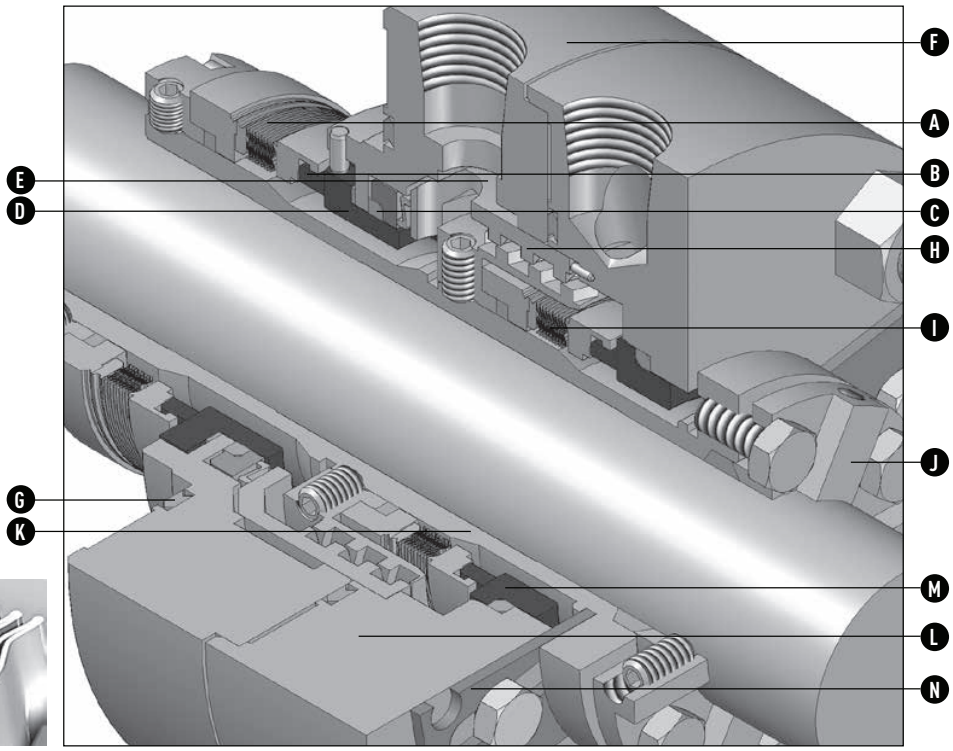
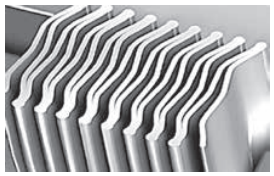
TYPE 2609HTL/3609HTL

API 682 TYPE C METAL BELLOWS SEALS

Technical Specification

A – Inner bellows assembly
B – Primary ring
C – Packing
D – Inner mating ring
E – Flow guide
F – Inner gland
G – Spiral wound gasket
H – Pumping device
I – Outer bellows assembly
J – Packing follower
K – Sleeve
L – Outer gland
M – Outer mating ring
N – Setting spacer





Sealol Welded Metal Bellows

Product Description

- **Type 2609HTL** – Dual-unpressurized rotating bellows cartridge seal Type C, Arrangement 2.
- **Type 3609HTL** – Dual-pressurized rotating bellows cartridge seal Type C, Arrangement 3.

This dependable API 682/ISO 21049 cartridge seal utilizes an impressive design innovation by incorporating the unique high temperature live-loaded (HTL) mating ring technology into dual tandem seal arrangements. This new design vastly enhances seal face stability over conventional designs and can extend your mean time between repair (MTBR) in many services.

Exceptional Face Stability

With advanced HTL mating ring design, seal face stability is achieved by eliminating thermal and mechanical forces that can contribute to seal face distortion. The sealing interface remains exceptionally stable in spite of thermal changes allowing the seal to adapt to a wide range of temperature excursions inherent in high-temperature applications.

