

2.5L 4-CYL - VIN [P]

1993 Jeep Cherokee

1993 CHRYSLER CORP. ENGINES
2.5L 4-Cylinder

Jeep: Cherokee, Wrangler

ENGINE IDENTIFICATION

NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

Engine can be identified by eighth character of Vehicle Identification Number (VIN). The VIN is stamped on a plate attached to top left corner of instrument panel.

Engine code is on a machined surface on right side of cylinder block between cylinders No. 3 and 4. This code may be required when ordering replacement parts.

ENGINE IDENTIFICATION CODES TABLE

Application	VIN Code
2.5L 4-Cylinder PFI	P

Some engines are manufactured with oversize or undersize components. These engines are identified by a letter code stamped on oil filter boss near distributor. Letters are decoded as follows:

- * "B" indicates all cylinder bores .010" (.25 mm) oversize.
- * "C" indicates all camshaft bearing bores .010" (.25 mm) oversize.
- * "M" indicates all main bearing journals .010" (.25 mm) undersize.
- * "P" indicates one or more connecting rod journals .010" (.25 mm) undersize.
- * "PM" indicates all crankshaft main bearing journals and one or more connecting rod journals .010" (.25 mm) undersize.

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

Engine is equipped with hydraulic valve lifters. No valve adjustment is required.

REMOVAL & INSTALLATION

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

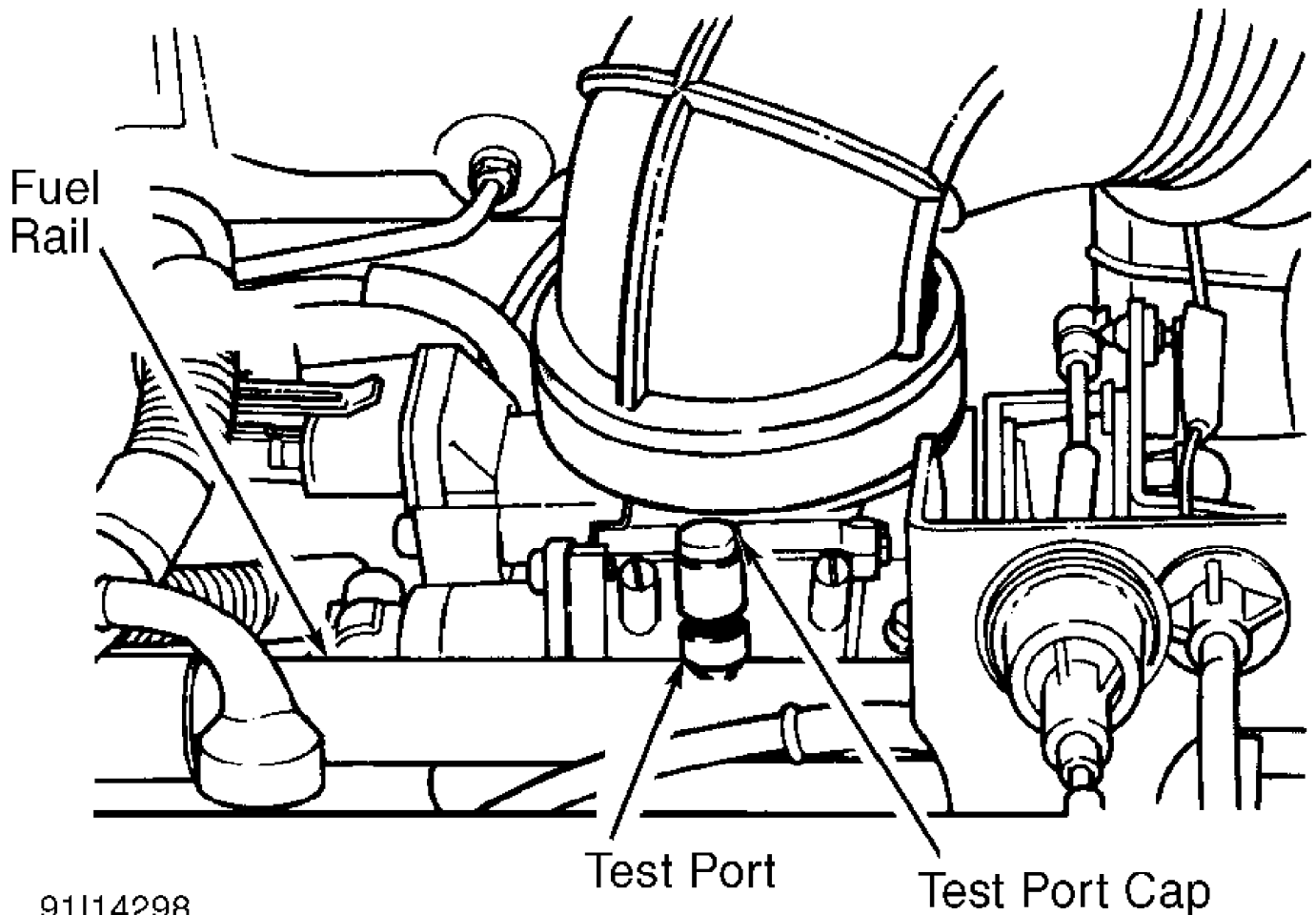
CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

FUEL PRESSURE RELEASE

CAUTION: Fuel system is under constant pressure. This pressure must be released before disconnecting or servicing any fuel supply or return system component. Wear proper eye protection when releasing fuel system pressure.

Disconnect negative battery cable. Remove fuel filler cap. Remove cap from pressure test port on fuel rail. See Fig. 1. Place shop towels around pressure test port to absorb spilled fuel. Press test port valve with a small screwdriver or punch wrapped in shop towels. Remove shop towels and dispose of properly. Install pressure test port cap.

CAUTION: Always replace "O" rings, spacers and retainers whenever fuel system quick-connect fittings are disconnected. Ensure fuel connections are secure by verifying that only retainer tabs protrude from connectors, and by pulling on tubes to verify that they are secure.



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Fig. 1: Locating Fuel Pressure Bleeding Test Port
Courtesy of Chrysler Corp.

COOLING SYSTEM BLEEDING

CAUTION: Engine coolant may be hot. To avoid scalding, carefully

release system pressure before removing radiator cap or drain cock.

Fill radiator completely and install pressure cap. Fill reserve/overflow tank to FULL mark. Operate engine until it reaches normal operating temperature. Shut off engine and allow it to cool. Recheck coolant level in reserve/overflow tank as necessary. Add coolant ONLY when engine is cold.

ENGINE

Removal (Cherokee)

1) Remove battery and air cleaner. Remove hood. Drain cooling system. Remove radiator hoses, coolant recovery hose and fan shroud. Disconnect transmission fluid cooler lines (if equipped).

2) Discharge A/C system (if equipped). Discharge A/C system using approved refrigerant recovery/recycling equipment. Remove A/C condenser (if equipped) and radiator. Remove fan. To maintain pulley and water pump alignment, install a 5/16 x 1/2" bolt through fan pulley into water pump flange.

3) Disconnect heater hoses, throttle linkage, cruise control cable (if equipped) and throttle valve rod. Disconnect wires from starter solenoid, oxygen (O2) sensor and all fuel injection harness connections.

4) Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect fuel supply and return lines at fuel rail. Disconnect TDC sensor wire connector. Remove A/C service valves and cap compressor ports (if equipped).

