Zero Leak Rod Seal Package

Resilon® Polyurethanes Maximize Performance and Extend Cylinder Life

Reliable Solutions:

Parker's combination of advanced seal design technology and material expertise has produced a reliable **zero-leak** rod seal package for hydraulic cylinders for greater equipment output which

- Extends useful cylinder life
- Maximizes equipment uptime, and
- Extends maintenance intervals

Integral to the design of the zero-leak seal package are the characteristics of Parker's Resilon® polyurethane material – with extended temperature range, wear resistance, compression set resistance, and toughness.

Contact Parker to learn about sealing solutions that exponentially extend cylinder life.

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Product Features:

- Zero-leak rod seal package
- High temperature operating range of -65°F to + 275°F
- Up to 5,000 PSI operation
- Seal profiles with knife trimmed sealing lips for zero leak contact points
- Patented Resilon® polyurethane with excellent wear and rebound characteristics
- Available in water resistant formulation

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Advanced Design Technology

Parker rod seal packages are specifically engineered combinations of primary rod seal, buffer seal, wiper and wear ring profiles. Each profile has features complementary to the package as a whole – collectively producing highly effective sealing. It is also imperative to understand that the material characteristics of Resilon® 4300 polyurethane, is as integral an aspect of the overall engineered design of the sealing package as each individual profile's engineered geometry.

Primary Rod Seals

The **BT Profile rod seal** is an unloaded u-cup with secondary stabilizer lip and knife trimmed sealing edge. The angle of the BT lip has been optimized for maintaining a contact force to seal on the rod and maximizing seal life.

Applications: The BT profile is used in high pressure applications where high wear resistance is important.

The **BD Profile rod seal** is a loaded u-cup with a secondary stabilizer lip and knife trimmed sealing edge. The energized lip maintains continuous high contact force against the sealing surface – making it a great choice for optimum low temperature and/or low pressure.

Applications: The BD profile is designed for maximum sealability in low pressure systems where the rod will not be traveling long distances at high speeds.

Buffer Seal

Parker's **BR Pofile** is a buffer seal that fits in front of the primary rod seal. Slotted pedestals and a flexible static side lip allow a check-valve type pressure relief to to prevent a pressure trap. The Nylatron back-up to prevent extrusion.

Applications: The BR removes the adverse effects of pressure spikes on the primary rod seal, thus improving the system's sealing capability.

Wiper

Parker's **AH Profile wiper** is the ultimate metal-clad excluder featuring press-fit installation to prevent O.D. contamination. An aggressive wiping lip, facing the environment, ensures the utmost performance in contaminant exclusion along the rod. The additional sealing lip works in conjunction with Parker rod seals to provide redundant sealing for leakage reduction.

Applications: Heavy duty hydraulic applications.

Application Recommendations	BT Rod Seal	BD Rod Seal	BR Buffer Seal
Excavators	✓		✓
Backhoe	✓		✓
Skid Steers	✓		✓
Material Handling Fork Lift	✓		✓
Bulldozer	✓		✓
Struts	✓		✓
Agricultural		✓	
Aerial Manlift		✓	
Crane		✓	✓

Advanced Material

Resilon® Polyurethanes: Patented PPDI-based formulation

Three Basic Types of Sealing Grade Materials
There are three chemical backbones used in compounding modern thermoplastic polyurethane seal materials: MDI , TODI, and PPDI.

All three backbones produce the abrasion resistance and long wear benefits that are typical of any good polyurethane seal material, however there are additional physical properties, such as heat resistance, compression set resistance, and rebound/resilience, which are required for effective, long-term sealing in critical hydraulic applications.

It is in these latter performance areas that the characteristics inherent to the chemical backbone formulations become most apparent and Parker's patented PPDI- based Resilon® 4300 polyurethane formulation proves as best over-all sealing performance of all commercially available TPU formulations currently on the market.

Rheometric examination of the dynamic behavior of MDI, TODI, and PPDI (4300) were measured under tensile mode and produced the data shown in the chart shown below.

Superior Heat Resistance: The low tangent delta, (Tan δ) values of Resilon PPDI across the practical application range indicate a lower rate of energy loss under loadn addition, the higher temperature upturn of the Tan δ value verifies the higher softening temperature for the Resilon PPDI formulation.

