

Chapter C13

Seal testing & support



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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 <https://www.kalsi.com/seal-handbook/>.

NOTICE: The information in this chapter is provided under the terms and conditions of the Offer of Sale, Disclaimer, and other notices provided in the front matter of this seal handbook.

1. You are responsible for testing the seals in your application

This handbook provides sealing information and options for additional evaluation by individuals having engineering proficiency. It is not practical for Kalsi Engineering to test its rotary sealing products (or the related engineering information herein) under every conceivable combination of service conditions and implementation variations that may be encountered in customer applications. Many oilfield downhole service conditions are virtually impossible to simulate on the surface, and the specific conditions vary depending on tool design. For example, heat transfer is dependent on equipment geometry and materials. It is therefore incumbent upon the customer to fully evaluate the sealing product to their own satisfaction before using the product in production items. This evaluation may include both laboratory testing and field testing of prototypes.

2. Prototype testing

One critical aspect of equipment prototype testing is providing ambient thermal conditions, including heat transfer conditions, which are equivalent to the range of actual field operating conditions. Most Kalsi Seal™ applications involve exposure to environmental fluids, and in most applications the fluid is flowing, and/or the piece of equipment is immersed in a fluid. A common mistake in laboratory testing is to simply test the equipment dry, or with stagnant fluid conditions that do not represent actual field heat dissipation conditions. This may result in overheating of the rotary seals due to seal and bearing generated heat, since the heat is not dissipated as it would be in the field. To prevent rotary seal damage, the test apparatus should simulate the heat dissipation conditions encountered in the field. If field heat dissipation conditions are not duplicated in a test apparatus, avoid rotary seal damage by testing at lower speed to check out basic equipment functions.

When performing laboratory prototype testing, it can be useful to monitor the lubricant temperature near the rotary seals via thermocouples to understand the local ambient temperature that the seals are exposed to. The lubricant temperature near a seal will typically be higher than that of the environmental fluid due to the heat generated by the rotary seals and bearings. See Chapter D8 for additional information about heat transfer considerations.

3. General application support

Experienced Kalsi Engineering personnel are available to provide general rotary seal technical support and can review your design to suggest ways to implement the rotary seals.

In order that they may best assist you, please forward drawings showing the rotary seal locations in your application, and fill out the application questionnaire that is provided on our web site [seal literature page](#). This will allow our staff to work closely with you during the seal implementation process and help you to avoid common pitfalls.

If problems are encountered with an application, please forward the seals, a completed application questionnaire and an installation sketch to Kalsi Engineering. In many cases, we can quickly diagnose an implementation problem by reviewing the used seals and the application information. Each seal should be tagged to tie it to a specific sealing location, equipment serial number, and operating conditions (if known). If possible, the seal part number and batch inspection number should also be recorded.

4. Engineering and technician training

Introduction

Kalsi Engineering provides three basic types of seal-related training courses that are tailored to the needs of the customer. Most of classes we give are for application engineering or recommended shop practices. We also have a class that provides an overview of our seal product line and the issues specific seal designs address. This class helps customers understand and differentiate between seal designs, so they can select the right seal when a need arises.

The classes can be attended at Kalsi Engineering's facilities, the customer's facilities, or online. Since our success depends on your success, we offer these classes free of charge. Call us at 281-240-6500 to schedule a class, or for more information.

Application engineering classes

The engineering classes typically last from three to four hours, depending on the type of equipment being discussed and the size of the class. Topics typically include design of the shaft running surface and seal installation path, design of the seal groove and shaft to seal housing clearance, bearing implementation, lubricant reservoir design, and heat transfer, ambient pressure, differential pressure, and environmental considerations.

Shop technician classes

We limit shop training classes to 30 to 40 minutes to minimize impact on production schedules. If desired, the shop training can take the form of a "lunch and learn" session. The shop training covers equipment disassembly, component inspection, seal installation, and equipment reassembly issues that can impact the life and reliability of the rotary seals.

