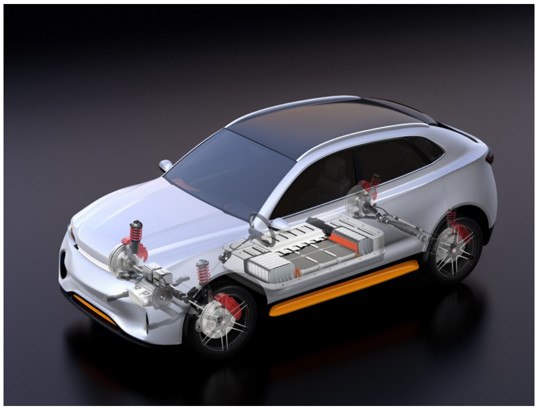
Hollow Keyhole Extrusion

Battery Cover Seals



Improved Performance for Low Pressure Applications:

Large perimeter, extruded gaskets fill a critical sealing need in the electric and electrified vehicle industry. They provide a simple and reliable means of customizing a seal for each specific battery housing while avoiding the expense of dedicated tooling.

Traditional solid Press-in-Place (PIP) seal cross-sections provide high compressive forces and have historically been necessary for higher pressure applications. However, assembly, ergonomics, and vehicle lightweighting are pushing the industry to seals that are easier to install and generate lower compressive forces in low pressure applications.

To satisfy these needs, Parker has developed a new “Keyhole” hollow seal design. This new seal cross-section is easier to install and generates significantly lower compressive load forces while maintaining seal reliability.

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Benefits:

- **Easier to install**
- **Fewer fasteners & thinner components**
- **Accommodate larger mating component variation**
- **Improved seal reliability**
- **Allows easy design changes without tooling**
- **Fits industry standard narrow groove sizes**
- **Existing solutions for all vehicle environments**

Product Features:

- **Self aligning; reduced insertion force**
- **Reduced compressive force**
- **Wider seal compression range**
- **Reduced rollover of seal CS**
- **Available as custom lengths or spliced seals**
- **Available for 3.5 x 5, 4 x 6, 5 x 8 mm grooves (chart on pg. 3)**
- **Manufactured using Parker’s premier material technology**

Parker

ENGINEERING YOUR SUCCESS.

Low Closure Force Battery Cover Seals

Key Advantages of the Keyhole Profile Design

Extraordinary Materials
Parker develops innovative material technology suited to your specific application needs. Among our various materials are several UL 94 HB & V0 class materials targeted for the electric vehicle market. Our recommended EPDM and silicone options offer outstanding load retention, even after 3000 hours of testing in hot air and engine coolant.

Improved Installation
The unique design of the "Keyhole" cross-section pilots itself into the groove and requires less force to install than a traditional Press-in-Place (PIP) seal.

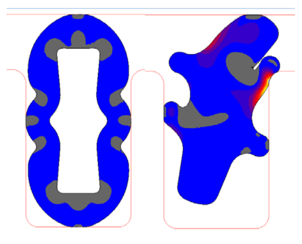


Figure 1: Hollow profile on the left and extruded press-in-place seal is on the right (above).

Traditional Press-in-Place cross-section seals have historically been acceptable from an ergonomics standpoint, but that design target continues to shift downward as plants become increasingly aware of the risk of repetitive motion injuries. In the world of installation ergonomics, less is more.

Accommodates Larger Gap
Gaps within the seal joint can come from a number of variables, but most are attributed to mating surface flatness and deflection. In Figure 2, the extruded PIP seal cross-section on the left was designed to accommodate up to 0.55 mm of gap.

In comparison, the "Keyhole" cross-section shown on the right can handle up to 0.8 mm of gap, meaning it can tolerate 45% more "application gap" compared to a traditional Press-in-Place seal design.

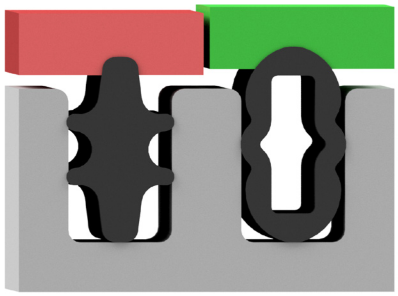


Figure 2: Nominal seal with LMC Gap (above).

