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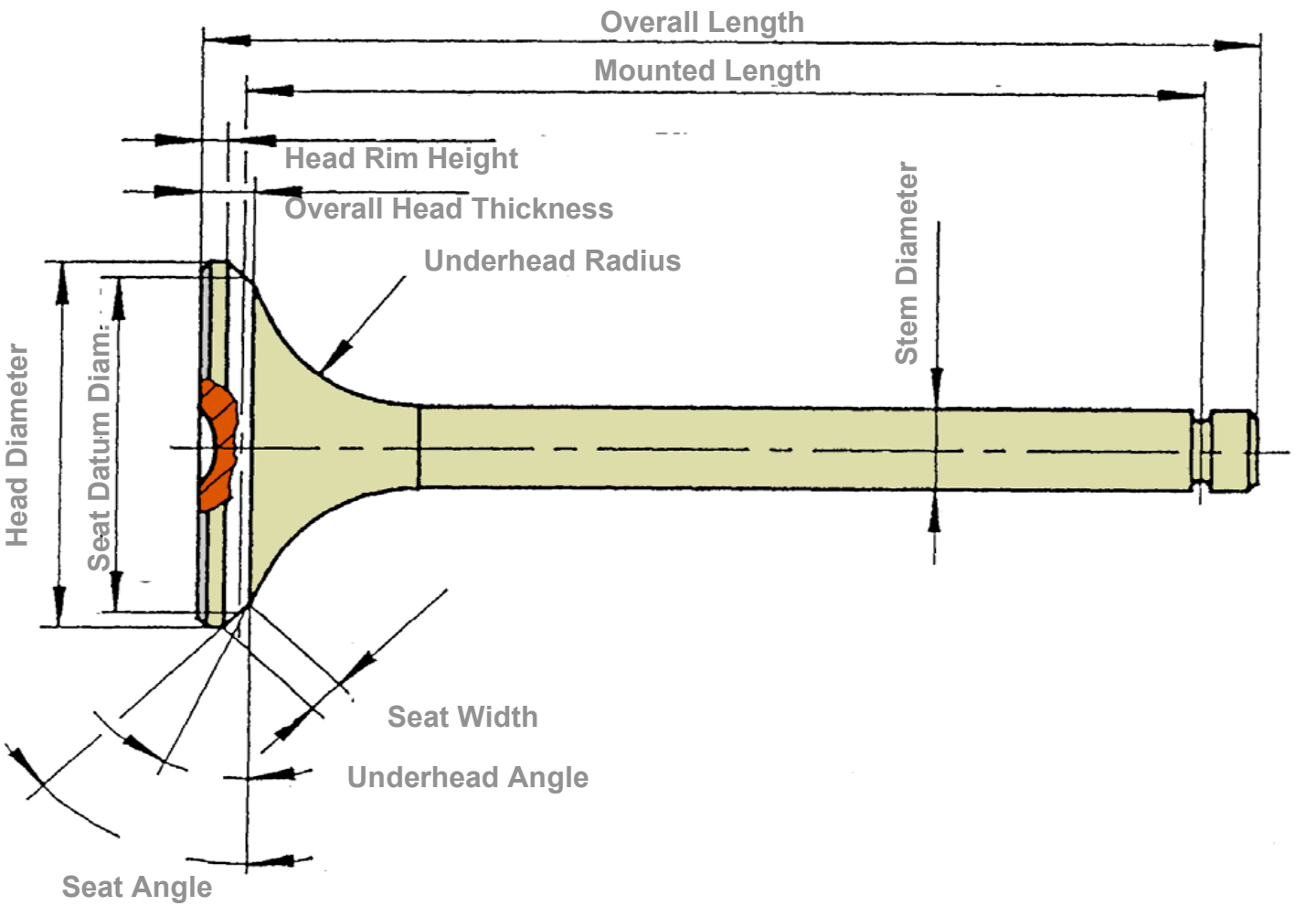
Valve Terminology:



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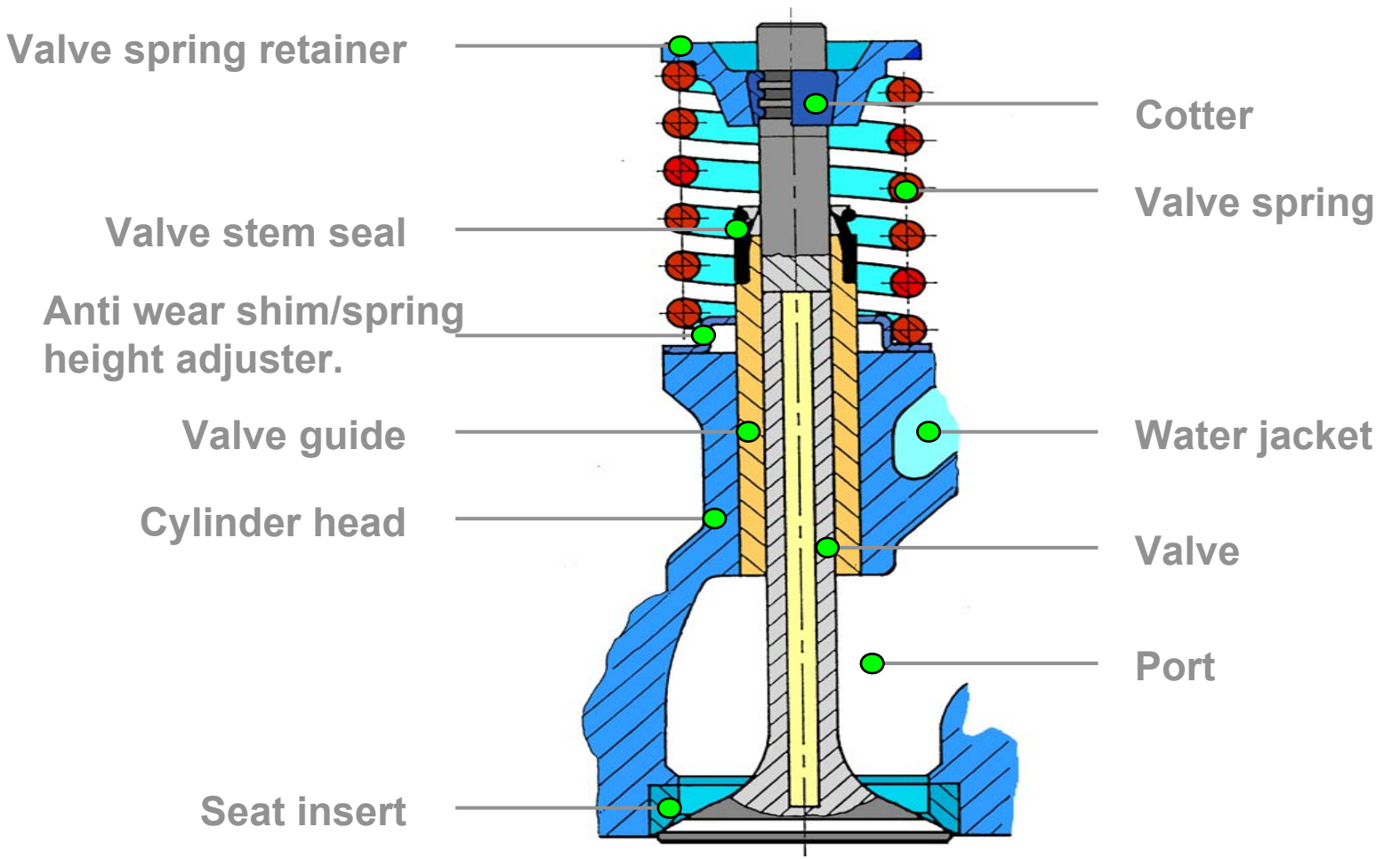
Valve Assembly:



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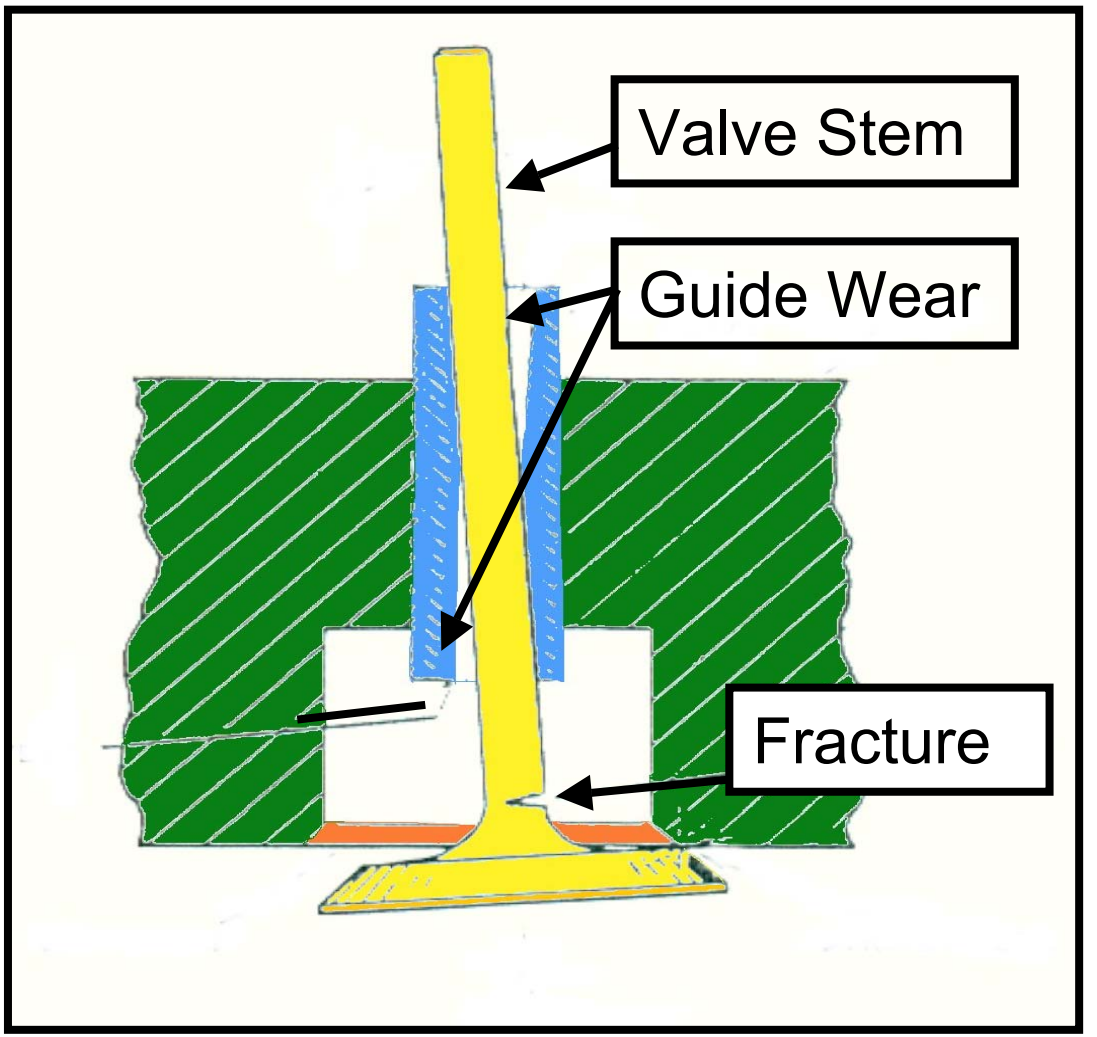
Valve Stem Breakage



Typical causes:
Excessively worn valve guide that fails to assist the valve to close squarely on the seat.

