

Pneuma-Seal®

ENGINEERED ELASTOMERIC
TECHNOLOGIES FOR SEALING,
CLAMPING, ACTUATING



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Inflatables

Seals

Pneuma-Seal inflatable seals are the perfect solution for difficult sealing conditions. They are particularly well suited for use with:

- Horizontal or vertical **sliding doors**.
- Processing equipment where **rapid sealing and unsealing** is required.
- Hinged doors with **flush thresholds** for easy personnel or equipment access.
- **Large fabricated doors** or other closures where it is impractical to machine the sealing surfaces to accommodate conventional seals and gaskets.

Doors and other closures can be positively sealed with inflatable seals. Seals are typically inflated with air (or other fluid) using a pressure regulated supply system. When pressurized, the seal conforms to uneven surfaces and provides an efficient, reliable barrier to dust, moisture, contaminants, and/or pressures. Seal operating pressures are usually in the range of 10 to 35 PSI (1–3 bar) but some styles can be designed to operate at lower or higher pressures depending on the need. Expansion capabilities (i.e. the ability to close a gap) vary by profile. Large gaps may be accommodated but it should be noted that as the gap increases, the pressure required to seal against a given pressure differential increases, thereby decreasing the seal's flex life.

Clamps

When in action, inflatable clamps provide uniform controlled pressure to firmly clamp pieces together during bonding steps or to hold pieces in place during machining or cutting operations. Typical applications include the bonding of airframe components, clamping during cutting operations, and stopping large pharmaceutical bottles on a conveyor line.

Actuators

An expanding inflatable actuator may be used together with a more traditional seal or clamp. In a typical application, the actuator pushes a seal made of a harder material (e.g. PTFE) which then seals against a rotating piece of equipment. During shutdown, the air is removed from the actuator, making changeout of the entire system easier. Also, much like inflatable seals and clamps, an inflatable actuator will account for any variation in sealing gap which is critical when sealing large equipment.

Inflatable actuators have also been used to push trays holding medical tools against a mating compression seal during delicate cleaning operations. This ensures a quick and effective seal every time.

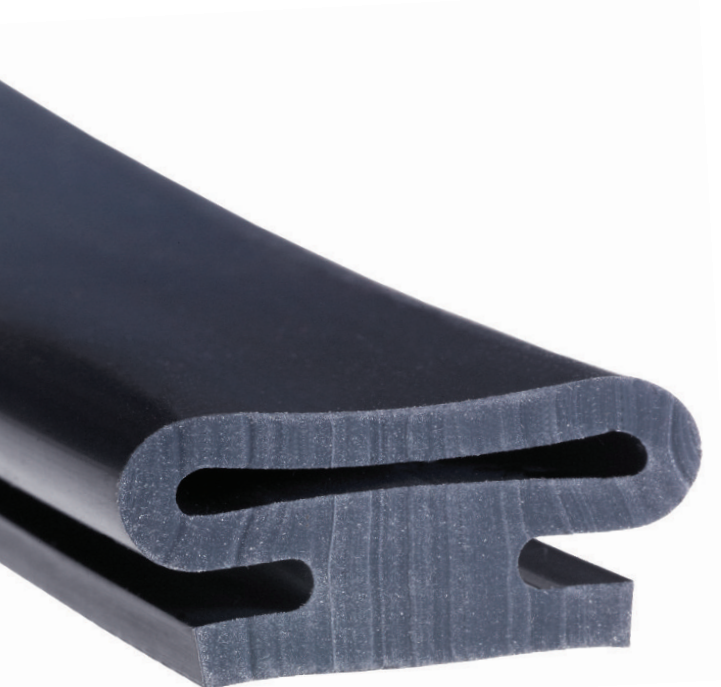
Pneuma-Seal Construction

Extruded Construction

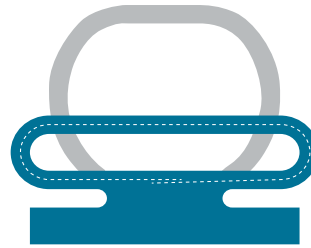


Extruded inflatable profiles are typically used as dust seals with little to no pressure differential. Note that the high pressure, low gap Type 10 profiles are an exception to this rule.

Seals made using extruded construction can be configured for practically any application, but may involve special forming processes. Most common, however, are seals designed for radial expansion inward/outward or clamps with specially sealed ends.



Molded, Fabric Reinforced Construction



In applications involving high pressure and/or repeated, continuous use or where safety and reliability are of major importance, a molded fabric-reinforced seal is recommended. The molding process eliminates spliced joints and the fabric reinforcing gives additional structural integrity ensuring better resistance to rupture and tear. Internal testing has shown that fabric reinforcing also provides superior flex life.

Molded fabric reinforced seals require special tooling for their manufacture. Beginning the design process with one of our standard profiles will guarantee that most, if not all, of the tooling required for your seal will be readily available.

Most fabric profiles can be manufactured using a number of different materials, but special setup charges may apply. Available fabrics (again depending on profile) include Nylon, Dacron®, Nomex®, or Kevlar® (see page 13).

If a custom cross section is required, we can design it but understand that a full set of molding tools will be required.

Dacron®, Nomex®, and Kevlar® are registered trademarks of E. I. du Pont de Nemours and Company or its affiliates.



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Products**

Seal Configurations

Inflatable seals can be configured to practically any shape or size. Individual seals can be supplied as continuous loops for axial or radial expansion, in strip form with specially sealed ends, in “U” or similar shapes with preformed corners, or as axially expanding rectangles.

In many cases, our inflatable profiles will conform to the corners or radii of a given installation without the necessity for

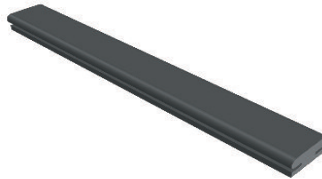
preforming or special molding, however, if the corners are tight then molding will most likely be required.

Minimum bend diameter data for circular seals and radius corner data for rectangular seals is available on the web by profile (see pawlingep.com/pneuma-seal/standard_profiles).

