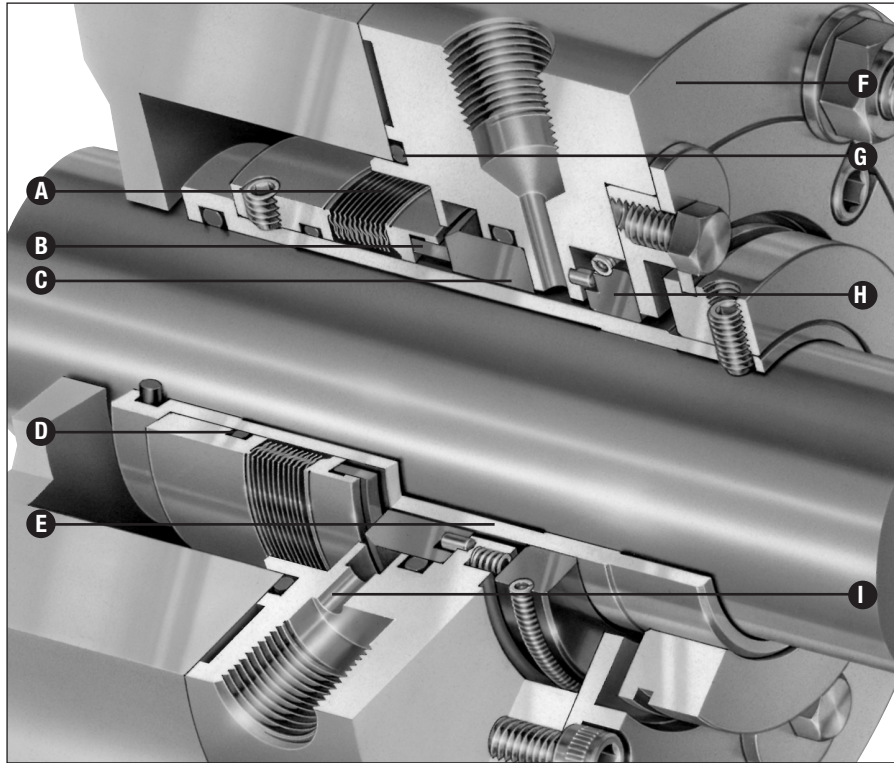




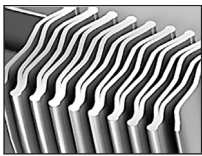
# TYPE 1670-2/1670-3

Second Edition API 682 Category II and III  
Type B Sealol® Metal Bellows Seals

- A – Bellows Assembly
- B – Insert/Primary Ring
- C – Mating Ring/Seat
- D – O-Ring
- E – Sleeve
- F – Gland
- G – Gland O-Ring
- H – Segmented Bushing Assembly
- I – Distributed Flush



Sealol® Welded Metal Bellows



Type 1670-2/1670-3

(Category II or III with segmented Bushing and Distributed Flush Shown)

TYPE 1670-2/1670-3

## Product Description

- **Type 1670-2** - Category II, Type B, Arrangement 1 single rotating Alloy C-276 (UNS N10276) bellows cartridge seal. This seal is available with either a fixed, floating, or segmented bushing option with either a single point or distributed flush arrangement
- **Type 1670-3** - Category III, Type B, Arrangement 1 single rotating Alloy C-276 bellows cartridge seal with segmented bushing and distributed flush arrangement standard. Category III seals come with the appropriate documentation in accordance with the API 682 specification

## Performance Capabilities

- Temperature:  
-40°C to 260°C/-40°F to 500°F  
(depending on material used)
- Pressure:  
Vacuum to 20 bar/300psi
- Speed:  
up to 25 m/s /5000 fpm
- Shaft Size:  
19mm to 110mm/0.750" to 4.330"

## Design Features

- API 682 qualification tested
- Sealol edge-welded metal bellows
- Easy-to-install cartridge design with registered fit
- Static secondary seals
- Standard components
- Segmented spring-loaded carbon throttle bushing for effective containment (optional)
- Distributed flush optimizes circulation of liquid at faces and prevents trapped vapor
- Available with a pumping ring when utilizing an API Plan 23

