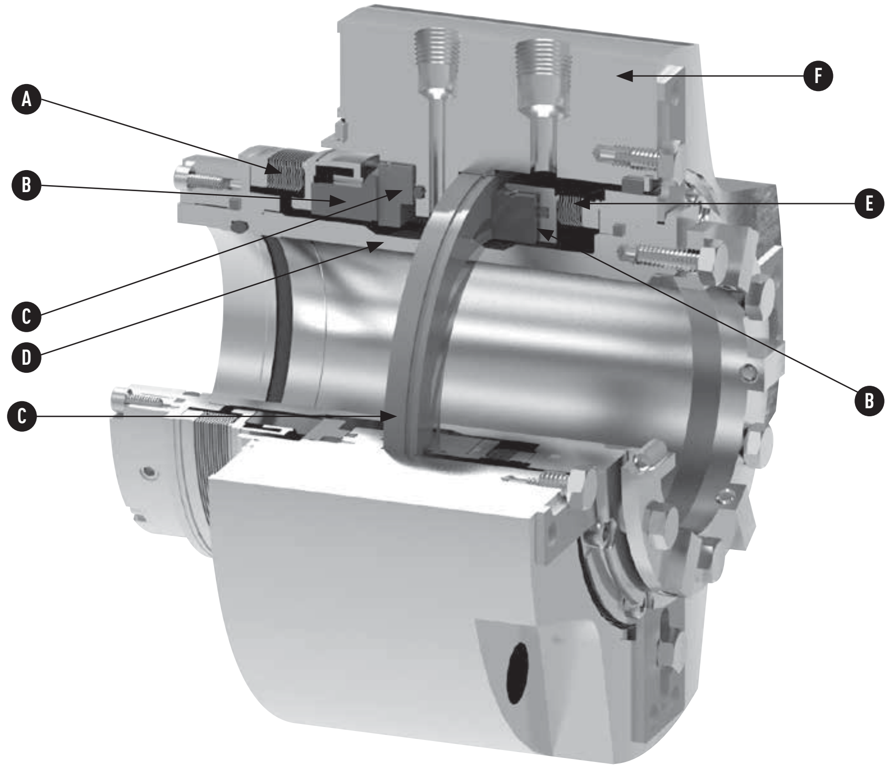
john crane
a smiths company

TYPE 2874HTC

NON-CONTACTING METAL BELLOWS GAS LUBRICATED SEAL

Technical Specification

A – Inboard HTC bellows assembly
B – Primary ring
C – Mating ring
D – Sleeve
E – Outboard bellows assembly
F – Gland plate



Product Description

- Non-contacting, outward-pumping, metal bellows, dual-pressurized gas seal that permits reliable operation in high-temperature services
- High-temperature corrosion (HTC) resistance for reliable sealing in hot hydrocarbon and low-temperature applications with enhanced seal face stability
- Significantly reduces life-cycle costs compared to conventional wet seals and systems and eliminates problems associated with coking barrier fluids and fouled heat exchangers
- API 682-qualified
- Zero fugitive emissions for maximum achievable control technology (MACT) compliance when sealing high temperature, volatile or hazardous fluids
- For use with API 610 pump and larger bore seal chambers
- Elastomer-free seal handles a wide range of applications

Design Features

- HTC provides exceptional seal face stability and robustness at elevated temperatures for increased mean time between repair (MTBR)
- Spiral groove technology for superior operating performance and lower energy consumption
- Pressure balanced design withstands full reverse pressurization
- John Crane edge-welded metal bellows
- Centrifugal advantage: process fluid at the OD of the bellows
- Non-elastomer static secondary seals have high- and low-temperature capability
- Meets API 682 design requirements Type C, Arrangement 3 with dual mating ring design

Performance Capabilities

Temperature: -75° to 425°C/-100° to 800°F

Pressure: Process fluid:
Vacuum to 16 barg/230 psig (N/Ar barrier)
Vacuum to 14 barg/200 psig (steam barrier)

Barrier:
Up to 18 barg/260 psig (N/Ar barrier)
Up to 16 barg/230 psig (steam barrier)

(Refer to Pressure Rating Limits)

Differential barrier gas pressure:
Minimum 2 bar/30 psi > maximum seal chamber pressure

Speed: 1,450 rpm min./3,600 rpm max.
(Outside this range contact John Crane Engineering)

Axial movement: Sizes ≤ 40 mm/1.57": ±0.76 mm/0.030",
Sizes > 40 mm/1.57": ±1.02 mm/0.040"

