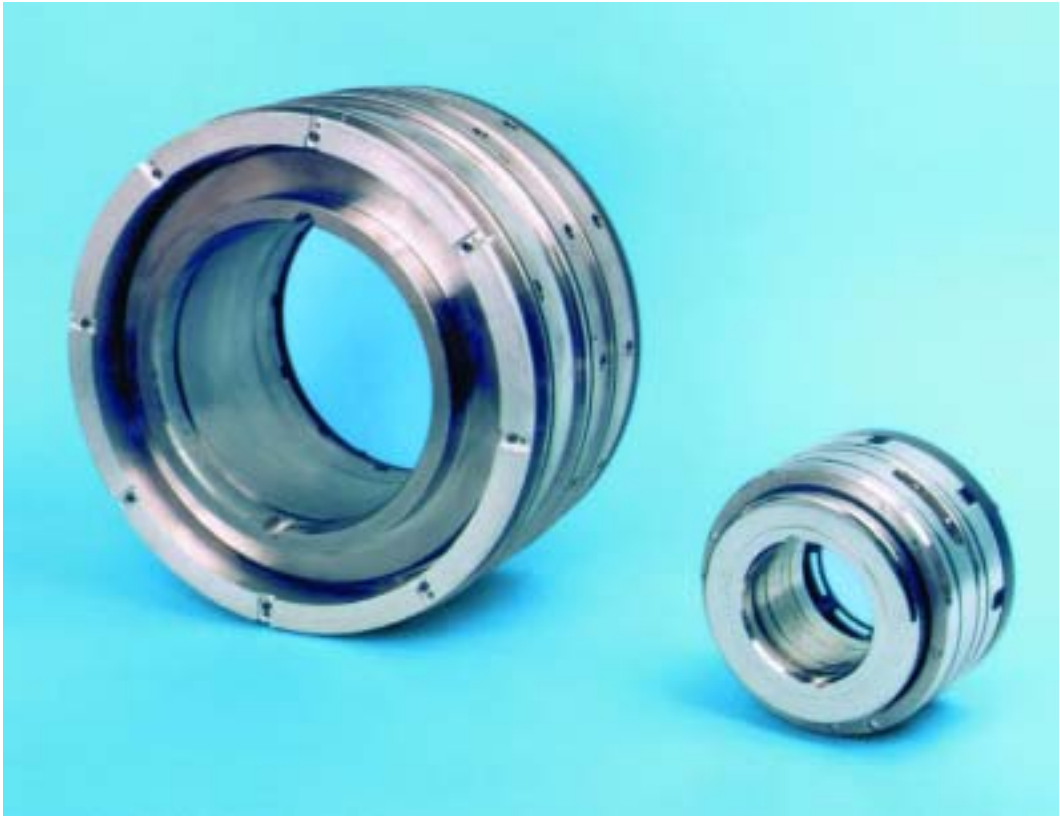
KAYDON

TURNING IDEAS INTO ENGINEERED SOLUTIONS



K-DGS Series Dry Gas Seals

The latest advancements in dry running gas seals from the pioneers of the technology.

KAYDON RING & SEAL, INC.

www.bergab.ru Берг АБ bergab@ya.ru Тел. (495)-228-06-21, факс (495) 223-3071

K-DGS Configurations

Single Seal

(K-DGS)

Compact and economical, the single seal configuration is recommended for non-toxic applications where redundant systems are not required. The single seal is capable of the pressures, speeds and temperatures handled by the tandem design. When used with a Kaydon K-CBS Circumferential Barrier Seal, the single DGS provides the same safety in operation as the tandem seal design. An economical alternative to the tandem configuration where redundant systems are not required.

Tandem

(K-DGS2)

This is the most popular configuration used in the industry. It is applied in one of two ways. The first way is when it is used as a redundant system: if the inboard gas seal takes a full pressure drop, the outboard seal works as the back up. The second way is for applications with higher pressures and/or speeds. The tandem design is used to reduce the operating conditions across each face seal. Generally, the pressure breakdown is split equally across both the inboard and outboard gas seals.

KAYDON EXCLUSIVE

Improved Double

(K-DGS + K-PCS)

In this unique Kaydon design, the high pressure side gas seal is replaced with a single Kaydon K-PCS Process Circumferential Seal. This cost effective solution reduces the seal's effects on the machine's rotordynamics and heat generation problems compared to typical double gas seals in more demanding applications. Designed for processes where buffer flow to process must be kept to a minimum.

