



Engineering Sealing Systems Training Course for API 682

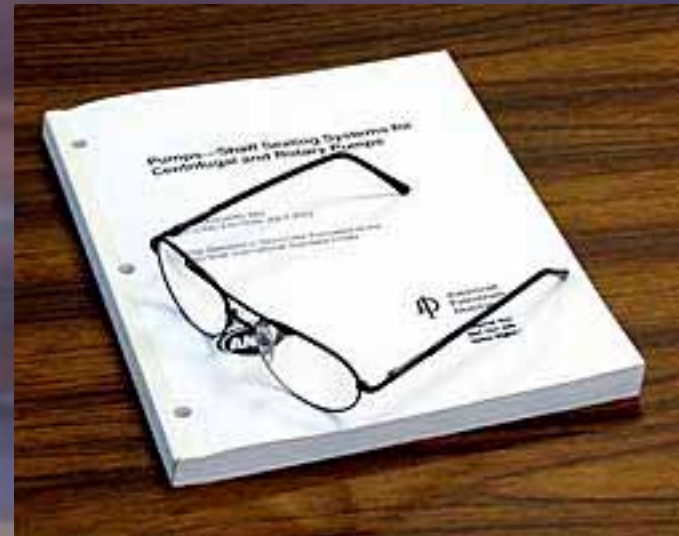
MS Jo/John Crane Korea

18~19th March 2009

**American
Petroleum Institute
682 Standard
3rd Edition & ISO
Standard 21049**

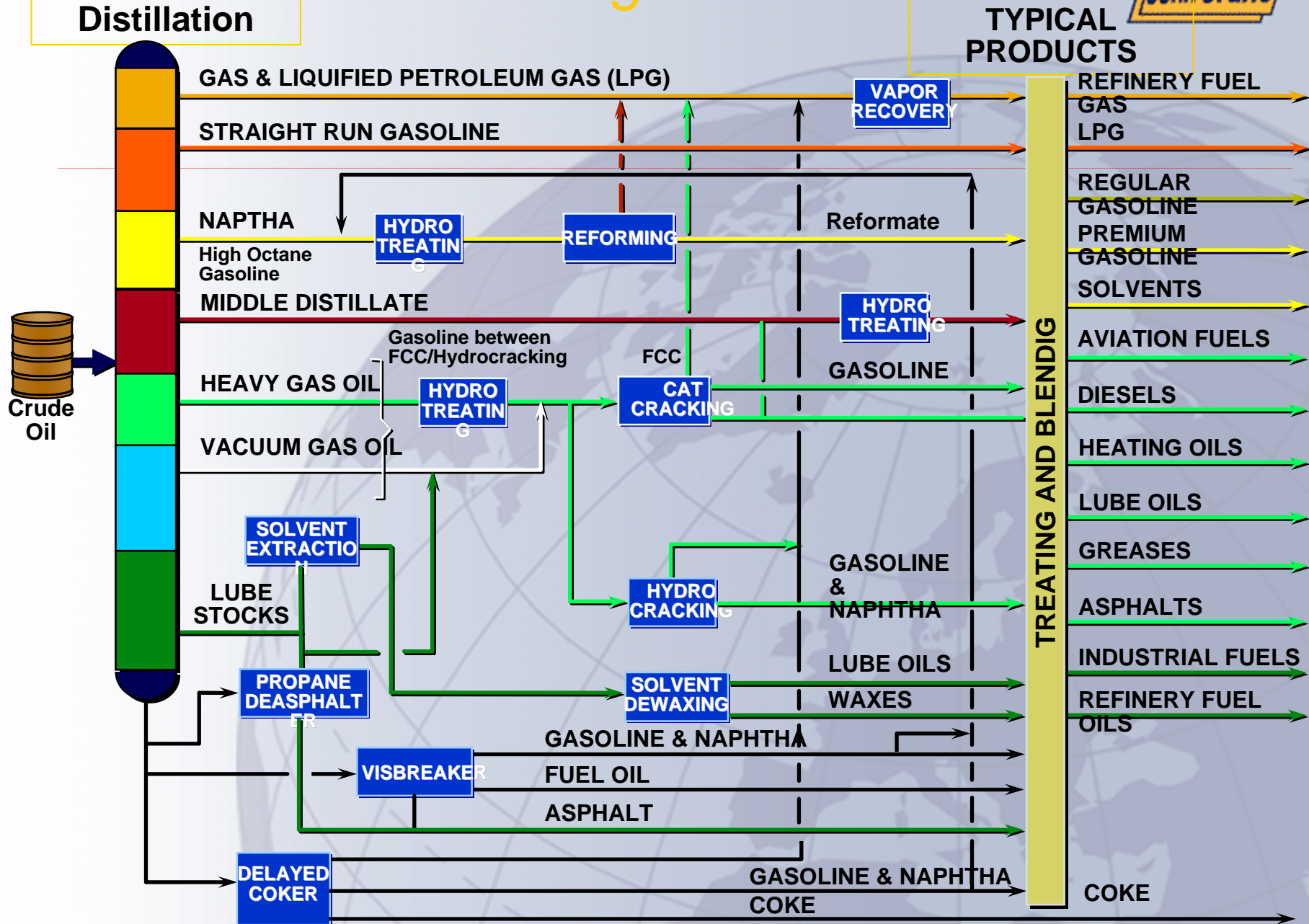


Introduction



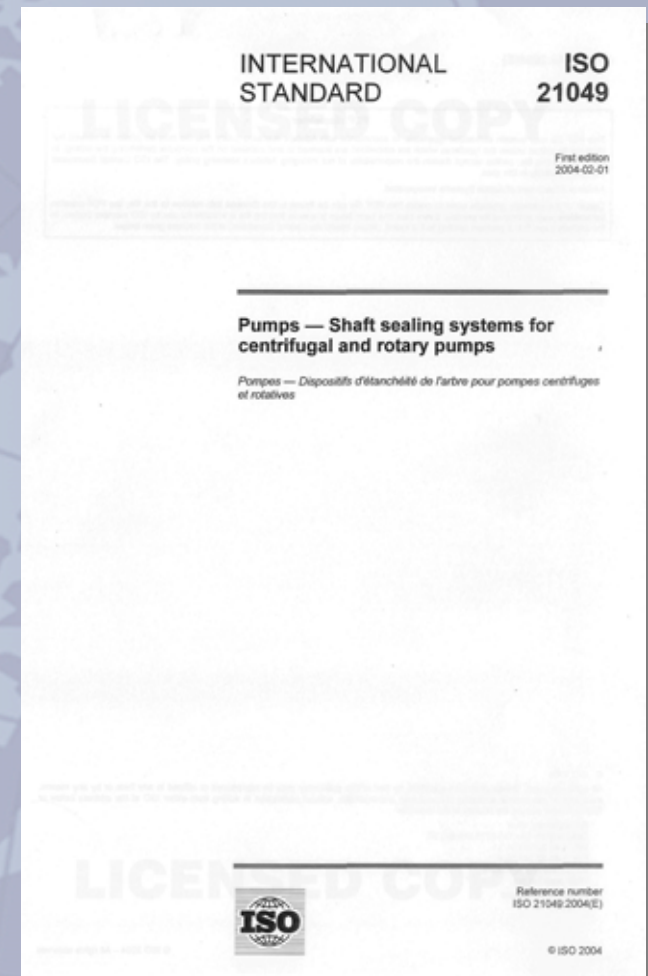
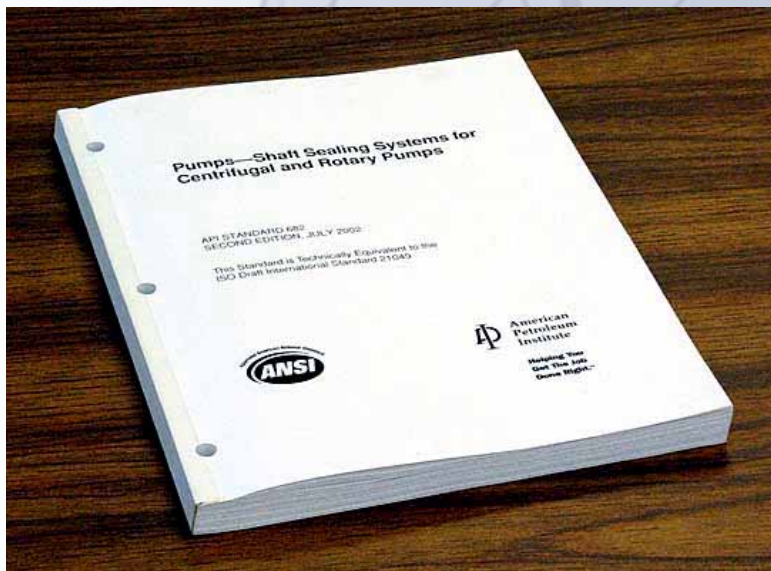
**Pumps-Shaft Sealing Systems for
Centrifugal and Rotary Pumps**

Knowledge Is Power



API 682 Publication Dates

- 1st Edition issued 1994
- 2nd Edition July 2002
- ISO 21049 February 2004
- 3rd Edition September 2004



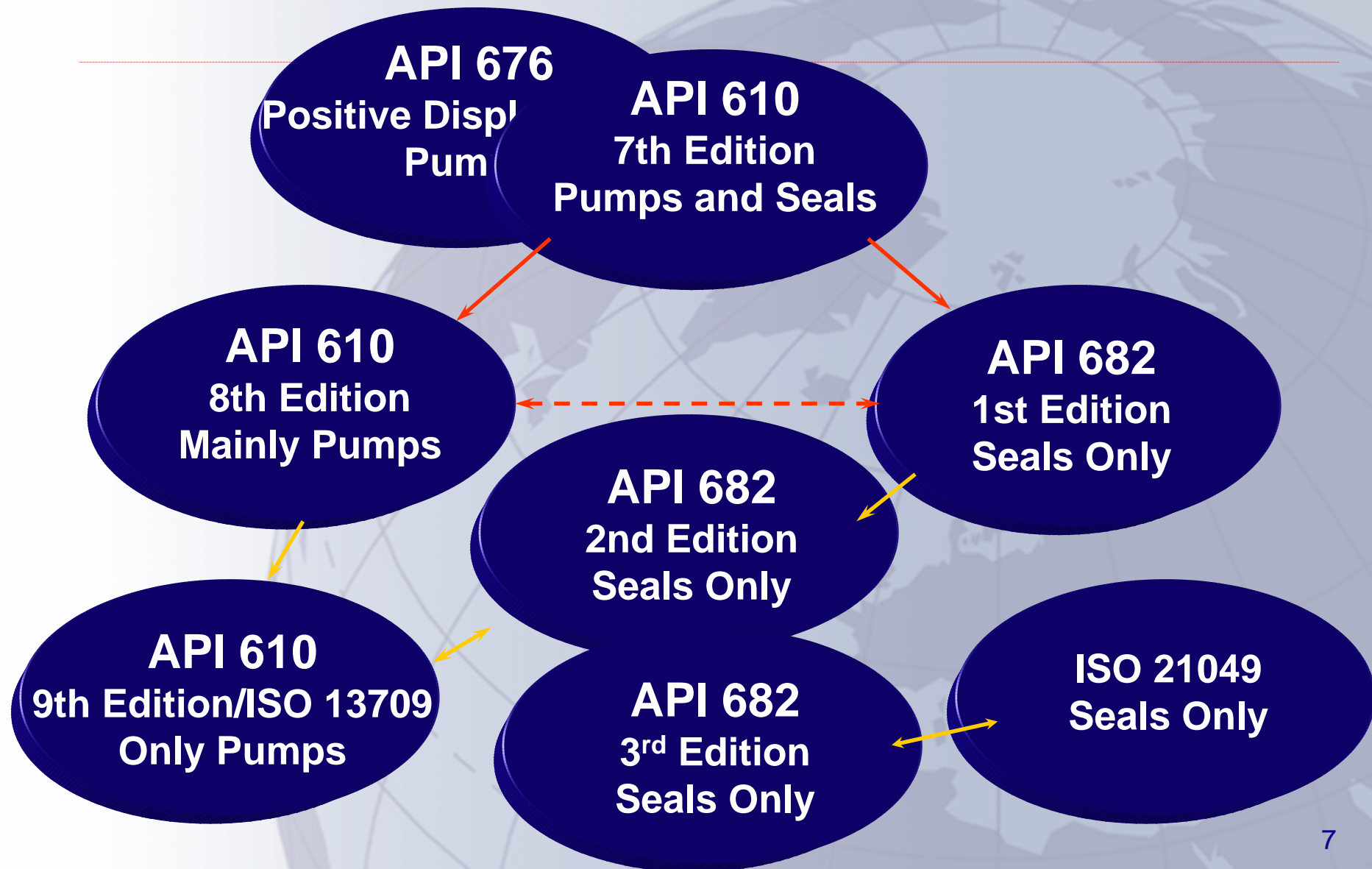
API 682 Mission Statement

“This standard is designed to default to the equipment types most commonly supplied that have a high probability of meeting the objective of **at least three years** of uninterrupted service while complying with **emissions regulations.**”

API 682 Standard - Aims

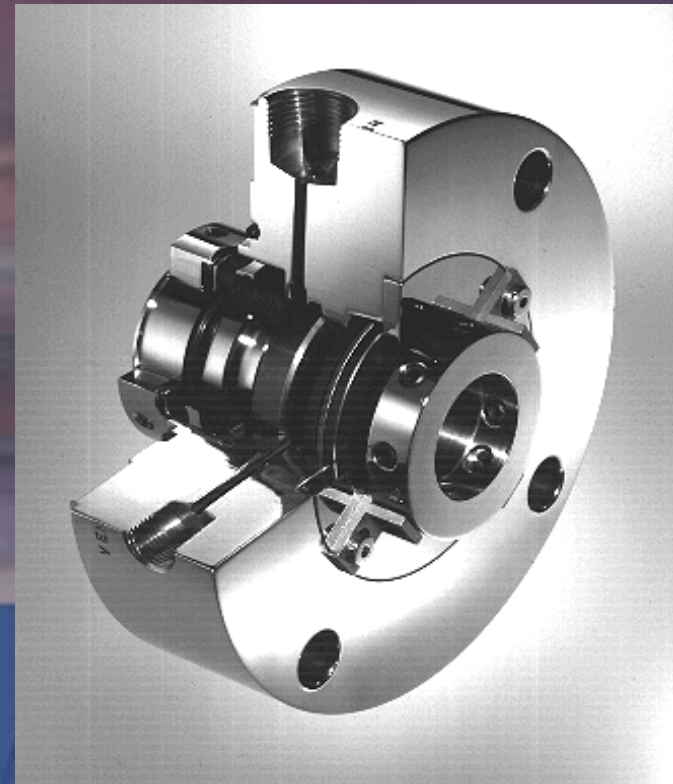
- **Maximum reliability and availability of equipment**
- **Meet emissions legislation**
- **Lower costs - standardisation & reliability**
- **Improved safety - tested & proven sealing systems**
- **Consistent seal application based on accumulation of best practices**
- **Seal interchangeability**

Development of Seal & Pump Standards





API 682 / ISO21049 Product Line



API 682 / ISO Seal Categories

Category 1

Chemical & Petrochemical Industry Pumps.

Heavy duty seals designed for ANSI and ISO enlarged bore seal chambers.

API 682
3rd Edition
ISO21049

Category 2

Oil & Gas Industry API Pumps.

Handles services previously defined as API-610 Applications.

Same qualification tested components as Cat. III Seals.

Category 3

Oil & Gas Industry API Pumps.

Premium seals meeting highest specification of API 682.

Require full qualification test reports.

