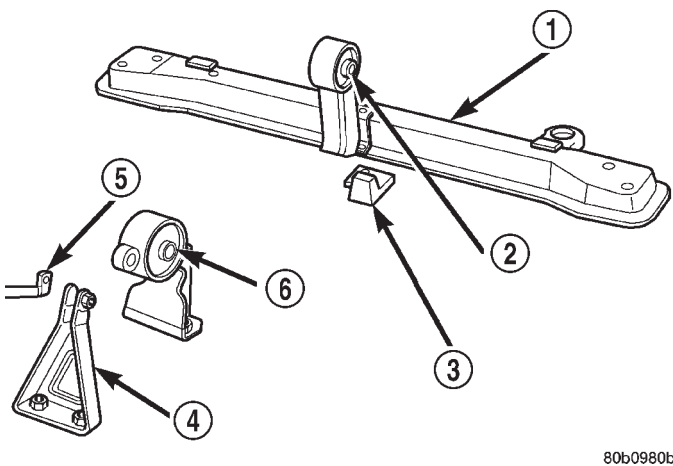


Fig. 23 Engine Mounting—Front and Rear

- 1 – LOWER RADIATOR SUPPORT
- 2 – FRONT ENGINE MOUNT
- 3 – DAMPER WEIGHT (SOME MODELS)
- 4 – REAR STRUT BRACKET
- 5 – SUPPORT BRACKET (SOME MODELS)
- 6 – REAR ENGINE MOUNT

INSTALLATION

FRONT MOUNT

- (1) Position front mount. Position damper weight (some models) and install front mount to lower radiator support attaching bolts. Tighten bolts to 61 N·m (45 ft. lbs.).
- (2) Install through bolt and tighten to 61 N·m (45 ft. lbs.) (Fig. 25).
- (3) Lower vehicle.

REAR MOUNT

- (1) Position rear mount.
- (2) Install bolts attaching rear mount to front suspension crossmember. Tighten bolts to 61 N·m (45 ft. lbs.).
- (3) Install rear strut and support brackets (Fig. 23). Tighten bolts to the following torque values:

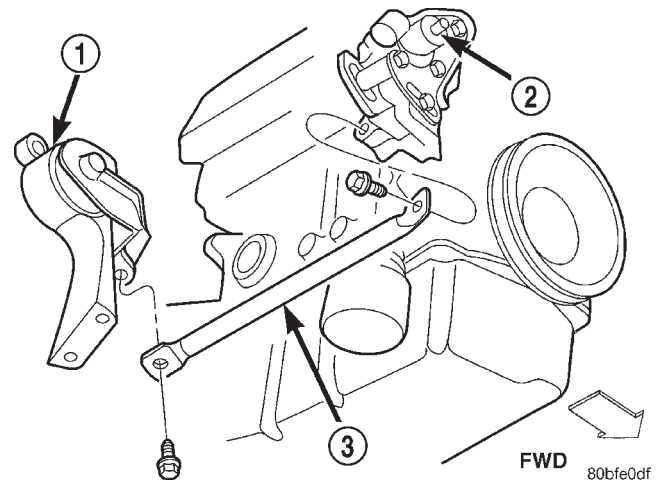


Fig. 24 Bending Strut—Rear

- 1 – REAR MOUNT
- 2 – POWER STEERING PUMP
- 3 – BENDING STRUT

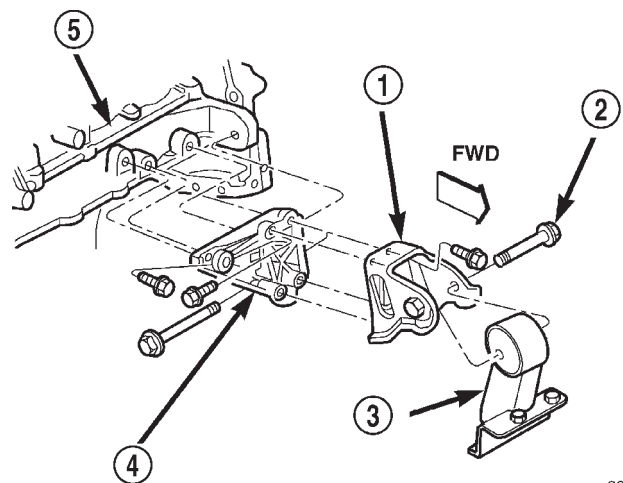
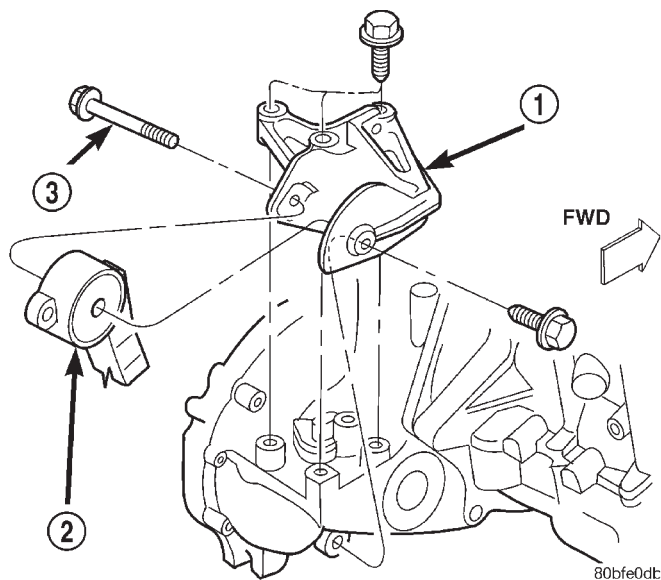


Fig. 25 Engine Mounting—Front

- 1 – FRONT TORQUE BRACKET
- 2 – THROUGH BOLT
- 3 – FRONT MOUNT
- 4 – STRUT
- 5 – ENGINE

- Bolts attaching strut bracket to front suspension crossmember: 61 N·m (45 ft. lbs.)
- Nut attaching support bracket to front suspension crossmember: 108 N·m (80 ft. lbs.)
- Bolt attaching support bracket to rear strut: 61 N·m (45 ft. lbs.)
- (4) Install through bolt and tighten to 61 N·m (45 ft. lbs.) (Fig. 26).
- (5) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

**Fig. 26 Engine Mounting—Rear**

- 1 - REAR TORQUE BRACKET
- 2 - REAR MOUNT
- 3 - THROUGH BOLT

ENGINE MOUNT AND SUPPORT BRACKET—RIGHT

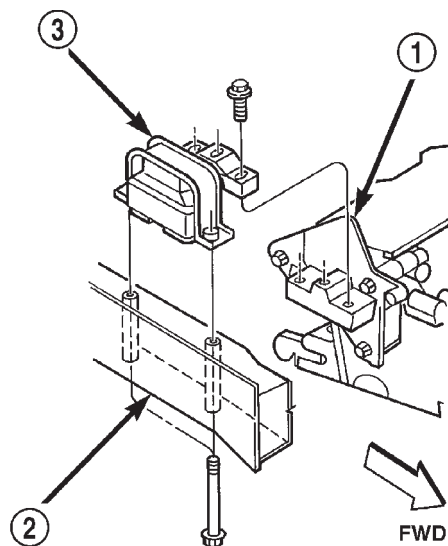
NOTE: The right side engine mount is a Hydro-Mount and may show surface cracks. This will not effect mount performance and should not be replaced. Replace the Hydro-Mount if fluid is leaking from mount.

REMOVAL

- (1) Raise vehicle on a hoist and remove inner splash shield.
- (2) Remove the right engine support assembly vertical fasteners from frame rail (Fig. 27).
- (3) Lower vehicle. Remove the load on the engine motor mounts by carefully supporting the engine assembly with a floor jack.
- (4) Remove the three bolts attaching the engine support assembly to the engine bracket.
- (5) Move the air conditioning receiver/drier aside.
- (6) Remove coolant reserve/recovery container. Refer to COOLING SYSTEM for procedure.
- (7) Remove right engine mount.
- (8) Remove the three bolts attaching the engine support bracket to the cylinder block.

INSTALLATION

- (1) Install engine support bracket (if removed). Tighten bolts to 33 N·m (24 ft. lbs.).

**Fig. 27 Engine Mounting—Right Side**

- 1 - ENGINE SUPPORT BRACKET
- 2 - FRAME RAIL
- 3 - RIGHT ENGINE MOUNT

(2) Position right engine mount and install frame rail to mount bolts. Tighten bolts to 61 N·m (45 ft. lbs.).

(3) Install the mount to engine bracket bolts and tighten to 61 N·m (45 ft. lbs.).

(4) Install coolant reserve/recovery container. Refer to COOLING SYSTEM for procedure.

(5) Position the air conditioning receiver/drier and install mounting screw.

(6) Install inner splash shield.

NOTE: If centering or adjusting the engine/transmission assembly is needed refer to Adjustments, in this section.

ENGINE MOUNT—LEFT

NOTE: If centering or adjusting the engine/transmission assembly is needed refer to Adjustments, in this section.

The left side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

REMOVAL

- (1) Support the transmission with a transmission jack.
- (2) Remove the three vertical bolts (A) from the mount to the transmission bracket (Fig. 28).

REMOVAL AND INSTALLATION (Continued)

(3) Remove the mount to frame rail fasteners (B) and remove mount (Fig. 28).

INSTALLATION

(1) Install mount. Tighten mount to frame rail fasteners (B) to 33 N·m (24 ft. lbs.) (Fig. 28).

(2) If removed, install transmission bracket and tighten bolts (C) and (D) to 61 N·m (45 ft. lbs.) (Fig. 28).

(3) Install mount to transmission bracket vertical bolts (A). Tighten to 61 N·m (45 ft. lbs.) (Fig. 28).

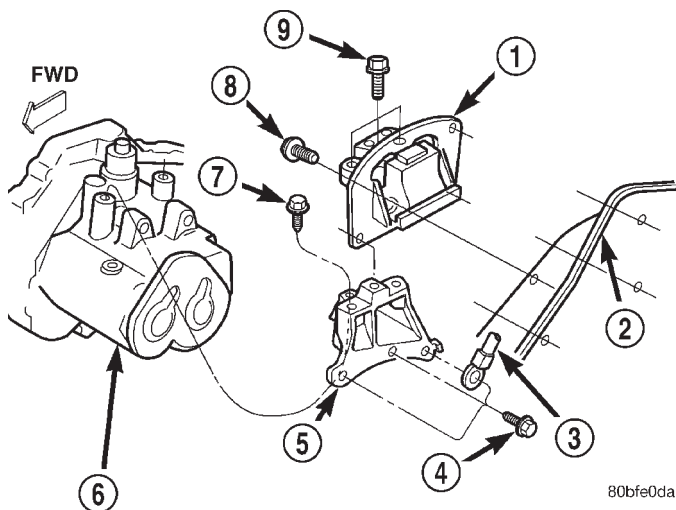


Fig. 28 Left Side Mount—Typical

- 1 – TRANSMISSION SUPPORT ASSEMBLY
- 2 – LEFT FRAME RAIL
- 3 – GROUND CABLE
- 4 – BOLT (D)
- 5 – TRANSMISSION BRACKET
- 6 – TRANSMISSION
- 7 – BOLT (C)
- 8 – BOLT (B)
- 9 – BOLT (A)

STRUCTURAL COLLAR

REMOVAL

(1) Raise vehicle on hoist.

NOTE: To remove transaxle dust cover, the front bending strut must be removed.

(2) Remove structural collar from oil pan to transaxle (Fig. 29).

INSTALLATION

CAUTION: The torque procedure for the structural collar must be followed, as damage to oil pan or collar could occur.

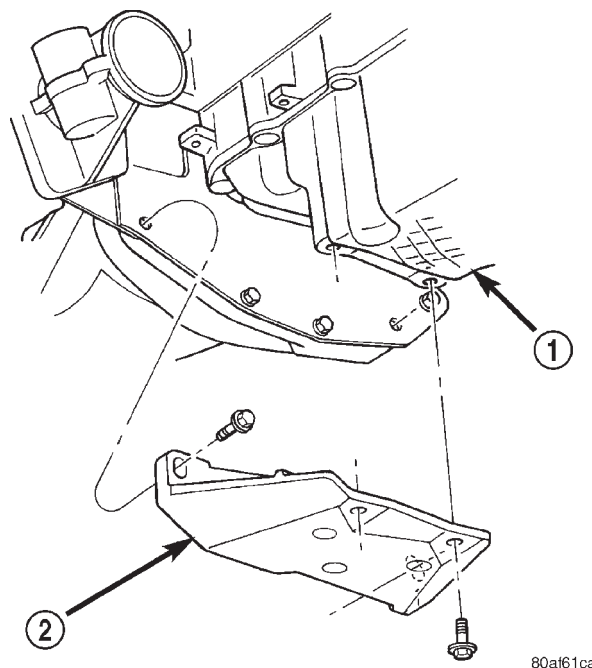


Fig. 29 Structural Collar—Removal and Installation

- 1 – OIL PAN
- 2 – STRUCTURAL COLLAR

(1) Install the structural collar (Fig. 29) using the following 3 step torque sequence:

- Step 1: Install the collar to oil pan bolts and tighten to 3 N·m (30 in. lbs.).
 - Step 2: Install collar to transaxle bolts and tighten to 108 N·m (80 ft. lbs.).
 - Step 3: Final torque the collar to oil pan bolts to 54 N·m (40 ft. lbs.).
- (2) Lower vehicle.

ENGINE ASSEMBLY

REMOVAL

(1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.

(2) Disconnect and remove battery and tray. Set Powertrain Control Module (PCM) aside.

(3) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(4) Remove upper radiator hose, radiator and fan module. Refer to Group 7, Cooling System for procedure.

(5) Remove lower radiator hose.

(6) Disconnect automatic transmission cooler lines and plug. If equipped.

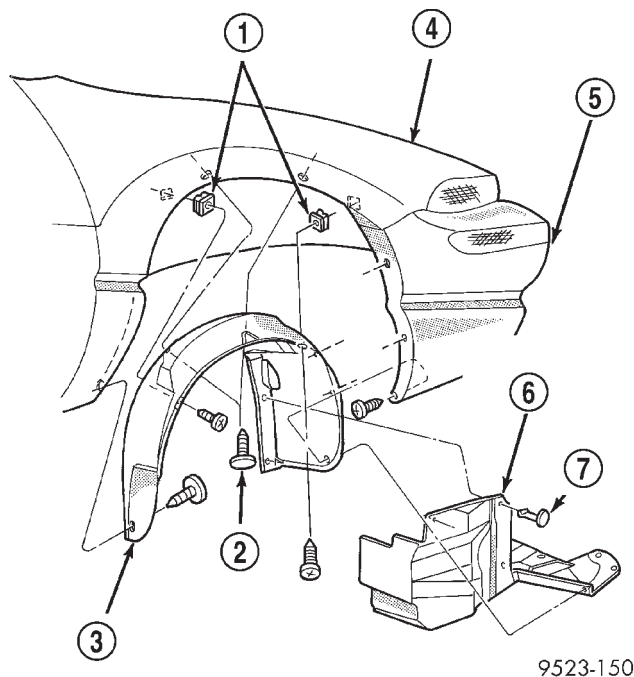
(7) Disconnect clutch cable (Manual) and transmission shift linkage.

(8) Disconnect throttle body linkage.

(9) Disconnect engine wiring harness.

REMOVAL AND INSTALLATION (Continued)

- (10) Disconnect heater hoses.
- (11) Remove refrigerant from air conditioning system using a refrigerant recovery machine. Refer to Group 24, Air Conditioning for procedure.
- (12) Hoist vehicle and remove right inner splash shield (Fig. 30).

**Fig. 30 Right Inner Splash Shield**

- 1 - NUT-SNAP
- 2 - PUSH-IN FASTENER
- 3 - WHEELHOUSE SPLASH SHIELD
- 4 - FENDER
- 5 - FASCIA
- 6 - ACCESSORY DRIVE BELT SPLASH SHIELD
- 7 - PUSH-IN FASTENER

- (13) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.
- (14) Remove axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.
- (15) Disconnect exhaust pipe from manifold.
- (16) Remove front and rear engine mount through bolts.
- (17) Lower vehicle. Remove air cleaner assembly.
- (18) Remove power steering pump and reservoir and set aside.
- (19) Remove A/C compressor.
- (20) Remove ground straps to body.
- (21) Raise vehicle enough to allow engine dolly and cradle Special Tools 6135 and 6710 to be installed under vehicle.
- (22) 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 (Fig. 31). Tighten mounts to cradle frame. This will keep support posts from moving when removing or installing engine and transmission.

(23) Install safety straps around the engine to cradle; tighten straps and lock them into position.

(24) Raise vehicle enough to see if straps are tight enough to hold cradle assembly to engine.

(25) Lower vehicle so weight of the engine and transmission ONLY is on the cradle assembly.

(26) Remove right and left engine/transmission mount vertical bolts.

(27) Raise vehicle slowly. 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 and transmission.

(2) Align engine and transmission mounts to attaching points. Install mounting bolts at the right and left engine/transmission mounts. Refer to procedures outlined in this section.

(3) Remove safety straps from engine and transmission assembly. Slowly raise vehicle enough to remove the engine dolly and cradle.

(4) Install axle shafts. Refer to Group 2, Suspension and Driveshafts for procedure.

(5) Install transmission and engine braces and splash shields.

(6) Connect exhaust system to manifold. Refer to Group 11, Exhaust System for procedure.

(7) Install power steering pump and reservoir. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(8) Install A/C compressor and hoses. Refer to Group 24, Heater and Air Conditioning for procedure.

(9) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(10) Install front and rear engine mount through bolts.

(11) Install inner splash shield and front wheels.

(12) **Manual Transmission:** Connect clutch cable and linkages. Refer to Group 6, Clutch for procedure.

(13) **Automatic Transmission:** Connect shifter linkage. Refer to Group 21, Transaxle for procedures.

(14) Connect fuel line and heater hoses.

(15) Install ground straps. Connect engine and throttle body electrical connections and harnesses. Refer to Group 8, Electrical for procedure.

(16) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(17) Install radiator and fan module. Install radiator hoses. Fill cooling system. Refer to Group 7, Cooling System for filling procedure.

REMOVAL AND INSTALLATION (Continued)

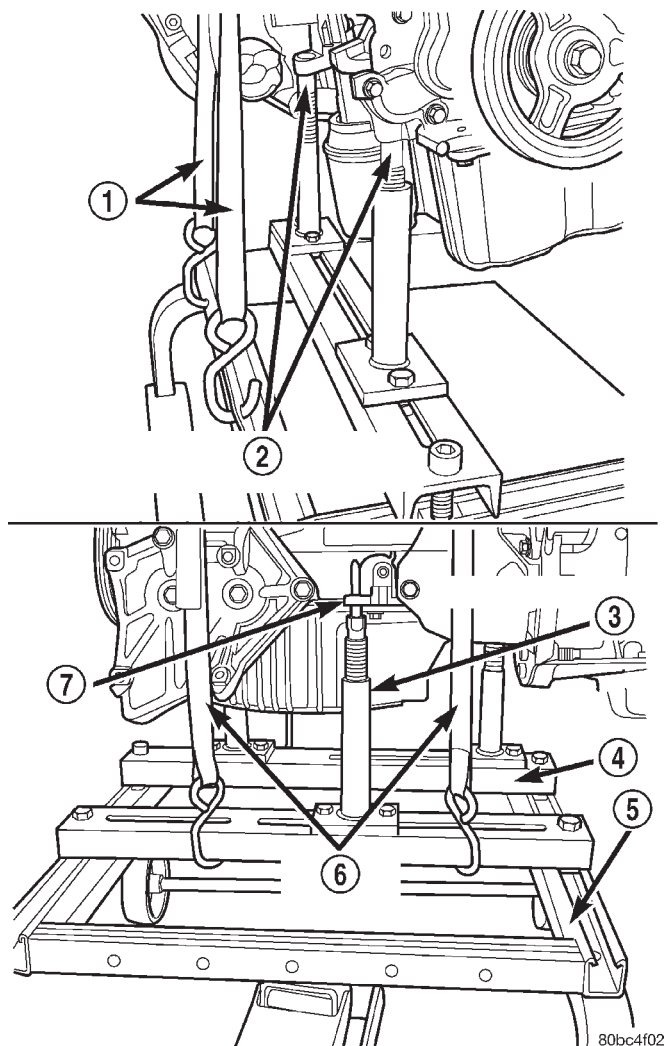


Fig. 31 Positioning Engine Cradle Support Post Mounts

- 1 - SAFETY STRAPS
- 2 - PLACE REAR POSTS INTO LOCATING HOLES
- 3 - SPECIAL TOOL 6848
- 4 - SPECIAL TOOL 6710
- 5 - SPECIAL TOOL 6135
- 6 - SAFETY STRAPS
- 7 - PLACE FRONT POST UNDER BLOCK FLANGE

(18) Install battery tray and battery. Set Powertrain Control Module (PCM) into place.

(19) Install air cleaner and hoses.

(20) Evacuate and charge air conditioning system. Refer to Group 24, Heating and Air Conditioning for procedures.

(21) Install oil filter. Fill engine crankcase with proper oil to correct level.

(22) Start engine and run until operating temperature is reached.

(23) Adjust transmission linkage, if necessary.

INTAKE MANIFOLD

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

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.

To release fuel pressure, refer to Group 14, Fuel System for procedure.

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs.**

(2) Disconnect negative cable from auxiliary jumper terminal (Fig. 32).

(3) Remove air inlet resonator. Refer to Group 14, Fuel System for procedure.

(4) Perform fuel system pressure relief procedure and disconnect the fuel supply line quick connect at the fuel rail assembly. Refer to Group 14, Fuel System for procedure.

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

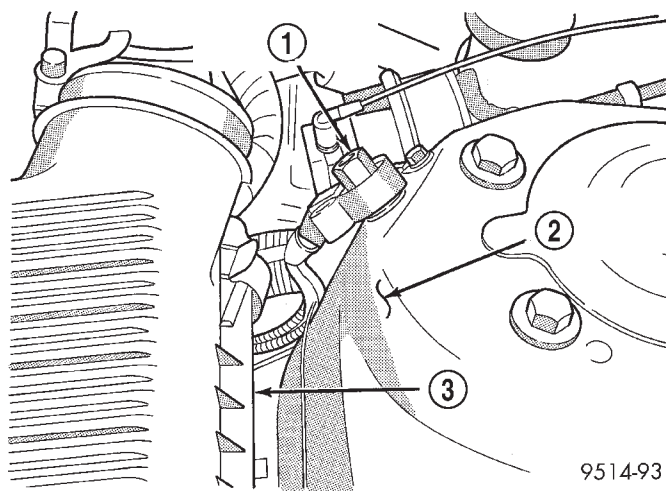


Fig. 32 Auxiliary Jumper Terminal

- 1 - AUXILIARY JUMPER TERMINAL
- 2 - LEFT STRUT TOWER
- 3 - AIR CLEANER HOUSING

(5) Remove fuel rail assembly attaching screws and remove fuel rail assembly from engine. Cover injector holes with a suitable covering.

CAUTION: Do not set fuel injectors on their tips, damage may occur to the injectors

REMOVAL AND INSTALLATION (Continued)

(6) Remove accelerator and speed control cables from throttle lever and bracket. Refer to Group 14, Fuel System for procedures.

(7) Disconnect idle air control (IAC) motor and throttle position sensor (TPS) wiring connectors (Fig. 33).

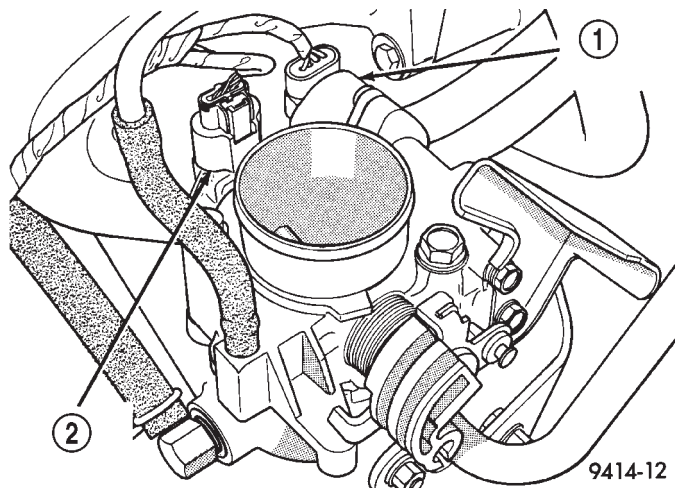


Fig. 33 Idle Air Control (IAC) Motor, Throttle Position Sensor (TPS) Wiring Connectors, and Vacuum Hose Connection.

- 1 - IDLE AIR CONTROL MOTOR
- 2 - THROTTLE POSITION SENSOR

(8) Disconnect intake air temperature electrical connector (Fig. 34).

(9) Disconnect leak detection pump and PCV hoses.

(10) Disconnect knock sensor electrical connector and disconnect wiring harness from tab located on the intake manifold (Fig. 34).

(11) Remove transaxle to throttle body support bracket fasteners at the throttle body and loosen the fastener at the transaxle end.

(12) Remove EGR tube bolts at the valve and at the intake manifold (Fig. 35). Remove tube from engine and discard gaskets.

(13) Remove the intake manifold to inlet water tube support fastener (Fig. 36).

(14) Remove intake manifold fasteners and washer assemblies. Remove intake manifold.

INSTALLATION

Replace all O-ring seals (Fig. 37). All intake manifold fasteners and washers are to be discarded and replaced with **NEW** fasteners and washers.

(1) Install new intake manifold O-ring seals. Tighten fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 36).

(2) Remove covering from fuel injector holes and insure the holes are clean. Install fuel rail assembly

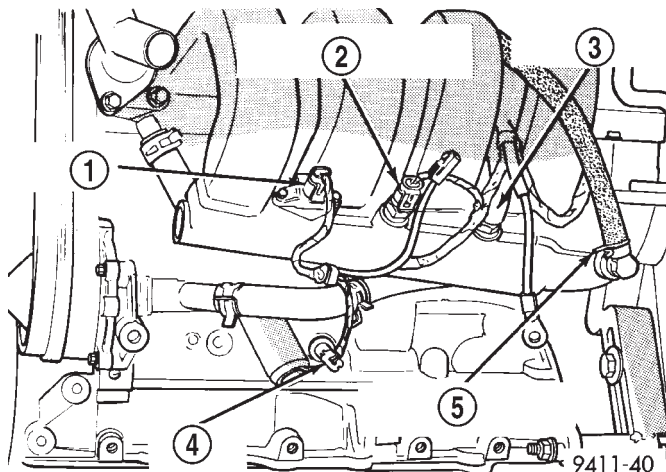


Fig. 34 Intake Manifold Electrical Connectors and Vacuum Hose Connections

- 1 - MAP SENSOR
- 2 - INTAKE AIR TEMPERATURE SENSOR
- 3 - VAPOR HOSE CONNECTION
- 4 - KNOCK SENSOR
- 5 - BRAKE BOOSTER HOSE CONNECTION

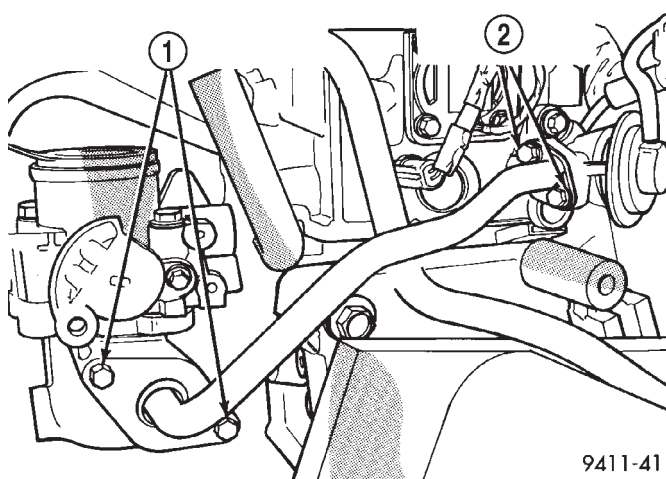


Fig. 35 Tube Assembly—Typical

- 1 - EGR TUBE TO INTAKE MANIFOLD FASTENERS
- 2 - EGR VALVE TO TUBE FASTENERS

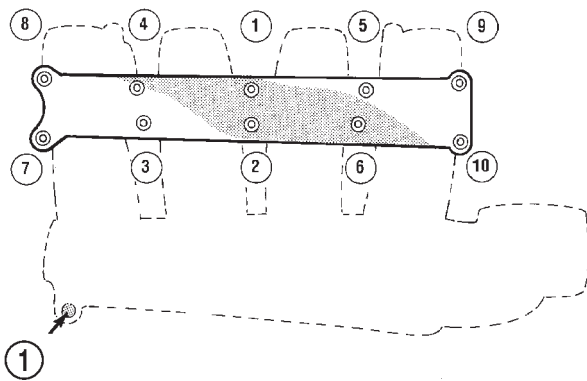
to intake manifold. Tighten screws to 23 N·m (200 in. lbs.).