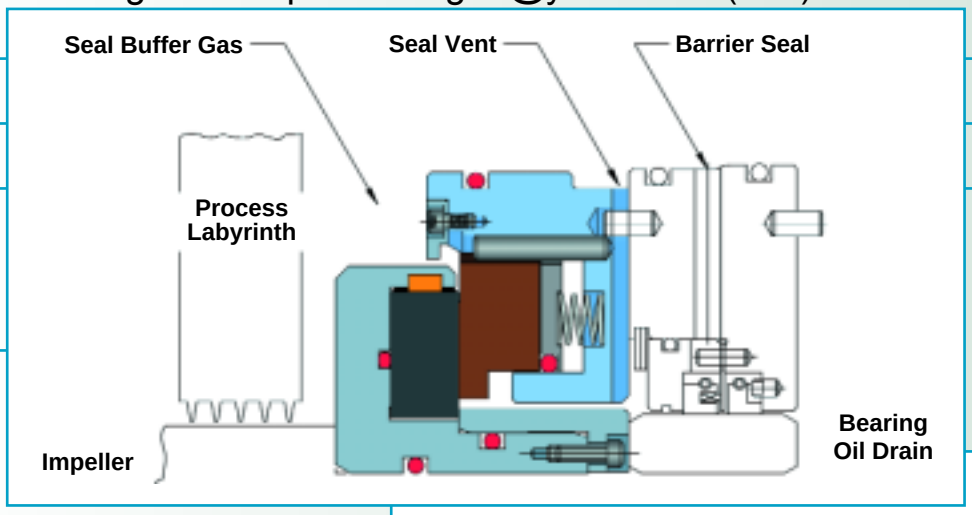
KAYDON EXCLUSIVE

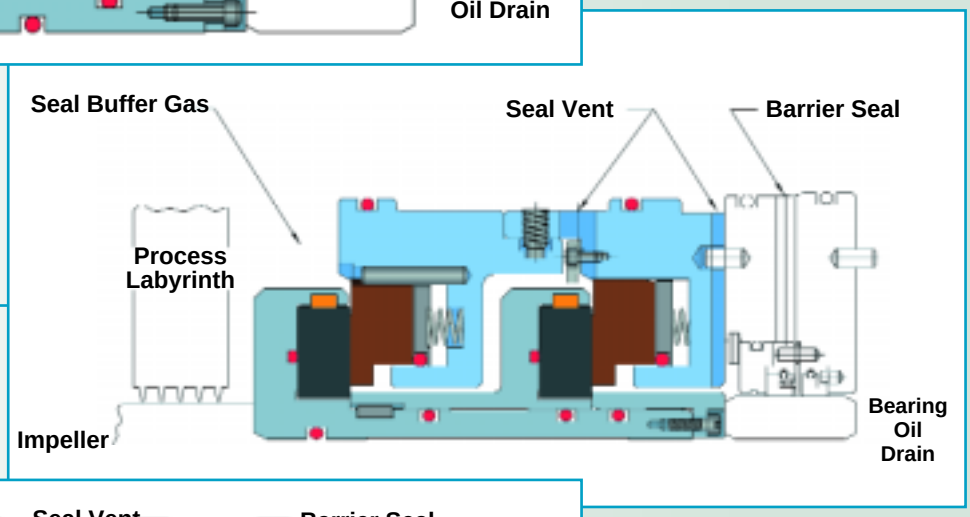
Improved Tandem

(K-DGS2 + K-PCS)

This configuration uses a K-PCS Process Circumferential Seal to replace the process side labyrinth. The result is less consumption of filtered process gas and contamination of the gas seal during process upsets.

For operating performance of the various configurations, please FAX or call.