5) Remove vacuum check valve from power brake booster (if equipped). Disconnect power steering hoses at steering gear (if equipped). Drain power steering pump reservoir. Cap power steering hoses and fittings.

6) Tag and disconnect any remaining hoses or electrical connectors. Raise and support vehicle. Disconnect exhaust pipe from exhaust manifold. Remove starter and flywheel cover.

7) On automatic transmission equipped models, mark converter and flexplate for installation reference. Remove converter-to-flexplate bolts. On all models, remove upper bellhousing bolts and loosen bottom bolts. Remove engine mount bolts.

8) Remove engine shock damper bracket. Lower vehicle. Attach lifting device to engine. Raise engine from front supports. Place support under bellhousing. Remove remaining bellhousing bolts. Remove engine.

Removal (Wrangler)

1) Pad windshield with cloth. Raise hood and rest it against windshield frame. Drain cooling system. Remove battery. Disconnect wiring from alternator, ignition coil, distributor, oil pressure sender and fuel injection wire harness.

2) Disconnect fuel line quick-connect couplings at fuel rail. Remove engine ground strap. Remove air cleaner. Disconnect vacuum purge hose from vapor canister tee. Unplug idle speed actuator connector. Disconnect throttle cable and remove it from bracket.

3) Disconnect throttle rod at bellcrank. Unplug oxygen (O2) sensor connector. Disconnect coolant hoses at radiator, intake manifold and thermostat housing. Remove fan shroud and radiator. Remove fan and spacer. Install a 5/16 x 1/2" bolt through fan pulley into water pump flange to maintain pulley and water pump alignment.

4) Remove check valve from power brake booster (if equipped). Disconnect power steering hoses at steering gear (if equipped). Drain power steering pump reservoir. Cap power steering hoses and fittings.

5) Tag and disconnect any remaining hoses or electrical connectors. Raise and support vehicle. Disconnect exhaust pipe from

exhaust manifold. Remove starter. Remove flywheel housing access cover. Remove engine mount through-bolts. Remove upper bellhousing bolts. Loosen lower bellhousing bolts.

6) Lower vehicle. Attach lifting device to engine. Raise engine from front supports. Place support under bellhousing. Remove remaining bellhousing bolts. Lift engine from engine compartment.

Installation (All Models)

Remove engine mount cushions from brackets to aid alignment of engine and transmission. To complete installation, reverse removal procedure. Adjust throttle and cruise control linkage (if equipped). Tighten bolts to specification. See TORQUE SPECIFICATIONS table. Refill and check fluid levels.

INTAKE MANIFOLD

Removal

1) Disconnect negative battery cable. Remove air inlet hose at throttle body and air cleaner. Remove power steering pump with hoses attached and wire it aside.

2) Release fuel pressure. See FUEL PRESSURE RELEASE. Remove power steering pump brackets at water pump and intake manifold. Disconnect fuel supply and return lines at fuel rail.

3) Disconnect accelerator cable. Unplug cruise control connector at throttle body, using finger pressure only. Remove crankcase ventilation and manifold pressure sensor hoses. Tag and disconnect all wiring and hoses.

4) Remove bolts No. 2 through 5 securing intake manifold to cylinder head. See Fig. 2. Slightly loosen bolt No. 1 and nuts No. 6 and 7. Remove intake manifold. Drain coolant from manifold.

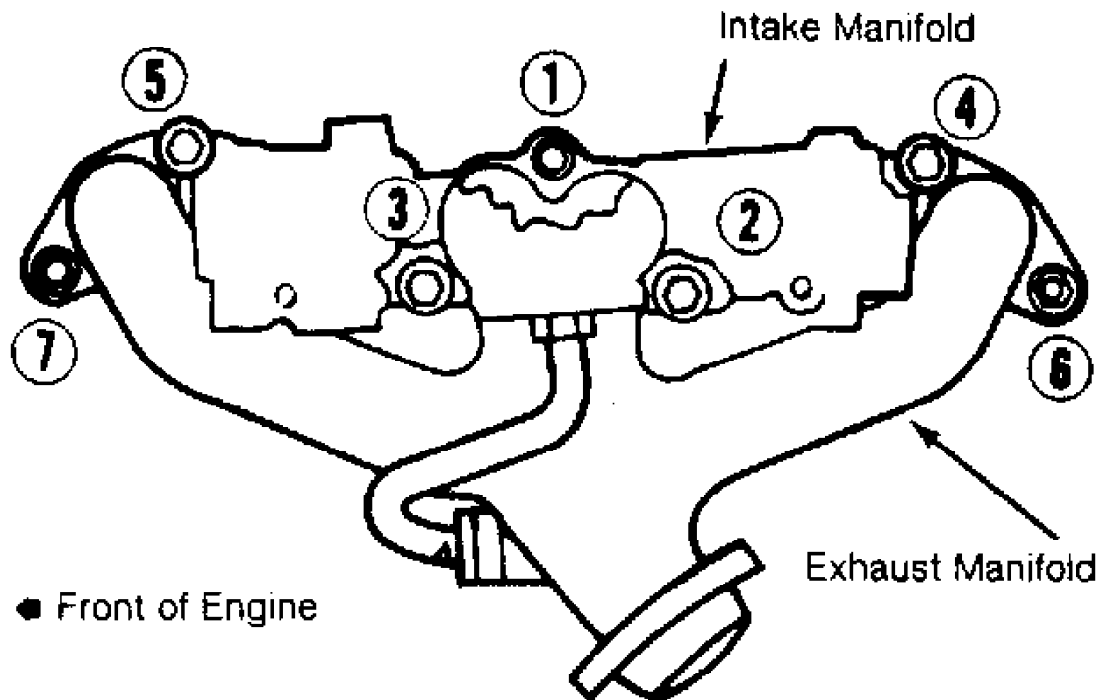


Fig. 2: Intake & Exhaust Manifold Bolt Tightening Sequence
Courtesy of Chrysler Corp.

Installation

Ensure all gasket surfaces are clean. Install intake

manifold. Finger tighten all bolts. Tighten intake manifold bolts to specification in correct sequence. See Fig. 2. Also see TORQUE SPECIFICATIONS table. To complete installation, reverse removal procedure. Fill and bleed cooling system.

EXHAUST MANIFOLD

Removal

Disconnect negative battery cable. Remove intake manifold. See INTAKE MANIFOLD. Raise and support vehicle. Disconnect exhaust pipe from exhaust manifold. Lower vehicle. Remove retaining nuts and bolts. Remove exhaust manifold.

Installation

1) Clean all gasket surfaces. Install intake and exhaust manifolds together, using NEW gasket. Ensure exhaust manifold is centrally located over end studs and spacer. Tighten bolt No. 1 to specification. See TORQUE SPECIFICATIONS table. Tighten bolts No. 2 through 5 to specification in sequence. See Fig. 2.

2) Install new spacers over cylinder head studs. Tighten nuts No. 6 and 7 to specification. To complete installation, reverse removal procedure. Start engine and check for leaks.

CYLINDER HEAD

Removal

1) Disconnect negative battery cable. Drain cooling system. Remove accessory drive belt. Remove A/C compressor (if equipped) and wire it aside. DO NOT discharge A/C system. Remove air cleaner.