Standard Seal Types & Arrangements

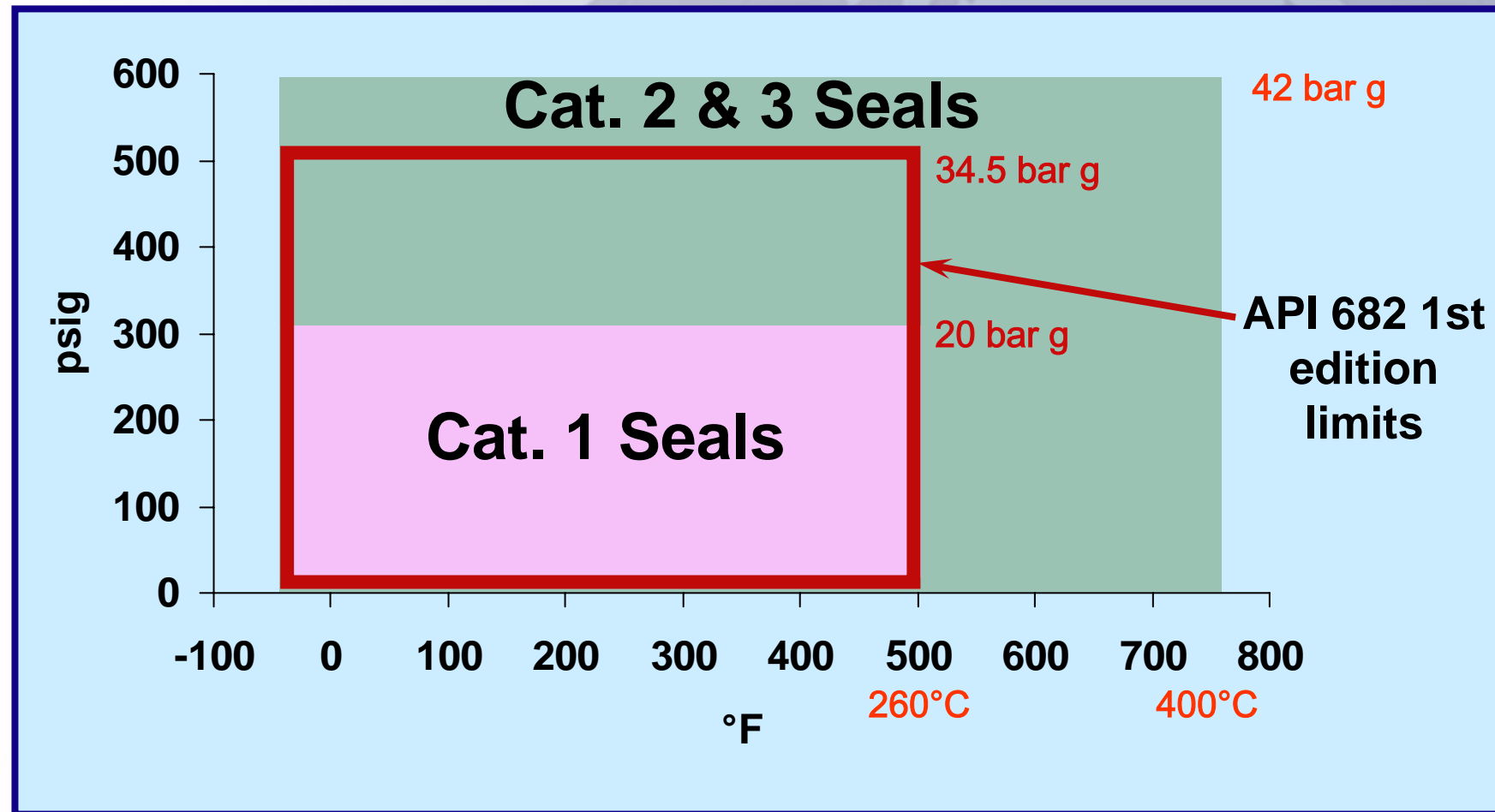
Seal Types

- Type A:** Rotating pusher seal using O-rings & multiple springs.
- Type B:** Rotating metal bellows using O-rings.
- Type C:** Stationary metal bellows using flexible graphite gaskets. Only applies to Cat. II & III for high temperature service.

Seal Arrangements

- Arrangement 1:** Single seal
- Arrangement 2:** Unpressurised dual seal (Tandem)
- Arrangement 3:** Pressurised dual (Double)

Category 1, 2, & 3 Operating Ranges



API 682 3rd Ed. / ISO Seal Categories

FEATURE	CATEGORY 1	CATEGORY 2	CATEGORY 3
Seal chamber size	ISO 3069, ASME B73.1 and ASME B73.2	ISO 13709 / API 610	ISO 13709 / API 610
Temperature range	−40 °C (−40 °F) to 260 °C (500 °F)	−40 °C (−40 °F) to 400 °C (750 °F)	−40 °C (−40 °F) to 400 °C (750 °F)
Pressure range	22 bar (315 psi).	42 bar (615 psi).	42 bar (615 psi).

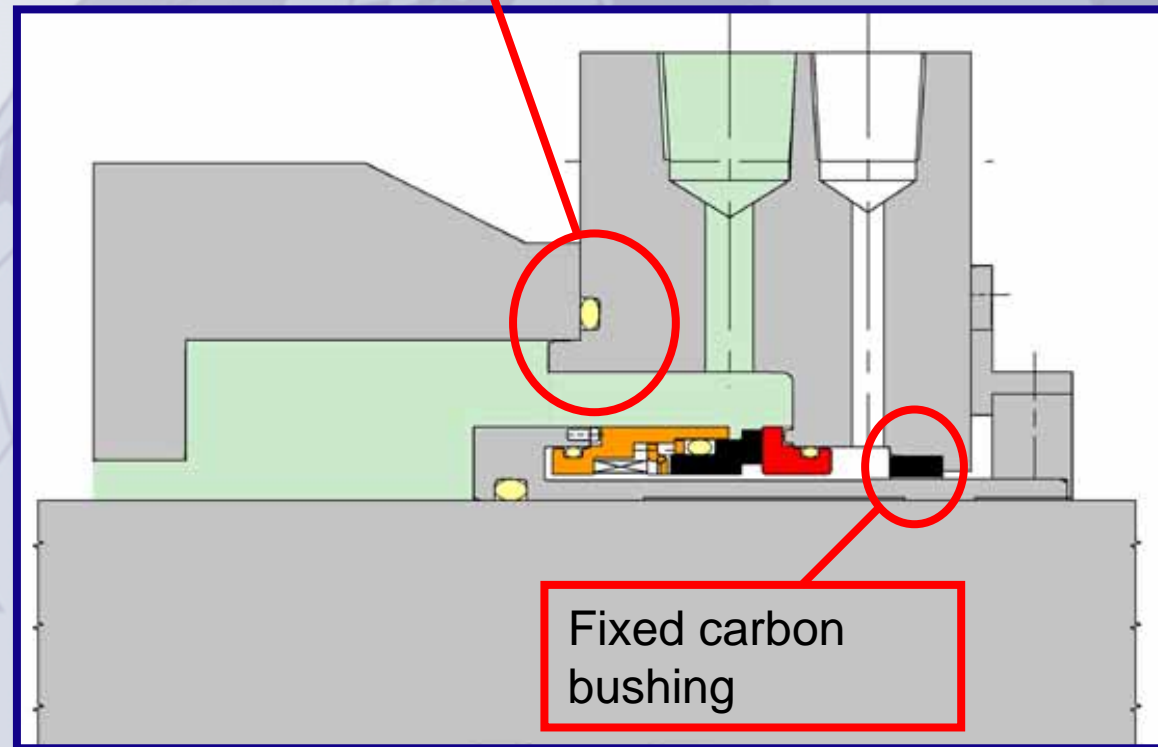
Category 1 Seal Types

5610Q-1

Type A

Arrangement 1

Registered fit with confined O-ring & metal-to-metal contact with pump seal chamber.