Seal Buffer Gas
Seal Vent
Barrier Seal
Process Labyrinth
Impeller
Bearing Oil Drain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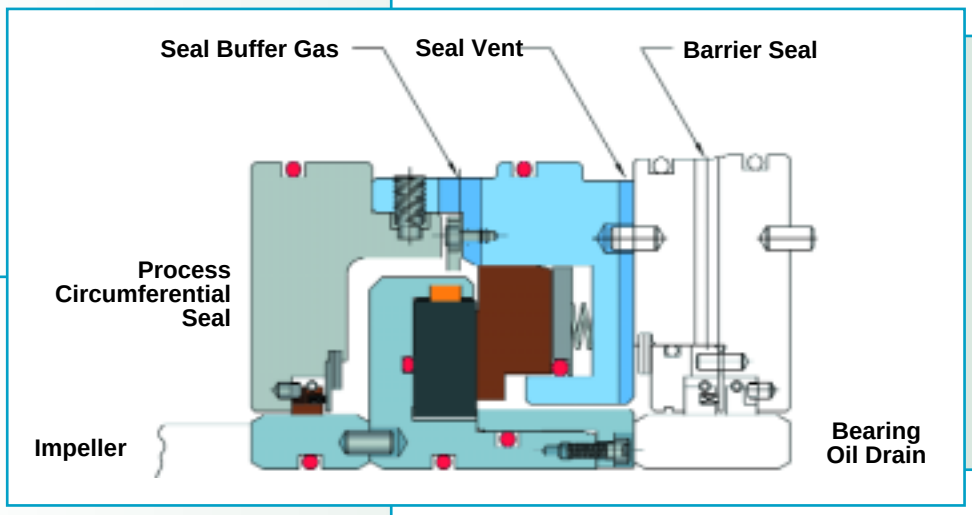
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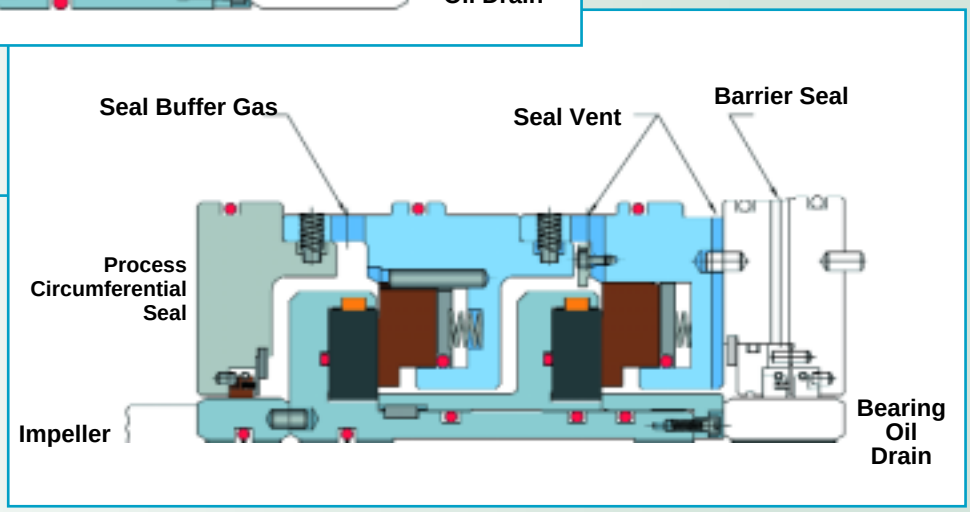
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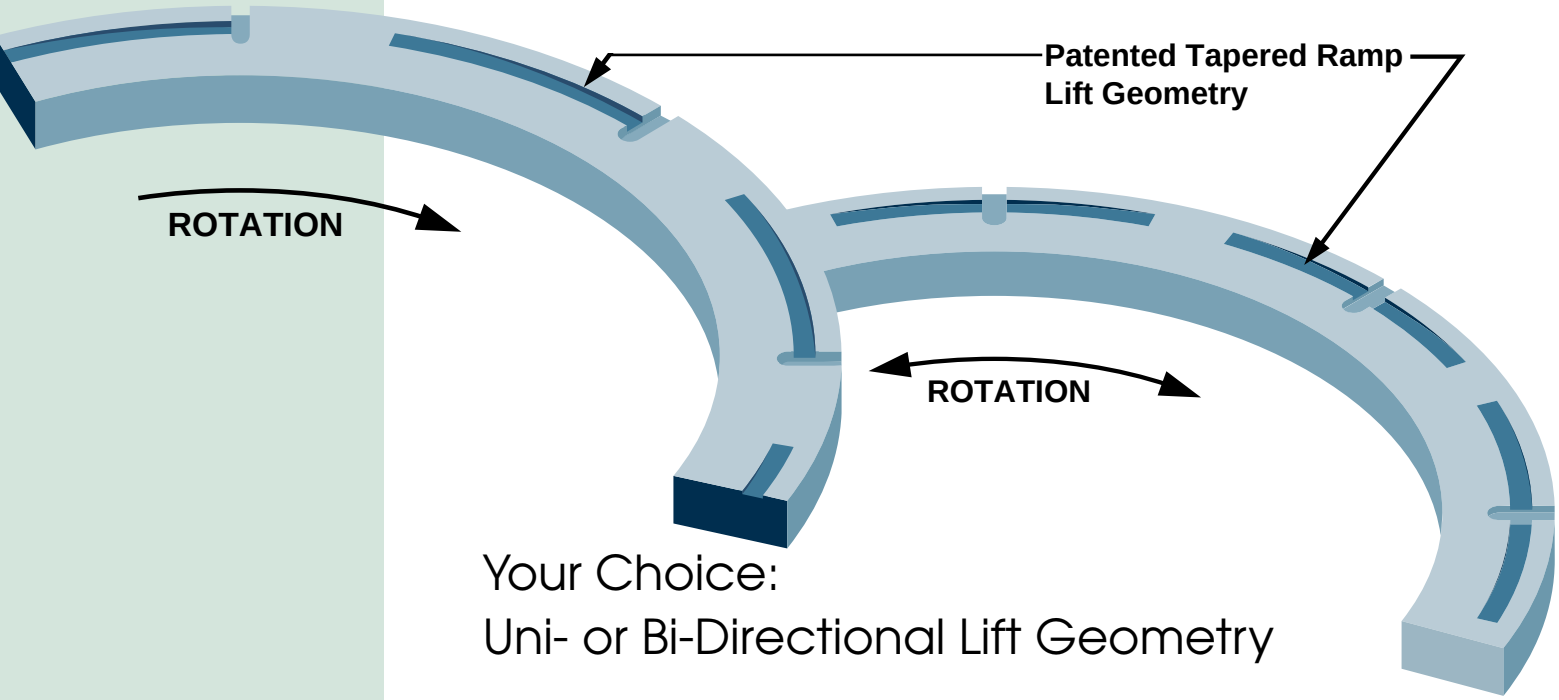
Engineering Makes the Performance Difference!

Kaydon continues a long tradition of engineering innovative, custom designed seals to meet the turbomachinery industry's critical sealing requirements. The company began business in the early 1930s as a manufacturer of gland packing rings (HUHN Style) to the steam turbine industry. Since the early 1950s, Kaydon engineers have designed, manufactured and dynamically tested advanced seal designs for the compressor industry. Our first—and the original—dry gas seal went into service in 1951 and continues to operate today! One compressor manufacturer reports that the Kaydon Dry Gas Seals, in operation since the early 1980s, continue to perform with over 1.2 million service hours so far. Our customers count on Kaydon seals which operate in pipeline compressors, refineries, utilities, and chemical plants in North America, South America and on platforms in the North Sea. In every case, Kaydon produced a custom engineered seal which performed to exacting specifications. Because we took a custom engineered approach to each application, our seals performed with the same integrity as the rest of the system. As we continue to make innovations in the technology, you can count us, as the dry gas seal pioneers, to give you the most reliable product.

