

Malfunctions

Ring Breaking

Rings can break in engine operation even if not previously damaged during assembly, and there are many reasons for this [39, 42, 43]. Ring breakage can occur on the one hand owing to fringe operating conditions - such as knocking combustion in gasoline and diesel engines, etc. - and on the other due to attendant geometrical conditions - ring closed gap too small, groove axial clearance too large, ring gets caught in the scavenging ports in 2-stroke engines, cross-sections too small especially due to slots in oil rings, special joint designs, etc.

Like with all fracture phenomena, a distinction must be made between overload fractures and fatigue fractures. Typically, a fatigue fracture occurs at the points at which the highest ring closure stress - about 180° from the gap - combines with an excessive pulsating or cyclical bending stress. However, ring breakages - producing relatively small fragments - are also observed near the gap. Furthermore, it is important especially with chromium plated rings to consider the notch sensitivity of the material, as notches are known to generate high localized stress peaks. Chromium coatings have the capacity to generate such notch stresses. Fundamentally it should be noted that with one and the same base material the thicker the chromium plating is, the greater will be the notch formation and the lower the fatigue strength of the rings.

Remedial actions:

- Change to ring designs with higher fatigue strength
 - Use other materials (higher bending strength with the same or not proportionately increased modulus of elasticity)
 - Use other coatings (thickness, material)
- Reduce axial clearances