Fixed carbon
bushing

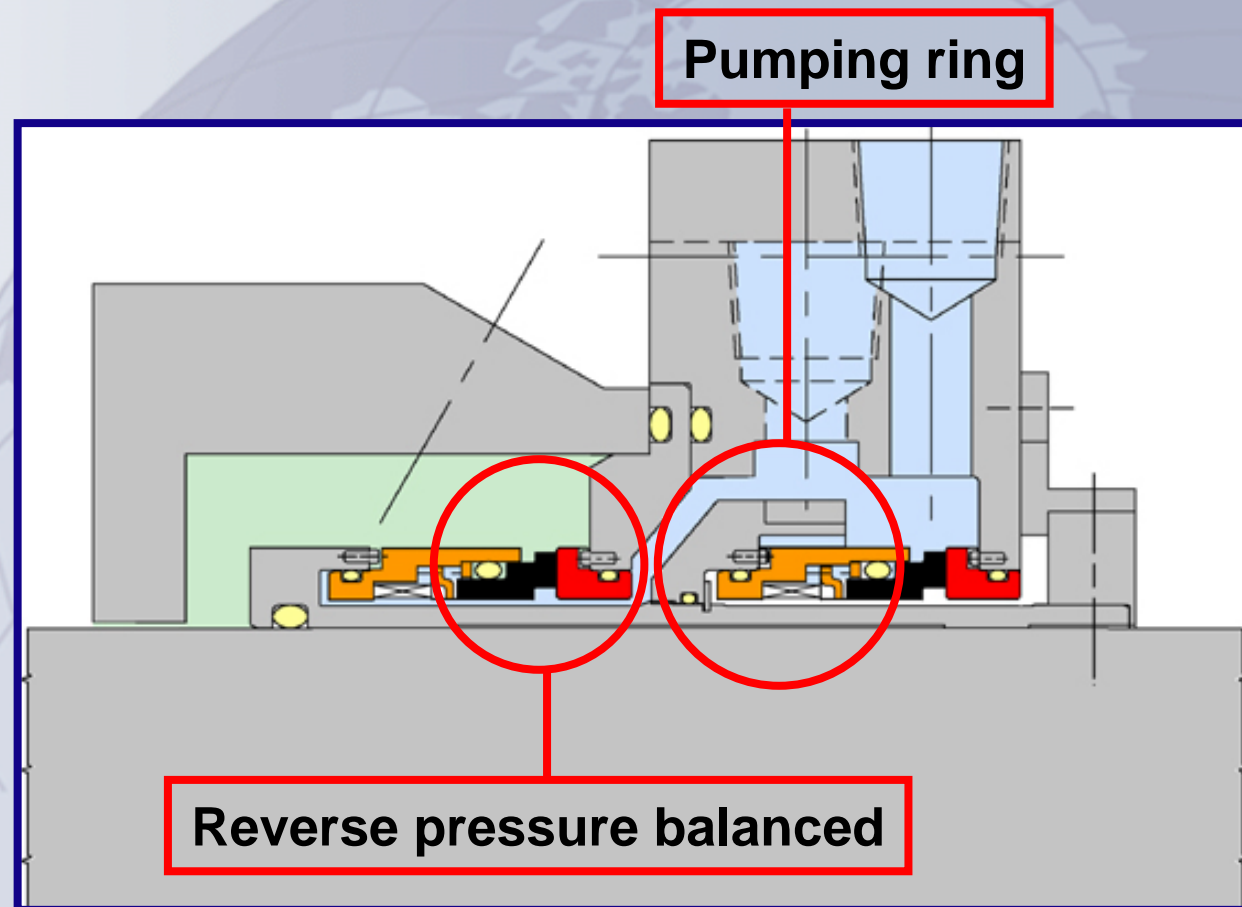
Stationary inner seal option

Category 1 Seal Types

5620P-1

Type A

Arrangement 2



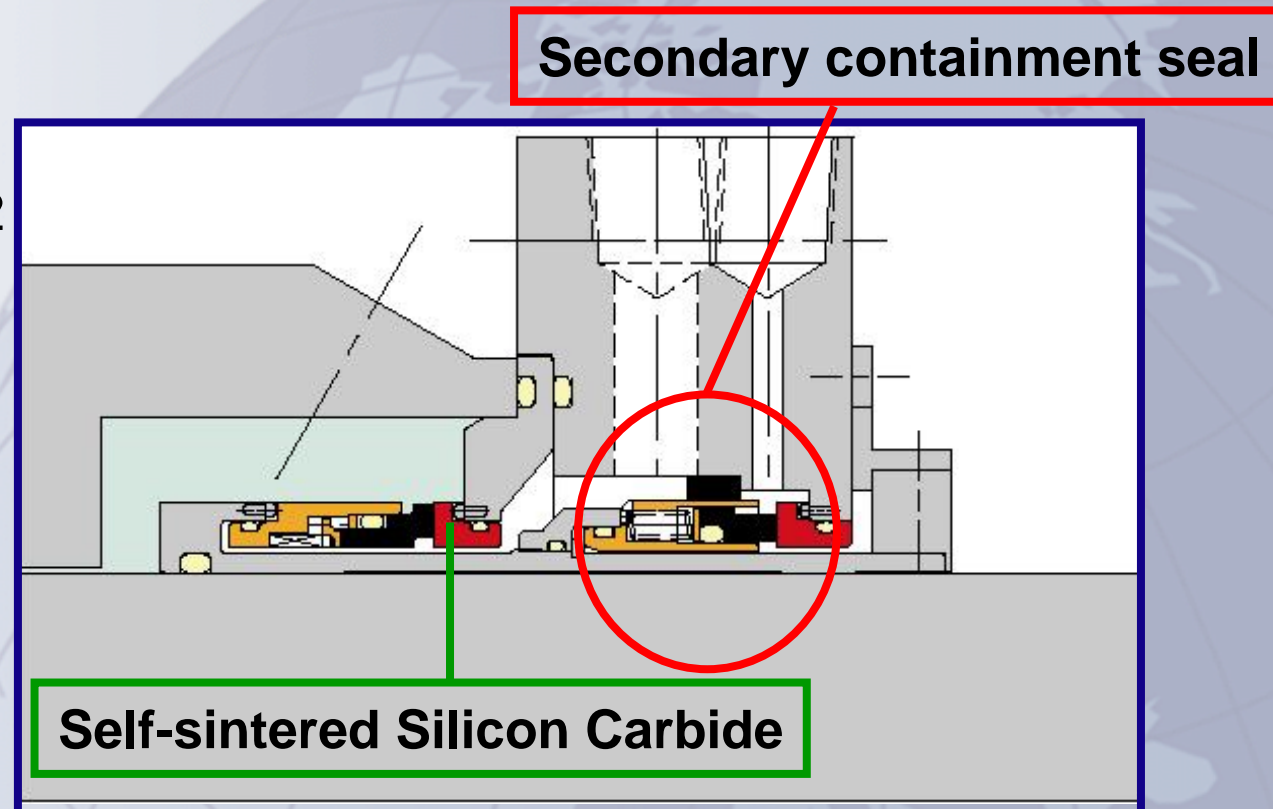
Stationary inner seal option

Category 1 Seal Types

5620D-1

Type A

Arrangement 2



Stationary inner seal option

Alloy C-276 Sealol edge-welded metal bellows

Fixed carbon bushing

Stationary inner seal option

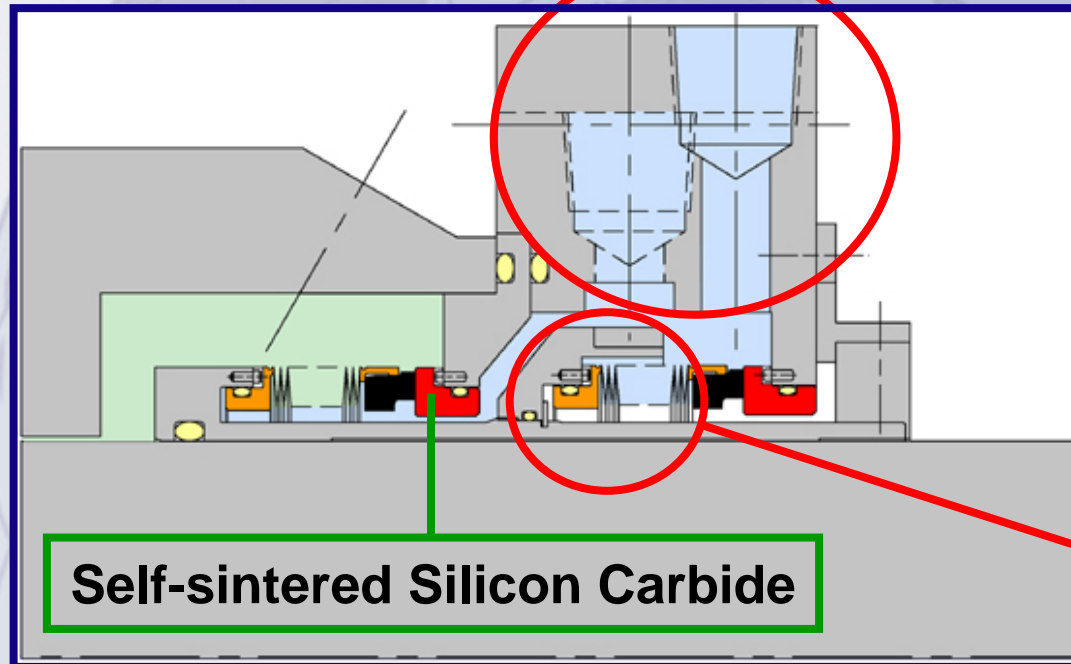
Category 1 Seal Types

5625P-1

Type B

Arrangement 2

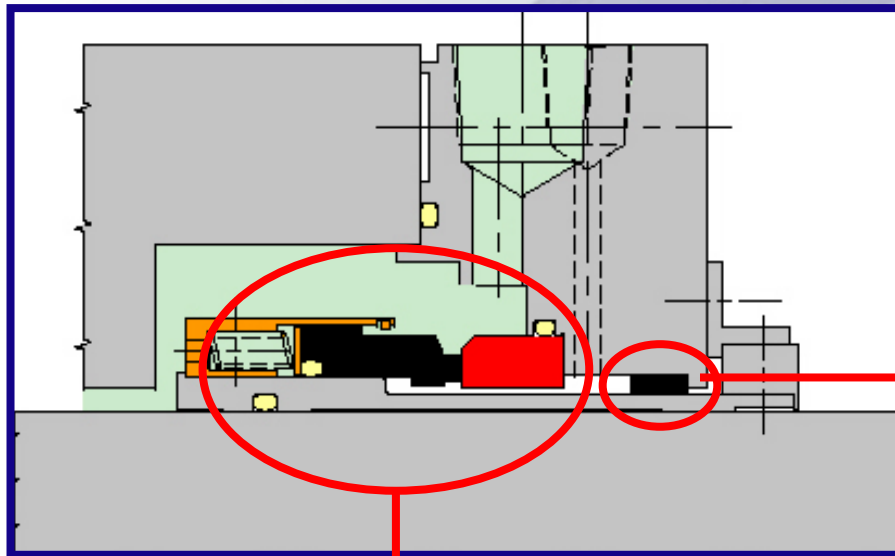
Dual seals have radial inlet and tangential outlet buffer/barrier fluid connections



Stationary inner seal option

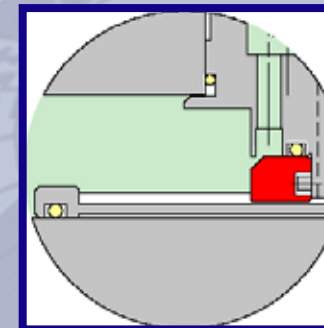
Category 2 Seal Types

1648-2 Type A, Arrangement 1

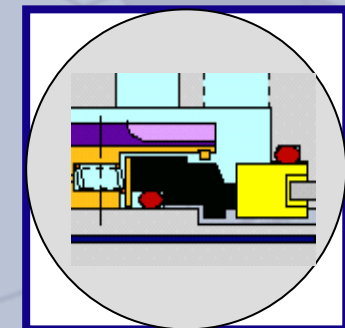


Based on successful Type 48 design

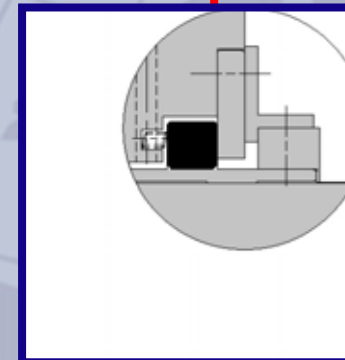
Standard bushing: Fixed
Standard flush: Single point
Optional bushing: Segmented or floating
Optional flush: Distributed



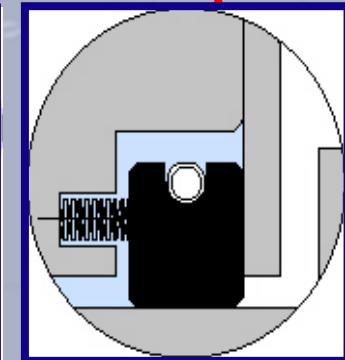
Distributed flush



**Pumping ring
(API Plan 23)**



Floating bushing



**Segmented
bushing (JC option)
(sleeve hard coating
optional)¹⁸**

Category 2 Seal Types

2648-2

Type A, Arrangement 2

Primary Face
Carbon - standard
Tungsten Carbide - optional

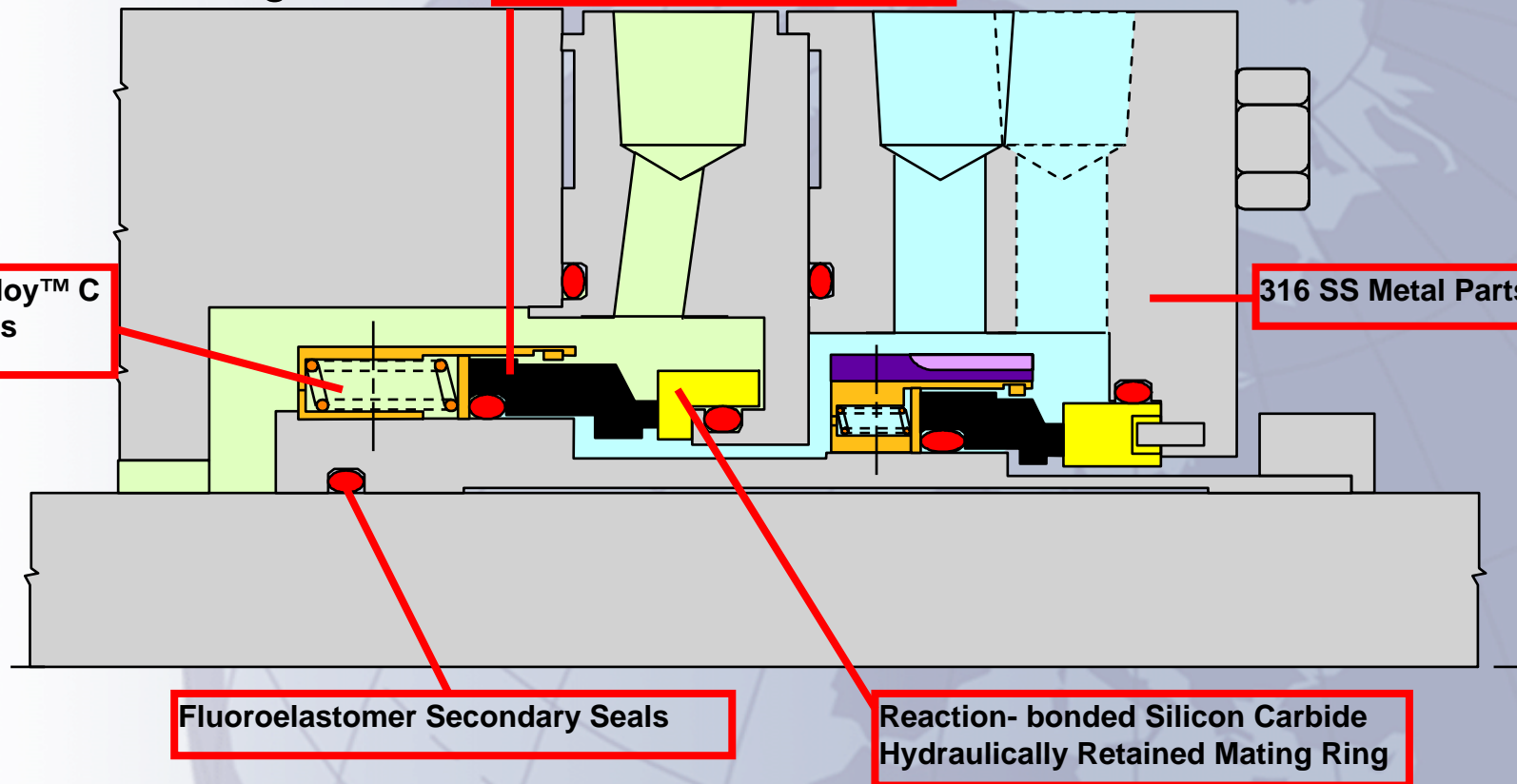
API flush plan 52
Same as Cat. III

Hastelloy™ C
Springs

316 SS Metal Parts

Fluoroelastomer Secondary Seals

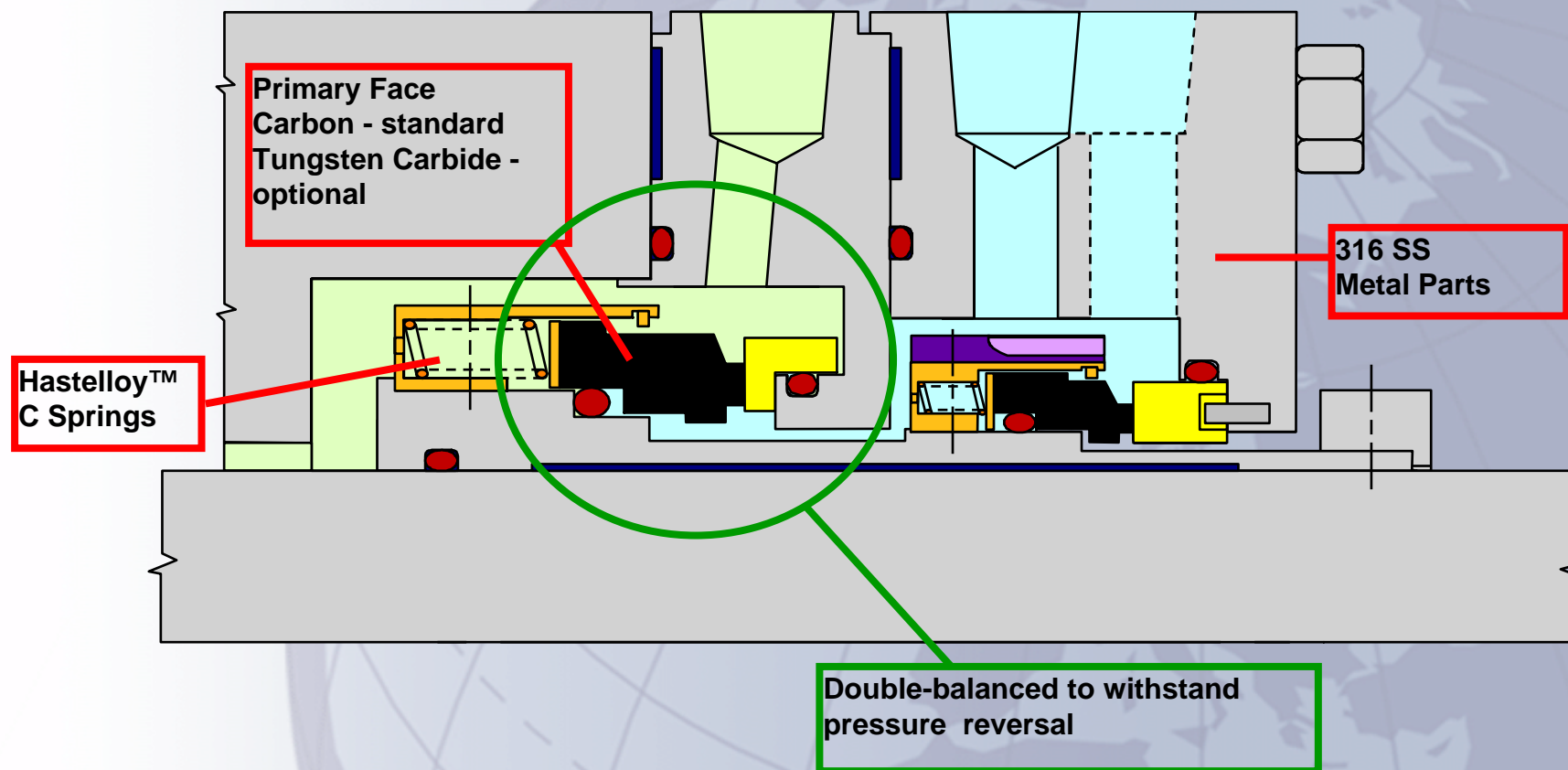
Reaction-bonded Silicon Carbide
Hydraulically Retained Mating Ring



Category 2 Seal Types

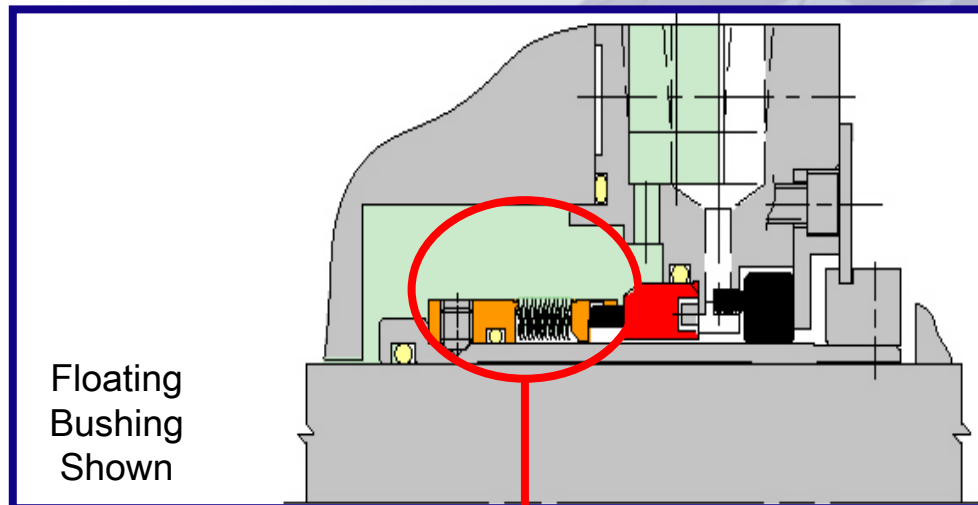
3648-2 Type A, Arrangement 3

API flush plan 53 or 54
Same as Cat. III



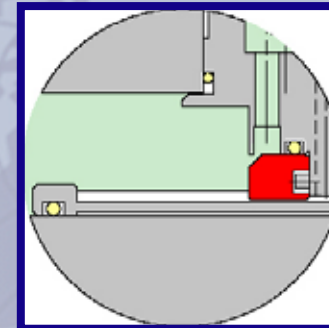
Category 2 Seal Types

1670-2 Type B, Arrangement 1

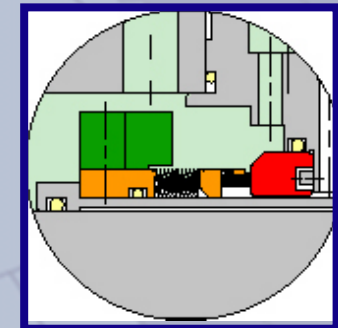


Sealol C-276 edge-welded metal bellows

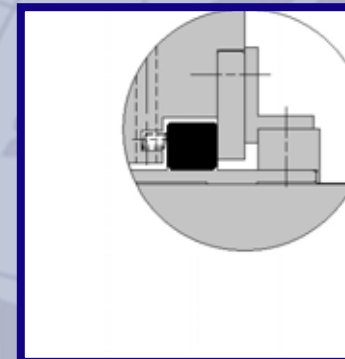
Standard bushing: Fixed
 Standard flush: Single point
 Optional bushing: Segmented or floating
 Optional flush: Distributed



