

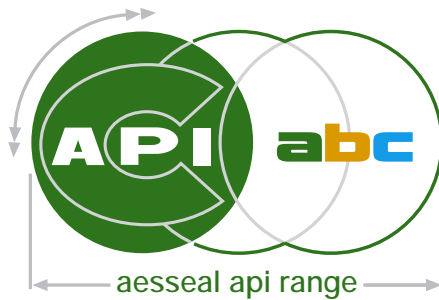
PART OF A FAMILY OF
PRODUCTS AWARDED
THE QUEENS AWARD
FOR ENTERPRISE:
INNOVATION 2004



ENVIRONMENTAL TECHNOLOGY

CAPI™ 610 & 682 Dual Seals

API 610 Version 9 & API 682 Certified
Cartridge Mechanical Seal Range



- PATENTED DESIGN FEATURES
- ROTARY AND STATIONARY
PUSHER SEAL DESIGNS
- ROTARY AND STATIONARY
BELLOWS SEAL DESIGNS
- FACE TO BACK, BACK TO BACK
AND FACE TO FACE SEAL TYPES
AVAILABLE
- MODULAR DESIGN
- HYDRAULICALLY BALANCED
SEAL FACES

Company Overview

Growing environmental awareness, changing consumer behaviour and more aggressive competition mean that both new and traditional markets are demanding ideas, innovative products and above all service.

This API mechanical seal and systems development is the result of a global strategy to expand the AESSEAL® product range which will allow further penetration into new markets and offer a more complete service to existing customers.

At the core of this strategy is the improvement of existing products and design excellence which has helped us achieve superior product performance.



AESSEAL plc, Mill Close, UK.



AESSEAL Inc. Knoxville USA.



AESSEAL Pty Ltd. South Africa



AESSEAL China Ltd.

AESSEAL® has 56 branches worldwide including headquarters in Europe, North America, South Africa and the Far East.



Worldwide Representation

Growth in excess of 25% per annum has allowed AESSEAL® to become the only major new international entrant to the mechanical seals industry in the last twenty years.

AESSEAL® now have a direct presence in every major market, with over 56 branches and more than 150 distributors selling to 83 different countries worldwide.

API Industry Introduction

The American Petroleum Institute is the primary trade association representing the oil and natural gas industry in the United States.

The latest API specifications set strict standards for the design and supply of mechanical seals. This rotating equipment standard is adopted by most refinery, petrochemical and offshore platforms around the world.

AESSEAL® made a strategic decision to enter this market in 1999. For further information on the full AESSEAL® API product range see "A Guide to API Seal and System Design" reference L-UK/US-APISEALS.



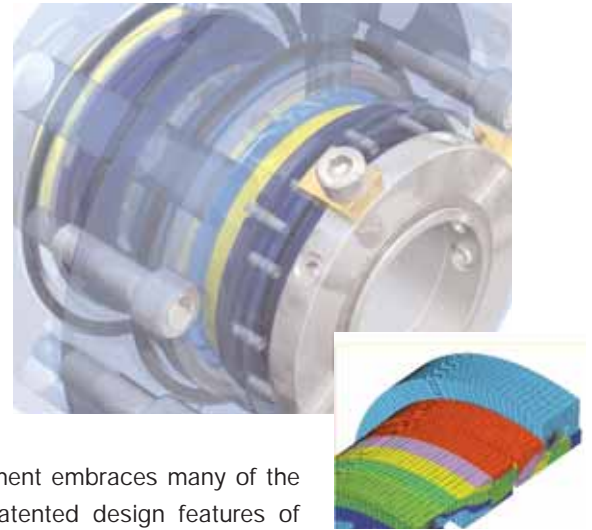
API 682 & 610 Version 8 Seal Development

Design

After spending over two million pounds (\$3M, €3.6M) in product development and inventory, 2002 saw the official launch of the AESSEAL® API cartridge mechanical seal range. The AESSEAL® patented Cartridge (CAPI™) range is designed to cover API 682 and 610 version 9 applications. Designed totally in house, with the latest computer aided design and engineering practices, usual product development times were significantly reduced. The range of seals was created with the aid of Finite Element Analysis (FEA) which helped to predict how the seal would perform under various conditions. Creating most of the product development electronically, instead of physically, reduced the time taken to finalise the design. It also meant fewer costly physical prototypes were needed which also saved time and money.



Computer controlled unmanned API 682 test facilities at AESSEAL plc UK Headquarters.



The API development embraces many of the innovative and patented design features of existing, service proven, AESSEAL® products.

Testing

Computer simulation is very effective in testing performance but all AESSEAL® mechanical seals still have to undergo thorough physical testing in a range of arduous environments. Testing to API 682 standards also ensures seals are qualified to run in some of the most arduous API applications. Tests were conducted on two test rigs which are capable of testing to API 682 requirements. The first rig (API 1) is capable of testing seals in hot water up to 200°C (392°F) and the second (API 2) tests seals in hot oil up to 260°C (500°F).

