P5065 Low Temperature Polyurethane

Technical Bulletin

No. 5279B1/USA

Parker P5065 polyurethane meets the performance demands of the agricultural equipment industry

Wear Resistant, Low Temperature Material

Parker's P5065A88 low temperature polyurethane is formulated specifically for the agricultural industry. After carefully listening to the needs of leading agricultural cylinder manufacturers, Parker has combined the most sought after features of seal materials into one compound. Topping the wish list was excellent low temperature performance, improved wear resistance for longer life and a soft feel for easy installation, all while being offered in an economical package to match the competitive nature of the agricultural hydraulic cylinder industry. Enter Parker's P5065A88, an 88 Shore A polyurethane meeting the exact needs mentioned above. Are you ready for longer cylinder life, improved low temperature properties and reduced installation times? Parker is.

Typical Physical Properties

Property	ASTM	DIN
Hardness (Shore A)	88	88
Tensile Strength (psi)	4267	6545
Ultimate Elongation (%)	607	662
Rebound (%)	57	
Compression Set (%, 22 Hrs. 70 °C)	24	
Specific Gravity	1.10	
Operating Pressure (psi)*	3,500 (10,000†)	
Operating Temperature Range	-65 to 212 °F -54 to 100 °C	

NOTE: The above are typical values and should not be used as specification limits.

*Pressure limitations are a function of the extrusion gap and may change if wear rings are used. Consult Catalog EPS 5276 or contact your authorized Parker distributor for further details.

†BD PolyPak profile with back-up operating pressure to 10,000 psi.

Warning: For safe and trouble-free use of these products, it is important that you read and follow the Parker Seal Group Product Safety Guide, Publication No. PSG 5004, available at www.parkerseals.com, or by calling 1-800-C-PARKER.

Material/Profile Availability

Parker's P5065 compound is offered in a wide range of profiles and sizes. Shown here are a few popular profiles commonly used in the agricultural industry.

BD PolyPak (w/o backup, w/ backup) | BS U-Cup | SHD | SH959

Both the BS U-Cup and BD PolyPak employ secondary lips that improve stability and sealing performance while featuring Parker's knife-trimmed primary sealing lips for the ultimate in leakage control. Parker's BD PolyPak is available with a backup for higher pressure applications (up to 10,000 psi). Parker's SHD and SH959 wipers are industry-proven profiles that will retrofit into many non-Parker excluder glands. See page 4 for hardware dimensions of popular sizes.

Contact Parker

As the leading developer of engineered solutions, Parker offers a large selection of materials and products to meet the sealing demands of the agricultural equipment industry. Call our experienced Application Engineers at (801) 972-3000 for technical support for all of your sealing needs.

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Engineered Polymer Systems Division
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www.parkerseals.com

Parker anything possible

Wear Resistant Characteristics of P5065 Outperform Competition in Independent Laboratory Test

An independent, third party laboratory recently conducted life cycle testing on Parker's P5065 compound, comparing the leakage performance and wear resistance against a popular competitive urethane. Two cylinders were fitted with Parker BD PolyPaks, while two identical cylinders were fitted with similar profiles from Competitor A.

Test Parameters

Pressure	1350 psi	**Temp.**	Ambient
Stroke Speed	2 in/sec	**Stroke Length**	5 in
Duration	20,000 continuous cycles		
Lubricant	Chevron 1000 THF		

Test Results

After 20,000 cycles, leakage results showed that the cylinders incorporating Parker's P5065 compound did not leak any measurable amount of oil; there was merely oil visible on the wiper. In contrast, the cylinders incorporating Competitor A's urethane showed significant leakage accumulation, as follows:

Total Leakage (mL)		
	Competitor A	**Parker P5065**
Cylinder 1	1.25	no measurable amount
Cylinder 2	0.40	no measurable amount

When the cylinders were torn down to inspect the seals, the reason for Parker's superior leakage performance became clear. Post-testing images show that the Parker seals have retained much of their original geometry (See Figure 1), while Competitor A's seals have been severely worn away on their dynamic surface, resulting in loss of interference, the disappearance of the secondary lip, and ultimately, shortened cylinder life due to seal leakage.

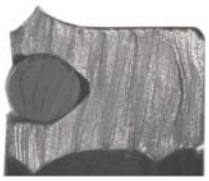
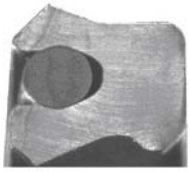
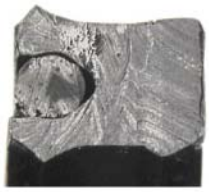
	Parker	Competitor A
Original profile		
After Testing: Cylinder 1		 Notice disappearance of secondary lip and ID thinning
After Testing: Cylinder 2		 Notice disappearance of secondary lip and ID thinning

Figure 1. Before and after images of seals

From these images and supporting measurements, it is clear that Parker's P5065 compound outperforms Competitor A both in leakage control and wear resistance.

