

Foreword

These instructions are provided to familiarize the user with the seal and its designated use. The instructions must be read and applied whenever work is done on the seal, and must be kept available for future reference.

ATTENTION These instructions are for the installation and operation of a single seal running against a seal/mating ring of appropriate material and design as used in rotating equipment. The instructions will help to avoid danger and increase reliability. The information required may change with other types of equipment or installation arrangement, and this manual must be read in conjunction with the instruction manuals supplied with the seal/mating ring, the pump and any ancillary equipment.

If the seal is to be used for an application other than that originally intended or outside the recommended performance limits, contact John Crane before installation.

Any warranty may be affected by improper handling, installation, or use of this seal. Contact John Crane for information as to exclusive product warranty and limitations of liability.

If questions or problems arise, contact your local John Crane Sales/Service Engineer or the original equipment manufacturer, as appropriate.

ATTENTION John Crane mechanical seals and seal/mating rings are precision products and must be handled appropriately. Take particular care to avoid damage to lapped sealing faces and flexible sealing rings. Do not excessively compress the seal before or during installation.

Safety Instructions

1. The following designations are used in this instruction manual to highlight instructions of particular importance.

NOTE Refers to special information on how to install or operate the seal most efficiently.

ATTENTION Refers to special information or instructions directed towards the prevention of damage to the seal or its surroundings.



Refers to mandatory instructions designed to prevent personal injury or extensive damage to the seal or its surroundings.

- Installation and removal of the seal must be carried out only by qualified personnel who have read and understood this instruction manual.
- The seal is designed exclusively for sealing rotating shafts. The manufacturer cannot be held liable for use of the seal for purposes other than this.

- The seal must only be used in technically perfect condition and in conjunction with a suitable seal/mating ring, and must be operated within the recommended performance limits in accordance with its designated use and the instructions set out in the manual.
- If the pumped fluid is hazardous or toxic, appropriate precautions must be taken to ensure that any seal leakage is adequately contained. Further information on sealing hazardous or toxic fluids should be obtained from John Crane prior to seal installation.
- PTFE and fluorocarbon components should never be burned or incinerated as the fumes are highly toxic. If fluorocarbons are accidentally heated above 400°C/750°F they can decompose and protective gloves must be worn when handling as hydrofluoric acid may be present.

Storage and Transport

Instructions for the handling, packaging, storage and transport of seal units and seals/mating rings are given in the John Crane Instruction Sheet ref. 1-Storage-E, available on request

Checking the Equipment

Successful operation and life of this seal is dependent on acceptable equipment dimensions, alignments and finishes. Before installation of the seal the following checks should be made with respect to the seal housing and the shaft, especially (where marked †) at the seal position. The usual equipment to measure these features would include a micrometer and dial indicator.

Shaft/sleeve outside diameter [†]	Refer to Dimensional Data table
Seal chamber bore diameter	Refer to Dimensional Data table
Shaft/sleeve finish [†]	0.2 to 1.2 µm Ra (machined)
Shaft/sleeve ovality/ out-of-roundness	<0.05 mm/0.002 in
Shaft end play/axil float	<0.08 mm/0.003 in F.I.M.
Shaft/sleeve lead-on	Refer to Lead-on Chamfer
Shaft/sleeve run-out [†]	<0.08 mm/0.003 in F.I.M. < 1,800 rpm <0.05 mm/0.002 in F.I.M. > 1,800 rpm
Seal housing end face squareness to shaft/sleeve	Refer to Housing Squareness to Shaft graph
Concentricity of the seal chamber bore to the shaft/sleeve	<0.15 mm/0.006 in F.I.M.

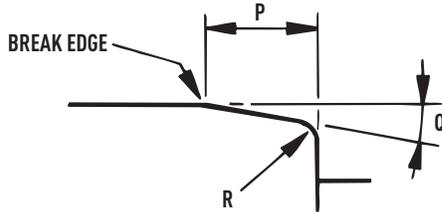
NOTE If the measured dimensions exceed the values given, correct the equipment to meet the specifications before installing the seal. If the seal is installed on a sleeve, the sleeve must be liquid- and pressure-light through its bore. The thickness of the gland plate must be sufficient to retain the service pressure without distortion.