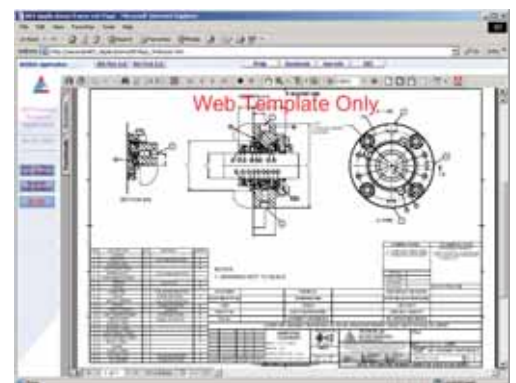
CAPI™ 682 Seals on www.aesseal.com - selecting your seal on the internet

The AESSEAL® CAPI™ 610 & 682 range of mechanical seals can be selected on line at the AESSEAL® website. There are two different methods of doing this as follows:

1. Selection by Seal Type: This section will lead the user to select an API type and available AESSEAL® API seals. This is useful if the user knows what API seal they want to use for their application / or they want to replace a currently used AESSEAL® API seal for their application.

2. Selection by API Type: This section is generated to allow the user to follow API's standard procedures to select an appropriate seal and sealing system for their application. It is recommended to use this section if you do not know what standard API seals and plans are suitable for your application.

Both methods allow the user to select the exact specification of the seal and then create a new general assembly drawing of it. For more information visit www.aesseal.com and click on the Applications link on the top bar. Once inside the applications section of the website follow the instructions.



Above: API mechanical seal selection from the AESSEAL website allows the user to generate a General Assembly drawing by inputting different variables.

Modularity - better by design



Modularity

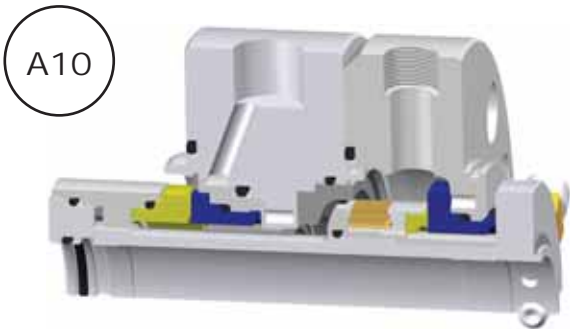
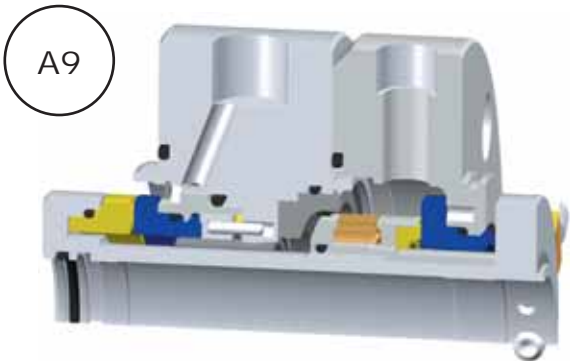
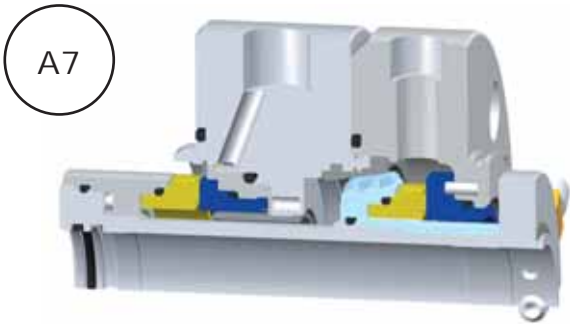
The API 682 specification details many possible seal *Arrangements*, *Types* and *Configurations* for dual seals.

Permissible dual seal *Types* include; Face to Back (FB), Back to Back (BB) and Face to Face (FF) designs.

In addition, the specification outlines two permissible dual seal *Arrangements*, 2 and 3. Essentially, these are low buffer and high barrier pressure designs.

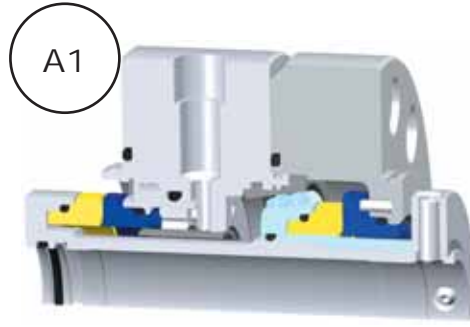
Lastly, the designs above may be *Configured* in multiple combinations of "Wet", "Containment" and "Non-contacting" seal face technology.

While certain seal types and configurations are necessary for certain applications, AESSEAL® have rationalized their seal arrangements 2 and 3 into one generic "pressure balanced" seal design. This is their preferred solution.



Seal Face Drive

The AESSEAL® CAPI™ 610 & 682 range of mechanical seals include a patented seal face drive design. This reduces the possibility of seal face cracking in arduous conditions.



API Plan 54 Option

All designs have an API Plan 54 option by removing the angled deflector.

