Plate Seals
Simrit Sealing Solutions

Simrit is the industrial sealing products division of the Freudenberg and NOK Group Companies, a global supplier of elastomeric seals and custom molded products, with production facilities in 25 countries and annual sales of over $12 billion in the service of all major technology industries.

While known for supplying superior sealing products with a history that spans over 150 years, Simrit is always looking toward the future. Innovation is the cornerstone of our company and we strive to bring that pioneering spirit to practical reality for our customers every day. Our expert engineers are dedicated to open and instant information exchange throughout the entire Freudenberg and NOK global network. It’s our way of ensuring that only the very “best of breed” solutions rise to the surface.

Simrit Plate Seals

Plate seals are hybrid seals designed to incorporate the best features of flat gaskets and O-rings, while eliminating the drawbacks associated with each of those sealing methods. Plate seals originally gained their reputation for reliability by solving the critical sealing demands of the aerospace industry.

Plate seals typically use aluminum or steel carriers with a groove machined into the face and a rubber sealing bead molded into the groove. The two main types of plate seals include groove-bonded and edge-bonded seals.

Simrit offers plate seals for a variety of applications where improved performance over gaskets, O-rings, and other seals is required. Advantages in assembly, inspection, performance, and retrofitting make them the finest static seals available.

The Simrit service package at a glance:

World’s largest product range—Superior design solutions from a single source.
Continuous innovation—Technological prominence gives our customers competitive advantage.
Unique expertise in materials and high-quality standards—The end-to-end leader for safe, cost-effective applications.
A vast range of integrated services—Holistic support from development through product deployment.
“Globality”—Global expertise united with the knowledge of local market requirements and customer demands.

A groove-bonded plate seal has a metal or composite carrier with a seal groove machined in both sides of the carrier. An elastomeric sealing element is permanently molded into that groove, utilizing both a chemical and a mechanical bond.

An edge-bonded plate seal consists of a metal or composite carrier and has the rubber sealing element molded to the edge of the carrier with a chemical bond. Edge-bonded plate seals are used in uni-directional applications, while groove-bonded plate seals can be used in bi-directional applications.
Groove-Bonded Plate Seals

The groove-bonded plate seal design is optimized to take full advantage of the sealing capabilities of the elastomer. The elastomer is completely contained in the groove, and the squeeze and the volume/void ratio are optimized for each elastomer type and application condition. Groove-bonded seals are bi-directional seals and offer extra protection to the elastomer in highly corrosive environments. They provide superior extrusion resistance in high pressure applications.

Edge-Bonded Plate Seals

The edge-bonded plate seal retains many of the advantages of groove bonded plate seals, such as controlled squeeze and metal-to-metal contact. The main advantage of the edge bonded design is the ability to stamp the metal retainers, which reduces the manufacturing cost for high-volume applications. Edge-bonded seals are typically uni-directional seals, with the elastomer on the high pressure side and the retainer on the lower pressure side.

The retainer onto which the seal is molded may be any metal and even some composite materials. The sealing element can consist of virtually any elastomeric compound, including Simriz® perfluoroelastomer (FFKM), for the most extreme environments, and even polyurethane.

Typical Applications for Groove-Bonded Plate Seals:
- Bi-directional applications
- Extreme pressure applications
- Lower volume applications with metal retainers
- Higher volume applications with plastic retainers

Typical Applications for Edge-Bonded (EPB) Plate Seals:
- Uni-directional applications
- High volume applications
- Less-critical performance requirements
- Incorporates all sealing fundamentals for lower cost

Compared to O-rings, die-cut seals, and cure-in-place seals, edge-bonded plate seals offer superior performance in these fundamental areas: controlled squeeze, resilience, alternate load path, confinement, and volume-to-void ratio. *where space limitations prevent use of a groove-bonded design.

Edge-Bonded Plate Seal Variation: Step with optional cross-holes increases the bonding area and adds a mechanical locking feature to seal resilience. The plate retainer thickness can be reduced considerably.

The Freudenberg-NOK organization draws from more than 150 years of experience and offers quality, well-known brand names including Freudenberg®, NOK®, International Seal®, Simriz®, Disogrin®, and Merkel™. Call Simrit today at 1-866-274-6748 to find out how our total sealing solutions can benefit you. Or visit www.simrit.com.
Advantages of Using Plate Seals

The many advantages of single plate/multi-port sealing over conventional O-ring-type seals are demonstrable and can be readily identified in areas of installation, overall cost, and performance.

Ease of Installation
- Rigid seals are easy to handle and install, particularly in blind or vertical installations
- Color-coded seal edges help ensure correct part identification
- Offers visual confirmation of seal installation
- Seal is chemically and mechanically bonded to mating surface and can not be dislocated
- Metal-to-metal contact prevents over-squeeze of seal and eliminates need to retorque bolts
- Requires less sealing force than flat gaskets
- The rigid structure enables automated installation in higher-volume applications

Cost Advantage
- Reduces expensive machining required on mating components
- Single plate/multi-port sealing capabilities reduce inventory, increase manufacturing productivity, and minimize warranty costs due to missing or poorly installed sealing elements
- Allows high pressure sealing without requiring backup rings
- Can reduce the amount of elastomer required, proving even more economical for high-cost elastomers

Performance
- Controlled squeeze metal-to-metal contact prevents over-compression, which is known to cause premature seal degradation
- Plate seals have the potential of reducing elastomer exposure and lessening fluid/swell issues

Benefits of using plate seals:
- Minimal flange preparation
- Visual installation check
- Limited area of fluid attack
- Narrow “line of contact” sealing
- High extrusion resistance
- Multi-port sealing
- Simplified installation
Simrit’s Proprietary Materials for Plate Seals

**Simriz® Perfluoroelastomer**

*Simriz*, Simrit’s proprietary family of perfluoroelastomer compounds, is now available for plate seals. Designed for thermal stability and nearly universal protection against chemical attack, *Simriz* compounds have a high level of elasticity and offer premier sealing performance. With a fluorination level of 72%, *Simriz* FFKM elastomers have a level of resistance close to that of pure PTFE (76%). At the same time, FFKM materials exhibit resilience that makes them an excellent choice for applications where resistance to aggressive chemicals and tight sealing is required.