FORMED BELLOWS SEAL

Installation, Operation & Maintenance Instructions

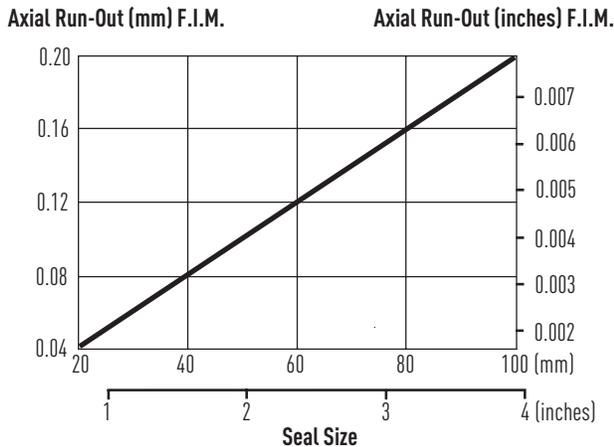
Lead-on Chamfer

For ease of installation, the lead-on edge of the shaft or sleeve should be chamfered as shown. Remove all sharp edges and burrs that could damage the O-ring.



P	2.5 mm
Q	10°
R	1.0 mm RADIUS

Housing Squareness to Shaft



Operating Conditions

The Type 515E is an asymmetric formed metal bellows seal unit for general sealing duties. The seal is bi-rotational and inherently pressure balanced. Positive drive is provided by socket set screws housed in the drive ring and clamped directly onto the shaft or sleeve.

Metric sizes conform to the DIN 24960, ISO 3069, and BS.5257:1975 European standards across the size range, and inch sizes comply with ANSI B73.1M-1991 up to and including 2.625 inches.

These instructions apply to the seal as installed in a pump and lubricated by recirculation of some of the pumped fluid in accordance with the application information contained in the John Crane Seal Specification Sheet ref. S-515E-E, and any John Crane seal selection literature or process. Typical operating limits are shown below.

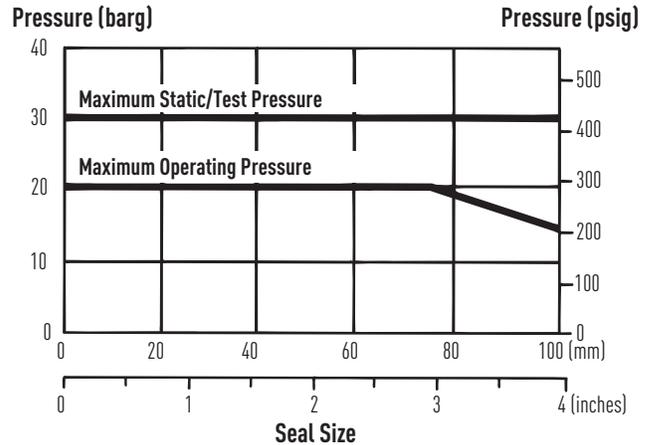
The selection of materials used in the construction of a seal should be made with regard to their temperature and chemical resistance/compatibility with the liquid being pumped.