Type A Dual Seals

With the innovative and modular design concept, the range of CAPI™ 610 & 682 Type A pusher dual seals satisfy all seal types defined by API 682. This enables the user to configure, relatively standard, seal designs to suit their application.

The A1 dual design is offered as Face to Back (FB) Tandem with pressure balanced seal faces and a patented, highly efficient, bi-directional pumping scroll complete with angled deflector.

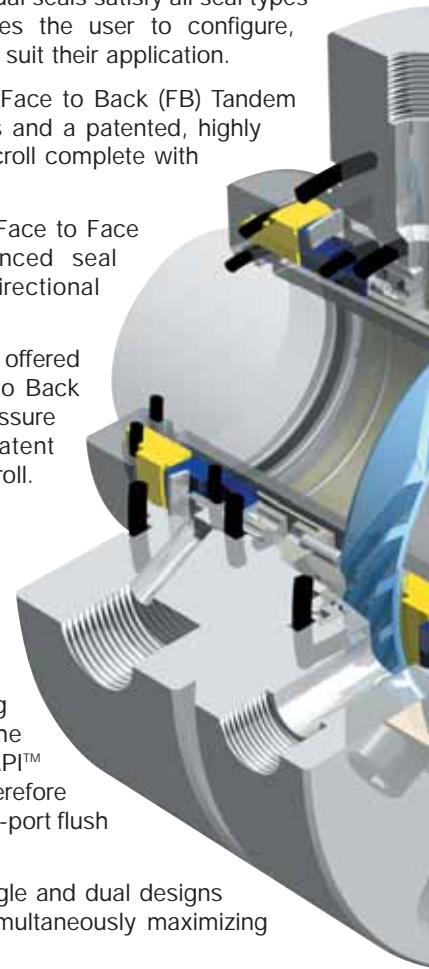
The A7 dual design is offered as Face to Face (FF), again with pressure balanced seal faces and a patented bi-directional pumping scroll.

The A9 and A10 dual designs are offered as Back to Back (BB) and Face to Back (FB) respectively, again with pressure balanced seal faces and a patent pending bi-directional pumping scroll.

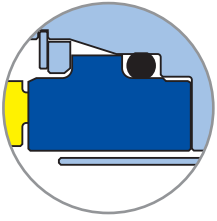
Two Part, Modular, Gland Assembly

All CAPI™ 610 & 682 dual seals are supplied with a patent pending two-part gland assembly. The inboard gland is modular to the CAPI™ 610 & 682 single seal range and therefore is supplied as standard with a multi-port flush option.

The gland modularity between single and dual designs reduces inventory levels whilst simultaneously maximizing customer service levels.



Design Feature	CAPI™ 610 & 682				
	A1	A2	A7	A8	A10
Rotary Seal Inboard			•	•	•
Rotary Seal Outboard					•
Stationary Seal Inboard	•	•			•
Stationary Seal Outboard	•	•	•	•	•
Multi Spring Pusher Seal	•	•	•	•	•
Metal Bellows Seal Inboard					•
Metal Bellows Seal Outboard					•
Directed Barrier Fluid Flow	•	•	•	•	•
Plan 53 Pumping Ring & Angled Deflector	•		•		•
Pressure Balanced Stationary Seat	•	•	•	•	•
* Inboard Restrained Stat. Seat Option			•	•	
Multi Port Flush Available	•	•	•	•	•
API 682 Spec. Designation	3CW-FB	3CW-FB	3CW-FF	3CW-FF	2CW



Restrained Stationary

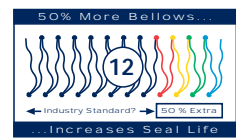
All rotary, arrangement 2 designs have the option of a restrained inboard stationary.

Mechanically Restrained Stationary Seat

High-pressure barrier fluid applications often place tremendous forces on seal faces, particularly if one or more seal faces are not pressure balanced.

Such forces can distort seal faces, leading to premature seal leakage.

The preferred AESSEAL® CAPI™ 610 & 682 dual seal arrangements have pressure balanced seal faces. These are suitable for both arrangement 2 and 3 applications. Restrained stationary seats for certain arrangement 2 designs are available to order only.



Bellows Design

12 Bellows Convolution - Many (not all) mechanical seal suppliers produce edge welded metal bellows with an 8 convolute stack. AESSEAL® produces a 12 convolute bellows as standard. With more convolutions the less stress there is on each convolute in the bellows stack. **Maximum convolutions means maximum seal life.**

The AESSEAL® CAPI™ 610 & 682 range of seals utilize the proven standard technology of the modular AESSEAL® bellows seal range. Note: Alloy 718 bellows are made to order only.