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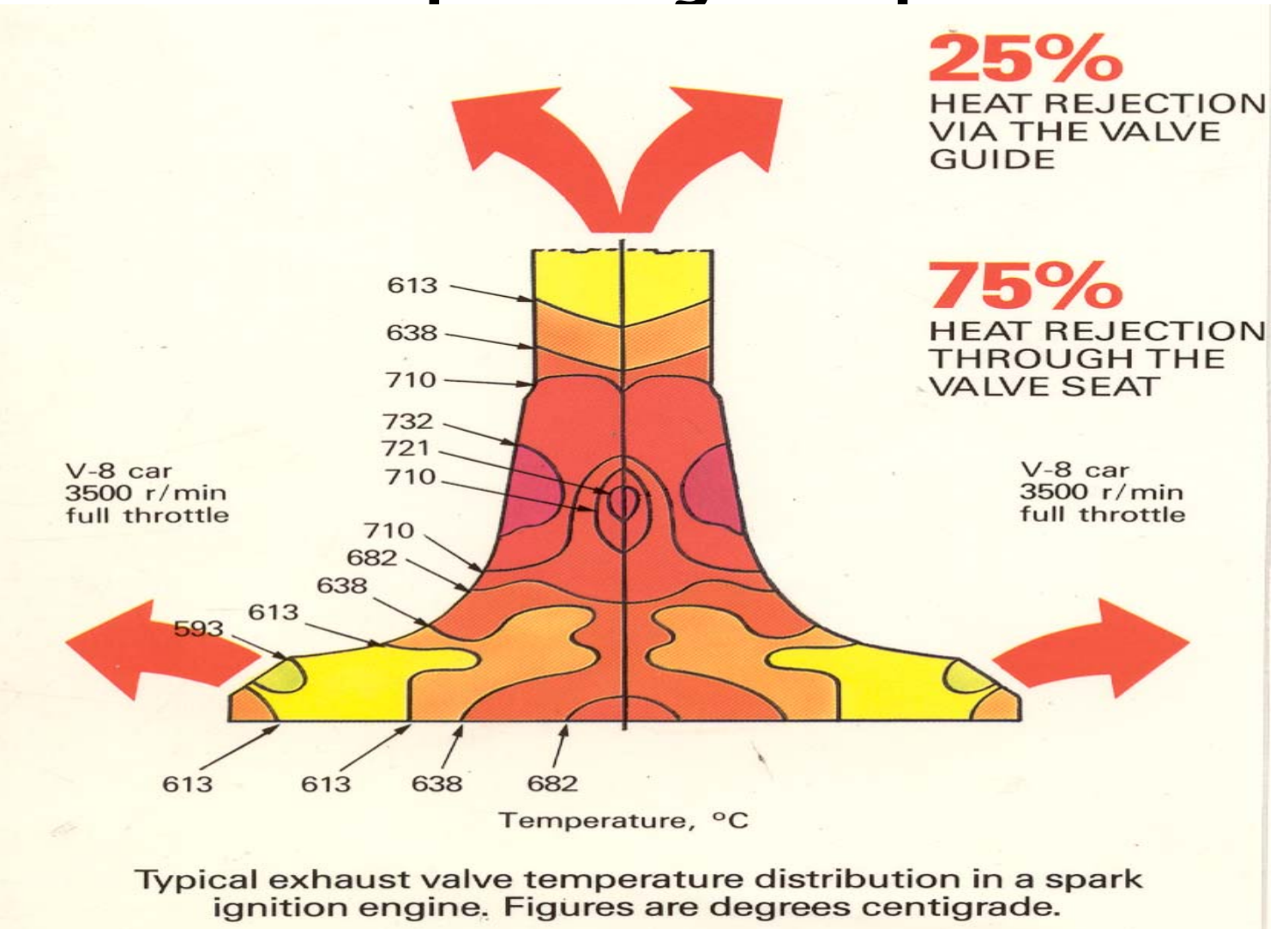
Valves - Operating Temperatures:



Typical exhaust valve temperature distribution in a spark ignition engine. Figures are degrees centigrade.

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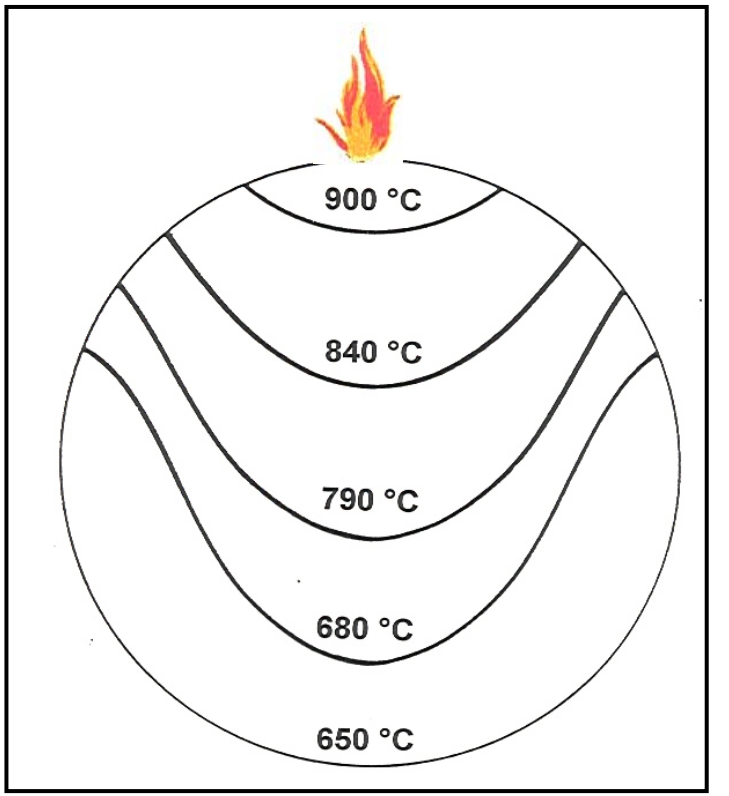
Burnt Valve Seat:

Typical causes:

- Incorrect valve clearance.
- Damage/deposits on valve seat.
- No valve rotation.