Temperature limits: -40° to 390°F/-40° to 200°C
(Depending on the materials used)

Pressure limits: Operating: Up to 20 barg/290 psig
Hydrostatic: Up to 30 barg/435 psig
(Refer to Pressure/Velocity (PV) Limits graph)

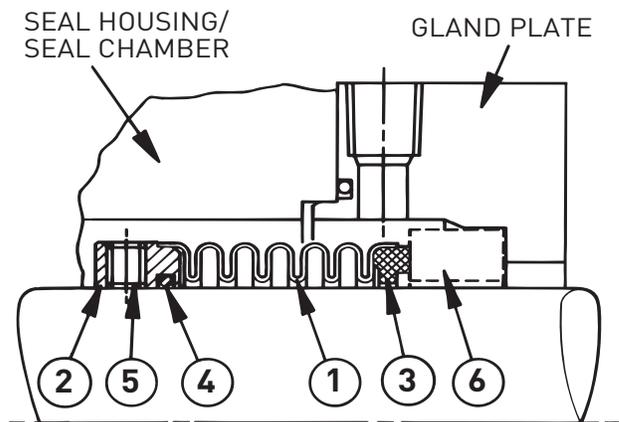
Speed limits: Up to 25 m/s/5,000 fpm

Pressure/Velocity (PV) Limits



The maximum operating pressures shown apply under the following conditions: carbon graphite face/primary ring running against a silicon carbide or tungsten carbide seat/mating ring at 3,600 rpm, with a lubricating sealed fluid at 175°F/80°C.

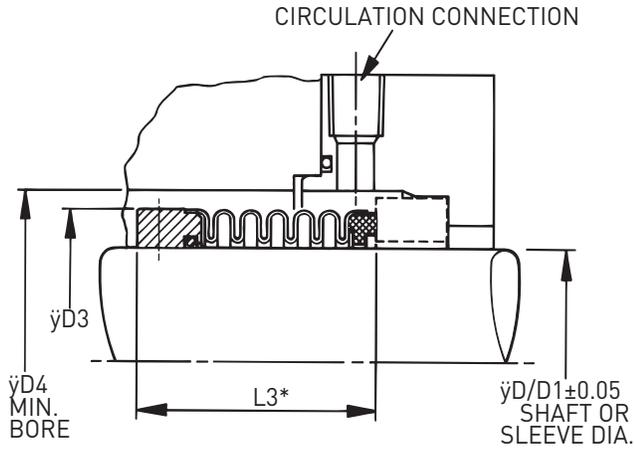
Typical Seal Arrangement



- 1 – Bellows assembly (Includes parts 2 and 3)
- 2 – Drive ring
- 3 – Face/Primary ring
- 4 – O-ring
- 5 – Set screw
- 6 – Seat/Mating ring and set ring*

*Refer to seat/mating ring instruction manual.

Seal Installation Dimensions



* Working length tolerances:

Seal size codes: 0180 TO 0300 \bar{n} L3 +0.8 $\bar{n}0$
 317 TO 0666 \bar{n} L3 +1.0 $\bar{n}0$
 0680 TO 1016 \bar{n} L3 +0.5 $\bar{n}0.5$

Dimensional Data (inches)

Seal Size (inches)	Seal Size Code	D1	D3	D4	L3
0.750	190	19.05	31.0	34.9	31.5
0.875	222	22.23	36.0	38.1	37.0
1.000	254	25.40	39.0	41.3	37.5
1.125	285	28.58	42.0	44.5	38.0
1.250	317	31.75	46.0	47.6	43.0
1.375	349	34.93	48.5	50.8	43.0
1.500	381	38.10	51.5	57.2	42.0
1.625	412	41.25	58.4	60.3	47.0
1.750	444	44.45	58.4	63.5	47.0
1.875	476	47.63	63.7	66.7	46.5
2.000	508	50.80	63.7	69.9	46.5
2.125	539	53.98	69.0	73.0	56.5
2.250	571	57.15	73.3	76.2	56.5
2.375	603	60.33	76.7	79.4	56.5
2.500	635	63.50	79.4	82.6	56.5
2.625	666	66.68	83.0	85.7	66.5
2.750	698	69.85	87.8	96.0	65.5
2.875	730	73.02	94.0	99.0	65.5
3.000	762	76.20	94.0	100.0	65.5
3.125	793	79.37	100.6	104.0	75.0
3.250	825	82.55	100.6	108.0	75.0
3.375	857	85.72	106.0	111.0	75.0
3.500	889	88.90	110.3	115.0	75.0
3.625	920	92.07	114.9	118.0	75.0
3.750	952	95.25	114.9	121.0	75.0
3.875	984	98.42	121.3	124.0	75.0
4.000	1016	101.60	121.3	127.0	75.0

