CYLINDER HEAD

DESCRIPTION

The cross flow designed, aluminum cylinder head contains a single over head camshaft with four valves per cylinder (Fig. 14). 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.

DIAGNOSIS AND TESTING—CYLINDER HEAD GASKET

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

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

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

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

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

- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50-70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

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

VISUAL TEST METHOD

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

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

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

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

CHEMICAL TEST METHOD

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

REMOVAL - CYLINDER HEAD

(1) Perform fuel system pressure release procedure before attempting any repairs (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(2) Disconnect negative battery cable.

(3) Remove power steering/air conditioning drive belt (Refer to 7 - COOLING ACCESSORY DRIVE / DRIVE BELTS - REMOVAL).

(4) Raise vehicle on hoist.
CYLINDER HEAD (Continued)

(5) Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).
(6) Disconnect exhaust pipe from exhaust manifold.
(7) Remove right front wheel.
(8) Remove accessory drive belt splash shield.
(9) Remove generator belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(10) Remove crankshaft vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
(11) Remove lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).
(12) Lower vehicle and remove upper torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).
(13) Remove ground strap and power steering hose support clip from engine mount bracket.
(14) Remove power steering pump assembly and set aside.
(15) Support engine from beneath with a suitable jack.
(16) Remove right side engine mount to bracket through bolt.
(17) Remove the lower engine mount bracket bolt. Raise engine slightly and remove the upper engine mount bracket bolts.
(18) Remove the engine mount bracket. This procedure may require additional raising/lowering of engine until bracket will clear engine components (Refer to 9 - ENGINE/ENGINE MOUNTING/ENGINE MOUNT BRACKET - REMOVAL).
(19) Remove front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).
(20) Rotate engine until timing marks are aligned.
(21) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).
(22) Remove timing belt tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER & PULLEY - REMOVAL).
(23) Remove camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).
(24) Remove rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).
(25) Disconnect fuel line at fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
(26) Remove coolant recovery container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL).
(27) Remove ground strap to cylinder head.
(28) Remove upper radiator hose.
(29) Remove intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
(30) Disconnect ignition coil electrical connector.
(31) Remove ignition coil and spark plug cables from engine.
(32) Remove make-up air hose from cylinder head cover.
(33) Disconnect cam sensor and engine coolant temperature (ECT) sensor electrical connectors.
(34) Remove heater tube to cylinder head attaching fasteners.
(35) Remove heater hose from thermostat housing connector.
(36) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
(37) Remove cylinder head bolts.
(38) Remove cylinder head and gasket (Fig. 14).

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

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

Remove all gasket material from cylinder head and block (Refer to 9 - ENGINE - STANDARD PROCEDURE). Be careful not to gouge or scratch the aluminum head sealing surface.

Clean all engine oil passages.

INSPECTION
(1) Cylinder head must be flat within 0.1 mm (0.004 in.) (Fig. 15).
(2) Inspect camshaft bearing journals for scoring.
(3) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
(4) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 16). (Refer to 9 - ENGINE - SPECIFICATIONS) Replace guides if they are not within specification.
(5) Check valve guide height (Fig. 17).
Fig. 14 Cylinder Head Assembly

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

Fig. 15 Checking Cylinder Head Flatness

1 - FEELER GAUGE
2 - STRAIGHT EDGE

Fig. 16 Checking Wear on Valve Guide—Typical

1 - TOP
2 - MIDDLE
3 - BOTTOM
4 - CUT AWAY VIEW OF VALVE GUIDE MEASUREMENT LOCATIONS
EXAMINING CYLINDER HEAD BOLTS

NOTE: The cylinder head bolts should be examined BEFORE reuse. If the threads are necked down, the bolt(s) should be replaced (Fig. 18).

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.

(1) Clean the cylinder head and cylinder block sealing surfaces (Refer to 9 - ENGINE/CYLINDER HEAD - CLEANING).
(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. 19). This will ensure that no piston-to-valve contact occurs upon installation of cylinder head in the event of camshaft rotation.

(5) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.
(6) Before installing cylinder head bolts, the threads should be oiled with engine oil. The 4 shorter bolts 164 mm (6.45 in.), are to be installed in positions 7, 8, 9, and 10 (Fig. 20).
(7) Tighten the cylinder head bolts in the sequence shown in (Fig. 20). Using the 4 step torque turn method, tighten according to the following values:

First:
- All bolts to 34 N·m (25 ft. lbs.)

Second:
- Bolts 1-6 to 68 N·m (50 ft. lbs.)
- Bolts 7-10 to 49 N·m (35 ft. lbs.)

Third:
- Bolts 1-6 to 68 N·m (50 ft. lbs.)
- Bolts 7-10 to 49 N·m (35 ft. lbs.)

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

Fourth:
- Tighten all bolts in the specified sequence an additional 90° (1/4 Turn)

(8) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
(9) Install heater hose to thermostat housing connector.
(10) Install heater tube to cylinder head attaching fasteners.
(11) Connect cam sensor and engine coolant temperature (ECT) sensor electrical connectors.
CYLINDER HEAD (Continued)

Fig. 20 Cylinder Head Tightening Sequence

(12) Connect make-up air hose to cylinder head cover.
(13) Install ignition coil and spark plug cables. Connect coil electrical connector.
(14) Install intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
(15) Install upper radiator hose.
(16) Install ground strap to cylinder head.
(17) Install coolant recovery container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - INSTALLATION).
(18) Connect fuel line to fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
(19) Install rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).
(20) Install timing belt tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER & PULLEY - INSTALLATION).
(21) Install camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).
(22) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).
(23) Install front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).
(24) Install engine mount bracket (Refer to 9 - ENGINE/ENGINE MOUNTING/ENGINE MOUNT BRACKET - INSTALLATION).
(25) Position engine and install right side engine mount to engine mount bracket through bolt. Tighten bolt to 118 N-m (87 ft. lbs.). Remove jack from beneath engine.
(26) Install power steering pump assembly.
(27) Install power steering hose support clip and ground strap to engine mount bracket.

(27) Install power steering hose support clip and ground strap to engine mount bracket.

(28) Install upper torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT INSTALLATION).
(29) Raise vehicle on hoist.
(30) Install lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT INSTALLATION).
(31) Install crankshaft vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
(32) Install accessory drive belts (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(33) Install accessory drive belt splash shield and front wheel.
(34) Connect exhaust pipe to exhaust manifold. Tighten fasteners to 23 N-m (200 in. lbs.).
(35) Lower vehicle and fill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).
(36) Connect negative cable to battery.
(37) Perform torque strut adjustment procedure (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - ADJUSTMENTS).

CYLINDER HEAD COVER

REMOVAL

(1) Disconnect make-up air (Fig. 21) and PCV (Fig. 22) hoses from cylinder head cover.
(2) Remove ignition coil and spark plug cables (Fig. 23).
(3) Remove cylinder head cover bolts.
(4) Remove cylinder head cover.