

Stem breakage through collet groove



Symptom: Excessive mechanical noise, bent stem and possible head detachment.
Cause: Poor assembly allowing uneven loading. Poor handling, dropping etc. Bouncing the valve after fitting by hitting the tip with a hammer. Valve bounce from excessive seating velocity.
Remedy: May not be possible due to extreme damage this failure can cause, however: Check seats, guides, springs, pistons and bores for damage and repair where necessary. Do not overspeed the engine.

Scuffed/sticking valve stem



Symptom: Poor performance due to low compression. Mechanical breakage due to sticking valves.
Cause: Marginal lubrication from inadequate valve to stem clearance, causing scuffing or metal transfer. This may ream out the valve guide leading to the second cause, excessive oil from too great a clearance carbonising on the stem to cause sticking.
Remedy: Ensure the valve stem to guide clearance is to specification. Ensure the correct valve stem seals have been used. Replace worn components where necessary.

Radial cracking of valve head, leading to a triangular segment breaking off



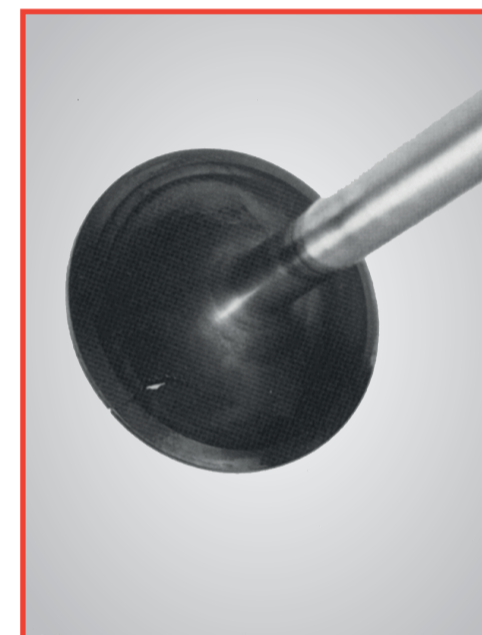
Symptom: Sudden mechanical noise. Rough running. Possible seizure.
Cause: Poor temperature distribution across the valve head resulting in high tensile stresses in the rim, often combined with severe deflection due to abnormal combustion pressures and temperatures. Extreme thermal cycles, (continual sudden changing from full power to shut-down). Damage marks on the rim producing stress raisers. Mechanical overload from valve bounce.
Remedy: Check the remaining valves for signs of cracking, replace where necessary. Ensure the correct valves have been used. Check engine settings, valve springs, guides and followers. Do not overspeed the engine.

“Gutter“ burnt through valve rim



Symptom: Loss of power. Rough running.
Cause: Valve clearance too small holding the valve off its seat. Sticking stem, poor/uneven seating or misalignment of the valve assembly. Overheating from pre-ignition. Excessive build up of carbon which flakes off the valve face to form a gas leakage path. Hard carbon particles peen into the seat surface until enough indentations line up to form a gas leakage path.
Remedy: Ensure valve clearance is to specification. Check stem to guide clearance and for any misalignment of the valve assembly. Check engine timing, carburettor settings and injection timing.

Blow hole through valve head, starting from a radial crack



Symptom: Rough running. Loss of compression. Poor starting.
Cause: Similar to a segmental breakage, but gas escapes through the crack and burns a hole. Extreme thermal cycles (continual sudden changing from full power to shut down). Damage marks on the rim producing stress raisers. Mechanical overload from valve bounce.
Remedy: Check remaining valves for signs of cracking, replace where necessary. Ensure the correct valves have been used. Check engine settings, valve springs, guides and followers. Do not overspeed engine.

Valve head breaking off stem



Symptom: Rough engine with sudden mechanical noise.
Cause: Mechanical overload, such as seating velocity too high from excessive valve clearances. Valve bounce, valve to piston contact caused by overspeeding, weak or broken valve springs or sticking valve stem. Uneven seating due to misalignment or distorted valve.
Remedy: May not be possible due to extreme damage this failure can cause, however: Check valve springs, guides and alignment and repair where necessary. Check seat guides, pistons and bores for damage. Reset the valve clearances.