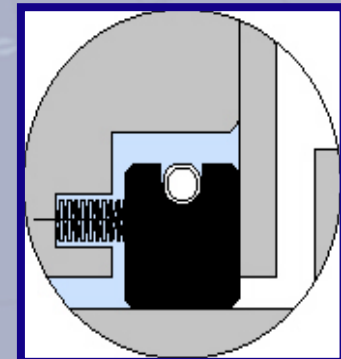
Distributed flush



**Pumping ring
(API Plan 23)**



Floating bushing



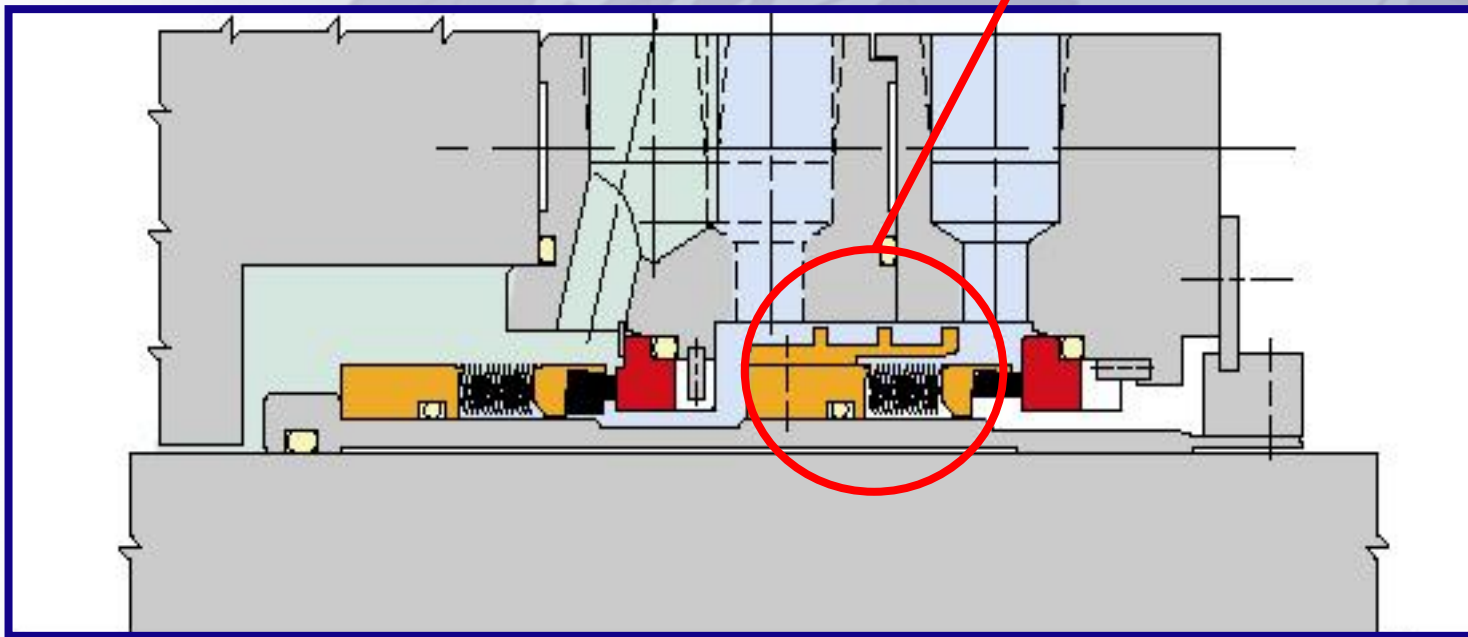
**Segmented
bushing (JC option)
(sleeve hard coating
optional) 21**

Category 2 Seal Types

2670-2 Type B, Arrangement 2

3670-2 Type B, Arrangement 3

Axial flow (scroll) pumping ring



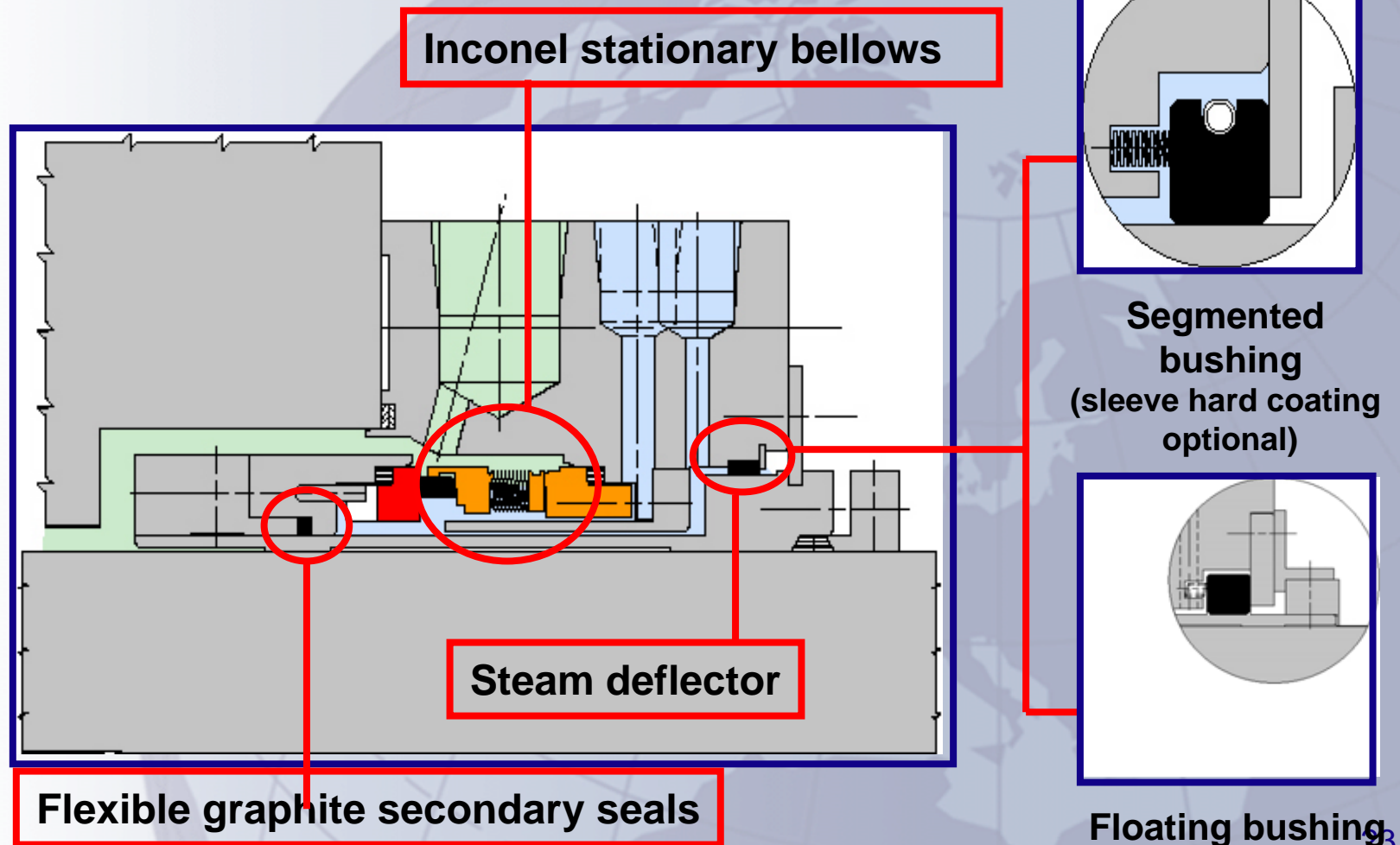
2670 uses API flush plan **52**

3670 uses API flush plan **53** or **54**

Same as Cat. III

Category 2 Seal Types

1604-2 Type C, Arrangement 1



Category 2 Seal Types

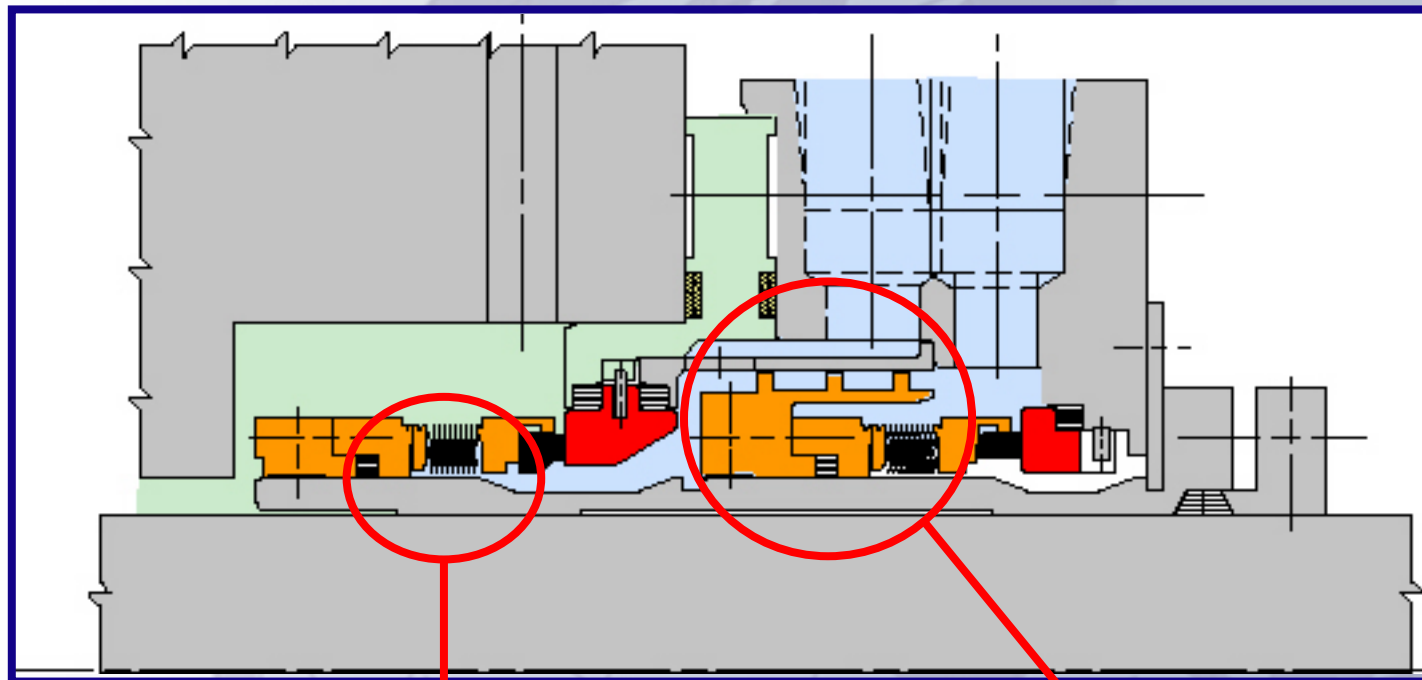
2609-2 Type C Arrangement 2

2609 uses API flush plan 52

3609-2 Type C Arrangement 3

3609 uses API flush plan 53 or 54

Same as Cat. III



High temperature
rotating Inconel bellows

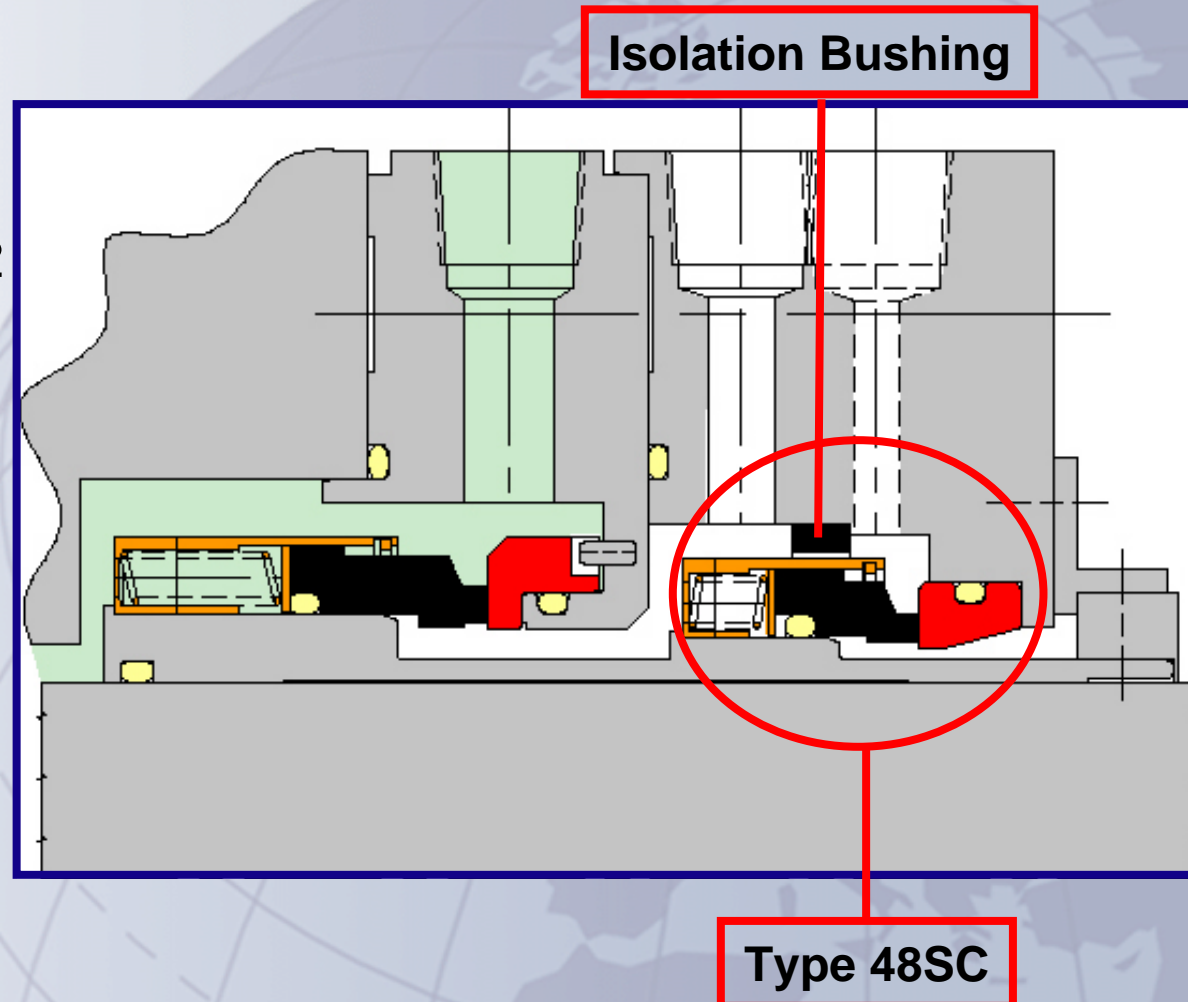
Axial flow (scroll) pumping ring &
flow guide