## Design Features

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

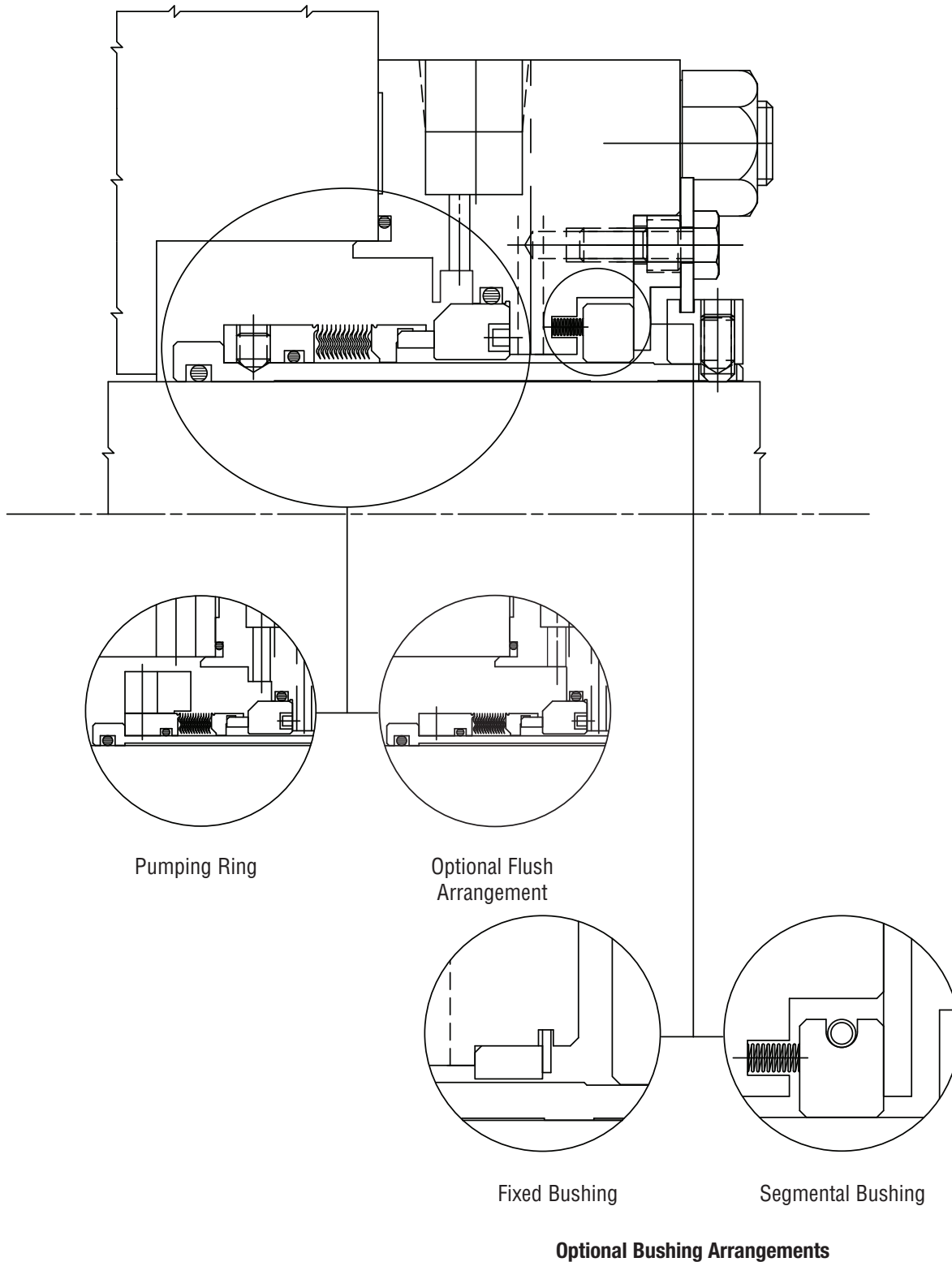


# TYPE 1670-2/1670-3

Second Edition API 682 Category II and III  
Type B Sealol® Metal Bellows Seals

## Type 1670 API Type B Arrangement 1 - Single Cartridge

Type 1670 Standard Arrangement Shown (Category II Seal)