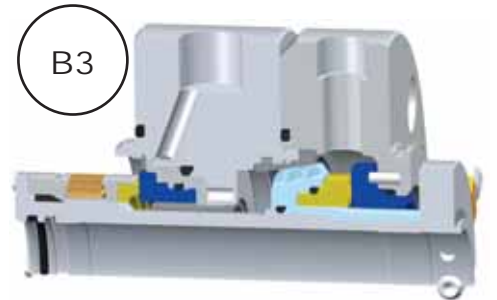
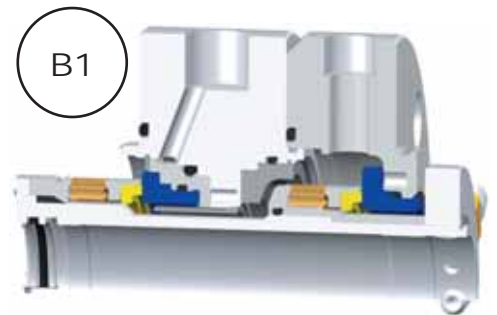
Type B Dual Seals

In accordance with the API 682 specification, the AESSEAL® CAPI™ Type B dual seal range is offered as a Rotating metal bellows design.

The B1 dual design is offered as Face to Back (FB) Tandem with pressure balanced seal faces and a patent pending, highly efficient bi-directional pumping scroll complete with angled deflector.

The B3 dual design is offered as Face to Face (FF), again with pressure balanced seal faces and a patented bi-directional pumping scroll.

Just like the single seal range, the Type B dual seal range is available with a bolt-on Plan 23 arrangement. When used with an AESSEAL® gland adapter, the Plan 23 adaptation can be used to effectively reduce the process temperature at the seal faces.



Directed Barrier Fluid Flow

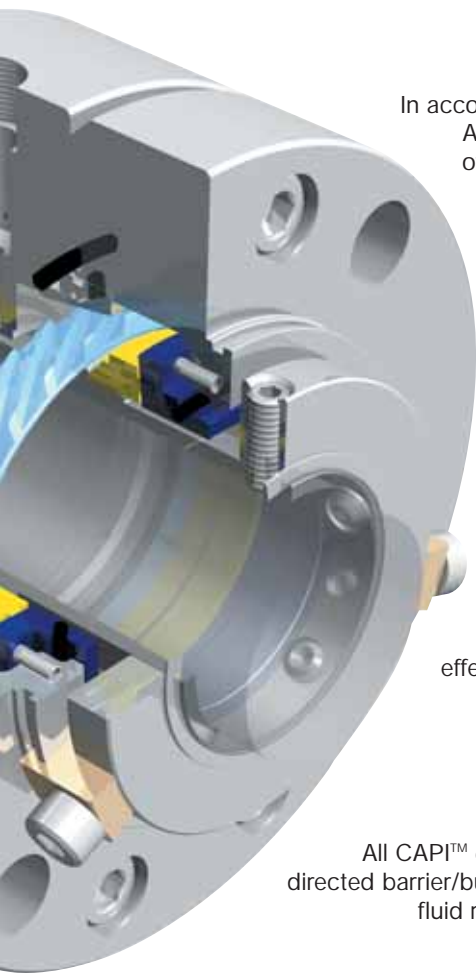
All CAPI™ 610 & 682 dual seals have a deflector and directed barrier/buffer fluid flow path. This ensures effective fluid replacement at both inboard and outboard seal faces.

AESSEAL® recognize the fact that many users in API associated industries, operate a wide variety of rotating equipment configurations. Such equipment has probably been commissioned over the last few decades, by a range of original equipment manufacturers.

Even with an exacting API 682 mechanical seal specification, customer on-site preference, physical equipment restrictions and even plant worldwide location, dictates what type of mechanical seal configuration is installed.

The AESSEAL® API Type A, B and C dual seal range offer the user an unprecedented range of API engineered sealing solutions to suit ALL application requirements.

The modular design allows the user to select the right solution for their application, without being unduly penalized with either extortionate seal prices or long delivery times.