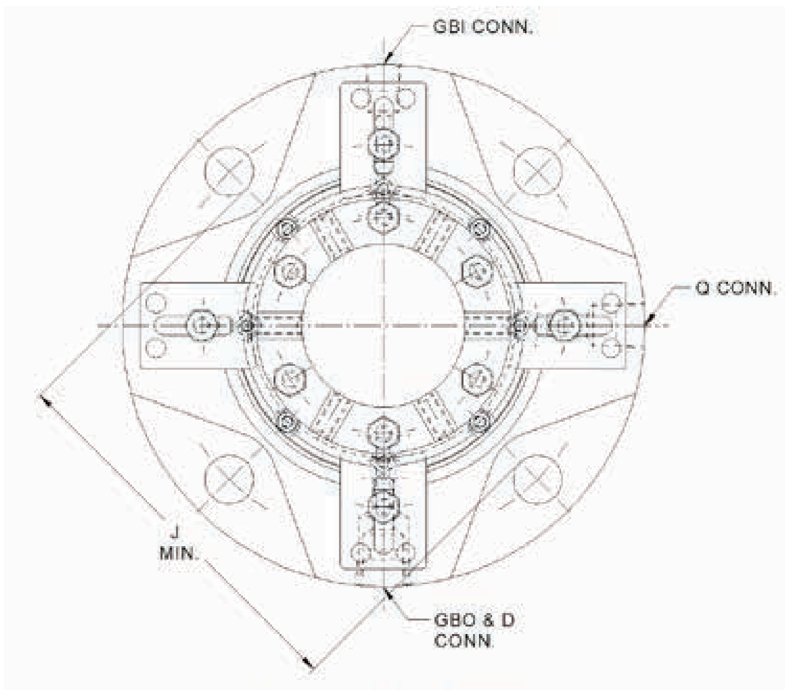
Runout: 0.05 mm/0.002" FIM MAX

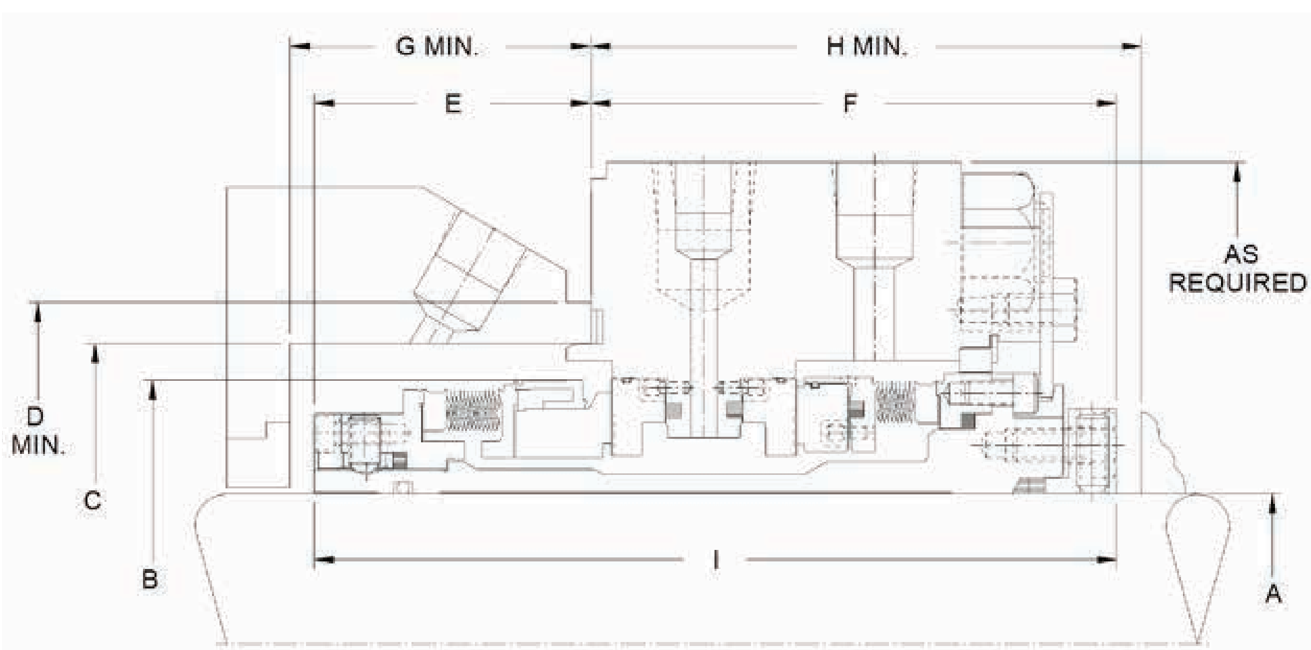
Solids: Up to 3% by weight

Barrier Consumption

The Type 2874HTC uses inert barrier gas to lubricate the seal faces. The inboard seal is operated at 2 bar/30 psi differential and the outboard seal operates at full pressure differential. It is estimated that 75% of total barrier consumption passes outboard into the atmosphere. The barrier consumption of the Type 2874HTC can be estimated as 16 normal liters of barrier gas per 100mm of shaft circumference, per hour, per bar of barrier pressure (one standard cubic foot of barrier gas per inch of shaft circumference, per hour, per 100 psig of barrier pressure). Actual consumption rates may vary. More specific values are available from John Crane Engineering.