**Conductive Elastomers**

Simrit offers a wide range of conductive elastomers. Both silicone and fluorosilicone families of electrically conductive compounds are available specifically for O-rings and plate seal applications. These plate seals and O-rings offer shielding for use in electromagnetic interference (EMI) and radio frequency interference (RFI) suppression applications. These EMI/RFI compounds are formulated with silver and silver-plated alloys, offer from .001 to .05 ohms centimeter resistance, and have excellent fuel and solvent compatibilities. These sealing materials are commonly used in aerospace, ship-borne, and ground-based electronics equipment.

**Comparative Temperature/Chemical Resistance Limits**

<table>
<thead>
<tr>
<th>Material Name</th>
<th>Simriz®</th>
<th>Super FKM</th>
<th>Aflas</th>
<th>Fluorocarbon</th>
<th>Ethylene Propylene</th>
<th>Nitrile</th>
<th>Silicone</th>
<th>Fluorosilicone</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D1418 Designation</td>
<td>FFKM</td>
<td>ETP</td>
<td>TFE/P</td>
<td>FKM</td>
<td>EPDM</td>
<td>NBR</td>
<td>VMQ</td>
<td>FVMQ</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Temperature</td>
<td>300°C</td>
<td>200°C</td>
<td>250°C</td>
<td>150°C</td>
<td>120°C</td>
<td>230°C</td>
<td>180°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>572°F</td>
<td>392°F</td>
<td>482°F</td>
<td>302°F</td>
<td>248°F</td>
<td>446°F</td>
<td>356°F</td>
<td></td>
</tr>
</tbody>
</table>

**Temperature Ranges for Plate Seals Materials**

*Simrit is the single-source developer of Simriz, starting with the base polymer, thus ensuring complete oversight and continuity in the compounding process. Eliminating any need for costly outsourcing, Simriz compounds offer the highest seal quality at a highly competitive price.*
Semiconductor Applications—Bonded Gate Seals

Bonded gate seals for semiconductor applications are produced through a unique manufacturing process where seal profiles are bonded directly to process chamber gates. This allows for less seal movement, reducing contamination in process.

Simrit bonded gate seals are available in a wide range of compounds, from FKMs for mild chemical processes, to advanced Simriz perfluoroelastomers (FFKM) for the most aggressive and particulation-sensitive environments. Bonded gates are also available for most of the major OEM tool sets.

Bonded Gates Features
- Unlike standard plate seals, special seal cross-section design allows cushioning without metal-to-metal contact
- Allows for less seal movement, reducing metal contamination in process
- Available in a wide range of compounds to suit the particular process

Benefits of the Bonded Gate Seal
- Eliminates costly premature seal failures due to seal “pop-out” which can occur when the gate is actuated to transfer product
- Eliminates rolling, twisting, and the abrasion associated with seal movement during gate operation of standard O-ring/groove designs
- Avoids substrate metal particle contamination
- Avoids expensive machining of standard or dovetail-shaped O-ring groove in mating components
- Bonded gates have extended service life over O-ring/groove designs, which can extend periodic maintenance cycles and allow for more tool “up-time”

Because of the dynamic nature of gate applications, O-ring/groove designs require a very tight-fitting O-ring to prevent premature “pop-out”. These O-rings are often very difficult to install and, if installed incorrectly, perform poorly, causing unscheduled maintenance and possible loss of product. Simrit bonded gates eliminate this problematic installation issue.

Other industries benefiting from plate seal performance include: agriculture and construction (applications for off-highway mobile equipment—oil pan seals, hydraulic pumps, fuel pumps, transmission housings); oil and gas; deep sea systems; nuclear technology; general consumer equipment (recreational vehicles and land maintenance); and marine (applications include freshwater supply and sanitation systems).
Aerospace Applications for Plate Seals

Simrit offers a variety of specialized plate seals for the aerospace industry, consisting of certified materials manufactured to exacting standards.

**NAS 1523 Fas-N-Seal® Fastener Seals**
- Pressure-tested to NAS 1523 specifications
- Available in a variety of AMS/ML-spec elastomers including nitrile, fluorocarbon, silicone, fluorosilicone, and neoprene
- Metals include aluminum, stainless steel, and chrome molybdenum steel
- Mechanically and chemically bonded sealing element
- Metal retainer serves as torque limiter
- Applicable to all types of fasteners

**AS27194-AS27198 Series Plate Seals**

Specified on AS27194 through AS27198 (formerly MS27194 through MS27198) drawings for aerospace and commercial flange applications, Simrit plate seals are typically used in flared tube and hose fitting applications. They seal both external and internal fuel lines, lubrication lines, oil lines, and bleed air lines. Simrit plate seal designs provide:

- Easy replacement on an existing rigid flange with limited accessibility and clearance
- Easy handling by the outside edges and installation in a non-horizontal position.
- Clear edge visibility assuring appropriate installation
- Entire range of standard AS sizes to meet the MS279762 mating hose/tube-fitting series
- A variety of elastomeric compounds with both aluminum and stainless metal alloys

Simrit offers custom-designed plate seals to reduce weight and increase performance in many aerospace applications. Our custom designs provide compatibility for the continually evolving hose-fitting designs on new engine applications.