API 682 Dual Seal Type							
9	A10	B1	B2	B3	B4	C3**	C5**

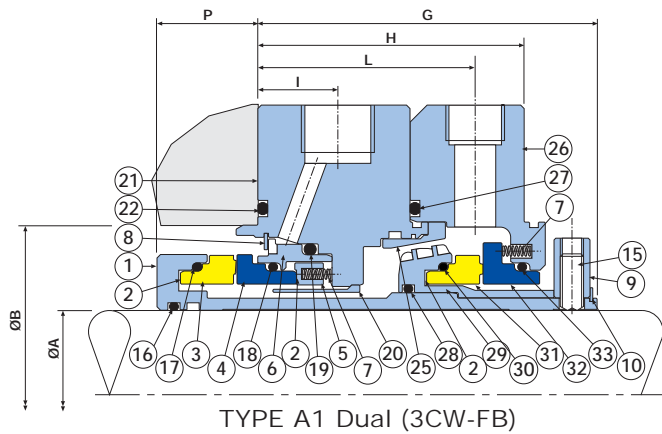
			

-CS	2CW-CS	2CW-CS	2CW-CS	2CW-CW	2CW-CW	2CW-CS	2CW-CW

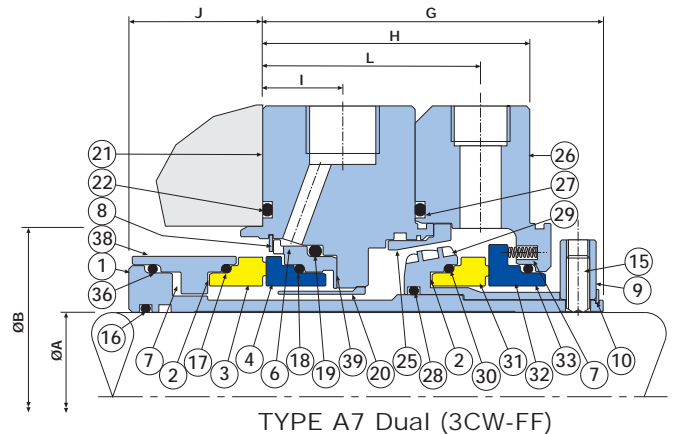
*Inboard Restrained Stationary Seat Option is made to order only (8-10 week lead time).

**Type C Dual seals are Engineered designs, made to order only (8-10 week lead time).

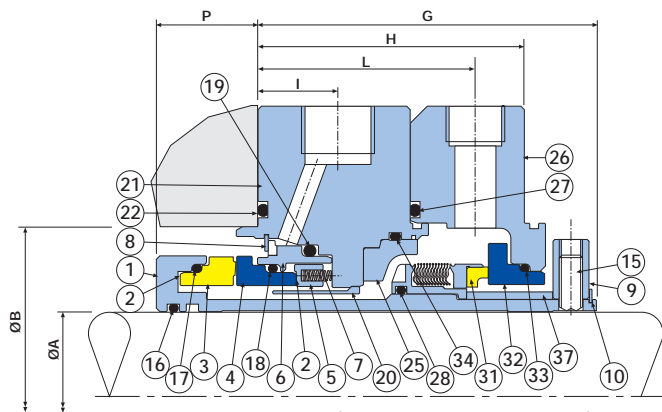
Modular, Configurable Engineered Solutions



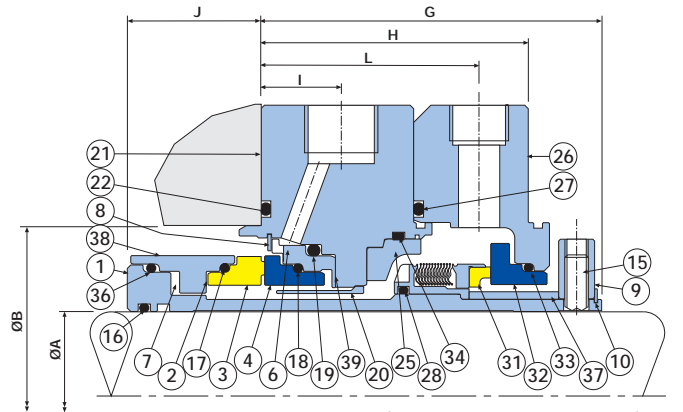
TYPE A1 Dual (3CW-FB)



TYPE A7 Dual (3CW-FF)

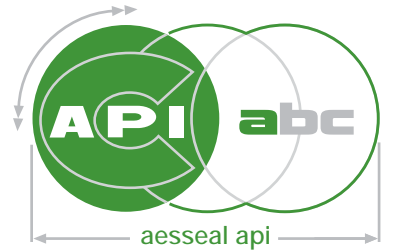
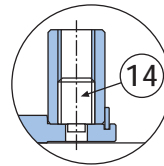
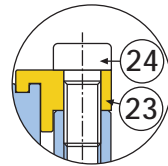


*TYPE A9 Dual (2CW-CW & 2CW-CS)



*TYPE A10 Dual (2CW-CW & 2CW-CS)

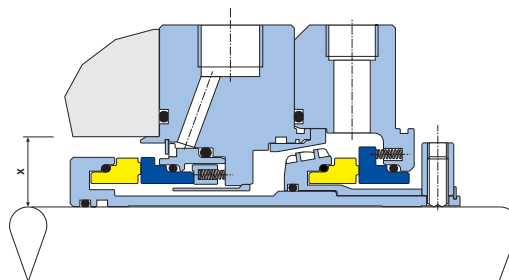
* A9 and A10 Dual Seals can be used in Arrangement 3 applications when process pressures 16barg (230psig).



AVAILABLE BELLOWS METALLURGIES	
SHS	Stainless / Alloy 276 / Stainless
HHH	Alloy 276 / 276 / 276
SAC	Stainless / AM350 / Alloy 42
S7C	Stainless / Alloy 718 / Alloy 42
* Alloy 718 Metal Bellows are made to order only.	

