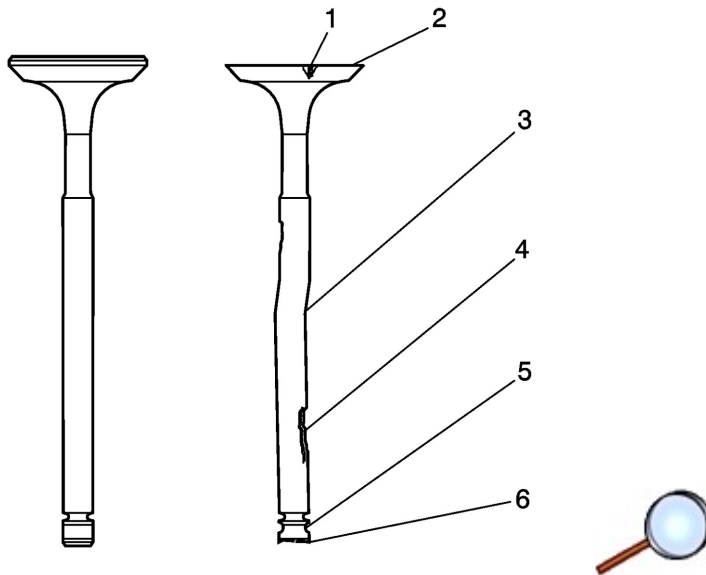


Cylinder Head Cleaning and Inspection

Special Tools

- J 7872 Magnetic Base Dial Indicator
- J 22738-B Valve Spring Tester
- J 28410 Gasket Remover

Valve Cleaning and Inspection



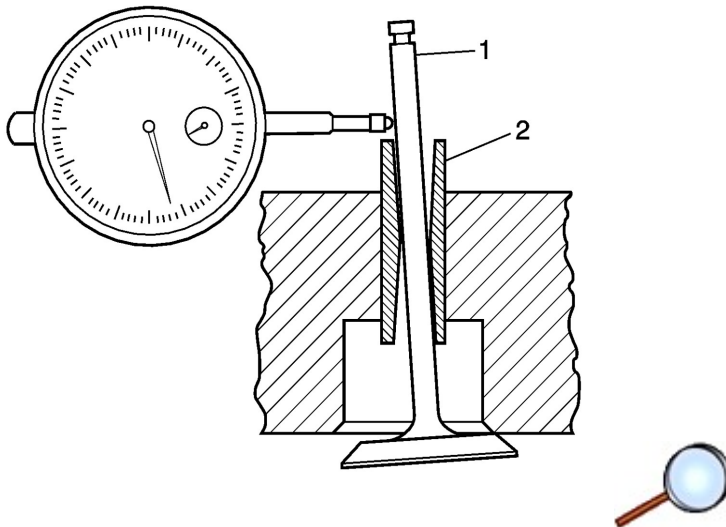
Note: Do not use a wire brush on any part of the valve stem.

Note: Do not grind or condition the intake valve. If the intake valve is out of specification, replace the valve.

1. Clean the valves of carbon, oil and varnish. Use a soft bristle wire brush to clean any carbon build-up from the valve head. Varnish can be removed by soaking in Parts Immersion Solvent. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).
2. Clean the valve guides.
3. Inspect the valve stem for pitting or wear (4).
4. Inspect the valve keeper groove for chipping or wear (5). Replace the valve if chipped or worn.
5. Inspect the valve face for burning or cracking (1). If pieces are broken off, inspect the corresponding piston and cylinder head area for damage.
6. Inspect the valve stem for burrs and scratches. Burrs and minor scratches may be removed with an oil stone.
7. Inspect the valve stem for straightness (3) and the valve head for bending or distortion using V-blocks. Bent or distorted valves must be replaced.
8. Clean the deposits from the valve face. Inspect the valve face for grooving.
9. Replace the valve if the face is grooved. Valve faces cannot be machined. If worn, or damaged, the valves must be replaced.
10. Replace the valve if the valve head O.D. and chamfer (2) is worn or out of specification. Refer to [Valve and Seat Grinding](#).
11. The valves may be lightly lapped to the valve seats.

12. Replace the valve if the valve tip (6) is worn.
13. If no apparent wear, pitting, grooving, or distortion is present, perform the valve measurement and reconditioning procedure to verify valve specification. Refer to [Valve and Seat Grinding](#).