Type 2874HTC Typical Arrangement





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Type 2874HTC Dimensional Data (mm)

API 610/682 SEAL CHAMBER NUMBER	A		B	C		D	E	F	G	H	I	J
3	≤ 42.9	+0.000 -0.015	84.51	90	+0.036 -0.000	105	56.77	83.44	59.94	86.61	140.21	109.96
4	≤ 53.04	+0.000 -0.015	90.88	100	+0.036 -0.000	115	50.83	99.52	54.00	102.69	150.34	121.95
5	≤ 61.65	+0.000 -0.020	105.28	120	+0.036 -0.000	135	55.19	104.95	58.37	108.13	160.15	142.01
6	≤ 74.32	+0.000 -0.020	118.29	130	+0.041 -0.000	145	57.25	105.79	60.43	108.97	163.04	151.92
7	≤ 83.85	+0.000 -0.020	130.84	140	+0.041 -0.000	155	66.93	106.81	70.10	109.98	173.74	162.08
8	≤ 97.18	+0.000 -0.023	143.61	160	+0.041 -0.000	175	60.27	116.51	63.45	119.68	176.78	182.98
9	≤ 102.26	+0.000 -0.023	150.04	170	+0.041 -0.000	185	64.69	116.71	67.87	119.89	181.41	191.87
10	≤ 116.23	+0.000 -0.023	162.79	180	+0.041 -0.000	195	71.98	116.71	75.16	119.89	188.70	201.98

Type 2874HTC Dimensional Data (inches)

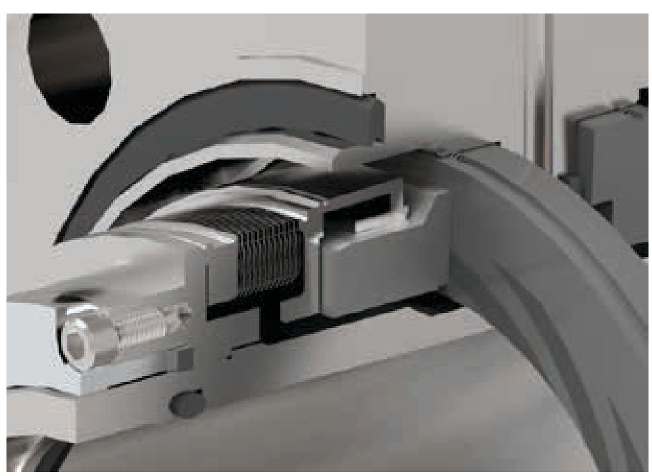
API 610/682 SEAL CHAMBER NUMBER	A		B	C		D	E	F	G	H	I	J
3	≤ 1.689	+0.0000 -0.0006	3.327	3.543	+0.0014 -0.0000	4.134	2.235	3.285	2.360	3.410	5.520	4.329
4	≤ 2.088	+0.0000 -0.0006	3.578	3.937	+0.0014 -0.0000	4.528	2.001	3.918	2.126	4.043	5.919	4.801
5	≤ 2.427	+0.0000 -0.0008	4.145	4.724	+0.0014 -0.0000	5.315	2.173	4.132	2.298	4.257	6.305	5.591
6	≤ 2.926	+0.0000 -0.0008	4.657	5.118	+0.0016 -0.0000	5.709	2.254	4.165	2.379	4.290	6.419	5.981
7	≤ 3.301	+0.0000 -0.0008	5.151	5.512	+0.0016 -0.0000	6.102	2.635	4.205	2.760	4.330	6.840	6.381
8	≤ 3.826	+0.0000 -0.0009	5.654	6.299	+0.0016 -0.0000	6.890	2.373	4.587	2.498	4.712	6.960	7.204
9	≤ 4.026	+0.0000 -0.0009	5.907	6.693	+0.0016 -0.0000	7.283	2.547	4.595	2.672	4.720	7.142	7.554
10	≤ 4.576	+0.0000 -0.0009	6.409	7.087	+0.0016 -0.0000	7.677	2.834	4.595	2.959	4.720	7.429	7.952

HTC Technology

The Type 2874HTC utilizes HTC Metal Bellows Technology which provides an effective solution in sealing corrosive fluids at elevated temperatures by utilizing a complete all-Inconel® metallurgy and unique face technology the provides exceptional seal face stability by reliably controlling seal face distortion across a wide range of pressure/temperature conditions. Such exceptional face stability can result in low leakage (barrier gas consumption) and longer seal life.