Low Temperature Characteristics of P5065 Outperform Competition in Side-by-Side Testing

In order to simulate cold temperature start-ups between long runs of machine time in agricultural equipment, Parker's EPS Division recently conducted an in-house procedure to compare P5065 to a competitive urethane. Side-by-side comparison testing of P5065, Parker's low temperature urethane, was compared in a BS U-Cup profile to a commonly used competitor seal for agricultural applications. After more than 150,000 cycles at 2,000 psi, Parker's P5065 emerged as the clear winner.

A two-pod Chew Test Stand was used to perform the testing. The test was performed twice, with the first test having the P5065 seal in pod 1 and the competitor seal in pod 2. The second test had the seals switched in the pods to eliminate any affects that hardware differences may have had. Each pod is covered by an environmental box, whose temperature can be set and controlled by either heating or cooling.

Procedure

After the test seals are measured and installed, and the air bled from the pods, an 11 step test procedure is followed to complete the testing as shown in Table 1.

Test Results

Upon completion of the procedure, the Parker seals have 6% less cumulative leakage, on average, than the competitor seals over the entire test. By comparing the two materials side by side in a procedure designed to simulate a common source of cylinder leakage in many agricultural applications, it can be clearly seen that Parker P5065's low temperature characteristics and superior wear resistance make it the seal material of choice.

Table 1. Test Steps

Step	Description	Temp.	Cycles & Pressure
1	Room temp. startup	Room	100 @ 0 psi, 100 @ 2,000 psi
2	Cold box	-20 °F (4 hour soak)	100 @ 0 psi, 100 @ 2,000 psi
3	Hot cycling	150 °F	50,000 @ 2,000 psi
4	Room temp. startup	Room	100 @ 0 psi, 100 @ 2,000 psi
5	Cold box	-20 °F (4 hour soak)	100 @ 0 psi, 100 @ 2,000 psi
6	Hot cycling	150°F	50,000 @ 2,000 psi
7	Room temp. startup	Room	100 @ 0 psi, 100 @ 2,000 psi
8	Cold box	-20 °F (4 hour soak)	100 @ 0 psi, 100 @ 2,000 psi
9	Hot cycling	150 °F	50,000 @ 2,000 psi
10	Room temp. startup	Room	100 @ 0 psi, 100 @ 2,000 psi
11	Cold box	-20 °F (4 hour soak)	100 @ 0 psi, 100 @ 2,000 psi

Cold Environment Operation is Critical

The operation and storage of agricultural equipment in cold environments makes low temperature seal performance a critical factor in material selection. One way to determine how well a seal material will perform across a wide range of temperatures is to measure its dynamic modulus. In Figure 2, Parker's P5065 compound and Competitor A's material are subjected to a Dynamic Modulus Analysis (DMA).

An elastomer's Dynamic Modulus can be separated into two different components; the Storage Modulus and the Loss Modulus. The Tangent Delta, shown in the plot, is the ratio of the Loss Modulus to the Storage Modulus. This translates to be the ratio of the energy absorbed, or "lost," by the material as heat to the energy used by the material to return to its original shape, providing sealing force.

The significant features of the Tangent Delta plot are as follows:

- The temperature value of the low temperature peak relates to the material's capability to maintain its elastic properties at lower temperature. A material with a peak at lower temperature is better for low temperature applications. In this regard, Parker P5065 outperforms Competitor A.
- The magnitude of the Tangent Delta over the operating temperature range relates to the ratio of the material's energy lost as heat to the energy maintained as a restoring force. As such, a lower curve is better than a higher curve. Parker's P5065 has an operating range of -65 °F to 212 °F (-54 °C to 100 °C). Across the vast majority of this range, Parker P5065 outperforms Competitor A.
- The constant width or flatness of the curve over the application temperature range relates to constant dynamic properties. A longer, flatter, and lower curve is most desirable. In this regard, Parker P5065 outperforms Competitor A.
- The high temperature upturn of the material is associated with the material's softening. A curve upturn at higher temperature relates to higher temperature capability and is significant even if this occurs outside the material's recommended operating range. Once again, Parker P5065 outperforms Competitor A.