Category 2 & 3 Secondary Containment Seals

2648-2C

Type A

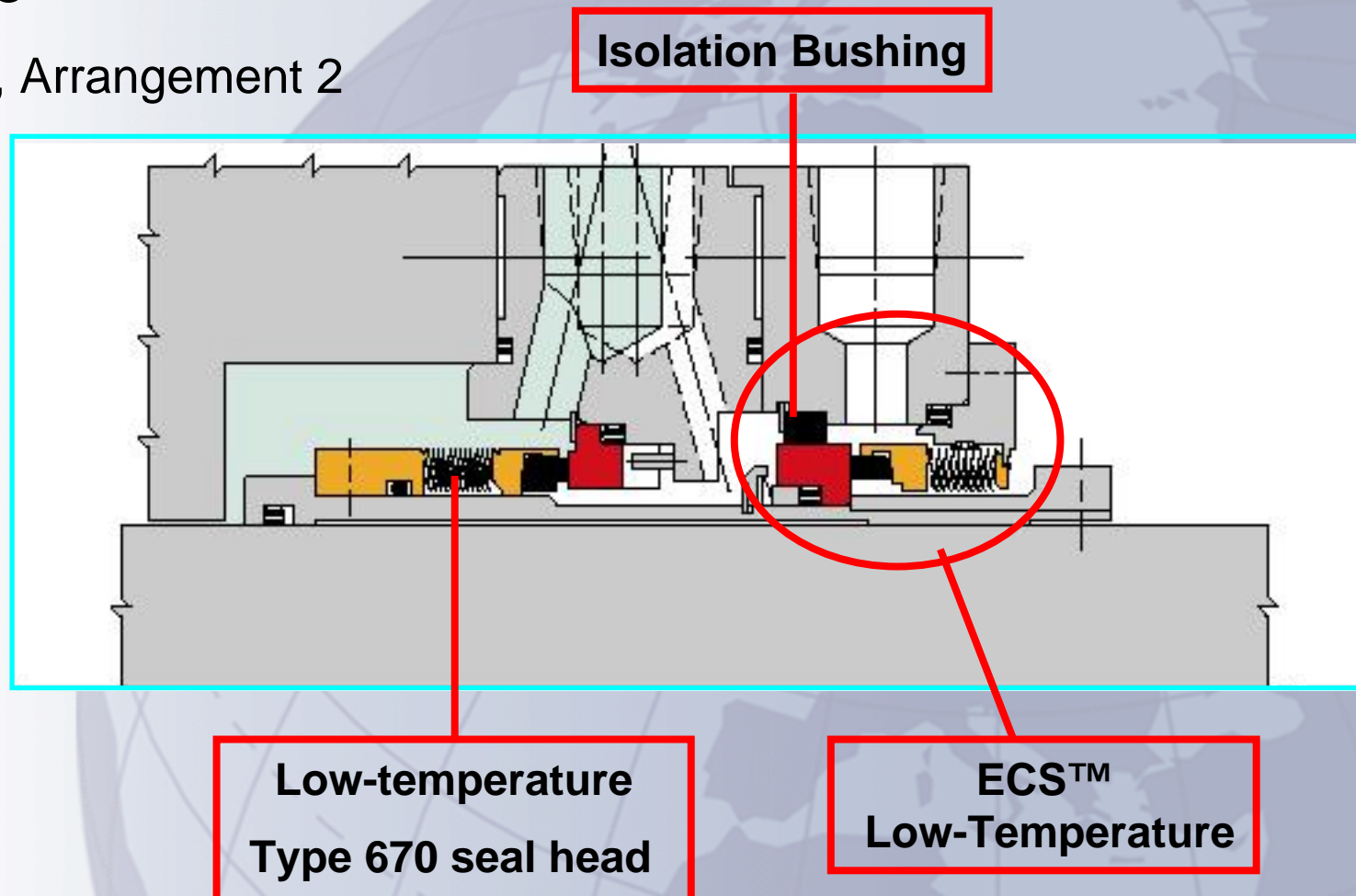
Arrangement 2



Category 2 & 3 Secondary Containment Seals

2670-2C

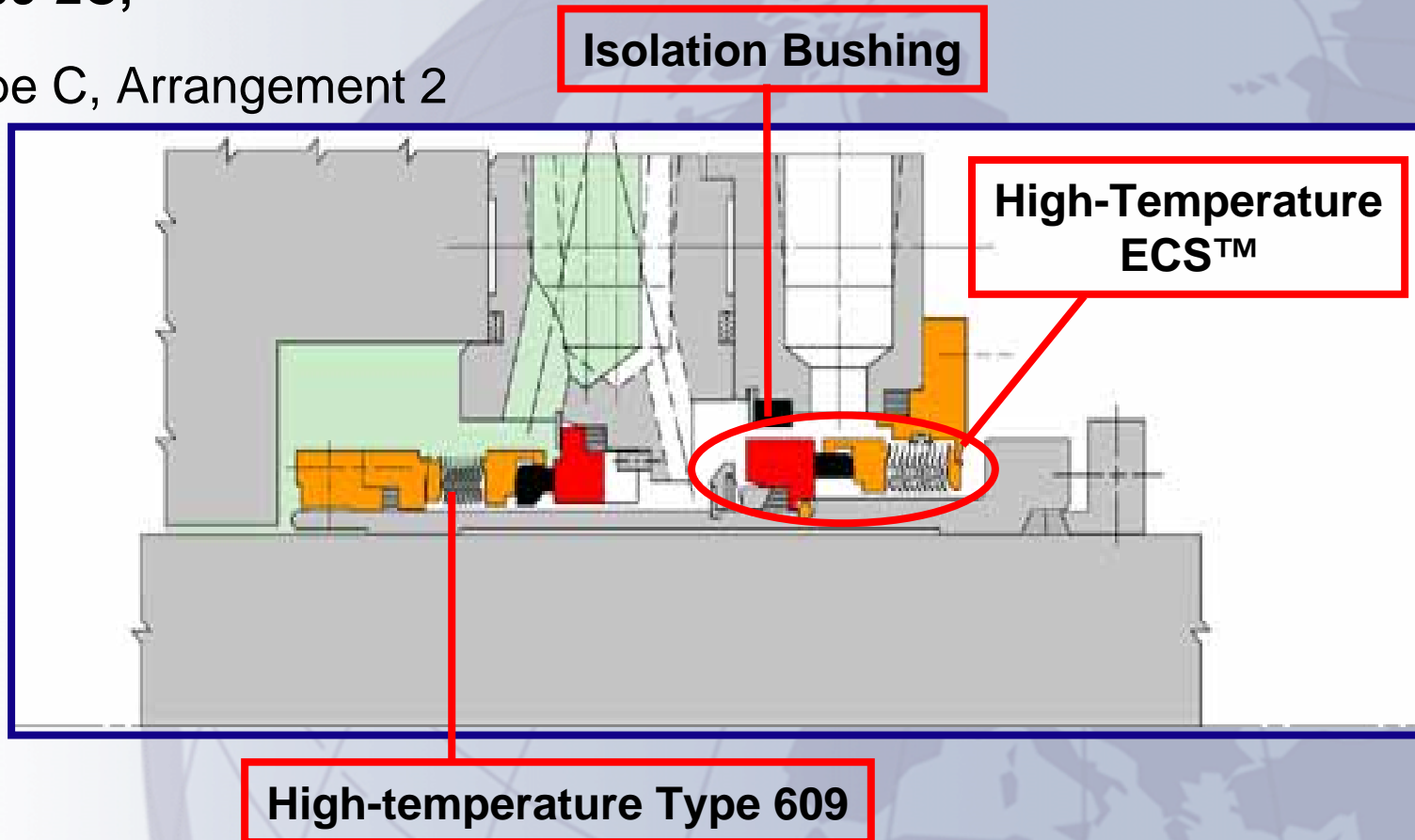
Type B, Arrangement 2



Category 2 & 3 Secondary Containment Seals

2609-2C,

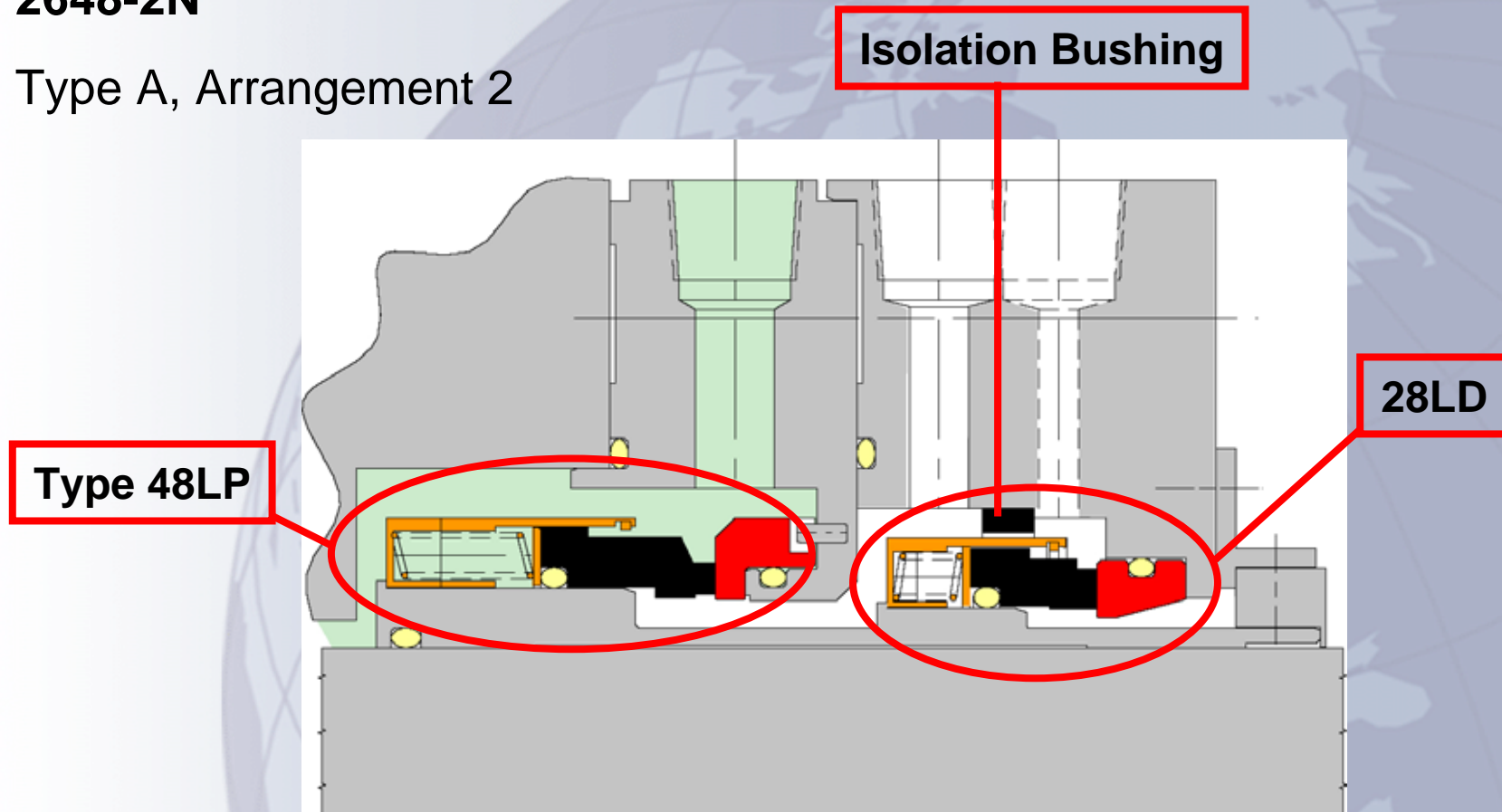
Type C, Arrangement 2



Category 2 & 3 Non-contacting Secondary Containment Seals

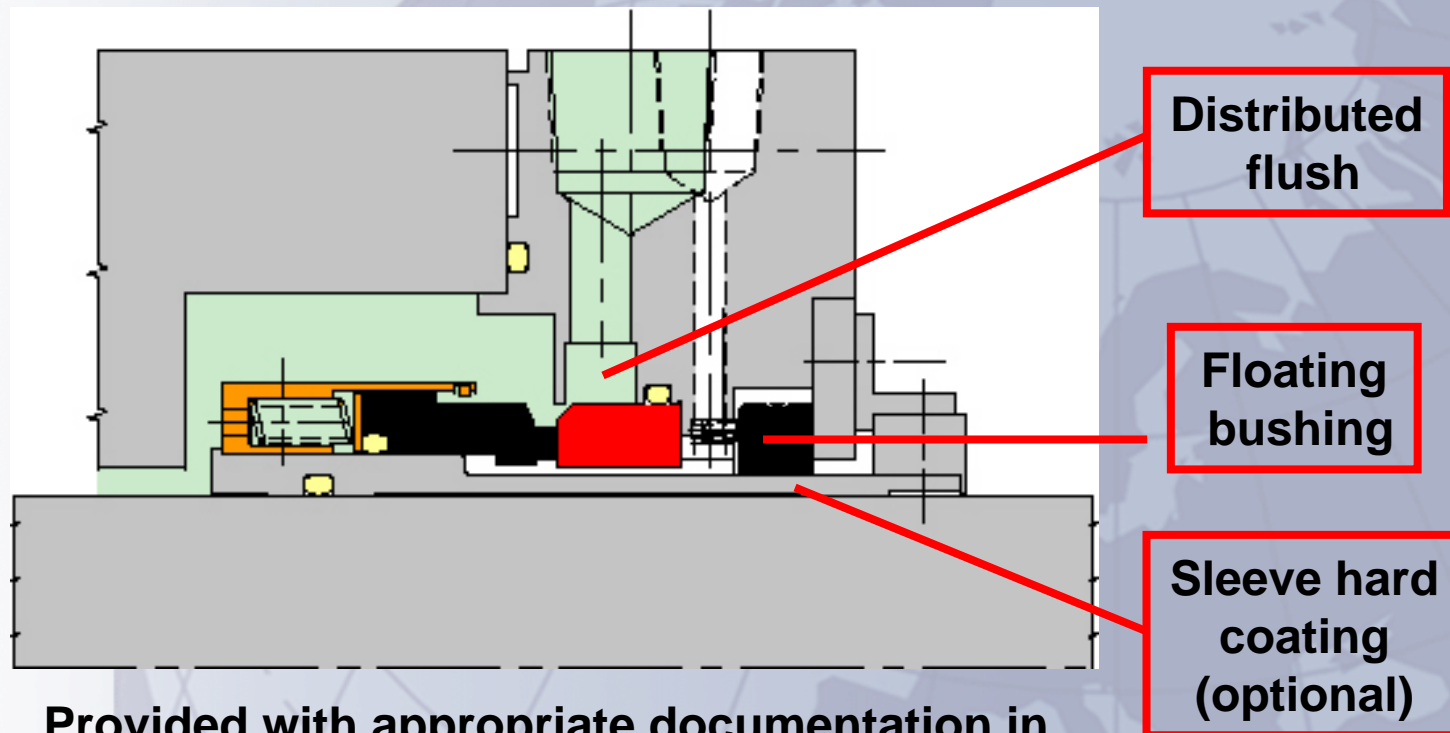
2648-2N

Type A, Arrangement 2



Category 3 Seal Types

1648-3 Type A, Arrangement 1

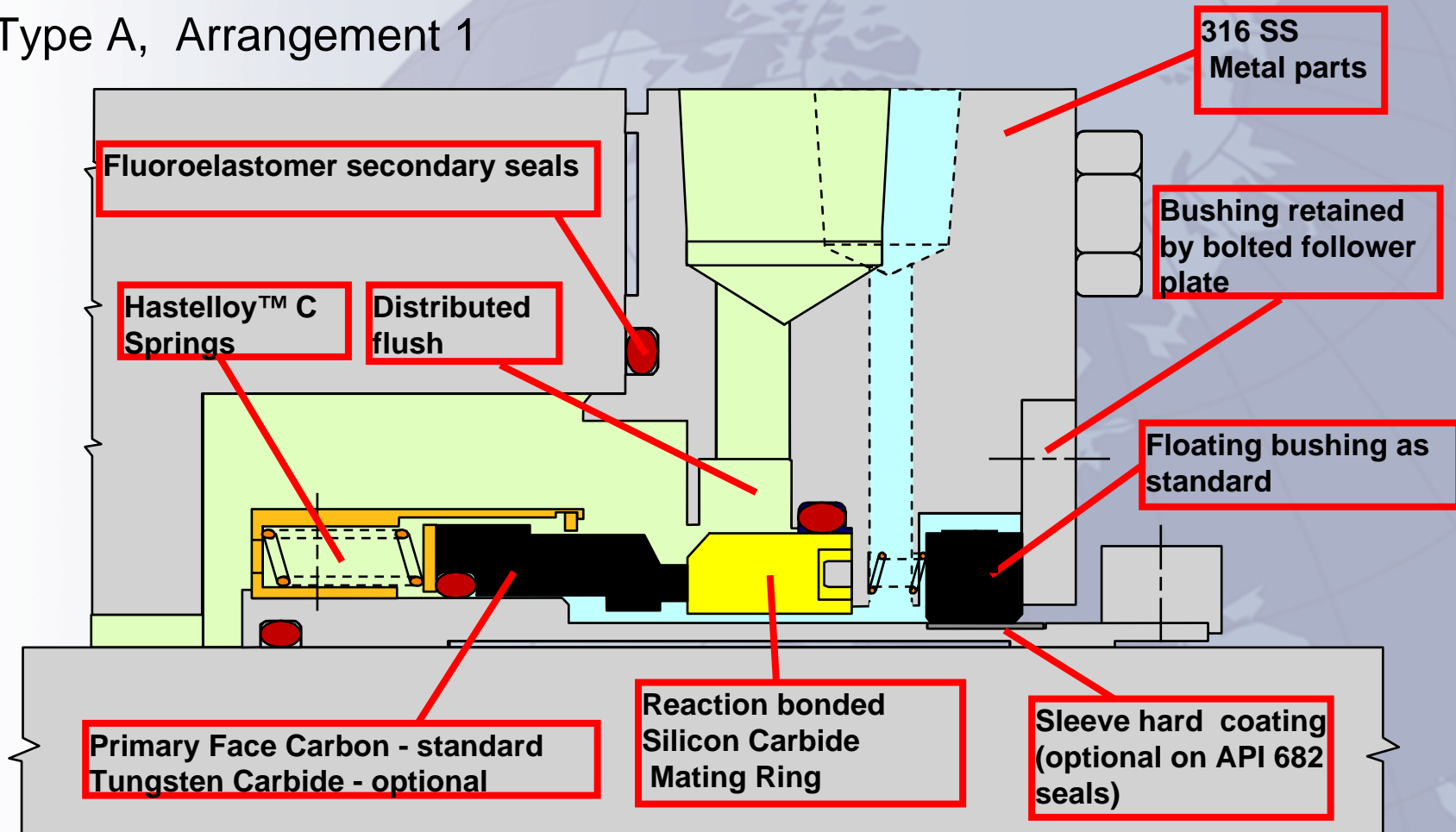


Provided with appropriate documentation in accordance with the API 682 Specification

Category 3 Seal Types

1648-3

Type A, Arrangement 1



Features

Seal Flush



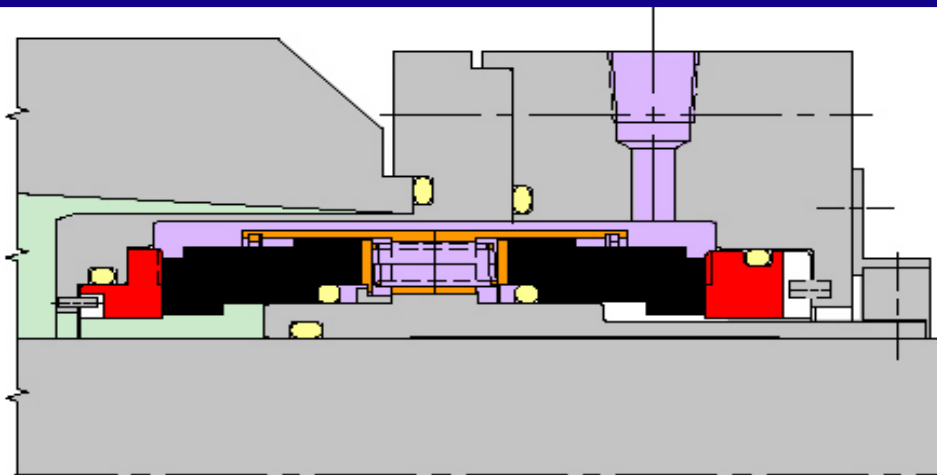
Distributed Flushing



Test shows even flush around the mating ring directed towards the seal interface

Category 1, 2, & 3 Non-contacting Gas-lubricated Seals