This rugged seal is capable of handling reverse pressurization and is designed to contain the process fluid in the event of loss of barrier gas pressure. The HTC design is also more forgiving in dirty hot hydrocarbon fluid applications.

The HTC has proven to be a superior design for high temperature, corrosive applications up to 425°C/800°F.



Outward-pumping spiral groove and HTC Technology

Inconel is a registered trademark of Inco Alloys International, Inc.

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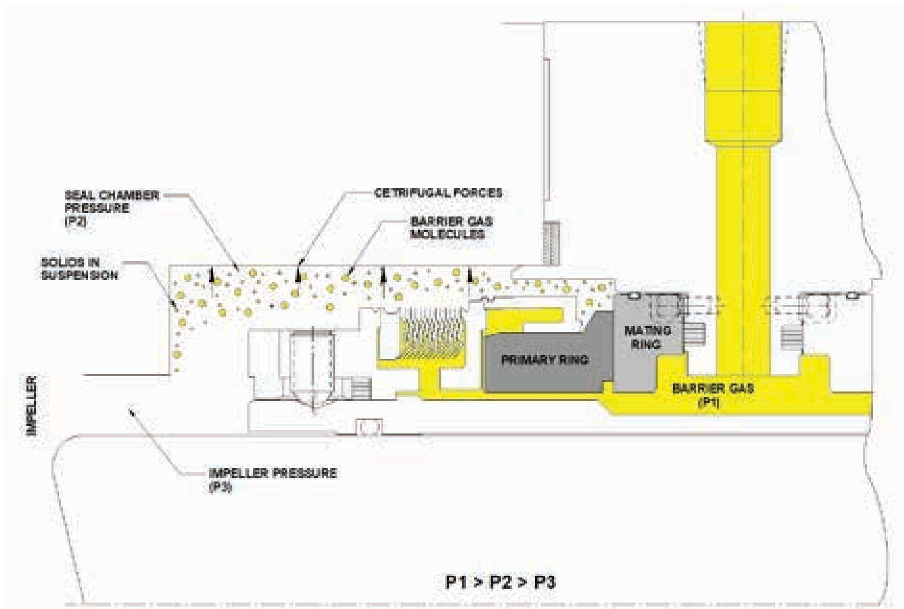
Non-contacting ID to OD Barrier Pumping Spiral Grooves



The Type 2874HTC uses spiral groove technology developed and patented by John Crane. The mating rings are micro-machined with a spiral groove pattern that is designed to pump the barrier gas from the inside diameter of the seal to its outside diameter. The primary rings seal against the un-grooved sealing dam of the mating rings. The inner face pair is pressurized on the inside diameter to a pressure differential of 2 bar/30 psi minimum. The outboard seal faces handle full differential pressure and also pump from the seal ID to the seal OD. The outboard seal pumps inert barrier gas into the atmosphere.

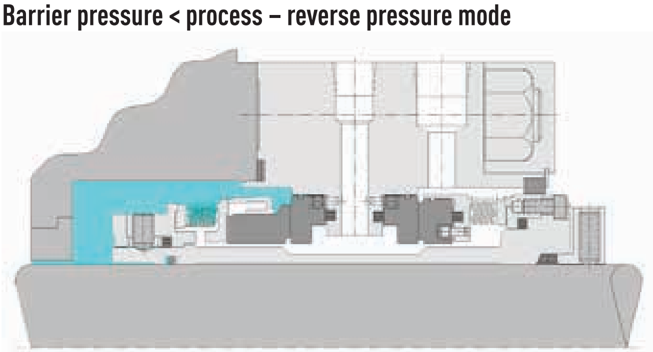
When the pump shaft turns, a band of high-pressure barrier gas is created between the seal faces. This lifts the seal faces and creates a non-contacting dynamic seal. No friction, no heat, no wear and no cooling requirements provide a sealing technology that is revolutionary. The stiff ring of compressed barrier gas exiting the seal interface creates a highly effective dry seal.

Centrifugal advantage: The rotating bellows assembly creates centrifugal action to spin-off any particles keeping the seal head assembly clean and flexible.