2) Remove A/C compressor mounting bracket-to-cylinder head bolts. Loosen A/C compressor mounting bracket-to-cylinder block bolts. Disconnect upper radiator hose and heater hoses. Remove valve cover.

3) Remove rocker arms, bridges, pivots and push rods. Tag all parts for installation reference. See ROCKER ARMS. Remove manifolds. See INTAKE MANIFOLD and EXHAUST MANIFOLD.

4) Tag and disconnect spark plug wires. Remove spark plugs. Remove cylinder head bolts. Remove cylinder head. Stuff clean lint-free shop towels into cylinder bores.

Inspection

1) Inspect cylinder head for cracks or damage. Using straightedge, check cylinder head for warpage across bolt holes and diagonals. Resurface or replace cylinder head if warpage exceeds specification or damage exists. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Cylinder head bolts may be REUSED ONLY ONCE. If this is the first time cylinder head has been removed, put a dab of paint on the head of each bolt. If the bolts already have paint on them, or if it is unknown whether they have been used before, DISCARD THEM and replace with NEW bolts.

Installation

1) Clean carbon from combustion chambers and tops of pistons. Ensure all gasket surfaces, head bolts and head bolt holes are clean. Install NEW cylinder head gasket with numbers or word TOP upward. DO NOT apply sealant to cylinder head gasket. Ensure all holes align properly.

2) Install cylinder head. Apply sealing compound to threads of cylinder head bolt No. 7 before installation. Install cylinder head bolts. Tighten all bolts in 3 stages in sequence to specs. See Fig. 3. For torque specifications see TORQUE SPECIFICATIONS table.

NOTE: During the final tightening sequence, bolt No. 7 will be

tightened to a lower torque than the others.

3) To complete installation, reverse removal procedure. Install all valve train components into their original locations. Refill cooling system. Remove coolant temperature sensor to bleed air from system while filling.

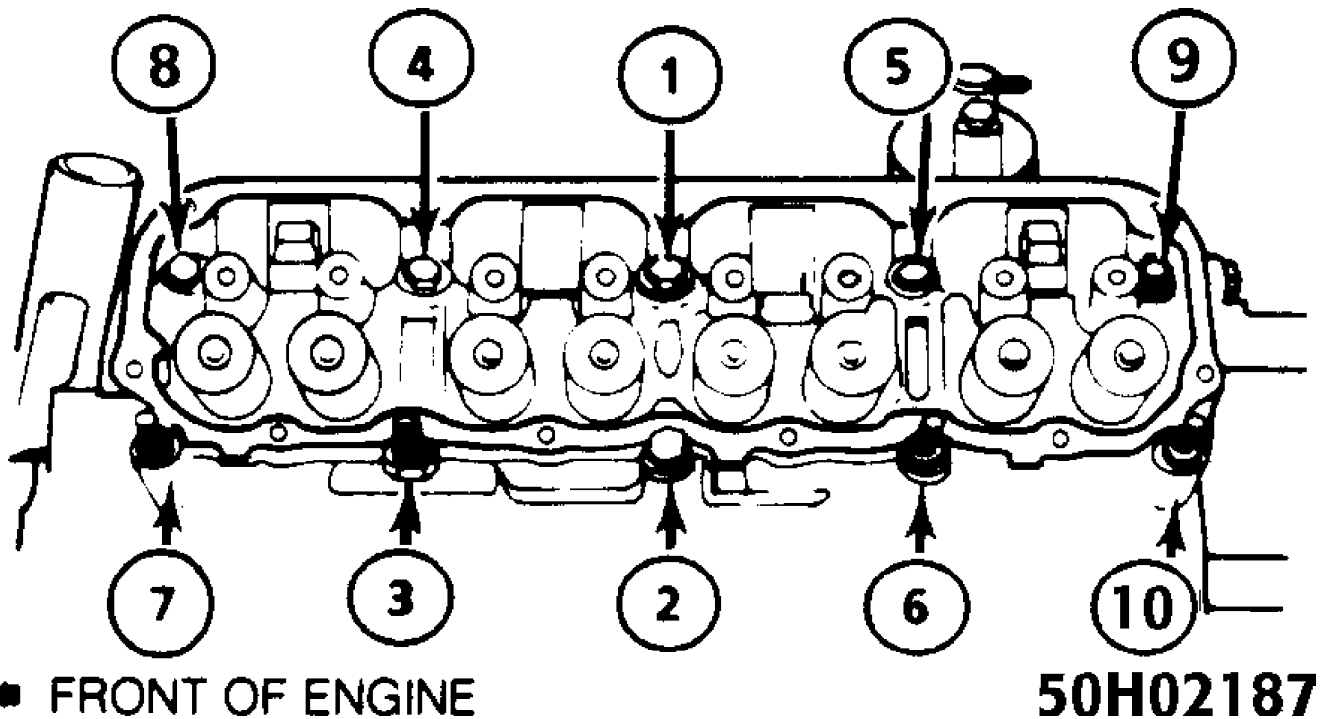


Fig. 3: Cylinder Head Bolt Tightening Sequence
Courtesy of Chrysler Corp.

FRONT COVER OIL SEAL

Removal & Installation

1) Remove drive belt. Remove vibration damper. Remove radiator shroud. Remove seal from front cover. Apply sealant to outer diameter of new seal. Coat crankshaft lightly with oil.

2) Drive seal into front cover, using Front Cover Aligner/Seal Installer (6139). Lightly coat seal contact area of vibration damper with oil. Lubricate vibration damper bolt with oil before installation. Reverse removal procedure to complete installation. See TORQUE SPECIFICATIONS table.