Radial Expansion Outward



Straight with Sealed Ends



Radial Expansion Inward



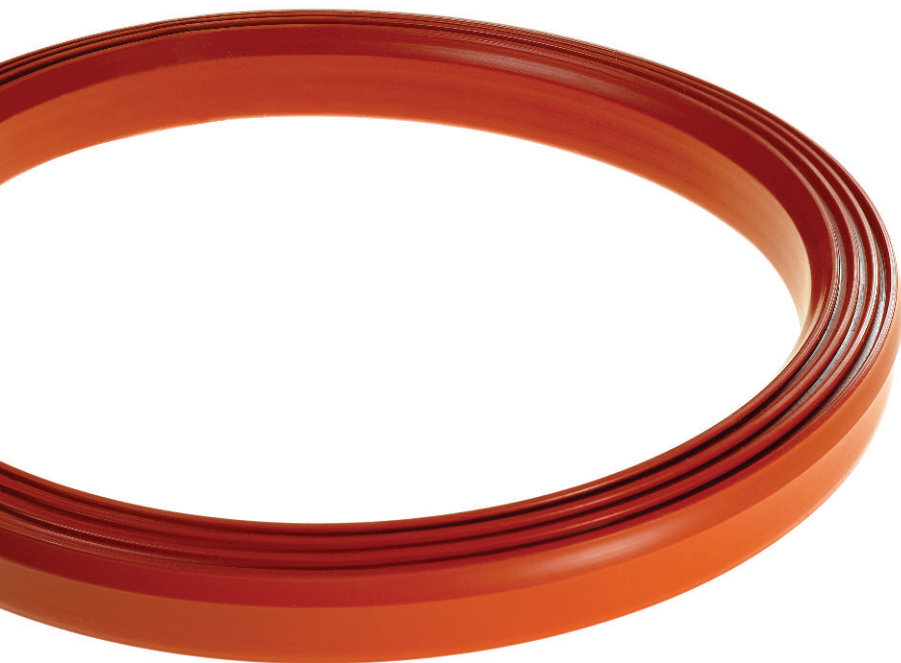
Axial Rectangular



Axial Circular

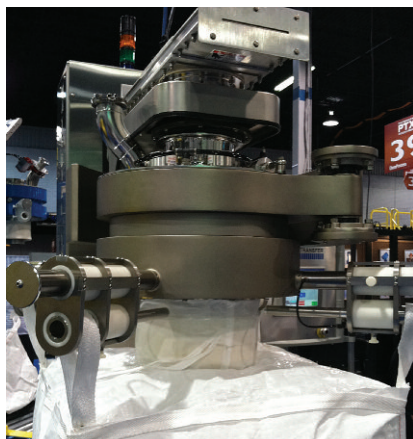


Axial U-Shaped



Applications in Detail

Bulk Bag Unloading Seal



Flexible intermediate bulk bag containers (FIBC) are commonly used in the pharmaceutical and food processing industries to efficiently transfer and store dry powders. These bags are made of a high quality, strong polypropylene fabric. In this process, optimizing the amount of material stored and reducing waste during loading are very important.

Inflatable seals are employed to seal the bag with the mating loading bin. The seal inflates outward against the sack spout, sealing it tight and holding it in place.

Types 1 and 2 style seals are commonly used for these quick connect/disconnect applications and can be supplied in EPDM or Silicone depending on specifics.

Airtight Doors



To ensure a positive seal and account for any tolerance variation, inflatable seals are installed along the periphery of airtight doors and are designed to expand radially outward against the door jamb. These door styles are often used in virology labs, research and development facilities, and airlocks designed for nuclear power and chemical processing plants.

Use of an inflatable seal not only ensures a quality seal time after time, but facilitates frequent access since there is no requirement to actuate multiple dogs to compress a more traditional sealing solution. Having a flush threshold also eases equipment transport.

Molded, fabric reinforced Types 1 or 3 EPDM inflatable profiles are good choices here because they can be mechanically retained to prevent sag without the use of adhesives.

Drum Unloading Seal



Ram style follower plates are used in instances where highly viscous fluids (e.g. cake frosting, peanut butter, oil, and mascara) need to be removed from a storage drum. Use of an inflatable seal along the edge of the follower plate maximizes the evacuation rate from the drum, because it will conform to gap variations between the plate and the inside of the drum. Also, one follower plate size may be used to evacuate a range of sizes or can be used in straight or tapered sided drums.

Types 1, 2 and 10 profiles are good choices for these applications. They all can be retained within a channel and can be manufactured using our FDA-compliant EPDM, Neoprene, or Silicone compounds.



**Pawling
Engineered
Products**

Sliding Marine Window Seal



Inflatable seals are the perfect choice for sliding window or door applications. In this instance, a sliding window has been designed for the Captain of this Coast Guard vessel. Under normal use, the window slides open so verbal orders may be issued. But when rough seas approach, the Captain can shut the window and inflate the seal to ensure zero leakage into the cabin.

Under extreme conditions, this boat is designed to withstand a 360° roll so ensuring a watertight seal is not a luxury; it's an absolute must.

Sliding window and door inflatable seals may also be designed in other applications such as sterilizer doors and FOUP (Front Opening Unified Pod) openings in large semiconductor processing tools.

Airframe Component Bonding Bladder



Current airframe manufacture involves the use of epoxies and other adhesives to bond the metal skin layers together which make up the airframe. To ensure a uniform bond, inflatable bladders are used as clamps to impart a consistent force along the surface during the process. These bladders are typically supplied with specially designed ends and made in various lengths as specified by the end user. In some cases, a series of bladders (with many different lengths) are used in one "tool" which bond complete sections together in one shot.

Types 1 and 7 inflatable profiles are well suited for bonding applications such as these, because they can be mechanically retained and have a smooth surface to generate maximum clamping forces.

Large Diameter Seal for Nuclear Power Reactor Cavity



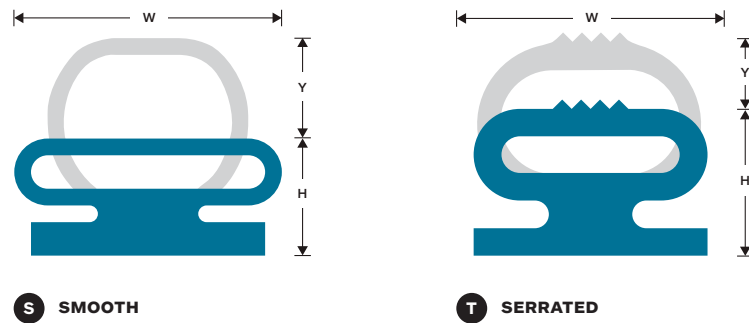
Pawling EP supplies large seals used during refueling outages in nuclear power plants. This custom inflatable seal is used to seal the annulus between the reactor refueling flange and the well floor.

Manufactured using E603A, one of our high strength, radiation resistant EPDM compounds and reinforced with two wraps of Kevlar® fabric, this seal is fully molded in a racetrack configuration and is installed in a groove which is 45 feet in diameter.

Secondarily, this seal must conform to the rigors of our quality assurance program which is in compliance with 10CFR50, Appendix B. Very specific proof tests are conducted as well as a pressure decay study to ensure conformity.

Type 1

These footed style seal profiles are widely used due to their ease of retention and ability to fully round out when inflated. Type 1 profiles may be used in straight, radial or axial expanding applications.



Specifications

PROFILE	TYPE	STANDARD MATERIALS	WIDTH (W)		HEIGHT (H)		RECOMMENDED GAP (Y)		AIR CONNECTORS
			IN	MM	IN	MM	IN	MM	
Extruded Construction									
PRS573	S	EP, VMQ	0.688	17.46	0.438	11.11	0.125	3.18	AC1
PRS978	S	EP	1.000	25.40	0.500	12.70	0.250	6.35	AC1
PRS951	T	VMQ	1.181	30.00	0.787	20.00	0.313	7.94	AC1
PRS537	S	EP, CR, VMQ	1.250	31.75	0.625	15.88	0.375	9.53	AC1
PR9185	T	VMQ	1.563	39.69	1.062	26.99	0.500	12.70	AC1
PRS535	S	EP, CR, VMQ, NBR	2.000	50.80	0.875	22.23	0.750	19.05	AC1, AC4A, AC4C, AC5, AC14E
PRS946	T	EP	2.375	60.33	1.375	34.93	0.813	20.64	AC1, AC4A, AC4C, AC5, AC14E
PRS548	S	EP, CR	3.000	76.20	1.250	31.75	1.000	25.40	AC1, AC4A, AC4C, AC5, AC14E
PRS934	S	EP	4.000	101.60	1.625	41.28	1.375	34.93	AC1, AC4A, AC4C, AC5, AC14E
Molded, Fabric Reinforced Construction									
PR13548	S		0.688	17.46	0.438	11.11	0.125	3.18	AC2
PRS717	S	EP	1.000	25.40	0.500	12.70	0.313	7.94	AC2
PRS580	S	EP	1.250	31.75	0.625	15.88	0.375	9.53	AC2
PRS582	S	EP	2.000	50.80	0.875	22.23	0.750	19.05	AC3A, AC3B, AC14E
PRS583	S	EP	3.000	76.20	1.250	31.75	1.250	31.75	AC3A, AC3B, AC14E
PRS705	S	EP	4.000	101.60	1.625	41.28	1.750	44.45	AC3A, AC3B, AC14E
PRS729	S		5.500	139.70	1.625	41.28	2.250	57.15	AC3A, AC3B, AC14E
PRS590	S		7.250	184.15	2.000	50.80	3.000	76.20	AC3A, AC3B, AC14E

Recommended Gap: Gap recommendations assume optimal sealing conditions. Depending on the application, the designed gap should be reduced to ensure effective sealing. Contact Pawling EP for further details.

