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Document No.

Date

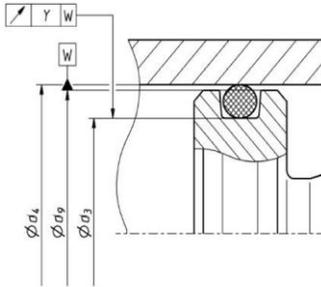
Revision No.

ERIKS Contact

Title

## O-Ring & Backup Failure Analysis

### Application



The O-ring and backup were received into the Tech Center on 7/29/10 for analysis. According to the information received, the O-ring and back up were being used in a static piston seal in nitrogen at temperatures up to 350 °F (177 °C) and pressures up to 10,000psi. The leak occurred when the pressure reached 7,500 psi.

The gland depth is 0.188", width of 0.4125" – corresponding to a compression of (10.5% =  $1 - 0.188/0.21$ ) typical, and stretch ( $5.631/5.6 = 101\% > 1.0$ ).

### Sample Analysis

Figure 1

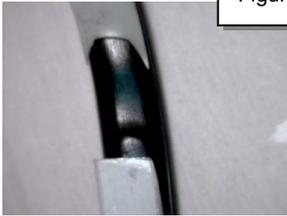


Figure 2

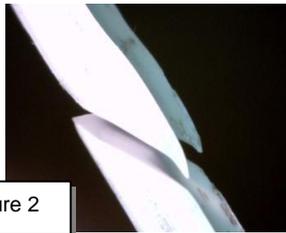
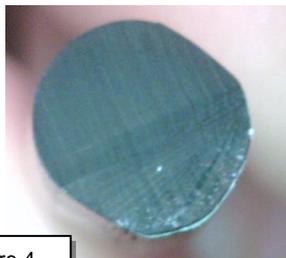


Figure 3



Figure 4



The O-ring experienced a compression set resulting in a radial height of 0.195" and axial width of 0.219" ( $68\% = (1 - 0.195/0.21)/.105$ ). The hardness was measured at 95-100 Shore A and the specific gravity at 1.12.

The backup experienced deformation at the scarf cut suggesting that it might be too large for the gland dimensions. Due to the backup being too large, the scarf cut would overlap itself. When pressurized, the O-ring would push the backup towards the gland wall, pulling the material

On the O-ring, there is an indentation from the backup scarf cut causing an axial gap as well as a radial gap. The axial gap is most likely where the leakage occurred. The material deformation and the compression set suggest that the operating temperature is too high for the HNBR being used.

### Summary & Recommendations

The backup deformation resulted from an overlapping of the scarf cut. This overlapping was most likely caused by the back up being too large for gland. The damage to the O-ring would suggest that it was exposed to high temperatures leading to high compression set. The leak would have occurred at the location of the axial gap caused by the backup scarf cut. An elastomer with better thermal property retention would be recommended in addition to updating the backup dimensions to better fit the in gland dimensions.

The information is, to the best of our knowledge, accurate and reliable to the date indicated. The above mentioned data have been obtained by tests we consider reliable. We don't assure that the same results can be obtained in other labs. Testing in actual service conditions is recommended prior to use.