Design Features

- HTL mating ring technology provides exceptional face stability
- API 682-qualified
- Edge-welded metal bellows
- ID and OD pressure capability — withstands reverse pressurization
- Alloy 718 bellows
- Dual-scroll pumping device standard

Performance Capabilities

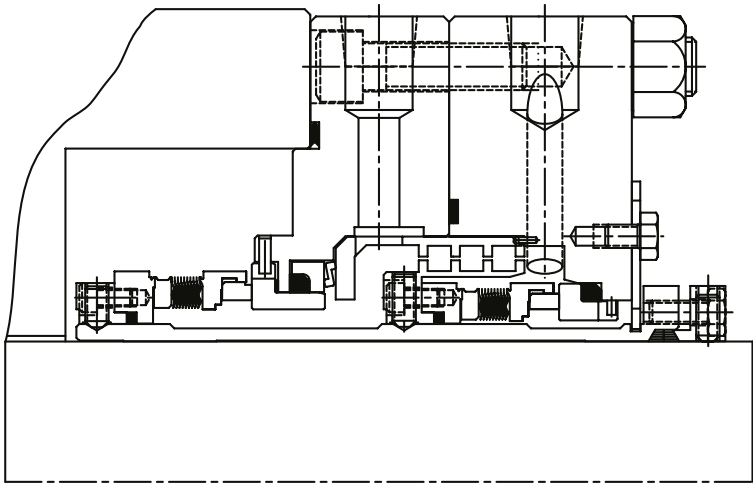
Temperature:	-75° to 425°C/-100° to 800°F
Pressure:	Type 2609HTL: Up to 300 psig/20 barg (vacuum) Type 3609HTL: Up to 150 psig/10 barg (vacuum)
Speed:	Up to 25 m/s/5,000 fpm
Shaft size:	1.5" to 4.33"/30mm to 110mm

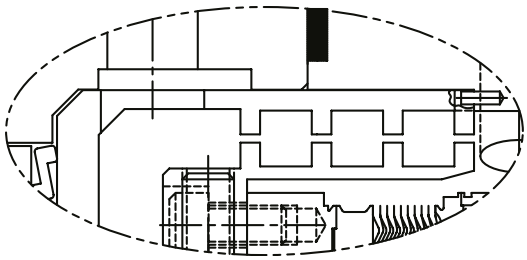
TYPE 2609HTL/3609HTL

API 682 TYPE C METAL BELLOWS SEALS

Technical Specification

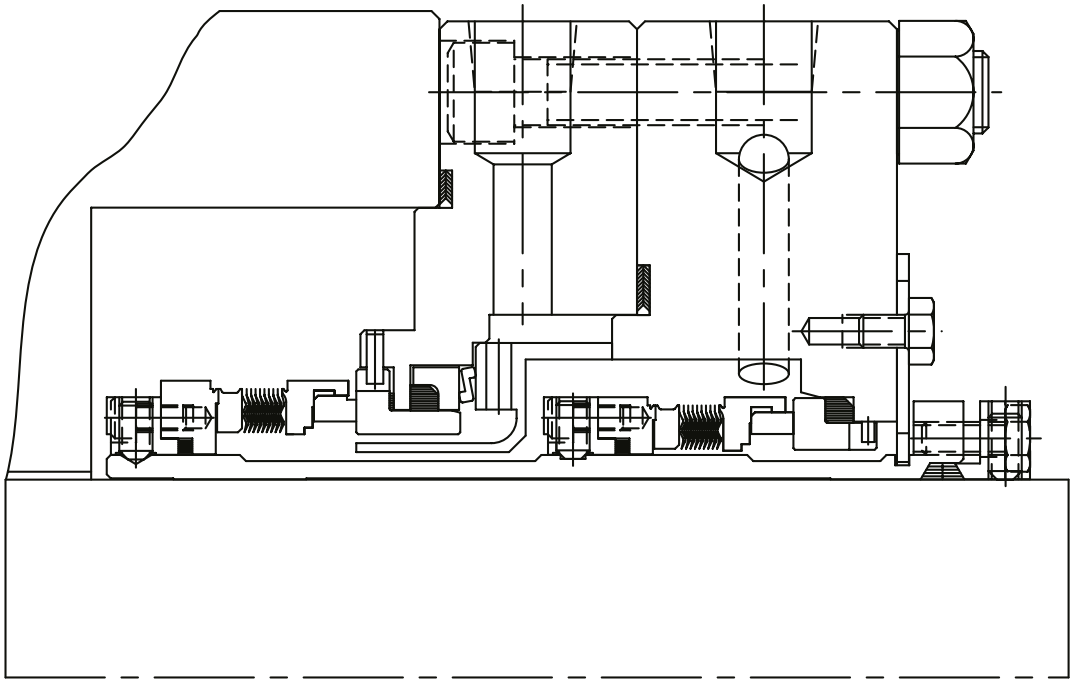
Typical Type 2609HTL/3609HTL API Type C Arrangements 2 and 3 - Dual Cartridge





A Dual Scroll Pumping Device

A dual seal with a Type 609 inner seal and Type 609 outer seal. Typically used with API Plan 52 or 53(A,B,C).



