O-rings are a universal seal throughout the world. However, some axial applications may benefit from a different sealing solution called Press-in-Place seals, or PIP seals.

First, let’s define axial seal. “Axial” implies the seal is being compressed from top to bottom. In other words, the seal is pressed between two flat surfaces. One flat surface has a groove cut into it to retain the O-ring and limit compression. This may also be called a face seal.

Some face seal applications may not lend themselves ideally to an O-ring. One example is a face seal groove that is oriented vertically or upside-down. The O-ring may fall out of the groove, adding to assembly time, or even resulting in a pinched or damaged O-ring.

Another problem may be when an O-ring is used in a non-circular groove, or racetrack groove. The hoop stress of the O-ring causes it to rebound to its circular shape, not staying in the groove.

One solution is to undercut the groove with a dovetail angle; however the dovetail groove has its own challenges. They are more expensive to machine and polish. The angled corners can wear down after many seal replacements. Lastly, the naturally high ratio of O-ring volume to Gland volume can result in an overfilled groove.

The Press-in-Place seal is customized with self-retaining features built into the seal. Three different categories of PIP seals can allow for several options in axial applications:

- Diamond Seal
- H-Seal
- Extruded PIP

Each can have additional advantages, such as low compression force, high line of sealing contact, reduced material usage, dual sealing beads, and work in a wide range of existing groove conditions.
Consolidated Diamond Seal

The Diamond Seal is arguably the most beneficial PIP seal for its many advantages. Its shape is a tall, thin profile, which has good contact pressure and requires less compressive force than an O-ring. The shape uses up to 60% narrower groove width for comparable seal heights. Additionally, the profile minimizes the amount of material used to make the seal, resulting in less weight. Intermittent retention and stabilizer ribs around the seal provide the necessary self-retaining and support needed in the groove. For the problem of an O-ring popping out of a racetrack groove, a custom Diamond Seal is molded to match the groove layout. The Diamond Seal is able to bend around a much tighter corner radii than a standard O-ring. The final benefit of the Diamond Seal is the ability to consolidate seals into a single element, resulting in few part numbers, reduced assembly errors and improved assembly speed.

Press-in-Place H-Seal

The second type of Press-In-Place is the H-Seal. The main benefit over a diamond seal is its ability to retrofit an existing O-ring groove geometry. The H
profile features two sealing beads, which adds stability if rolling is a concern. The second point of contact can add additional confidence for those requiring redundant sealing. Finally, like the Diamond Seal, a major benefit to the H-seal is the ability to consolidate several seals into a single solution.

**Extruded Press-in-Place**

![Extruded PIP Seals](image)

The final type of PIP seal is the Extruded Press-In-Place. The extrusion process results in a precision-cut seal having a flat face, with retention ribs on either the inner or outer diameters. Retention ribs are engineered to grab the groove wall, and can be designed for an existing O-ring groove or even a very narrow or wide groove. The extrusion process for PIP seals offers a significant tooling savings compared to molded PIP seal options. Another unique characteristic of the extrusion process is the lack of molding parting line, which is inherent in O-rings and other molded shapes.

**Conclusion**

Press-In-Place seals are available in nearly every material family and engineered for optimum size and configuration for each unique application. Extruded PIP seals can be as small as .500” inner diameter, or have an outer diameter as large as 19”. Molded PIP seals can be as large as 60 inches in diameter. The Gallagher Engineering Department and Parker Application Engineers are happy to assist you with the right PIP seal design. Please contact us today!

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