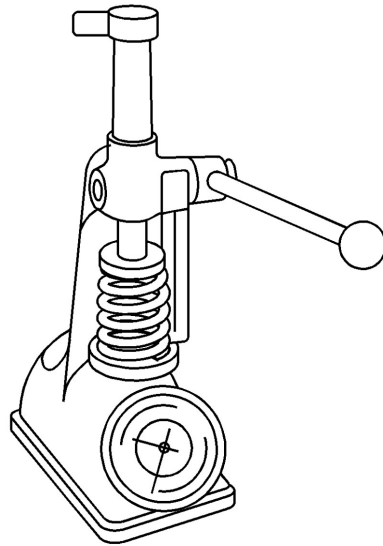
Valve Guide Measurement



1. Measure the valve stem (1)-to-guide (2) clearance. Excessive valve stem-to-guide clearance may cause an excessive oil consumption and may also cause a valve to break. Insufficient clearance will result in noisy and sticky functioning of the valve and will disturb the engine assembly smoothness.
2. Clamp the J 7872 dial indicator to the cylinder head at the camshaft cover rail.
3. Locate the dial indicator so that the movement of the valve stem from side to side, crossways to the cylinder head, will cause a direct movement of the indicator stem. The dial indicator stem must contact the side of the valve stem just above the valve guide.
4. Drop the valve head about 0.064 mm (0.0025 in) off the valve seat.
5. Use light pressure when moving the valve stem from side to side in order to obtain a clearance reading. Refer to [Engine Mechanical Specifications](#) for proper clearance.
Note: Valve guide wear at the bottom 10 mm (0.390 in) of the valve guide is not significant to normal operation.
6. If the clearance for the valve is greater than specifications and a new standard diameter valve stem will not bring the clearance within specifications, replace the cylinder head.

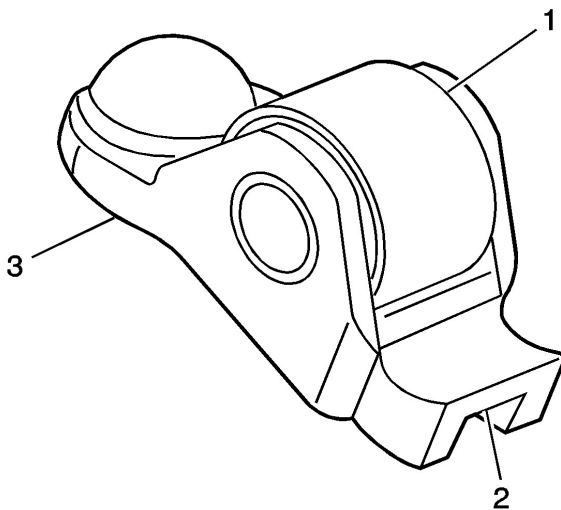
Valve Spring Cleaning and Inspection

1. Clean the valve springs in solvent.
Warning: Refer to [Safety Glasses Warning](#).
2. Dry the valve springs with compressed air.
3. Inspect the valve springs for broken coils or coil ends.



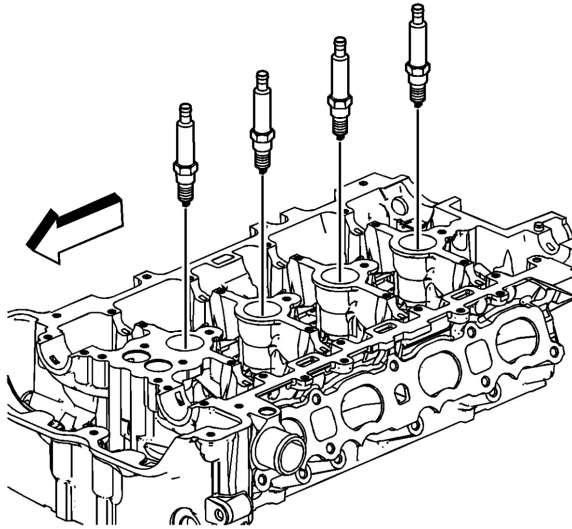
4. Measure the valve spring tension using the J 22738-B tester . Refer to [Engine Mechanical Specifications](#).
5. If low valve spring load is found, replace the valve springs. DO NOT use shims to increase spring load. The use of shims can cause the valve spring to bottom out before the camshaft lobe is at peak lift.

Valve Rocker Arm Cleaning and Inspection

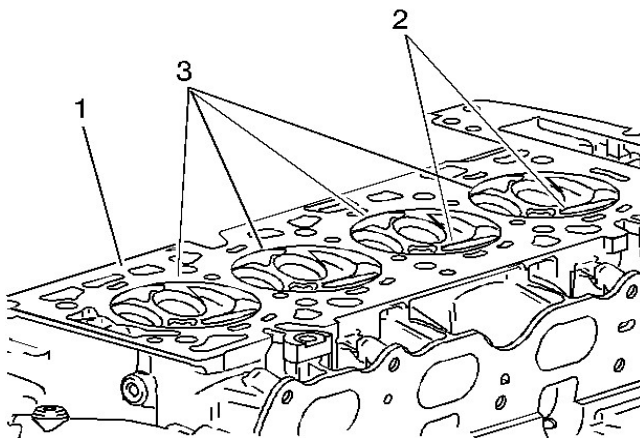


1. Inspect the camshaft follower roller (1) for the following:
 - Flat spots
 - Excessive scoring and pitting
 - Ensure the roller spins freely
2. Inspect the camshaft follower valve tip area (2).
3. Inspect the camshaft follower stationary hydraulic lash adjuster (SHLA) pivot area (3).
4. Replace the camshaft follower or followers as necessary.

