Engine Repair

Cylinder Head Service

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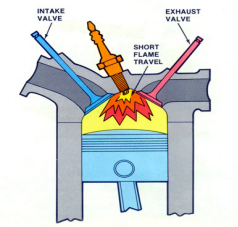
Engine Repair

Cylinder Head Design

- The size of the combustion chamber affects the compression ratio
- The shape of the combustion chamber helps to control the combustion process
  - cross-flow design
  - hemispherical
  - wedge
  - high swirl or masked
  - stratified charge



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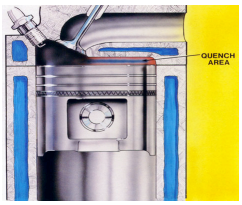
Combustion Chamber Design

- Quench areas are cooler areas within the combustion chamber
- Quench areas may be used to reduce detonation
- Quenching is always present near colder engine components and may result in excessive HC emissions
- Combustion chamber designs can increase cylinder turbulence to promote better combustion



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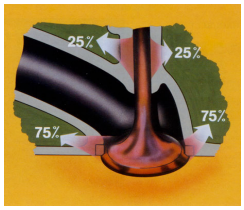
Valve Cooling

- The valve's head is exposed to the combustion process
  - 75% of the heat is dissipated through the valve seat
  - 25% of the heat is dissipated through the valve guide
- A narrow valve margin will overheat and cause premature valve failure
- A narrow valve margin may also become red hot and cause detonation



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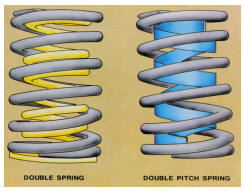
Valve Spring Types

- Special valve spring assemblies are used to increase strength and reduce spring resonance and vibration
  - variable rate springs
  - double spring
  - double pitch springs



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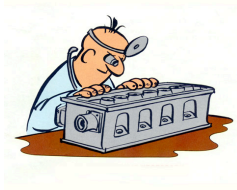
Cylinder Head Inspection

- machining begins after cleaning and a careful inspection
- cylinder heads are checked for
  - cracks
  - warpage
  - valve guide wear



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Checking Surface Finish

- Surface finish systems of measurement:
  - RMS - Root Mean Square
  - RA - Roughness Average
- A surface finish rougher than 125 RMS has too many peaks and valleys on the metal's surface to seal properly and a surface finish smoother than 60 RMS, it may create sealing problems

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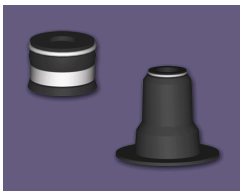
Valve Guide Seals

- valve guide seals prevent excess oil from being drawn into the combustion chamber
  - umbrella
  - positive
- valve guide seals are always replaced during cylinder head service
- valve guide seals may be replaced on car by pressurizing the cylinder to keep the valves in place with the springs removed



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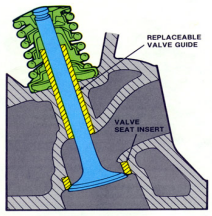
Replaceable Valve Guides

- replaceable valve guides and seats are used to extend valve guide and seat life
- the components are replaced when worn beyond factory specifications



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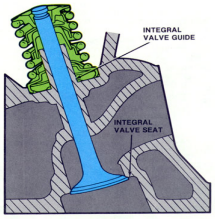
Integral Valve Guides

- Worn integral valve guides can be
  - machined oversize for use with oversize valves
  - have replaceable guides installed
  - knurled



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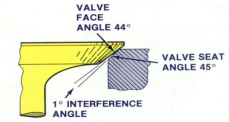
Interference Angle

- the valve face and valve seat are ground at angles with a difference of 1 degree
- this interference angle promotes proper sealing at normal engine operating temperatures and helps to prevent carbon buildup on the valve face and seat



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Machining Valves

- follow the valve resurfacing equipment's instructions carefully
- remove the minimum amount of material necessary to correct surface damage and true the valve's face
- if the valve margin is less than specification after machining the valve must be replaced
- remember to machine the valve for a one degree interference angle

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Machining Valve Seats

- valve seat resurfacing is done after the valve guides have been inspected, measured and reconditioned
- valve seats machined to
  - remove any seat damage and restore proper seat angles
  - properly position the valve face in the valve seat
  - insure proper valve guide to seat alignment

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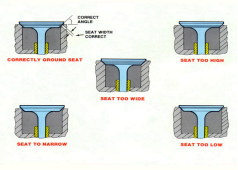
Valve Seat Angles

- valve seats use three angles to control valve seat width and valve face contact
- proper valve seat width is normally 1/16”
- the valve seat should contact the valve face near the center of the valve’s face



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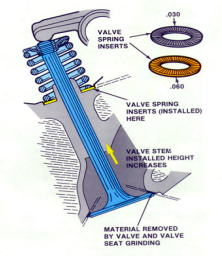
Valve Spring Tension

- machining the valve seat and valve will increase the valve stem installed height
- shims may be necessary to maintain proper spring tension



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Valve Stem Installed Height

- machining the valve seat and valve will increase the valve stem installed height
- if the height exceed specifications the valve stem tip will need to be machined