2800 Type A, Arrangement 3



**Dual mating ring design meets
API 682 design specifications**

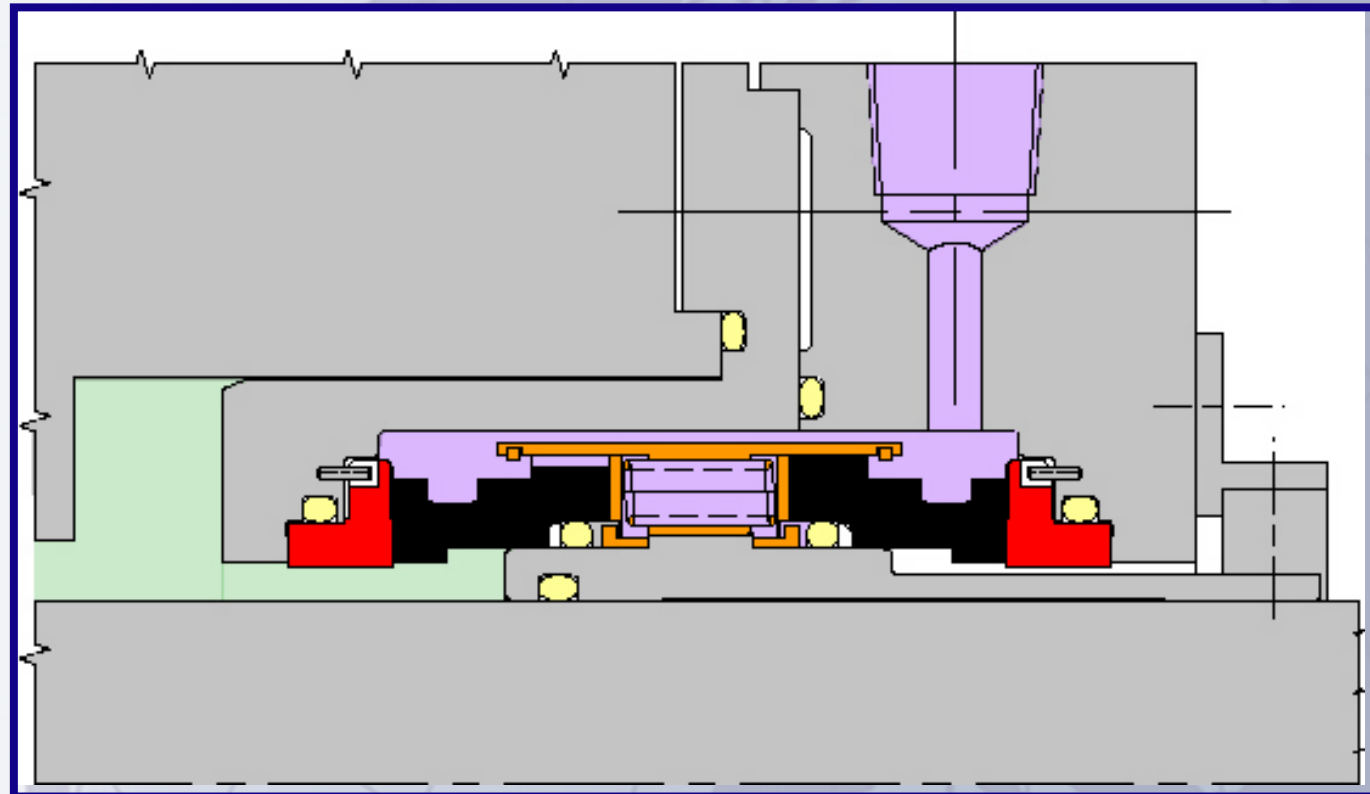


**Patented
spiral groove**

0 to 300 psig / 21 bar g

Category 1, 2, & 3 Non-contacting Gas-lubricated Seals

2800HP Type A, Arrangement 3



Dual mating ring design conforms to API 682 design requirements

300 psig / 21 bar g to 600 psig / 41 bar g

con

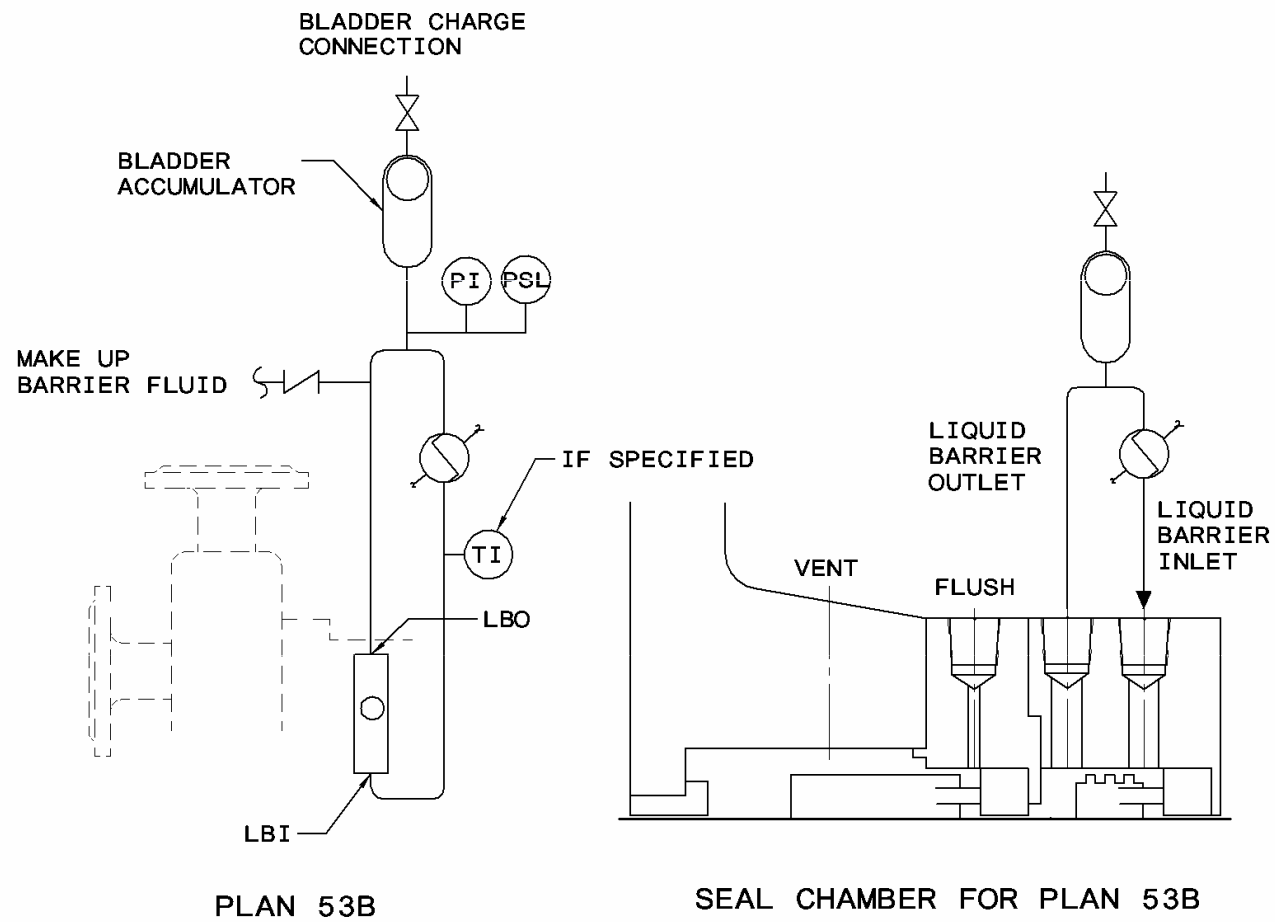


API 682 2nd Edition / ISO21049 Piping Plans

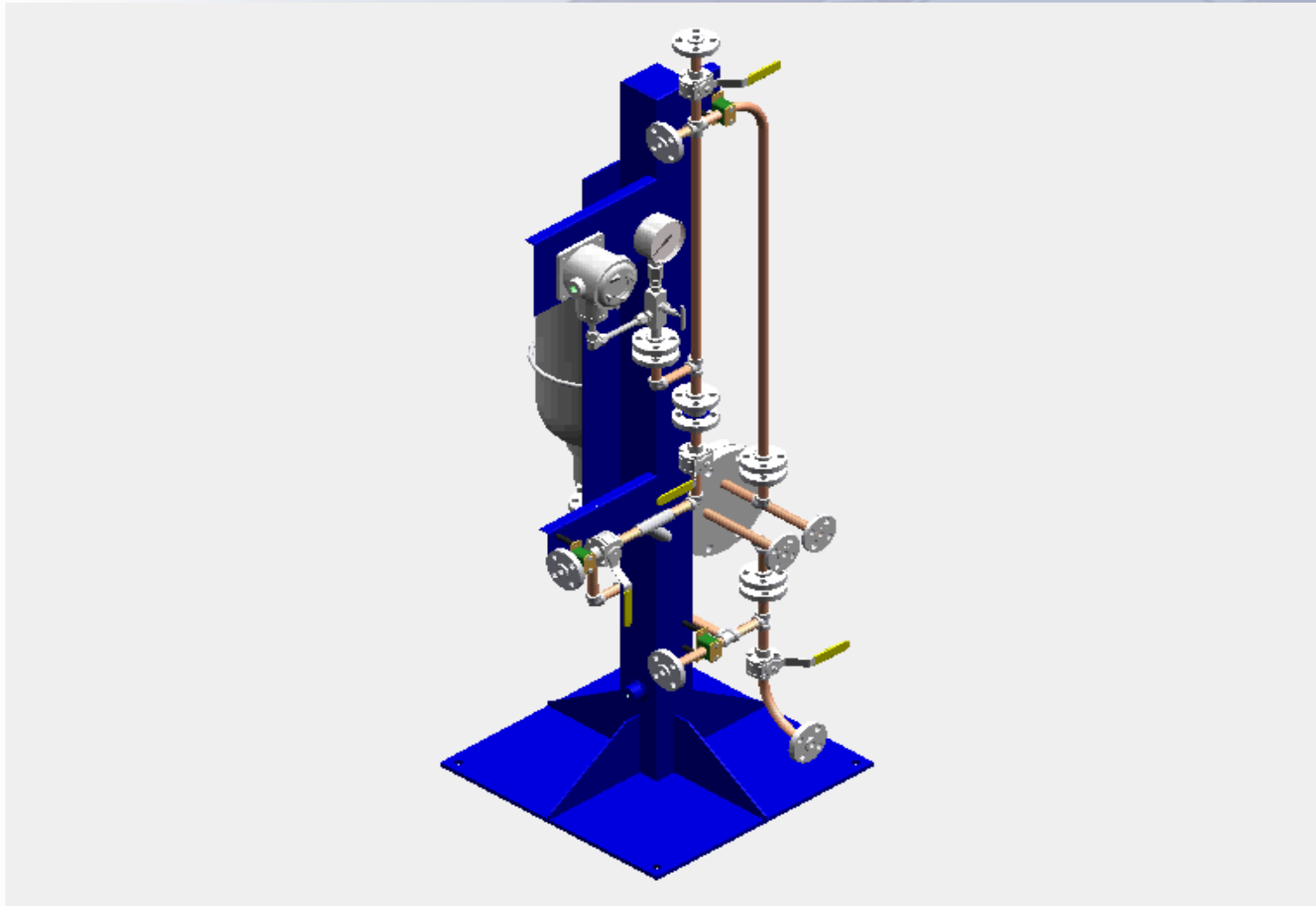
New Piping Plans

- Plan 53's - Arrangement 3, Contacting Wet (CW) Seals
 - 53a – traditional configuration
 - 53b – bladder accumulator
 - 53c – piston pot/ accumulator
- Plan 65 – Arrangement 1 (CW)
- Plan 72 – Arrangement 2 w/ Containment Seal (CS)
- Plan 74 – Arrangement 3, Non-Contacting (NC) Seals
- Plan 75 – Arrangement 2 w/ Containment Seal (CS)
- Plan 76 – Arrangement 2 w/ Containment Seal (CS)