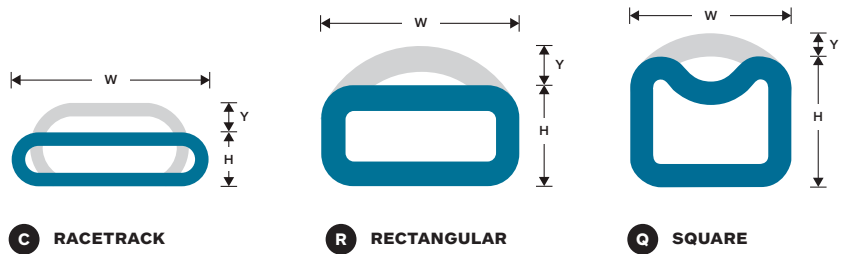
Materials: In some cases, a profile can be specially manufactured in other materials, although setup charges may apply. FDA-compliant EPDMs and Silicones may also be available.

Retention Systems: See page 16 for details on available mechanical retention systems.

Need More Technical Info? See pawlingep.com/pneuma-seal/standard_profiles for full details on profiles listed above.

Type 2

These profiles are designed primarily for tightly spaced endless radial expansion inward or outward sealing applications where the seal can be snap fit into a retainer groove. Straight and axial configurations are also available although adhesives may be required to keep the seal in place.



Specifications

PROFILE	TYPE	STANDARD MATERIALS	WIDTH (W)		HEIGHT (H)		RECOMMENDED GAP (Y)		AIR CONNECTORS
			IN	MM	IN	MM	IN	MM	
Extruded Construction									
PRS900	R	EP	0.405	10.29	0.188	4.76	0.094	2.38	AC1
PR10487	R	EP	0.500	12.70	0.313	7.94	0.094	2.38	AC1
PR4982	Q		0.655	16.64	0.531	13.49	0.188	4.76	AC1
PRS554	R	EP	0.703	17.86	0.352	8.94	0.188	4.76	AC1
PRS920	C	EP	0.750	19.05	0.250	6.35	0.188	4.76	AC1
PRS102	R	EP	0.928	23.57	0.310	7.87	0.188	4.76	AC1
PRS577	R	EP	0.938	23.81	0.500	12.70	0.250	6.35	AC1
PRS903	C	EP	1.250	31.75	0.375	9.53	0.375	9.53	AC1
PRS509	C	VMQ	1.500	38.10	0.375	9.53	0.375	9.53	AC1
PRS525	C	CR	1.500	38.10	0.500	12.70	0.438	11.11	AC1
PRS905	R		1.500	38.10	0.750	19.05	0.500	12.70	AC1, AC4A, AC4C, AC5
PRS571	R	CR	1.625	41.28	0.250	6.35	0.438	11.11	AC1
PRS423	C	EP	2.000	50.80	0.500	12.70	0.750	19.05	AC1, AC4A, AC4C, AC5
PRS564	C	EP	2.500	63.50	0.500	12.70	0.875	22.23	AC1, AC4A, AC4C, AC5
PRS520	C	CR	3.000	76.20	0.750	19.05	1.000	25.40	AC1, AC4A, AC4C, AC5
PRS578	C	EP	3.250	82.55	0.500	12.70	1.000	25.40	AC1, AC4A, AC4C, AC5
PR10287	C		5.640	143.26	1.210	30.73	1.750	44.45	AC1, AC4A, AC4C, AC5
Molded, Fabric Reinforced Construction									
PRS733	C		0.750	19.05	0.375	9.53	0.125	3.18	AC2
PRS701	C	EP	1.250	31.75	0.375	9.53	0.375	9.53	AC2
PRS702	C	EP	2.000	50.80	0.500	12.70	0.750	19.05	AC3A, AC3B
PRS703	C	EP	3.000	76.20	0.750	19.05	1.250	31.75	AC3A, AC3B
PRS706	C		4.000	101.60	1.000	25.40	1.750	44.45	AC3A, AC3B

Recommended Gap: Gap recommendations assume optimal sealing conditions. Depending on the application, the designed gap should be reduced to ensure effective sealing. Contact Pawling EP for further details.

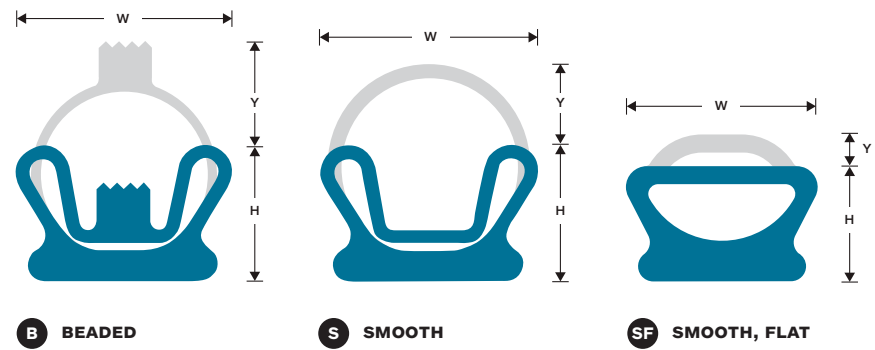
Materials: In some cases, a profile can be specially manufactured in other materials, although setup charges may apply. FDA-compliant EPDMs and Silicones may also be available.

Retention Systems: Adhesives are required if used in configurations other than radially expanding inward/outward. Note, however, that adhesives are significantly less reliable than the mechanical retention systems used with Type 1 or 3 seals.

Need More Technical Info? See pawlingep.com/pneuma-seal/standard_profiles for full details on profiles listed above.

Type 3

The footed snap seal delivers relatively large travel for its width so it can close large gaps. The dovetail designed base may also be retained mechanically. These profiles are best suited for expansion axially or radially outward. They are not recommended for inward expansion.



Specifications

PROFILE	TYPE	STANDARD MATERIALS	WIDTH (W)		HEIGHT (H)		RECOMMENDED GAP (Y)		AIR CONNECTORS
			IN	MM	IN	MM	IN	MM	
Extruded Construction									
PRS980	SF	VMQ	0.625	15.88	0.531	13.49	0.094	2.38	AC1
Molded, Fabric Reinforced Construction									
PRS599	B	EP	0.625	15.88	0.500	12.70	0.375	9.53	AC2
PRS591	B	EP	0.688	17.46	0.500	12.70	0.438	11.11	AC2
PRS598	S	EP	0.688	17.46	0.500	12.70	0.250	6.35	AC2
PRS581	B	EP	1.000	25.40	0.625	15.88	0.500	12.70	AC2
PRS597	S	EP	1.000	25.40	0.625	15.88	0.375	9.53	AC2
PRS709	SF	EP	1.000	25.40	0.625	15.88	0.313	7.94	AC3A
PRS594	B	EP	2.000	50.80	1.219	30.96	1.219	30.96	AC3A
PRS708	S	EP	2.000	50.80	1.219	30.96	0.813	20.64	AC3A

Recommended Gap: Gap recommendations assume optimal sealing conditions. Depending on the application, the designed gap should be reduced to ensure effective sealing. Contact Pawling EP for further details.

