Chapter C8

Dual Durometer Kalsi Seals

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Individual chapters of the Kalsi Seals Handbook are periodically updated. To determine if a newer revision of this chapter exists, please visit www.kalsi.com/seal-handbook.htm.

1. Dual Durometer seal construction reduces contact pressure

The patented Dual Durometer™ seal construction (Figure 1) provides lower interfacial contact pressure, torque, and heat, compared to single durometer Kalsi Seals having similar extrusion resistance. The outer part of the seal, which defines the static sealing lip, is made from a relatively soft compound to minimize interfacial contact pressure. The inner part of the seal, which defines the dynamic sealing lip, is made from a harder, more extrusion resistant compound to bridge higher pressure.

Figure 1
Dual Durometer construction is applicable to many Kalsi Seal geometries

Dual Durometer Kalsi Seals employ composite construction. The outer material is softer than the inner material, to reduce interfacial contact pressure. This reduces torque and seal generated heat, and improves extrusion resistance. The construction technique is applicable to various un-grooved hydrodynamic seal geometries.

By appropriate compound and wave pattern selection, the Dual Durometer Seal™ can be tailored for specific applications. As an example, for a high pressure seal application, such as an oilfield rotating control device, the dynamic sealing lip can be made from a harder, more extrusion-resistant compound than would otherwise be possible in a single durometer seal, while keeping the interfacial contact pressure in a useful range for hydrodynamic lubrication.

As another example, for a moderate pressure application, the torque and self-generated heat can be minimized while maintaining the necessary extrusion resistance. In moderate pressure field usage, 65/80 Shore A Dual Durometer Kalsi Seals with conventional sine waves have been used successfully to reduce contact pressure and minimize heat generation in artificial lift pump top drive sealing, providing several years of rotating life in a number of instances without active cooling. The 65/80 Shore A seals ran cooler than a –10 HNBR single durometer seal, and proved to be essential to operational success.

2. Applicable to various hydrodynamic seal geometries

The Dual Durometer technology is a construction method, rather than a specific seal geometry. It is possible to use Dual Durometer construction with most un-grooved Kalsi

Seal geometries, provided that the radial cross-sectional depth is large enough to accept two layers. The benefit provided by Dual Durometer construction is more pronounced when the radial depth of the softer layer is significantly larger than the radial depth of the harder layer. We prefer that the total radial cross-sectional depth of a Dual Durometer Seal be 0.270" (6.86mm) or larger, but will consider manufacturing smaller cross-sections on a case by case basis. Dual Durometer construction is not applicable to Axially Constrained Seals.

3. Specifying a Dual Durometer Seal

Kalsi Seal *geometries* are identified by drawing based basic part numbers, which are provided on our website.[1] Kalsi Seal *materials*, including Dual Durometer material combinations, are identified by a *"dash number"* that is appended to the basic part number. For example, the PN 568-121-106 seal is an Enhanced Lubrication Seal made in accordance with drawing 568-121 using the -106 material combination (70/90 Shore A HNBR). The dash numbers for available materials are provided on our website.

When Dual Durometer Seals are made using existing single durometer tooling, the as molded seal diameter depends on the molding shrinkage characteristics of the selected material combination, and the shrinkage correction factor a specific mold was designed for. In many cases involving molds designed for HNBR seal materials, the diameter impact on an HNBR Dual Durometer Seal is insignificant. In cases where the as-molded diameter from existing tooling is undesirable, dedicated tooling for a specific diameter and material combination can be built, or the customer's shaft size can be adjusted to fit the seal.

4. Dual Durometer Seal implementation considerations

Installed axial width increases over a single durometer seal

The installed axial width of a Dual Durometer Seal is wider than a single durometer seal made from the same mold, because the initial radial compression causes more axial spread at the softer outer material. Because of this fact, a wider groove is typically recommended for Dual Durometer Seals. Call for specific recommendations.

Abrasive service recommendations

When Dual Durometer Seals are used to partition an abrasive environment from a lubricant, lubricant overpressure should be maintained at all times, even when the

[1] The website does not display part numbers for custom private branded seals.

machine is not operating. The absence of lubricant overpressure may be detrimental to the abrasive exclusion capability of a Dual Durometer Seal.

Footprint width

The footprint width of an installed Dual Durometer Seal is less than that of a single durometer seal made from the same mold. This is because the lighter lip loading results in less deformation related axial spreading of the dynamic lip. The lighter lip loading and narrower footprint width help to reduce the breakout torque of a Dual Durometer Seal.

Enhanced lubrication seal considerations

Enhanced Lubrication Seals have a narrower installed footprint width, compared to a sine wave or zigzag wave seal having the same dynamic lip width. This is caused by the unique shape of the Enhanced Lubrication waves. This narrowing effect is negligible with Type A waves, and most pronounced with the Type B, C, and F waves.

At this writing, nearly all testing of Dual Durometer Enhanced Lubrication Seals has involved Type A waves and the -106 material combination (70/90 Durometer Shore A HNBR). Such seals exhibited excellent high pressure extrusion resistance, and higher hydrodynamic pumping related leakage than comparable single durometer Enhanced Lubrication Seals constructed of -11 HNBR material. See the *"Catalog & Technical Data"* section of this handbook for published test results.

Cost considerations

Because of a more complex manufacturing process, Dual Durometer Seals are more expensive than single durometer seals of comparable size.