TIMING CHAIN & SPROCKETS

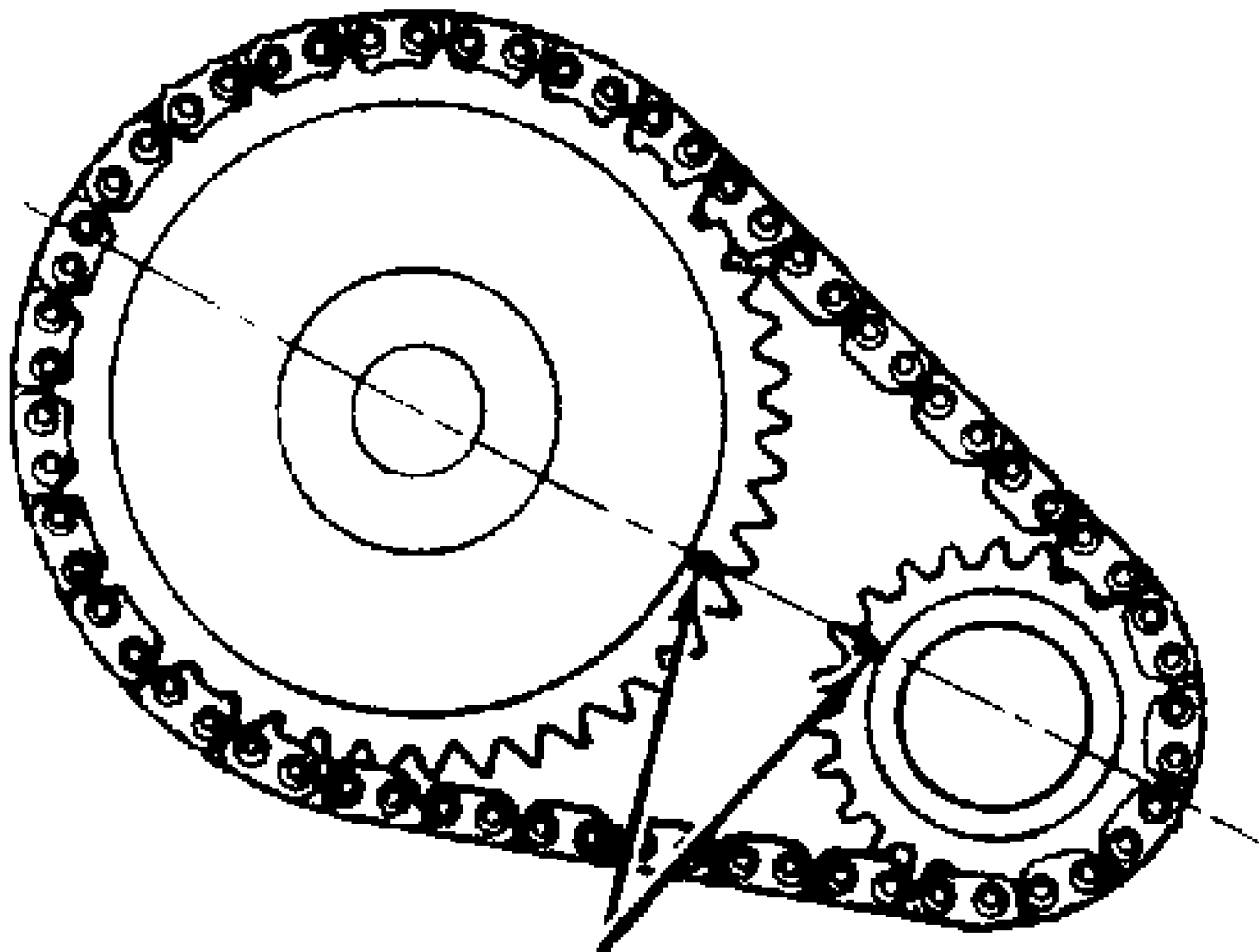
Removal

1) Disconnect negative battery cable. Remove drive belt, fan and hub assembly. Remove fan shroud. Remove accessory drive brackets attached to timing case cover. Remove A/C compressor (if equipped) with hoses attached and wire it aside. DO NOT discharge A/C system. Remove alternator bracket assembly from cylinder head.

2) Remove vibration damper retaining bolt and washer. Remove vibration damper and key. Remove front cover retaining bolts and front cover. Cut oil pan gasket flush with face of cylinder block. Remove cut-off pieces.

3) Rotate crankshaft until timing marks on crankshaft and camshaft sprockets align. See Fig. 4. Remove oil slinger and camshaft

sprocket retaining bolt. Remove sprockets and chain as an assembly.
Remove front cover oil seal.



Timing Marks

Fig. 4: Aligning Sprocket Timing Marks
Courtesy of Chrysler Corp.

Installation

1) Turn tensioner lever down to unlock position. Pull tensioner block toward lever to compress spring. Turn lever up to lock position. See Fig. 5. Install timing chain and sprockets as an assembly. Ensure timing marks align. Install camshaft sprocket retaining bolt and washer. Tighten to specification. See the TORQUE SPECIFICATIONS table.

NOTE: Ensure chain tensioner is in unlock (down) position before installing front cover.

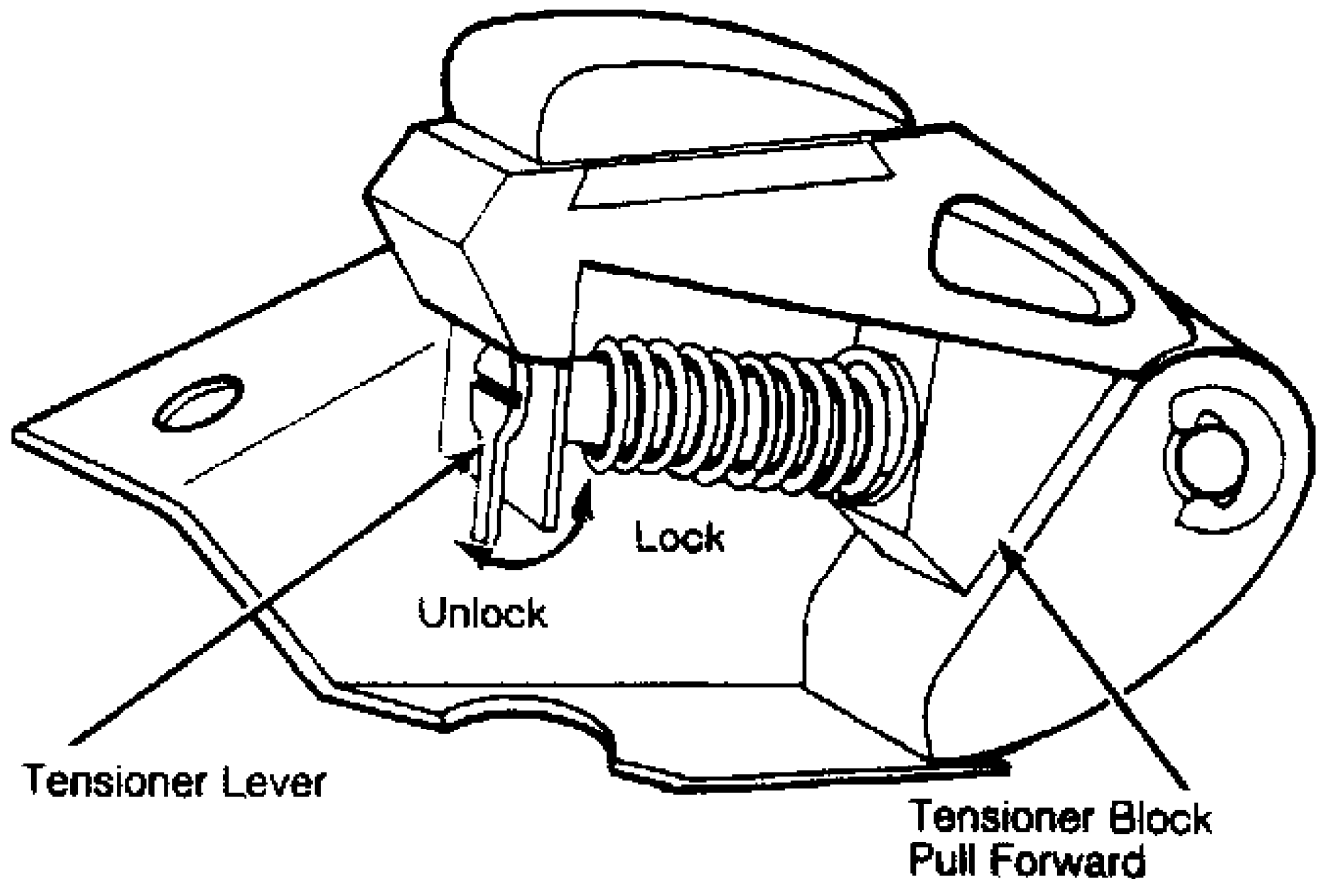


Fig. 5: Locating Chain Tensioner Lock
 Courtesy of Chrysler Corp.

