Machine Tool Compatibility – Seals and Sealing

Achieving machine and seal swell compatibility or making a "machine friendly" fluid is always one of the major goals of reputable metalworking fluid formulators. However, aiming for a "machine friendly" fluid is easier than actually achieving it.

Machine seals, particularly those that are made out of elastomers, are parts that wear and will need to be changed periodically. How long a particular seal lasts will be determined in large part by: how hard it is worked, how it was installed, and by the materials it is in contact with.

Metalworking fluids in general and water soluble products in particular are hard on seals because of the complexity of their formulation and the large variety of chemicals used in their formulation. There are no standards for metalworking fluid seal swell compatibility. However, over the years it has seemed reasonable to use the standards used for hydraulic fluids as they are often on the other side of the seal from the coolant. When testing seals for use with hydraulic fluids, seal swell between 0% and 10% is acceptable. Thus, we use less than 7.5% seal swell for the working solution with a standard NBR-1 (Nitrile) seal for our internal standard (less than 3% is typical).

After more than 70 years of testing both TRIM® products and those of our competitors against different seal materials, we can say with great confidence that not all seals or seal materials are similar and that the specific composition (e.g. percent nitrile content) will make a difference in the performance of the seals. Just because the seal is labeled similarly does not mean that they are equivalents. Our standard testing is done against a battery of standard "O" rings made from six different elastomers.

Our testing indicates that these six different elastomers typically rank in the following order when tested against ours or competitive products at working concentrations. We can recommend seals made from any of the first three materials for good performance as far as metalworking fluid compatibility is concerned, and sometimes one or more of the last three work very well in relation to a specific fluid.

1. Fluorosilicone
2. Fluorocarbon
3. Nitrile (45% nitrile content or better)
4. Silicone
5. Ethylene Propylene
6. Neoprene

NOTES:

1. When testing seals against TRIM coolants at working concentrations, typical seal swell is less for the standard NBR material (less than 3%).

REFERENCES:

1. ASTM D 2000-1
2. ASTM D 471
3. ASTM D 3183
4. ASTM D 5964
5. DIN 51 524
6. DIN 53 521
7. DIN 53 538
8. Zatkoff Seals and Packing Applications Catalogue, Toledo, OH (Parker Hannifin Master Distributor) +1 419-866-1600

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