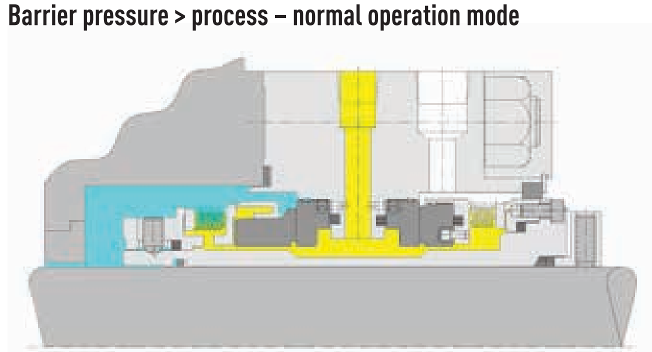
Reverse Pressure Capability

The Type 2874HTC pressure balanced design ensures full reverse pressure containment capability. In the event of a temporary loss of barrier pressure where seal chamber pressure exceeds barrier gas pressure, the Type 2874HTC will continue to seal the process fluid protecting the barrier chamber and system from exposure to the process fluid. Lubrication is provided to the seal faces as long as there is process fluid between them.

Barrier pressure < process – reverse pressure mode



Barrier pressure > process – normal operation mode



- Seal in normal operating mode with barrier gas (yellow) at minimum 2 bar/30 psi above process pressure.
- Inboard seal functioning normally in non-contacting mode.

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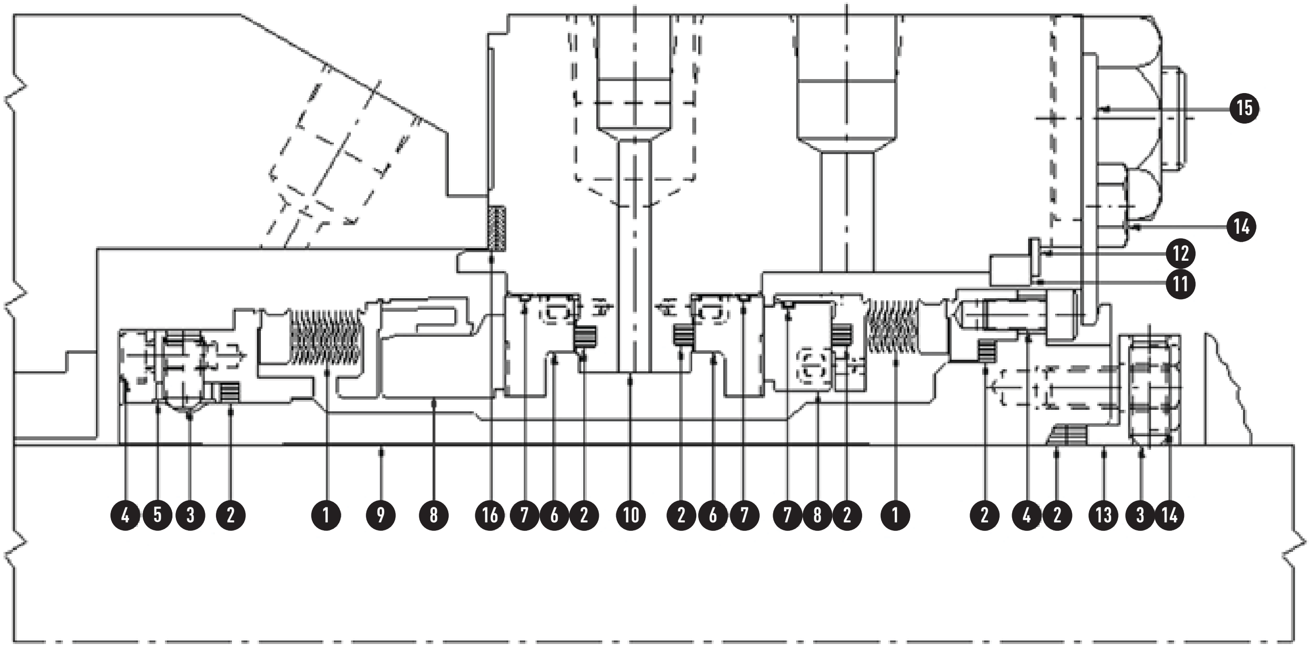
Technical Specification

Type 2874HTC Components



Materials of Construction

SEAL COMPONENTS	MATERIALS	
Description	**Standard**	**Options**
1 – Bellows	Alloy 718 (UNS N07718)	—
2 – Static seal	Flexible carbon graphite	—
3 – Set screw	Inner: 316 SS Outer: Hard alloy steel	—
4 – Socket head cap screw	316 SS	—
5 – Compression ring	316 SS	—
6 – Mating ring	Silicon carbide*	Tungsten carbide
7 – Canted spring	Alloy C-276 (UNS N10276)	—
8 – Primary rings (Inboard and Outboard)	Silicon carbide composite	Silicon carbide
9 – Sleeve	316 SS (UNS 31600)	Consult John Crane
10 – Gland	316 SS (UNS 31600)	Consult John Crane
11 – Bushing (optional)	Carbon	—
12 – Retaining ring	302 SS	—
13 – Packing follower	316 SS	—
14 – Hex head cap screw	316 SS	—
15 – Spacer	302 SS	—
16 – Gland gasket	Spiral wound metal gasket	—

*Silicon carbide mating ring recommended for steam barrier.