2) Verify proper installation by rotating crankshaft until timing mark on camshaft is at approximately one o'clock position. Timing sprockets are installed correctly if there are 20 timing chain pins between timing marks on both sprockets.

3) Clean all gasket surfaces. Install oil slinger. Apply sealing compound to both sides of front cover gasket. Install gasket onto cylinder block. Replace front section of oil pan seal with similar piece cut from new seal.

4) Coat outer surface of NEW seal with RTV sealant and place into position. Apply sealant where oil pan and cylinder block meet. Place front cover onto cylinder block. Place Front Cover Aligner/Seal Installer (6139) in front engine cover seal area.

5) Install cover retaining bolts, and tighten to specification. To complete installation, reverse removal procedure. Lubricate vibration damper retaining bolt before installation, and tighten to specification. See TORQUE SPECIFICATIONS table.

ROCKER ARMS

Removal

Remove valve cover. Alternately loosen rocker arm cap screws one turn at a time to prevent damaging bridges. Remove bridges, pivots, rocker arms and push rods. Tag all parts for reassembly reference.

Installation

1) Lubricate push rod ends with Mopar Engine Oil Supplement (4318002). Install push rods into their original locations. Ensure bottom end of each push rod is centered in valve lifter.

2) Lubricate pivot contact area of each rocker arm with engine oil supplement. Install rocker arms, pivots and bridges into their original locations. Loosely install cap screws, then tighten alternately one turn at a time to specification. Reverse removal procedure to complete installation.

3) Pour remaining engine oil supplement over entire valve train. Supplement must remain in engine oil for at least 1000 miles (1600 km), but need not be drained until next scheduled oil change.

CAMSHAFT

Removal

1) Disconnect negative battery cable. Drain cooling system. Discharge A/C system (if equipped), using approved refrigerant recovery/recycling equipment. Remove A/C condenser (if equipped) and radiator. Mark distributor and engine block for installation reference. Remove distributor and ignition wiring. Remove rocker arms, bridges, pivots and push rods. See **ROCKER ARMS**.

2) Remove valve lifters using Hydraulic Valve Lifter Remover/Installer (C-4129-A). Tag each valve lifter for installation reference. Remove timing chain and sprockets. See **TIMING CHAIN & SPROCKETS**. Remove camshaft.

Inspection

Inspect lobes, journals, bearings and distributor drive gear for wear. If camshaft sprocket or chain rubs against engine front cover, examine oil pressure relief holes in rear camshaft journal. Oil pressure relief holes **MUST** be free of debris.

Installation

1) Lubricate camshaft and dip valve lifters into Mopar Engine Oil Supplement (4318002). Install camshaft. Reverse removal procedure to complete installation.

2) Pour remaining oil supplement over entire valve train. Supplement must remain in engine oil for at least 1000 miles (1600 km), but need not be drained until next scheduled oil change. Refill cooling system. Adjust ignition timing. Check for leaks.

REAR CRANKSHAFT OIL SEAL

Removal

Remove transmission, clutch housing and flywheel or flexplate. Pry oil seal from housing. Avoid damage to surrounding area.

Installation

Coat outer lip of replacement seal with engine oil. Using Installer (6271), install seal flush with cylinder block. Use only **NEW** bolts when installing flywheel or flexplate. Ensure felt lip is inside flywheel mounting surface to avoid tearing seal. To complete installation, reverse removal procedure. Tighten flywheel or flexplate bolts to specification, then an additional 60 degrees. See the **TORQUE SPECIFICATIONS** table.

WATER PUMP

Removal

Disconnect negative battery cable. Drain cooling system. Remove fan shroud and drive belts. Remove fan assembly. Disconnect

heater hoses and lower radiator hose at water pump. Remove water pump retaining bolts. Remove water pump.

Installation

Install water pump. Tighten bolts to specification. See TORQUE SPECIFICATIONS table. Ensure pump turns freely. Ensure belt is installed correctly to prevent engine overheating because water pump rotates in wrong direction. To complete installation, reverse removal procedure. Fill and purge air from cooling system. Remove coolant temperature sensor to bleed air from system while filling.

OIL PAN

Removal

1) Disconnect negative battery cable. Raise and support vehicle at side sills. Drain engine oil. Disconnect exhaust pipe at exhaust manifold. Disconnect exhaust hanger at catalytic converter. Lower exhaust pipe. Remove starter. Remove flywheel access cover.

2) Position jackstand directly under vibration damper. Place wooden block between vibration damper and jackstand. Remove through bolts from engine mounts. Raise engine enough to remove oil pan. Remove oil pan retaining bolts. Remove oil pan by sliding it to rear.

Installation

1) Ensure all gasket surfaces are clean. Fabricate 4 alignment dowels from 1 1/2 x 1/4" bolts. Cut heads off bolts and cut slot in end of bolts to allow removal with screwdriver. Install 2 dowels in timing cover and 2 dowels in block. Slide gasket over dowels into position against block and timing cover.

2) Install oil pan. Install sufficient bolts to hold oil pan in place. Remove alignment dowels. Install remaining oil pan bolts and tighten to specification. See TORQUE SPECIFICATIONS table. To complete installation, reverse removal procedure. Fill crankcase. Start engine. Check for leaks.

OVERHAUL

CYLINDER HEAD

Inspection

Inspect for cracks in combustion chambers, coolant passages, ports and exhaust valve seats. Using straightedge, check cylinder head for warpage in several areas. Repair or replace cylinder head if warpage exceeds specification or damage exists. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Springs

Use Valve Spring Tester (J-22738-02) to test each valve spring. Measure free length of each valve spring. Replace valve springs that do not meet specifications. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

Valve Stem Oil Seals

Replace valve stem oil seals if they have deteriorated or whenever valves are serviced. Oil seals are marked INT and EXH for intake and exhaust valves, respectively. Oversize oil seals must be used with valves having .015" (.38 mm) oversize stems.

Valve Guides

Measure diameter of valve guide approximately 3/8" (10 mm) from valve spring side of head, both parallel and at right angle to long axis of head. If difference between measurements exceeds .0025"