(3) Connect PCV and brake booster hoses.

(4) Inspect quick connect fittings for damage, replace if necessary. Refer to Group 14, Fuel System for procedure. 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.

(5) Install throttle body. Tighten fasteners to 22 N·m (200 in. lbs.). Install transaxle to throttle body support bracket and tighten to 12 N·m (105 in. lbs.).

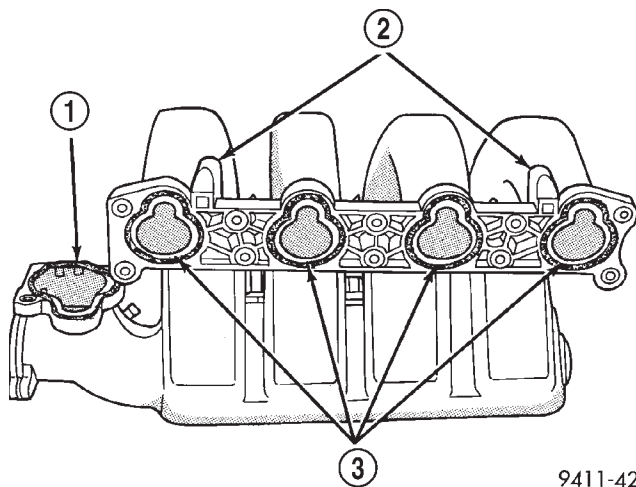
REMOVAL AND INSTALLATION (Continued)



9411-45

Fig. 36 Intake Manifold Tightening Sequence

1 - INTAKE MANIFOLD TO WATER INLET SUPPORT



9411-42

Fig. 37 Intake Manifold O-Rings

- 1 - THROTTLE BODY TO MANIFOLD GASKET
 2 - INJECTOR RAIL MOUNTS
 3 - CAPTIVE O-RING GASKET

at the throttle body first. Next tighten the bracket at the transaxle.

(6) Connect manifold absolute pressure (MAP) and intake air temperature sensor wiring connectors.

(7) Connect knock sensor electrical and starter relay connectors. Connect wiring harness to intake manifold tab.

(8) Connect Idle Air Control (IAC) motor and Throttle Position Sensor (TPS) wiring connectors.

(9) Connect vacuum hoses to throttle body.

(10) Install accelerator and speed control cables to their bracket and connect them to the throttle lever. Refer to Group 14, Fuel System Throttle Body Installation procedure.

(11) With new EGR gaskets in position, loosely assemble the EGR tube onto valve and intake manifold finger tight. Tighten tube fasteners at the EGR

valve first to 11 N·m (95 in. lbs.). Then, tighten the intake manifold side fasteners to 11 N·m (95 in. lbs.).

(12) Connect negative cable to auxiliary jumper terminal.

(13) With the DRB scan tool use ASD Fuel System Test to pressurize system to check for leaks.

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.

EXHAUST MANIFOLD**REMOVAL**

(1) Disconnect exhaust pipe from manifold.

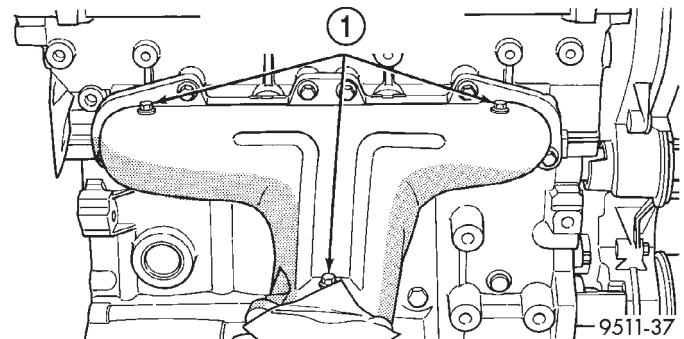
(2) Remove the entire exhaust system. Refer to Group 11, Exhaust System for procedure.

(3) Remove exhaust manifold heat shield (Fig. 38).

(4) Disconnect oxygen sensor electrical connector.

(5) Remove exhaust manifold retaining fasteners and remove exhaust manifold (Fig. 39).

(6) Remove and discard manifold gasket.



9511-37

Fig. 38 Exhaust Manifold Heat Shield

1 - HEAT SHIELD ATTACHING SCREWS

INSTALLATION

(1) Install new 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.). Repeat this procedure until all fasteners are at specified torque.

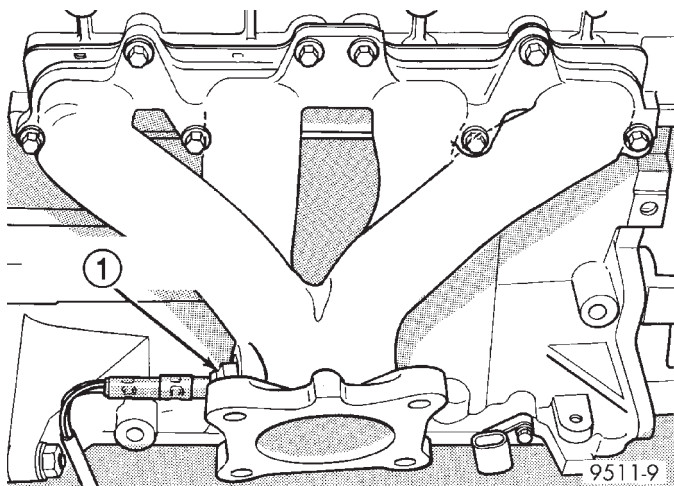
(3) Connect oxygen sensor electrical connector.

(4) Install exhaust manifold heat shield.

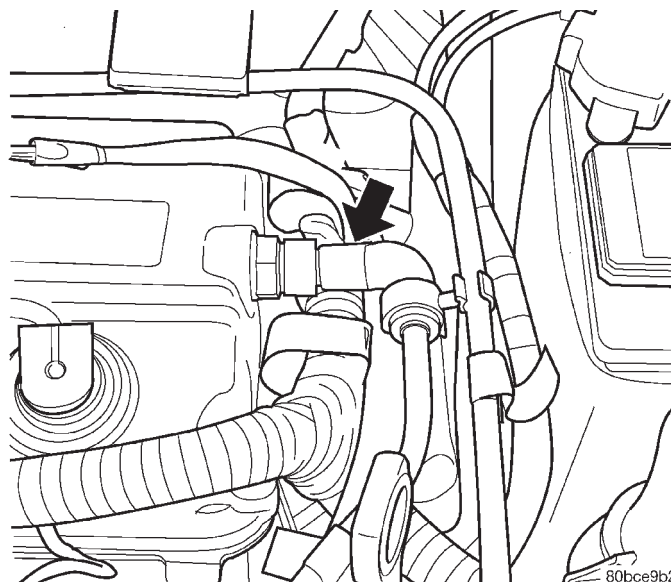
(5) Install exhaust system. Refer to Group 11, Exhaust System for procedure.

(6) Attach exhaust pipe with gasket to the manifold and tighten fasteners to 28 N·m (250 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

**Fig. 39 Exhaust Manifold**

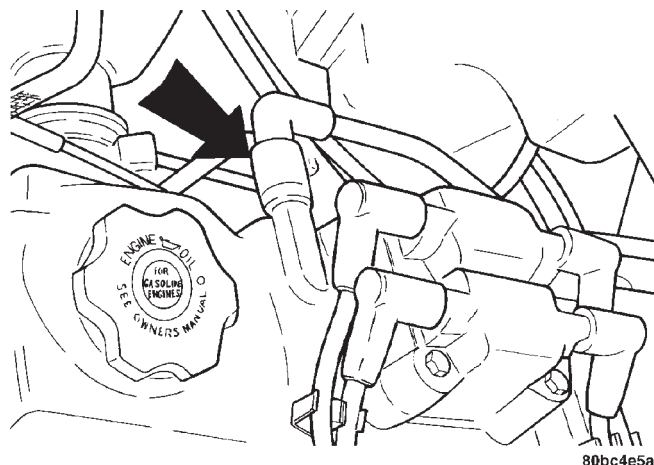
1 - HEATED OXYGEN SENSOR

**Fig. 41 PCV Valve Hose**

CYLINDER HEAD COVER

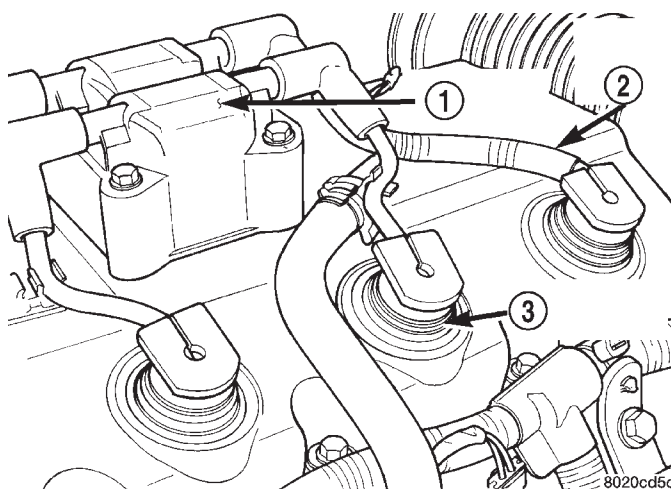
REMOVAL

- (1) Disconnect make-up air (Fig. 40) and PCV (Fig. 41) hoses from cylinder head cover.
- (2) Remove ignition coil and spark plug cables (Fig. 42).
- (3) Remove cylinder head cover bolts.
- (4) Remove cylinder head cover.

**Fig. 40 Make-Up Air Hose**

INSTALLATION

- (1) Clean gasket surfaces. Inspect gasket and seals (Fig. 43). Replace as necessary. For replacement of spark plug tube seals, refer to Spark Plug Tube Seals in this section for procedure.

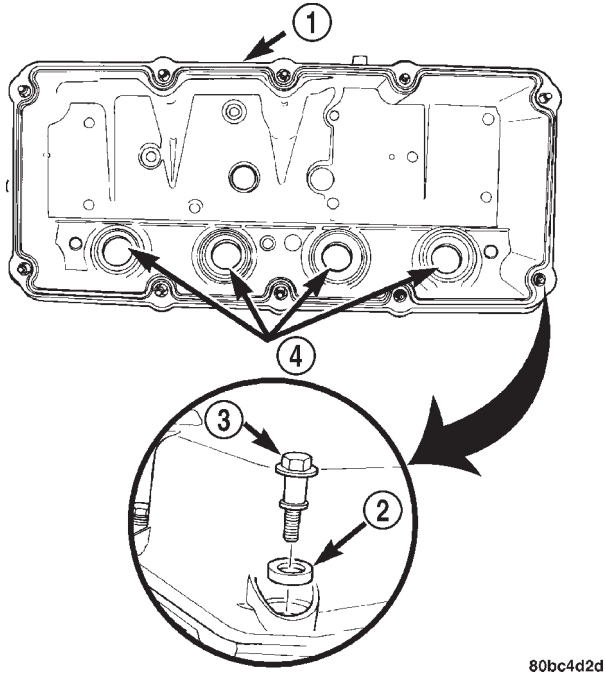
**Fig. 42 Ignition Coil and Spark Plug Cables**

- 1 - IGNITION COILS
- 2 - SPARK PLUG CABLE
- 3 - SPARK PLUG INSULATOR

CAUTION: Do not attempt to loosen or remove baffle plate attaching screws. The screws are self-tapping, and in the attempt to retighten, thread damage (stripping) will result.

- (2) Install cylinder head cover and gasket. Tighten bolts to 12 N·m (105 in. lbs.).
- (3) Install ignition coil and spark plug cables (Fig. 42). Tighten ignition coil fasteners to 12 N·m (105 in. lbs.).
- (4) Connect make-up air (Fig. 40) and PCV (Fig. 41) hoses.

REMOVAL AND INSTALLATION (Continued)



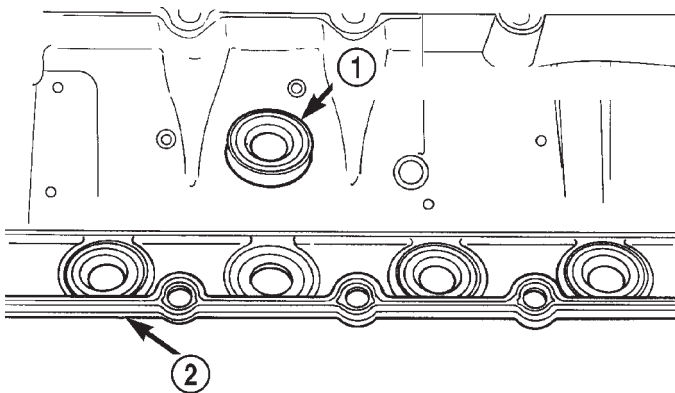
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Fig. 43 Cylinder Head Cover Gasket and Seals

- 1 - CYLINDER HEAD COVER GASKET
- 2 - SEAL
- 3 - BOLT
- 4 - SPARK PLUG TUBE SEALS

SPARK PLUG TUBE SEALS

The spark plug tube seals are located in the cylinder head cover (Fig. 44). These seals are pressed into the cylinder head cover to seal the outside perimeter of the spark plug tubes. If these seals show signs of hardness and/or cracking, they should be replaced.



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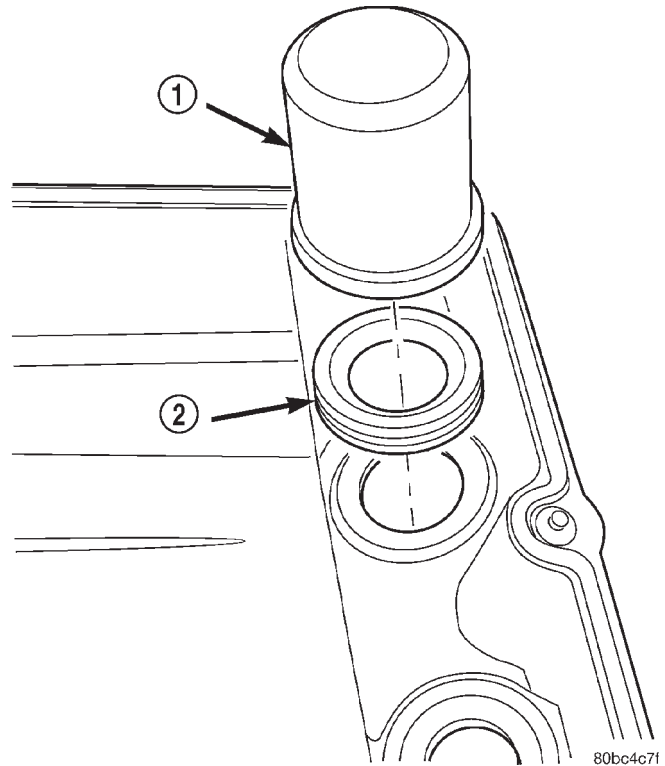
Fig. 44 Spark Plug Tube Seals

- 1 - SPARK PLUG TUBE SEAL
- 2 - CYLINDER HEAD COVER

REMOVAL

(1) Remove cylinder head. Refer to procedure in this section.

(2) Using an appropriate tool, carefully remove spark plug tube seals. Care should be taken not to damage cylinder head cover sealing surfaces.



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Fig. 45 Spark Plug Tube Seal Installation

- 1 - SPECIAL TOOL MB-998306
- 2 - SPARK PLUG TUBE SEAL

INSTALLATION

(1) Clean all sealing surfaces.

NOTE: Position seal with the concave side facing the installation tool.

(2) Install seals using Special Tool MB-998306. Only hand pressure on tool is needed to install new seals.

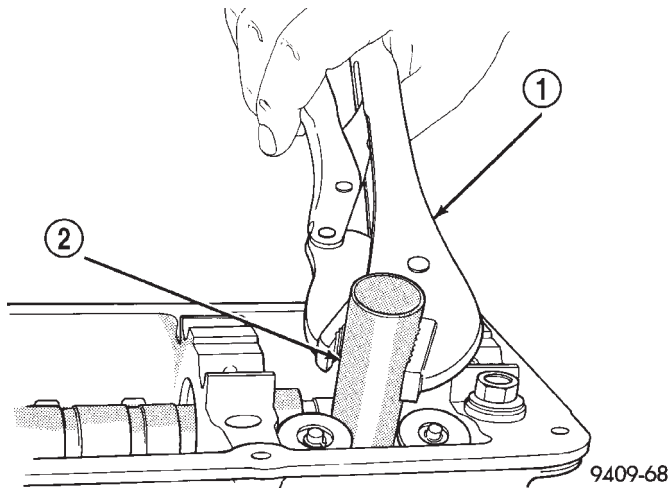
(3) Install cylinder head cover. Refer to procedures in this section.

SPARK PLUG TUBE

(1) Remove cylinder head cover. Refer to procedure in this section.

(2) Using locking pliers remove the tube from the cylinder head (Fig. 46). Discard old tube.

REMOVAL AND INSTALLATION (Continued)

**Fig. 46 Spark Plug Tube—Removal**

- 1 - LOCKING PLIERS
2 - SPARK PLUG TUBE

(3) Clean area around spark plug with Mopar® parts cleaner or equivalent.

(4) Apply Mopar® Stud and Bearing Mount or equivalent to a new tube approximately 1 mm from the end in a 3 mm wide area.

(5) Install sealer end of tube into the cylinder head. Then carefully install the tube using a hardwood block and mallet until the tube is seated into the bottom of the bore.

(6) Install cylinder head cover. Refer to procedure in this section.

CAMSHAFT

NOTE: TO REMOVE CAMSHAFT, THE CYLINDER HEAD MUST BE REMOVED.

REMOVAL

(1) Perform fuel system pressure release procedure **before attempting any repairs**. Refer to Group 14, Fuel System

(2) Remove the cylinder head cover. Refer to procedure in this section.

(3) Mark rocker arm shaft assemblies so that they are installed in their original positions.

(4) Remove rocker arm shaft bolts. Refer to procedure in this section.

(5) Remove timing belt, timing belt tensioner, and camshaft sprocket. Refer to procedures in this section.

(6) Remove rear timing belt cover.

(7) Remove cylinder head. Refer to procedure in this section.

(8) Remove camshaft sensor and camshaft target magnet.

(9) Remove camshaft from the rear of cylinder head.

INSPECT CYLINDER HEAD FOR THE FOLLOWING:**NOTE:**

- Check oil feed holes for blockage.
- Inspect cylinder head camshaft bearings for wear. Refer to Cylinder Head, Inspection and Cleaning.
- Check camshaft bearing journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

INSTALLATION

(1) Lubricate the camshaft journals with oil and install camshaft **without** rocker arm assemblies installed.

(2) Install camshaft target magnet into the end of the camshaft. Tighten mounting screw to 3.4 N·m (30 in. lbs.).

(3) Install camshaft position sensor and tighten mounting screws to 9 N·m (80 in. lbs.).

(4) Measure camshaft end play using the following procedure:

- Mount dial indicator C-3339 or equivalent, to a stationary point on cylinder head (Fig. 47).

- Using a suitable tool, move camshaft to rearward limits of travel.

- Zero the dial indicator.

- Move camshaft forward to limits of travel and read dial indicator.

- End play travel: 0.13 - 0.33 mm (0.005 - 0.013 in.).

(5) Install front camshaft seal. Camshaft must be installed before the camshaft seal is installed. Refer to procedure in this section.

(6) Install cylinder head. Refer to procedure in this section.

(7) Install camshaft sprocket and tighten to 115 N·m (85 ft. lbs.).

(8) Install rear timing belt cover.

(9) Install timing belt tensioner and timing belt. Refer to procedures in this section.

(10) Install rocker arm assemblies in correct order as removed. Tighten the rocker arm assemblies in sequence shown in (Fig. 48) to 28 N·m (250 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

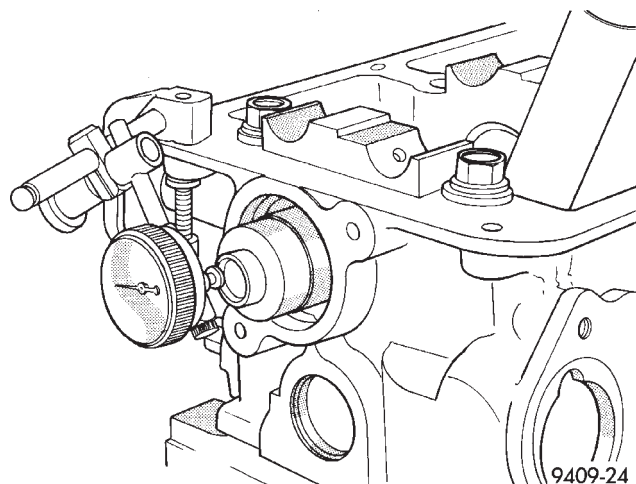


Fig. 47 Camshaft End Play

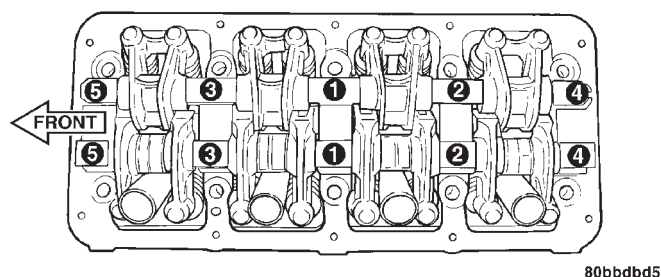


Fig. 48 Rocker Arm Shaft Tightening Sequence

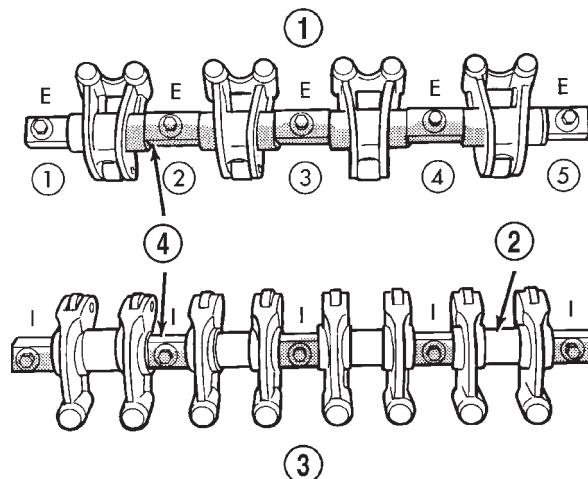
- (11) Install cylinder head cover and tighten fasteners to 12 N·m (105 in. lbs.).
- (12) Install ignition coil and ignition cables.

ROCKER ARM/HYDRAULIC LASH ADJUSTER

REMOVAL

- (1) Remove cylinder head cover using procedure in this section.
- (2) Identify the rocker arm shaft assemblies before removal.
- (3) Loosen the attaching fasteners. Remove rocker arm shaft assemblies from cylinder head.
- (4) Identify the rocker arms spacers and retainers for reassembly. Disassemble the rocker arm assemblies by removing the attaching bolts from the shaft (Fig. 49).
- (5) Slide the rocker arms and spacers off the shaft. Keep the spacers and rocker arms in the same location for reassembly.

NOTE: Inspect the rocker arm for scoring, wear on the roller or damage to the rocker arm (Fig. 50). Replace if necessary. Check the location where the rocker arms mount to the shafts for wear or damage. Replace if damaged or worn. The rocker arm shaft is hollow and is used as a lubrication oil duct. Check oil holes for clogging with small wire, clean

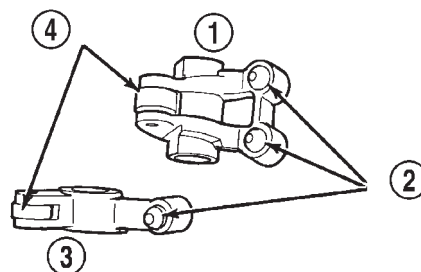


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Fig. 49 Rocker Arm Shaft Assemblies

- 1 - EXHAUST ROCKER ARM ASSEMBLY
- 2 - PLASTIC SHAFT SPACERS
- 3 - INTAKE ROCKER ARM ASSEMBLY
- 4 - ROCKER ARM SHAFT RETAINERS

as required. Lubricate the rocker arms and spacers. Install onto shafts in their original position (Fig. 49).



9509-22

Fig. 50 Rocker Arm Assemblies

- 1 - EXHAUST ROCKER ARM
- 2 - HYDRAULIC LASH ADJUSTERS
- 3 - INTAKE ROCKER ARM
- 4 - ROLLERS

INSTALLATION

CAUTION: Set crankshaft to 3 notches before TDC before installing rocker arm shafts. Refer to Timing Belt System and Camshaft Seal Service of this section for procedure.

REMOVAL AND INSTALLATION (Continued)

(1) Install rocker arm/hydraulic lash adjuster assembly making sure that adjusters are at least partially full of oil. This is indicated by little or no plunger travel when the lash adjuster is depressed. If there is excessive plunger travel. Place the rocker arm assembly into clean engine oil and pump the plunger until the lash adjuster travel is taken up. If travel is not reduced, replace the assembly. Hydraulic lash adjuster and rocker arm are serviced as an assembly.

(2) Install rocker arm and shaft assemblies with NOTCH in the rocker arm shafts pointing up and toward the timing belt side of the engine (Fig. 51). Install the retainers in their original positions on the exhaust and intake shafts (Fig. 49).

CAUTION: When installing the intake rocker arm shaft assembly be sure that the plastic spacers do not interfere with the spark plug tubes. If the spacers do interfere rotate until they are at the proper angle. To avoid damaging the spark plug tubes, do not attempt rotating the spacers by forcing down the shaft assembly.

(3) Tighten bolts to 28 N·m (250 in. lbs.) in sequence shown in (Fig. 52).

