



Second Generation Wide Footprint Kalsi Seal

Benefits of the New Wide Footprint Seal

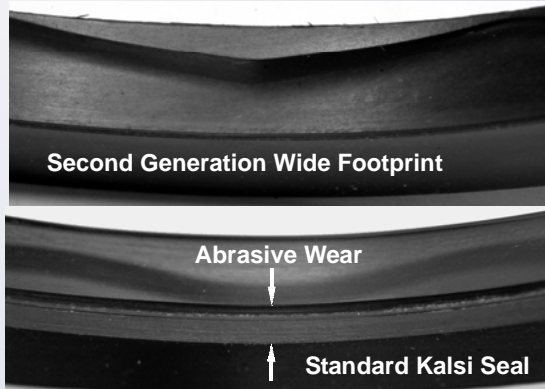
The second generation Wide Footprint Seal¹ provides longer rotating service life in abrasive, high pressure service conditions *while fitting in the existing Standard Kalsi Seal gland*. The increased life is achieved by increasing sacrificial wear material and reducing the under-lip seal temperature compared to the Standard Kalsi Seal.

More Sacrificial Wear Material for Longer Life

The first generation Wide Footprint Seal design, widely used in oil and gas drilling operations, has built a solid reputation for long life, due to:

- A seal lip that is 50% wider than the Standard Kalsi Seal at the narrowest locations
- Increased radial compression
- Improved abrasive exclusion

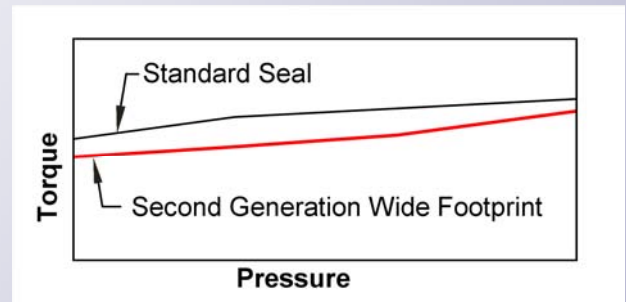
The increased seal width and radial compression provide significantly more sacrificial material to accommodate abrasive wear and extrusion damage, resulting in longer seal life. The optimized geometry of the second generation Wide Footprint Seal, which also incorporates these features, provides excellent abrasive exclusion performance compared to the Standard Seal (See photo below).



The Wide Footprint Seal exhibits no wear after a 115 hour rotary test with highly abrasive oilfield drilling fluid at 200°F.

Cooler Running Seals for Higher Reliability

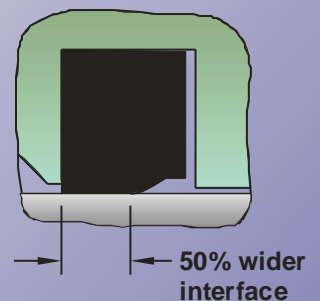
Due to improved lubrication, the second generation Wide Footprint Seal generates less heat than the Standard Kalsi Seal, even with the added sacrificial material. Seal running torque is a measure of lubrication, and the source of seal-generated heat. The figure below shows the running torque comparison between the second generation Wide Footprint Seal and the Standard Kalsi Seal. The reduced running torque of the Wide Footprint seal results in as much as a 25°F reduction in under-lip temperature.



The average torque of the second generation Wide Footprint Seal is ~20% lower than that of the Standard Kalsi Seal. This results in cooler under lip seal temperatures, providing higher reliability and longer life in extreme operating conditions.

All These Advantages in Standard Seal Gland!

The second generation Wide Footprint Seal was developed as a superior replacement for the Standard Seal. In thousands of hours of rotary testing, spanning multiple years of development, the second generation Wide Footprint Seal outperformed the Standard Seal in all tested conditions. The second generation Wide Footprint Seal, with all its benefits, fits in the Standard Kalsi Seal gland.



Longer life, reduced heat & wear, same gland

Availability

HNBR Wide Footprint Seals are available in various diameters, for use with the equivalent standard seal radial gland depth. For a complete list of available Wide Footprint Seal sizes, see www.kalsi.com.

In an abrasive environment, the use of positive lubricant pressure differential or spring loading is recommended to prevent skew induced-wear² for Standard or Wide Footprint Seals. If the use of springs or differential pressure is impractical, the Axially Constrained Seal³ style is typically recommended.

Commitment to Customer Support

The **Kalsi Seals Handbook**, which is available at www.kalsi.com, provides detailed technical information, including installation dimensions and guidelines. Experienced Kalsi Engineering personnel are available to provide technical support, which includes review of the rotary seal application and implementation.



The engineering support team provides technical review and input for rotary seal implementations. The team has 115 years of combined experience in rotary seals and oil field equipment.

Computer-controlled rotary test fixtures are available to evaluate seal performance with customer-specified lubricants, process fluids, speeds, pressures, temperatures, and other application-specific conditions.

Kalsi Engineering offers two training classes that provide detailed instruction on maintenance and engineering practices that will provide optimum life and reliability. The classes are available at the customer's location, Kalsi Engineering's facility, or via Web-X.

¹Covered by U.S. and foreign patents. "Wide Footprint", Wide Footprint Seal", "Kalsi Seal", "Axially Constrained Seal" and "Kalsi Seals" are trademarks of Kalsi Engineering, Inc.

²For a description of skew-induced wear, and combating it with springs or differential pressure, see the **Kalsi Seals Handbook**.

³For a description of Axially Constrained Seals, see the **Kalsi Seals Handbook**.

Commitment to Quality and Performance

The quality and consistent performance of Kalsi Seals are ensured through rigorous testing (compression set, rotary performance, and breakout torque tests), 100% visual inspection of all seals by trained personnel, and adherence to other rigorous quality control procedures.



All Kalsi Seals undergo a 100% visual inspection. Here, Rome performs a visual inspection as well as key dimension and material property checks.

Commitment to Continuous Improvement Through Research and Testing

Kalsi Engineering's research and development mission is continual seal improvement directed at the needs of existing and new rotary seal applications. Seals are developed and refined through state-of-the-art analysis techniques and rigorous testing (10,000 hours of rotary seal testing annually).



Kalsi Engineering performs an average of 10,000 hours of rotary seal testing every year. Much of the testing is aimed at developing seals capable of surviving higher temperatures at higher pressures and speeds for longer durations.

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