Materials: In some cases, a profile can be specially manufactured in other materials, although setup charges may apply. FDA-compliant EPDMs and Silicones may also be available.

Retention Systems: See page 17 for details on available mechanical retention systems.

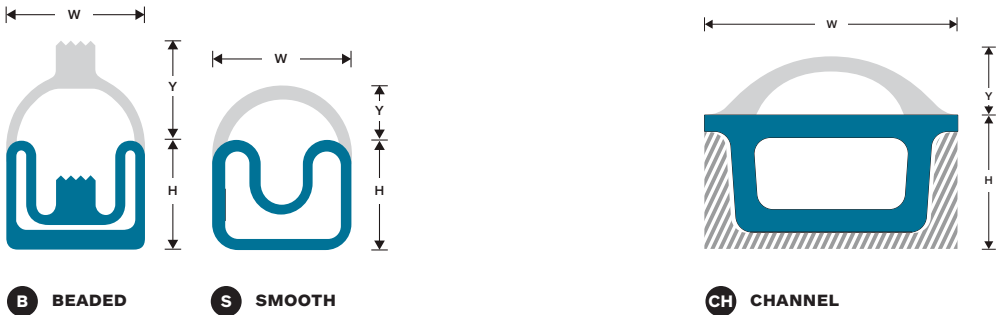
Need More Technical Info? See pawlingep.com/pneuma-seal/standard_profiles for full details on profiles listed above.

Type 4

Similar to the Type 3 profiles, these designs cover a large gap for their width and can be easily retained within a square channel.

Type 7

These channel style profiles handle heavy duty lifting and/or gripping applications and can be mounted in standard aluminum retainers.



Specifications

PROFILE	TYPE	STANDARD MATERIALS	WIDTH (W)		HEIGHT (H)		RECOMMENDED GAP (Y)		AIR CONNECTORS
			IN	MM	IN	MM	IN	MM	
Type 4									
Extruded Construction									
PR6648	S	EP	0.930	23.62	0.750	19.05	0.375	9.53	AC1
Molded, Fabric Reinforced Construction									
PRS715	B	EP	0.540	13.72	0.440	11.68	0.375	9.53	AC2
PRS707	B		0.656	16.67	0.438	11.11	0.438	11.11	AC2
Type 7									
Extruded Construction									
PRS576	CH		1.945	49.40	0.898	22.81	0.500	12.70	AC1, AC4A, AC4C, AC14E
PRS505	CH	CR	3.000	76.20	1.438	36.51	0.750	19.05	AC1, AC4A, AC4C, AC14E
PRS436	CH		4.000	101.60	1.750	44.45	1.000	25.40	AC1, AC4A, AC4C, AC14E

Recommended Gap: Gap recommendations assume optimal sealing conditions. Depending on the application, the designed gap should be reduced to ensure effective sealing. Contact Pawling EP for further details.

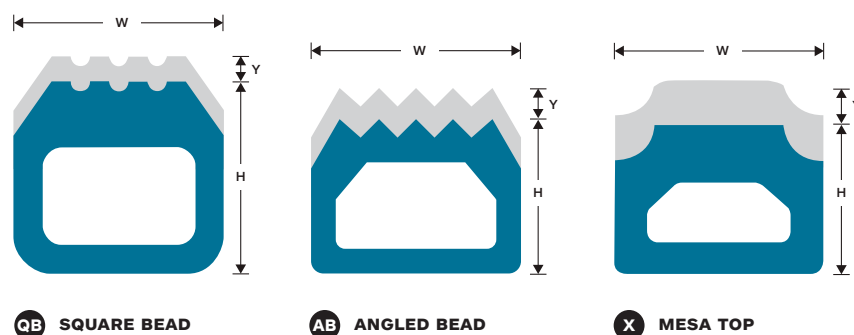
Materials: In some cases, a profile can be specially manufactured in other materials, although setup charges may apply. FDA-compliant EPDMs and Silicones may also be available.

Retention Systems: Adhesives are required if used in configurations other than radially expanding inward/outward. Note, however, that adhesives are significantly less reliable than the mechanical retention systems used with Type 1 or 3 seals.

Need More Technical Info? See pawlingep.com/pneuma-seal/standard_profiles for full details on profiles listed above.

Type 10

These heavy duty channel profiles can seal against high differential pressures, but the sealing gap must be relatively small. Axial, radial, and straight seal configurations are common for this series.



Specifications

PROFILE	TYPE	STANDARD MATERIALS	WIDTH (W)		HEIGHT (H)		RECOMMENDED GAP (Y)		AIR CONNECTORS
			IN	MM	IN	MM	IN	MM	
Extruded Construction									
PRS973	AB	EP, VMQ	0.256	6.50	0.197	5.00	0.059	1.50	AC10, AC11, AC12, AC13
PRS991	X	EP, VMQ	0.256	6.50	0.197	5.00	0.059	1.50	AC10, AC11, AC12, AC13
PRS977	AB	EP, VMQ	0.394	10.00	0.315	8.00	0.078	2.00	AC10, AC11, AC12, AC13
PR15092	QB	EP, VMQ	0.551	14.00	0.394	10.00	0.118	3.00	AC10, AC11, AC12, AC13
PRS993	X	EP, VMQ	0.551	14.00	0.394	10.00	0.118	3.00	AC10, AC11, AC12, AC13
PRS950	QB	EP, VMQ	0.630	16.00	0.472	12.00	0.118	3.00	AC10, AC11, AC12, AC13
PRS995	X	EP, VMQ	0.630	16.00	0.472	12.00	0.118	3.00	AC10, AC11, AC12, AC13
PRS971	AB	EP, VMQ	0.630	16.00	0.551	14.00	0.138	3.50	AC10, AC11, AC12, AC13
PRS960	QB	EP, VMQ	0.630	16.00	0.709	18.00	0.138	3.50	AC10, AC11, AC12, AC13
PRS969	AB	EP, VMQ	0.787	20.00	0.787	20.00	0.157	4.00	AC10, AC11, AC12, AC13
PRS970	AB	EP, VMQ	0.827	21.00	0.945	24.00	0.197	5.00	AC10, AC11, AC12, AC13
PRS997	X	EP, VMQ	0.827	21.00	0.945	24.00	0.197	5.00	AC10, AC11, AC12, AC13
PRS955	QB	EP, VMQ	0.866	22.00	0.748	19.00	0.138	3.50	AC10, AC11, AC12, AC13
PRS952	QB	EP, VMQ	1.024	26.00	0.748	19.00	0.178	4.50	AC10, AC11, AC12, AC13
PRS966	QB	EP, VMQ	1.181	30.00	0.630	16.00	0.197	5.00	AC10, AC11, AC12, AC13
PR6119	QB	EP, VMQ	1.378	35.00	1.260	32.00	0.394	10.00	AC10, AC11, AC12, AC13
PRS999	X	EP, VMQ	1.378	35.00	1.260	32.00	0.394	10.00	AC10, AC11, AC12, AC13

Recommended Gap: Gap recommendations assume optimal sealing conditions. Depending on the application, the designed gap should be reduced to ensure effective sealing. Contact Pawling EP for further details.