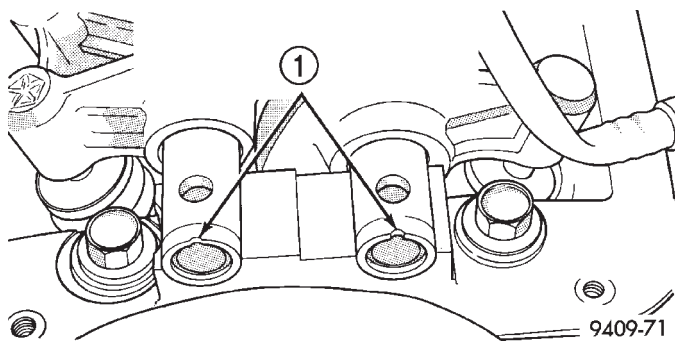


Fig. 51 Rocker Arm Shaft Notches

1 - NOTCHES FACING UP AND TOWARD THE TIMING BELT SIDE OF THE ENGINE

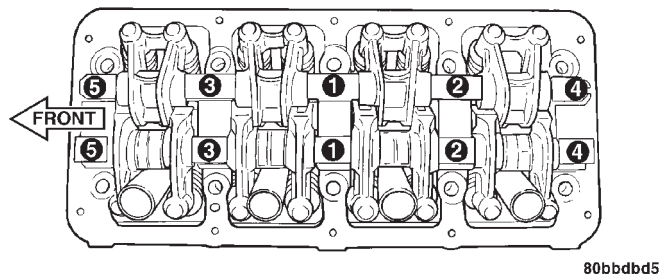


Fig. 52 Rocker Arm Shaft Tightening Sequence

HYDRAULIC LASH ADJUSTER NOISE

A tappet-like noise may be produced from several items. Refer to Lash Adjuster Noise - Diagnosis in Standard Service Procedures, in this Group. **Lash adjusters are replaced with the rocker arm as an assembly.**

VALVE SEAL AND SPRING—IN VEHICLE

REMOVAL

(1) Remove rocker arm shafts assemblies. Refer to procedure in this section.

(2) Rotate crankshaft until piston is at TDC on compression stroke.

(3) With air hose attached to adapter tool installed in spark plug hole, apply 90-120 psi air pressure.

(4) Using Special Tool MD-998772A with adapter 6779 (Fig. 53) compress valve springs and remove valve locks.

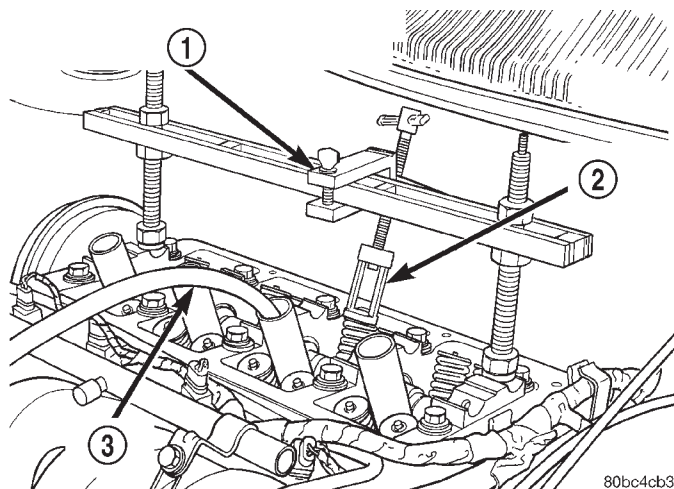


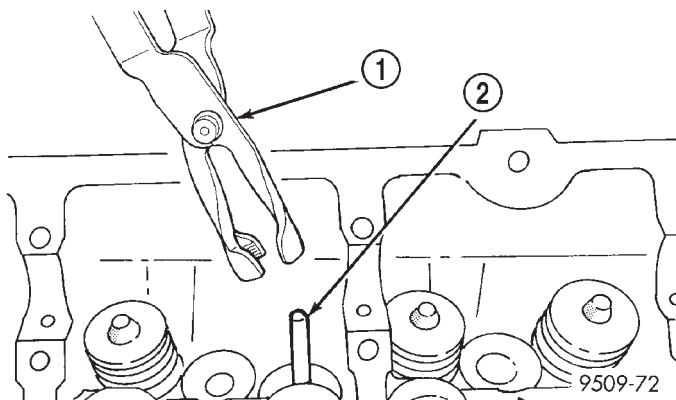
Fig. 53 Valve Spring—Removing and Installing

1 - VALVE SPRING COMPRESSOR SPECIAL TOOL MD-998772A
2 - ADAPTER 6779
3 - AIR HOSE

(5) Remove valve spring.

(6) Remove valve stem seal by using a valve stem seal tool (Fig. 54).

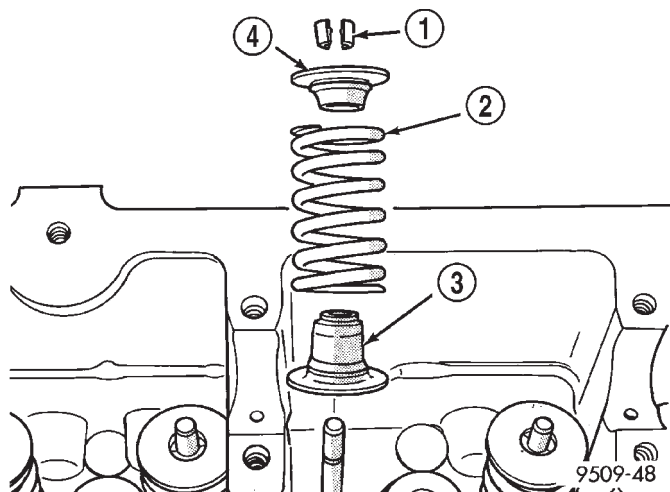
REMOVAL AND INSTALLATION (Continued)

**Fig. 54 Valve Stem Oil Seal Tool**

- 1 - VALVE SEAL TOOL
2 - VALVE STEM

INSTALLATION

- (1) Install valve seal/valve spring seat assembly. Refer to Valve Installation procedure in this section.
- (2) Using Special Tool MD-998772A compress valve springs only enough to install locks. Correct alignment of tool is necessary to avoid nicking valve stems (air pressure required), piston at TDC.

**Fig. 55 Valve Spring Assembly**

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

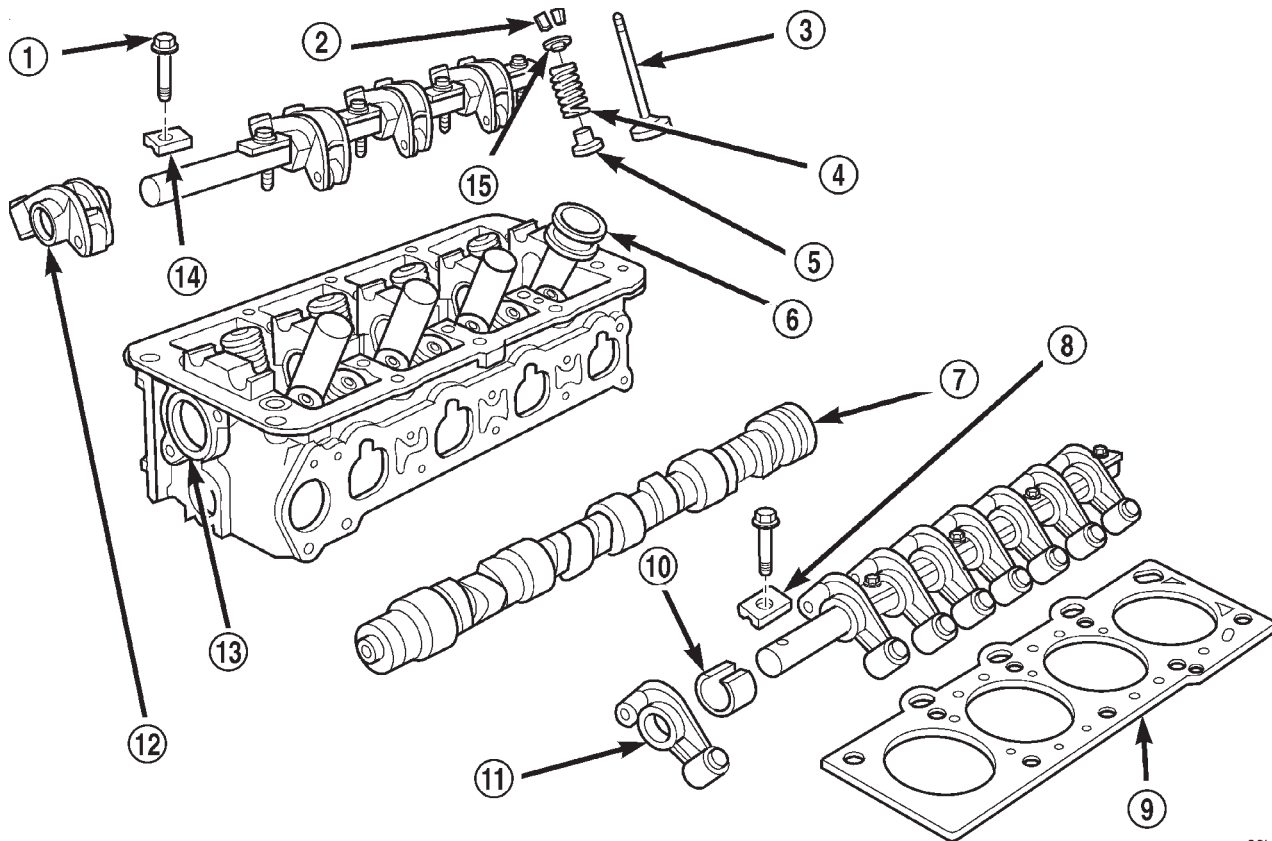
- (3) Install rocker arm shaft assemblies. Refer to procedure in this section.
- (4) Install cylinder head cover. Refer to procedure in this section.

CYLINDER HEAD**REMOVAL**

- (1) Perform fuel system pressure release procedure **before attempting any repairs**. Refer to Group 14, Fuel System.
- (2) Disconnect battery negative cable from auxiliary jumper terminal.
- (3) Drain cooling system. Refer to Group 7, Cooling System.
- (4) Remove air cleaner inlet duct and air cleaner upper housing, disconnect all vacuum lines, electrical wiring and fuel lines from throttle body.
- (5) Remove throttle linkage.
- (6) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.
- (7) Remove power brake vacuum hose from intake manifold.
- (8) Raise vehicle and remove exhaust pipe from manifold.
- (9) Remove power steering fluid reservoir and set aside.
- (10) Disconnect ignition coil wiring connector and remove ignition coil from engine.
- (11) Remove cylinder head cover. Refer to procedure in this section.
- (12) Remove cam sensor and fuel injectors wiring connectors.
- (13) Remove intake manifold. Refer to procedure in this section.
- (14) Remove timing belt, camshaft sprocket and rear timing belt cover. Refer to procedures in this section.
- (15) Remove rocker arm shaft assemblies.
- (16) Remove cylinder head bolts in reverse order of tightening sequence (Fig. 60).
- (17) Carefully lift cylinder head from block.

NOTE: Inspect camshaft bearing journals for scoring. Cylinder head must be flat within 0.1 mm (0.004 inch) (Fig. 56).

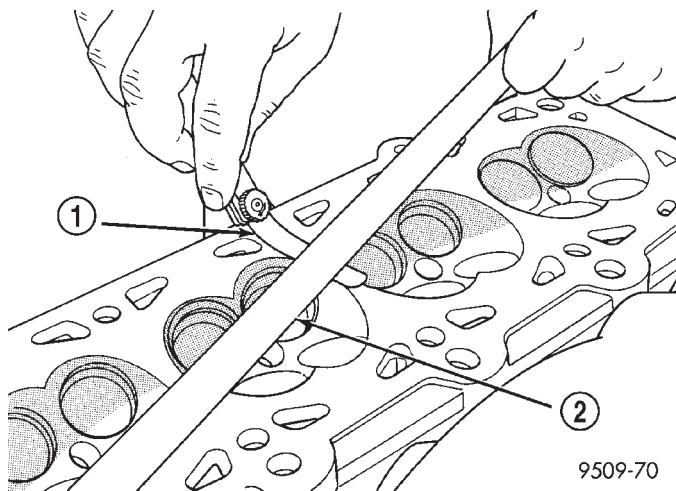
REMOVAL AND INSTALLATION (Continued)



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Cylinder Head and Valve Assembly

- | | |
|---|--|
| 1 - ROCKER SHAFT RETAINING BOLT | 10 - SPACER |
| 2 - VALVE RETAINING LOCKS | 11 - INTAKE ROCKER ARM/HYDRAULIC LASH ADJUSTER ASSEMBLY |
| 3 - VALVE | 12 - EXHAUST ROCKER ARM/HYDRAULIC LASH ADJUSTER ASSEMBLY |
| 4 - VALVE SPRING | 13 - CAMSHAFT SEAL |
| 5 - VALVE SEAL AND VALVE SPRING SEAT ASSEMBLY | 14 - RETAINER SPACER |
| 6 - SPARK PLUG TUBE SEAL | 15 - VALVE SPRING RETAINER |
| 7 - CAMSHAFT | |
| 8 - ROCKER ARM SHAFT RETAINER SPACER | |
| 9 - GASKET | |



9509-70

Fig. 56 Checking Cylinder Head Flatness

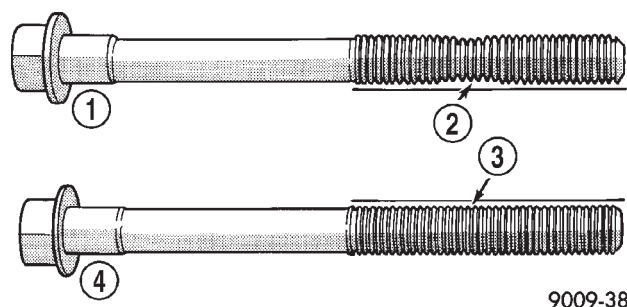
- 1 - FEELER GAUGE
2 - STRAIGHT EDGE

INSTALLATION**EXAMINING CYLINDER HEAD BOLTS**

NOTE: The cylinder head bolts should be examined **BEFORE** reuse. If the threads are necked down, the bolts should be replaced (Fig. 57).

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(s) should be replaced.

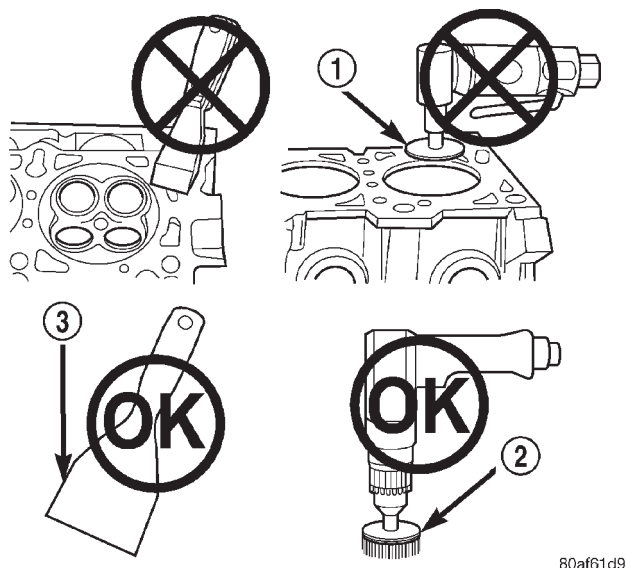
REMOVAL AND INSTALLATION (Continued)

**Fig. 57 Checking Bolts for Stretching (Necking)**

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

CLEANING CYLINDER HEAD SEALING SURFACES

CAUTION: When cleaning cylinder head and cylinder block surfaces, **DO NOT** use a metal scraper. Sealing surfaces could be cut or ground, resulting in gasket leaks. Use only the cleaning methods shown in (Fig. 58). If required, use a white (120 grit) 3M Roloc™ bristle disk on aluminum surfaces. A yellow (80 grit) bristle disk can be used on cast iron surfaces with care.

**Fig. 58 Proper Tool Usage for Surface Preparation**

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

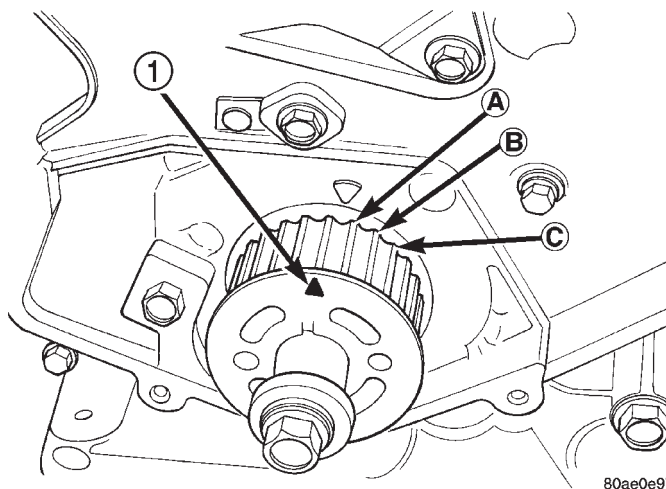
(1) Clean the cylinder head and cylinder block sealing surfaces using a wood/plastic scraper. Apply solvent or a commercially available gasket remover to help soften the gasket residue. If additional cleaning is required, use a white (120 grit) 3M Roloc™

bristle disk and a drill motor to remove gasket residue.

(2) Apply Mopar® Gasket Sealant (aerosol can) to both sides of the new cylinder head gasket.

(3) Position a new cylinder head gasket on the locating dowels.

(4) Position crankshaft sprocket to TDC, then rotate crankshaft until mark is three teeth before TDC (Fig. 59). This will ensure that no piston-to-valve contact occurs upon installation of cylinder head in the event of camshaft rotation.

**Fig. 59 Crankshaft Sprocket Position**

- 1 - TDC MARK

(5) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

(6) Before installing the cylinder head bolts, the threads should be oiled with engine oil. The 4 short bolts 110 mm (4.330 in.) are to be installed in positions 7, 8, 9, and 10 (Fig. 60).

(7) Tighten the cylinder head bolts in the sequence shown in (Fig. 60). Using the 4 step torque method, tighten according to the following values:

- First All to 34 N·m (25 ft. lbs.)
- Second All to 68 N·m (50 ft. lbs.)
- Third All to 68 N·m (50 ft. lbs.)
- Fourth Turn an additional 1/4 Turn, **Do not use a torque wrench for this step.**

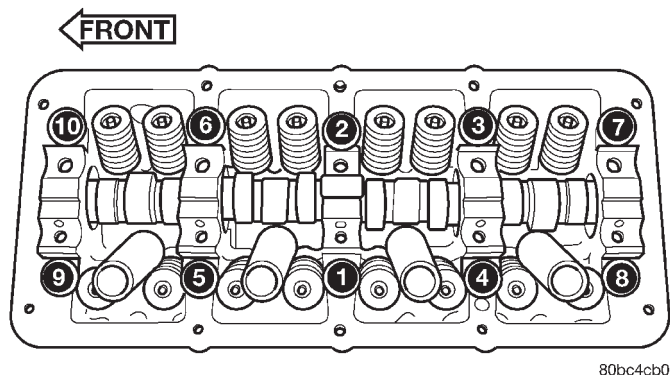
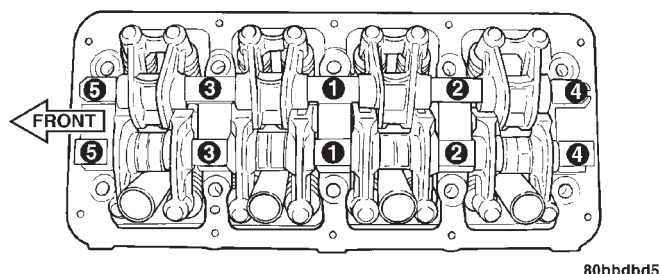
(8) Install rocker shaft assemblies in correct order as removed. Tighten rocker arm shaft bolts in sequence shown in (Fig. 61) to 28 N·m (250 in. lbs.).

(9) Install rear timing belt cover, camshaft sprocket, and timing belt. Refer to procedures in this section.

(10) Install intake manifold. Refer to procedure in this section.

(11) Connect electrical connectors to cam sensor and fuel injectors.

REMOVAL AND INSTALLATION (Continued)

**Fig. 60 Cylinder Head Tightening Sequence****Fig. 61 Rocker arm Tightening Sequence**

(12) Install cylinder head cover and tighten fasteners to 12 N·m (105 in. lbs.).

(13) Connect PCV and make-up air hose to cylinder head cover.

(14) Install power steering reservoir.

(15) Install ignition coil and connect wiring connector.

(16) Connect power brake booster vacuum hose to intake manifold.

(17) Connect throttle linkage to throttle body.

(18) Connect all vacuum lines and electrical wiring connectors.

(19) Install air cleaner inlet duct and upper air cleaner housing.

(20) Raise vehicle on hoist and connect exhaust system to exhaust manifold.

(21) Lower vehicle and connect negative cable to auxiliary battery terminal.

(22) With the DRB scan tool use ASD Fuel System Test to pressurize fuel system. Check for fuel leaks.

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.

VALVE SERVICE WITH THE CYLINDER HEAD REMOVED**REMOVAL**

(1) With cylinder head removed, compress valve springs using Special Tool C-3422-B with Adaptor 6526.

(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 to insure installation in original location.

VALVE INSPECTION

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

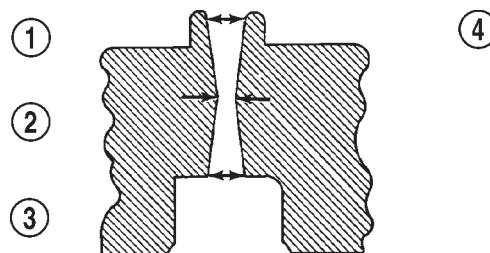
(2) Measure valve stems for wear. Measure stem about 60 mm beneath the valve lock grooves.

(3) If valve stems are worn more than 0.05 mm (0.002 in.), replace valve.

VALVE GUIDES

(1) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(2) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 62). Replace guides if they are not within specification. For specifications, refer to Engine Specifications in this section.



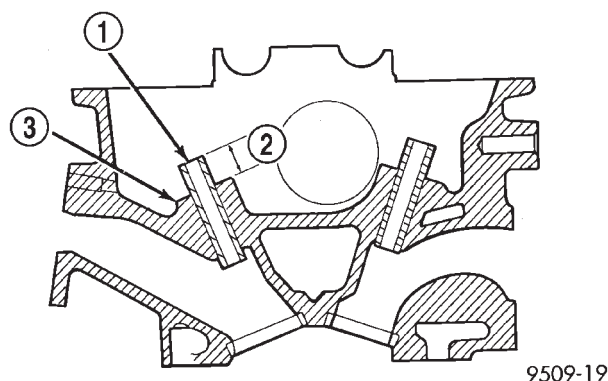
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Fig. 62 Checking Wear on Valve Guide—Typical

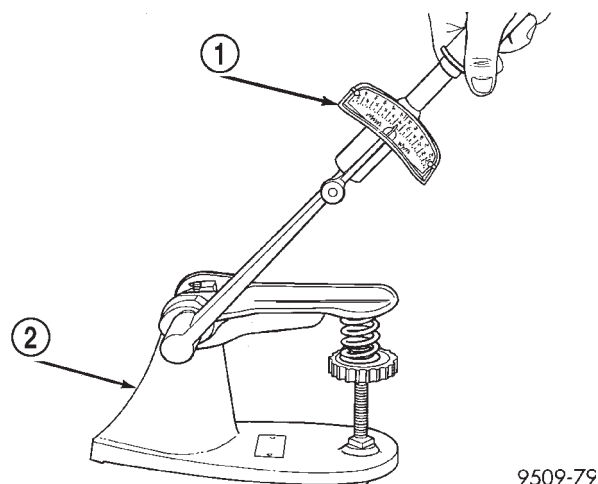
- 1 – TOP
- 2 – MIDDLE
- 3 – BOTTOM
- 4 – CUT AWAY VIEW OF VALVE GUIDE MEASUREMENT LOCATIONS

(3) Check valve guide height (Fig. 63).

REMOVAL AND INSTALLATION (Continued)

**Fig. 63 Valve Guide Height**

- 1 - VALVE GUIDE
- 2 - 13.25 - 13.75 MM
(.521 -.541 IN.)
- 3 - SPRING SEAT

**Fig. 64 Valve Spring Testing**

- 1 - TORQUE WRENCH
- 2 - VALVE SPRING TESTER

TESTING VALVE SPRINGS

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested Special Tool C-647. As an example, the compression length of the spring to be tested is 33.34 mm (1-5/16 in.). Turn tool table until surface is in line with the 33.34 mm (1-5/16 in.) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device (Fig. 64). Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Discard the springs that do not meet specifications. The following specifications apply to both intake and exhaust valve springs:

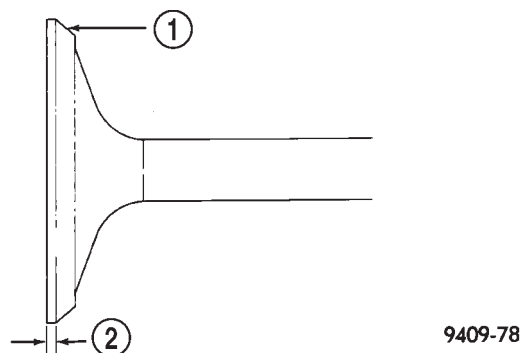
- Valve Closed Nominal Tension—70 lbs. @ 39.8 mm (1.57 in.)
- Valve Closed Nominal Tension—160 lbs. @ 32.6 mm (1.28 in.)

(2) Verify springs are not distorted with a steel square and surface plate, check springs from both ends. If the spring is more than 1.5 mm (1/16 in.) out of square, install a new spring.

REFACING VALVES AND VALVE SEATS

(1) The intake and exhaust valve seats and valve face have a 45 degree angle.

(2) Inspect the remaining margin after the valves are refaced (Fig. 65). Intake valves with less than 0.95 mm (1/32 in.) margin and exhaust valves with less than 1.05 mm (3/64 in.) margin should be discarded.

**Fig. 65 Intake and Exhaust Valve Refacing**

- 1 - VALVE FACE
- 2 - VALVE MARGIN

(3) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained. For specifications, refer to Engine Specifications in this section.

(4) Measure the concentricity of valve seat and valve guide using a valve seat runout dial indicator. Total runout should not exceed. 0.051 mm (0.002 in.) (total indicator reading).

(5) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

REMOVAL AND INSTALLATION (Continued)

(6) Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. The intake valve seat must be serviced when the valve seat width is 2.0 mm (0.079 in.) or greater. The exhaust valve seat must be serviced when the valve seat width is 2.5 mm (0.098 in.) or greater. Otherwise the cylinder head must be replaced.

(7) When seat is properly positioned the width of intake and exhaust seats should be 0.75–1.25 mm (0.030–0.049 in.) (Fig. 66).

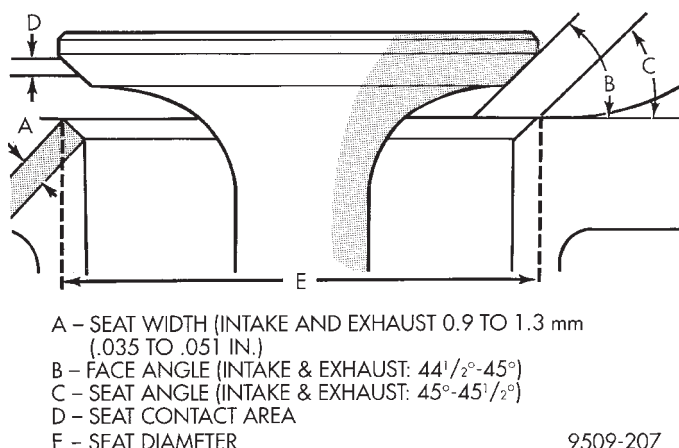


Fig. 66 Valve Seat Refacing

(8) Check valve tip to spring seat dimensions A after grinding the valve seats or faces. Grind valve tip until within specifications. Measure from valve tip to spring seat when installed in the head (measurement A) (Fig. 67). For specifications, refer to Engine Specifications in this section. The valve tip chamfer may need to be reground to prevent seal damage when the valve is installed.