ITEM	DESCRIPTION	MATERIAL
1	Sleeve	316L Stainless Steel
2	Drive Pin	316 Stainless Steel
3	Rotary Face	Ant. Carbon - RB SIC
4	Stationary Face	SIC
5	Spring Plate	316L Stainless Steel
6	Stat Holder/Flow Ring	316L Stainless Steel
7	Springs	Alloy 276
8	Circlip	Stainless Steel
9	Clamp Ring	316L Stainless Steel
10	Circlip	Stainless Steel
13	Gland Bolts	Stainless Steel
14	Anti Tamper Screw	Stainless Steel
15	Drive Screw	Nickel Plated Carbon Steel
16	Sleeve O Ring	Viton® - EPR - Kalrez® - Aflas®
17	Rotary O Ring	Viton® - EPR - Kalrez® - Aflas®
18	Stationary O Ring	Viton® - EPR - Kalrez® - Aflas®
19	Stat Holder O Ring	Viton® - EPR - Kalrez® - Aflas®
20	Deflector	316L Stainless Steel
21	Gland	316L Stainless Steel
22	Gland O Ring	Viton® - EPR - Kalrez® - Aflas®
23	Setting Clip	Phosphor Bronze
24	Clip Screw	Stainless Steel
25	Angled Deflector	316L Stainless Steel
26	Outer Gland	316L Stainless Steel
27	Outer Gland O Ring	Viton® - EPR - Kalrez® - Aflas®
28	Rotary Holder O Ring	Viton® - EPR - Kalrez® - Aflas®
29	Rotary Holder	316L Stainless Steel
30	Rotary O Ring	Viton® - EPR - Kalrez® - Aflas®
31	Rotary Face	Carbon - RB SIC - SHS/HHH/SAC/S7C - see table
32	Stationary Face	Sintered Sic
33	Stationary O Ring	Viton® - EPR - Kalrez® - Aflas®
34	Deflector O Ring	Viton® - EPR - Kalrez® - Aflas®
36	Rotary Holder O Ring	Viton® - EPR - Kalrez® - Aflas®
37	Drive Tube	Stainless Steel
38	Rotary Holder	316L Stainless Steel
39	Drive Pin	316L Stainless Steel

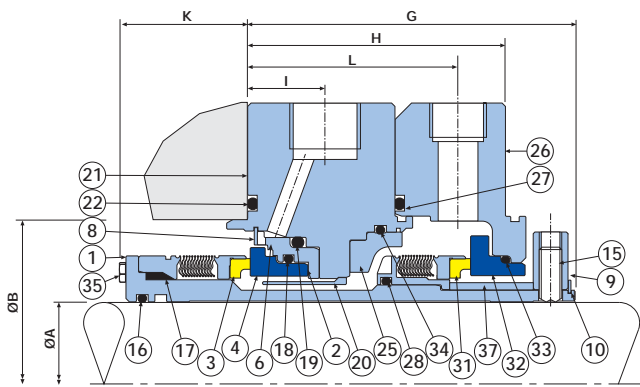
API 610 Version 7 Modularity



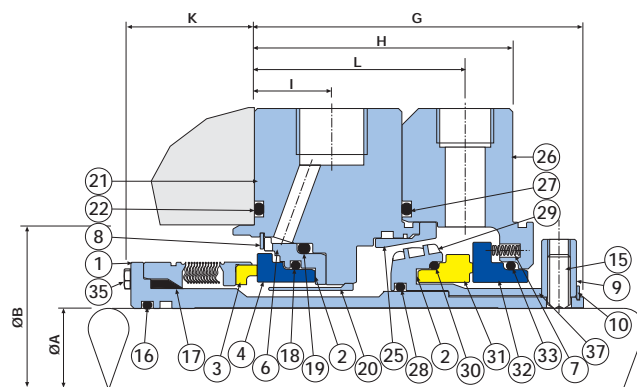
Seal Size	x (minimum)
<2.250" (57mm)	= 0.875" (22mm)
>2.250" - 3.250" (57-82mm)	= 1.000" (25.4mm)
>3.250" (82mm)	= 1.125" (28.5mm)

The highly modular AESSEAL® CAPI™ 682 seal range is also modular to API 610 Version 7 specification. API 610 v7 pumps have a smaller radial cross section to that of API 610 v9 and API 682.

The table below is a GUIDE ONLY and illustrates the minimum radial cross section for API 610 v7 pumps.



*TYPE B1 Dual (2CW-CW & 2CW-CS)



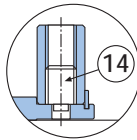
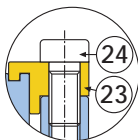
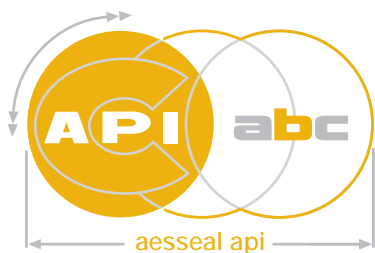
TYPE B3 Dual (3CW-FF)

*B1 Dual Seals can be used in Arrangement 3 applications when process pressures are less than or equal to 16barg (230psig).

AVAILABLE BELLOWS METALLURGIES

SHS	Stainless / Alloy 276 / Stainless
HHH	Alloy 276 / 276 / 276
SAC	Stainless / AM350 / Alloy 42
S7C	Stainless / Alloy 718 / Alloy 42

* Alloy 718 Metal Bellows are made to order only.