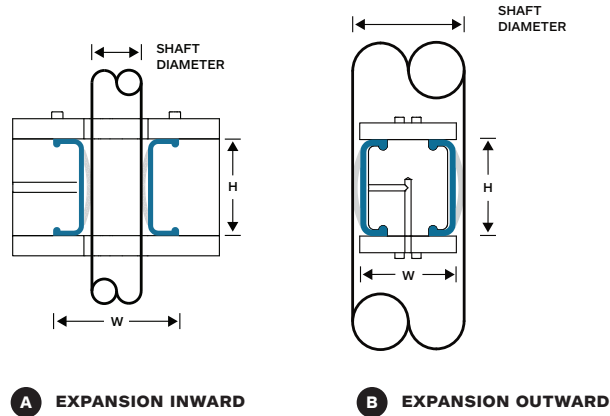
Materials: In some cases, a profile can be specially manufactured in other materials, although setup charges may apply. FDA-compliant EPDMs and Silicones may also be available.

Retention Systems: Adhesives are required if used in configurations other than radially expanding inward/outward. Note, however, that adhesives are significantly less reliable than the mechanical retention systems used with Type 1 or 3 seals.

Need More Technical Info? See pawlingep.com/pneuma-seal/standard_profiles for full details on profiles listed above.

Type 22

When the OD or ID of the surface is too small for a standard inflatable profile, fully molded Type 22 bladders (with mating housing) may be a good solution. Typically, Pawling EP supplies the molded bladders only but, on request, can supply the complete system—housing included.



Specifications

PART NO.	TYPE	WIDTH (W)		HEIGHT (H)		SHAFT DIAMETER		SEALING RANGE	
		IN	MM	IN	MM	IN	MM	IN	MM
For Radial Expansion Inward									
PR16376-1	A	1.313	33.34	1.250	31.75	0.500	12.70	0.490–0.520	12.45–13.21
PR16376-4	A	2.313	58.74	1.500	38.10	1.250	31.75	1.240–1.275	31.50–32.39
PR16376-5	A	2.563	65.09	1.500	38.10	1.500	38.10	1.490–1.544	37.85–39.22
PR16376-6	A	2.813	71.44	1.500	38.10	1.750	44.45	1.740–1.790	44.20–45.47
PR16376-7	A	3.125	79.38	1.750	44.45	2.000	50.80	1.990–2.085	50.55–52.96
PR16376-8	A	3.375	85.73	1.750	44.45	2.250	57.15	2.240–2.335	56.90–59.31
PR16376-9	A	3.625	92.08	1.500	38.10	2.500	63.50	2.490–2.590	63.25–65.79
PR16376-10	A	3.875	98.43	2.000	50.80	2.750	69.85	2.740–2.850	69.60–72.39
PR16376-11	A	4.188	106.36	2.000	50.80	3.000	76.20	2.990–3.140	75.95–79.76
PR16376-12	A	4.500	114.30	2.250	57.15	3.250	82.55	3.240–3.382	82.30–85.90
PR16376-13	A	4.813	122.24	2.500	63.50	3.500	88.90	3.490–3.690	88.65–93.73
PR16376-14	A	5.125	130.18	2.750	69.85	3.750	95.25	3.740–3.925	95.00–99.70
PR16376-15	A	5.438	137.11	3.000	76.20	4.000	101.60	3.900–4.160	99.06–105.66
For Radial Expansion Outward									
PR16436-1	B	0.705	17.91	1.000	25.40	0.750	19.05	0.716–0.760	12.70–19.30
PR16436-2	B	9.955	24.26	1.250	31.75	1.000	25.40	0.970–1.010	24.64–25.65
PR16436-3	B	1.205	30.61	1.500	38.10	1.250	31.75	1.223–1.260	31.06–32.00
PR16436-4	B	1.438	36.53	1.500	38.10	1.500	38.10	1.458–1.510	37.03–38.35
PR16436-5	B	1.688	42.88	1.500	38.10	1.750	44.45	1.708–1.760	43.38–44.70
PR16436-6	B	1.891	48.03	1.750	44.45	2.000	50.80	1.913–2.010	48.59–51.05
PR16436-7	B	2.141	54.38	1.750	44.45	2.250	57.15	2.165–2.260	54.99–57.40
PR16436-8	B	2.375	60.33	1.750	44.45	2.500	63.50	2.410–2.510	61.21–63.75
PR16436-9	B	2.610	66.29	2.000	50.80	2.750	69.85	2.650–2.760	67.31–70.10
PR16436-10	B	2.813	71.45	2.000	50.80	3.000	76.20	2.860–3.010	72.64–76.45
PR16436-11	B	3.062	77.77	2.250	57.15	3.250	82.55	3.117–3.260	79.17–82.80
PR16436-12	B	3.250	82.55	2.500	63.50	3.500	88.90	3.310–3.510	84.07–89.15
PR16436-13	B	3.500	88.90	2.750	69.85	3.750	95.25	3.575–3.760	90.81–95.50
PR16436-14	B	3.750	95.25	3.000	76.20	4.000	101.60	3.840–4.010	97.54–101.85

Recommended Gap: Sealing Gap recommendations assume optimal design conditions. Depending on the application, the gap may need to be reduced to ensure effective sealing. Contact Pawling EP for further details.

Materials: Molded Type 22 bladders are typically supplied in EPDM, but may be manufactured in other materials upon request.

Need More Technical Info? See pawlingep.com/pneuma-seal/standard_profiles for full details on profiles listed above.

Elastomers

Our inflatable profiles are available in a wide variety of materials, although specific elastomer choices vary by profile (see profile detail pages 6–11). If necessary, seals can be custom made using non standard materials, however special setup charges may apply.

Note that the elastomer ratings are based on Pawling EP compounds used in inflatable seals. Ratings from other manufacturers may differ due to compounding variables and end product use. Fabric reinforcement may also overcome the drawbacks associated with some elastomers.

O = OUTSTANDING E = EXCELLENT VG = VERY GOOD G = GOOD F = FAIR P = POOR

Specifications

COMMON NAME — BASE POLYMER	EPDM OR EP RUBBER	NEOPRENE	NBR OR BUNA-N	NATURAL RUBBER	BUTYL	SILICONE	FLUOROSILICONE	FLUOROCARBON
CHEMICAL NAME	ETHYLENE PROPYLENE	CHLOROPRENE	ACRYLONITRILE BUTADIENE	NATURAL ISOPRENE	ISOBUTYLENE ISOPRENE	SILICONE	FLUOROSILICONE	FLUOROCARBON
ASTM DESIGNATION (ASTM D1418)	EP	CR	NBR	NR	IIR	VMQ	FVMQ	FKM
Tensile Strength (psi)	>2000	>2000	>2000	>2000	>2000	>1200	>1200	>1400
Hardness Range (Durometer Shore A)	40–80	20–80	40–80	50–70	40–75	40–80	40–70	70–90
Tear Resistance	G	G	F	G	G	F	P	F
Abrasion Resistance	G to E	VG	G	E	G	P	F	G
Compression Set	G	G	G	E	F	VG	E	E
Resilience Cold	G	G	G	G	P	E	G	F
Resilience Hot	VG	VG	G	F	VG	E	E	E
Radiation Resistance	O	G	P	F to G	G	G	E	E
Impermeability to Gases	G	G	G	F	O	F	E	P
ACID RESISTANCE								
Mild Dilute	E	E	F to G	F to P	E	E	E	O
Strong Concentrate	G	G	F to G	P	G	F	G	E
SOLVENT RESISTANCE								
Aliphatic Hydrocarbons	P	F to G	E	P	P	P	G	E
Aromatic Hydrocarbons	P	P	P	P	P	P	E	E
Oxygenated (Ketones, etc)	G	P	P	P	G	P	F	F
RESISTANCE TO:								
Swelling in Lubricating Oil	P	G	VG	P	P	P	E	O
Oil and Gasoline	P	G	E	P	P	F	G	E
Animal Oils	F	F	E	P	F	G	E	E
Water Absorption	VG	G	VG	VG	VG	E	E	E
Oxidation	E	VG	G	F to P	E	E	O	G
Ozone	O	VG	F	F to P	F to G	E	O	E
Sunlight Aging	O	VG	P	F to P	VG	E	E	G
Heat Aging	VG	G	G	G to F	G	O	E	E
Low Temperature	VG	G	F to G	G	G	O	G	F
Flame	P	G	P	P	P	F	E	E
Vegetable Oils	F	G	G	P	F	P	E	E
Chlorinated Hydrocarbons	P	P	F	P	P	P to F	F	G



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Fabric Reinforcement

Molded, fabric reinforced seals are recommended when sealing against pressure differentials greater than 14 psig (1 bar) or to exert clamping/actuating forces greater than normal. Use of fabric reinforcement also adds to the seal's overall strength and resilience.