Cylinder Head and Gasket Surface Cleaning and Inspection



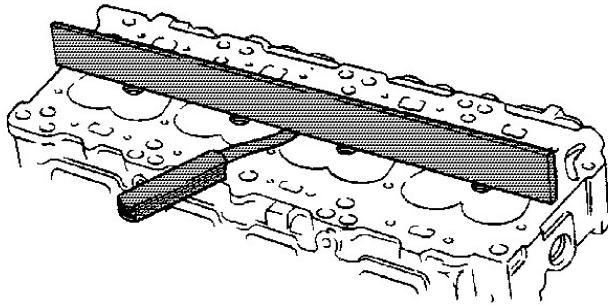
1. Remove the spark plugs.
2. Inspect the cylinder head gasket and mating surfaces for leaks, corrosion, and blow-by. If the gasket has failed, use the following faults to determine the cause:
 - Improper installation
 - Loose or warped cylinder head
 - Missing, off location or not fully seated dowel pins
 - Corrosion in the seal area around the coolant passages
 - Chips or debris in the cylinder head bolt holes
 - Bolt holes in the cylinder block not drilled or tapped deep enough



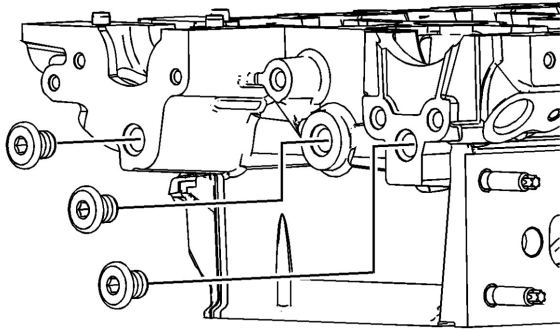
3. Inspect the cylinder head gasket surface.
 - The cylinder head may be reused if corrosion is found only outside a 4 mm (0.375 in) band around each combustion chamber (1).
 - Replace the cylinder head if the area between the valve seats is cracked (2).
 - Replace the cylinder head if corrosion has been found inside a 4 mm (0.375 in) band around each combustion chamber (3).
4. Clean the cylinder head bolts.

Note: Do not use a wire brush on any gasket sealing surface.

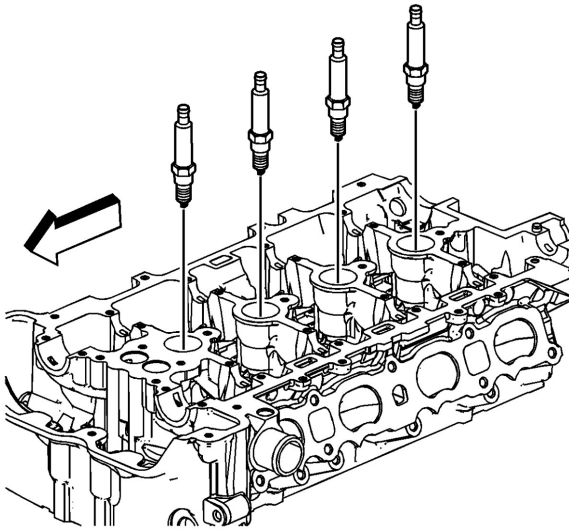
5. Remove the sealant from the rear cap mating surfaces with J 28410 gasket remover or equivalent. Care must be used to avoid gouging or scraping the sealing surfaces.
 6. Inspect the intake camshaft bearing rear caps for damage.
 7. Inspect the rear bearing mating surfaces for damage.
 8. Inspect the remaining bearing caps for damage.
 9. Clean the cylinder head. Remove all varnish, soot and carbon to the bare metal.
 10. Clean the valve guides.
 11. Clean the threaded holes. Use a nylon bristle brush.
 12. Clean the remains of the sealer from the plug holes.
 13. Inspect the cylinder head bolts for damaged threads or stretching and damaged heads caused by improper use of tools.
 14. Replace all suspect bolts.
 15. Inspect the cylinder head for cracks. Inspect between the valve seats and in the exhaust ports.
- Note:** Do not attempt to weld the cylinder head; replace it.
16. Inspect the cylinder head deck for corrosion, sand inclusions and blow holes.



17. Inspect the cylinder head deck surface for flatness. Refer to [Engine Mechanical Specifications](#). If the cylinder head is out of specification, replace the cylinder head. Do not machine the cylinder head.
18. Inspect all the threaded holes for damage. Threads may be reconditioned with thread inserts.
19. Inspect the sealing surfaces.



20. Inspect the cylinder head plugs.



21. Install the spark plugs and tighten to **20 N•m (15 lb ft)**.