Dimensional Data (mm)					
Seal Size (mm)	Seal Size Code	D1	D3	D4	L3
18	180	18	31.0	34	31.5
20	200	20	31.0	36	31.5
22	220	22	31.0	38	31.5
24	240	24	36.0	40	36.7
25	250	25	36.0	41	37.0
28	280	28	39.0	44	37.5
30	300	30	42.0	46	38.0
32	320	32	46.0	48	43.0
33	330	33	46.0	49	43.0
35	350	35	48.5	51	43.0
38	380	38	51.5	58	42.0
40	400	40	54.0	60	42.0
43	430	43	58.4	63	47.0
45	450	45	58.4	65	47.0
48	480	48	63.7	68	47.0
50	500	50	63.7	70	46.5
53	530	53	69.0	73	56.5
55	550	55	71.0	75	56.5
58	580	58	73.3	73	56.5
60	600	60	76.7	85	56.5
63	630	63	79.4	88	56.5
65	650	65	83.0	90	66.5
68	680	68	87.8	93	66.5
70	700	70	87.8	95	65.5
75	750	75	94.0	104	65.5
80	800	80	100.6	109	75.0
85	850	85	106.0	114	75.0
90	900	90	110.3	119	75.0
95	950	95	114.9	124	75.0
100	1000	100	121.3	129	75.0

Setting the Seal

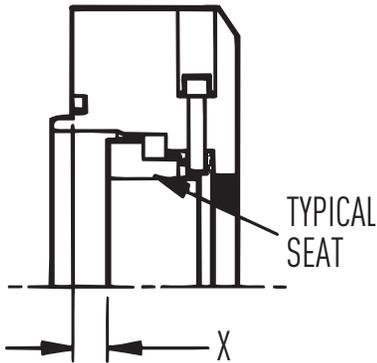
The seal must be installed to its correct working length L3, therefore it is essential that the back of the seal retainer is correctly positioned on the shaft. Setting procedure is described with respect to the shaft, but is equally applicable to a fitted sleeve.

ATTENTION If L3 is overlength, the seal will be undercompressed and will leak. If L3 is underlength, the seal will be overcompressed and this will cause dry-running and high wear of the seal faces.

Find the true seal position as follows:

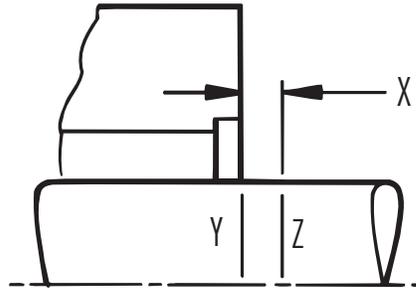
1. Refer to the appropriate seat/mating ring instruction manual to obtain dimension "X" from the face of the gland plate to the seat mating surface (Figure 1).

FIGURE 1



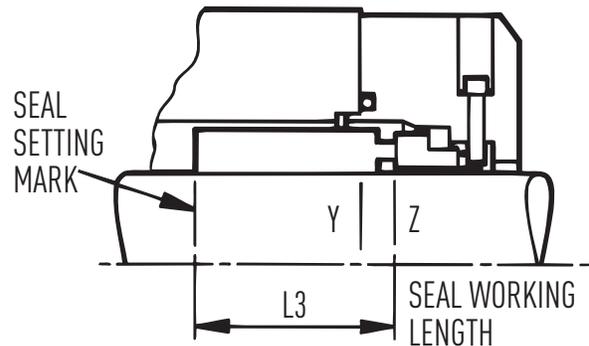
2. With the shaft in its working position, mark the surface at "Y" in line with the seal housing end face and mark the shaft again at "Z" the obtained distance away from the face position (Figure 2). This second mark is a datum for the seal working length L3.