Fabrics are integrally molded into each inflatable seal using special processes. Available fabrics vary by profile. As an example, due to Kevlar's thickness, we are unable to supply this reinforcement in some of the smaller seal profiles.

Nylon

A high tenacity yarn that is tough and abrasion resistant. Nylon is the most common fabric used in our inflatable products, because it is strong and pliant which enhances a seal's dynamic properties.

Dacron® Brand Polyester

Dacron is another high tenacity, high modulus yarn used primarily when high flexibility is required. Dacron can be used with silicone and organic polymers and is especially effective in applications where heat > 250°F (120°C) is present.

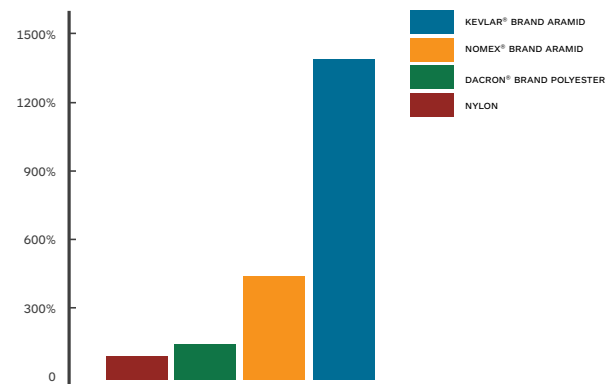
Nomex® Brand Aramid

Nomex is one step above Dacron in its ability to withstand temperatures and chemicals. Nomex is often used in conjunction with silicone as both materials are able to withstand temperatures > 250°F (120°C).

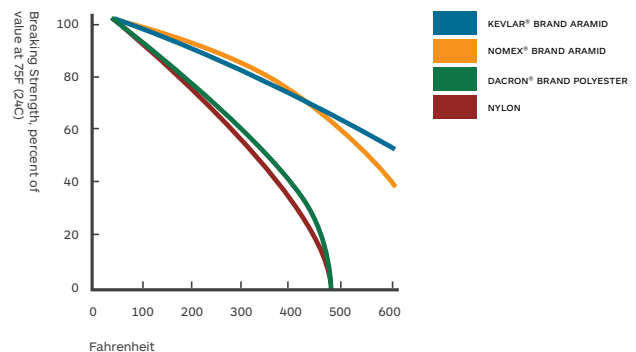
Kevlar® Brand Aramid

Kevlar is by far the strongest fabric Pawling EP uses. It is temperature resistant, tough, and has a high modulus. Kevlar can only be used in larger cross sections due to its thickness and its high cost needs to be weighed against the benefits provided.

FABRIC STRENGTH AS COMPARED TO NYLON



STRENGTH OF TYPICAL INDUSTRIAL YARNS AT ELEVATED TEMPERATURES



Dacron®, Nomex®, and Kevlar® are registered trademarks of E. I. du Pont de Nemours and Company or its affiliates. Typical Industrial Yarn Strength chart is also courtesy of E. I. du Pont de Nemours and Company or its affiliates.

Air Connectors

For endless seals, the air connector is typically located on the seal's underside (or base) which protects the connector. For bladders with closed solid ends, the connector may be placed out of one or both ends. For some Types 1, 2, and 10 profiles, sidewall connectors are available, although they may compromise seal function and/or life.

Custom, stainless steel and/or multiple connectors can also be supplied, although special setup charges may apply. Contact Pawling EP for more information.

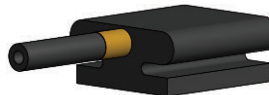
AC1

0.125" (3.175 mm) ID × either 0.250" (6.35) or 0.313" (7.94) OD flexible hose vulcanized to base or end of seal.



AC2

0.188" (4.78 mm) ID × 0.375" (9.53 mm) OD flexible reinforced hose crimped to base or end of seal.



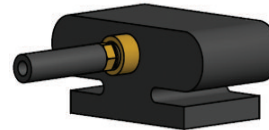
AC3A

0.250" (6.35 mm) ID × 0.470" (11.94 mm) OD flexible reinforced hose crimped to base or end of seal.



AC3B

0.250" (6.35 mm) ID × 0.470" (11.94 mm) OD flexible reinforced hose attached to 1/8 NPT female connector on base or end of seal.

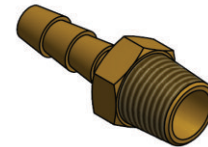


AC14

1/8 NPT Male connector attached to end of seal.



Available End Fittings for AC1–AC3B Connectors



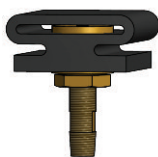
1/8 NPT Male
1/8 NPT Female
.305-32 NEF Tire Core
G 1/8 Male
R 1/8 Male



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AC4A

1/8 NPT/S
connector, 2.000"
(50.80 mm) long
mechanically
attached to base
of seal.

**AC4B**

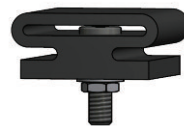
0.250" (6.35 mm) ID
× 0.470" (11.94 mm)
OD flexible
reinforced hose
attached
to mechanical
connector on base
of seal.

**AC4C**

Push-Connect
connector for
0.125" (3.20 mm)
OD or 0.250" (6.40
mm) OD tubing
attached to base
of seal.

**AC5**

.305-32 NEF tire
core valve
mechanically
attached to base
of seal.



Connectors for Type 10 Inflatable Profiles

These connectors are commonly used with our Type 10 profiles. They are molded in place out the base and include a reinforcement cone. Details on overall valve length, thread finish, and cone size may be found on the web in the profile details section (pawlingep.com/pneuma-seal/standard_profiles).

Custom, stainless steel and/or multiple connectors can also be supplied, although special setup charges may apply. Contact Pawling EP for more information.

AC10

Threaded valve
connector.

**AC11**

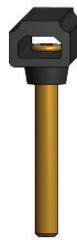
O-ring connector.
Valve is pressed
into a mating bore
and the O-ring
creates the seal.

**AC12**

Threaded/hose
barb connector.
Hose is press fit
onto barbed end.

**AC13**

Straight pipe
connector. Hose is
attached to
connector with
clamp.



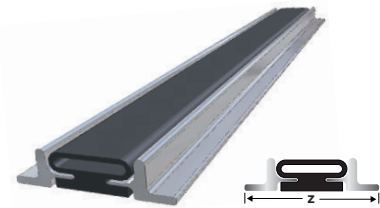
Type

1

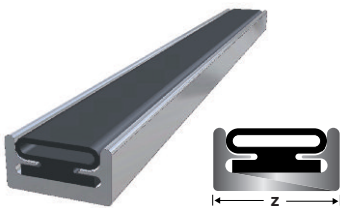
Mechanical Retainers



Z-CLIP
Stainless steel clips screwed down at defined intervals. Seal is then snaked between clips.