A dual seal arrangement with a diverter (option). Type 609 inner seal with a Type 609 outer seal. Typically used with API Plan 54.

TYPE 2609HTL/3609HTL

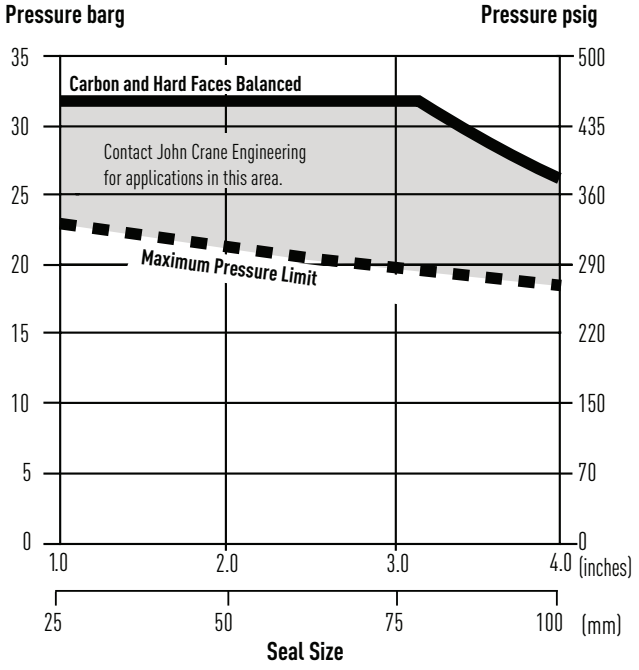
API 682 TYPE C METAL BELLOWS SEALS

Technical Specification

Materials of Construction

SEAL COMPONENTS	MATERIALS	
Description	**Standard**	**Options**
Mating ring	Silicon carbide reaction bonded	—
Primary ring	Premium grade carbon	Tungsten carbide nickel bound Silicon carbide sintered
Primary ring adapter	Alloy 42 (UNS K94100)	—
Adapter	Alloy 625 (UNS NO6625)	—
Bellows	Alloy 718 (UNS NO7718)	—
Adaptive hardware	316 stainless steel	—
Static seals	Flexible graphite	—

Basic Pressure Rating



The basic pressure rating is for a standard seal, as shown in the typical arrangement, when installed according to the criteria given in this data sheet and generally accepted industrial practices.

The basic pressure rating assumes stable operation at 3,600 rpm in clean, cool, lubricating non-volatile liquid with an adequate flush rate. When used with the multiplier factors, the basic pressure rating can be adjusted to provide a conservative estimate of the dynamic pressure rating.

Contact John Crane Engineering for process services outside this range for a more specific assessment of the dynamic pressure rating.

Notes

1. Basic pressure rating curve based on single-ply bellows.
2. Basic pressure rating curve is differential pressure applied to seal outside diameter.
3. For arrangement 3 seals, use differential pressure limits recommended in API 682. (Consult John Crane Engineering)
4. Consult John Crane Engineering for applications outside these limits.
5. Consult John Crane Engineering for inside diameter differential pressure vs temperature limits for dual seals with pressurized barrier.

TYPE 2609HTL/3609HTL

API 682 TYPE C METAL BELLOWS SEALS

Technical Specification

Multiplier Factors

	Selection Considerations	Multiplier Factors	
		Carbon vs. SiC	SiC vs. SiC T/C vs. SiC
Speed	Up to 3,600 rpm	x 1.00	x 1.00
	Above 3,600 rpm	x (3,600/speed)	x (3,600/speed)
Sealed fluid lubricity	Petrol/gasoline, kerosene, or better water	x 1.00	x 1.00
	Aqueous solutions	x 0.75	x 0.75
	Flashing hydrocarbons* (see note 1)	x 0.60	(see note 2)
Sealed fluid temperature (see note 3)	Up to 80°C/175°F	x 1.00	x 1.00
	Up to 120°C/250°F	x 0.90	x 1.00
	Up to 205°C/400°F	x 0.80	x 1.00
	Up to 315°C/600°F	x 0.65	x 1.00
	Above 315°C/600°F	x 0.65	(see note 4)

Example of determining pressure rating limits:

Seal:	Type 2609HTL
Size:	89 mm/3.5" diameter
Product:	High viscosity gas oil
Face materials:	Premium grade carbon vs. silicon carbide
Operating temperature:	325°C/620°F
Operating shaft speed:	3,600 rpm

Example for determining dynamic pressure rating:

The maximum pressure for a particular application is the lesser of the maximum pressure limit curve or the pressure calculated when the multiplier factors are applied to the specific seal face material curve.