Excessive valve stem and guide wear



Symptom: Valve gear noise, high oil consumption, exhaust smoke on initial start up.
Cause: Too great or too small valve stem to guide clearance. Poor valve stem lubrication or ingress of dirt through the air intake system. It should be noted that the cause of this problem is not always obvious. Unless the cause is readily apparent, additional advice should be sought.
Remedy: Ensure correct valve and guides are fitted. Check alignment, valve stem to guide clearances, valve stem seals and lubrication system.

Inlet valve underhead carbon build-up



Symptom: Poor starting. Loss of power. Blue smoke from exhaust (when throttle closed).
Cause: Excessive clearance between valve stem and guide. Valve stem seal failure or wear. Excessive oil supply due to blocked drainage paths. Incorrect grade of lubricating oil used.
Remedy: Check valve stems, guides and stem seals for wear and replace where necessary. Ensure there is no blockage in the engine drainage or breathing systems.

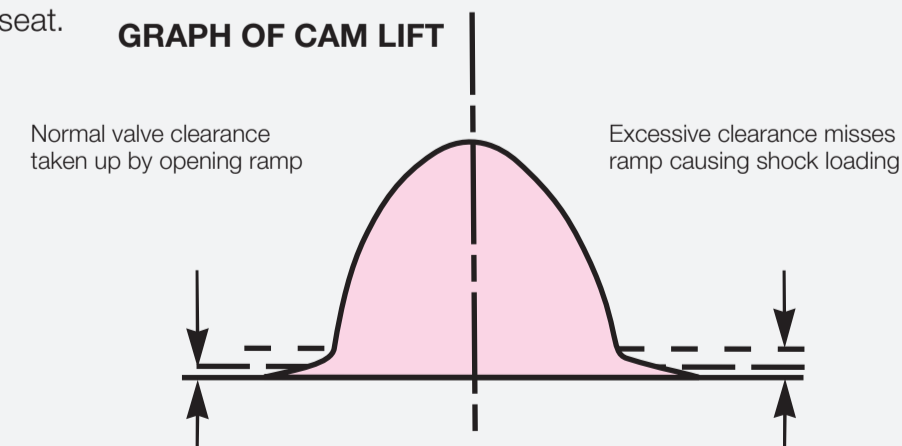
Valve breakages – fracture at lower cotter groove



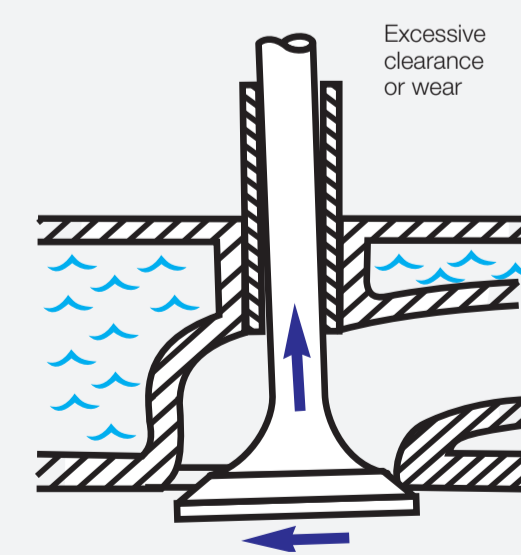
Symptom: Valve breakage shortly after cylinder head rebuild, during initial start-up or during test run.
Cause: Over extension / “pump-up” of hydraulic lifters (photo 1). Incorrect seating of the valve spring to the head (photo 2). Engine over-speed or weak springs.
Remedy: Where possible fit new hydraulic lifters with new valves. Ensure the engine block is thoroughly cleaned to remove all traces of debris. Take extreme care to seat all valve springs correctly in the recess of the cylinder head. Renew engine oil and replace oil and air filters.

VALVE OPERATING CONDITIONS

- Initial valve opening and final valve closing occurs very gently. Cam lobe profiles include lifting and lowering ramps to achieve this.
- Ensure the valve clearances are not too great to prevent the valve being hammered open or dropped onto its seat.