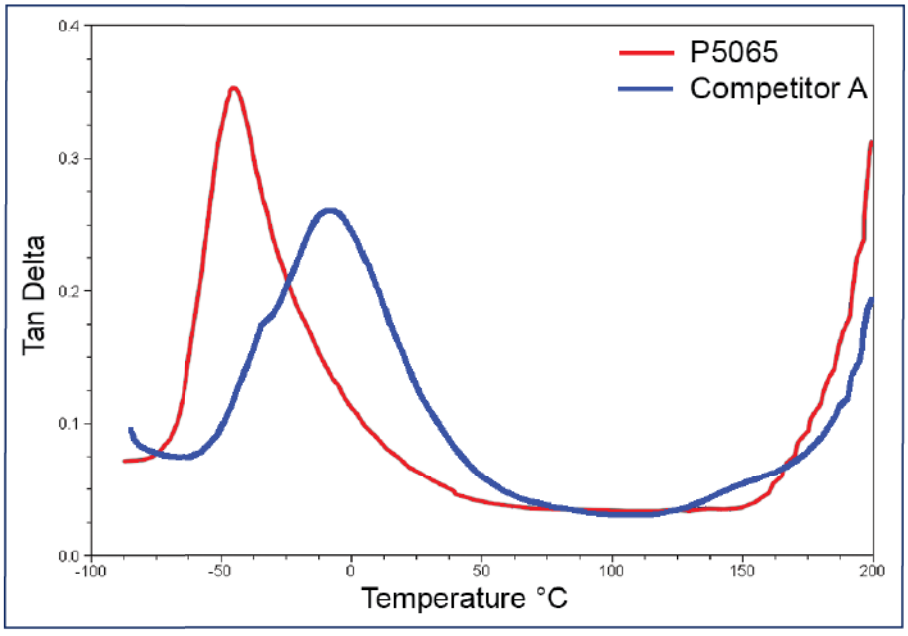
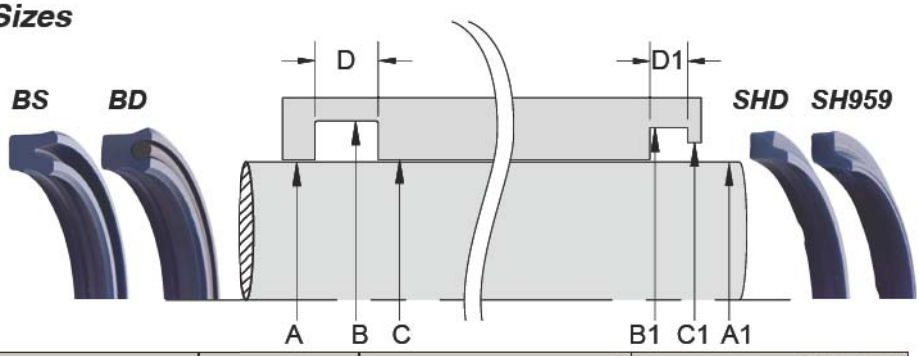


Figure 2. Dynamic Modulus Analysis

Gland Dimensions for Popular Sizes

In addition to the offering below, other cross-sections and widths are available. Parker offers complete seal and wiper kits ranging from ¼" to 9" rod diameters. Contact your Parker EPS Customer Service Representative at (801) 972-3000 or your authorized Parker distributor with your specific size requirements.