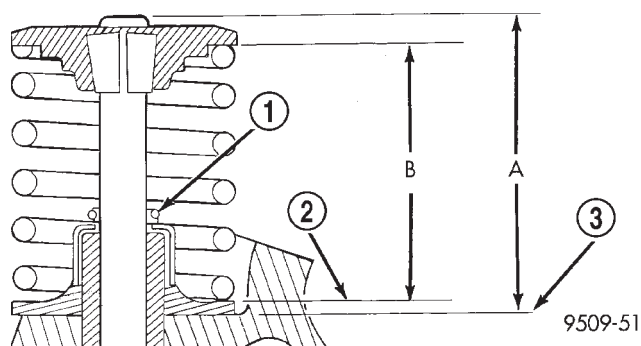


Fig. 67 Spring Installed Height and Valve Tip to Spring Seat Dimensions

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

CLEANING

Clean all valve guides, valves and valve spring assemblies thoroughly with suitable cleaning solution before reassembling.

VALVE INSTALLATION

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

(2) Install new valve stem seals on all valves using a valve stem seal tool (Fig. 68). The valve stem seals should be pushed firmly and squarely over valve guide.

CAUTION: If oversize valves are used, there is only one oversize valve available. The same stem seal is used on both the standard and oversize valve.

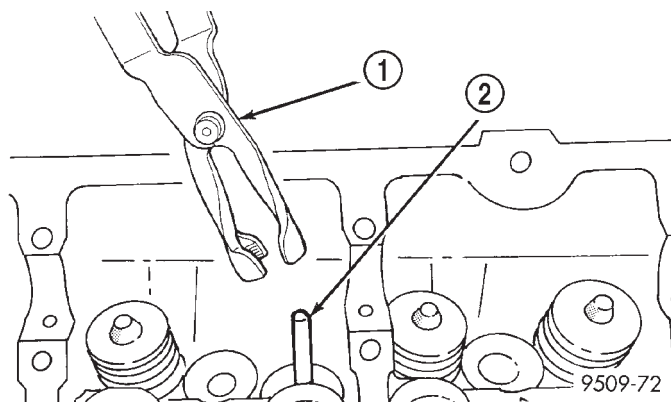


Fig. 68 Valve Stem Oil Seal Tool

- 1 – VALVE SEAL TOOL
- 2 – VALVE STEM

(3) Install valve springs and retainers. Compress valve springs 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.

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

(4) Check the valve spring installed height after refacing the valve and seat (measurement B) (Fig. 67). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 40.18 mm (1.58 in.), install a 0.762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.

(5) Install rocker arm shafts as previously described in this section.

(6) Checking dry lash. Dry lash is the amount of clearance that exists between the base circle of an

REMOVAL AND INSTALLATION (Continued)

installed cam and the rocker arm roller when the adjuster is drained of oil and completely collapsed. Specified dry lash is 1.17 mm (0.046 in.) for intake and 1.28 mm (0.050 in.) for exhaust. After performing dry lash check, refill adjuster with oil and allow 10 minutes for adjuster(s) to bleed down before rotating cam.

CRANKSHAFT DAMPER

REMOVAL

(1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(2) Raise vehicle on a hoist and remove right inner splash shield (Fig. 69).

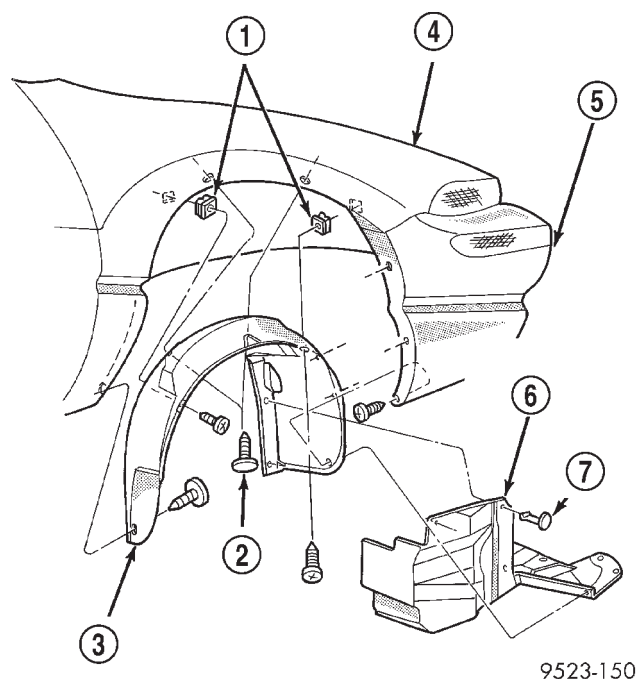


Fig. 69 Right Inner Splash Shield

- 1 - NUT-SNAP
- 2 - PUSH-IN FASTENER
- 3 - WHEELHOUSE SPLASH SHIELD
- 4 - FENDER
- 5 - FASCIA
- 6 - ACCESSORY DRIVE BELT SPLASH SHIELD
- 7 - PUSH-IN FASTENER

(3) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827-A (Fig. 70).

INSTALLATION

(1) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 71).

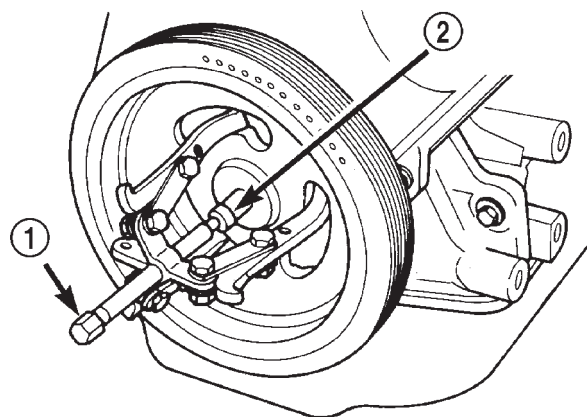


Fig. 70 Crankshaft Damper—Removal

- 1 - SPECIAL TOOL 1026
- 2 - SPECIAL TOOL 6827-A INSERT

(2) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(3) Raise vehicle on hoist and install right inner splash shield.

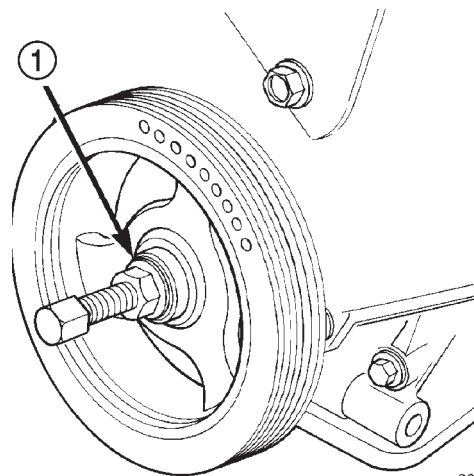


Fig. 71 Crankshaft Damper—Installation

- 1 - M12-1.75 x 150 MM BOLT, WASHER AND THRUST BEARING FROM SPECIAL TOOL 6792

TIMING BELT COVER

FRONT TIMING BELT COVER

REMOVAL

(1) Disconnect negative cable from auxiliary jumper terminal.

(2) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(3) Raise vehicle on a hoist and remove right inner splash shield.

REMOVAL AND INSTALLATION (Continued)

(4) Remove crankshaft damper. Refer to procedure in this section.

(5) Lower vehicle and place a jack under engine.

(6) Remove right engine mount. Refer to procedure in this section.

(7) Remove generator and bracket (Fig. 72). Refer to Group 8C, Charging System for specific procedures.

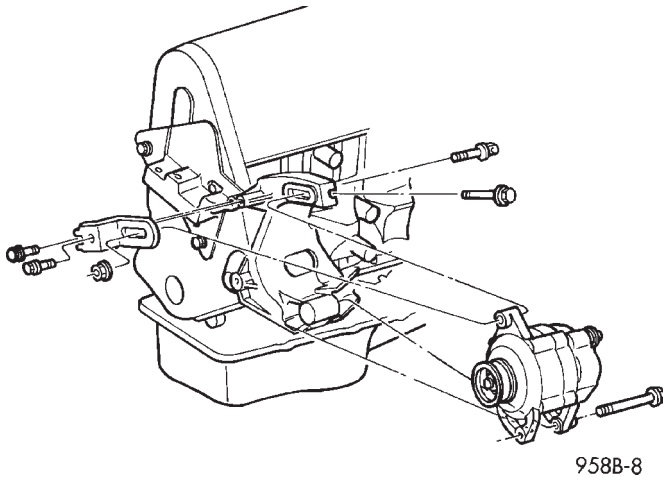


Fig. 72 Generator and Brackets

(8) Remove right engine mount bracket (Fig. 73).

(9) Remove front timing belt cover (Fig. 74).

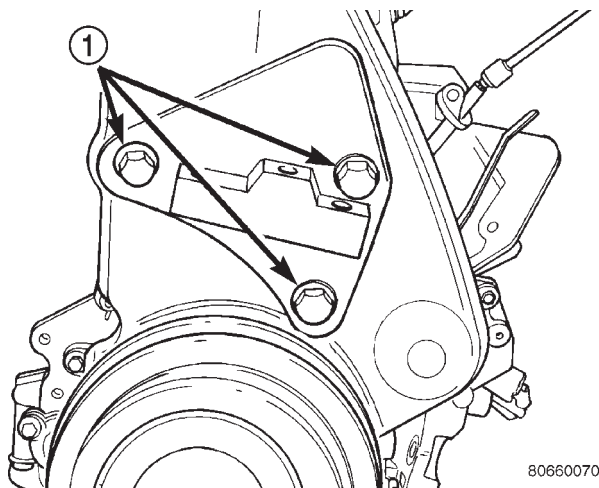


Fig. 73 Right Engine Mount Bracket

1 - ENGINE MOUNT BRACKET-TO-ENGINE FASTENERS

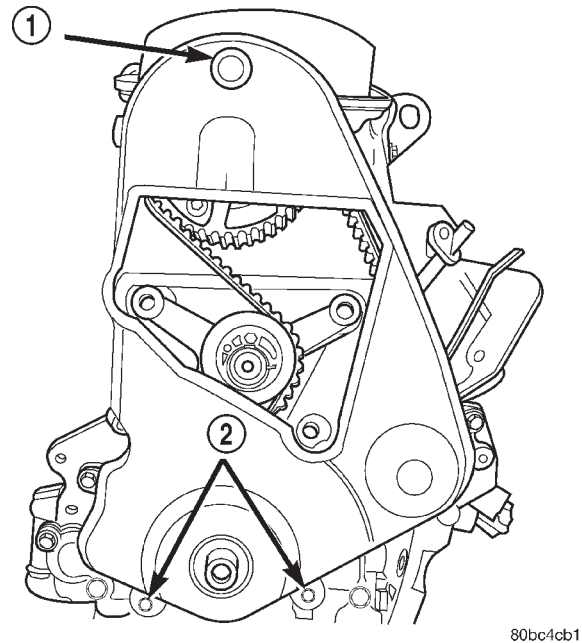


Fig. 74 Front Timing Belt Cover

1 - ACCESS PLUG

2 - BOLTS

INSTALLATION

(1) Install front timing cover and tighten bolts to 12 N·m (105 in. lbs.).

(2) Install engine mount bracket.

(3) Install right engine mount. Refer to procedure in this section for installation.

(4) Remove jack from under engine.

(5) Install generator bracket (Fig. 72). Tighten mounting bolts to 61 N·m (45 ft. lbs.).

(6) Install generator (Fig. 72). Refer to Group 8C, Charging System for procedures.

(7) Install crankshaft damper. Refer to procedure in this section for installation.

(8) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(9) Raise vehicle on hoist and install right inner splash shield.

(10) Connect negative cable.

REMOVAL AND INSTALLATION (Continued)

REAR TIMING BELT COVER

REMOVAL

- (1) Remove front timing belt cover following procedure in this section.
- (2) Remove timing belt and timing belt tensioner. Refer to procedures in this section.
- (3) Hold camshaft sprocket with Special Tools C-4687 and modified Adaptor C-4687-1 (Fig. 75), while removing attaching bolt.

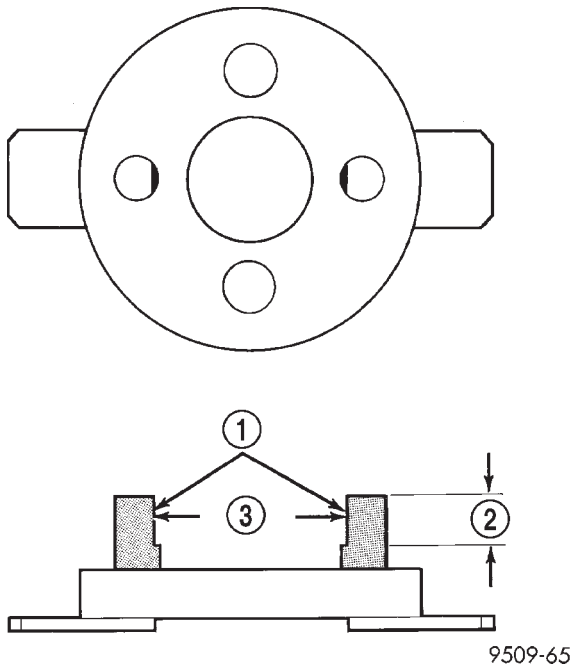


Fig. 75 Modification to Special Tool C-4687-1

- 1 - GRIND LOCATION
- 2 - 12.7 MM (1/2 IN.)
- 3 - 50.8 MM (2 IN.)

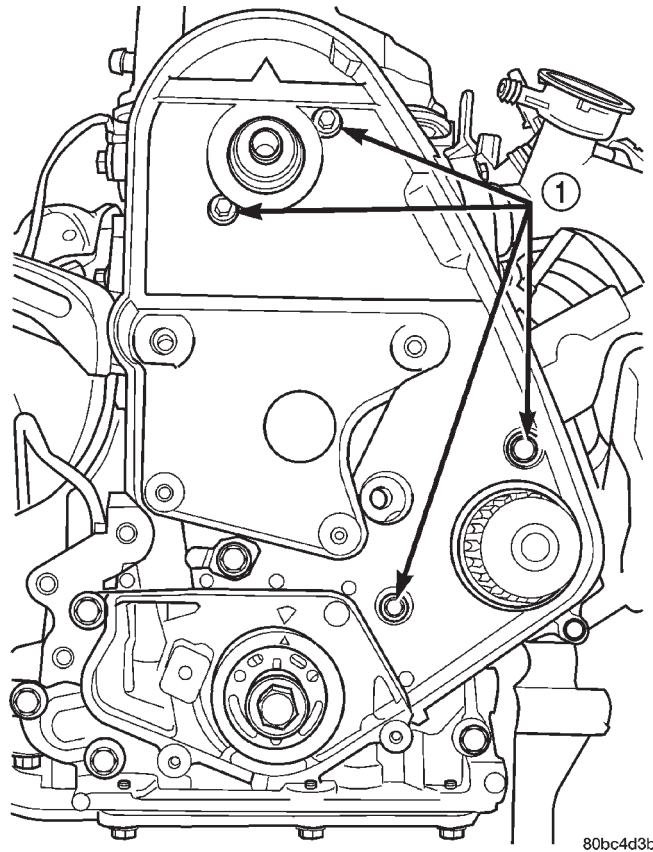


Fig. 76 Rear Timing Belt Cover

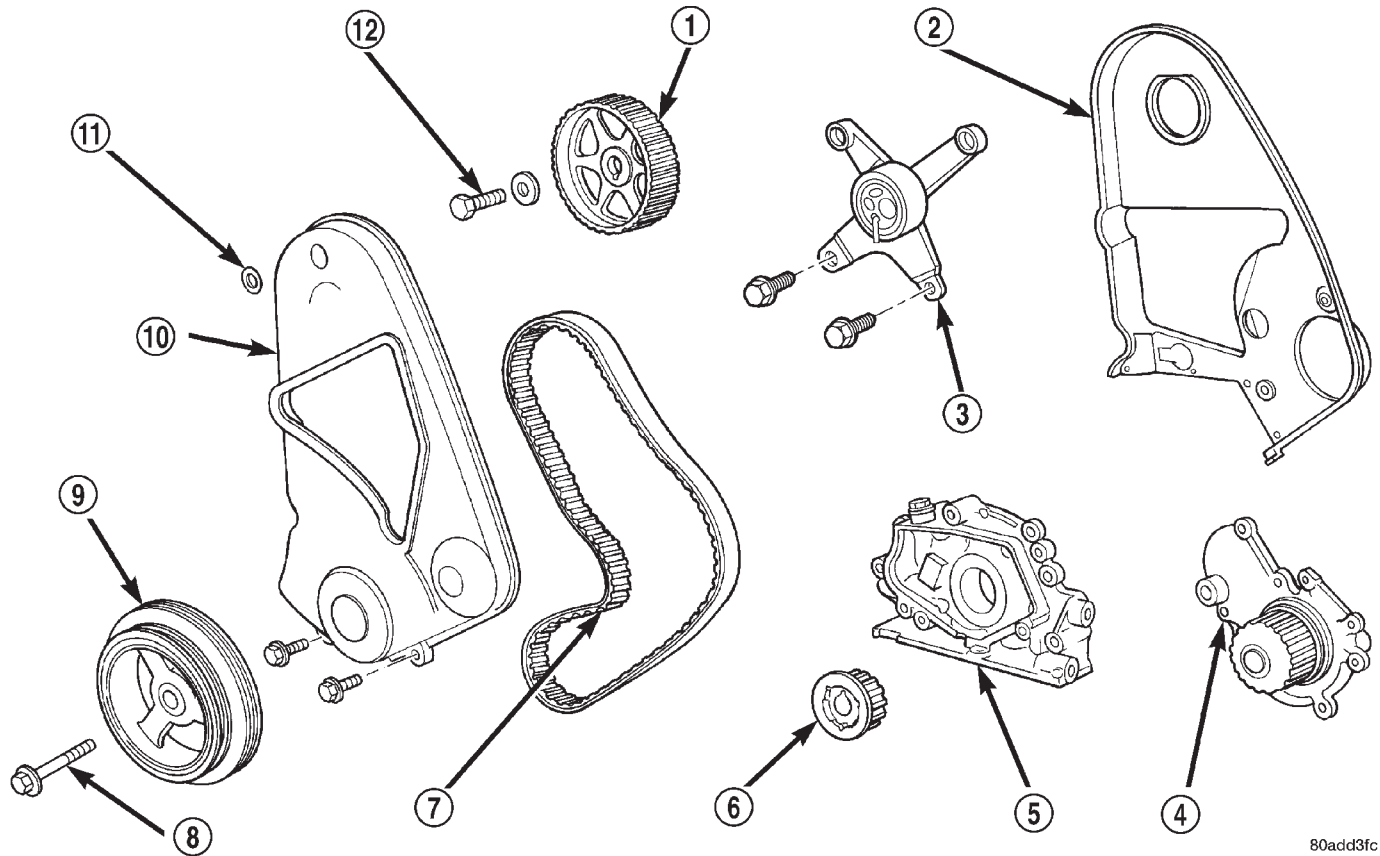
1 - BOLTS

TIMING BELT

CAUTION: The 2.0L SOHC engine is a non-free-wheeling design. Therefore, do not rotate the camshaft once the timing belt has been removed as damage to valve components may occur.

- (4) Remove camshaft sprocket.
- (5) Remove rear timing cover attaching bolts (Fig. 76).
- (6) Remove rear timing cover (Fig. 76).

REMOVAL AND INSTALLATION (Continued)



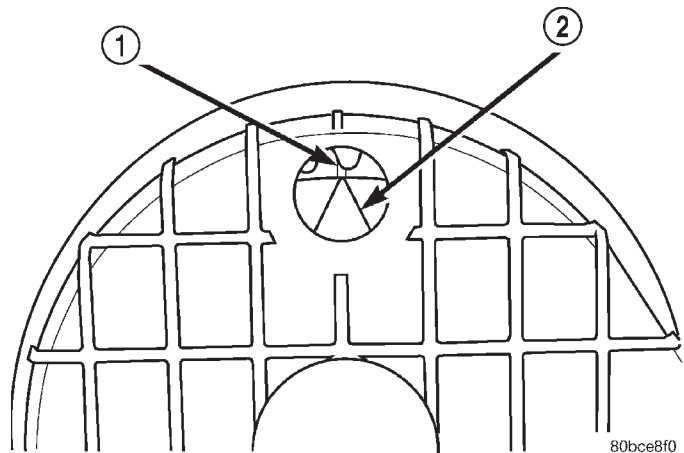
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Fig. 77 Timing Belt System

- | | |
|------------------------------------|-------------------------------|
| 1 - CAMSHAFT SPROCKET | 7 - TIMING BELT |
| 2 - REAR TIMING BELT COVER | 8 - BOLT |
| 3 - TIMING BELT TENSIONER ASSEMBLY | 9 - CRANKSHAFT DAMPER |
| 4 - WATER PUMP | 10 - FRONT TIMING BELT COVER |
| 5 - OIL PUMP BODY | 11 - ACCESS PLUG |
| 6 - CRANKSHAFT SPROCKET | 12 - CAMSHAFT BOLT AND WASHER |

CHECKING BELT TIMING—COVER INSTALLED

- Remove number one spark plug.
- Using a dial indicator, set number one cylinder to TDC on the compression stroke.
- Remove the access plug from the outer timing belt cover (Fig. 77).
- Check the timing mark on the camshaft sprocket, it should align with the arrow on the rear belt cover (Fig. 78).



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Fig. 78 Camshaft Timing Marks

- | |
|------------------------------|
| 1 - CAM SPROCKET TIMING MARK |
| 2 - ARROW ON REAR COVER |

REMOVAL AND INSTALLATION (Continued)

REMOVAL—TIMING BELT

- (1) Disconnect negative cable from auxiliary jumper terminal.
- (2) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.
- (3) Raise vehicle on a hoist and remove right inner splash shield (Fig. 79).
- (4) Remove right front wheel.

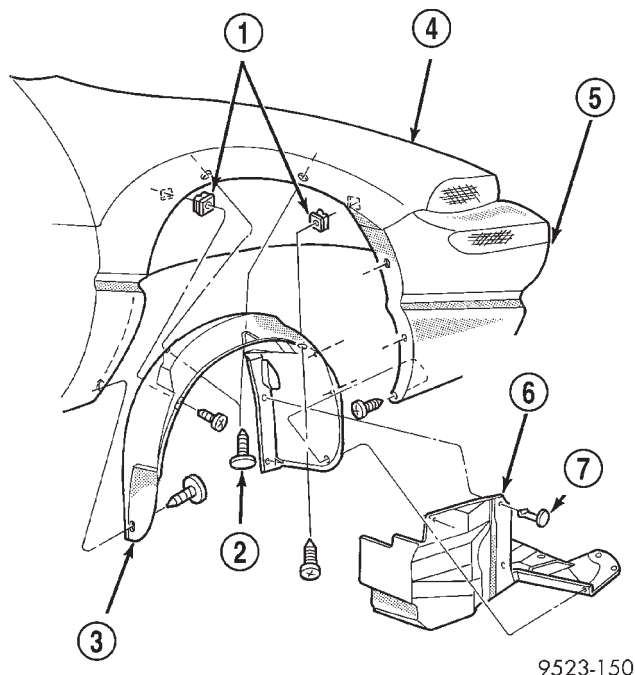


Fig. 79 Right Inner Splash Shield

- 1 - NUT-SNAP
- 2 - PUSH-IN FASTENER
- 3 - WHEELHOUSE SPLASH SHIELD
- 4 - FENDER
- 5 - FASCIA
- 6 - ACCESSORY DRIVE BELT SPLASH SHIELD
- 7 - PUSH-IN FASTENER

(5) Remove crankshaft damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827-A (Fig. 80).

- (6) Lower vehicle and place a jack under engine.
- (7) Remove right engine mount. Refer to procedure in this section.
- (8) Remove generator and bracket (Fig. 81). Refer to Group 8C, Charging System for specific procedures.
- (9) Remove right engine mount bracket (Fig. 82).
- (10) Remove accessory drive belt idler pulley from generator bracket.
- (11) Remove bolts attaching generator bracket to engine. Move bracket away from engine for clearance to remove the front timing cover.
- (12) Remove front timing belt cover (Fig. 83).

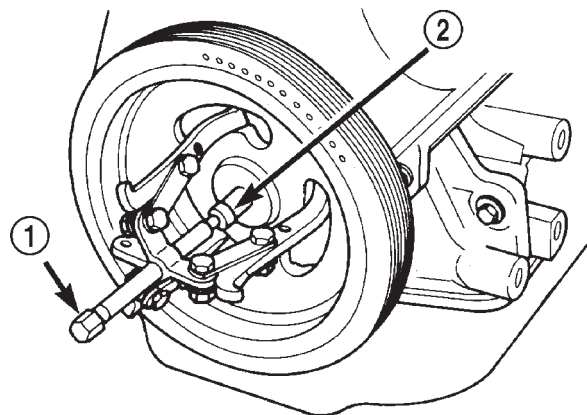


Fig. 80 Crankshaft Damper—Removal

- 1 - SPECIAL TOOL 1026
- 2 - SPECIAL TOOL 6827-A INSERT

CAUTION: Align camshaft and crankshaft timing marks before removing the timing belt by rotating the engine with the crankshaft.

(13) Install a 8 mm Allen wrench into the belt tensioner. Insert the long end of a 1/8" or 3 mm Allen wrench into the pin hole on the front of the tensioner (Fig. 84). Rotate the tensioner counterclockwise with the 8 mm Allen wrench, while pushing in lightly on the 1/8" or 3 mm Allen wrench until it slides into the locking hole.

(14) Remove timing belt.

CAUTION: Do not rotate the camshaft once the timing belt has been removed as damage to valve components may occur.