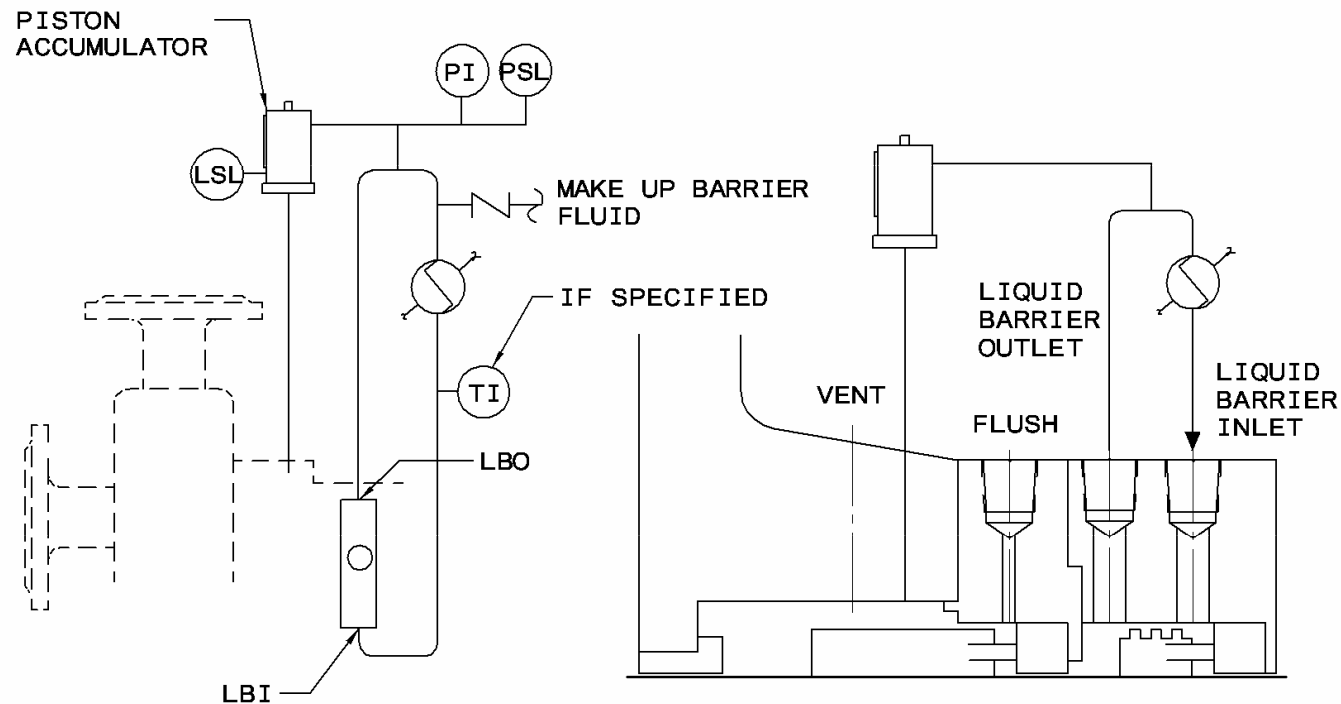
Plan 53b (A.4.12)



Plan 53B



Plan 53c (A.4.12)



PLAN 53C

SEAL CHAMBER FOR PLAN 53C

Plan 53c (A.4.12)

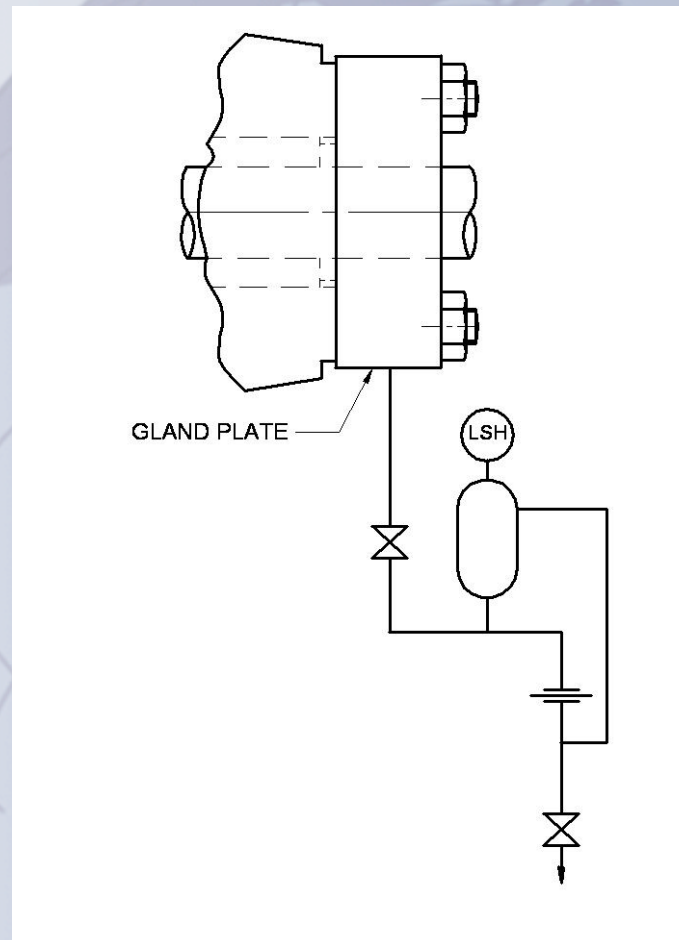


- Piston pot eliminates nitrogen contact with barrier liquid
- Allows for higher pressure applications
- Piston provides constant pressure ratio to seals (1.1:1)
- Configuration includes:
 - Piston pot
 - Pressure indicator
 - Pressure switch
 - Heat exchanger
 - Level switch

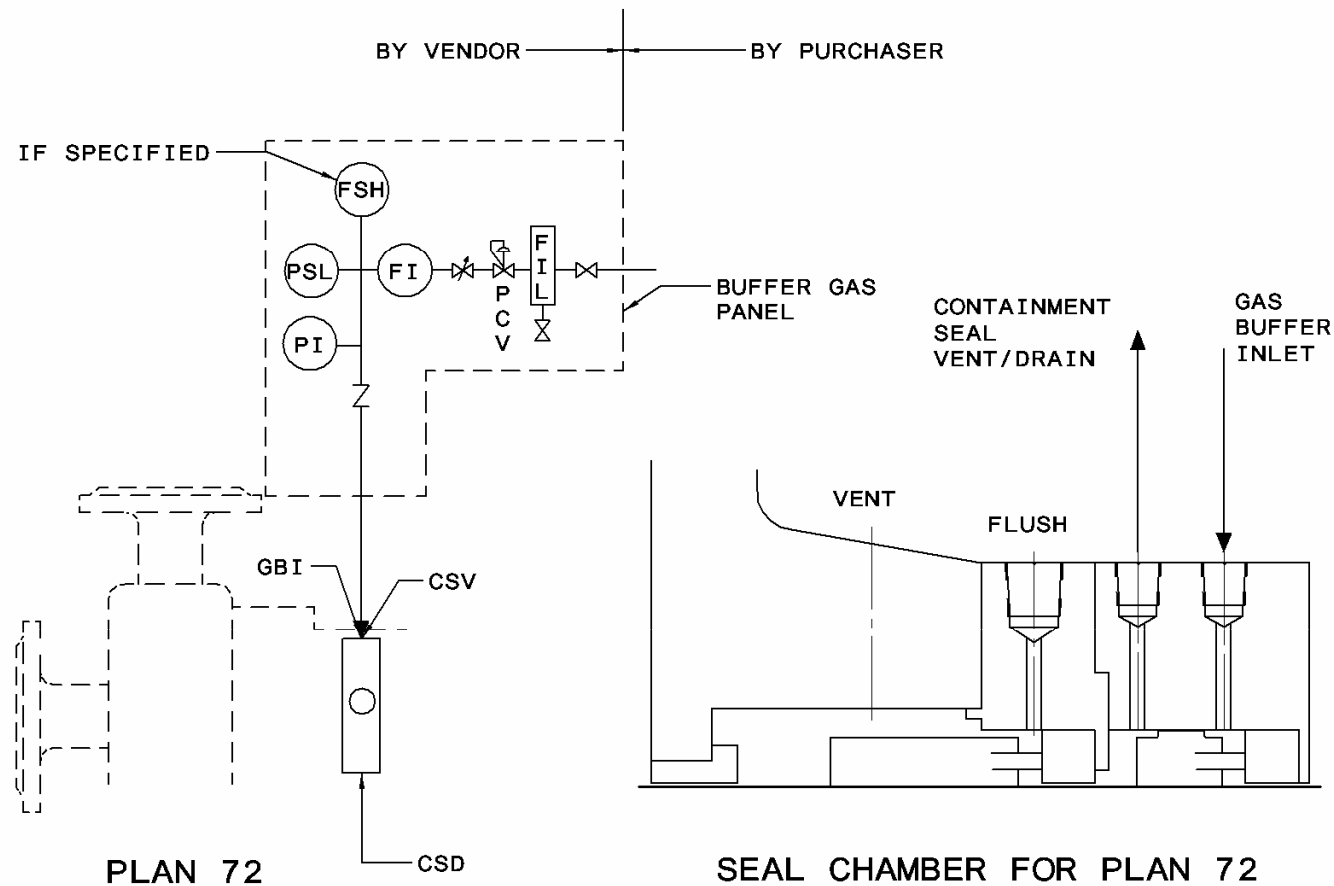
Plan 65

- Plan 65 is new for ISO edition
- Designed for single seal leakage management

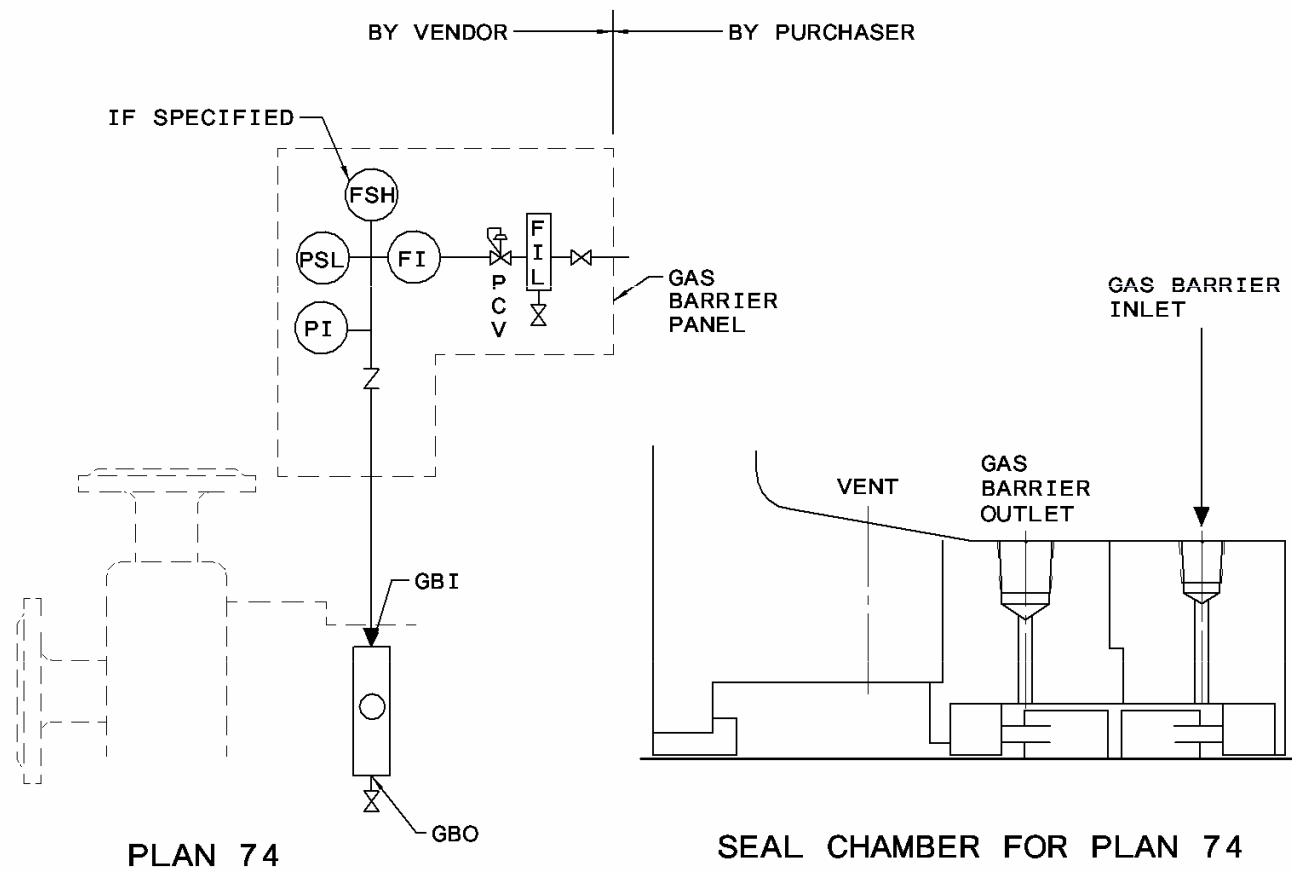
Plan 65



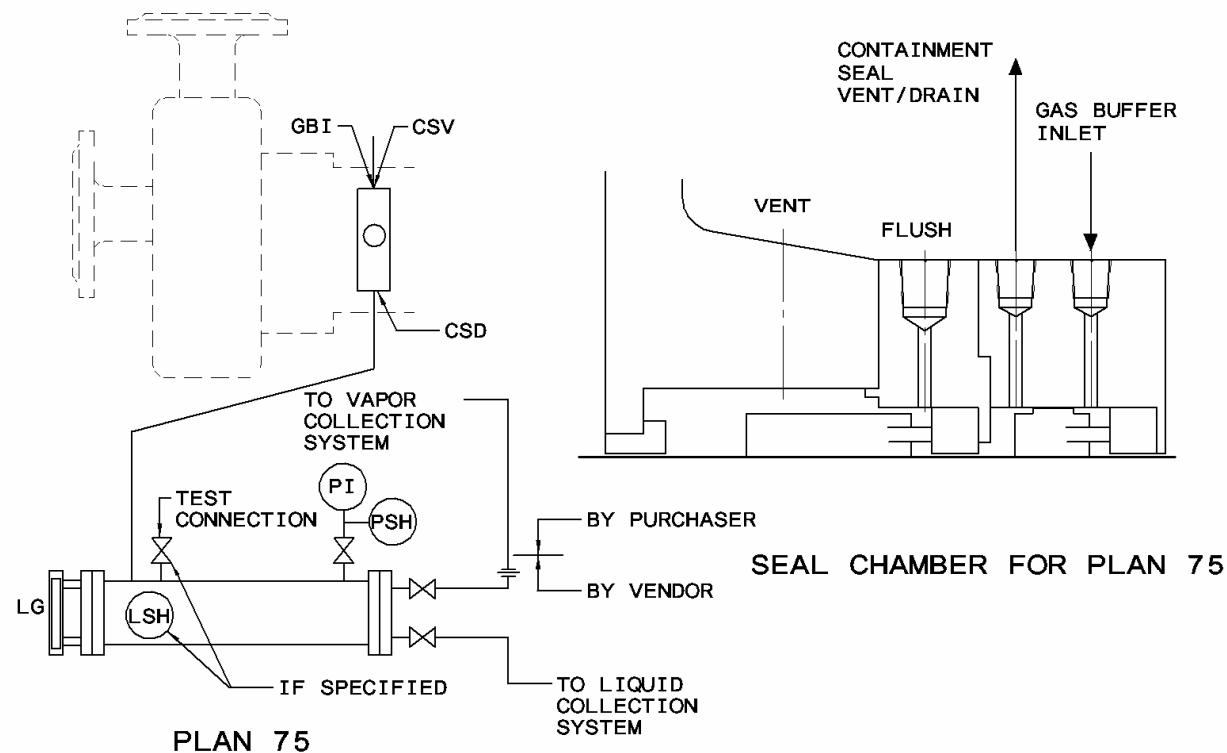
Plan 72 (A.4.16)