Barrier Gas Control Panels

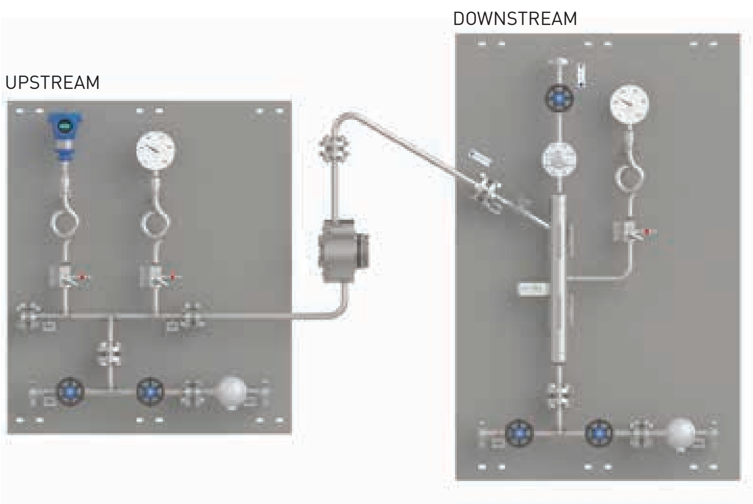
John Crane provides your complete system requirements for effectively operating the Type 2874HTC cartridge seal. These support systems significantly improve life-cycle costs as compared to wet seal barrier fluid systems such as API Plan 53 and 54. An API Plan 74 panel for nitrogen or argon barrier gas or a steam barrier gas system are available.

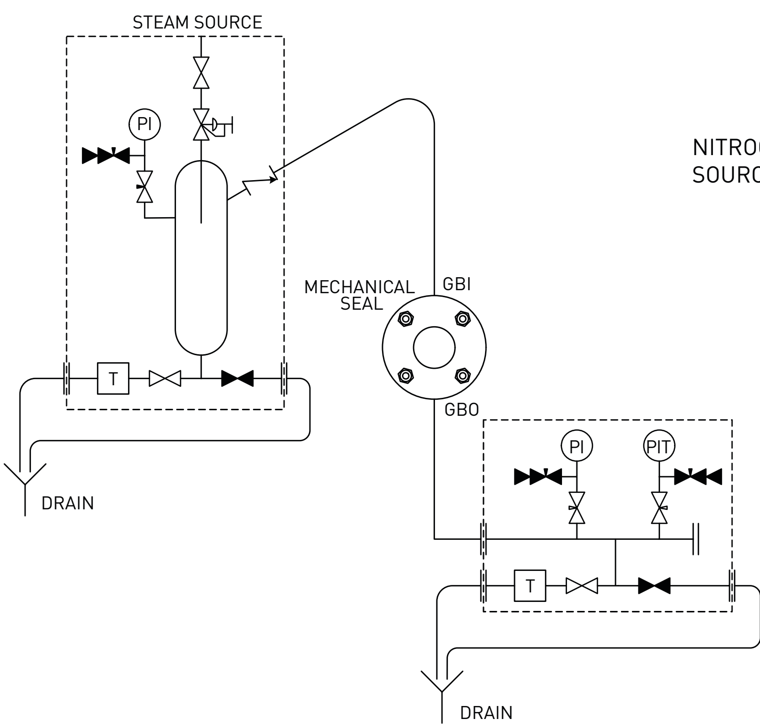
For API Plan 74, the Type 2874HTC is a dual seal arrangement where an inert gas (normally nitrogen) is supplied to the seal and maintained at a pressure higher than the seal chamber pressure. Standard instruments and controls are arranged to deliver clean dry barrier gas at a pressure specified by the operator. An API Plan 74 is the minimum requirement when operating a Type 2874HTC seal.

A clean and dry steam barrier can also be utilized as an alternative for reliable operation of the Type 2874HTC. Dry steam is supplied to the seal through a conditioning system that that removes condensate, filters the steam and regulates the steam barrier pressure. Also provided at the barrier outlet of the seal is a steam trap which helps to remove any condensate from the barrier cavity to keep the condition of the steam in the seal cavity dry.

