Chapter C2

Standard 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. Standard Kalsi Seals

Standard Kalsi Seals (Figure 1) are a general-purpose rotary seal design that has the original *"standard"* dynamic lip width. This type of seal is used in certain applications where wider lips or greater hydrodynamic pumping related leakage are undesirable. For example, and application that is sensitive to breakout torque may require use of one of our standard rotary seals. When moderately higher leakage can be accommodated, a Hybrid Seal with the standard lip width should be considered. Contact us for seal selection guidance.

Originally based on a sine wave type hydrodynamic inlet, most of the Standard Kalsi Seal product line has been upgraded to the more efficient zigzag inlet design. Both the old and the new inlet designs have similar hydrodynamic leakage, but the newer zigzag inlet provides better interfacial lubrication, and is suitable for up to 400°F operation when used with the -30 FKM material.

In oilfield mud motors, the Standard Kalsi Seal has been largely supplanted by more recent seal designs, except in miniature cross-sections. The Axially Constrained Seal is generally preferred for pressure compensation pistons because no axial spring force is required, allowing for simpler piston design. Wide Footprint Seals are generally preferred as pressure retaining seals because they have more sacrificial material and significantly more extrusion resistance, which provide higher reliability and longer life.

Figure 1

Standard Kalsi Seals

Standard Kalsi Seals have the original *"standard"* dynamic lip width, and are used in certain applications where a wider lip or greater hydrodynamic leakage is undesirable.

Available seal sizes

Standard Kalsi Seals are available in seven standard cross-sectional sizes ranging from 0.145" to 0.415" (3.68 to 10.54 mm) deep, and are produced in diameters ranging from 0.394" to 16-1/2" (10.0 to 419.1 mm). A dxf file that includes artistic renditions of installed Kalsi Seals is available on our website for incorporation into customer assembly drawings.

For available seal sizes, visit kalsiseals.com.

GA539.9

Radial Size (Inch)	0.145	0.186	0.212	0.270	0.300	0.335	0.415
Axial Size (Inch)	0.170	0.170	0.220	0.250	0.250	0.250	0.300
							

Figure 2

Available seal cross-sectional sizes

Standard Kalsi Seals are available in radial cross-sectional depths ranging from 0.145" to 0.415", and in diameters ranging from 0.394" to 16-1/2".

Available seal sizes

For best results in terms of abrasion resistance, install with positive differential pressure acting from the lubricant end of the seal, or spring load (see Engineering Section). Regardless of the material used, sine wave based Standard Kalsi Seals are only recommended for service temperatures of 280°F (137.8°C) or less when axially spring loaded, due to geometry constraints. Most zigzag based Standard Kalsi Seals are suitable for use at temperatures up to 400°F (204.4°C) when suitable high temperature materials are used.

2. Lubricant recommendation for -11 HNBR seals

For Standard Kalsi Seals made from the -11 (80 to 90 Shore A HNBR) material, the general purpose minimum lubricant viscosity recommendations for operating at a bulk lubricant temperature of 162°F (72.2°C) are shown in Figure 3.

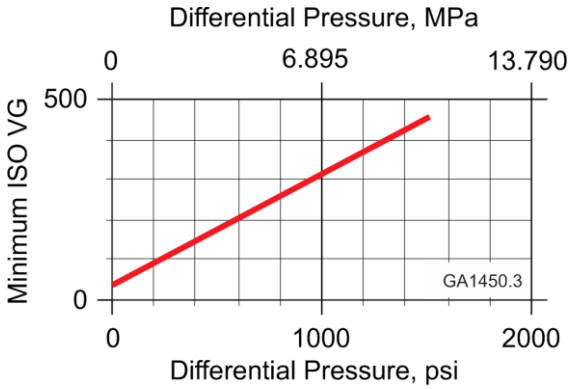

Figure 3

General purpose minimum lubricant viscosity recommendations for Standard Kalsi Seals based on a limited number of well-cooled rotary tests using synthetic hydrocarbon lubricants at a bulk lubricant temperature of 162°F (72.2°C). The tests were performed at 480 rpm using 2.75" (69.85mm) seals.

For available seal sizes, visit kalsiseals.com.

3. Kalsi Seal rotary leakage test examples

Kalsi Engineering has performed a number of laboratory tests of 2.75" (69.85 mm) ID, 0.335" (8.51 mm) radial cross-section PN 344-25-11 Standard Kalsi Seals to characterize hydrodynamic running torque and rotary leakage.

Figure 5 shows the upper bound leakage of Standard Kalsi Seals at 162°F (72.2°C) using a lubricant viscosity and a seal material commonly recommended for high differential pressure usage. The leakage information in Figure 5 is considered to be conservatively high because of the low test temperature.

At lower pressure, thinner lubricant provides lower torque. In order to minimize seal generated heat, the thinnest lubricant that accommodates the desired PV range is generally recommended.

4. Estimating Kalsi Seal hydrodynamic leakage

To estimate upper bound rotary hydrodynamic leakage Q (ml per hour) for 0.335" (8.51 mm) radial cross-section Standard Kalsi Seals with the -11 HNBR material, use Equation 1 with lubricant constants from Figure 4.