A Rod Diameter		B Groove Diameter		C Throat Diameter*		D Groove Width +.015 / -.000	BS U-Cup	BD Polypak**
0.500	+.000 / -.001	0.750	+.002 / -.000	0.501	+.002 / -.000	0.207	5065BS12500500-187	5065BD12500500N187
0.625	+.000 / -.001	0.875	+.002 / -.000	0.626	+.002 / -.000	0.207	5065BS12500625-187	5065BD12500625N187
0.750	+.000 / -.001	1.000	+.002 / -.000	0.751	+.002 / -.000	0.207	5065BS12500750-187	5065BD12500750N187
0.875	+.000 / -.001	1.125	+.002 / -.000	0.876	+.002 / -.000	0.207	5065BS12500875-187	5065BD12500875N187
1.000	+.000 / -.001	1.250	+.002 / -.000	1.001	+.002 / -.000	0.275	5065BS12501000-250	5065BD12501000N250
1.000	+.000 / -.002	1.375	+.002 / -.000	1.001	+.002 / -.000	0.344	5065BS18701000-312	5065BD18701000N312
1.125	+.000 / -.002	1.500	+.002 / -.000	1.126	+.002 / -.000	0.344	5065BS18701125-312	5065BD18701125N312
1.250	+.000 / -.002	1.625	+.002 / -.000	1.251	+.002 / -.000	0.344	5065BS18701250-312	5065BD18701250N312
1.375	+.000 / -.002	1.750	+.002 / -.000	1.376	+.002 / -.000	0.344	5065BS18701375-312	5065BD18701375N312
1.500	+.000 / -.002	1.875	+.002 / -.000	1.501	+.002 / -.000	0.413	5065BS18701500-375	5065BD18701500N375
1.500	+.000 / -.002	2.000	+.003 / -.000	1.501	+.003 / -.000	0.413	5065BS25001500-375	5065BD25001500N375
1.625	+.000 / -.002	2.000	+.002 / -.000	1.626	+.002 / -.000	0.413	5065BS18701625-375	5065BD18701625N375
1.750	+.000 / -.002	2.125	+.002 / -.000	1.751	+.002 / -.000	0.413	5065BS18701750-375	5065BD18701750N375
1.750	+.000 / -.002	2.250	+.003 / -.000	1.751	+.003 / -.000	0.413	5065BS25001750-375	5065BD25001750N375
1.875	+.000 / -.002	2.250	+.002 / -.000	1.876	+.002 / -.000	0.413	5065BS18701875-375	5065BD18701875N375
2.000	+.000 / -.002	2.375	+.002 / -.000	2.001	+.002 / -.000	0.413	5065BS18702000-375	5065BD18702000N375
2.000	+.000 / -.002	2.500	+.003 / -.000	2.001	+.003 / -.000	0.413	5065BS25002000-375	5065BD25002000N375
2.250	+.000 / -.002	2.625	+.002 / -.000	2.251	+.002 / -.000	0.413	5065BS18702250-375	5065BD18702250N375
2.250	+.000 / -.002	2.750	+.003 / -.000	2.251	+.003 / -.000	0.413	5065BS25002250-375	5065BD25002250N375
2.500	+.000 / -.002	2.875	+.002 / -.000	2.501	+.002 / -.000	0.413	5065BS18702500-375	5065BD18702500N375
2.500	+.000 / -.002	3.000	+.003 / -.000	2.501	+.003 / -.000	0.413	5065BS25002500-375	5065BD25002500N375
2.750	+.000 / -.002	3.250	+.003 / -.000	2.751	+.003 / -.000	0.413	5065BS25002750-375	5065BD25002750N375
3.000	+.000 / -.002	3.500	+.003 / -.000	3.001	+.003 / -.000	0.413	5065BS25003000-375	5065BD25003000N375

*Throat diameter will change if wear rings are used. Consult Catalog EPS 5276 or contact your authorized Parker distributor.
**BD Polypak also available with positively-actuated back-up. Example part number: 5065BD12500500R1N187.

A1 Rod Diameter +.000 / -.002	SHD Wiper				SH959 Wiper			
	B1 Groove Diameter +.006 / -.000	C1 Shoulder Diameter +.010 / -.000	D1 Groove Width +.004 / -.000	SHD Wiper Part Number	B1 Groove Diameter +.004 / -.000	C1 Shoulder Diameter +.005 / -.000	D1 Groove Width ±.003	SH959 Wiper Part Number
0.500	0.747	0.660	0.124	5065SHD500	0.760	0.647	0.107	5065SH959-1
0.625	0.872	0.785	0.124	5065SHD625	0.885	0.772	0.107	5065SH959-3
0.750	1.122	0.995	0.187	5065SHD750	1.010	0.897	0.107	5065SH959-5
0.875	1.247	1.120	0.187	5065SHD875	1.147	1.023	0.107	5065SH959-7
1.000	1.372	1.245	0.187	5065SHD1000	1.272	1.148	0.107	5065SH959-9
1.125	1.497	1.370	0.187	5065SHD1125	1.397	1.273	0.107	5065SH959-11
1.250	1.622	1.495	0.187	5065SHD1250	1.522	1.398	0.107	5065SH959-13
1.375	1.747	1.620	0.187	5065SHD1375	1.677	1.542	0.107	5065SH959-15
1.500	1.872	1.745	0.187	5065SHD1500	1.802	1.668	0.107	5065SH959-17
1.625	1.997	1.870	0.187	5065SHD1625	1.927	1.793	0.107	5065SH959-18
1.750	2.122	1.995	0.187	5065SHD1750	2.052	1.918	0.107	5065SH959-19
1.875	2.247	2.120	0.187	5065SHD1875	2.177	2.043	0.107	5065SH959-20
2.000	2.497	2.327	0.249	5065SHD2000	2.302	2.178	0.107	5065SH959-21
2.250	2.747	2.577	0.249	5065SHD2250	2.552	2.428	0.107	5065SH959-23
2.500	2.997	2.827	0.249	5065SHD2500	2.802	2.678	0.107	5065SH959-25
2.750	3.247	3.077	0.249	5065SHD2750	3.114	2.959	0.122	5065SH959-27
3.000	3.497	3.327	0.249	5065SHD3000	3.364	3.209	0.122	5065SH959-29