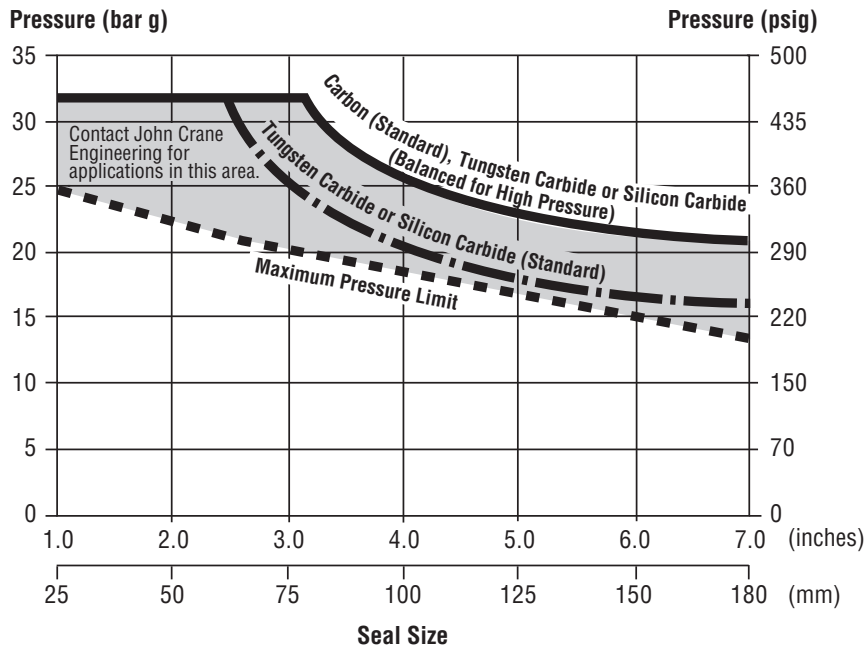




# TYPE 1670-2/1670-3

## Second Edition API 682 Category II and III Type B Sealol® Metal Bellows Seals

### 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 3600 rpm in a 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.

For process services outside this range or for a more specific assessment of the dynamic pressure rating, contact John Crane Engineering.

**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. Consult John Crane Engineering for applications outside these limits.

### Materials of Construction

	Selection Considerations	Multiplier Factors	
		Carbon vs. SiC	T/C vs. SiC
<b>Speed</b>	Up to 3600 rpm Above 3600 rpm	x 1.00 x (3600/speed)	x 1.00 x (3600/speed)
<b>Sealed Fluid Lubricity</b>	Petrol/Gasoline, Kerosene, or Better Water and Aqueous Solutions (<80°C/176°F) Flashing Hydrocarbons* (see note 1)	x 1.00 x 0.75 x 0.60	x 1.00 x 0.75 (see note 2)
<b>Sealed Fluid Temperature (see note 3)</b>	Up to 80°C/175°F Up to 120°C/250°F Up to 205°C/400°F	x 1.00 x 0.90 x 0.80	x 1.00 x 1.00 x 1.00

**Example for Determining Pressure Rating Limits:**

**Seal:** Type 1670  
**Size:** 50mm/2"  
**Product:** 50/50 Glycol and Water  
**Face Material:** Carbon vs. Silicon Carbide  
**Operating Temperature:** 95°C/200°F  
**Operating Speed:** 3600 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:**

21 bar g/300 psig max pressure  
**Carbon Limit Curve:** 32 bar g/460 psig

**Calculated Limit:** 32 bar g/460 psig x 1.00 x 0.75 x 0.90 = 20 bar g/310 psig

At 3600 rpm with the service conditions noted, a 50mm/2" (Seal Size) Type 1670 has a maximum operating pressure limit of 20 bar g/310 psig.

\* 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 0.6, consult John Crane.

**NOTES:**

1. Specific gravity ≥ 0.6 and ratio of sealed pressure to vapor pressure > 1.5.
2. More details regarding the fluid and the operating conditions are required.
3. Temperature at the seal faces includes effects of flush, quench and cooling.



# TYPE 1670-2/1670-3

Second Edition API 682 Category II and III  
Type B Sealol® Metal Bellows Seals

## Materials of Construction

SEAL COMPONENTS	MATERIALS	
	Description	Options
Seat/Mating Ring	Standard	Options
Seat/Mating Ring	Silicon Carbide Reaction Bonded	—
Insert/Primary Ring	Premium Grade Carbon	Tungsten Carbide Nickel Bound Sintered Silicon Carbide
End Fittings	Alloy C-276 (UNS N10276)	—
Bellows	Alloy C-276 (UNS N10276)	—
Adaptive Hardware	316 Stainless Steel (UNS 31600)	Alloy C-276-(UNSN10276)
Static Seals	Fluorocarbon	Amine Resistant Perfluoroelastomer Medium Nitrile Perfluoroelastomer

## Sealol Welded Metal Bellows

### Design Features

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

### Sealol Bellows Benefits

- Uniform plate rigidity and stress distribution
- Enhanced fatigue strength
- Pressure-balanced by design
- Less heat
- Lower power consumption

## 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 125 micrometers (0.005")
- Squareness of the seal chamber face to the shaft shall not exceed 5 micrometers per cm (0.0005" per inch) of seal chamber bore
- Runout of the sleeve outer diameter to the inner diameter shall be 25 micrometers FIM (0.001")
- Shaft-to-sleeve diametrical clearance shall be to Tolerance Grade F7/h6

## Recommendations for Viscous Fluids

- 0 - 1,000 cSt: Standard Seal
- 1,000 - 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  
cP (centipoise) = cSt (centistoke) x specific gravity.