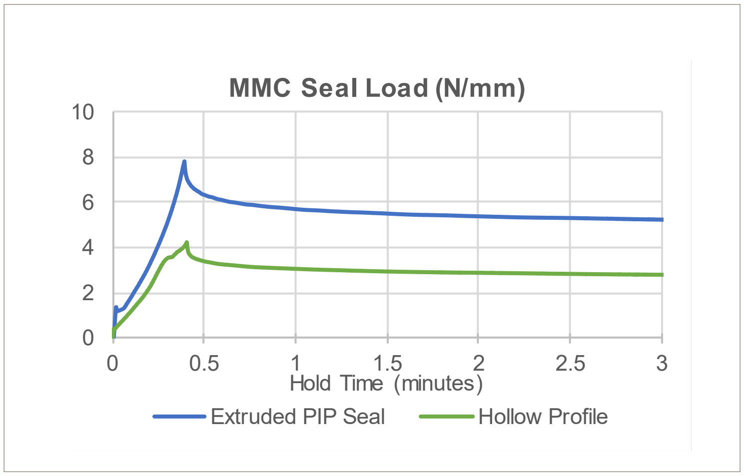


Figure 3: Seal Load

Less Fasteners & Thinner Covers
The lower compressive load attributed to the "Keyhole" hollow cross-section results in lower total application cost by allowing for fewer fasteners and/or thinner and less rigid mating components. Engineers must design the joint for the worst case (peak) load; on average, the "Keyhole" cross-section delivers a 45% load reduction compared to a traditional solid Press-in-Place cross-section. These lower loads are not just a mathematical prediction, but are verified empirically using actual seals in test grooves (see Figure 3).

Roll Over Stability

Knowing that seal rollover is a major area of concern within in the industry for improving the long-term reliability of cover seals, Parker developed both a method to simulate rollover using Finite Element Analysis (FEA) and also a test procedure to confirm the findings using physical parts in the lab. Traditional extruded Press-in-Place seal cross-sections are known to experience a certain amount of roll-over under the wrong conditions, but they still provide an acceptable seal, most of the time.

The "Keyhole" cross-section improves upon this and provides even greater reliability and roll-over stability under the harshest of test conditions.

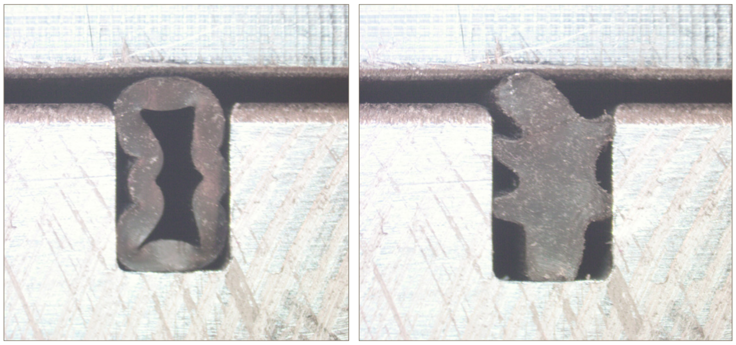
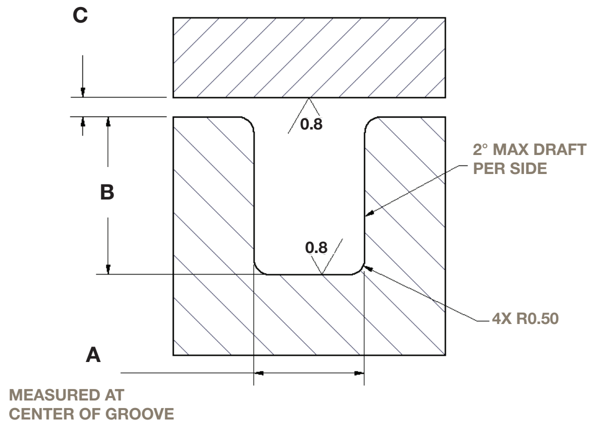


Figure 4: NMC results in stability fixture shown above.



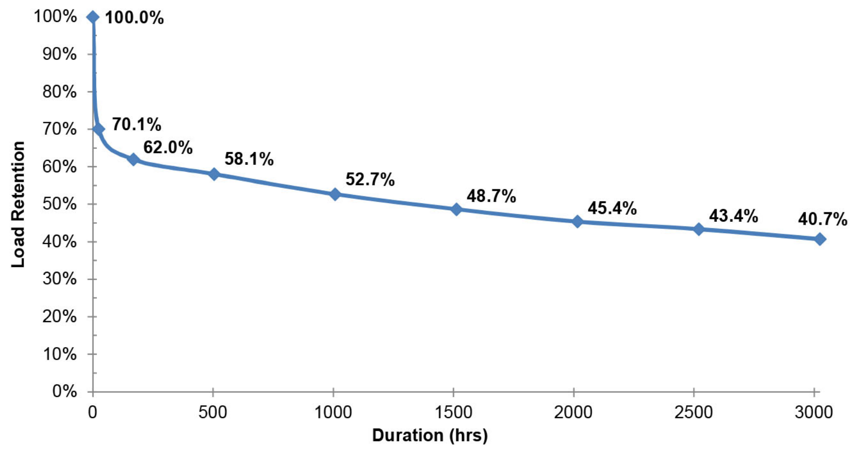
Std. Groove	A Width (mm)	B Height (mm)	C Gap (mm)
3.5 x 5.0	3.50 ± 0.15	5.00 ± 0.15	0.60 max.
4.0 x 6.0	4.00 ± 0.20	6.00 ± 0.20	0.80 max.
5.0 x 8.0	5.00 ± 0.25	8.00 ± 0.25	1.20 max.

Figure 5: Standard Groove Sizes for the Keyhole

E7736

Test Fluid: Air

Test Temperature: 100°C



S7395

Test Fluid: Air

Test Temperature: 100°C