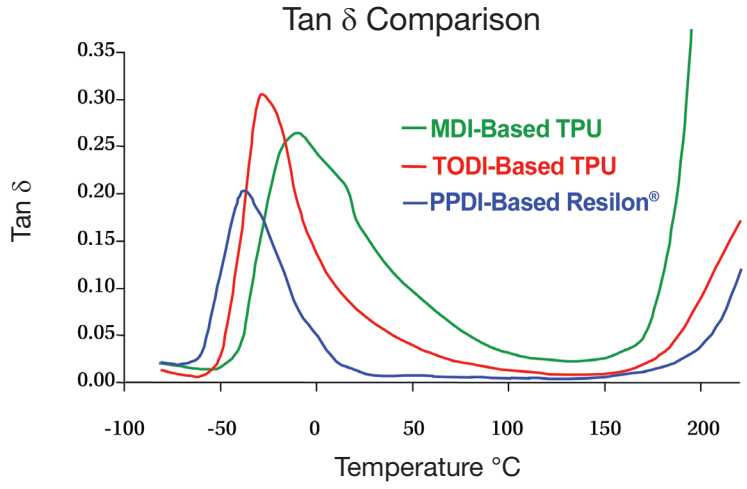
Superior Resilience/Rebound
Resilon 4300 also has superior resilience/rebound characteristics compared to other available TPU materials. Quick rebound is a major advantage in applications likely to experience severe shock loads and momentary pressure spikes. Resilon's enhanced resilience/ rebound characteristics allow the sealing lips of rod or piston seal profiles to conform to the moving seal interface with greater rapidity, maintaining critical sealing lip contact.

Zero-Leak Rod Seal Package

Table 1.

Resilon Polyurethane: Typical Physical Properties

	4300A90	4301A90
Hardness, Shore A, pts	90	92
Tensile Strength at Break, psi	8021	7188
Ultimate Elongation, %	638	548
100% Modulus, psi	1674	1958
Compression set at 158°F, %	30.9	22.3
Rebound, %	61	41
Service Temperature, °F in oil in water	 -65 to +275 N/A	 -35 to +275 -35 to +225



Comparing Tan δ Values of High Performance Polyurethanes

The ability of a material to recover from deformation under dynamic load, can be measured by calculating the Tan Delta – or ratio – of the material's storage modulus to loss modulus. In layman's terms, under dynamic load, a lower and flatter Tan Delta "line" is preferred because it means the material experiences less of an energy loss and recovers to a state closer to its original functionality.

Proven Performance

The performance of Parker's rod sealing system can be well displayed in the following test designed to capture a rigorous duty cycle often seen in harsh applications with temperature/ pressure extremes and a high speed and cycle count (see Table 2).

We tested Parker's Resilon® 4300 polyurethane and Parker's water resistant polyurethane 4301 against two other manufacturers products. The sealing solution was a BT U-cup, BR buffer ring, 4733 wear ring and AH double lipped canned wiper depicted below. The 4301 was tested at a higher temperature and pressure.

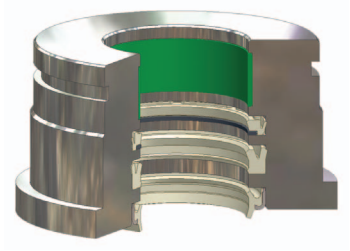


Table 2. Test Parameters

Stroke Length	24"
Retract Speed	18"/sec
Test Duration	300,900 Cycles Total
Endurance Test	
Temperature	93°C Rod Temp
Retract Pressure	4,000 psi
Extend Pressure	Low pressure first half of stroke; 4,000 psi last half of stroke
Pressure Spikes	None
Environmental Cold Test	
Duration	50 cycles low pressure, then 50 cycles high pressure
Temperature	-40° F held a minimum of 4 hours

Table 3: Cylinder Test Results

	Mfg A	Mfg B	Parker Resilon® 4300	Parker Resilon® 4301
Pressure (psi)	4000	4000	4000	4500
Rod Temperature	93°C	93°C	93°C	110°C
Cold Start-up (drops)	0.6	8	0	0.2
Total Leakage (drops)	138	21	0	0.6

Results: ZERO LEAKAGE

Zero Leakage
There was zero leakage from Parker's rod seal package featuring Resilon 4300 polyurethane seals over 309,000 cycles, whereas both Mfg A and Mfg B seals leaked throughout the test.

We tested our Resilon 4301 at even higher temperature and pressures. To keep pace with future technological advancements in cylinder applications sealing requirements will become even more challenging.

The results of Parker's 4301 material under an even more challenging duty cycle than Mfg A and Mfg B are shown in Table 3 — only 0.6 drops.

These results are typical of Parker rod sealing solutions and span a wide range of challenging applications for hydraulic cylinders.

Call Parker
To learn more, call Parker's experienced fluid power sealing experts at 801 972 3000.

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