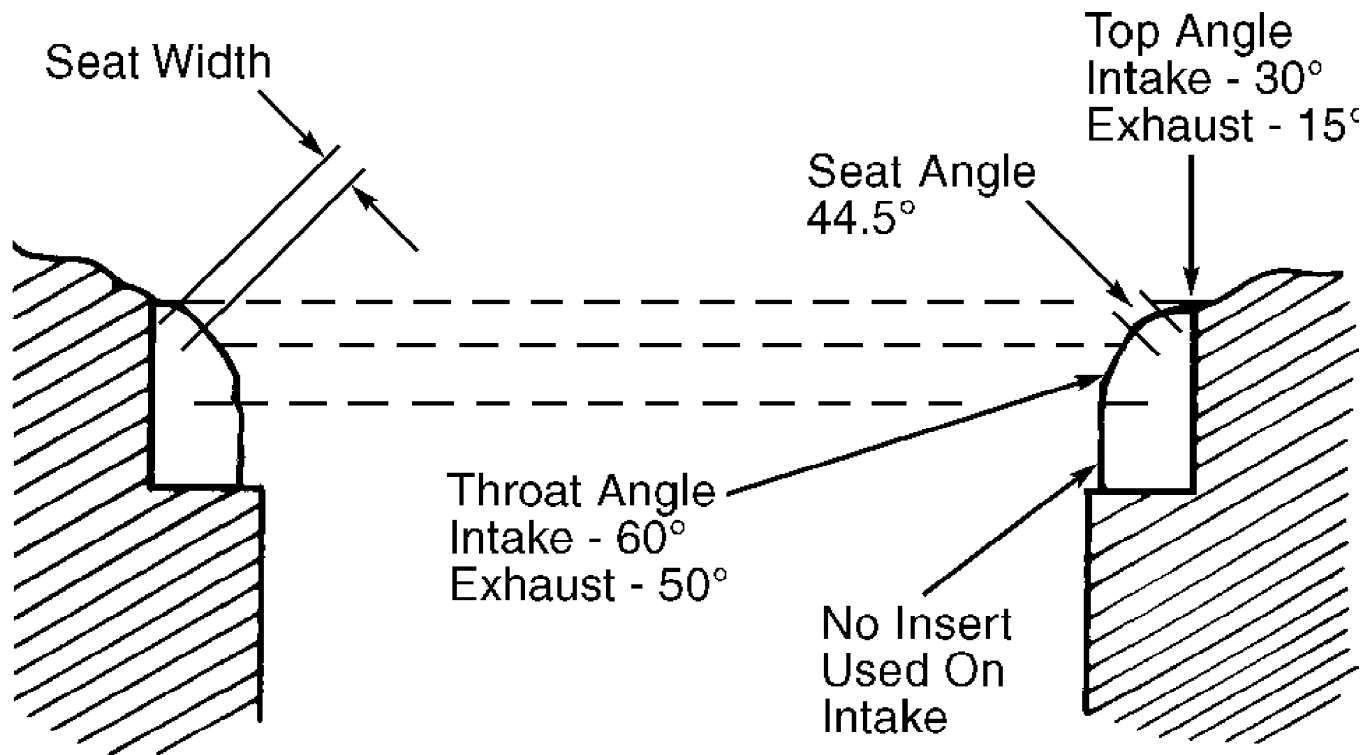
(.063 mm), or if diameter exceeds specification by .003" (.08 mm), ream valve guide for oversize valve stem. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Reface valve seats after reaming valve guides.

Valve Seats

Reface valve seats to specification. Remove only enough metal to provide smooth finish. Use tapered stones to obtain specified seat width. See Fig. 6. Seat width runout should not exceed .0025" (.063 mm) after refacing. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valves

Reface valves to specification. At least 1/32" (.79 mm) margin must remain after refacing valve. Valve stem tip can be resurfaced and chamfered when worn. DO NOT remove more than .01" (.25 mm). See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.



91C14300

Fig. 6: Checking Valve Seat Dimensions
Courtesy of Chrysler Corp.

VALVE TRAIN

Rocker Arms

Inspect pivot and valve stem contact surfaces of each rocker arm. Replace any rocker arm that is scuffed, pitted, cracked or excessively worn.

Push Rods

Inspect push rods for excessive wear. If wear is excessive because of lack of oil, replace and inspect corresponding valve lifter for excessive wear. Roll push rods on a flat surface to check for straightness. Replace push rod and/or valve lifter, if necessary. If

wear exists along length of push rod, inspect cylinder head for obstruction.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Note locations of arrow on piston crown and oil squirt hole in connecting rod. Position piston and rod assembly on support. See Fig. 7. Press piston pin from piston. Discard pin. Piston pin CANNOT be reused after removal. Inspect piston pin bore in connecting rod for nicks or burrs and remove as necessary.

2) Clean piston pin bore and replacement piston pin. Piston and piston pin must be at room temperature when measuring fit. Piston pin should fall through piston at room temperature. If pin jams in pin bore, replace piston.

3) Position piston on support so that arrow on piston crown will point to front of engine and connecting squirt hole will face camshaft when installed. Insert piston pin through piston pin bore and into connecting rod pin bore.

4) Press pin through rod and piston until pilot aligns with mark on support. Pin should be centered in rod. Piston pin installation requires approximately 2000 lbs. (900 kg) of force. Replace connecting rod if noticeably less force is required, or if rod moves on pin.

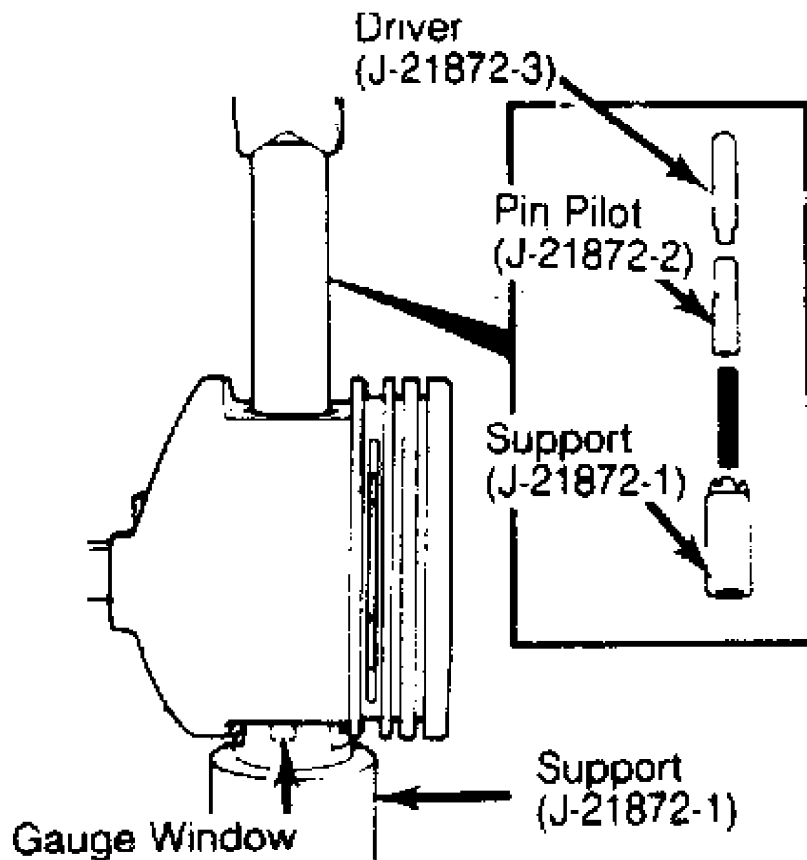


Fig. 7: Removing & Installing Piston Pin
Courtesy of Chrysler Corp.

Fitting Pistons

Measure cylinder bore 2 5/16" (59 mm) below top of bore.

Measure piston diameter at right angle to piston pin at center line of pin. Piston clearance is difference between measurements. Pistons up to .004" (.10 mm) undersize may be enlarged by knurling or shot peening. Replace pistons if clearance is greater than .004" (.10 mm) or more.