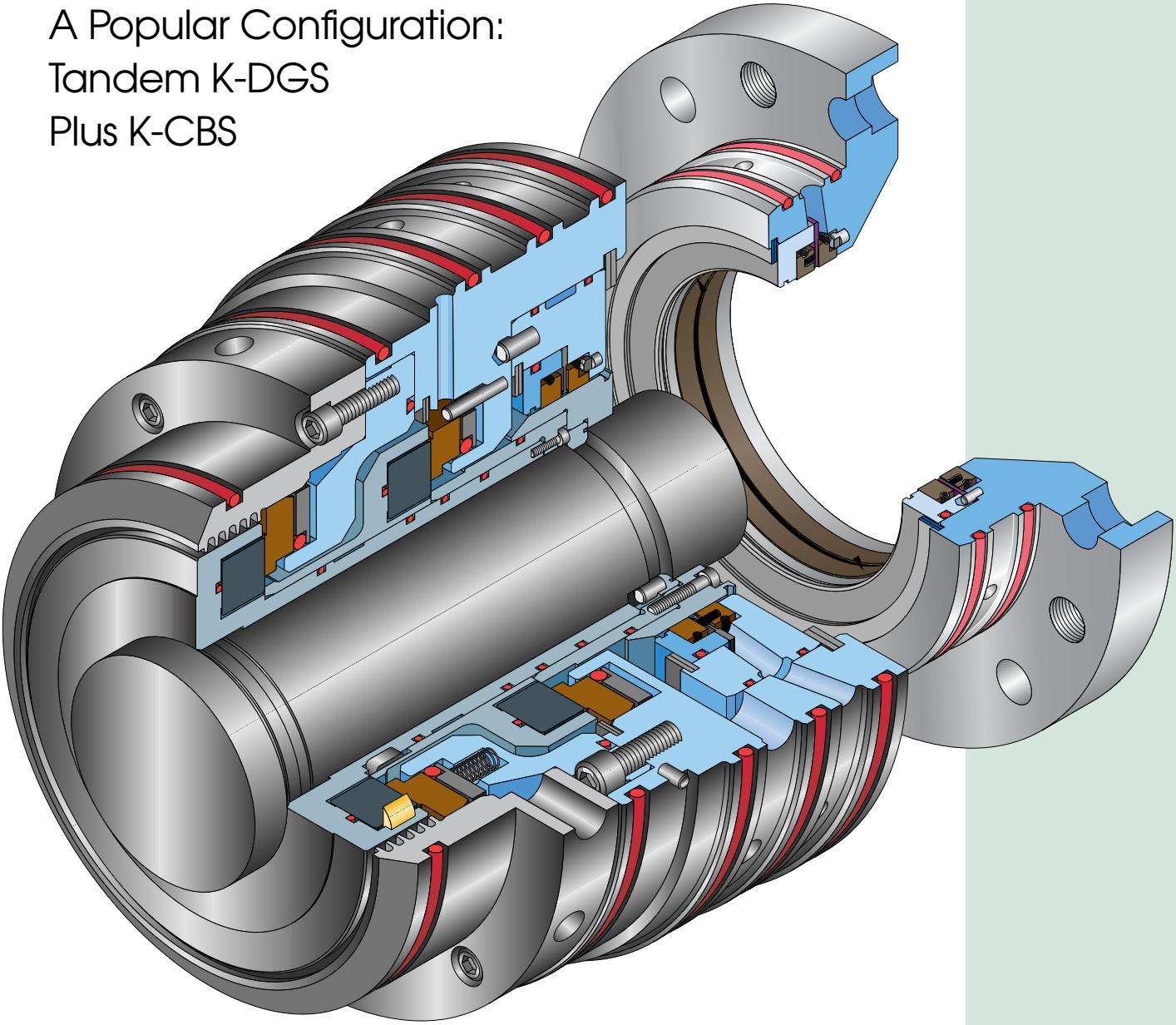


Your Choice: Uni- or Bi-Directional Lift Geometry

Kaydon manufactures both uni-and bi-directional seals. Since the early 1980s, our Tapered Ramp bi-directional designs have proven themselves with reliable performance. The simplicity and elegance of the Kaydon design is evident: a mirror image of the uni-directional design give equal hydrodynamic lift in both directions of rotation. This patented design is extremely efficient to custom engineer for specialized performance parameters.

Kaydon patent no. 5,066,026.

A Popular Configuration:
Tandem K-DGS
Plus K-CBS



Available as an integrated, one-piece system, or as separate cartridges with one purpose: PERFORMANCE!