Equation 1:

$$Q = Y \times S^2 \times V_{RPM}$$

Where:

Q = hydrodynamic leakage, ml per hour

S = shaft diameter, inches

Y = viscosity constant from Figure 4

V_{RPM} = shaft velocity, revolutions per minute

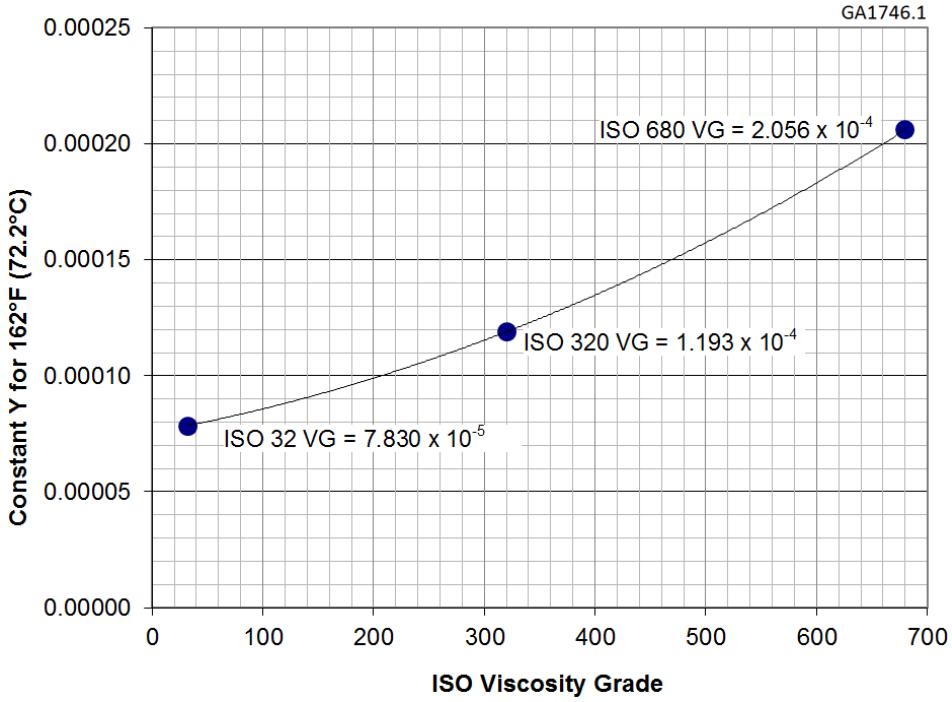

Figure 4

Viscosity Constant Y for Standard or Wide Footprint Kalsi Seals

Viscosity Constant Y at 162°F (72.2°C) for Standard or Wide Footprint Kalsi Seals with various ISO Viscosity Grade[1] lubricants. These constants represent upper bound leakage from empirical data.

1 The viscosity range in centistokes at 104°F (40°C) for each ISO viscosity grade is the viscosity represented by the grade name ±10%. For example, the 104°F (40°C) viscosity of ISO 680 viscosity grade is 612 to 748 cSt.

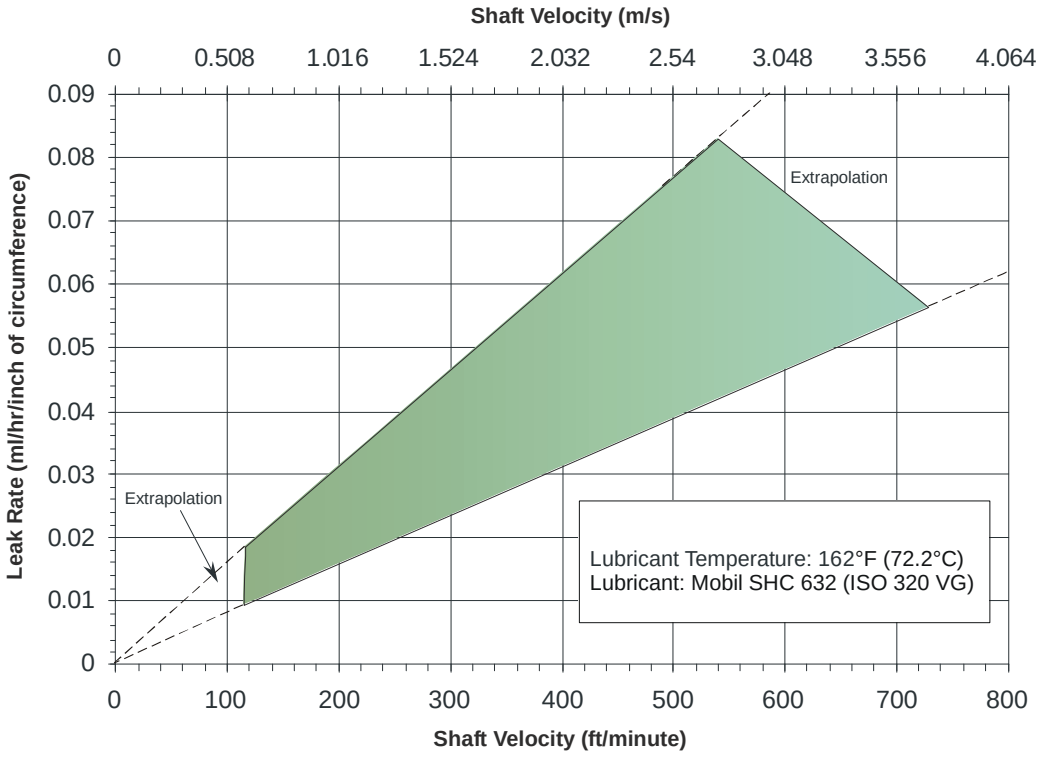

Figure 5

Hydrodynamic leakage characteristics of a Standard or Wide Footprint Seal using an ISO 320 viscosity grade lubricant at 162ºF (72.2ºC).