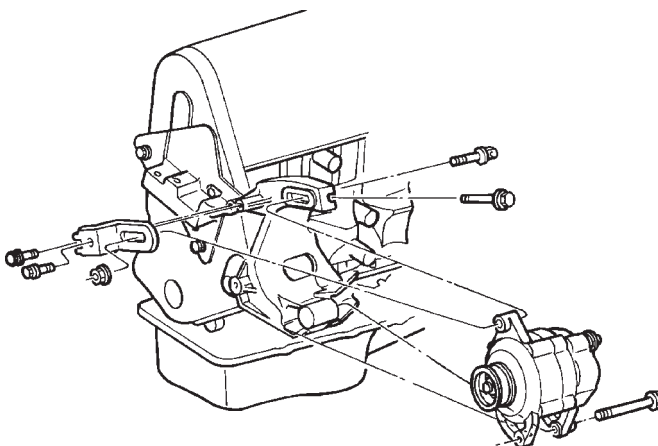
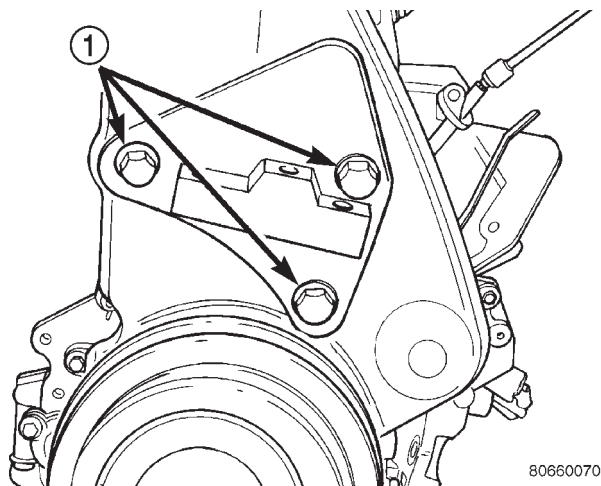


Fig. 81 Generator and Brackets

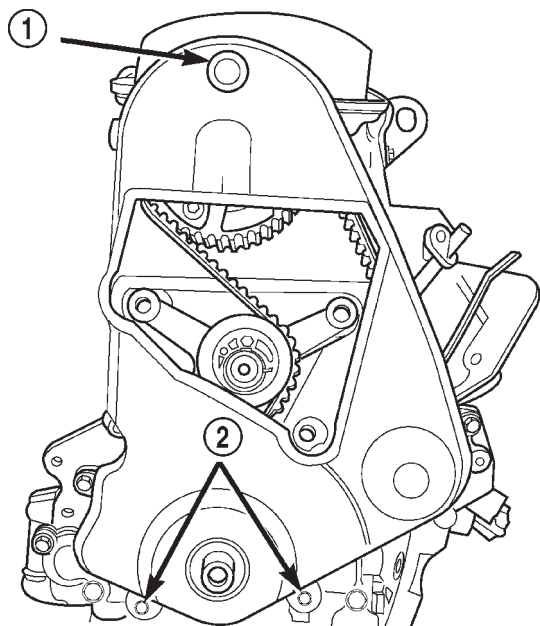
REMOVAL AND INSTALLATION (Continued)



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Fig. 82 Right Engine Mount Bracket—Typical

1 - ENGINE MOUNT BRACKET-TO-ENGINE FASTENERS



80bc4cb1

Fig. 83 Front Timing Belt Cover

1 - ACCESS PLUG

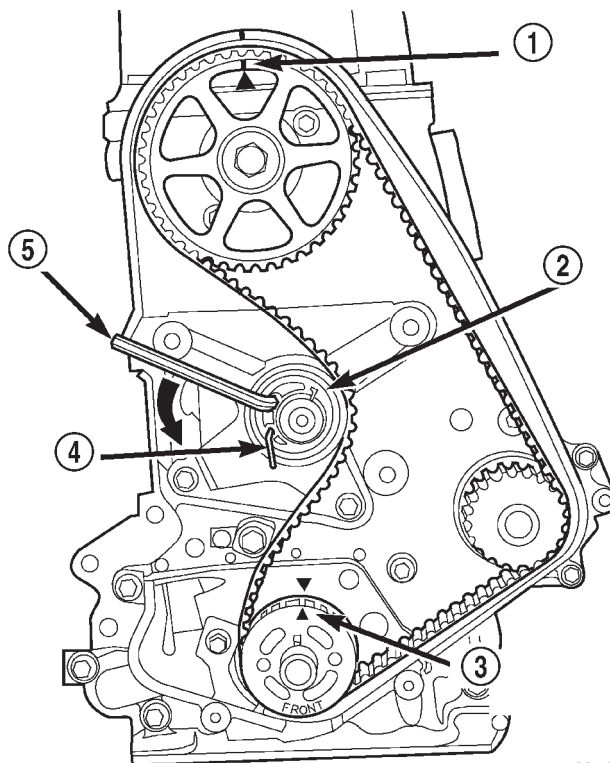
2 - BOLTS

**CAMSHAFT AND CRANKSHAFT TIMING
PROCEDURE AND BELT INSTALLATION**

(1) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing, then back off to 3 notches before TDC (Fig. 85).

(2) Set camshaft to TDC by aligning mark on sprocket with the arrow on the rear of timing belt cover (Fig. 86).

(3) Move crankshaft to 1/2 mark before TDC (Fig. 87) for belt installation.



80add3fe

Fig. 84 Remove Timing Belt

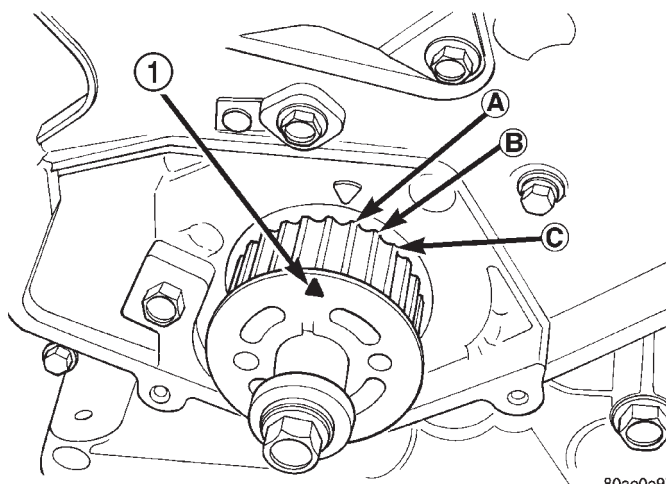
1 - CAMSHAFT TIMING MARKS

2 - BELT TENSIONER

3 - CRANKSHAFT AT TDC

4 - 1/8" OR 3mm ALLEN WRENCH

5 - 8 mm ALLEN WRENCH

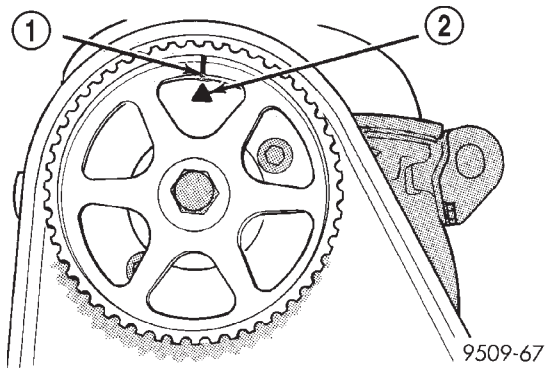


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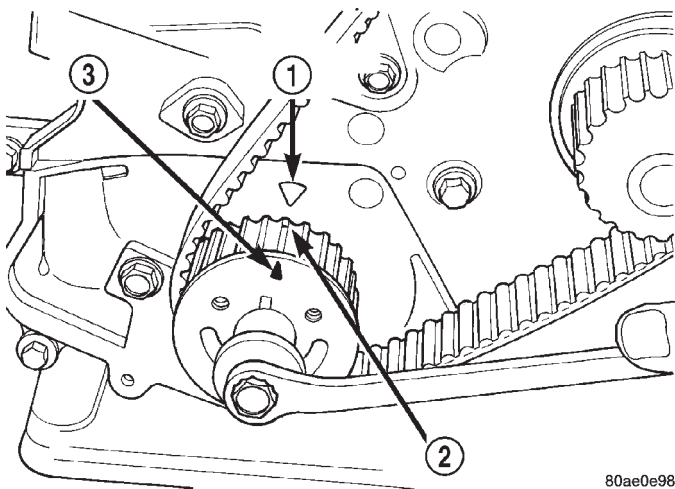
Fig. 85 Crankshaft Sprocket Timing

1 - TDC MARK

REMOVAL AND INSTALLATION (Continued)

**Fig. 86 Camshaft Timing Mark**

- 1 - CAM SPROCKET TIMING MARK
2 - ARROW ON REAR COVER

**Fig. 87 Adjusting Crankshaft Sprocket for Timing Belt Installation**

- 1 - TDC REFERENCE MARK
2 - 1/2 NOTCH LOCATION
3 - TDC MARK

(4) Install timing belt. Starting at the crankshaft, go around the water pump sprocket and then around the camshaft sprocket.

(5) Move crankshaft sprocket to TDC to take up belt slack.

(6) Remove the 1/8" or 3 mm Allen wrench from belt tensioner.

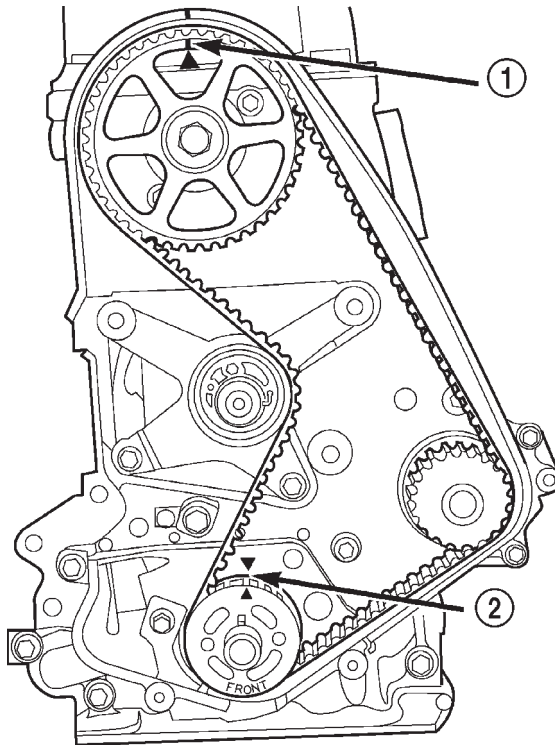
(7) Rotate crankshaft 2 revolutions and check the alignment of the timing marks (Fig. 88).

(8) Install front half of timing cover.

(9) Install generator bracket and attaching bolts.

(10) Install idler pulley to generator bracket.

(11) Install engine mount bracket.



80add405

Fig. 88 Crankshaft and Camshaft Timing

- 1 - CAMSHAFT TIMING MARKS
2 - CRANKSHAFT AT TDC

(12) Install generator bracket to engine (Fig. 81). Tighten attaching bolts to 61 N·m (45 ft. lbs.).

(13) Install generator (Fig. 81). Refer to Group 8C, Charging System for procedure.

(14) Install right engine mount. Refer to procedure in this section.

(15) Remove jack from under engine.

(16) Install crankshaft damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792. Install crankshaft damper bolt and tighten to 142 N·m (105 ft. lbs.) (Fig. 89).

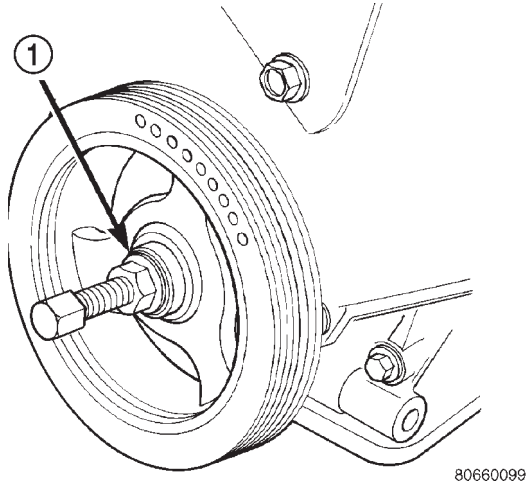
(17) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive section for procedure.

(18) Raise vehicle on hoist and install right inner splash shield.

(19) Install right front wheel and lower vehicle.

(20) Connect negative cable.

REMOVAL AND INSTALLATION (Continued)

**Fig. 89 Crankshaft Damper—Installation**

1 – M12–1.75 × 150 MM BOLT, WASHER AND THRUST BEARING FROM SPECIAL TOOL 6792

TIMING BELT TENSIONER**REMOVAL**

- (1) Remove timing belt. Refer to procedure in this section.
- (2) Remove tensioner assembly attaching bolts (Fig. 90).
- (3) Remove tensioner assembly.

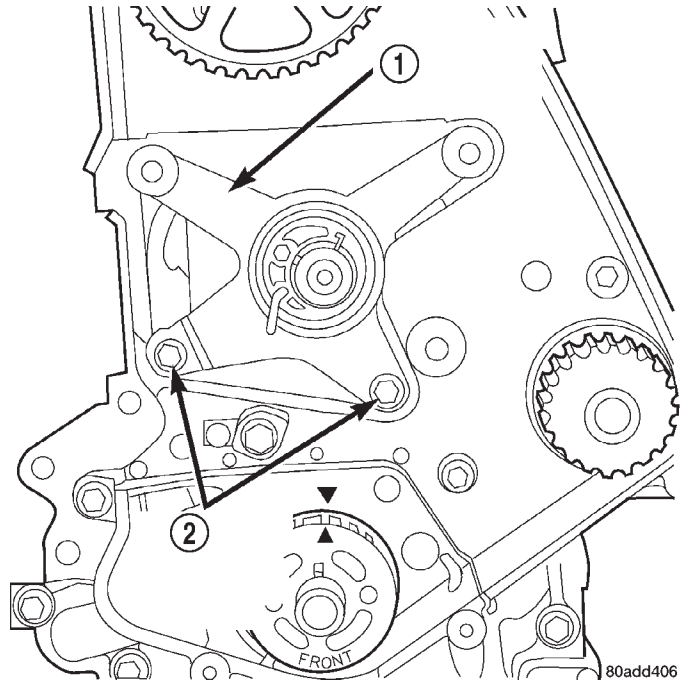
CAUTION: The timing belt tensioner is serviced as an assembly. To prevent premature timing belt failure, **DO NOT** separate the tensioner pulley from mounting bracket.

INSTALLATION

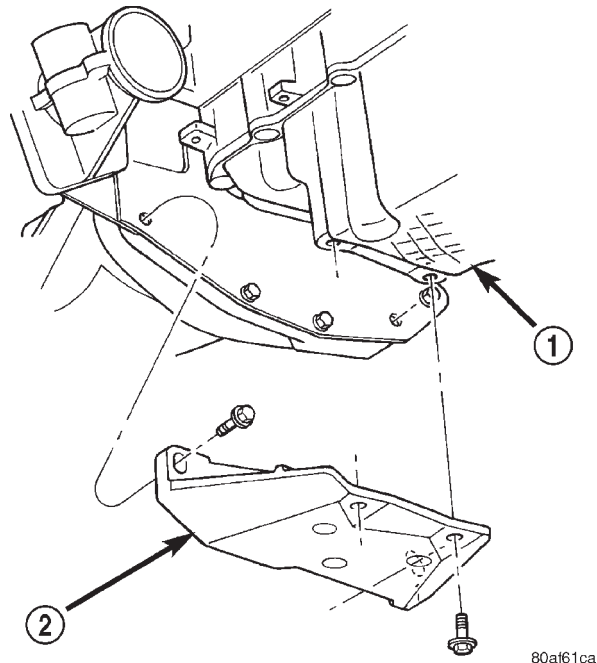
- (1) Install timing belt tensioner assembly. Tighten attaching bolts to 31 N·m (275 in. lbs.).
- (2) Install timing belt. Refer to procedure in this section.

OIL PAN**REMOVAL**

- (1) Drain engine oil.
- (2) Remove front engine mount bracket. Refer to Engine Mount—Front, in this section for procedures.
- (3) Remove powertrain bending strut.
- (4) Remove structural collar from oil pan to transaxle (Fig. 91).
- (5) Remove transaxle lower dust cover.
- (6) If equipped with air conditioning, remove oil filter and adaptor. Refer to procedures in this section.
- (7) Remove oil pan.
- (8) Clean oil pan and all gasket surfaces.

**Fig. 90 Timing Belt Tensioner Assembly—Removal/Installation**

1 – TIMING BELT TENSIONER ASSEMBLY
2 – TENSIONER ASSEMBLY ATTACHING BOLTS

**Fig. 91 Structural Collar—Removal and Installation**

1 – OIL PAN
2 – STRUCTURAL COLLAR

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Apply Mopar® Engine RTV GEN II or equivalent at the oil pump to engine block parting line (Fig. 92).

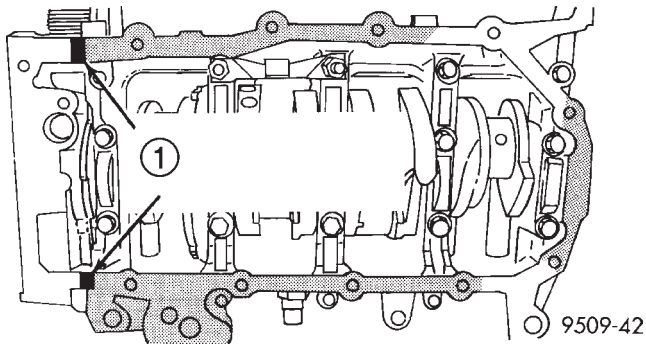


Fig. 92 Oil Pan Sealing

1 - PLACE A 1/8 INCH BEAD OF SEALER AT THE PARTING LINE OF THE OIL PUMP TO ENGINE BLOCK

- (2) Install a new oil pan gasket to pan.
- (3) Install pan and tighten screws to 12 N·m (105 in. lbs.).
- (4) Install oil filter and adaptor.
- (5) Install transaxle lower dust cover.
- (6) Install powertrain bending strut.
- (7) Install front engine mount and bracket.

CAUTION: The torque procedure for the structural collar must be followed, as damage to oil pan or collar could occur.

(8) Install the structural collar (Fig. 91) using the following 3 step torque sequence:

- Step 1: Install the collar to oil pan bolts and tighten to 3 N·m (30 in. lbs.).
- Step 2: Install collar to transaxle bolts and tighten to 108 N·m (80 ft. lbs.).
- Step 3: Final torque the collar to oil pan bolts to 54 N·m (40 ft. lbs.).

(9) Fill engine crankcase with proper oil to correct level.

CAMSHAFT OIL SEAL

REMOVAL

CAUTION: Do Not Rotate the camshaft or crankshaft when timing belt is removed damage to the engine may occur.

(1) Remove crankshaft damper, front timing belt cover, timing belt and tensioner assembly. Refer to procedures in this section.

(2) Hold camshaft sprocket with Special Tools C-4687 and modified C-4687-1 as shown in (Fig. 93), while removing attaching bolt.

(3) Remove sprocket from camshaft.

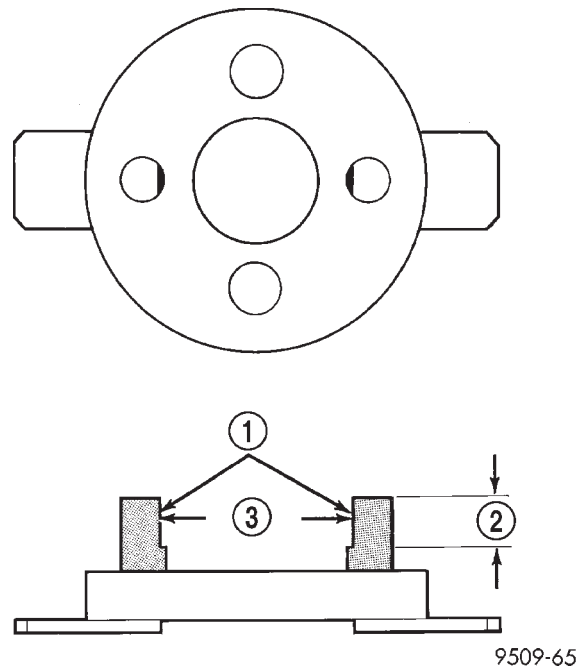


Fig. 93 Modification to Special Tool

- 1 - GRIND LOCATION
- 2 - 12.7 MM (1/2 IN.)
- 3 - 50.8 MM (2 IN.)

(4) Remove rear timing belt cover.

(5) Remove camshaft seal by carefully using a suitable pry tool. Be careful not to nick or damage the camshaft seal surface or cylinder head seal retaining bore.

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

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

INSTALLATION

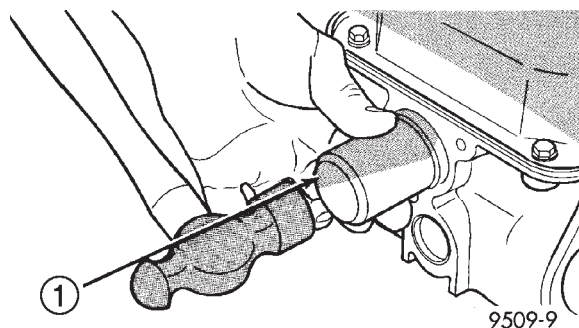
(1) Install camshaft seal flush with cylinder head using Special Tool MD998306 (Fig. 94).

(2) Install rear timing belt cover.

(3) Install camshaft sprocket retaining bolt. Hold camshaft sprocket with Special Tools C-4687 and modified C-4687-1 (Fig. 93). Tighten sprocket retaining bolt to 115 N·m (85 ft. lbs.).

(4) Install timing belt tensioner, timing belt, front cover, and crankshaft damper. Refer to procedures in this section.

REMOVAL AND INSTALLATION (Continued)

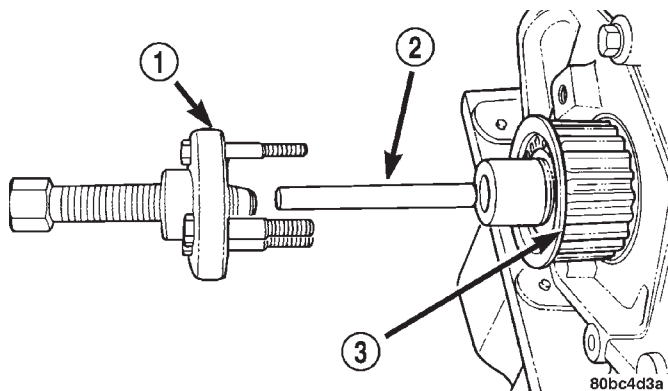
**Fig. 94 Camshaft Oil Seal—Installation**

1 - SPECIAL TOOL MD 998306

CRANKSHAFT OIL SEAL—FRONT**REMOVAL**

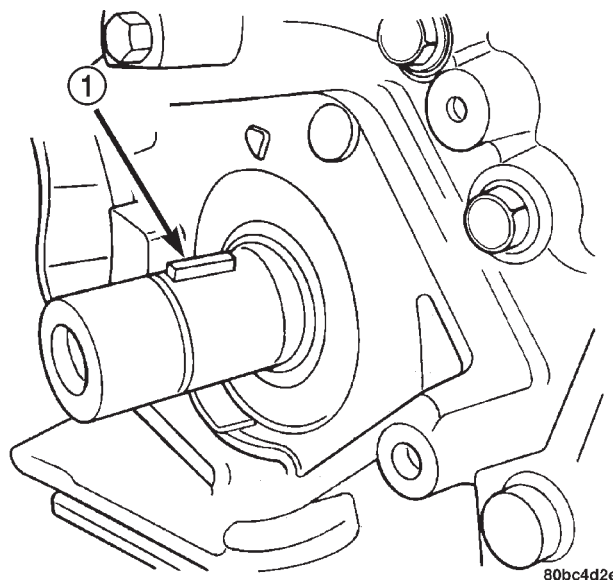
- (1) Remove accessory drive belts. Refer to COOLING SYSTEM for procedure.
- (2) Remove crankshaft damper. Refer to procedure in this section.
- (3) Remove front timing belt cover and timing belt. Refer to procedures in this section.
- (4) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 95).
- (5) Remove crankshaft sprocket key from crankshaft (Fig. 96).

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

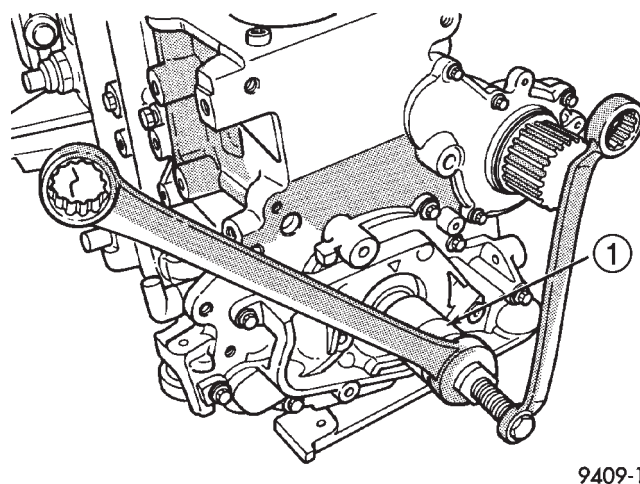
**Fig. 95 Crankshaft Sprocket—Removal**

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

- (6) Using Special Tool 6771, remove front crankshaft oil seal (Fig. 97). Do not damage the seal contact area on the crankshaft.

**Fig. 96 Crankshaft Key**

1 - CRANKSHAFT KEY

**Fig. 97 Front Crankshaft Oil Seal—Removal**

1 - SPECIAL TOOL 6771

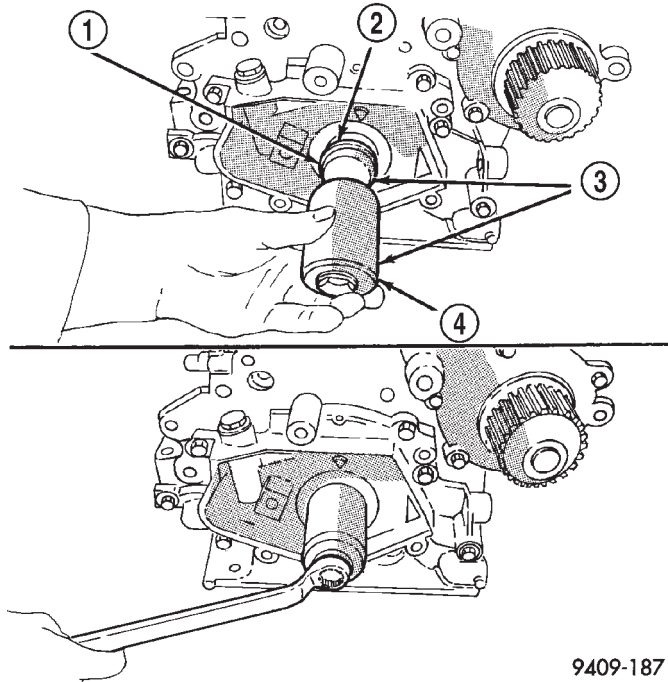
INSTALLATION

- (1) Position seal into opening with seal spring towards the inside of engine. Using Special Tool 6780-1 (Fig. 98), install seal until flush with cover.
- (2) Install crankshaft sprocket key (Fig. 96).
- (3) Install crankshaft sprocket (Fig. 99) using Special Tool 6792.

NOTE: Make sure the word "front" on the sprocket is facing outward.

NOTE: Use of Special Tool 6792 is required to set proper crankshaft sprocket depth for proper timing belt tracking.

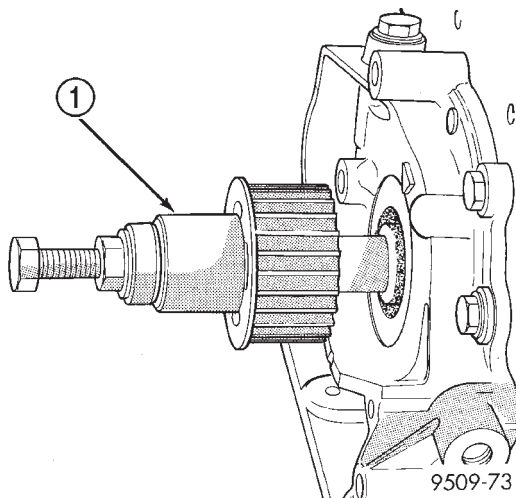
REMOVAL AND INSTALLATION (Continued)



9409-187

Fig. 98 Front Crankshaft Oil Seal—Installation

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



9509-73

Fig. 99 Crankshaft Sprocket—Installation

- 1 - SPECIAL TOOL 6792

(4) Install timing belt and cover. Refer to procedures in this section.

(5) Install crankshaft damper. Refer to procedure in this section.

(6) Install accessory drive belts. Refer to COOLING SYSTEM for procedure.