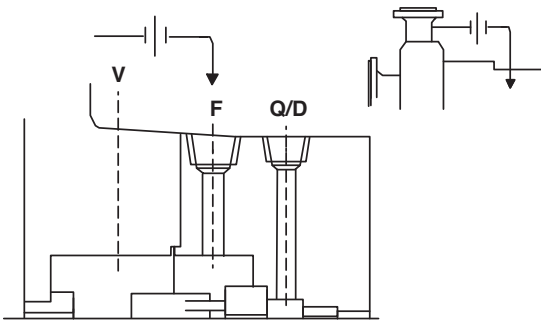
# TYPE 1670-2/1670-3

Second Edition API 682 Category II and III  
Type B Seal<sup>®</sup> Metal Bellows Seals

## Piping Plans Recommended with the Type 1670-2/1670-3

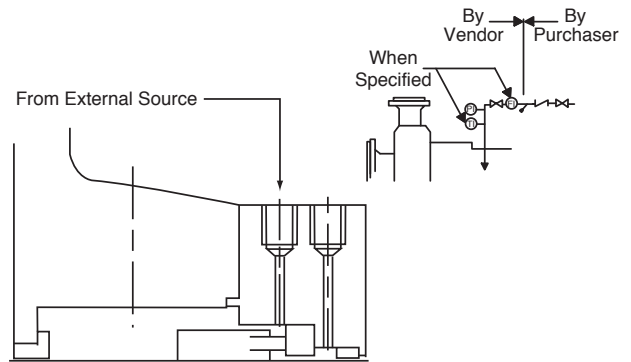
### API Plan 11

Recirculation from pump case through orifice to seal.



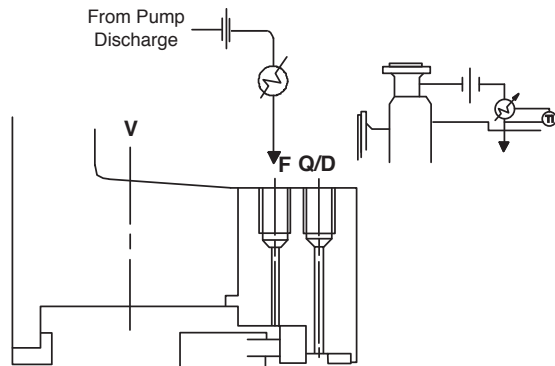
### API Plan 32

Injection to seal from external source of clean cool fluid.



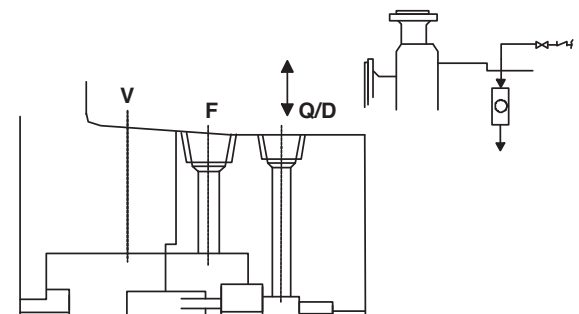
### API Plan 21

Recirculation from pump case through orifice and cooler or heat exchanger to seal.



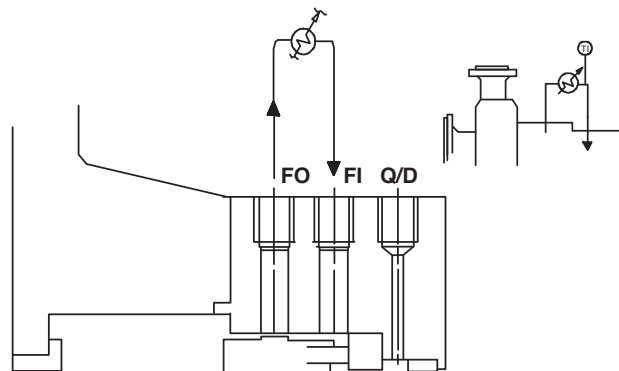
### API Plan 32

External fluid quench (steam, gas, water, etc.) typically used with fixed, floating or segmental bushing.



### API Plan 23

Recirculation from seal with pumping ring through heat exchanger and back to seal.





# TYPE 1670-2/1670-3

Second Edition API 682 Category II and III  
Type B Sealol® Metal Bellows Seals

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For your nearest John Crane facility, please contact one of the locations below.



<b>Europe</b> Slough, UK	<b>North America</b> Morton Grove	<b>Latin America</b> São Paulo, Brazil	<b>Middle East &amp; Africa</b> Dubai, United Arab Emirates	<b>Asia Pacific</b> Singapore
Tel: +44-1753-224000 Fax: +44-1753-224224	Tel: +1-847-967-2400 Fax: +1-847-967-3915	Tel: +55-11-3371-2500 Fax: +55-11-3371-2599	Tel: +97-1488-39510 Fax: +97-1488-37766	Tel: +65-6512-5200 Fax: +65-6512-5233