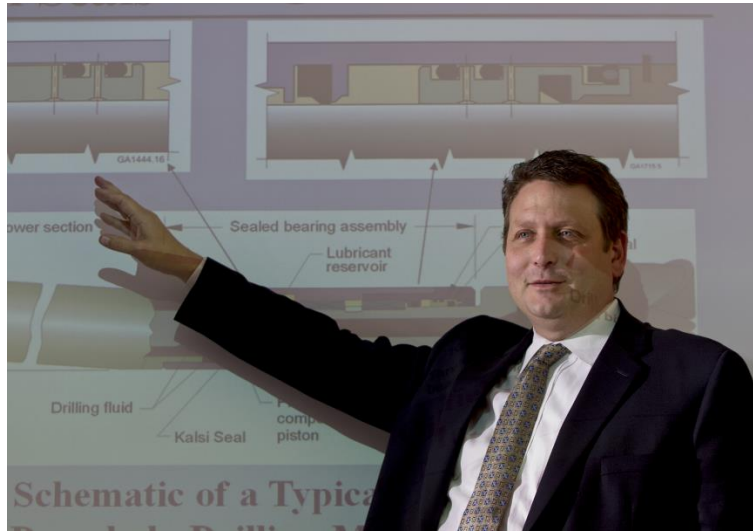


Figure 1

Engineering and shop training classes

Kalsi Engineering provides free seal-related training classes. One type of class is geared toward engineers and designers, and another is geared toward shop personnel. A class that provides an overview of our sealing products is also offered.

5. Consulting engineering support

Our laboratory is equipped with a number of computer-controlled rotary seal test fixtures (Figure 2) that are routinely used for quality control, research and development. These fixtures are available on a for-profit basis to evaluate rotary seal performance with customer specified lubricants, process fluids, environmental temperatures and other application-specific conditions.

6. Seal test fixture capabilities

Bench testing of rotary shaft seals

Figure 2 shows the standard horizontal shaft test fixtures that are used to perform much of our instrumented rotary seal testing. These bench test fixtures are capable of testing seals up to 5" (127 mm) in diameter against various environments.

These fixtures test two seals at a time, so there is no net axial hydraulic load on the shaft. This arrangement allows high differential pressure tests to be performed without axially loading the fixture bearings and allows multiple specimens to be tested.

The tests are ordinarily conducted on easily replaceable wear sleeves, which can be concentric or intentionally eccentric. The shafts on these bench test fixtures incorporate a rotary coupling to allow water to circulate under the wear sleeves in order to simulate the

circulation of drilling fluids through downhole mud motor applications, and to maintain the desired temperature at the seal-to-sleeve interface.

The test fixture shafts are driven by a variable speed AC motor capable of operating within a range of zero to 3,600 rpm. An automatic data acquisition system is employed to record all pertinent data (Figure 3). The data is transmitted, in real time to a proprietary data processing program which produces Excel spreadsheets of the test results. Recorded data includes the frictional torque generated by the operation of the seals, bulk oil, seal carrier, environment, and coolant water temperature, hydrodynamic pumping-related seal leakage, shaft speed, and lubricant pressure.