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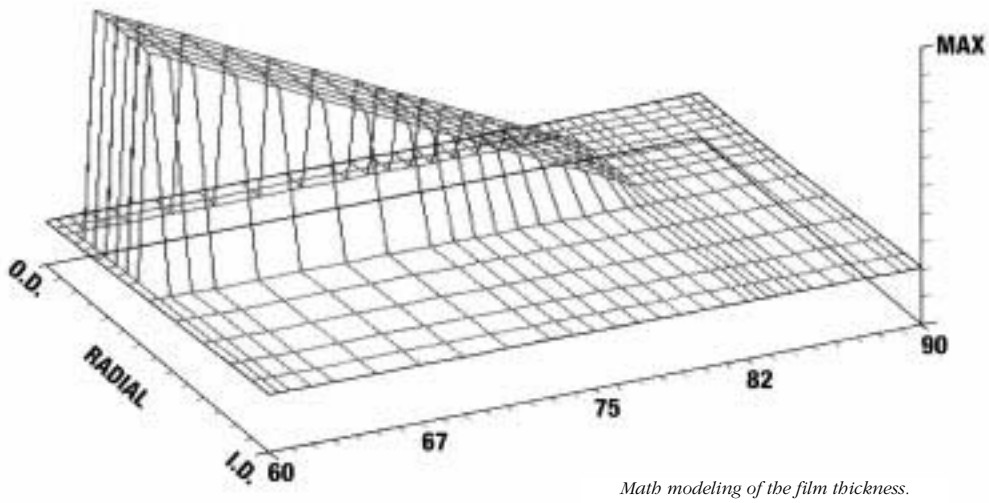
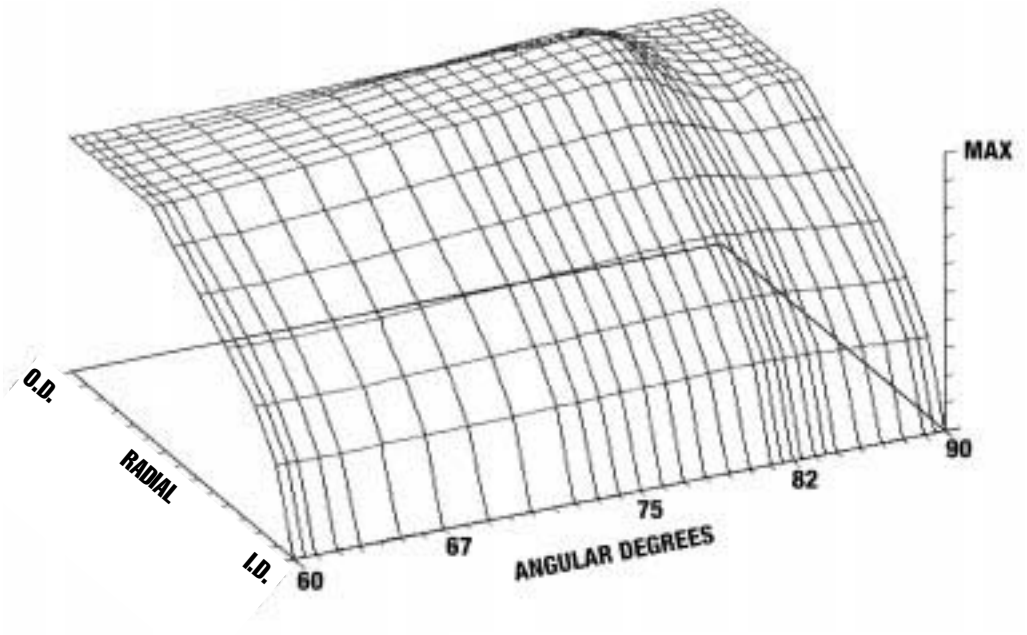
Engineered Seal Performance

What are your performance criteria? Kaydon makes no assumptions that can compromise the performance you expect. Kaydon engineers work closely with each customer to determine the specific operating requirements and assembly of the seal to the compressor casing.

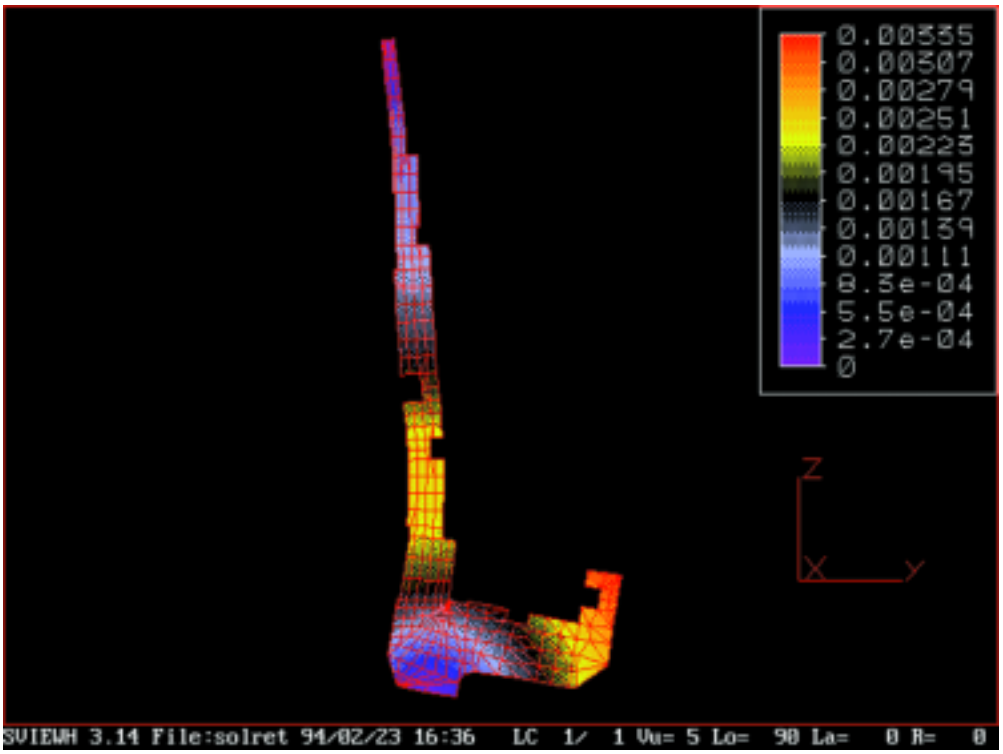
Based on the type of gas and the leakage requirements for the specific application, Kaydon engineers perform analyses to determine the hydrostatic and hydrodynamic lift forces required across the sealing face to ensure proper operation. The hydrostatic component separates the seal faces when the compressor is pressurized, but not rotating. Hydrodynamic lift by Kaydon's patented tapered ramp lift geometry provides face separation at approximately 100 rpm. Through computer modeling, a graphic 'mesh' description of the film thickness is generated which shows the pressure distribution across the seal face in a circumferential arc. Once the pressure distribution is calculated, we identify the centroid through which the net seat (or unseating) force acts. This allows for a complete force balance analysis across the seal ring. Then an FEA analysis is performed to determine the amount of twist that can be expected about the centroid of the seal ring due to mechanical and thermal deflections. This is compared to the extensive data Kaydon has accumulated over years of performance experience and support testing for each installation. A complete FEA analysis is also performed to determine centrifugal, thermal and pressure distortions on each of the seal components.