Maximum pressure limit curve: 19.5 barg/283 psig max. pressure

Carbon face limit curve: 28 barg/406 psig

Calculated limit: 28 barg/406 psig x 1.00 x 1.00 x 0.65 = 18 barg/261 psig

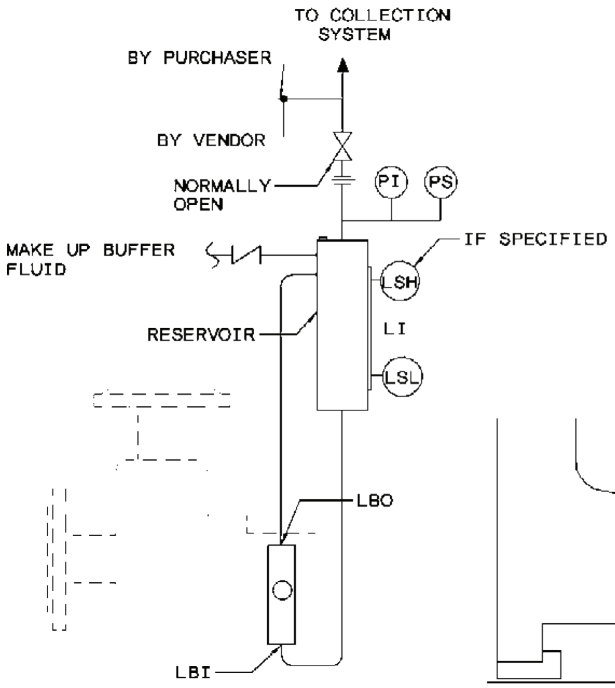
At 3,600 rpm with the service conditions noted, an 89 mm/3.5" Type 3609HTL has a maximum operating OD pressure limit of 18 barg/261psig

*The ratio of sealed pressure to vapor pressure must be greater than 1.5, otherwise consult John Crane. If the specific gravity is less than 0.60, consult John Crane.

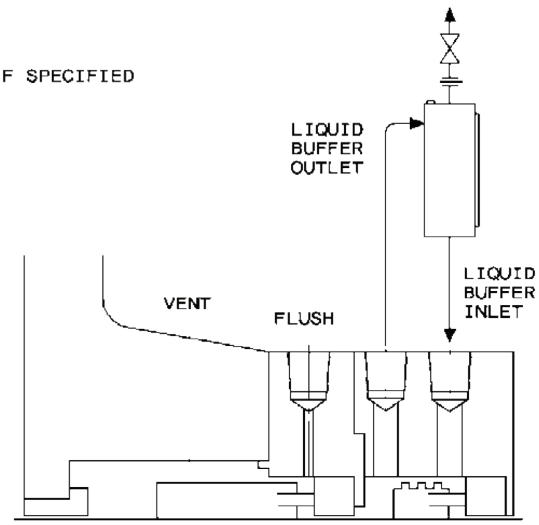
Piping Plan Recommended with the Type 2609HTL

API Plan 52

Non-pressurized external fluid reservoir with forced circulation (typically used with dual seal arrangement 2).



