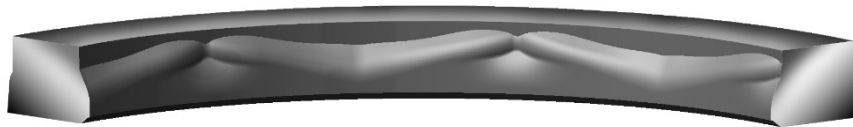


## Chapter C15

### Chamfered Enhanced Lubrication Kalsi Seals



#### Revision 2 September 22, 2015

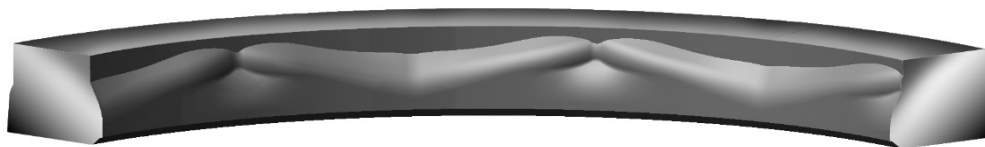
Individual chapters of the Kalsi Seals Handbook are periodically updated. To determine if a newer revision of this chapter exists, please visit [www.kalsi.com/seal-handbook.htm](http://www.kalsi.com/seal-handbook.htm).

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## 1. Introduction to Chamfered Enhanced Lubrication Seals

Chamfered Enhanced Lubrication seals<sup>1</sup> (Figure 1) are a subset of Enhanced Lubrication Seals. They were designed and successfully tested for applications where the pressure of an abrasive environment is higher than the pressure of the seal lubricant. Kalsi Engineering refers to this condition as “*reverse pressure*”.

This breakthrough allows the seal to be used in equipment that has a simple gravity fed lubricant reservoir.



**Figure 1**

### **Chamfered Enhanced Lubrication Seals**

The Chamfered Enhanced Lubrication Seal can operate continuously with reverse pressures of up to 500 psi. This allows the seal to be used in equipment that has a simple gravity fed lubricant reservoir.

## 2. Reverse pressure testing of Enhanced Lubrication Seals

### **A 300 hour reverse pressure test**

A chamfered 0.339” cross-section PN 674-3-15 Wide Footprint, Type F Enhanced Lubrication Seal was tested against drilling fluid for 300 hours. The drilling fluid was 9.8 lbs/gallon, and was formulated to contain 1.25 to 2.50 percent sand. The ISO 150 viscosity grade seal lubricant was supplied from a gravity fed lubricator, and the drilling fluid was maintained at 450 to 500 psi. The rotary speed of the 2.75” shaft was 750 rpm (540 feet/min), and the bulk lubricant temperature was maintained at 162°F via thermocouple-controlled under-sleeve coolant circulation.

The seal was in very good condition at the conclusion of the test. Although there were lessons to be learned, the performance of the seal exceeded our expectations.

### **Other reverse pressure testing**

Other tests have been run, but the one described above is the most demanding test to date. The tests performed on Type F Chamfered Enhanced Lubrication Seals are summarized in Table 1 and include tests with condition differences, such as less speed,

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<sup>1</sup> “Enhanced Lubrication Seals” and “Enhanced Lubrication Seal” are trademarks of Kalsi Engineering, Inc. Covered by issued and pending U.S. and foreign patents.

less pressure, less total duration, and different lubricant viscosities. Tests were also performed on un-chamfered Type F Enhanced Lubrication Seals. The collection of tests have provided us with the following insights:

- The maximum hydrodynamic pumping related leak rate is not measurably influenced by changes to differential pressure or speed, for ISO lubricant viscosity grades between 68 and 150.
- The hydrodynamic pumping related leak rate decreases as the differential pressure increases, when using an ISO 320 viscosity grade lubricant.
- An exclusion edge chamfer increases the ability of the seal to exclude abrasives in reverse pressure conditions.<sup>2</sup>
- With gravity fed lubricators, one must take care during the initial lubricant filling operation to ensure that the waves of the seal will be exposed to lubricant during rotation. Evacuating the air with a vacuum pump prior to introducing the lubricant is a reliable method.

### **Conclusion**

The tests performed to date suggest that Chamfered Enhanced Lubrication Seals can be operated with an environment pressure that is up to about 500 psi greater than the lubricant pressure at bulk temperatures up to about 162°F. Such seals may have commercial merit in cost sensitive applications such as low pressure rotating heads.

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<sup>2</sup> Reverse pressure tests with an un-chamfered Wide Footprint Enhanced Lubrication Seal were performed at 50, 90 and 500 psi for 120 hours. Seal Abrasion damage was minimal at 500 psi but was significant at 50 and 90 psi.

Test #	Lubricant ISO viscosity grade	Bulk lubricant Temperature, °F	Speed, feet/min	Drilling fluid pressure, psi	Test duration, hours	Leak rate per wave, ml/hour
14	150	162	288	50	92	NA
15				90	92	NA
18			540	500	295	0.012
24				500	308	0.019
25				50	250	0.011
46	68	170	262	105	140	NA
53				450	95	0.017
54				480	125	0.008
55				50	100	-0.001
58	320	162	270	50	24	0.064
58				250	24	0.036
58				500	24	0.019

Table 1

**Gravity fed lubricator tests with Type F Chamfered Enhanced Lubrication Seals**

The test durations are the result of achieving a minimum target and stopping the test at our convenience. Tests with durations exceeding 200 hundred hours were directed at satisfying API 16RCD dynamic sealing test requirements. Seals were in excellent condition at the conclusion of each test.

**Caveats**

The lab testing is presented with the following caveats:

- The testing did not include reversing pressure or zero pressure difference conditions. Experience suggests that such pressure conditions have unique challenges.
- New tooling is required to produce Chamfered Enhanced Lubrication Seals.
- The implications of scaling the seals up to larger cross-sections have not yet been explored through testing.

For available seal sizes, visit [kalsiseals.com](http://kalsiseals.com).