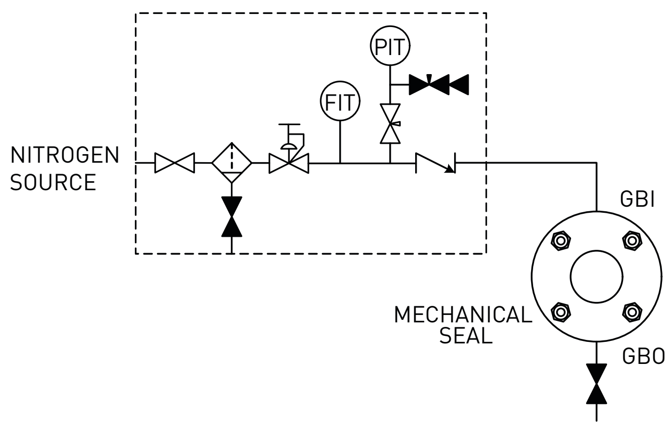
Consult Pressure Rating Limits on page 1.

Steam barrier system





Gas barrier system (API Plan 74)



TYPE 2874HTC

NON-CONTACTING METAL BELLOWS GAS LUBRICATED SEAL

Technical Specification

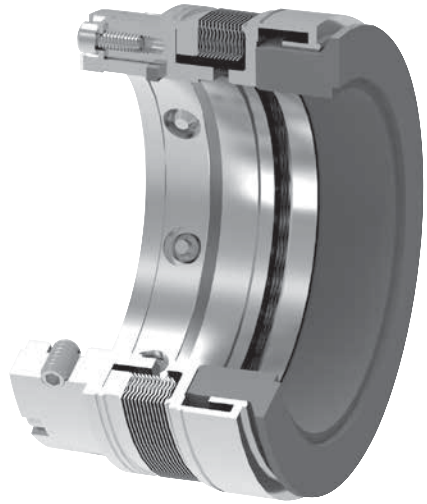
Edge-welded Metal Bellows

Bellows design features:

- Optimum 45° tilt angle
- Three-sweep radius
- Nesting ripple plate design
- Static secondary seal
- Light spring loads

Bellows benefits:

- Uniform plate rigidity and stress distribution
- Enhanced fatigue strength
- Pressure-balanced by design
- Eliminates problems associated with dynamic O-rings



Advanced Silicon Carbide Composite Primary Ring

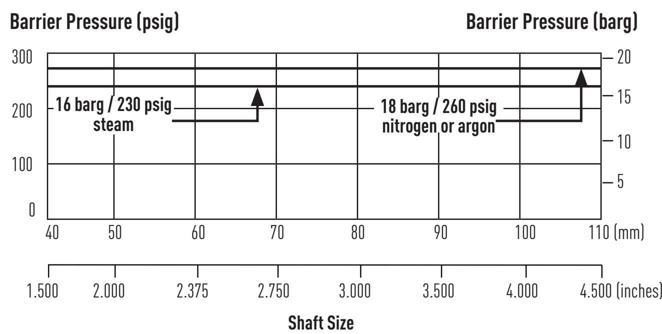
Advanced silicon carbide composite is a state-of-the-art, sintered silicon carbide with low friction and the inherent lubricity of free graphite. This silicon carbide is a tough, hard, heat-resistant, long-wearing, inert seal face material. When compared with other seal face materials, the silicon carbide composite enhances seal face pairing during system upsets, loss of barrier and slower-speed start-ups.

Static Carbon Graphite Secondary Seals

The Type 2874HTC is an elastomer-free seal that utilizes chemically inert static carbon graphite secondary seals. These chemically inert secondary seals are perfect for higher temperature applications, enhanced chemical compatibility and can handle a wider range of applications effectively while eliminating the cost of expensive perfluoroelastomers.

The static carbon graphite seals solve problems in applications when dynamic O-rings are prone to attack or when restrictive movement (hang-up) from the sealing environment occurs. O-ring performance may be affected by process contamination, swelling, degradation, thermal gradients, dry-nitrogen environments and polymerization.