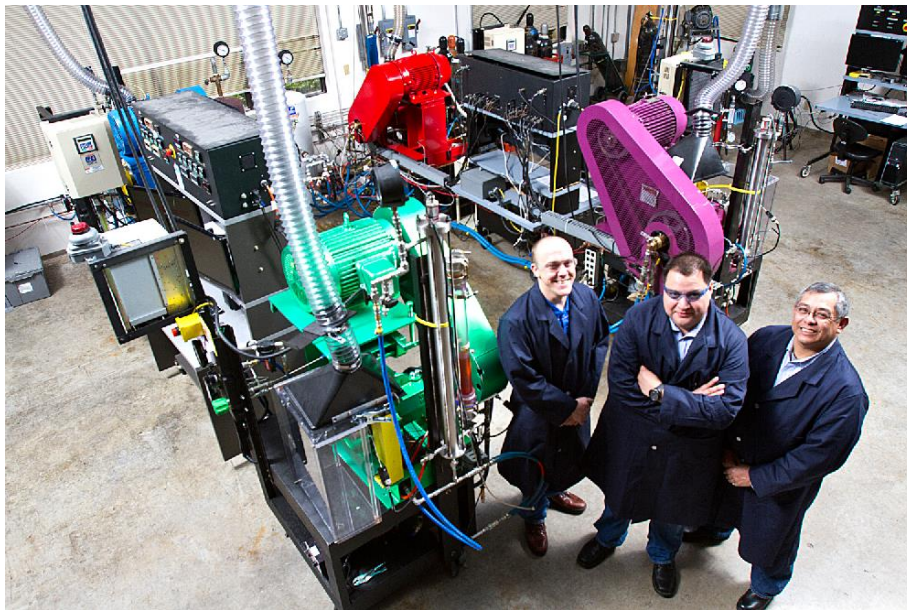


Figure 2

Rotary shaft seal testing laboratory

Kalsi Engineering performs an average of 10,000 hours of rotary shaft seal testing every year. Much of the testing is aimed at developing seals that can survive ever harsher conditions. These fixtures are available on a for-profit basis to evaluate seal performance with customer specified lubricants, process fluids, environmental temperatures, and other application-specific conditions.



Figure 3

Fully instrumented horizontal seal test fixtures

Our battery of five bench test fixtures are fully instrumented for 24-hour operation and can test rotary shaft seals up to 5.00" (127 mm) in diameter.

Large diameter rotary seal testing

Figure 4 shows one of several larger diameter fixtures that are used to test rotary shaft seals up to 10.50" (266.7mm) diameter. These are primarily used to conduct seal tests for high-pressure rotary control device (RCD) and swivel applications.

We have, at various times in the company's history, produced test fixtures for specific applications, such as rotary seal housings, large diameters, or pump simulation.

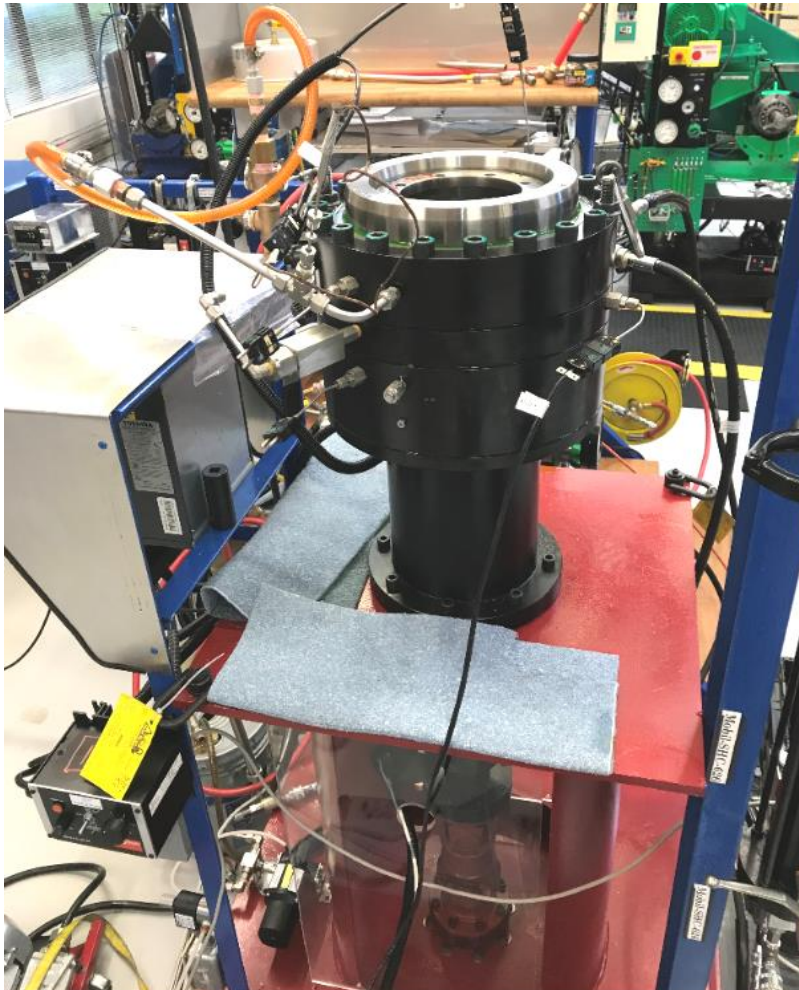


Figure 4

Large diameter vertical shaft rotary seal test fixtures

This is one of several fully instrumented large diameter rotary shaft seal test fixtures that allow around the clock testing under the high-pressure operating conditions of RCDs and hydraulic swivels. Testing full size RCD seals on these fixtures helps to assure that our RCD seal customers will be able to meet the dynamic pressure rating test requirements of API Specification 16RCD.