Temperatures on valve head due to combustion gas leakage.

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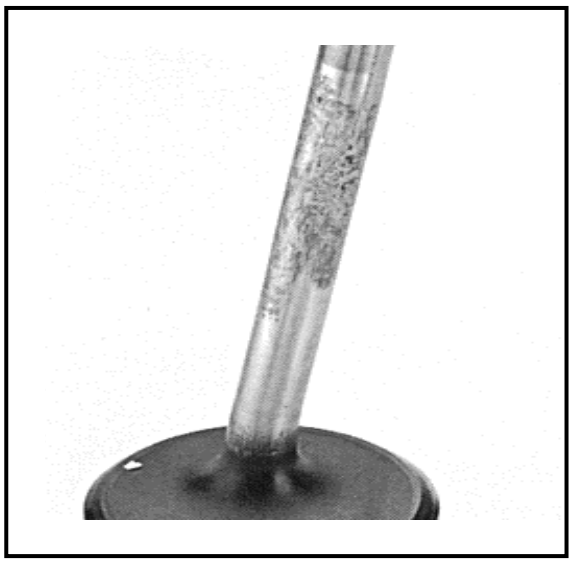
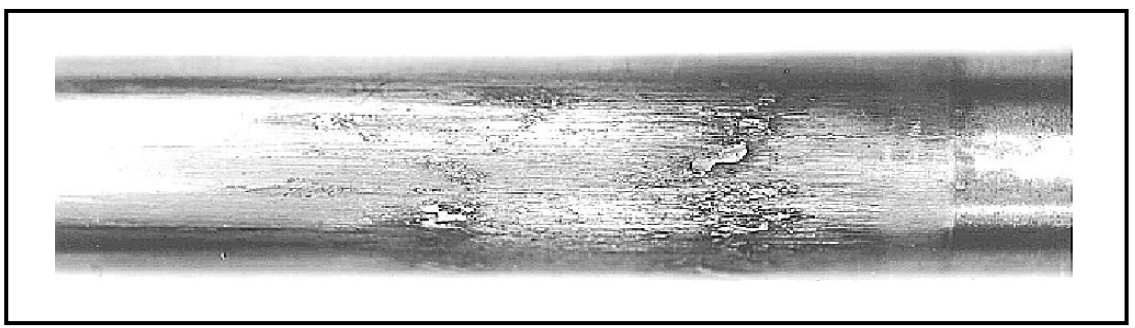
Valve Stem to Valve Guide Seizure:

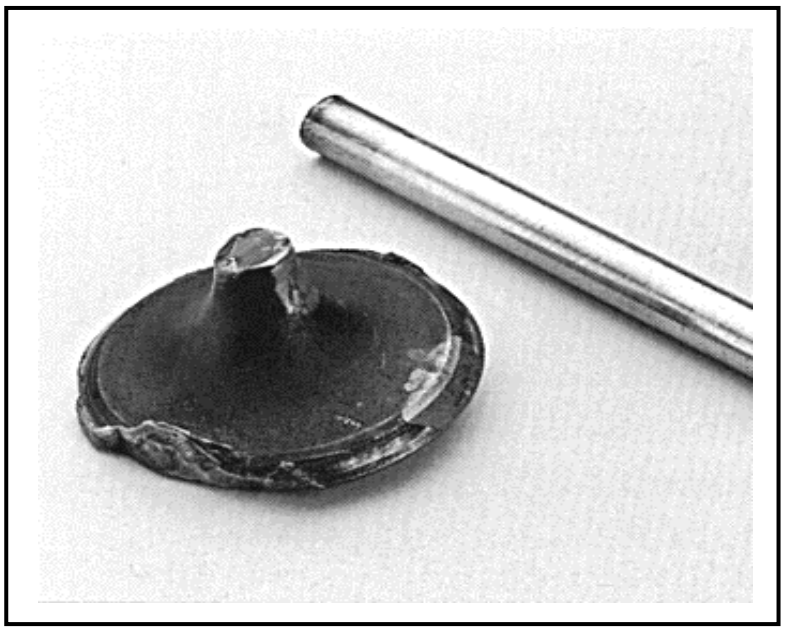




Typical causes:

- Insufficient clearance, resulting from failure to check diameter of valve guide bore after replacement.
- Contaminated oil.
- Overheating.
- Insufficient lubrication.
- Bent valve stem.

Mechanical Damage:



Typical causes:

- Impact with piston "foreign" component.
- Excessive valve spring pressure.
- Excessive valve guide wear.

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Excessive Valve Stem & Valve Guide Wear:

Typical causes:

(a) Incorrect stem to guide clearances, usually fitted with two much clearance, resulting in bell-mouthing of the guide.

(b) Excessive carbon packing of the port end of the guide, leading to stem scuffing.

(c) Scoring and scuffing of the stem due to lack of oil or breakdown of the oil film.

(d) Abrasive wear from foreign bodies trapped between stem and guide, for example residual carborundum particles after overhaul.

(e) Temporary lack of coverage by the engine lubrication supply when starting a cold engine in sub-zero temperatures.

(f) Misalignment of valve guide to valve seat, resulting in high side loading.

(g) On rocker operated valves, excessive side thrust due to incorrect valve height after overhaul - i.e. valve heavily recessed due to too much metal removal from valve seat and face. Incorrect fitting of special high lift cams which affects the rocker geometry.

(h) A bent valve stem.

(i) A badly worn valve tip - this increases side loading.

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Bent valve:

Typically caused by:

- Incorrect valve clearance.
- Incorrect piston protrusion value.
- Foreign object in combustion chamber.