CRANKSHAFT OIL SEAL—REAR

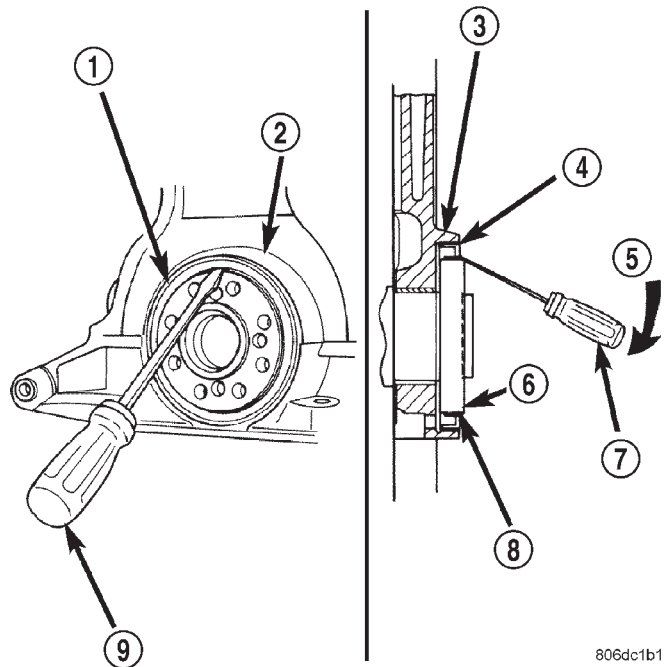
REMOVAL

(1) Remove transaxle. Refer to TRANSAXLE for procedure.

(2) Remove flex plate.

(3) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 100) through the dust lip against metal case of the seal. Pry out seal.

CAUTION: Do not permit the screwdriver blade to contact crankshaft seal surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.



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Fig. 100 Rear Crankshaft Oil Seal—Removal

- 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

INSTALLATION

CAUTION: If 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.

REMOVAL AND INSTALLATION (Continued)

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

(1) Place Special Tool 6926-1 Seal Guide on crankshaft (Fig. 101).

(2) Position seal over guide tool (Fig. 101). 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.

(3) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 102) until the tool bottoms out against the block (Fig. 103).

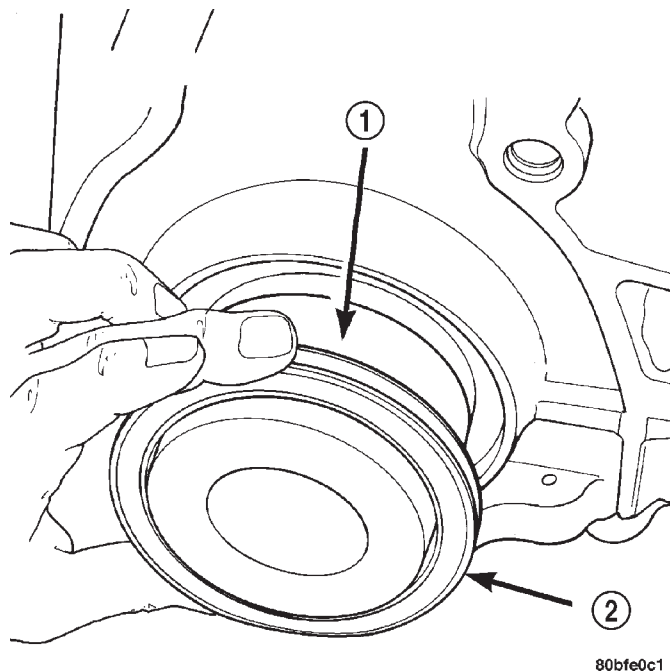
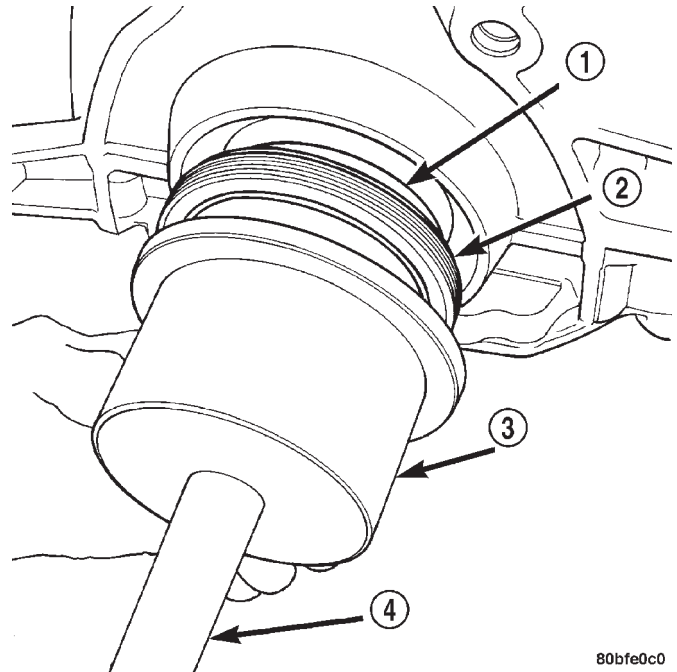


Fig. 101 Rear Crankshaft Seal and Special Tool 6926-1

- 1 - SPECIAL TOOL 6926-1 PILOT
- 2 - SEAL

(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. Refer to TRANSAXLE for procedure.



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Fig. 102 Crankshaft Seal and Special Tools 6926-2 & C-4171

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

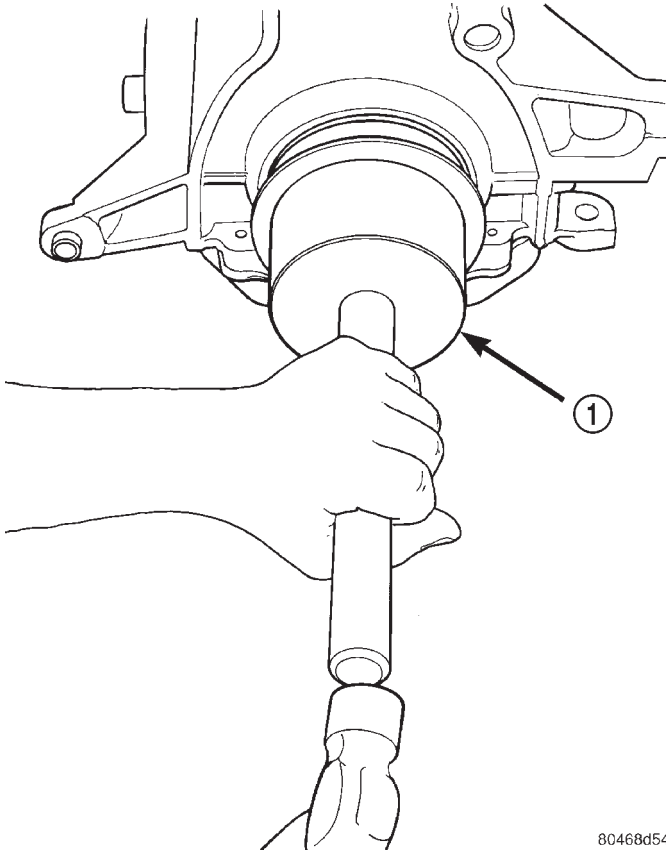
ENGINE CORE PLUGS

REMOVAL

Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug (Fig. 104). With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 104).

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

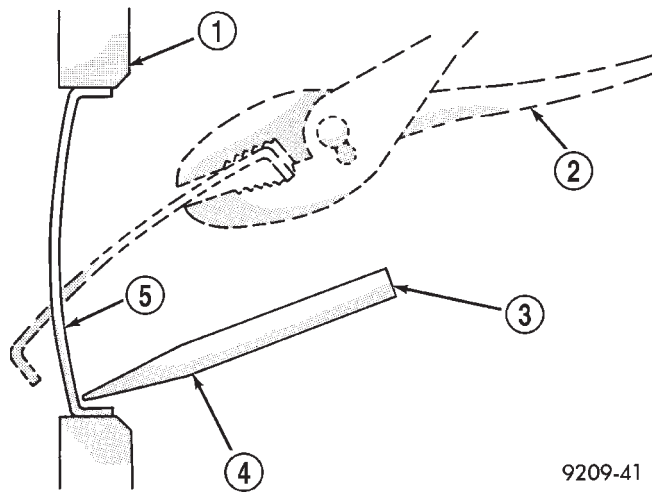
REMOVAL AND INSTALLATION (Continued)



80468d54

Fig. 103 Rear Crankshaft Seal—Installation

1 - SPECIAL TOOL 6926-2 INSTALLER



9209-41

Fig. 104 Core Hole Plug Removal

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

INSTALLATION

Thoroughly clean all debris/rust from 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 Adhesive. Make certain the new plug is cleaned of all oil or grease. Using a proper driver, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 inch.) inside the lead in chamfer (Fig. 104).

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

CRANKSHAFT**REMOVAL**

- (1) Remove engine assembly. Refer to procedure in this section.
- (2) Mount engine on an engine stand.
- (3) Remove oil filter and adapter from bedplate (Fig. 105).
- (4) Remove oil pan. Refer to procedure in this section.
- (5) Remove crankshaft sprocket and oil pump. Refer to procedures in this section.
- (6) Remove all bedplate bolts from the engine block (Fig. 106).
- (7) Using a mallet tap the bedplate loose from the engine block dowel pins.

CAUTION: Do not pry up on one side of the bedplate. Damage may occur to cylinder block and bedplate alignment.

- (8) Bedplate should be removed evenly from the cylinder block dowel pins.

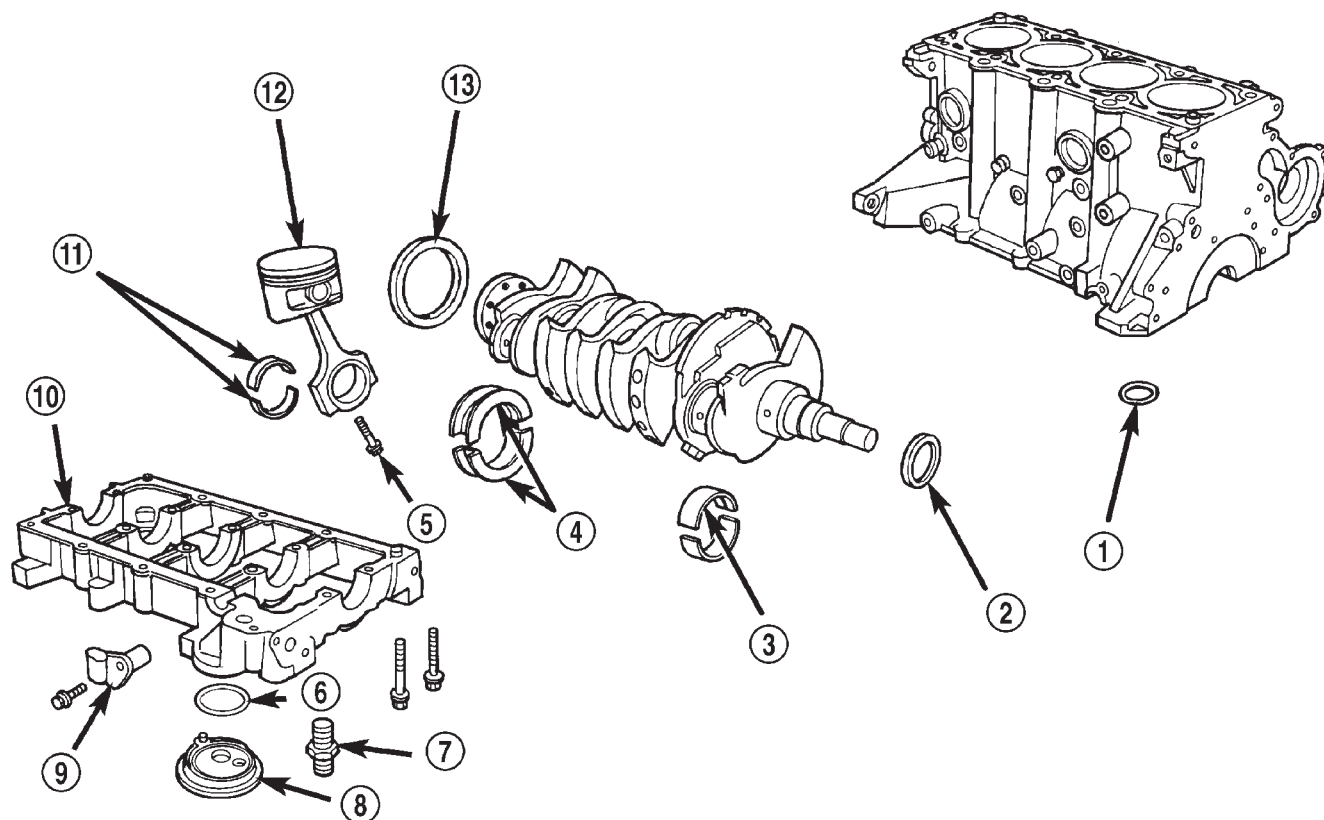
- (9) Lift out crankshaft from cylinder block. Be sure not to damage the main bearings or journals when removing the crankshaft.

CRANKSHAFT MAIN BEARINGS LOCATION

The crankshaft is supported in five main bearings. All upper bearing shells in the crankcase have oil grooves. All lower bearing shells installed in the (bedplate) main bearing cap are plain. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 107).

NOTE: The upper and lower main Bearing shells are Not interchangeable. The lower shells have a revised tab to prevent improper installation.

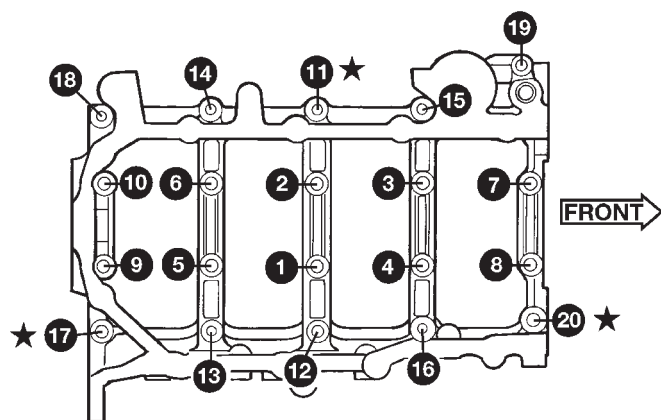
REMOVAL AND INSTALLATION (Continued)



80bcea90

Fig. 105 Cylinder Block and Components

- | | |
|-----------------------------|--|
| 1 - OIL PASSAGE O-RING | 8 - OIL FILTER ADAPTER |
| 2 - SEAL | 9 - CRANKSHAFT POSITION SENSOR (CPS) |
| 3 - UPPER BEARING (GROOVED) | 10 - MAIN BEARING CAP/BED PLATE ASSEMBLY |
| 4 - THRUST BEARINGS | 11 - CONNECTING ROD BEARINGS |
| 5 - BOLT | 12 - PISTON AND CONNECTING ROD ASSEMBLY |
| 6 - O-RING | 13 - SEAL |
| 7 - NIPPLE | |



★ INDICATES DOWEL LOCATION

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Fig. 106 Bedplate Bolts**CRANKSHAFT MAIN JOURNALS INSPECTION**

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to .025 mm (.001 inch). Journal grinding should not exceed .305 mm (.012 inch) under the standard journal diameter. DO NOT grind thrust faces of Number 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.

CAUTION: With the nodular cast iron crankshafts used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

Upper and lower Number 3 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves

REMOVAL AND INSTALLATION (Continued)

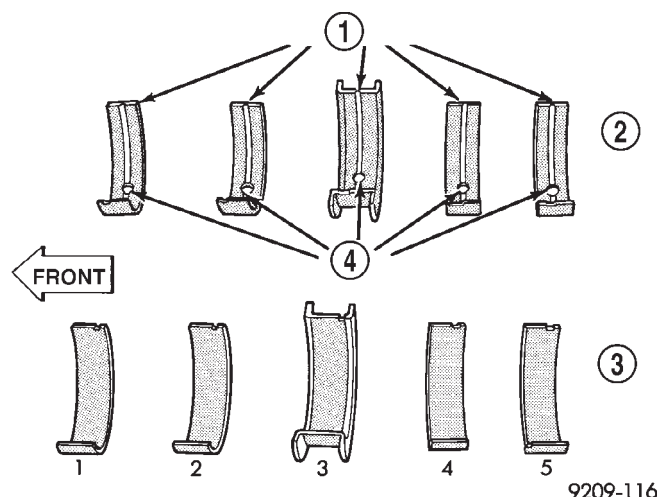


Fig. 107 Main Bearing Identification

- 1 - OIL GROOVES
- 2 - UPPER BEARINGS
- 3 - LOWER BEARINGS
- 4 - OIL HOLES

in the engine (Fig. 107). All bearing cap bolts removed during service procedures are to be cleaned and oiled before installation. Bearing shells are available in standard and the following undersized: 0.016 mm (.0006 inch), .032 mm (.0012 inch), .250 mm (.010 inch). Never install an undersize bearing that will reduce clearance below specifications.

INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block. Install O-ring into recess in the block (Fig. 108).

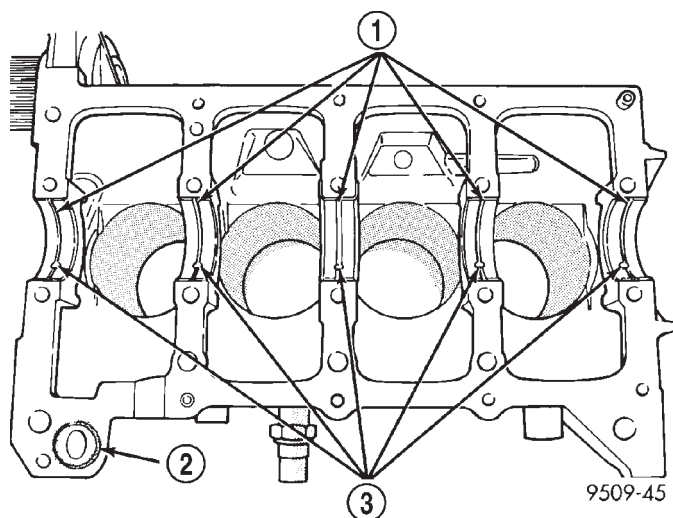


Fig. 108 Installing Main Bearing Upper Shell

- 1 - LUBRICATION GROOVES
- 2 - O-RING
- 3 - OIL HOLES

(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 bedplate mating surface. It will affect the sealer ability to seal the bedplate to cylinder block.

(3) Oil the bearings and journals and install crankshaft and O-ring in cylinder block.

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

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar® Bed Plate Sealant to cylinder block as shown in (Fig. 109).

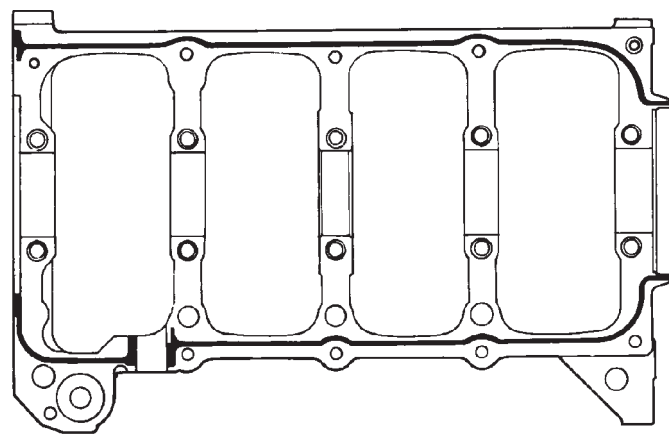


Fig. 109 Main Bearing Caps/Bedplate Sealing

(5) Install lower main bearings into main bearing cap/bedplate. Make certain the bearing tabs are seated into the bedplate slots. Install the main bearing/bedplate into engine block.

(6) Before installing the bolts oil threads with clean engine oil, wipe off any excess oil.

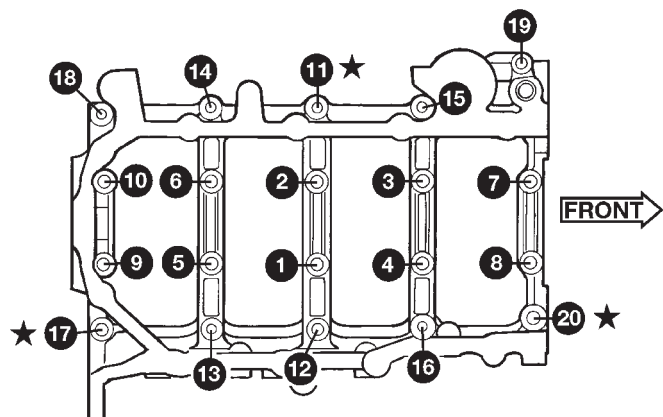
(7) Install main bearing bedplate to engine block bolts 11, 17 and 20 finger tight. Tighten this bolts down together until the bedplate contacts the cylinder block. Torque bolts to 30 N·m (22 ft. lbs.) (Fig. 110).

(8) Install main bearing bedplate to engine block bolts (1 - 10) and torque each bolt to 81 N·m (60 ft. lbs.) in sequence shown in (Fig. 110).

(9) Install main bearing bedplate to engine block bolts (11 - 20), with baffle studs in positions 12, 13 and 16 and torque each bolt to 30 N·m (22 ft. lbs.) in sequence shown in (Fig. 110).

(10) After the main bearing bedplate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

REMOVAL AND INSTALLATION (Continued)



★ INDICATES DOWEL LOCATION

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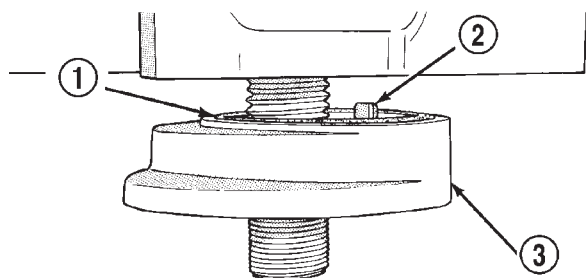
Fig. 110 Main Bearing Caps/Bedplate Torque Sequence

- (11) Install oil pump. If crankshaft end play is to be checked, refer to service procedure in this section.
- (12) Install crankshaft sprocket.
- (13) Install oil pan.
- (14) Install oil filter adapter (Fig. 105) and oil filter.
- (15) Install engine assembly. Refer to procedure in this section.

OIL FILTER ADAPTER

REMOVAL

- (1) Remove oil filter.
- (2) Remove oil filter adapter (Fig. 111).



9409-59

Fig. 111 Engine Oil Filter Adapter to Engine Block

- 1 - O-RING
- 2 - LOCATING ROLL PIN
- 3 - OIL FILTER ADAPTER

INSTALLATION

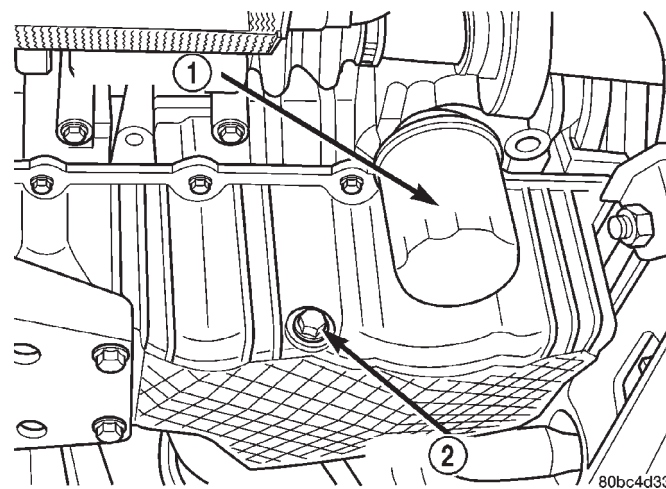
- (1) Clean sealing surfaces.
- (2) Ensure O-ring is in the groove on adapter.
- (3) Align roll pin into engine block and tighten assembly to 80 N·m (60 ft. lbs.) (Fig. 111).

OIL FILTER

REMOVE AND INSTALL

CAUTION: When servicing the oil filter (Fig. 112), avoid deforming the filter. Use an appropriate oil filter removing tool. Position filter wrench strap close the seam at the base of the filter. The oil filter seam that joins the can to the base, is reinforced by the base plate.

- (1) Turn filter counterclockwise to remove.
- (2) Clean and check the filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber.
- (3) To install, lubricate new filter gasket. Screw filter on until gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).



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Fig. 112 Engine Oil Filter

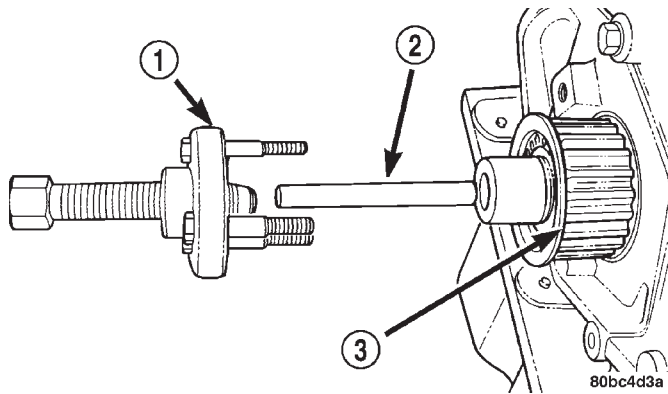
- 1 - OIL FILTER
- 2 - DRAIN PLUG

OIL PUMP

REMOVAL

- (1) Disconnect negative cable from battery.
- (2) Remove crankshaft damper, timing belt, and tensioner. Refer to procedures in this section.
- (3) Remove camshaft sprocket and rear timing belt cover. Refer to procedures in this section.
- (4) Remove oil pan. Refer to procedure in this section.
- (5) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 113).
- (6) Remove oil pick-up tube.
- (7) Remove oil pump (Fig. 114) and front crankshaft seal.

REMOVAL AND INSTALLATION (Continued)

**Fig. 113 Crankshaft Sprocket—Removal**

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

INSTALLATION

(1) Make sure all surfaces are clean and free of oil and dirt.

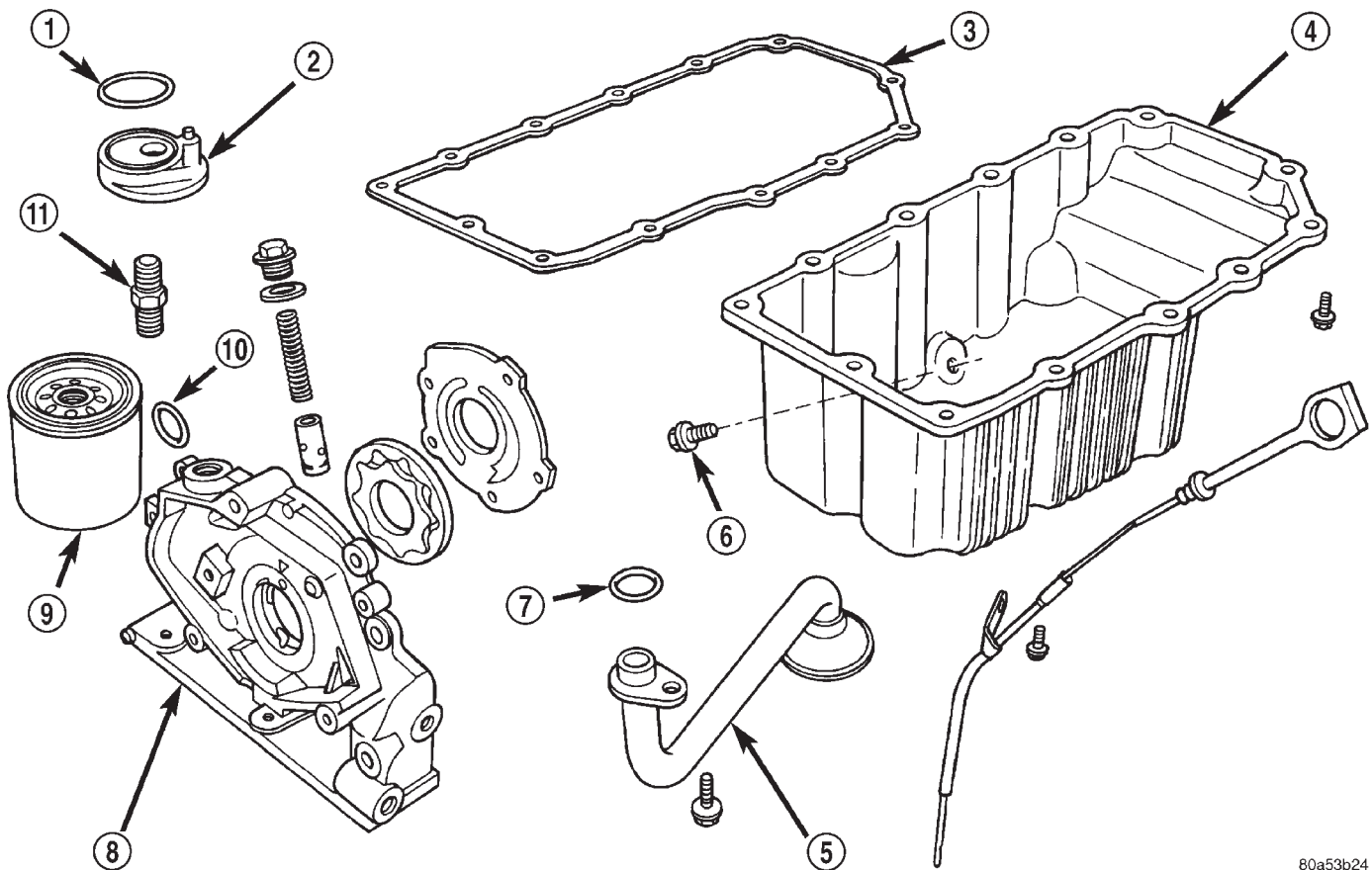
(2) Apply Mopar® Gasket Maker to oil pump as shown in (Fig. 115). Install oil ring into oil pump body discharge passage.