Pressure Rating Limits



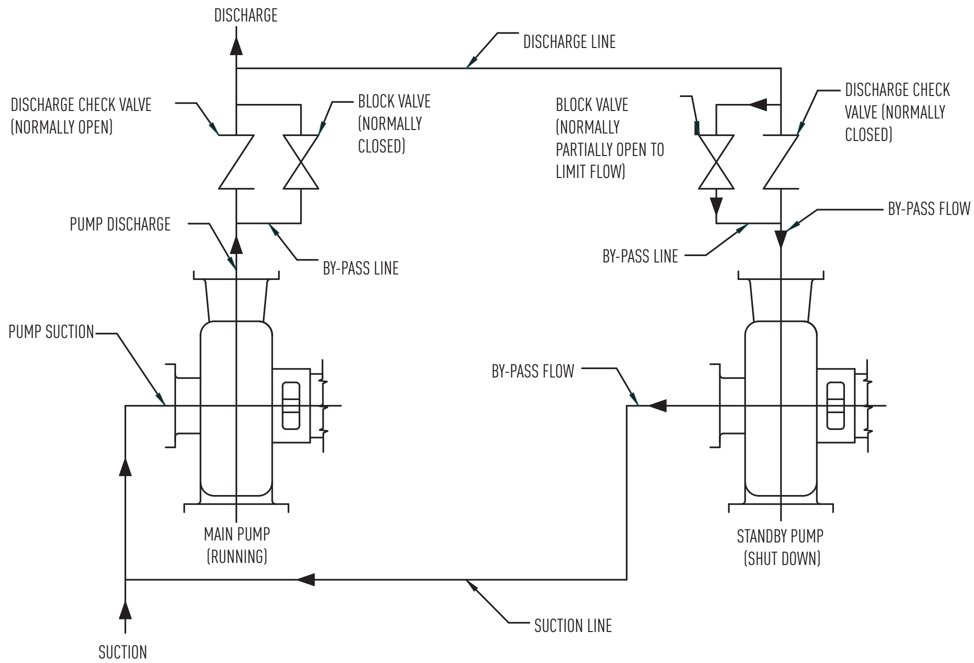
Differential barrier gas pressure minimum 2 bar/30 psi > maximum seal chamber pressure.

The basic pressure rating is based on a standard seal installed according to the criteria given in this data sheet at a minimum speed of 1,450 rpm, and according to generally accepted industrial practices.

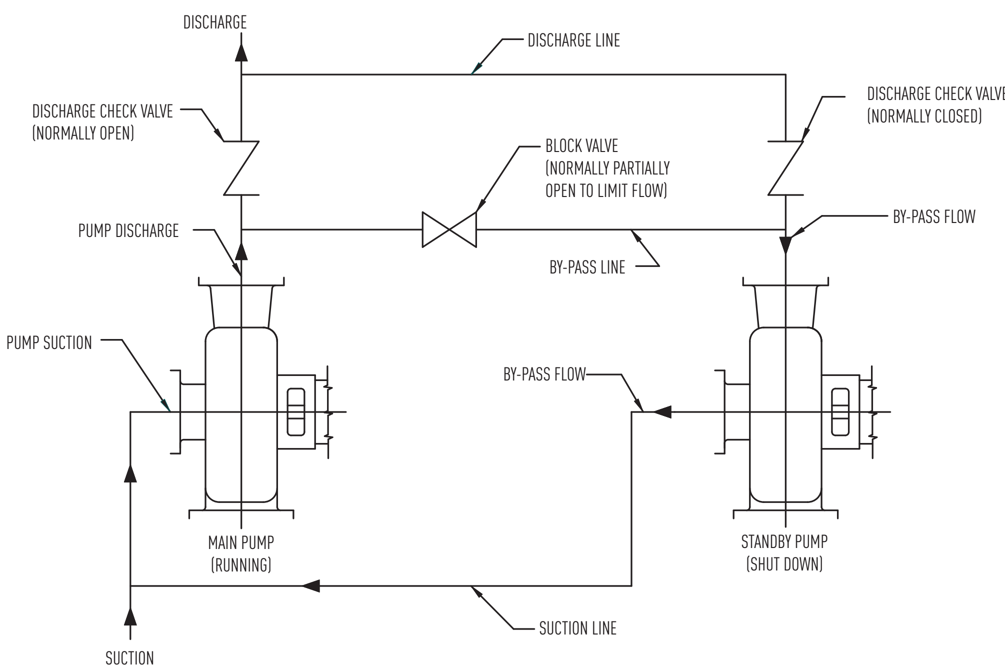
Contact John Crane for process services outside this range and with more detailed application information in order to obtain the actual dynamic pressure rating.

Piping Options for Hot Standby Pumps

HOT BY-PASS FOR A STANDBY PUMP - OPTION 1



HOT BY-PASS FOR A STANDBY PUMP - OPTION 2



Often gas-lubricated seals are installed on primary and standby pumps. Above are the recommended piping plans that allow standby pumps to manage barrier collection in static conditions. Both diagrams offer continuous circulation of pumped fluid in order to maintain temperature and avoid cavitation upon start-up of stand by equipment. Detailed information and recommendations for specific applications are available from John Crane Engineering.