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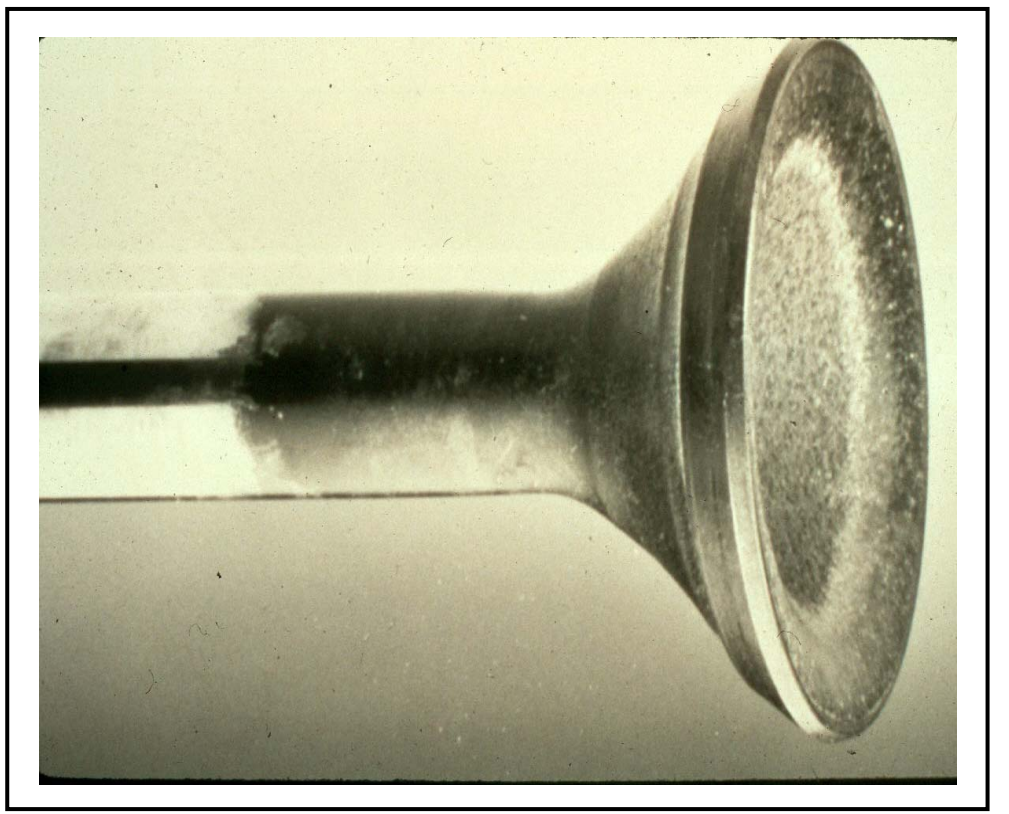
Cupping:



Caused by:

Abnormal operating temperature conditions, combined with excessive valve spring pressure/high velocity impact seating.

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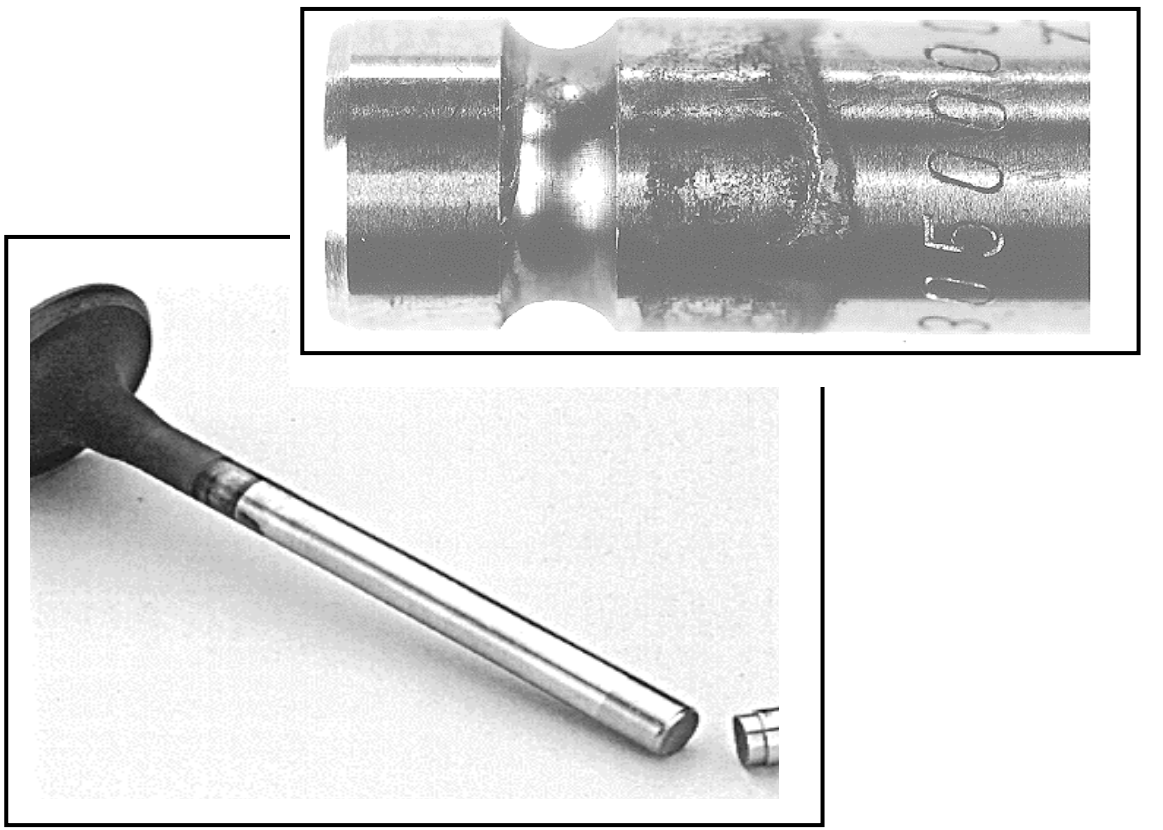
Valve Tip Breakage:



Typical causes:

- Poor valve train alignment due to re-use of worn cotters and associated valve train components.