Math modeling of the film thickness.



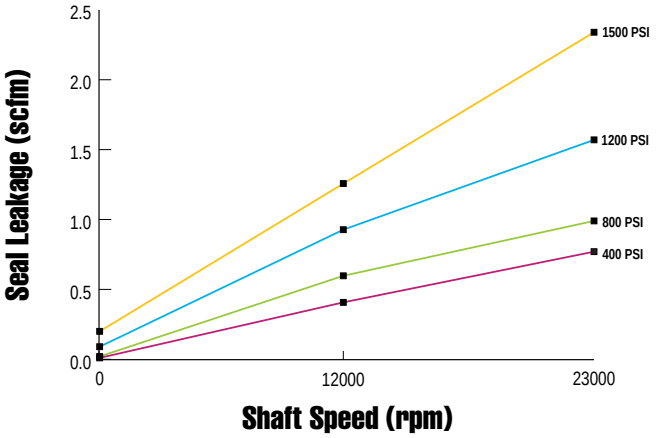
Graphic "mesh" depiction of pressure distribution.



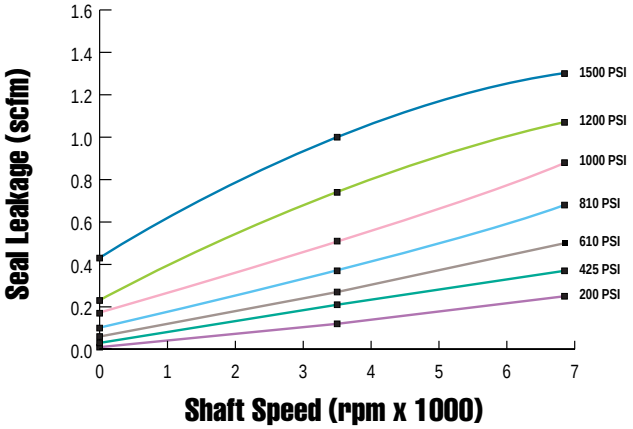
FEA analysis shows what distortions can be expected in each application before fabrication of the product.

Proven Performance*

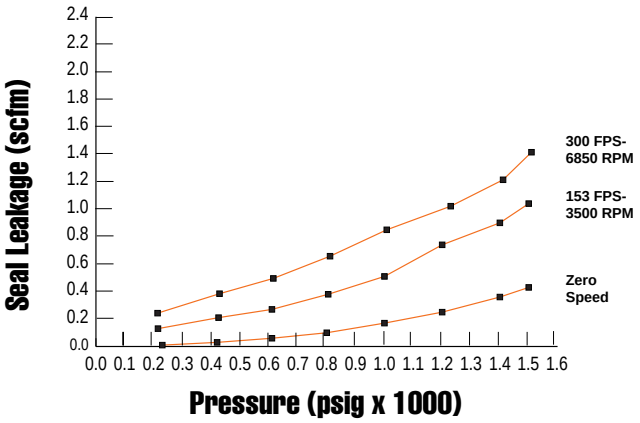
4.75″ Diameter Seal Leakage vs. Speed
(at constant pressure)



8.5″ Diameter Seal Leakage vs, Speed
(at constant pressure)



8.5″ Balance Dia. Seal Leakage vs. Pressure
(7.0″ Dia. Shaft; 10.0″ O.D. Rotating)



*Actual test data—not analytical modeling! For operating performance curves of your application, contact Kaydon.

Quality Control, Testing & Documentation

Kaydon controls all manufacturing processes to surpass industry standards at every step of the manufacturing process. Coordinate measuring verifies accuracy to tolerances up to ±0.00002" and all silicon carbide components are required to receive FPI and X-ray inspection to ensure structural integrity at the molecular level.

Each K-DGS we ship is individually tested. Tests can be customized to the requirements of each user or OEM. We include a printout of the real time test from our computerized data acquisition system. Documentation includes the real time data acquisition output for each seal, assembly instructions, detailed installation procedures and complete material certifications. Our test rigs are designed to simulate the actual conditions of overhung compressors, using tilting pad journal bearings and thrust bearings. We can test to 2000 PSI and up to 55,000 rpm.

Our standard battery of tests includes the documentation of these parameters:

- Pressure trams at multiple speed requirements:

Speed	Pressure
0	20, 40, 60, 80, 100 and 110% of operating pressure
50%	(same)
100%	(same)
110%	(same)

- Rotating elements are tested at over-speed conditions

- Customers are welcome to witness all seal testing and full inspection of the seal and seal components!

We also offer training seminars on the handling, assembly, disassembly and operation characteristics of the K-DGS Dry Gas Seal.

