



# Hybrid Seal

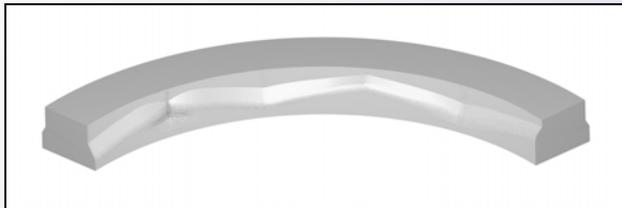
## Flexible Sealing Technology

### Features and Benefits of the Hybrid Seal

The Hybrid Seal<sup>1</sup> combines Enhanced Lubrication waves with zig-zag waves to extend reliability and performance over standard seals in demanding downhole and surface applications.

Compared to Kalsi Seals with conventional waves, the Hybrid Seal provides the following benefits:

- Higher pressure capacity in applications with thin or thick viscosity lubricants
- Lower running torque, resulting in cooler under lip seal temperatures
- Improved lubrication and performance in seals with reduced radial cross-sections
- Increased tolerance of seal material variability



*The Enhanced Lubrication wave accommodates thinner viscosity lubricants and higher pressures and speeds.*

### Design Flexibility for Tailored Performance

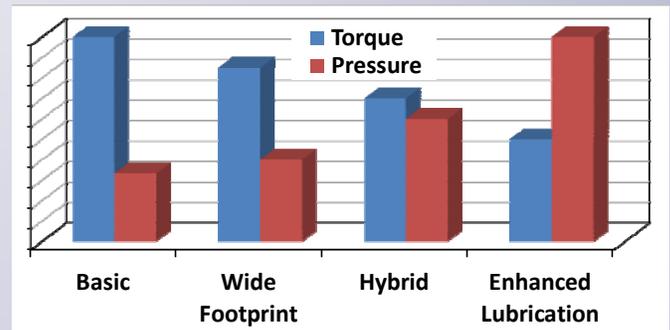
The Hybrid Seal can be designed to perform anywhere between the high pressure capable, low torque Enhanced Lubrication Seal (EL) and the low leaking Second Generation Wide Footprint Seal. This flexibility in performance, to meet application requirements, is achieved by varying the number and type of Enhanced Lubrication waves. There are 6 EL wave options, varying from very aggressive (type A) to modest (type C) hydrodynamic pumping related leakage. For applications requiring accurate leakage prediction, contact Kalsi Engineering.

The Hybrid Seal can be manufactured in standard (614-Series) and Wide Footprint (637-Series) variations.

The increased seal width of the 637-Series provides significantly more sacrificial material to accommodate abrasive wear and extrusion damage, resulting in longer seal life.

### Cooler Running Seals for Higher Reliability

Due to improved lubrication, the Hybrid Seal generates less heat than the second generation Wide Footprint and basic Kalsi Seals. Running torque is a measure of the friction (the source of seal-generated heat) and an indication of lubrication. The figure below compares the running torque and pressure capacity of the second generation Wide Footprint Seal, basic Kalsi Seal, Hybrid Seal, and Enhanced Lubrication Seal. The reduced running torque of the Hybrid Seal results in as much as a 25°F reduction in under-lip temperature.



*The average torque of the Hybrid Seal is between the Enhanced Lubrication Seal and the second generation Wide Footprint Seal, and is lower than that of the basic Kalsi Seal. This results in cooler under lip seal temperatures, providing higher reliability and longer life in extreme operating conditions. The performance depicted is based on a Hybrid seal with one type A wave for every two conventional waves.*

### All These Advantages in Standard Seal Gland!

The Hybrid Seal was developed as a superior replacement for seals with conventional waves in demanding downhole and surface applications. The Hybrid Seal extends capacity and increases reliability. With all its benefits, it still fits in the standard Kalsi Seal gland.

**Longer life, reduced heat & wear, same gland**



## Availability

HNBR Hybrid Seals are available in various diameters, for use with the equivalent Wide Footprint or basic Kalsi seal radial gland depth. For a complete list of available Hybrid Seal sizes, see [www.kalsi.com](http://www.kalsi.com).

In an abrasive environment, the use of positive lubricant pressure differential or spring loading is recommended to prevent skew induced-wear<sup>2</sup> of Standard, Wide Footprint, and Hybrid Seals. If the use of springs or differential pressure is impractical, the Axially Constrained Seal<sup>3</sup> style is typically recommended.

## Commitment to Customer Support

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



*The engineering support team provides technical review and input for rotary seal implementations. The team has over 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.

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

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

<sup>3</sup>For 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, Robert Palacios 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.*

# Longer life, reduced heat & wear, same gland

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