TWO-PIECE
Extruded aluminum two piece retainer. One side is typically permanently welded or screwed in place; the other is moveable to facilitate seal installation.



SLIDE-IN
Extruded aluminum retainer for strip seals. Seal is fed into retainer from one end.

SEAL TYPE	(Z) IN	MM	RETAINER
PRS573	1.563	39.70	PRS874
PRS978, PRS717	1.750	44.45	PRS487
PRS537, PRS580	2.000	50.80	PRS487
PRS535, PRS582	3.000	76.60	PRS488
PRS548, PRS583	3.375	85.73	PRS489
PRS934, PRS705	4.875	123.83	PRS818

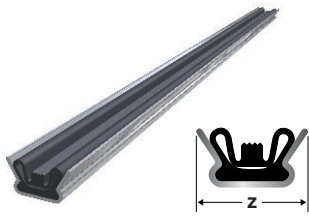
SEAL TYPE	(Z) IN	MM	RETAINER
PRS537, PRS580	3.125	79.38	PR9494
PRS535, PRS582	3.750	95.25	PR5710
PRS548, PRS583	4.375	111.13	PR5223
PRS934, PRS705	5.750	146.05	PR5224

SEAL TYPE	(Z) IN	MM	RETAINER
PRS537, PRS580	1.563	39.70	PR4009
PRS535, PRS582	2.500	63.50	PR5690
PRS548, PRS583	3.625	92.08	PR6491



Type 3

Mechanical Retainer and Retainer Groove Dimensions



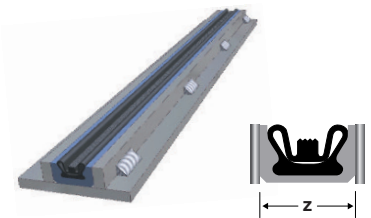
SNAP-IN

Extruded aluminum retainer. Seal snaps in place.



MACHINED GROOVE

Seal snaps in place.



RUBBER SNAP-IN

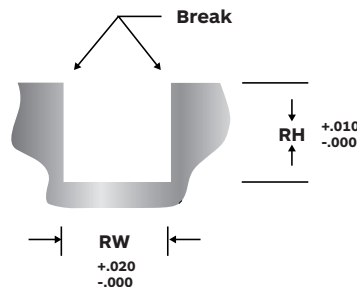
Extruded rubber retainer rigidly supported on the sides or in a channel. Seal snaps in place.

SEAL TYPE	(Z) IN	MM	RETAINER
PRS599	0.875	22.23	PR3593
PRS591, PRS598	1.000	25.40	PR3592
PRS581, PRS597	1.250	31.75	PR3406
PRS594, PRS708	2.500	63.40	PR4226

Machined groove details may be found on the web in the profile details section (pawlingep.com/pneuma-seal/standard_profiles) or contact Pawling EP for more information.

SEAL TYPE	(Z) IN	MM	RETAINER
PRS581, PRS597	1.500	38.10	PR3073
PRS594, PRS708	3.000	76.20	PR13161

Recommended Retainer Grooves for Types 1, 2, 4, and 10 Profiles



Machined grooves may be used to retain and protect seals and are common in circular, radial expansion in/out configurations. Axially configured Type 10 profiles may also be housed in a machined groove. Seals are sized so that their tension or compressive forces are generally sufficient to hold them in place. If used in other configurations, adhesives may be required.

Machined groove details may be found on the web in the profile details section (pawlingep.com/pneuma-seal/standard_profiles) or contact Pawling EP for more information.

Recommended Dimensions

RW = seal profile width (W dimension) with its plus tolerance

RH = seal profile height (H dimension) with its plus tolerance

Surface finish of bottom of machined groove should be 63 microinches or better with finish laying parallel to seal.

Corner Details

As a general rule, depending on specific profile, Pneuma-Seal cross sections, either molded, fabric reinforced or extruded, are flexible enough in radial seal applications to conform to a corner radius of between four (4) and eight (8) times its relaxed height; however, the expansion in these corners will be restricted unless the radius is even more liberal. The effect is more severe when the seal is designed for inward expansion. When the designer has a choice, configuring the seal with corners that expand outward is highly recommended. Square right angle corners are not available for seals which expand radially inward or radially outward.

Extruded Construction

In axially expanding (face seal) applications, extruded corners (Fig. 2) can be preformed to centerline radii approximately twice the cross section width. (see pawlingep.com for details). For some profiles, specially molded 90° RSC corners are available (see below). Note that Pawling EP does not recommend a miter cut and splice corner construction, because this will focus the most strain on the weakest portion of the seal.

Molded, Fabric Reinforced Construction

When using molded, fabric-reinforced profiles, corner dimensions (both radiused and 90°) are largely determined by tooling availability. It is best to review our web-site to obtain the latest list of existing corner molds by profile (see pawlingep.com/pneuma-seal/standard_profiles for details).

Fig. 1: Corner expanding outward.

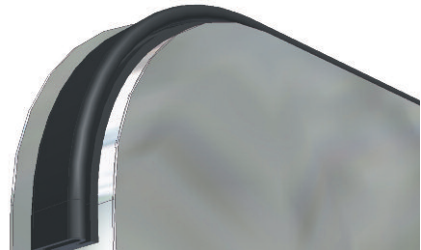


Fig. 2: Axial corner with specially formed or molded corner.



Fig. 3: Axial square corner.



Is a square corner truly square?

RSC Availability

Profile	RSC Corner
PRS573	PR22395
PRS978	PR34505
PRS537	PR28754
PRS535	PR28755
PRS548	PR28756

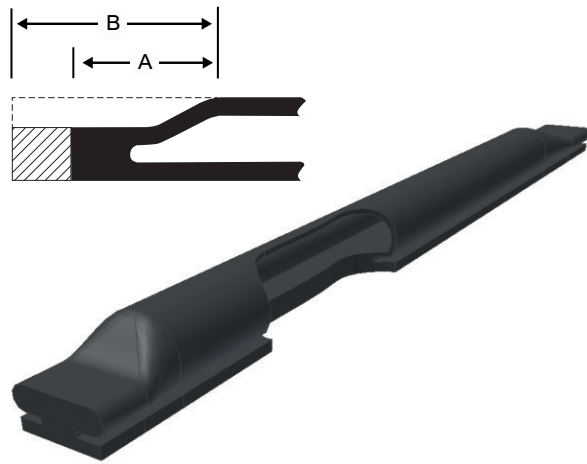
The traditional design of an inflatable seal square corner focuses an inordinate amount of stress at the corner ID. Experience has shown that a seal with square corners lasts about 10 percent as long as one with larger corner radii (e.g. 10,000 cycles for the square corner v. 100,000 for one with gentle corner radii). Over the past several years, we have worked hard to improve our square corners which has led to the development of the new RSC™ corner design. While the corners are designed for square applications, they employ a small radius at the ID to relieve the stress in this area. The result. A huge improvement in performance. So far, we have rolled out the RSC corners in our most popular profiles and continue to make this new technology a part of our overall product line. See pawlingep.com for more details on this exciting improvement.



