F1109S01

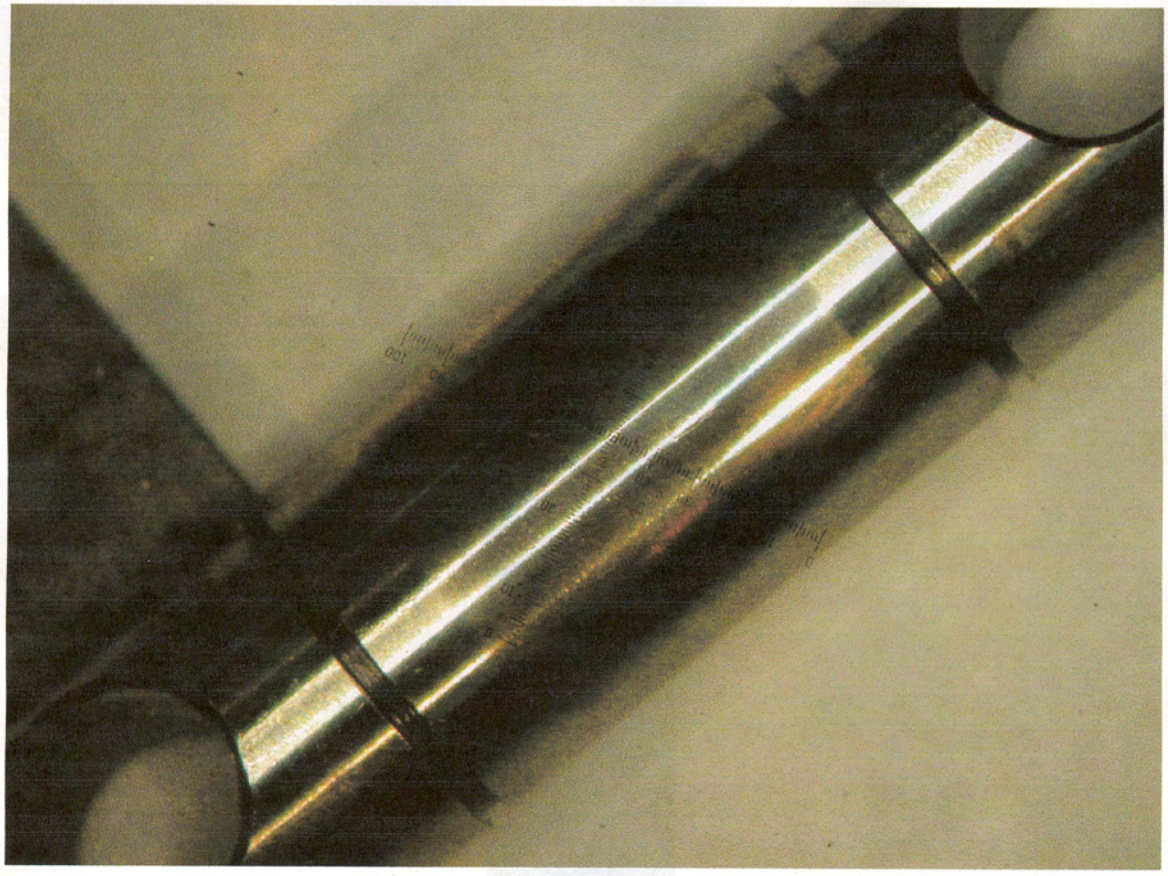
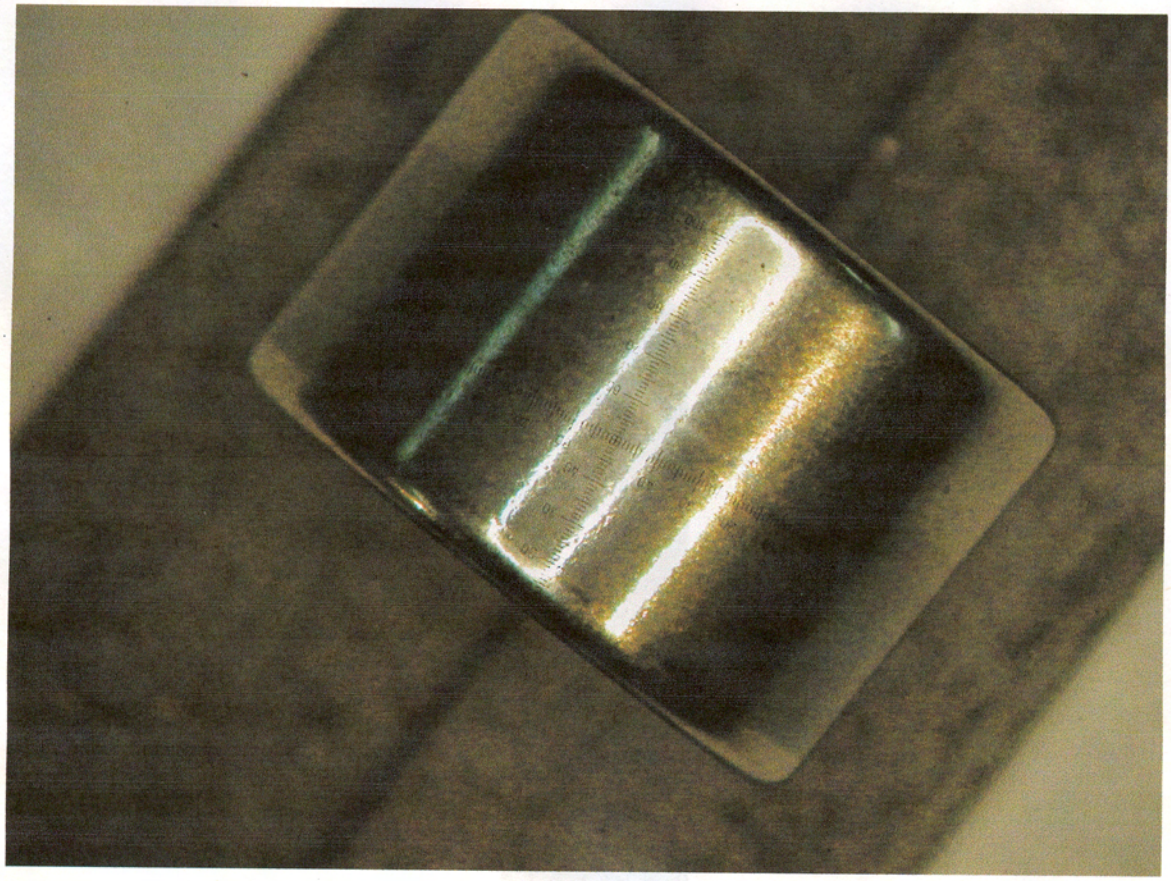


