

Valve Face Burning

1. Exhaust Valve Guttering - Fig. 1

This refers to exhaust valve burn out that is local; usually in one location or but possibly appears in other areas. The burn out will form a deep channel in the valve head. Radial cracks may develop, or pieces may even break away, depending on the design of the valve head and if left running too long.

With both austenitic valve heads and hard-faced valves (stellite etc.) the likely causes are:

a. Lack of tappet clearance results in light seating and carbon build up on the seating face. Both factors lead to destruction of the thermal heat path outlet from the valve face through the valve seat to the coolant. This causes a considerable rise in valve head temperature, particularly in the valve face area. Eventually, the conditions exceed the material's resistance to hot corrosion or burning. As the localised gas leak increases, so does the torching effect through the gap, eventually producing the characteristic gutter.

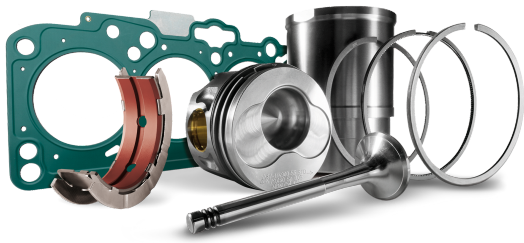
b. High carbon deposit build up between the valve face and seat caused by over-rich combustion, excessive oil consumption, etc. This also destroys the thermal path and ultimately leads to valve burn out. However, partial breakaway of these deposits can accelerate failure by causing localised gas leakage.

c. Nickel based alloys have a high hot corrosion resistance but are weak in the erosion phase when torching occurs. Therefore, their rare but characteristic mode of failure is nearly always a deep gutter due to a local gas leak.



Fig. 1

d. Pre-ignition due to incorrect air/fuel ratio, inaccurate timing or incandescent hot spots on the valve head periphery. These produce high gas loads and localised temperatures, which sometimes lead to guttering. In some engines, piston failure occurs before the valve shows signs of distress.



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2. Inlet Valve Guttering

This is a comparatively rare occurrence and may be due to broad faced burning (see below). This is because some alloy carbon structural steels used for inlet valves exhibit the same burning and erosion characteristics as the nickel based alloys

3. Exhaust Valve Broad-Face Burning - Fig. 2

This applies to burnt valves where there is no deep gutter or local channelling. The affected area extends for a distance around the valve face. The valve material burns or corrodes away more or less evenly. This allows gas to escape through a very narrow gap over a wide area, with resultant loss of performance. Non-hard faced valves are more prone to this, the likely causes of this type of failure are:

a. Misalignment between the valve head and seat brought about by –

- Incorrect alignment of the valve guide to seat
- Inherent valve bridge weakness
- Engine overload
- Valve head distortion due to poor cooling etc.

b. Valve springs too weak.

c. Valve seat insert movement.

4. Inlet Valve Broad-Face Burning

This is rare, but the basic reasons are as listed under exhaust valve broad-face burn



Fig. 2