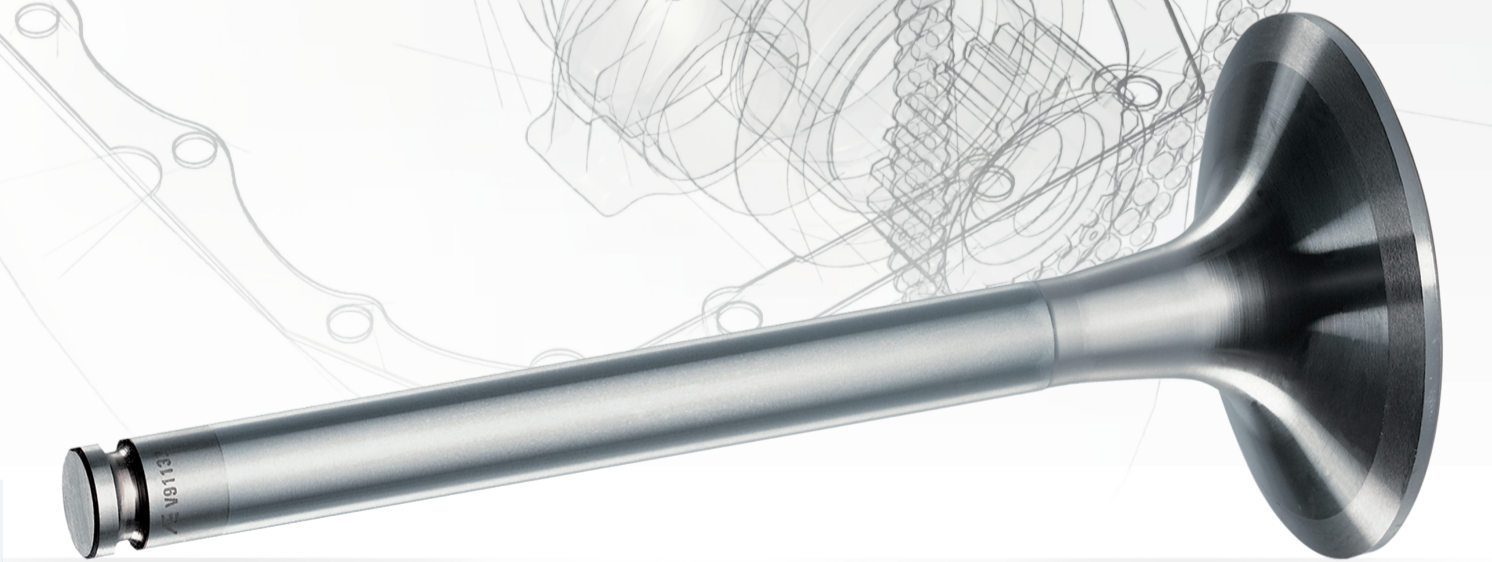
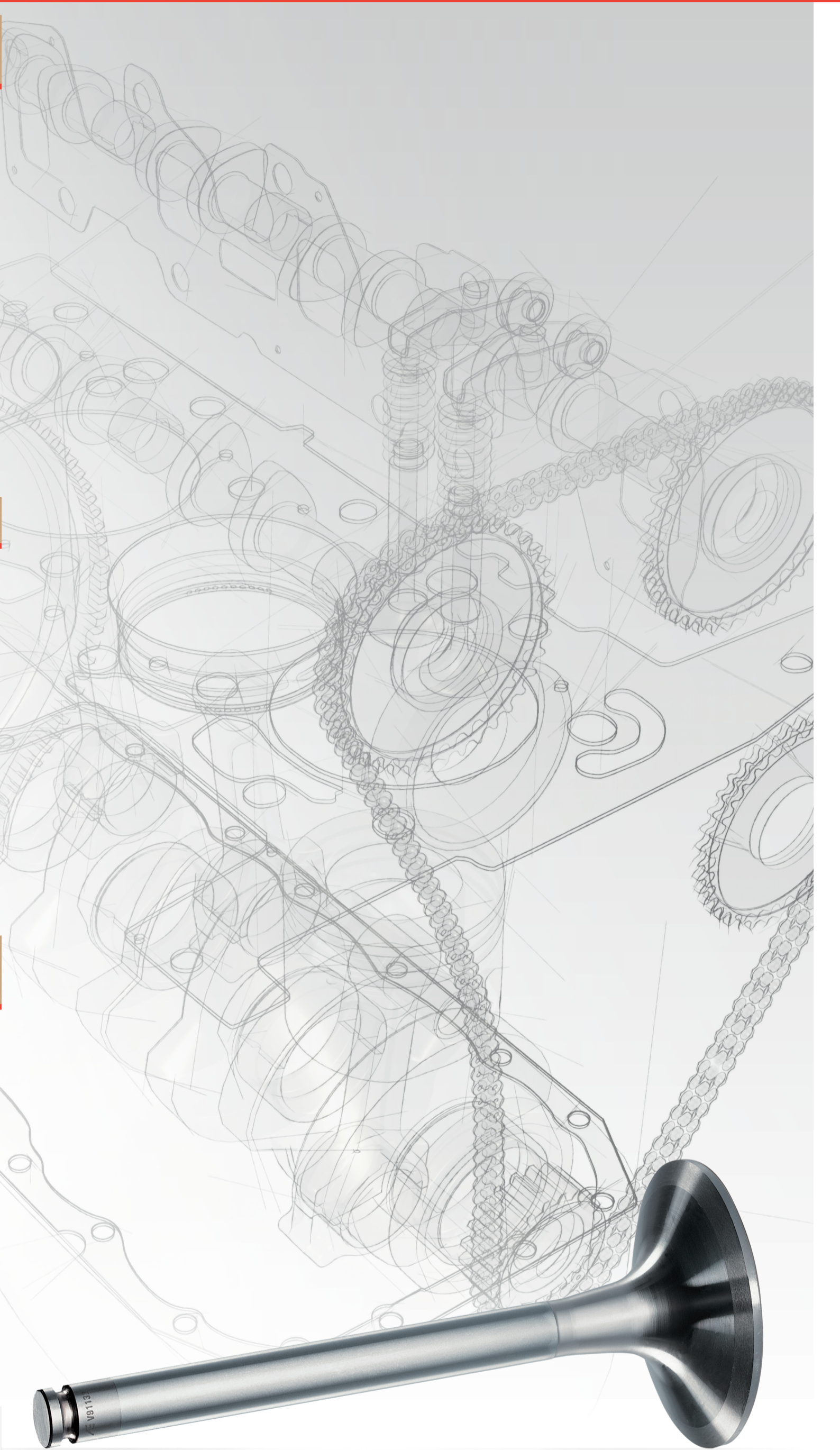
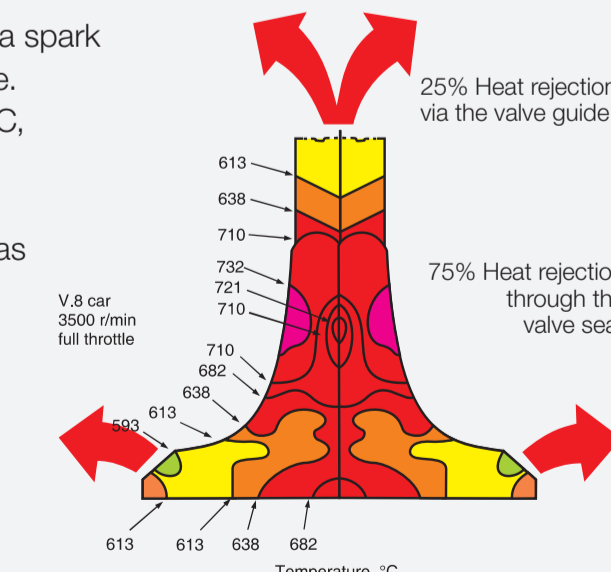


- The valve seat must be concentric with the valve guide. Any eccentricity that exists between the valve seat and guide will force the valve sideways.
- Excessive valve guide wear will occur as a result of this which can lead to a fatigue failure of the valve stem.



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

- An exhaust valve may operate at up to 800 °C, and 75% of its cooling is by transferring heat to the valve seat.
- Ensure the valve seat contact is correct and as specified by the engine manufacturer.



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