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Radial Cracking of Valve Head:

Typical causes: extreme thermal cycles (continual sudden changing from full power to shutdown), damage on valve seat/seat insert producing stress raisers or mechanical overload due to valve bounce.
Symptom: Rough running, loss of compression & poor starting.
Remedy: Check all valves for cracking and replace where necessary, check engine settings, valve springs, guides and followers.
Do not overpeed the engine.

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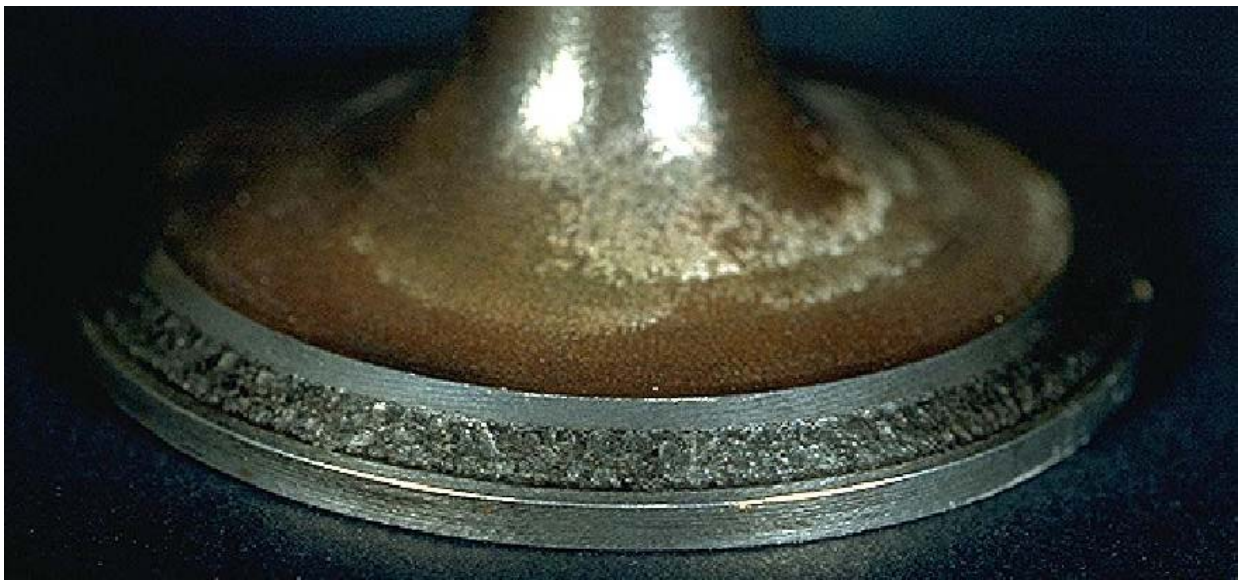
Valve Seat Erosion.



Typical causes: solid particles (often carbon deposits) trapped between the valve and seat.
Symptom: rough running, loss of compression & poor starting.
Remedy: check all valves and replace where necessary, identify the cause (usually combustion related) and rectify.

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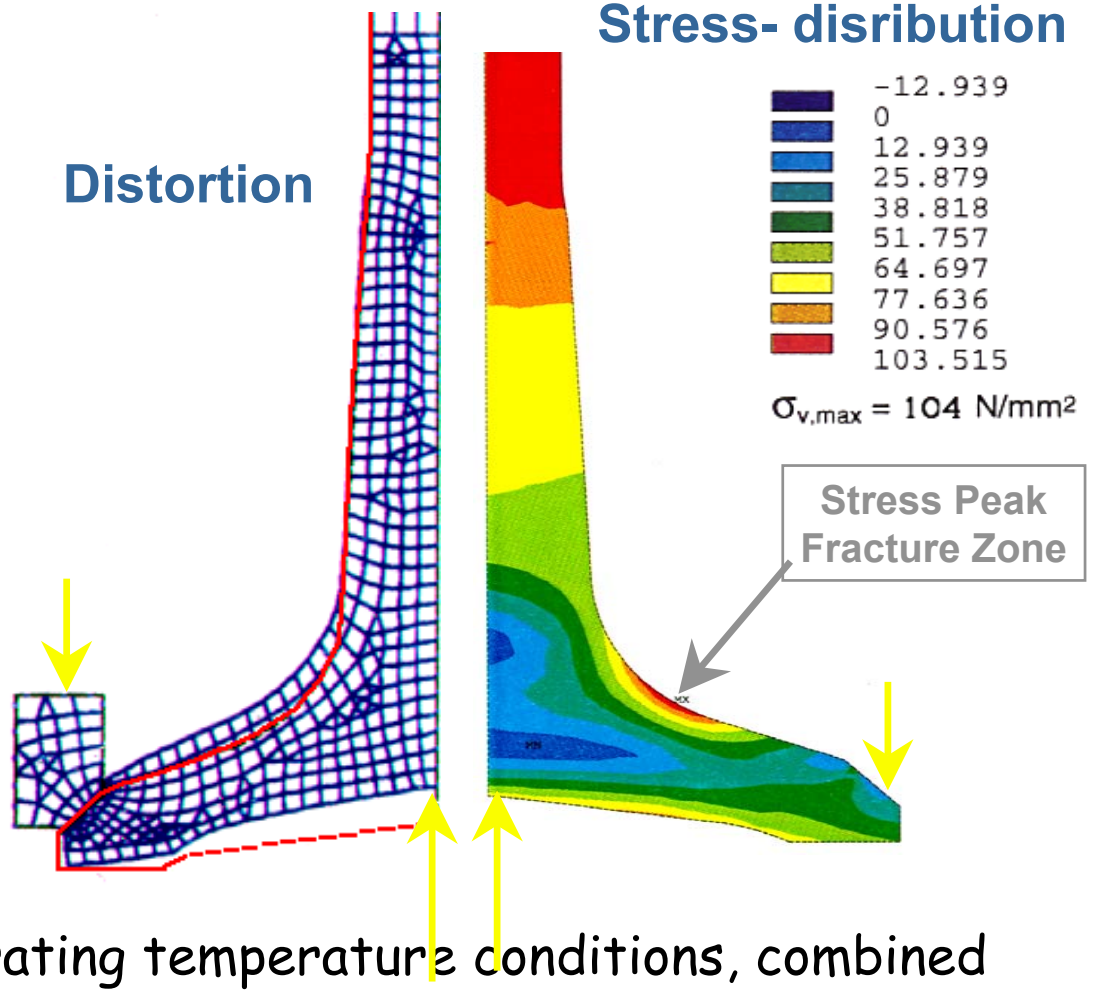
Overload on Valve Head:



Typical causes: Abnormal operating temperature conditions, combined with excessive valve spring pressure/high velocity impact seating.

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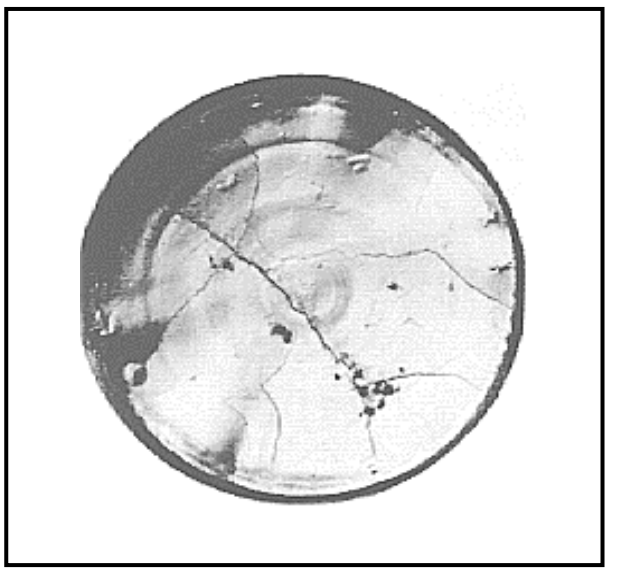
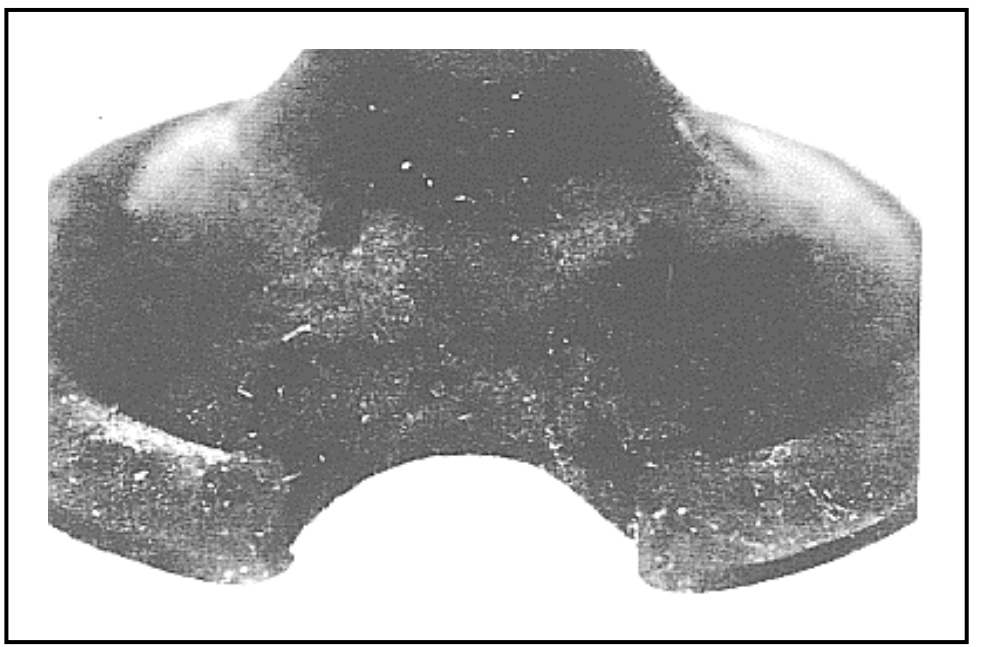
Effects of Incorrect Valve Clearance:

Valve clearance too large:



Cracked stem tip

Valve clearance too small:



Burnt valve seat

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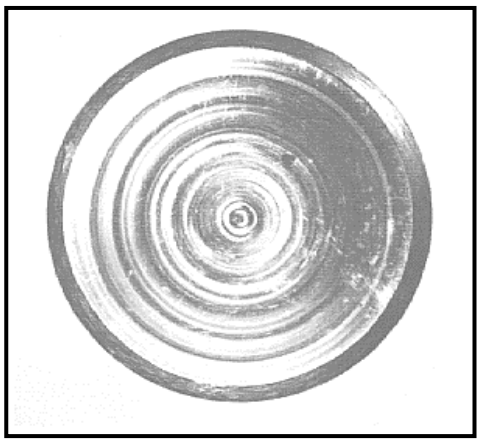
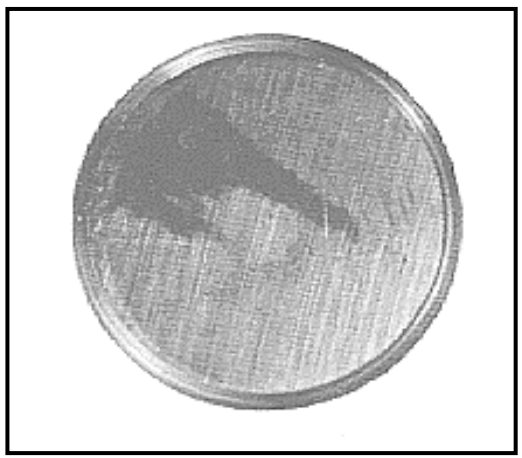
Effect of Incorrect Valve Rotation:

