Modern Automotive Technology
Chapter 51
Engine Top End Service
Learning Objectives

- Check for cylinder head damage.
- Describe how to correct worn valve guides, warped cylinder heads, damaged valve seats, and other troubles.
- Grind valve seats and valves.
- Assemble a cylinder head.
- Inspect, test, and service valve train assemblies.
- Adjust engine valves.
- Describe safety practices that must be followed while performing engine top end service.
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1. Interference Angle is set on the valve grind machine.

2. Valve Train Noise (either a Tapping or clattering noise) is caused by the rockers striking the valve stems.
Interference Angle

Valve is ground one degree less than the valve seat to aid seating and sealing
Top End Assembly
3. Magnafluxing is the process used to find cracks in cast iron parts.

4. A Valve Job involves the service of the cylinder head and valve train.
Dye penetrant is used on aluminum—dye penetrant is sprayed on the part, then developer is sprayed on, turning cracks red.
Crack Detection

Magnafluxing is used on cast iron parts—uses magnetism and metal powder to highlight cracks.
Common Valve Problems
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5. Knurling a Valve Guide is a Machine shop operation used to press indentations in the guide to reduce its inside diameter.

6. Valve Seat Runout occurs when the seat is not centered around the valve guide.
Measuring Valve Guide
Valve Stem Clearance

Dial indicator can be used to measure clearance
Knurling a Valve Guide

Reduces guide inside diameter to restore proper stem-to-guide clearance
Reaming a Valve Guide

Enlarges guide for an oversize valve stem
Three-Angle Valve Job

First cut cleans and reconditions area below seat.

Second cut cleans and reconditions area above seat.

Three or four revolutions of cutter produce a precision seat.
Seat Contact Patterns

Exhaust valve

1/64" (0.4 mm) overhang

3/32" (2.4 mm) contact area

Intake valve

1/64" (0.4 mm) overhang

1/16" (1.6 mm) contact area
Adjusting Contact Area

60º cut narrows the seat and moves it up, while a 15º cut moves it down.
Checking Seat Runout

Dial indicator reading equals runout.
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7. Valve Lifter-Down Rate is measured by timing how long it takes to push the plunger to the bottom of its stroke under controlled conditions.

8. Cylinder Head Milling is a machine shop operation done to correct head warpage.
Valve Adjustment

- Adjustment is critical to performance and service life
- If a valve train is too tight, a valve may be held open, causing burning
- If a valve train is too loose, noise and damage may result
Adjusting Hydraulic Lifters—Engine Off

- Valve train on base circle
- Lobe away from lifter or rocker
- Clearance when valve open
- Remote starter switch
- Crank engine
Adjusting Mechanical Lifters

- Adjusting screw
- Locknut
- Airjet valve

Do not force feeler gauge
Measuring Cylinder Head Warpage

Thickness of feeler gauge that fits under straightedge equals warpage
Measuring Cylinder Head
Warpage

Check across the head at these angles
Milling a Cylinder Head

Machining operation removes metal from the deck to correct warpage
Milled Cylinder Head

Allows for good head gasket sealing
9. Valve Spring Shims are used to maintain correct tension when the springs are installed on the cylinder heads.

10. A Valve Grind Gasket Set typically includes a head gasket(s), intake and exhaust manifold gaskets, and valve seals.
Valve Spring Squareness

Not more than 1/16" (1.6 mm) variance while rotating spring
Valve Spring Free Height and Tension

Measure the length of each spring with no pressure, then compress to specified height and read pressure scale.
Spring Installed Height

Distance from the top of the spring to the bottom, when installed on the head. If reading is too high, “shim” the valve.
Valve Spring Shim

Restores spring pressure, preventing valve float
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