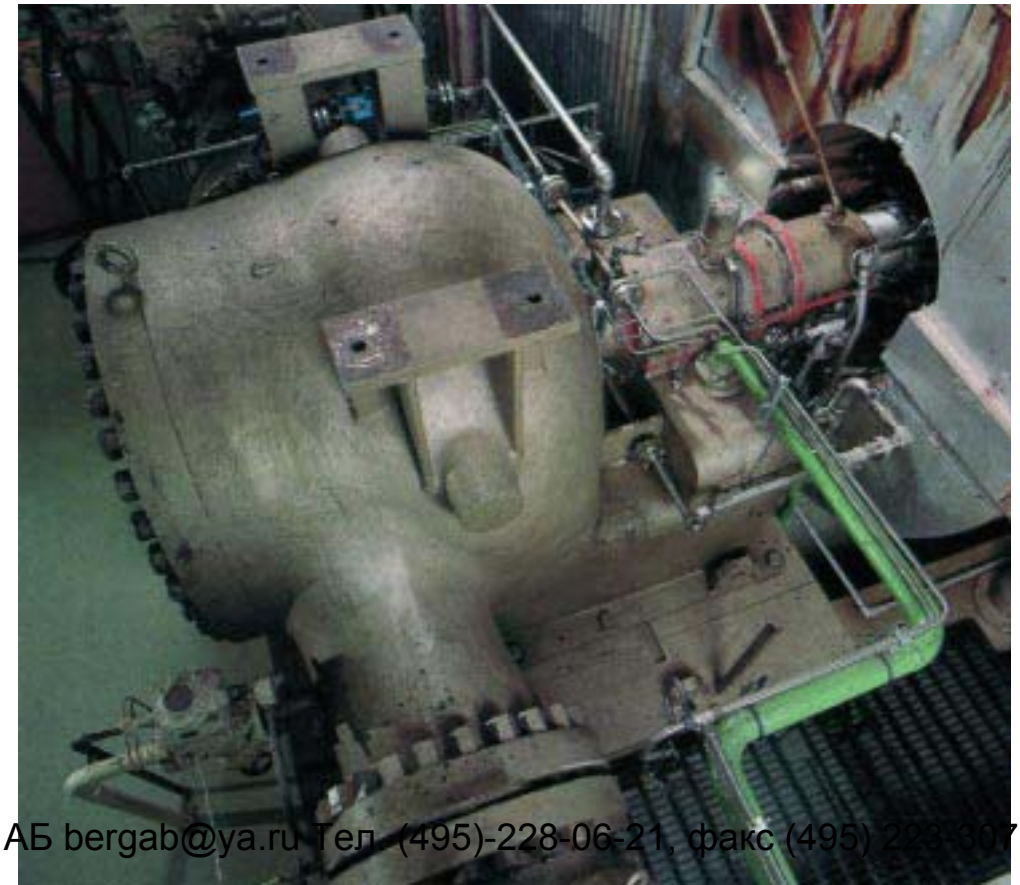
At Kaydon, we believe in *close communication* at every step. For information which addresses your specific application, call Kaydon today.

DGS System Integration

The dry gas seal is a critical component which must be seamlessly integrated with the compressor system. This is only accomplished by close partnering at the engineering level.

Gas seals can have a dramatic effect on the compressor's shaft, particularly at high speeds. This is why Kaydon carefully controls clearance fits and geometrical position of all rotating components used in the gas seal. Balancing requirements are established per ISO 1940 or 2W/N.

Together, we will solve your systems problems. If vibration trip alarms are a problem, Kaydon identified that oil from the bearing side of the compressor or contamination of the gas seal from the process side may be the problem. In response, Kaydon pioneered the use of contact circumferential barrier seals on the bearing side of the compressor. This not only reduces and/or eliminates the possibility of bearing oil reaching the gas seal (and those bothersome vibration trip alarms), but it also significantly reduces the amount of air or nitrogen buffer gas consumption compared to labyrinth seals. A further enhancement can be achieved by using a circumferential seal to replace the upstream labyrinth. This Kaydon innovation reduces the volume of clean process gas required and presents a physical barrier, keeping coalescing gases from reaching the gas seal.