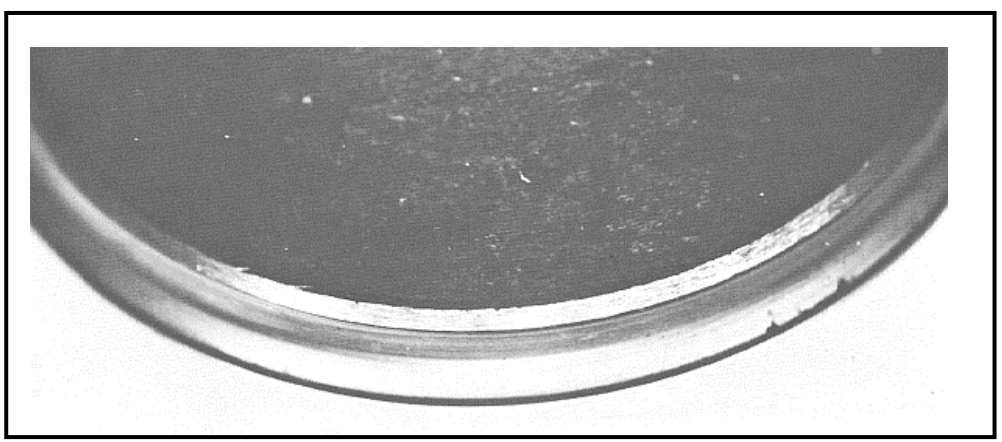
Excessive valve rotation

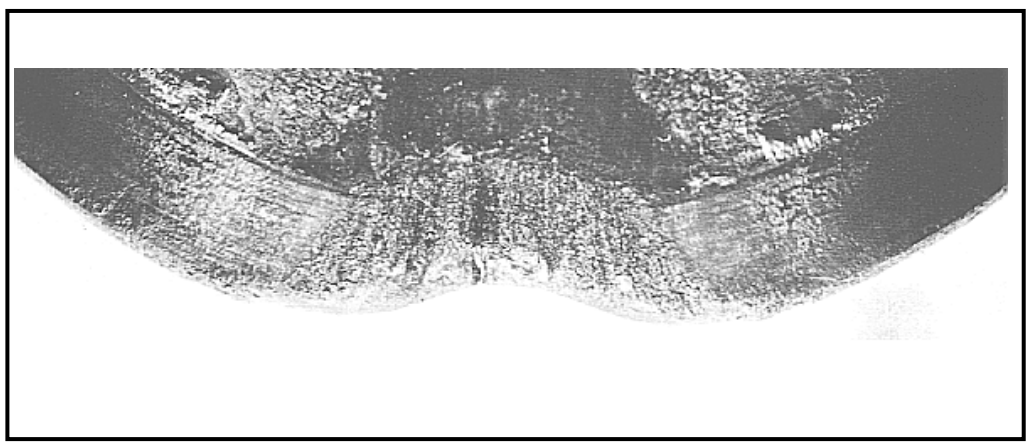


No valve rotation



Valve tip





Valve seat

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Valve guides - Interference Fit in the Cylinder Head:

The interference fit of valve guides in aluminium and cast iron heads varies due to the differences in the coefficient of expansion (aluminium having a greater coefficient of expansion than cast iron). Generally, a valve guide installed in an aluminium head will require greater interference than if installed in a cast iron head.

1. Cast iron and bronze valve guides in a **Cast iron cylinder head**: .001" to .0015" (0.025 to 0.038mm).

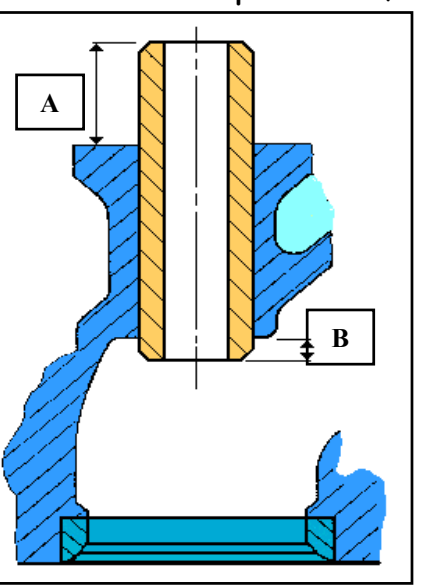
2. Cast iron and bronze valve guides in an **Aluminium cylinder head**: .0015" to .002" (0.038 to 0.051mm).

3. All heads especially aluminium heads should be evenly warmed up to around 150° Celsius prior to valve guide insertion to enable the valve guide acceptance bore (in the head) to achieve maximum expansion.

4. If possible the valve guides should be pre cooled to achieve maximum contraction. Cooling methods: deep freeze, liquid nitrogen (preferred) or plumber's pipe freeze spray.

5. By following the above instructions the valve guides will almost drop into place thereby preserving the carefully factory machined bore size and surface finish both of which will ensure maximum service life of the component.

6. **In all cases** the valve guide bore should be measured **after** fitting to ensure the correct valve stem to valve guide clearance.



• Measure valve guide protrusion in the direction of the valve spring (**A**) and also into the port (**B**) before removing 'old' guides. Install replacement guides in the same position.
• Excessive valve guide protrusion in the direction of the valve spring (**A**) may result in the spring retainer/collets fouling the valve guide. Conversely, excessive protrusion into the port (**B**) can affect gas flow and temperature transfer characteristics of the valve/guide..

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Valve to Guide Clearance Guidelines:

(mm)	Inlet valve (µm)	Exhaust valve (µm)
Stem dia. 6 - 7	10 - 40	25 - 55
Stem dia. 8 - 9	20 - 50	35 - 65
Stem dia. 10 - 12	40 - 70	55 - 85