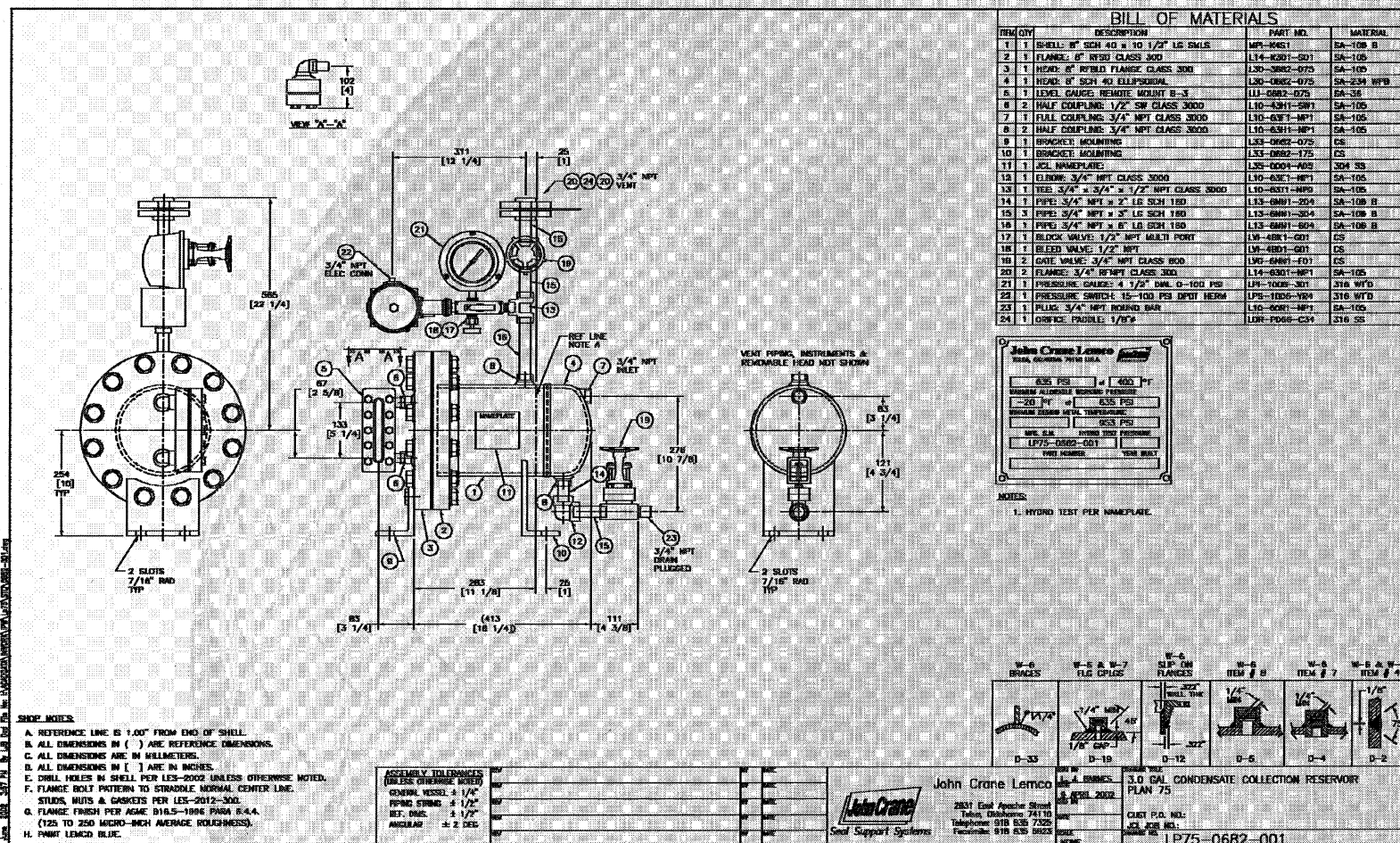
Plan 74 (A.4.17)



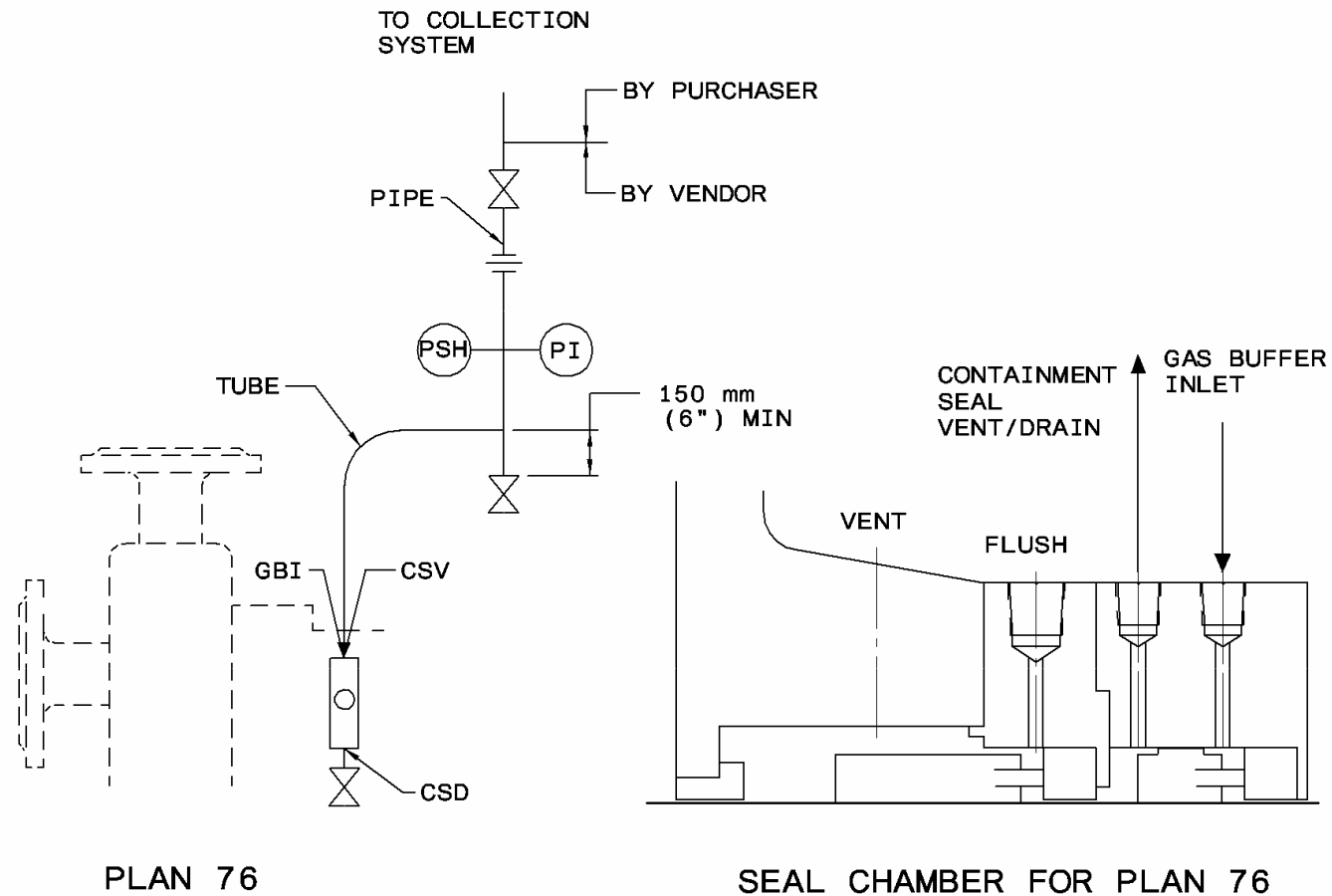
Plan 75 (A.4.18)



Plan 75 (A.4.18)



Plan 76 (A.4.19)





API 682, 3rd Edition ISO21049

Seal Codes

Annex J: API 610 Codes

BTTFN

B : Balanced Seal

T : Tandem Seals

T : Throttle Bushing

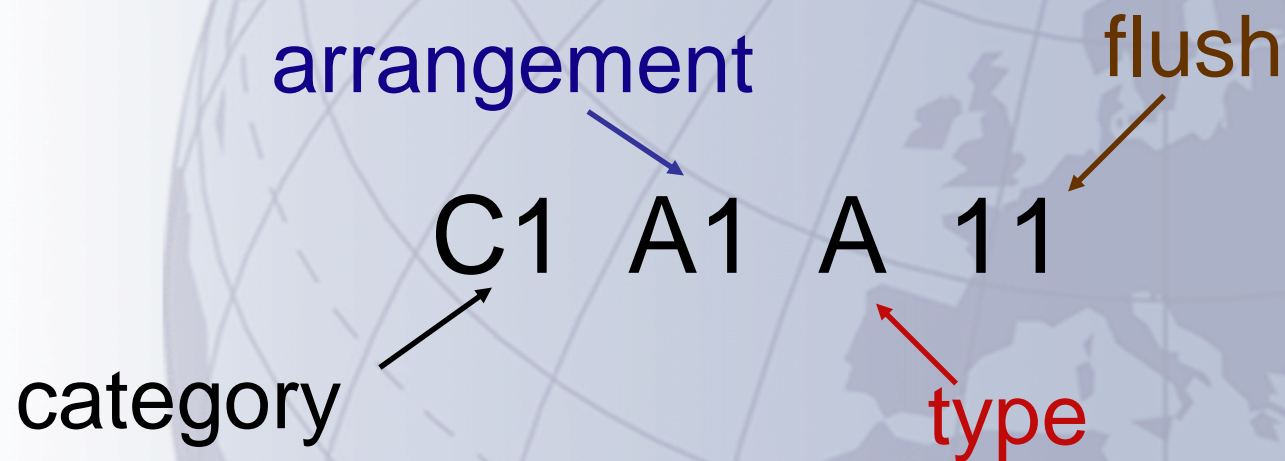
F : Viton vs Viton

N : Carbon vs Silicone Carbide

Annex J: Codes



- Informative
- Four segment code
- Different from 1st Edition
- Different from API 610



Annex J: Codes

Annex J (Seal Codes)

- New coding structure
 - First letter = Category
 - second letter = Arrangement
 - Third letter = Seal Type
 - Fourth letter(s) = Flush arrangement

- Example is C3A2C1152 is Category 3 Type C seal in an arrangement 2 using Plans 11 and 52

Gland Plate Connections for Single Seals



Table 1

Symbol	Connection	Location	Size *
F	Flush	0	1/2
D	Drain	180	3/8
Q	Quench	90	3/8
FI	Flush In (Plan 23 only)	180	1/2
FO	Flush Out (Plan 23 only)	0	1/2

* All sizes are NPT taper thread connections

Location:

Horizontal Pumps: 0 degrees = Top Dead Centre

Vertical Pumps: "F" defines 0 degrees

Gland Plate Connections for Dual Seals

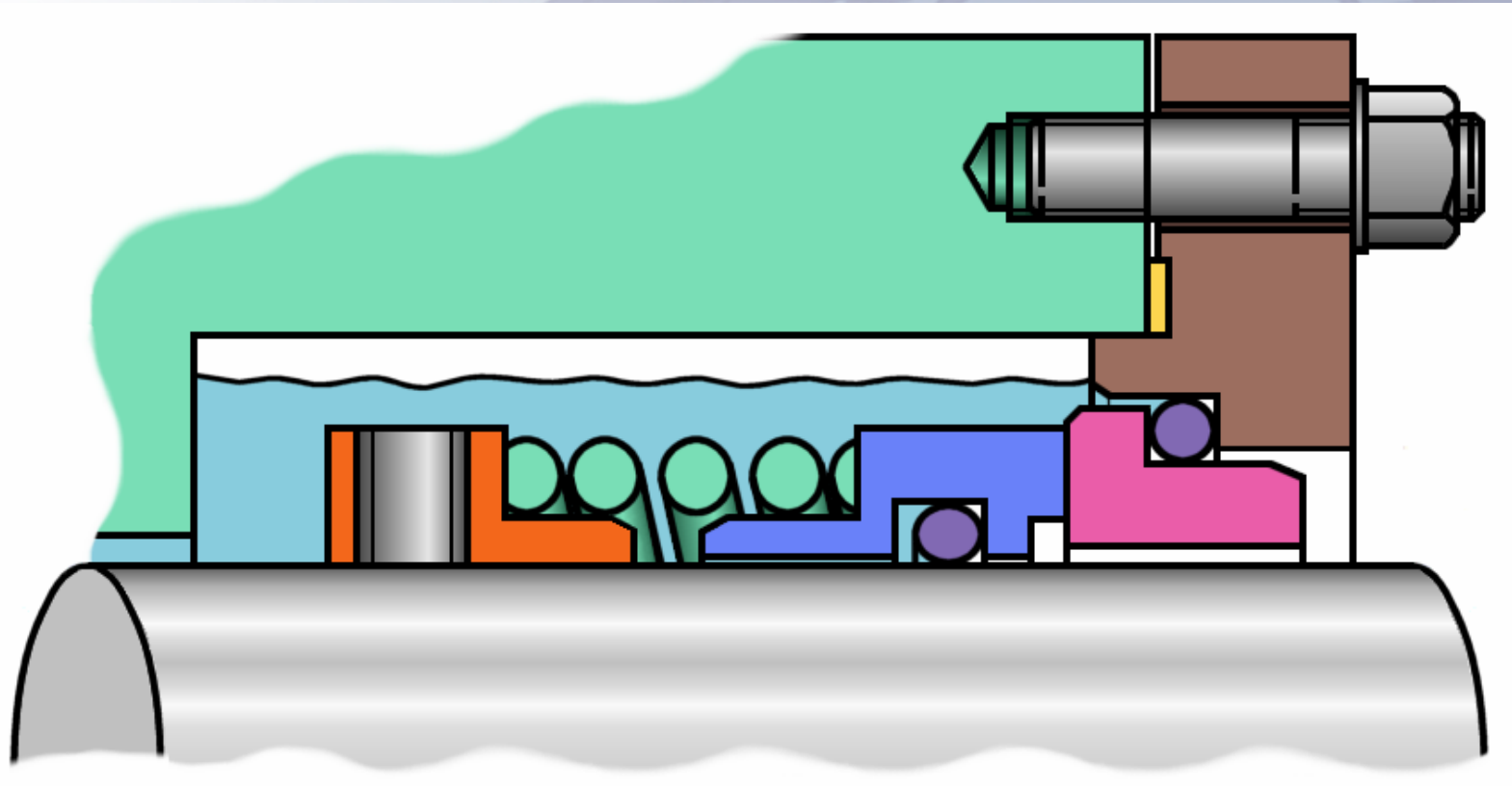


Table 1

Symbol	Connection	Location	Size
LBI	Liquid Buffer/Barrier In	180	1/2
LBO	Liquid Buffer/Barrier Out	0	1/2
CSV	Containment Seal Vent	0	1/2
CSD	Containment Seal Drain	180	1/2
GBI	Gas Barrier In	0	1/4
GBO	Gas Barrier Out	180	1/2

* All sizes are NPT taper thread connections

What happen?



Demonstration

API 682 Summary

- **Only three arrangements**
 - single
 - dual unpressurised
 - dual pressurised
- **Testing on five fluid groups,**
 - Propane, water, caustic, cold oil, hot oil
- **Specifies materials of construction**
- **Secondary containment on all single seals**
- **Forced circulation on dual seals**
- **Full interchangeability**



**Thank you
for
Your Attention**