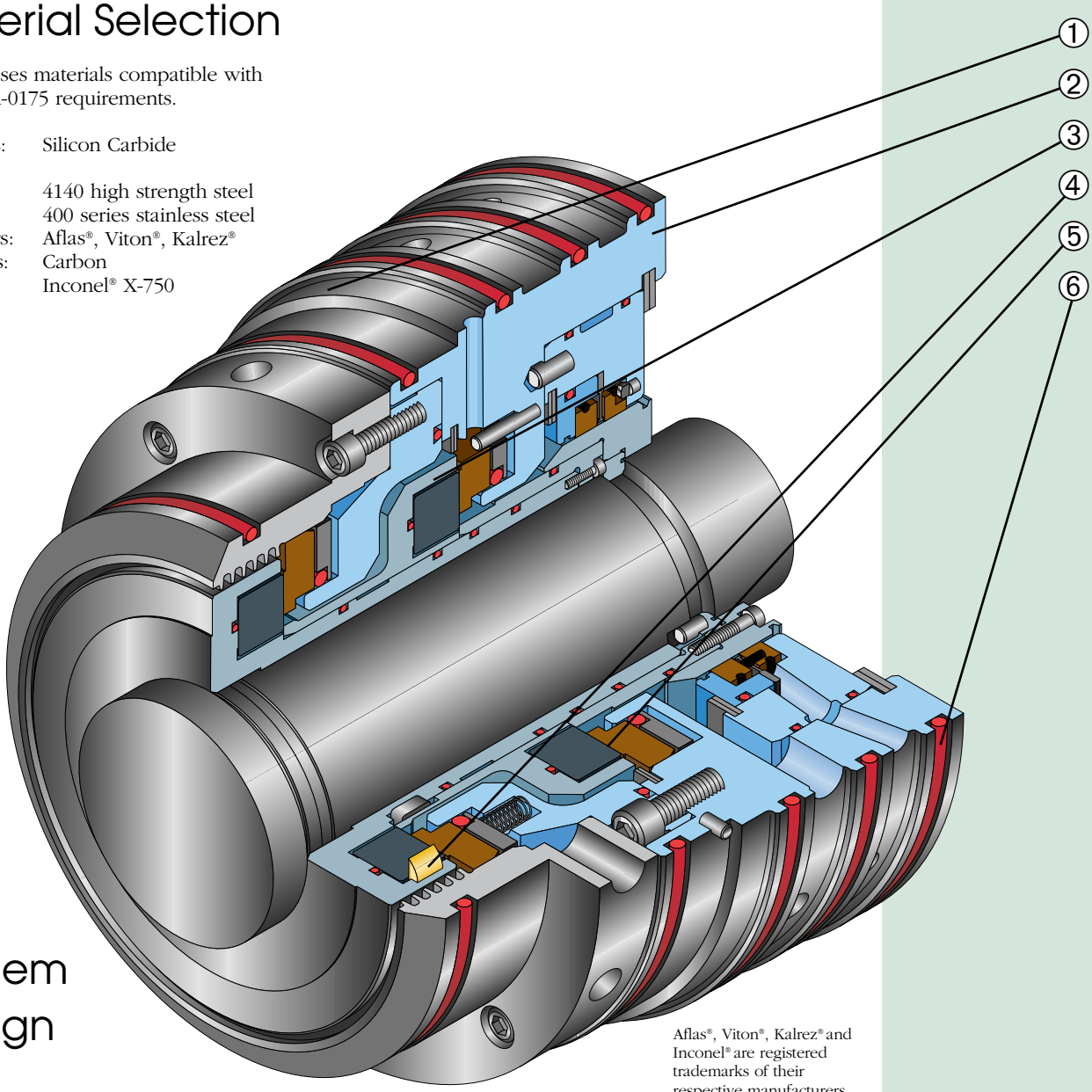
K-DGS Design Features

① Cartridge design for ease of installation
② Integrated Kaydon barrier seal reduces auxiliary buffer gas consumption
③ Encapsulated silicon carbide shoulder
④ Key-driven shoulder—eliminates stress concentration, minimizing local distortion
⑤ Patented Tapered Ramp lift geometry ensures hydrodynamic lift
⑥ High performance, decompression resistant O-ring materials

Material Selection

Kaydon uses materials compatible with NACE MR-0175 requirements.

Shoulders:	Silicon Carbide
Rotating Elements:	4140 high strength steel
Housings:	400 series stainless steel
Elastomers:	Aflas®, Viton®, Kalrez®
Seal Rings:	Carbon
Springs:	Inconel® X-750



Tandem Design

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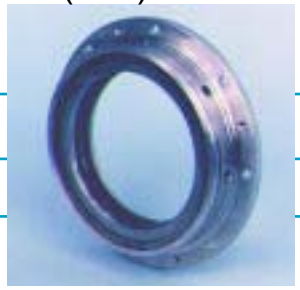


KAYDON

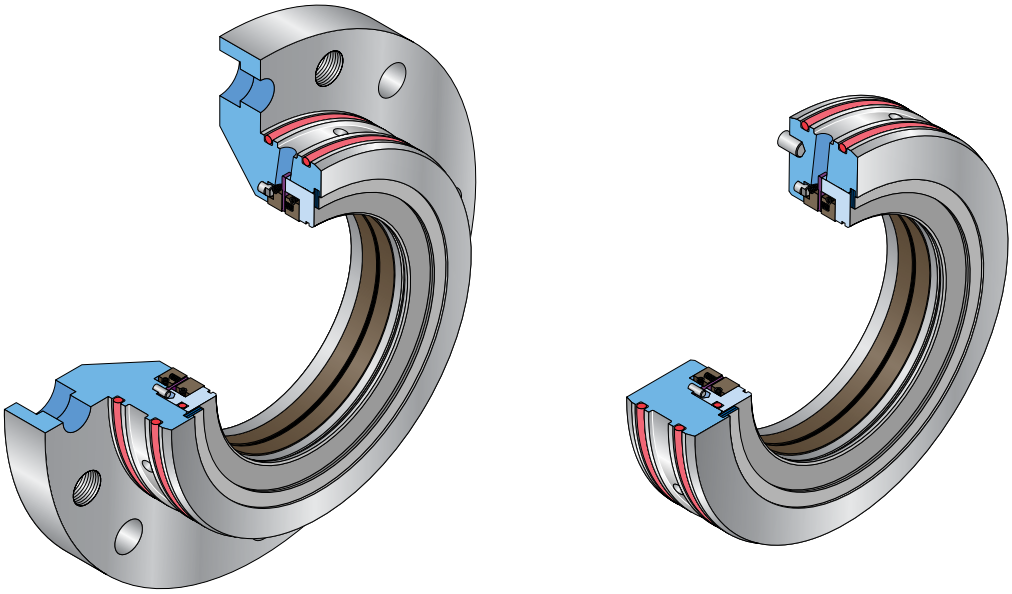
K-CBS Circumferential Barrier Seals

A Superior Support System for Any Dry Gas Seal

Segmented bore contact barrier seals can be fitted to any style gas seal. Normally they serve to prevent gas leakage from escaping through the bearing by acting as a barrier to encourage leakage to exit through the vent. In compressors with oil lubricated bearings, these seals also exclude oil from entering the gas seal. These positive seals also provide gas containment in the event of loss of primary seal function while the compressor is being shut down. Kaydon's K-CBS significantly reduces consumption of buffer gas compared to labyrinths which provides substantial cost savings. By including a suitable buffer gas and a DGS seal, leakage of dangerous or toxic gases can be virtually eliminated.

The K-CBS barrier seal can also be integrated with the K-DGS dry gas seal as a complete system.

Call Kaydon for complete details!



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P.O. Box 626, Baltimore, MD 21203
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