(3) Prime oil pump before installation.

(4) Align oil pump rotor flats with flats on crankshaft as you install the oil pump to the block.

NOTE: Front crankshaft seal MUST be out of pump to align, or damage may result.

(5) Torque all oil pump attaching bolts to 28 N·m (250 in. lbs.).

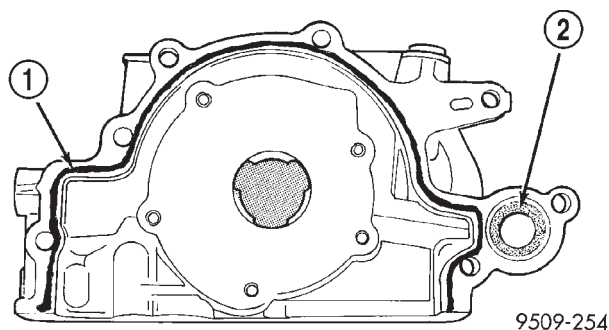


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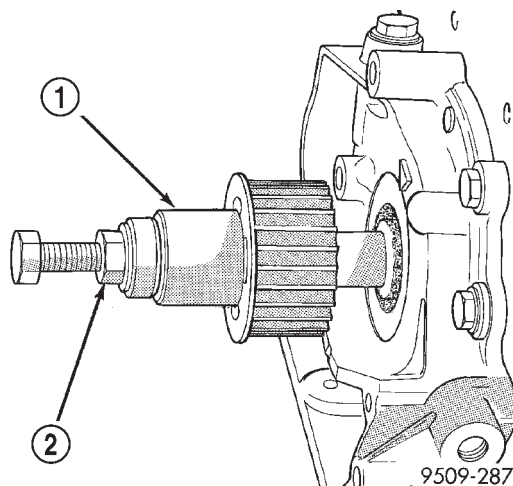
Fig. 114 Oil Pump and Tube

- | | |
|------------------------|-------------------|
| 1 - O-RING | 7 - O-RING |
| 2 - OIL FILTER ADAPTER | 8 - OIL PUMP BODY |
| 3 - OIL PAN GASKET | 9 - FILTER |
| 4 - OIL PAN | 10 - O-RING |
| 5 - OIL PICK-UP TUBE | 11 - NIPPLE |
| 6 - DRAIN PLUG | |

REMOVAL AND INSTALLATION (Continued)

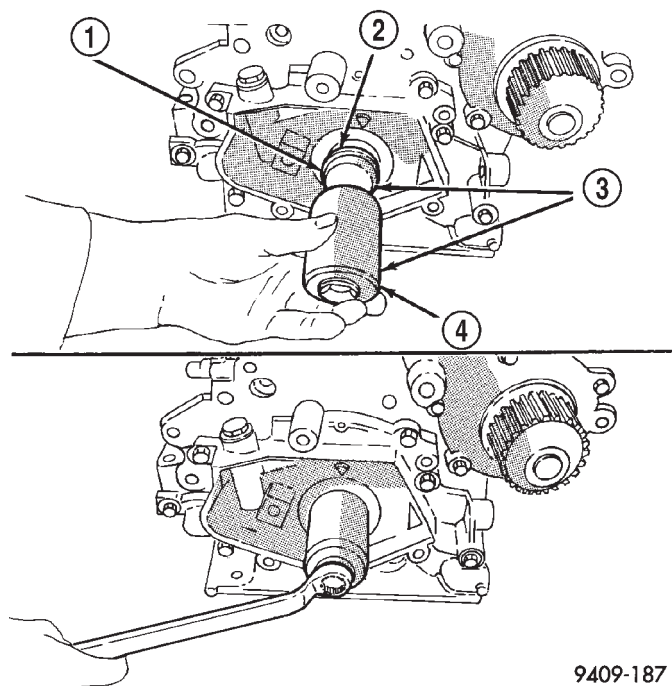
**Fig. 115 Oil Pump Sealing**

- 1 - APPLY GASKET MAKER TO OIL PUMP BODY FLANGE
2 - O-RING

**Fig. 117 Crankshaft Sprocket—Installation**

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

(6) Install new front crankshaft seal using Special Tool 6780 (Fig. 116).

**Fig. 116 Front Crankshaft Seal—Installation**

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

(7) Install crankshaft sprocket, using Special Tool 6792 (Fig. 117).

(8) Install oil pick-up tube and oil pan.

(9) Install rear timing belt cover and camshaft sprocket.

(10) Install timing belt tensioner, timing belt, and front timing belt cover.

(11) Install crankshaft damper.

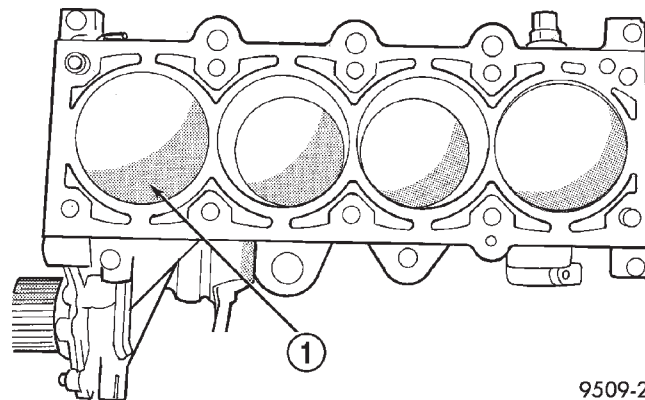
(12) Fill engine crankcase with proper oil to correct level.

(13) Connect negative cable to battery.

PISTON AND CONNECTING ROD**REMOVAL**

(1) Remove cylinder head and oil pan. Refer to procedures in this section.

(2) 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.** Mark piston with matching cylinder number (Fig. 118).

**Fig. 118 Piston Markings**

- 1 - WEIGHT DESIGNATION AND DIRECTIONAL ARROW WILL BE IMPRINTED IN THIS AREA

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

REMOVAL AND INSTALLATION (Continued)

(3) Using a permanent ink marker or scribe tool mark the cylinder number on the side of the rod and cap (Fig. 119) for identification.

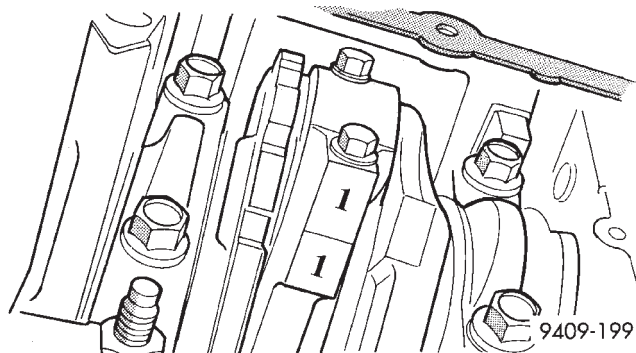


Fig. 119 Identify Connecting Rod to Cylinder

(4) Pistons will have a stamping in the approximate location shown in (Fig. 118). These stamps will be either a directional arrow or a weight identification for the assembly. L is for light and H is for heavy. These assemblies should all be the same weight class. Service piston assemblies are marked with a S and can be used with either L or H production assemblies. The weight designation stamps should face toward the timing belt side of the engine.

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

(6) Remove connecting rod cap bolts **Do not use old bolts if reinstalling connecting rod.**

(7) To protect crankshaft journal and fractured rod surfaces, install Special Tool 8189, connecting rod guides onto connecting rod (Fig. 120). Carefully push each piston and rod assembly out of cylinder bore.

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

(8) 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.

PISTON RING—REMOVAL

(1) The identification mark on face of upper and intermediate piston rings must point toward piston crown.

(2) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 121).

(3) Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.

(4) Clean ring grooves of any carbon deposits.

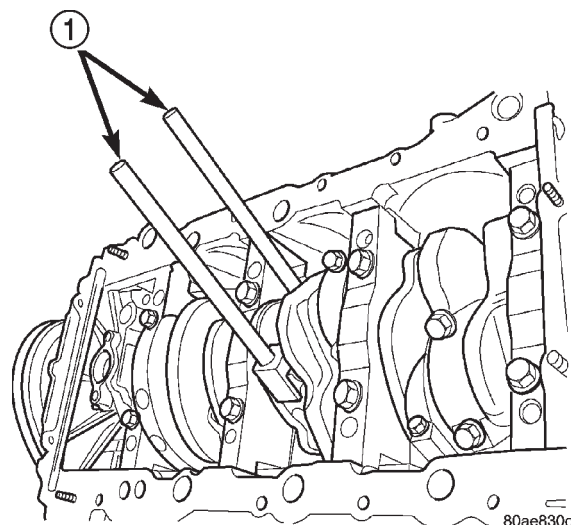


Fig. 120 Connecting Rod Guides—Typical

1 - SPECIAL TOOL 8189 CONNECTING ROD GUIDES

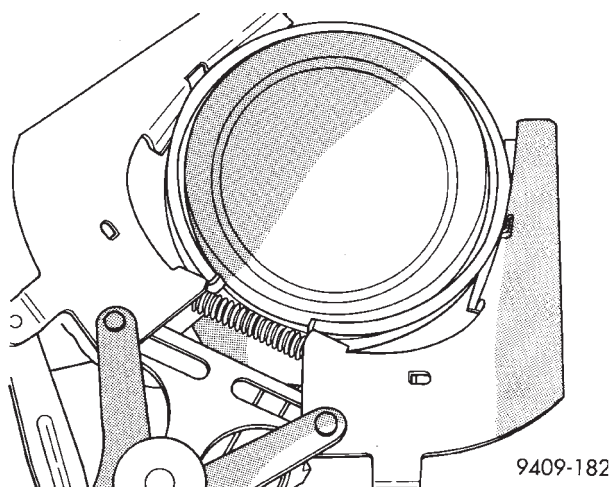


**Fig. 121 Piston Rings—Removing and Installing
PISTON RINGS—INSTALLATION**

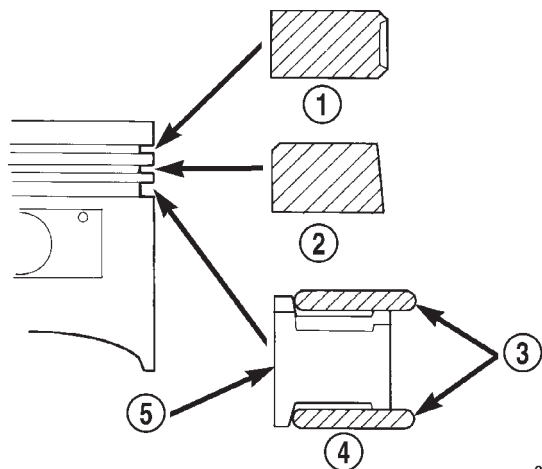
(1) Install rings with manufacturers identification mark facing up, to the top of the piston (Fig. 122).

CAUTION: Install piston rings in the following order:

- a. Oil ring expander.
- b. Upper oil ring side rail.
- c. Lower oil ring side rail.
- d. No. 2 Intermediate piston ring.
- e. No. 1 Upper piston ring.
- f. Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander (Fig. 123).**

(2) Install upper side rail first and then the lower side rail.

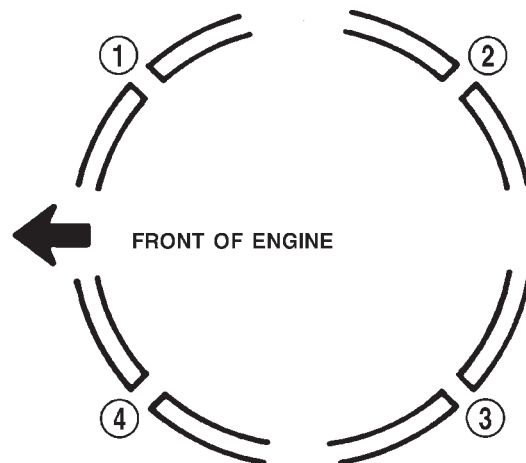
REMOVAL AND INSTALLATION (Continued)



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Fig. 122 Piston Ring Installation

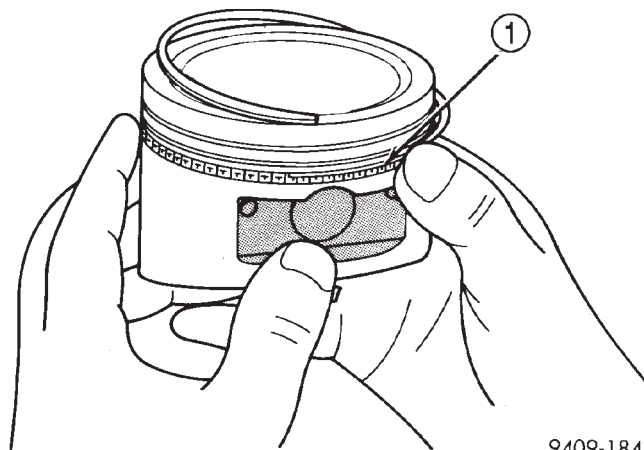
- 1 - NO. 1 PISTON RING
- 2 - NO. 2 PISTON RING
- 3 - SIDE RAIL
- 4 - OIL RING
- 5 - SPACER EXPANDER



9509-46

Fig. 124 Piston Ring End Gap Position

- 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



9409-184

Fig. 123 Installing Side Rail

- 1 - SIDE RAIL END

(3) Install No. 2 piston ring and then No. 1 piston ring (Fig. 122).

(4) Position piston ring end gaps as shown in (Fig. 124).

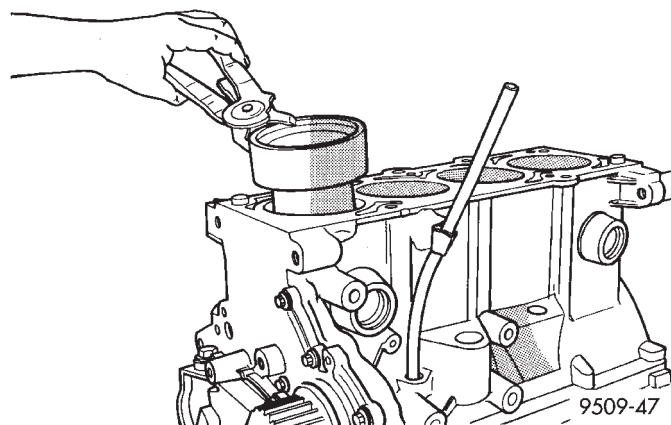
(5) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction. Staggering ring gap is important for oil control.

PISTON AND ROD—INSTALLATION

(1) 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.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 124).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 125). **Be sure position of rings does not change during this operation.**



9509-47

Fig. 125 Installing Piston

(4) The weight stamp designation L or H will be in the front half of the piston should face toward the front of the engine (Fig. 118).

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Lubricate connecting rod journal with clean engine oil.

(6) Position upper bearing half and install Special Tool 8189, connecting rod guides onto connecting rod (Fig. 120).

(7) Insert rod and piston assembly into cylinder bore and carefully guide rod over the crankshaft journal.

REMOVAL AND INSTALLATION (Continued)

(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.

(10) Install connecting rod lower bearing half and cap. Install **New** bolts and tighten to 27 N·m (20 ft. lbs.) plus 1/4 turn.

(11) Install cylinder head and oil pan. Refer to procedures in this section.

DISASSEMBLY AND ASSEMBLY

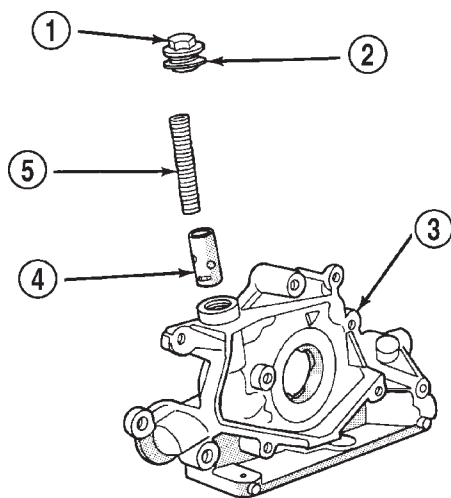
OIL PUMP

(1) To remove the relief valve, proceed as follows:

(2) Remove the threaded plug and gasket from the oil pump (Fig. 126).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 126) or serious damage may occur.

(3) Remove spring and relief valve (Fig. 126).



9409-62

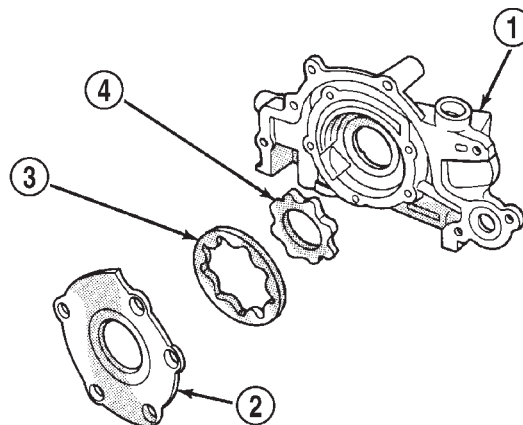
Fig. 126 Oil Pressure Relief Valve

- 1 - RETAINER CAP
- 2 - GASKET
- 3 - OIL PUMP BODY
- 4 - RELIEF VALVE
- 5 - SPRING

(4) Remove oil pump cover screws, and lift off cover.

(5) Remove pump rotors.

(6) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 127).



9409-63

Fig. 127 Oil Pump

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

CLEANING AND INSPECTION

INTAKE MANIFOLD

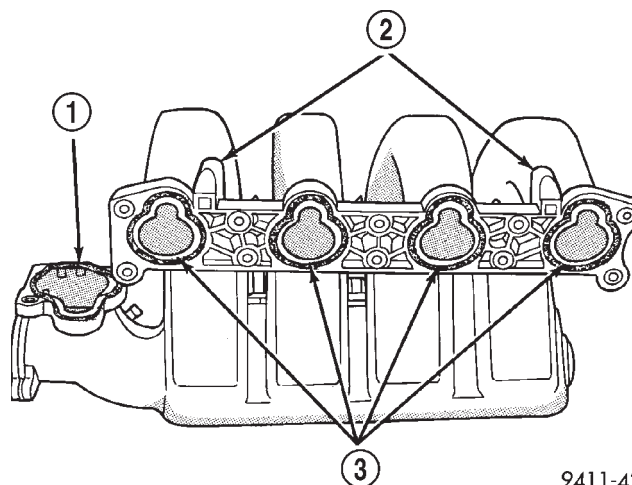
CLEANING

Clean all mating surfaces.

INSPECTION

Inspect for:

- Cracked or distorted manifold.
- Damaged O-ring sealing surfaces on manifold (Fig. 128).



9411-42

Fig. 128 Intake Manifold

- 1 - THROTTLE BODY TO MANIFOLD GASKET
- 2 - INJECTOR RAIL MOUNTS
- 3 - CAPTIVE O-RING GASKET

CLEANING AND INSPECTION (Continued)

EXHAUST MANIFOLD

CLEANING

(1) Discard gasket 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.

CYLINDER HEAD

CLEANING

Remove all gasket material from cylinder head. Be careful not to gouge or scratch the aluminum head sealing surface. Clean all engine oil passages.

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 aluminum gasket surfaces:

- Metal scraper
- Abrasive pad or paper to clean cylinder block and head
- High speed power tool with an abrasive pad or a wire brush (Fig. 129)

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

Only use the following for cleaning gasket surfaces:

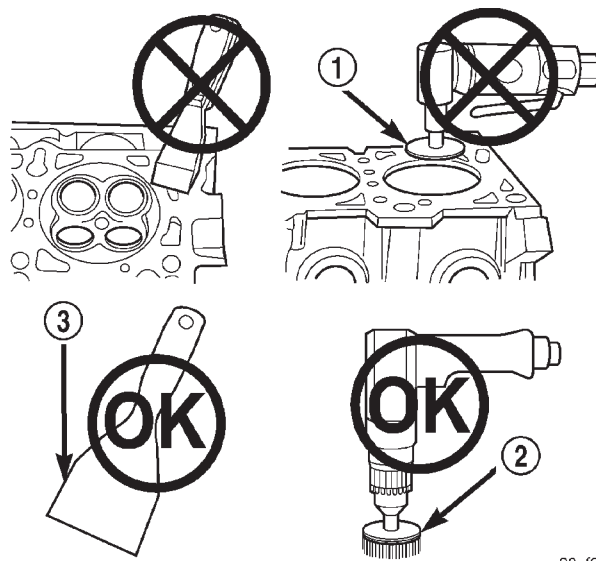
- Solvent or a commercially available gasket remover
- Plastic or wood scraper (Fig. 129)
- Drill motor with 3M Roloc[™] Bristle Disc (white or yellow) (Fig. 129)

CAUTION: Excessive pressure or high RPM 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.

INSPECTING CYLINDER HEAD

Check cylinder head for flatness with a straight edge. Cylinder head must be flat within 0.1 mm (0.004 in.) (Fig. 130).

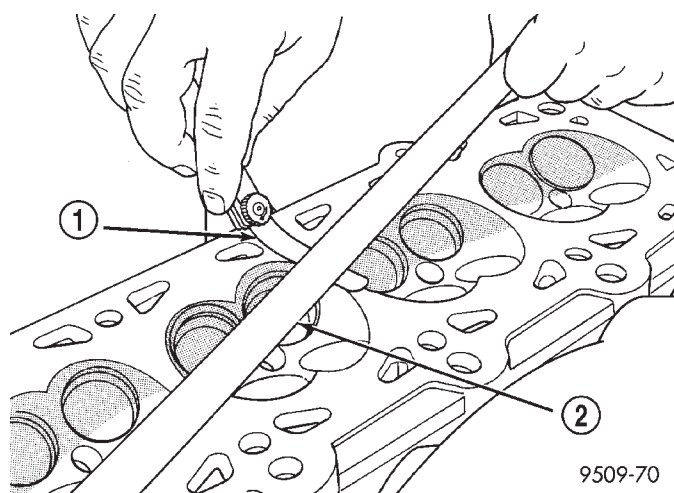
Inspect cylinder head camshaft bearings for wear. Check the camshaft journals for scratches and worn areas. If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches



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Fig. 129 Proper Tool Usage For Surface Preparation

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



9509-70

Fig. 130 Checking Cylinder Head Flatness

- 1 - FEELER GAUGE
2 - STRAIGHT EDGE

are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm/hydraulic lash adjuster if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.

CLEANING AND INSPECTION (Continued)

OIL PUMP

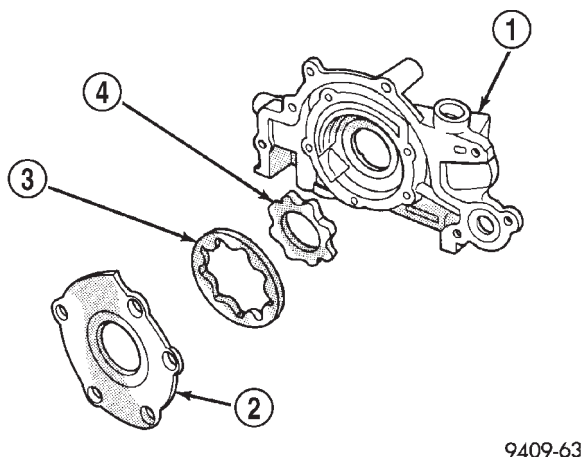
CLEANING

Clean all parts thoroughly using a suitable cleaning solvent.

INSPECTION

(1) Mating surface of the oil pump should be smooth. Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 131). If a 0.076 mm (0.003 inch.) feeler gauge can be inserted between cover and straightedge, cover should be replaced.

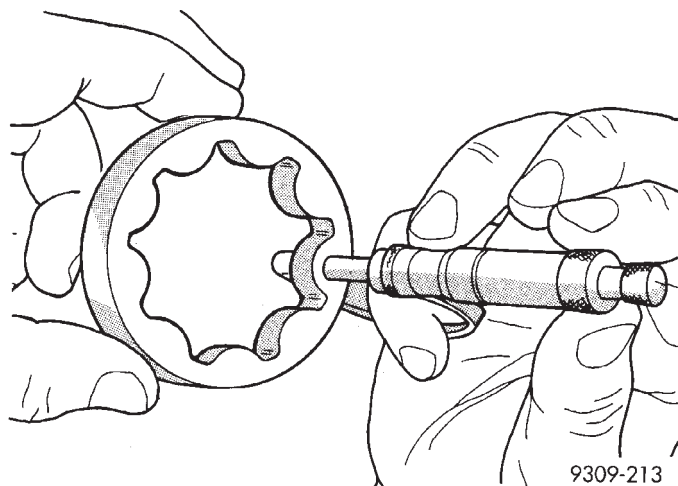


9409-63

Fig. 131 Checking Oil Pump Cover Flatness

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

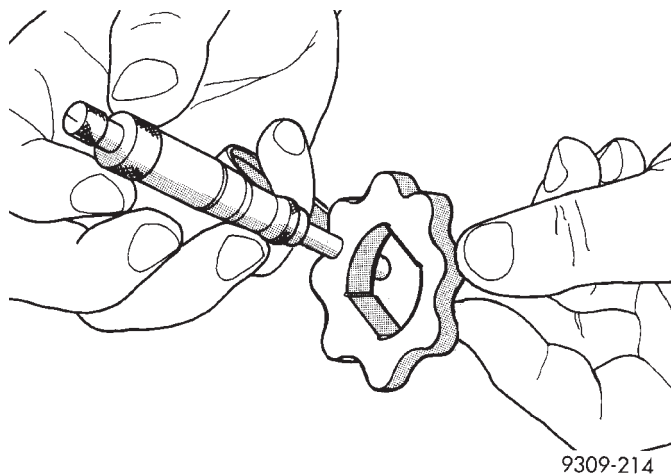
(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 7.64 mm (0.301 inch.) or less (Fig. 132), or if the diameter is 79.95 mm (3.148 inches) or less, replace outer rotor.