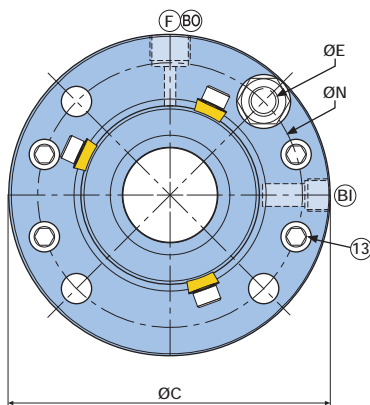


ITEM DESCRIPTION	MATERIAL
1 Sleeve	316L Stainless Steel
2 Drive Pin	316 Stainless Steel
3 Rotary Bellows Unit	Carbon - RB SIC - SHS/HHH/SAC/S7C - see table
4 Stationary Face	SIC
6 Stat Holder	316L Stainless Steel
7 Springs	Alloy 276
8 Circlip	Stainless Steel
9 Clamp Ring	316L Stainless Steel
10 Circlip	Stainless Steel
13 Gland Bolts	Stainless Steel
14 Anti Tamper Screw	Stainless Steel
15 Drive Screw	Nickel Plated Carbon Steel
16 Sleeve O Ring	Viton® - EPR - Kalrez® - Aflas®
17 Rotary Wedge	Graphite
18 Stationary O Ring	Viton® - EPR - Kalrez® - Aflas®
19 Stat Holder O Ring	Viton® - EPR - Kalrez® - Aflas®
20 Deflector	316L Stainless Steel
21 Gland	316L Stainless Steel
22 Gland O Ring	Viton® - EPR - Kalrez® - Aflas®
23 Setting Clip	Phosphor Bronze
24 Clip Screw	Stainless Steel
25 Angled Deflector	316L Stainless Steel
26 Outer Gland	316L Stainless Steel
27 Outer Gland O Ring	Viton® - EPR - Kalrez® - Aflas®
28 Rotary Holder O Ring	Viton® - EPR - Kalrez® - Aflas®
29 Rotary Holder	316L Stainless Steel
30 Rotary O Ring	Viton® - EPR - Kalrez® - Aflas®
31 Rotary Face or Rotary Bellows Unit	316LSS - Carbon - RB SIC SHS/HHH/SAC/S7C - see table
32 Stationary Face	SIC
33 Stationary O Ring	Viton® - EPR - Kalrez® - Aflas®
34 Deflector O Ring	Viton® - EPR - Kalrez® - Aflas®
35 Rotary Drive Screws	Stainless Steel
37 Drive Tube	316L Stainless Steel

Further Information

All parts lists show wetted components in 316L stainless steel. Other metallurgies such as DIN 1.4462 and Alloy 255 are available on request.

Specific CAPI™ 682 designs are available to suit certain OEM pieces of rotating equipment. Log on to www.aesseal.com and review the "applications - partners section" to find out more about this developing range.



CAPI™ 682 & 610 v9 Dimensional Information

The API 682 specification indicates full seal dimensional details for metric shaft sizes only. The CAPI™ 610 & 682 metric dimension table below conforms to both API 682 and API 610 v9 specifications in their entirety.

Since the inboard and outboard lengths of the seal are not defined by the API specification, these could change for each manufacturer.

CAPI™ 610 & 682 Metric size chart

Seal Size	ØA	ØB	ØC	(BO)*	ØE	(F)*	G	H	I	J	K	L	ØN	P	(BI)*
20mm	20.0	70.0	130.0	3/8" NPT	M12	1/2" NPT	99.1	77.8	23.4	40.0	35.0	63.5	105.0	30.0	3/8" NPT
30mm	30.0	80.0	140.0	3/8" NPT	M12	1/2" NPT	99.1	77.8	23.4	40.0	40.0	63.5	115.0	30.0	3/8" NPT
40mm	40.0	90.0	150.0	3/8" NPT	M12	1/2" NPT	99.1	77.8	23.4	40.0	40.0	63.5	125.0	30.0	3/8" NPT
50mm	50.0	100.0	170.0	3/8" NPT	M16	1/2" NPT	99.1	77.8	23.4	40.0	40.0	63.5	140.0	30.0	3/8" NPT
60mm	60.0	120.0	190.0	3/8" NPT	M16	1/2" NPT	99.1	77.8	23.4	40.0	47.0	63.5	160.0	30.0	3/8" NPT
70mm	70.0	130.0	200.0	3/8" NPT	M16	1/2" NPT	99.1	77.8	23.4	42.0	49.0	63.5	170.0	30.0	3/8" NPT
80mm	80.0	140.0	210.0	3/8" NPT	M16	1/2" NPT	102.6	77.8	23.4	42.0	49.0	63.5	180.0	30.0	3/8" NPT
90mm	90.0	160.0	240.0	3/8" NPT	M20	1/2" NPT	102.6	77.8	23.4	42.0	49.0	63.5	205.0	30.0	3/8" NPT
100mm	100.0	170.0	250.0	3/8" NPT	M20	1/2" NPT	102.6	77.8	23.4	42.0	49.0	63.5	215.0	30.0	3/8" NPT
110mm	110.0	180.0	260.0	3/8" NPT	M20	1/2" NPT	102.6	77.8	23.4	42.0	49.0	63.5	225.0	30.0	3/8" NPT

*Ports can be designed to customer requirements.