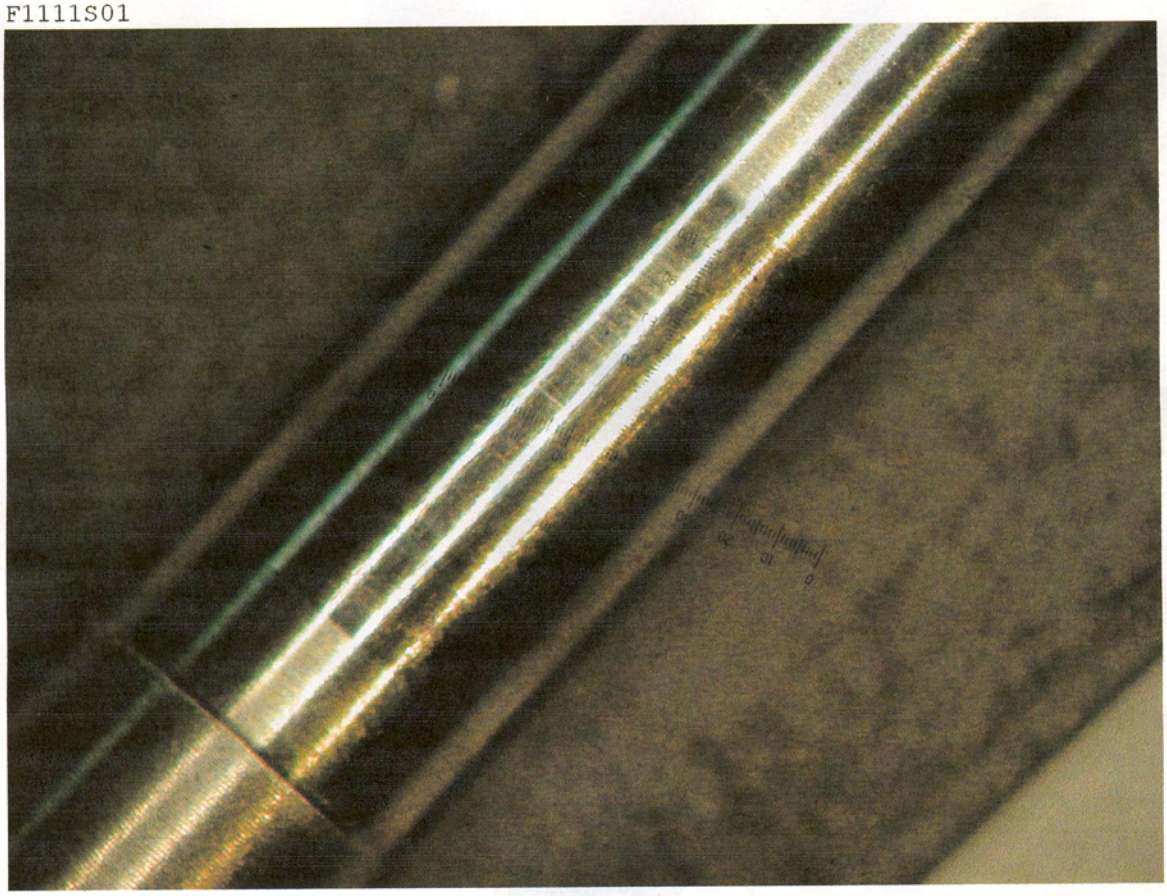
Photo F1109S01 is of the lower (load bearing) surface of the rocker shaft. It shows severe heat damage. Heat damage should not be seen on a rolling element bearing assembly as there is very little friction and the design requires almost no lubrication. Another concern is that there is considerable cold working of the steel for presumably a very low mileage part. One possible explanation for both conditions is that an uncontrolled valve train repeatedly gave an unusually heavy impact when the parts crashed together from either loft or surge. The heat was possible generated from plastic deformation of the shaft. The colors of the affected area show local temperatures of 500°F to 550°F which is extremely high. The heat was apparently generated here at the shaft rather than in the rocker because the rocker body showed no signs of being annealed which would have happened from this high of a temperature.

F1110S01



The roller outer surface shown in this photo has signs of moderate brinelling and some scuffing as well as a small amount of heat generation. None of these things are significant except the fact that they have appeared so early in the part's life. It is not normal to see these conditions accelerated so quickly. The brinelling and scuffing could be attributed to the surge and/or loft conditions outlined above. The scuffing is normally blamed on the roller not rolling but dragging across the valve tip slightly while slightly sticking to the roller pin. Solid rollers are generally past there service limit when opening a valve against a 300# seat pressure spring. This application should use a needle roller.

F1111S01



The roller pin is shown here. It too shows accelerated scuffing and heat generation, contributing to the theory that the solid roller is inadequate for the high spring loads.