9309-213

Fig. 132 Measuring Outer Rotor Thickness

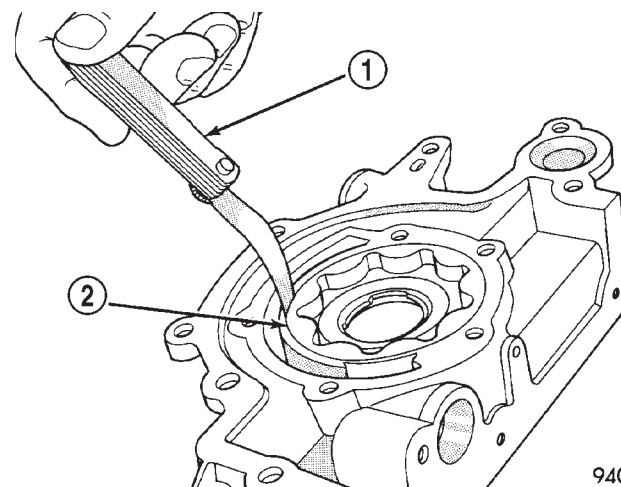
(4) If inner rotor measures 7.64 mm (0.301 inch) or less replace inner rotor (Fig. 133).



9309-214

Fig. 133 Measuring Inner Rotor Thickness

(5) Slide outer rotor into pump housing, press to one side with fingers and measure clearance between rotor and housing (Fig. 134). If measurement is 0.39 mm (0.015 inch.) or more, replace housing only if outer rotor is in specification.



9409-65

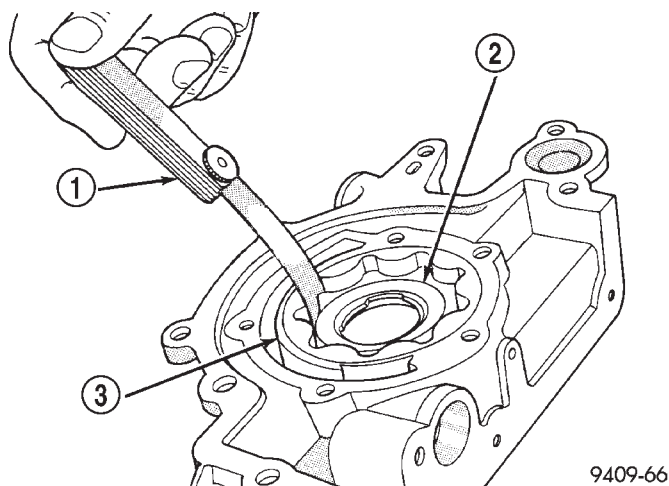
Fig. 134 Measuring Outer Rotor Clearance in Housing

- 1 - FEELER GAUGE
- 2 - OUTER ROTOR

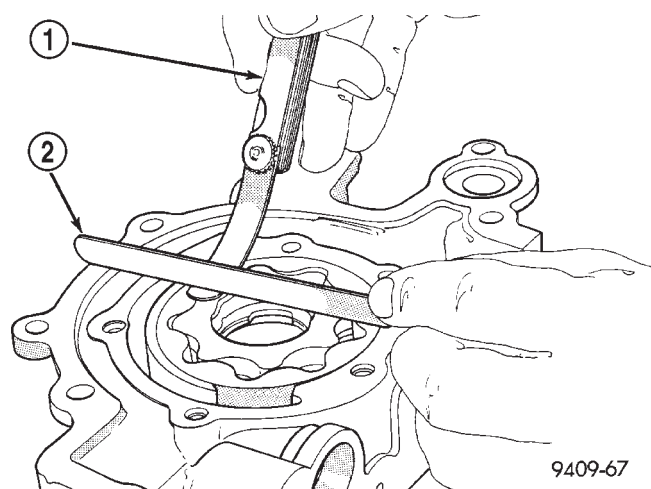
(6) Install inner rotor into pump housing. If clearance between inner and outer rotors (Fig. 135) is 0.203 mm (0.008 inch) or more, replace both rotors.

(7) Place a straightedge across the face of the pump housing, between bolt holes. If a feeler gauge of 0.102 mm (0.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 136). **ONLY** if rotors are in specifications.

CLEANING AND INSPECTION (Continued)

**Fig. 135 Measuring Clearance Between Rotors**

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

**Fig. 136 Measuring Clearance Over Rotors**

- 1 - FEELER GAUGE
2 - STRAIGHT EDGE

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 60.7 mm (2.39 inches) it should test between 18 and 19 pounds when compressed to 40.5 mm (1.60 inches). Replace spring that fails to meet specifications.

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings, damaged or missing oil pick-up tube O-ring, clogged oil pick-up tube screen, clogged oil filter and stuck open pressure relief valve or other reasons for oil pressure loss.

CYLINDER BLOCK**CLEANING**

Clean cylinder block thoroughly using a suitable cleaning solvent.

INSPECTION

Inspect all core hole plugs for evidence of leaking. If new core plugs are installed, refer to Engine Core Plugs in this section.

Inspect block and cylinder bores for cracks or fractures.

ADJUSTMENTS**ENGINE SUPPORT ADJUSTMENT**

The right and left support assemblies are slotted to allow for right/left drive train adjustment in relation to drive shaft assembly length.

Check and reposition right and left engine support assemblies as required. Adjust drive train position, if required, for the following conditions:

- Drive shaft distress: See Group 2, Suspension and Driveshaft.
- Any front end structural damage (after repair).
- Support Assembly replacement.

ENGINE SUPPORT ADJUSTMENT

(1) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(2) Loosen the right engine support assembly vertical fasteners.

(3) Loosen the left engine support assembly vertical bolts.

(4) Pry the engine right or left as required to achieve the proper drive shaft assembly length. Refer to Group 2, Suspension and Driveshaft for driveshaft identification and related assembly length measuring.

(5) Tighten right engine support assembly vertical bolts to 61 N·m (45 ft. lbs.) and tighten left engine support assembly bolts to 61 N·m (45 ft. lbs.).

(6) Recheck drive shaft length.

SPECIFICATIONS

2.0L SOHC ENGINE

DESCRIPTION	SPECIFICATION
General Specification	
Type	In-Line OHV, SOHC
Number of Cylinders	4
Displacement	2.0 Liters (122 cu. in.)
Bore	87.5 mm (3.445 in.)
Stroke	83.0 mm (3.268 in.)
Compression Ratio	9.8:1
Firing Order	1-3-4-2
Compression Pressure	1172–1551 kPa (170–225 psi)
Max. Variation Between Cylinders	25%
Cylinder Block	
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.)
Pistons (Federal Emission)	
Piston Diameter	87.463–87.481 mm (3.4434–3.4441 in.)
Clearance @ 17.5 mm (11/16 in.) from bottom of skirt	0.012–0.044 mm (0.0004–0.0017 in.)
Weight	325–335 grams (11.47–11.82 oz.)
Land Clearance (Diametrical)	0.734–0.797 mm (0.029–0.031 in.)
Piston Length	64 mm (2.520 in.)
Piston Ring Groove Depth No. 1	3.989–4.188 mm (0.157–0.165 in.)
Piston Ring Groove Depth No. 2	4.462–4.661 mm (0.176–0.184 in.)

DESCRIPTION	SPECIFICATION
Piston Ring Groove Depth No. 3	3.847–4.131 mm (0.151–0.163 in.)
Pistons (Low Emission Vehicle—LEV/ULEV)	
Piston Diameter	87.456–87.474 mm (3.4432–3.4439 in.)
Clearance @ 10.42 mm (0.42 in.) from bottom of skirt	0.018–0.50 mm (0.0008–0.0020 in.)
Weight	320–329 grams (11.29–11.60 oz.)
Land Clearance (Diametrical)	0.758–0.790 mm (0.0299–0.0312 in.)
Piston Length	55.8 mm (2.197 in.)
Piston Ring Groove Depth No. 1	3.989–4.188 mm (0.157–0.165 in.)
Piston Ring Groove Depth No. 2	4.462–4.661 mm (0.176–0.184 in.)
Piston Ring Groove Depth No. 3	3.847–4.131 mm (0.151–0.163 in.)
Piston Pins	
Clearance in Piston	0.008–0.015 mm (0.0003–0.0006 in.)
Clearance in Connecting Rod (Interference Fit)	0.018–0.043 mm (0.0007–0.0017 in.)
Diameter	21.000–21.003 mm (0.8268–0.8269 in.)
End Play	None
Length	74.75–75.25 mm (2.943–2.963 in.)
Piston Rings	
Ring Gap—Top Compression Ring	0.23–0.52 mm (0.009–0.020 in.)
Wear Limit	0.8 mm (0.031 in.)
Ring Gap—2nd Compression Ring	0.49–0.78 mm (0.019–0.031 in.)
Wear Limit	1.0 mm (0.039 in.)
Ring Gap—Oil Control Steel Rails	0.23–0.66 mm (0.009–0.026 in.)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
Wear Limit	1.0 mm (0.039 in.)
Ring Side Clearance— Compression Rings	0.025–0.065 mm (0.0010–0.0026 in.)
Wear Limit	0.10 mm (0.004 in.)
Ring Side Clearance—Oil Ring Pack	0.004–0.178 mm (0.0002–0.0070 in.)
Ring Width— Compression Rings	1.17–1.19 mm (0.046–0.047 in.)
Ring Width—Oil Ring Pack	2.854–3.008 mm (0.1124–0.1184 in.)
Connecting Rod	
Bearing Clearance	0.026–0.059 mm (0.001–0.0023 in.)
Wear Limit	0.075 mm (0.003 in.)
Bore Diameter—Piston Pin	20.96–20.98 mm (0.8252–0.8260 in.)
Bore Diameter— Crankshaft End	50.991–51.005 mm (2.0075–2.0081 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)	543 grams (1.20 lbs.)
Crankshaft	
Connecting Rod Journal Diameter	47.9924–48.0076 mm (1.8894–1.8900 in.)
Main Bearing Journal Diameter	51.9924–52.0076 mm (2.0469–2.0475 in.)
Journal Out-of-Round (Max.)	0.0035 mm (0.0001 in.)
Journal Taper (Max.)	0.0038 mm (0.0001 in.)
End Play	0.09–0.24 mm (0.0035–0.0094 in.)
Wear Limit	0.37 mm (0.015 in.)
Main Bearing Diametrical Clearance	0.022–0.062 mm (0.0008–0.0024 in.)

DESCRIPTION	SPECIFICATION
Rocker Arm Shaft	
Rocker Arm Shaft Diameter	19.966–19.984 mm (0.7861–0.7868 in.)
Rocker Arm Shaft Retainers	
Intake—Width	28.43–28.49 mm (1.1193–1.1217 in.)
Exhaust—Width 1 & 5	29.15–29.25 mm (1.1477–1.1516 in.)
Exhaust—Width 2,3, and 4	40.40–40.50 mm (1.5906–1.5945 in.)
Rocker Arm/Hydraulic Lash Adjuster	
Rocker Arm Inside Diameter	20.00–20.02 mm (0.787–0.788 in.)
Rocker Arm Shaft Clearance	0.016–0.054 mm (0.0006–0.0021 in.)
Body Diameter	22.949–22.962 mm (0.9035–0.9040 in.)
Plunger Travel Minimum (Dry)	2.2 mm (0.087 in.)
Dry Lash—Intake	1.17 mm (0.046 in.)
Dry Lash—Exhaust	1.28 mm (0.050 in.)
Rocker Arm Ratio	1.4 to 1
Cylinder Head Camshaft Bearing Diameter	
Journal No.1	41.20–41.221 mm (1.622–1.6228 in.)
Journal No.2	41.60–41.62 mm (1.637–1.638 in.)
Journal No.3	42.0–42.02 mm (1.653–1.654 in.)
Journal No.4	42.4–42.42 mm (1.669–1.670 in.)
Journal No.5	42.8–42.82 mm (1.685–1.6858 in.)
Camshaft	
Journal Diameter	
No.1	41.128–41.147 mm (1.619–1.6199 in.)
No.2	41.528–41.547 mm (1.634–1.635 in.)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
No.3	41.928–41.947 mm (1.650–1.651 in.)
No.4	42.328–42.374 mm (1.666–1.668 in.)
No.5	42.728–42.747 mm (1.682–1.6829 in.)
Bearing Clearance— Diametrical	0.053–0.093 mm (0.0027–0.003 in.)
Bearing Clearance (Max. allowable)	0.12 mm (0.0047 in.)
End Play	0.05–0.39 mm (0.002–0.015 in.)
Lift (Zero Lash)	
Intake	7.2 mm (0.283 in.)
Exhaust	7.03 mm (0.277 in.)
Exhaust Valve Timing*	
Closes (ATDC)	5.4°
Opens (BBDC)	43.7°
Duration	229.1°
Intake Valve Timing*	
Closes (ABDC)	41.1°
Opens (ATDC)	13.9°
Duration	207.2°
Valve Overlap	84.8°
*All readings in crankshaft degrees, at 0.5 mm (0.019 in.) of valve lift.	
Cylinder Head	
Material	Cast Aluminum
Gasket Thickness (Compressed)	1.15 mm (0.045 in.)
Valve Seat	
Angle	45°
Seat Diameter—Intake	33 mm (1.299 in.)
Seat Diameter—Exhaust	28 mm (1.102 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.)

DESCRIPTION	SPECIFICATION
Service Limit—Intake	2.0 mm (0.079 in.)
Service Limit—Exhaust	2.5 mm (0.098 in.)
Valve Guide	
Diameter I.D.	5.975–6.000 mm (0.235–0.236 in.)
Guide Bore Diameter (Std.)	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.)
Valves	
Face Angle Intake and Exhaust	45–45.5°
Head Diameter—Intake	32.12–33.37 mm 1.303–1.313 in.)
Head Diameter—Exhaust	28.57–28.83 mm (1.124–1.135 in.)
Valve Margin	
Intake	1.15–1.48 mm (0.0452–0.0583
Service Limit	0.95 mm (1/32 in.)
Exhaust	1.475–1.805 mm (0.058–0.071 in.)
Service Limit	1.05 mm (3/64 in.)
Valve Length (Overall)	
Intake	114.69–115.19 mm (4.515–4.535 in.)
Exhaust	116.94–117.44 mm (4.603–4.623 in.)
Valve Stem Tip Height	
Intake	45.01–46.07 mm (1.77–1.81 in.)
Exhaust	43.51–44.57 mm (1.71–1.75 in.)
Valve Stem Diameter	
Intake	5.934–5.952 mm (0.2337–0.2344 in.)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
Exhaust	5.906–5.924 mm (0.2326–0.2333 in.)
Valve Stem to Guide Clearance	
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.)
Valve Springs	
Free Length (Approx.)	46.75 mm (1.84 in.)
Nominal Force (Valve Closed)	331 N @ 39.8 mm (70 ft. @ 1.57 in.)
Nominal Force (Valve Open)	711 N @ 32.6 mm (160 lbs. @ 1.28 in.)
Installed Height	40.18 mm (1.580 in.)
Oil Pump	
Clearance Over Rotors (Max.)	0.10 mm (0.004 in.)
Cover Out-of-Flat (Max.)	0.076 mm (0.003 in.)
Inner Rotor Thickness (Min.)	7.64 mm (0.301 in.)
Outer Rotor Thickness (Min.)	7.64 mm (0.301 in.)
Outer Rotor Clearance (Max.)	0.039 mm (0.015 in.)
Outer Rotor Diameter (Min.)	79.95 mm (3.148 in.)

DESCRIPTION	SPECIFICATION
Tip Clearance Between Rotors (Max.)	0.20 mm (0.008 in.)
Oil Pressure	
At Curb Idle Speed*	25 kPa (4 psi)
At 3000 rpm	170–550 kPa (25–80 psi)
*If pressure is ZERO at curb idle, DO NOT run engine at 3000 rpm.	

TORQUE

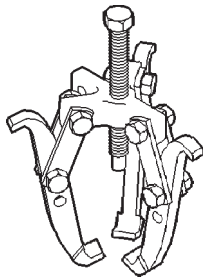
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Sensor Pick-up—Bolts	9.6	—	85
Camshaft Sprocket—Bolt	115	85	—
Connecting Rod Cap—Bolts	27 + $\frac{1}{4}$ turn	20 + $\frac{1}{4}$ turn	—
Structural Collar—Bolts	Refer to Procedure		
Crankshaft Main Bearing Cap/Bedplate			
—M8 Bolts	34	25	—
—M11 Bolts	81	60	—
Crankshaft Damper	136	100	—
Cylinder Head—Bolts	Refer to Procedure		
Cylinder Head Cover—Bolts	12	—	105
Drive Plate to Crankshaft	95	70	—
Engine Mount Bracket Right—Bolts	61	45	—
Engine Mounting	Refer to Procedure		
Engine Torque Bracket—Rear			
—Bolts w/Auto. Transaxle	110	80	—
—Bolts w/Manual Transaxle	61	45	—
Engine Mount Front Bracket to Engine—Bolts	33	24	—
Exhaust Manifold to Cylinder Head—Bolts	23	—	200
Powertrain Bending Strut—Front			
—Long Bolts	101	75	—

SPECIFICATIONS (Continued)

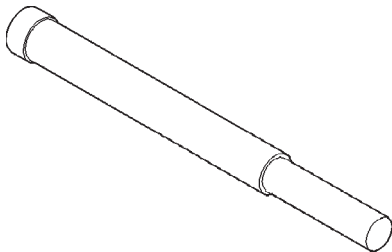
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
—Short Bolts	61	45	—
Intake Manifold—Bolts	12	—	105
Oil Filter Adaptor	80	60	—
Oil Filter	20	15	—
Oil Pan—Bolts	12	—	105
Oil Pan Drain—Plug	27	20	—
Oil Pump to Block	28	—	250
Oil Pump Cover Plate—Bolts	12	—	105
Oil Pump Pick-up Tube—Bolt	28	—	250
Oil Pump Relief Valve—Cap	41	30	—
PCV Valve	5.6	—	50
Rocker Arm Shaft—Bolts	28	—	250
Spark Plugs	28	—	250
Timing Belt Cover—Bolts	12	—	105
Timing Belt Tensioner Assembly—Bolts	28	—	250
Water Pump—Bolts	12	—	105

SPECIAL TOOLS

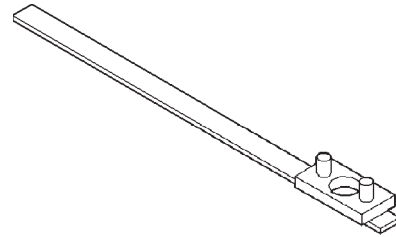
2.0L SOHC ENGINE



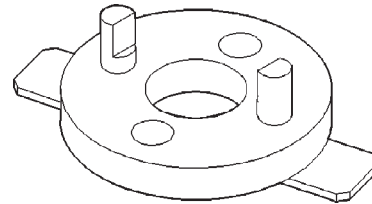
Puller 1026



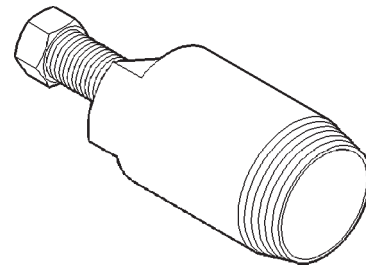
Crankshaft Damper Removal Insert 6827-A



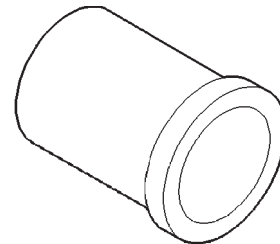
Camshaft Sprocket Remover/Installer C-4687



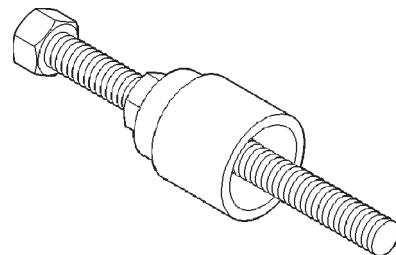
Camshaft Sprocket Remover/Installer Adapter C-4687-1



Camshaft Seal Remover C-4679-A

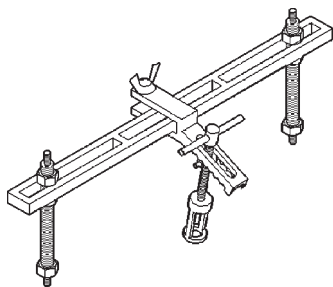
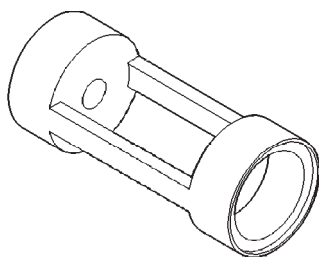
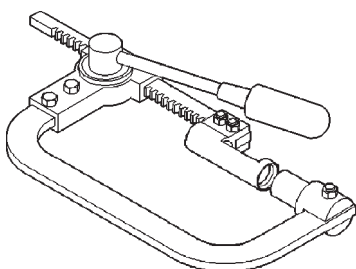
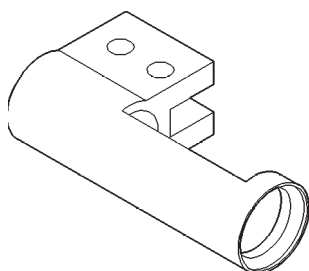
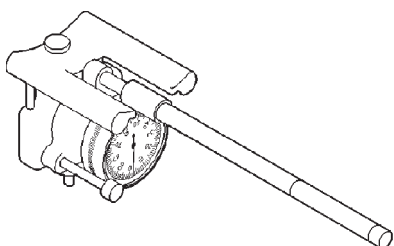


Camshaft Seal Installer MD-998306

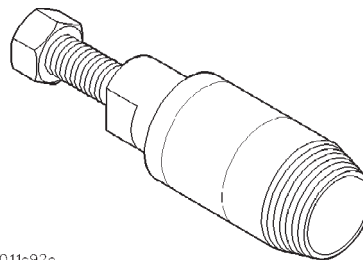


Crankshaft Damper Installer 6792

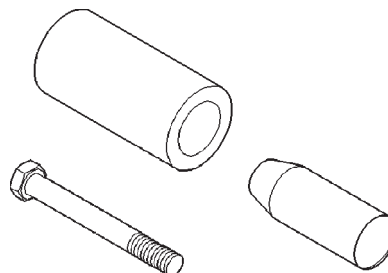
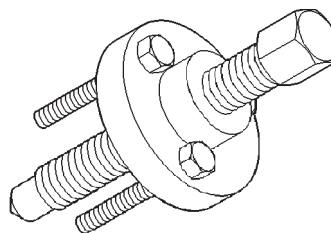
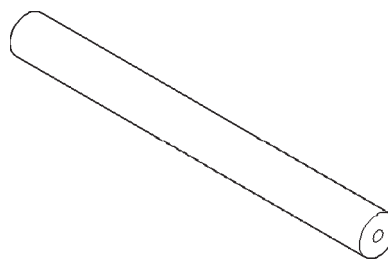
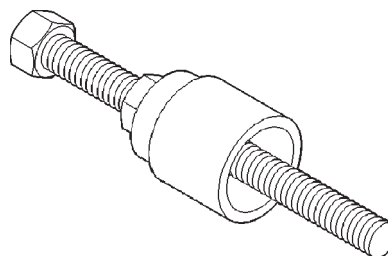
SPECIAL TOOLS (Continued)

**Valve Spring Compressor MD-998772-A****Spring Compressor Adapter 6779****Valve Spring Compressor C-3422-B****Spring Compressor Adaptor 6526**

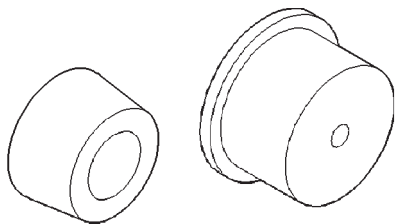
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Cylinder Bore Indicator C-119

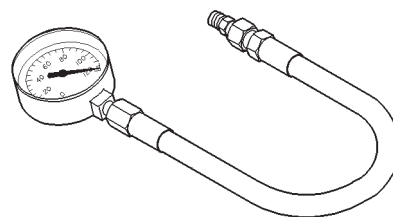
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Front Crankshaft Seal Remover 6771**Front Crankshaft Seal Installer 6780****Crankshaft Sprocket Remover 6793****Crankshaft Sprocket Remover Insert C-4685-C2****Crankshaft Sprocket Installer 6792**

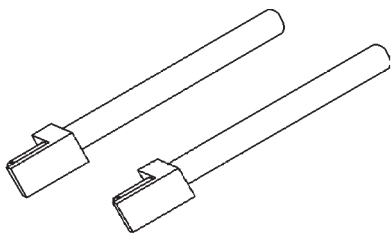
SPECIAL TOOLS (Continued)



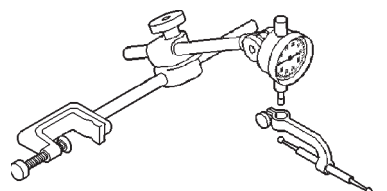
Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2



Pressure Gauge C-3292

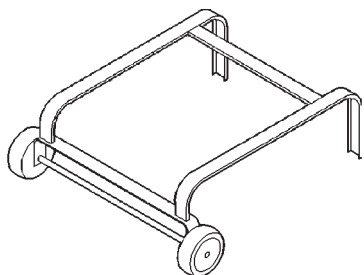


Connecting Rod Guides 8189

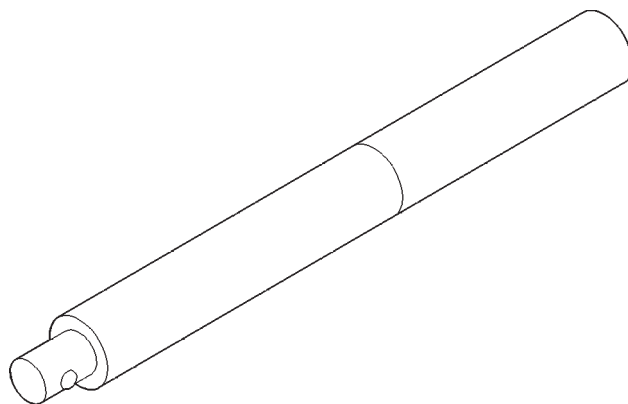


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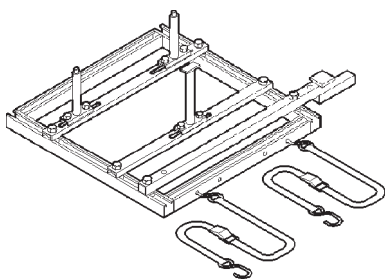
Dial Indicator C-3339



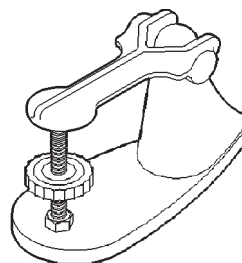
Dolly 6135



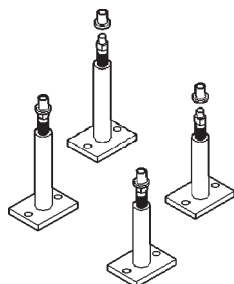
Driver Handle C-4171



Cradle 6710

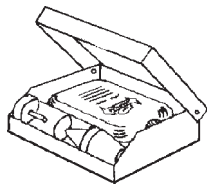


Valve Spring Tester C-647

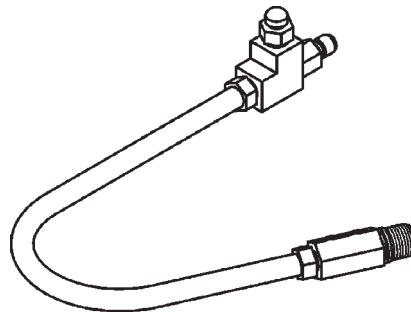


Post Kit Engine Cradle 6848

SPECIAL TOOLS (Continued)



Combustion Leak Tester C-3685-A



Cylinder Compression Pressure Adaptor 8116