PLAN 52

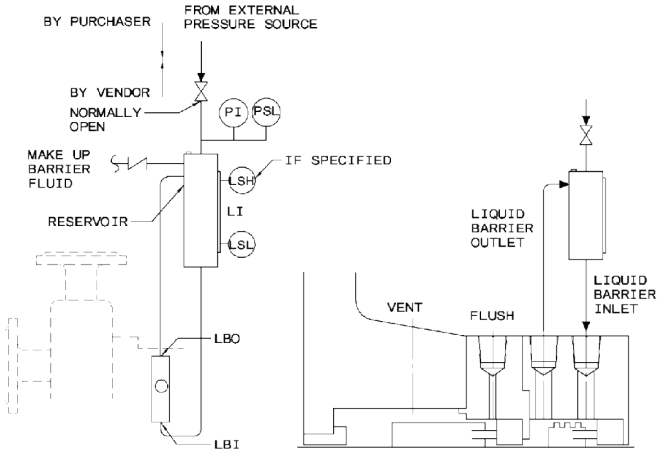


SEAL CHAMBER FOR PLAN 52

Piping Plan Recommended with the Type 3609HTL

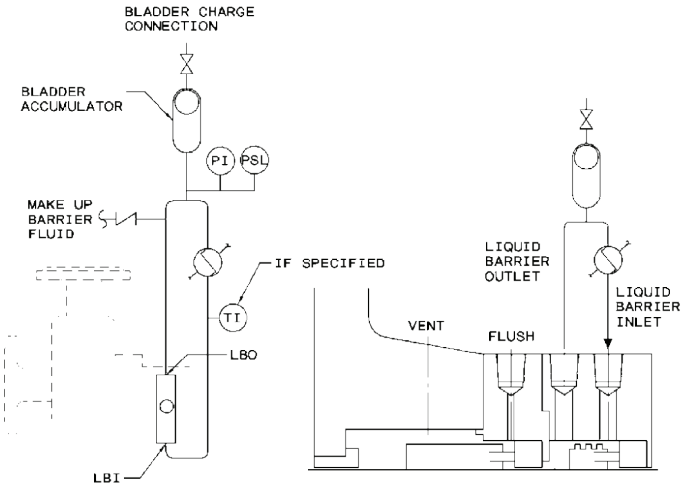
API Plan 53 (A, B, C)

Pressurized external fluid reservoir with forced circulation (typically used with dual seal arrangement 3).