Piston Rings

Install piston rings. DO NOT interchange piston rings. Top ring has a Gray scraping surface; second ring is Black. Ensure ring end gap and side clearance are within specifications. Install compression rings with dot(s) on ring surface toward top of piston. Position ring end gaps in specified area. Ring gaps may vary 20 degrees from locations illustrated. See Fig. 8. Also see PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

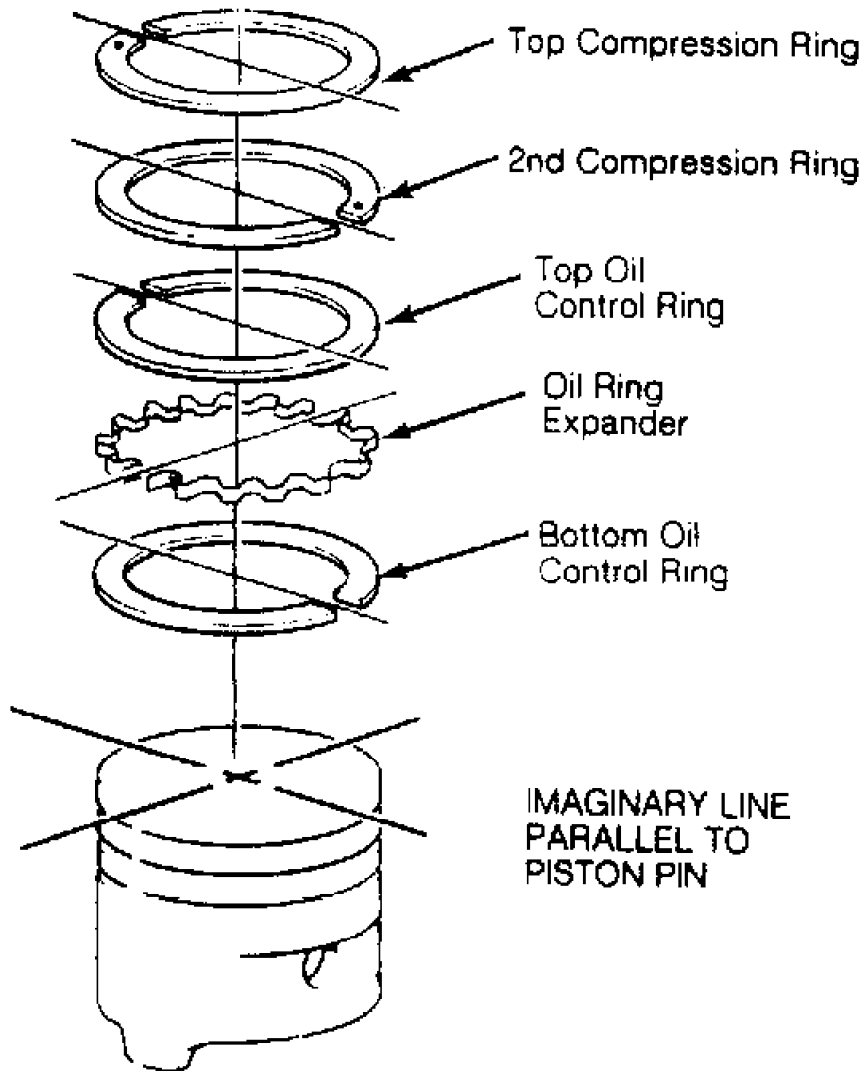


Fig. 8: Positioning Piston Ring Gaps
Courtesy of Chrysler Corp.

Rod Bearings

1) Inspect bearings for wear or damage. Replace as necessary.

Using Plastigage, check bearing clearance. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS. Bearings are available for standard and undersize applications.

2) If necessary, different size upper and lower bearings may be combined to obtain correct oil clearance. Tighten bolts to specification. Check rod side play. Rotate crankshaft to ensure freedom of movement. See TORQUE SPECIFICATIONS table. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table.

NOTE: Never combine bearing inserts that differ by more than .001" (.03 mm) in size. Odd size inserts must be on bottom (rod cap) side.

Crankshaft & Main Bearings

1) Inspect bearings for damage or wear. Replace as necessary. Using Plastigage, measure bearing clearance. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS. Bearings are available in standard and undersize. If necessary, different size upper and lower bearings may be installed to obtain correct oil clearance. Lubricate bearings before installation.

NOTE: If different size bearings are installed, the odd size bearings must all be uniform in location (upper or lower). Never combine bearing inserts that differ by more than .001" (.03 mm).

2) Install upper bearing inserts. Install bearing caps and lower inserts. Tighten bearing caps No. 1, 3, 4 and 5 in 3 stages to specification. Pry crankshaft to front or rear and tighten bolts for cap No. 2 to specification in 3 stages. Rotate crankshaft to ensure freedom of movement after tightening each cap. See the TORQUE SPECIFICATIONS table. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table.

Thrust Bearing

Check crankshaft end play. If end play is not within specification, replace bearing No. 2. If end play is still not within specification, replace crankshaft. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Cylinder Block

1) Measure cylinder bore diameter crosswise to cylinder block near top of bore. Repeat measurement at bottom of bore. Subtract smaller diameter from larger diameter to determine taper. Repeat measurements for each cylinder.

2) Repeat measurements with measuring device rotated 120 degrees. Repeat this step for a total of 3 measurements. Cylinder out-of-round is the difference between measurements. Repeat for each cylinder.

3) Bore and hone cylinders for oversize pistons if taper or out-of-round exceeds specification. Move hone up and down to provide a 60-degree crosshatch pattern. DO NOT use a rigid hone or exceed 10 strokes per cylinder. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

LUBRICATION

ENGINE OILING

A distributor-driven pump supplies oil through a full-flow oil filter to an oil gallery on right side of block and intersecting lifter bores. Oil then flows to camshaft and crankshaft bearings. The

rocker arms receive oil through the push rods and lifters.

Crankcase Capacity

Crankcase capacity is 4 qts. (3.8L) with oil filter change.

Oil Pressure

Normal oil pressure should be 25-35 psi (1.8-2.5 kg/cm²) at 800 RPM or 37-75 psi (2.6-5.3 kg/cm²) at 1600 RPM. Oil pressure relief occurs at 75 psi (5.3 kg/cm²).

OIL PUMP

Removal & Disassembly

Remove oil pump retaining bolts. DO NOT move oil pick-up pipe in pump body. If oil pick-up pipe is moved, pick-up pipe must be replaced to ensure an airtight seal. Remove pump cover. Disassemble pump.

Inspection

1) Inspect for wear and damage. Place Plastigage across full width of each gear. Temporarily install cover, and tighten bolts to 70 INCH lbs. (8 N.m). Remove cover. Examine Plastigage to determine end clearance.

2) Rotate gears, and measure clearance between each tooth and oil pump body, directly opposite point of mesh. Replace oil pump if not within specification. See OIL PUMP SPECIFICATIONS table.

OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Gear End Clearance .....	.002-.006 (.05-.15)
Gear-to-Body Clearance .....	.002-.004 (.05-.10)

Reassembly & Installation

1) Apply sealant to pick-up pipe and pump cover area prior to installation. To install pick-up tube, use Pipe Installer (7624). Ensure pick-up pipe support bracket is aligned with pump cover bolt. If relief valve is replaced, ensure replacement valve is same diameter as that removed.