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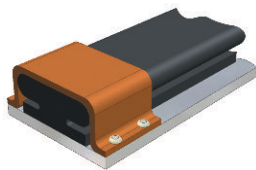
End Details

For straight seals, the design requires a solid, non-expanding portion at each end followed by a transition area where the expansion gradually increases until it reaches full expansion height. In most instances, special inflato-boot or inflato-plug ends are used to promote cycle life. If the design requires a connector out one or both ends, then extended ends are required. Extended ends are also required if pressure plates are used.

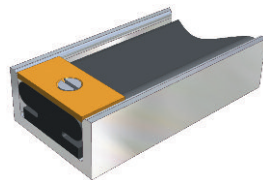


To increase cycle life and reduce the stresses on the ends, pressure plates may be used. For details on clamp dimensions and styles, contact Pawling EP.

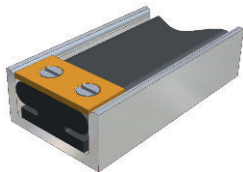
Formed Pressure Plate



Single Screw Pressure Plate



Double Screw Pressure Plate



Standard Boot End Dimensions

SEAL	STANDARD END (A)		EXTENDED END (B)	
	IN	MM	IN	MM
TYPE 1				
PRS573	0.875	22.23	2.375	60.33
PRS537	1.125	28.58	1.875	47.63
PRS535	1.188	30.18	2.250	57.15
PRS548	1.688	42.88	3.250	82.55
PRS717	0.875	22.23	2.375	60.33
PRS580	1.125	28.58	3.125	79.38
PRS582	1.500	38.10	3.500	88.90
PRS583	2.250	57.15	4.125	104.78
PRS705	2.375	60.33	4.125	104.78
PRS729	3.500	88.90	5.000	127.00
PRS590	5.500	139.70	9.500	241.30
TYPE 3				
PRS599	1.500	38.10	2.250	57.15
PRS591, PRS598	1.500	38.10	2.250	57.15
PRS581, PRS597	1.625	41.28	2.250	57.15
PRS594, PRS708	2.000	50.80	3.500	88.90
TYPE 10				
PRS973, PRS991	0.700	17.78	1.200	30.48
PRS977	0.710	18.03	1.210	30.73
PR15092, PRS993	0.812	20.62	1.312	33.32
PRS950, PRS995	0.812	20.62	1.312	33.32
PRS971	0.875	22.23	1.375	34.93
PRS960	0.875	22.23	1.375	34.93
PRS969	0.885	22.48	1.385	35.18
PRS970, PRS997	0.940	23.88	1.440	36.58
PRS955	0.875	22.23	1.375	34.93
PRS952	0.900	22.86	1.400	35.56
PRS966	0.940	23.88	1.440	36.58
PR6119, PRS999	1.300	33.02	1.800	45.72

NOTES

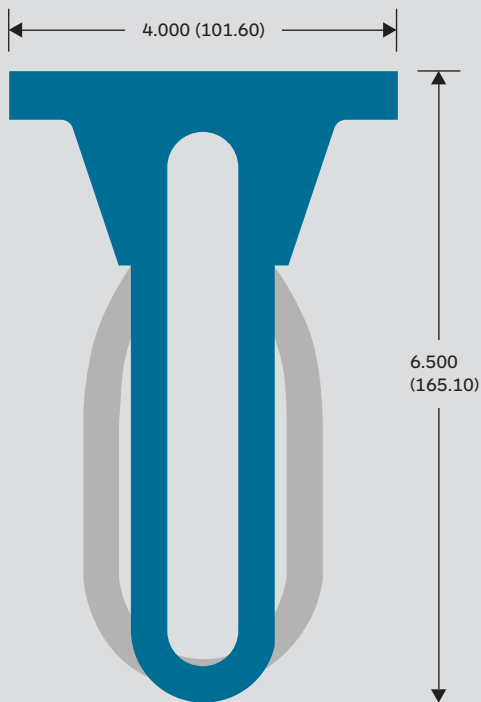
A and B Dimensions are approximate to within 0.094" (2.388 mm).

Custom Profiles

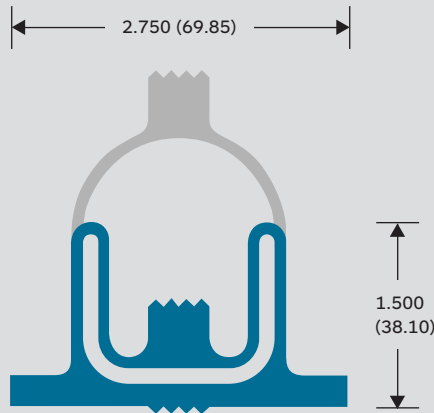
Pawling EP can design and manufacture unique inflatable profiles when the application requires it. These profiles can also be made using special materials. Note, however, that non-recurring setup and/or tooling charges are typically required in order to manufacture these unique seals.

The profiles below are examples of some custom cross sections developed over the years. In our history, we have easily manufactured over 1000 unique custom inflatable profiles—both extruded and molded, fabric reinforced.

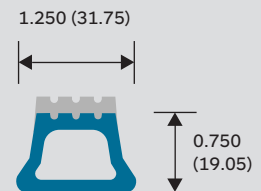
PRS585



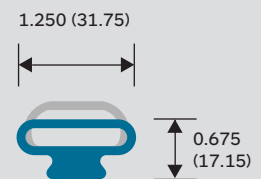
PRS714



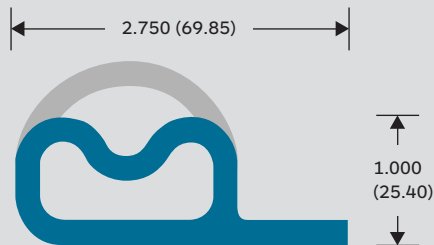
PRS947



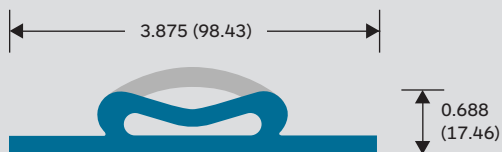
PRS736



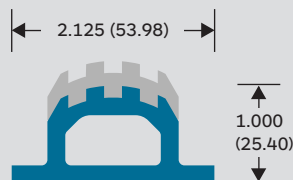
PRS533



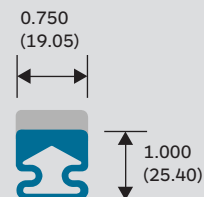
PRS917



PRS28429



PRS22359







Pawling Engineered Products, Inc. is a global manufacturer of highly specialized and innovative elastomeric products. Striving to be the best at what we do defines our culture. Offering customers cutting edge technology, world class engineering, deep materials understanding and close customer support is what sets us apart.

Our industry leading inflatable sealing, clamping and actuating technology is rooted in a long, distinguished tradition of innovation. Today, we play an integral role in critical operations across the healthcare, scientific, pharmaceutical, semiconductor, nuclear power, aerospace, and food, chemical and materials processing industries.

Our Pneuma-Seal products help customers incorporate better motion controls into bonding, cutting and conveyor operations. They make “gentle gripping” possible, from positioning doctor blades in paper processing equipment to clamping aerospace parts during bonding and riveting,

In environments where cleanliness and containment are paramount, our inflatable seals protect against fine particles, extreme temperatures and caustic materials to ensure the integrity of wafer fabrication in semiconductor clean rooms, automobile emissions testing, and product purity in high volume dry food processing equipment. Our advanced sealing technology even helped put a man on the moon, and for years played a significant role in NASA's space shuttle program.

In this design guide, you will find the latest information regarding our Pneuma-Seal inflatable seals and clamps. If you need more information, you can always reach us on the web (pawlingep.com/pneuma-seal) or call one of our Sales Engineers. They will be happy to help you determine the best seal for your application.

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