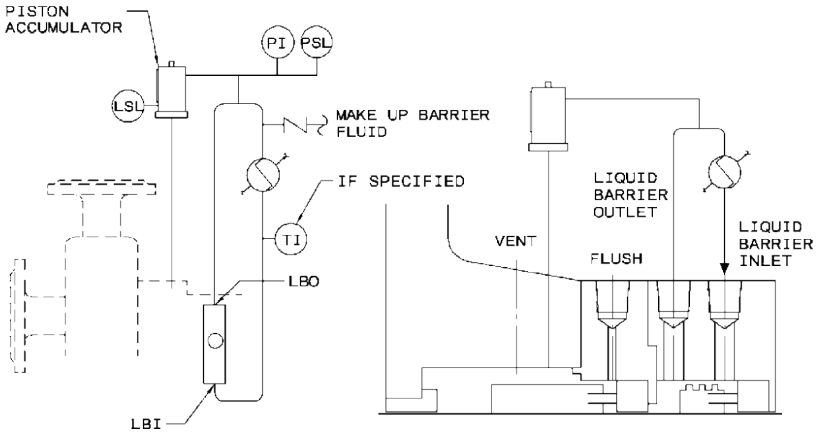
PLAN 53A

SEAL CHAMBER FOR PLAN 53A



PLAN 53B

SEAL CHAMBER FOR PLAN 53B

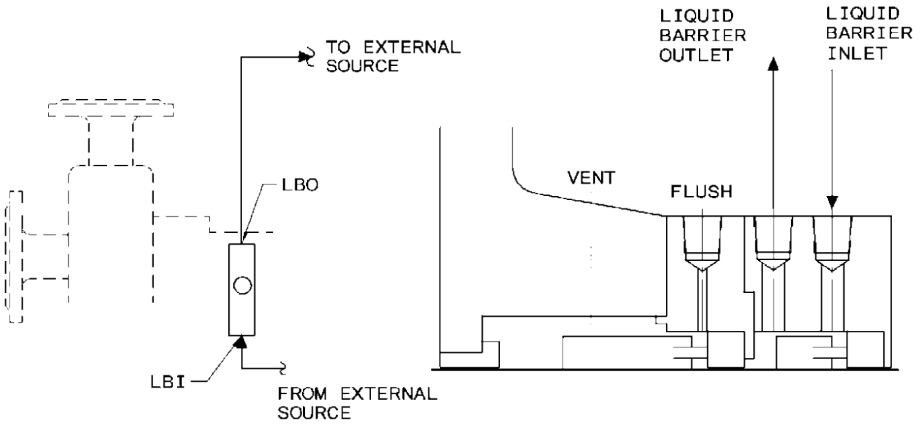


PLAN 53C

SEAL CHAMBER FOR PLAN 53C

API Plan 54

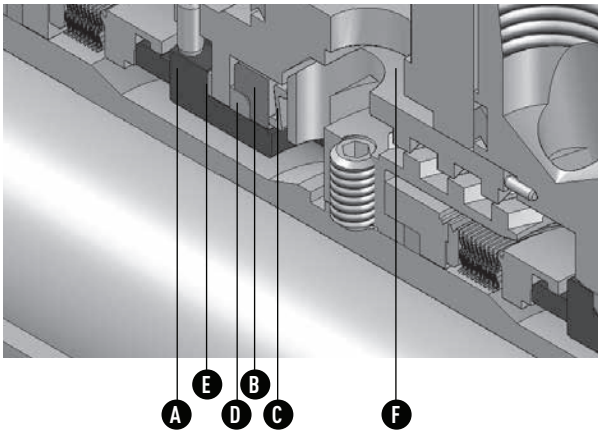
Circulation of clean fluid from external system (typically used with dual seal arrangement 3).



PLAN 54 SEAL CHAMBER FOR PLAN 54

HTL Mating Ring (High-Temperature Live-Loaded)

COMPONENTS	MATERIALS
Description	**Standard**
A – Mating ring	Reaction bonded silicon carbide
B – Compression ring	Silicon carbide
C – Z-spring	Alloy 718
D – Packing	Flexible graphite
E – Gasket	Flexible graphite
F – Flow guide	316 stainless steel



TYPE 2609HTL/3609HTL

API 682 TYPE C METAL BELLOWS SEALS

Technical Specification

HTL Mating Ring Technology

HTL technology utilizes a specially shaped mating ring, compression ring, and energized Z-Spring to "live-load" the secondary flexible graphite packing and to control any radial and axial forces that may be imparted to the mating ring. By utilizing components with similar coefficients of thermal expansion, the HTL mating ring design minimizes or eliminates face distortion due to the relative differences in the thermal growth between components and by eliminating contact with metal surfaces. There are no forces transferred from the gland to the mating ring ensuring face stability and face flatness.

The mating ring has dual pressure capability and can reliably handle full reverse pressure.

Inconel

- Alloy 718 nickel-chromium iron alloy is excellent for use in corrosive environments at elevated temperatures.
- This heat-treatable alloy retains excellent mechanical properties over a wide temperature range. Alloy 718 is utilized for the bellows plates and is the highest strength bellows material available.

Recommendations for Viscous Fluids

0 - 3,500 cSt:	Hard face material
3,500 - 10,500 cSt:	Consult John Crane Engineering

Note: SSU (Saybolt Universal Seconds) approximately equals cSt (centistoke) x 4.6347
Centipoise = cSt (centistoke) x specific gravity.

Welded Metal 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
- Less heat
- Lower power consumption

Typical Applications

- Hydrocarbons
- Aromatic fractionation products (benzene, toluene, solvents, etc.)
- Crude oil fractionation products (fuel oil, lubricating oil, gasoline, etc.)
- Chemicals, caustics, some acids, aqueous solutions, lubricating liquids
- Heat transfer fluids

Angular and Radial Movement

Excessive runout will have a detrimental effect on seal performance in the form of component wear or excessive leakage.

API 682 limits runout as follows:

- Centering of the seal is to be by a register fit. The register fit surface shall be concentric to the shaft and have a total indicated runout (FIM) of not more than 0.005"/125 micrometers.
- Squareness of the seal chamber face to the shaft shall not exceed 0.0005" per inch of seal chamber bore (15 micrometers per cm).
- Runout of the sleeve outer diameter to the inner diameter shall be 0.001"/25 micrometers FIM.
- Shaft-to-sleeve diametrical clearance shall be 0.001" to 0.003"/25 to 75 micrometers.

TYPE 2609HTL/3609HTL

API 682 TYPE C METAL BELLOWS SEALS

Technical Specification

North America
United States of America
Tel: 1-847-967-2400

Europe
United Kingdom
Tel: 44-1753-224000

Latin America
Brazil
Tel: 55-11-3371-2500

Middle East & Africa
United Arab Emirates
Tel: 971-481-27800

Asia Pacific
Singapore
Tel: 65-6518-1800