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## INFLUENCING FACTORS FOR PTFE SEALS

- Hardware Surface Finish & Hardness
- Sealing Jacket Material, Temperature, PV Limit
- Surface Speed, Pressure, Media
- Mating Surface Material Selection
- Mating Surface Coatings
- Design Considerations

Advanced EMC Technologies, manufacturers PTFE based spring energized seals for many various requirements, low friction extreme temperature, chemical compatibility, wear and self lubricating applications.

The purpose of this report is to help select sealing solutions for specific applications. In general PTFE seals with spring energizers can be designed for static, reciprocating and slow to medium rotary service. Our lip seal designs are reserved for high-speed rotary applications with low pressure where friction is of concern.

### 1.0 Hardware Surface Finish & Hardness

The operating life of Fluorolon PTFE seals are greatly influenced by the dynamic surface over which the seal slides. This finish has a direct effect on friction, wear and seal ability. In our testing of PTFE seals over various surface finishes the frictional force increase on an 8RMS vs 32RMS on a Fluorolon 1115, Graphite/PTFE seal, was over 350%. Our recommendation on surface finish is typically a 2RMS to 16 RMS finish depending on applications.

A. Gases and Liquids @ Cryogenic Temp: 2Rms to 4RMS
B. Gases at Non-Cryogenic Temp: 6RMS to 12RMS
C. Liquids: 8RMS to 16 RMS

**1.1** The hardness of the mating surface has a significant effect on seal wear. Adhesion between PTFE and a hard mating surface is lower resulting in reduced friction, thus promotes less wear.

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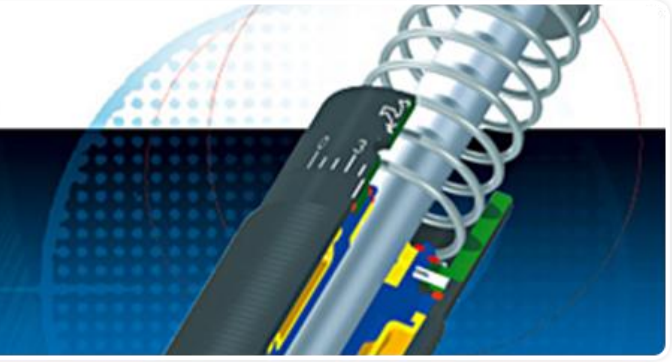
# Energized Teflon PTFE Seals



**2.0** Seal Jacket material should be based on a variety of considerations including media, friction requirements, pressure and velocity wear expectations, operating temperature and cost.

A. The PV is the medium value representing the product of pressure and velocity. The PV limit is extremely important in selecting the proper Fluorolon seal material to obtain maximum reliability and performance.
B. Temperature has a significant effect on the physical properties of the material. As the temperature increases physical properties decline. When temperatures approach the limit of PTFE compounds 550 degrees F, the loss of properties accelerate.

**3.0** Mating surface selection is varied depending on application this choice should consider the compatibility with the seal material. As discussed in 1.0 and 1.1 surface finish and hardness have a significant effect on seal performance. Stainless grades such as 17-4 and 440C have Rc of 40 and 60 when hardened. In addition have good chemical resistance. The selection of hardware can be discussed with your metals supplier to obtain needed specifications.

Many of the hard surface coatings produce lower friction and wear.

A. Hard Chrome - Rc65
B. Dense Chrome - Rc70
C. Electroless Nickel - Rc50 as-plated Rc-62 after HT
D. Plasma - Rc73
E. Gas Nitriding - Rc70

**4.0** Seal wear in dynamic systems is unavoidable. However with careful consideration of frictional issues listed below, we can minimize heat build up and the excessive wear in efforts to maximize seal performance.
The total force to overcome friction in a system is dependent on several factors.

A. Coefficient of friction of the seal material
B. Spring force
C. System Pressure
D. Dynamic Surface
E. Diameter of the dynamic surface

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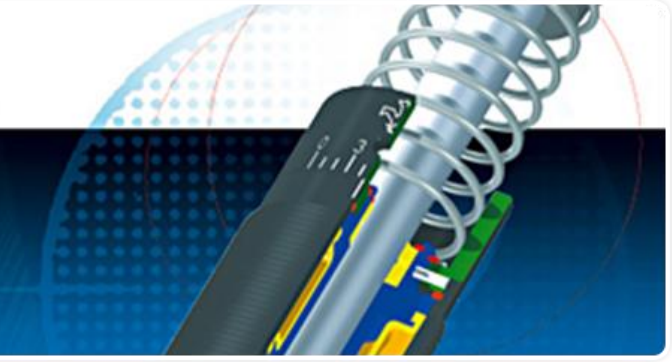

Design considerations in selecting PTFE Fluorolon seals are dimensional as well. The radial clearance between piston and shaft effect seal performance. As system pressures and temperatures increase, the clearance must be reduced to minimize the possibility of seal extrusion. Some very general guidelines are listed below:

A. Pressure of: 150 psi Maximum Radial Clearance: .004
B. Pressure of: 500 psi Maximum Radial Clearance: .004
C. Pressure of: 1000psi Maximum Radial Clearance: .0035
D. Pressure of: 3000psi Maximum Radial Clearance: .0030

**4.1** The Piston/Shaft and Bore Tolerance considerations are significant even though Fluorolon spring energized seals have the ability to compensate for wide tolerances. Optimum results may be obtained when following recommended tolerances. Suggested guidelines may range from +/-.0005 on sizes to .375 dia. On larger sizes from 4.0 dia. And larger the tolerances increase to +/- .003.

This Technical Report is a guideline for improved seal performance on PTFE seals. Selection of Fluorolon seals for particular industry application requires a complete understanding of the criteria the seal will be operating within, along with the factors listed in this report.

It is always are recommendation to test any seal for reliability in your specific application.

We hope this information assists in your engineering design efforts.

**For more information from our design engineers or a Request For Quote contact us today!**
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