For the above reason, CAPI™ 610 & 682 glands are NOT inventoried as standard. The gland dimensions are shown to provide a guide to the sizes that AES wish to offer. THESE ARE SUBJECT TO CHANGE DEPENDING ON THE OEM EQUIPMENT DIMENSIONS.

Full dimensional information for imperial shaft sizes are not detailed. Contact AESSEAL® Technical Department for all API imperial shaft enquiries.

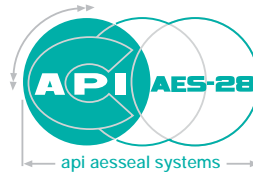
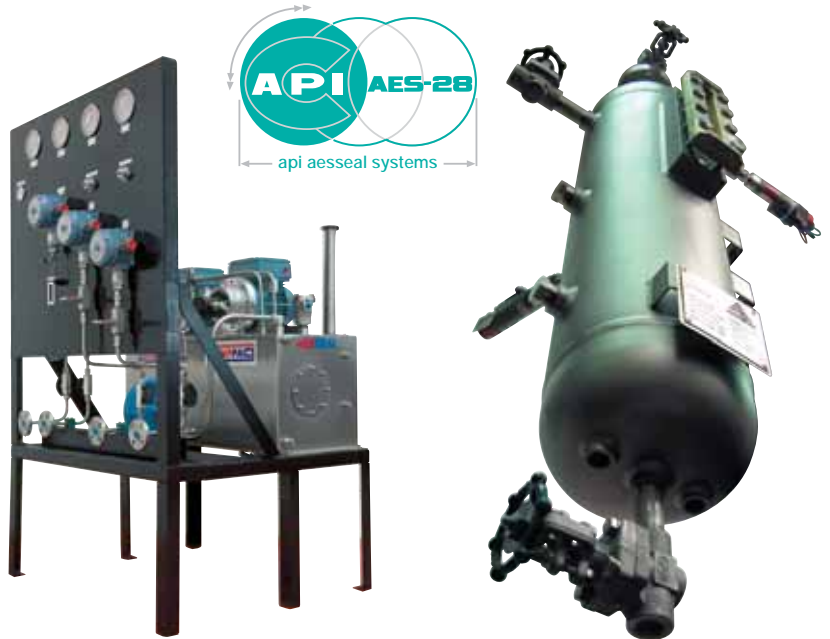
Product availability key

- = Planned inventory items, subject to demand.
- = Typically 2 - 4 week lead time.
- = Made to order only. Lead time 6+ weeks

API Seal Support Systems

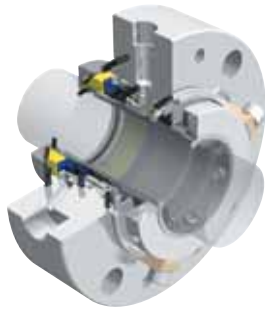
It would be inappropriate to produce an industry leading range of seals only to be let down by the quality of seal support systems. For these reasons, AESSEAL® has designed a range of Lloyds certified, API seal support systems which work in harmony with the CAPI™ 610 & 682 seal range.

They are also based around the modular principle of the AES-15™ and AES-28™ vessels which can be adapted to suit on site specifications using a range of add-on instrumentation packages. For more information on the options available order the API systems brochure. This and other brochures can be ordered from marketing@aes seal.com or downloaded from our website at www.aes seal.com.

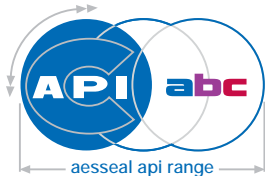


CAPI™ 610 & 682 Single

As well as the CAPI™ 610 & 682 dual range there is also a CAPI™ 610 & 682 single seal range available. Based around the same modular technology the single range consists of many rotary and stationary pusher and bellows designs, with hydraulically balanced seal faces.

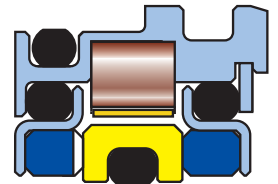


For more information or to download this brochure contact marketing@aes seal.com or visit www.aes seal.com.



API Bearing Protectors

The MagTecta OM™ is designed specifically for oil mist recirculation, the modern API compliant and environmentally friendly option to lubricate bearings.



For more information or to download this brochure contact marketing@aes seal.com or visit www.aes seal.com.



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INVESTOR IN PEOPLE



USE DOUBLE MECHANICAL SEALS WITH HAZARDOUS PRODUCTS. ALWAYS TAKE SAFETY PRECAUTIONS:

- GUARD YOUR EQUIPMENT
- WEAR PROTECTIVE CLOTHING



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