2) Fill pump cavity with petroleum jelly. Install cover. Tighten cover bolts to specification. Check pump gears for freedom of rotation. Install new gasket and oil pump. Tighten retaining bolts to specification. See TORQUE SPECIFICATIONS table.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Camshaft Sprocket Bolt	80 (108)
Connecting Rod Cap Nuts	33 (45)
Cylinder Head Bolts (1)	
Stage 1	22 (30)
Stage 2	45 (61)
Stage 3	(2) 110 (149)
Drive Plate-To-Converter Bolts	40 (54)
Exhaust Manifold Bolts (3)	
Bolt No. 1	30 (41)
Bolt No. 2-5	23 (31)

Nut No. 6 & 7	30 (41)
Fan Bolts	18 (24)
Flexplate-To-Crankshaft Bolts	(4) 50 (68)
Flywheel-To-Crankshaft Bolts	(4) 50 (68)
Intake Manifold Bolts (3)	
Bolt No. 1	30 (41)
Bolt No. 2-5	23 (31)
Nut No. 6 & 7	30 (41)
Main Bearing Cap Bolts	
Stage 1	40 (54)
Stage 2	70 (95)
Stage 3	80 (108)
Oil Pump Retaining Bolts	
Long	17 (23)
Short	10 (14)
Oxygen (O2) Sensor	23 (31)
Pulley-To-Vibration Damper Bolts	20 (27)
Rocker Arm Bolts	21 (28)
Starter Bolts	33 (45)
Throttle Body-To-Intake Bolts	10 (14)
Vibration Damper Bolt	(5) 80 (108)
Water Pump Bolts	25 (34)

INCH Lbs. (N.m)

Front Cover-To-Block Bolts	62 (7)
Oil Pan Bolts	
1/4" X 20	114 (13)
5/16" X 18	156 (18)
Oil Pump Cover Bolts	70 (8)
Valve Cover Bolts	85 (9)

- (1) - Tighten in sequence. See Fig. 3.
- (2) - All except bolt No. 7. Tighten bolt No. 7 to 100 ft. lbs. (136 N.m).
- (3) - Tighten bolts in sequence. See Fig. 2.
- (4) - Tighten to specification and an additional 60 degrees.
- (5) - With bolt cleaned and threads lubricated with oil.

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS TABLE

Application	Specification
Displacement	150 Cu. In. (2.5L)
Bore	3.88" (98.5 mm)
Stroke	3.19" (81.0 mm)
Compression Ratio	
Cherokee	9.2:1
Wrangler	9.1:1
Fuel System	PFI
Horsepower @ RPM	
Cherokee	130 @ 5250
Wrangler	123 @ 5250
Torque Ft. Lbs. @ RPM	
Cherokee	149 @ 3000
Wrangler	139 @ 3250

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS TABLE

Application	In. (mm)
Crankshaft	
End Play .....	.0015-.0065 (.038-.165)
Runout	(1)
Main Bearings	
Journal Diameter	2.4996-2.5001 (63.490-63.503)
Journal Out-Of-Round .....	.0005 (.013)
Journal Taper .....	.0005 (.013)
Oil Clearance .....	.0010-.0025 (.025-.063)
Connecting Rod Bearings	
Journal Diameter	2.0934-2.0955 (53.172-53.226)
Journal Out-Of-Round .....	.0005 (.013)
Journal Taper .....	.0005 (.013)
Oil Clearance .....	.0015-.0025 (.038-.063)

(1) - Information not available from manufacturer.

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	
Pin Bore .....	.9288-.9298 (23.591-23.617)
Crankpin Bore	2.2080-2.2085 (56.083-56.096)
Center-To-Center Length	6.123-6.127 (155.52-155.63)
Maximum Bend .....	.003 (.08)
Maximum Twist .....	.006 (.15)
Side Play .....	.010-.019 (.25-.48)

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE

Application	In. (mm)
Piston	
Clearance .....	.0013-.0021 (.033-.053)
Diameter	(1)
Pins	
Diameter .....	.9306-.9307 (23.637-23.640)
Piston Fit .....	.0003-.0007 (.007-.018)
Rod Fit	Press Fit
Rings	
No. 1 & 2	
End Gap .....	.010-.020 (.25-.51)
Side Clearance .....	.0017-.0032 (.043-.081)
No. 3 (Oil)	
End Gap .....	.015-.055 (.38-1.40)
Side Clearance .....	.001-.010 (.03-.24)

(1) - Information is not available from manufacturer.
 Replace pistons if piston clearance exceeds
 .004" (.10 mm).

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK SPECIFICATIONS TABLE

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.875-3.877 (98.42-98.48)
Maximum Taper	.001 (.03)
Maximum Out-Of-Round	.001 (.03)
Minimum Deck Height	9.320 (236.73)
Maximum Deck Warpage	.008 (.20)

VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS SPECIFICATIONS TABLE

Application	Specification
Intake Valves	
Face Angle	45 °
Head Diameter	1.90" (48.3 mm)
Minimum Margin	.031" (.79 mm)
Minimum Refinish Length	4.889" (124.18 mm)
Stem Diameter	.311-.312" (7.89-7.92 mm)
Valve Tip Maximum Refinish	.010" (.25 mm)
Exhaust Valves	
Face Angle	45 °
Head Diameter	1.50" (38.1 mm)
Minimum Margin	.031" (.79 mm)
Minimum Refinish Length	4.927" (125.15 mm)
Stem Diameter	.311-.312" (7.90-7.92 mm)
Valve Tip Maximum Refinish	.010" (.25 mm)
Valve Springs	
Free Length	2.0" (51 mm)
Installed Height	(1)
Out-Of-Square	(1)
Pressure (2)	
Valve Closed	80-90 @ 1.64 (36.3-40.8 @ 40.8)
Valve Open	200 @ 1.216 (90.7 @ 30.9)

(1) - Information is not available from manufacturer.

(2) - Lbs. @ In. (kg @ mm).

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD SPECIFICATIONS TABLE

Application	Specification
Cylinder Head Height	(1)
Maximum Warpage	.008" (.20 mm)
Valve Seats	
Intake Valve	
Seat Angle	44.5-45 °
Seat Width	.040-.060" (1.02-1.52 mm)
Maximum Seat Runout	.0025" (.063 mm)
Exhaust Valve	
Seat Angle	44.5-45 °

Seat Width	.040-.060"	(1.02-1.52 mm)
Maximum Seat Runout	.0025"	(.063 mm)
Seat Bore Diameter		(1)
Valve Guides		
Intake Valve		
Valve Guide I.D.	.313-.314"	(7.95-7.98 mm)
Valve Stem-To-Guide		
Oil Clearance	.001-.003"	(.03-.08 mm)
Exhaust Valve		
Valve Guide I.D.	.313-.314"	(7.95-7.98 mm)
Valve Stem-To-Guide		
Oil Clearance	.001-.003"	(.03-.08 mm)

(1) - Information is not available from manufacturer.

CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	(1)
End Play	(2) 0 (0)
Journal Diameter	
No. 1	2.029-2.030 (51.54-51.56)
No. 2	2.019-2.020 (51.28-51.31)
No. 3	2.009-2.010 (51.03-51.05)
No. 4	1.999-2.000 (50.78-50.80)
Journal Runout	(3)
Lobe Height	(1)
Lobe Lift	.265 (6.73)
Oil Clearance	.001-.003 (.03-.08)

(1) - Information is not available from manufacturer.

(2) - Engine running.

(3) - Information is not available from manufacturer.

Manufacturer specifies .001" (.03 mm) maximum base circle runout.

VALVE LIFTERS SPECIFICATIONS

VALVE LIFTERS SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	.9055-.9065 (22.987-23.025)
Lifter Diameter	.9040-.9045 (22.962-22.974)
Oil Clearance	.001-.002 (.03-.05)