FIGURE 2



3. From the dimension table, find the dimension L3 for the size of the seal being fitted, and measure the distance back from position "Z" (Figure 3). The new marked position is the point on the shaft where the back of the seal is to be located.

FIGURE 3



Installing the Seal

Before starting the installation, read the following instructions carefully, both to be aware of special information, and because the fitting sequence may be different depending on the construction of the pump. The instructions assume fitting onto a plain shaft from the impeller end of the pump.

ATTENTION Excessive compression that causes adjacent corrugations to touch can permanently damage the bellows of the seal.

1. Remove the protective packaging from the seal, check for damage and wipe clean. Save package labels for future reference.
2. Fit the seal/mating ring into the gland plate as described in the seal instruction manual. Check that the gland plate O-ring or gasket is clean, undamaged and in place, and then position the gland plate on the shaft, clear of the seal location; avoid impact with the shaft.

NOTE Use a suitable lubricant when fitting the seal. The recommended lubricants for an elastomer O-ring are soft hand soap and water, glycerine, or silicone grease: do not use washing-up liquid, liquid soaps, or hand cleaning gels. Light mineral oil may be used with most elastomers.

ATTENTION Do not use hydrocarbon-based liquids on ethylene propylene elastomers.

3. Clean the shaft and sparingly lubricate the surface.

ATTENTION Accurate torque settings will avoid set screw damage and eliminate seal movement in operation.

4. Adjust the set screws until clear of the drive ring bore, then slide the seal onto the shaft, and accurately align the back of the drive ring with the seal setting mark. Lightly tighten the set screws to hold the seal in position, then continue to tighten the screws evenly and progressively to the torque recommended in the table.
5. Wipe the lapped surfaces of the seal and seat/mating ring perfectly clean and dry. Install the seal housing, then locate the gland plate squarely on the fixing studs, and pull on the plate to compress the seal as necessary to fit the retaining nuts.
6. Recheck that the gland plate O-ring or gasket is in position, then tighten the nuts as advised by the pump instruction manual. Do not overtighten.

The torque values given below are for stainless steel (001) cup point set screws.

Recommended Torques for Set Screws

Seal Size Code	Set Screw Size	Torque	
		(Nm)	(lbf ft)
0180 to 0350	M4	3	2.3
0380 to 0550	M5	4	3.0
0571 to 1016	M8	11	8.0

Maintenance

During operation, periodic inspection of the seal should be carried out. A measure of seal condition is the level of leakage, and as no maintenance is possible while installed, the seal should be replaced when leakage becomes unacceptable. It is recommended that a spare seal unit and seat/mating ring are held in stock to allow immediate replacement of a removed seal.

Before Commissioning the Equipment

1. Check that the gland plate nuts are securely tightened according to the pump manual torque setting.
2. Complete the assembly of the pump, and turn the shaft (by hand, if possible) to ensure free rotation. Check for correct alignment of the coupling and driver before connection.
3. Consult all available equipment instruction manuals to check for correctness of all auxiliary piping and connections, particularly seal recirculation/flush, heating or cooling requirements, and services external to the seal.

ATTENTION This mechanical seal is designed to operate in a liquid so that the heat energy it creates is adequately removed, and therefore the following check should be carried out, not only after seal installation, but also following a period of pump shut-down.

4. Check that the seal chamber fluid lines are open and free of any obstruction, and ensure that the seal chamber is filled with fluid and fully vented.

ATTENTION Dry-running — often indicated by a squealing noise from the seal area — will cause overheating and scoring or other damage to the sealing surfaces, resulting in excessive leakage or a much shortened seal life.

Decommissioning the Equipment

1. Ensure that the pump is electrically isolated.



If the equipment has been used on toxic or hazardous fluids, ensure that the equipment is correctly decontaminated and made safe prior to commencing work. Remember that fluid is often trapped during draining and may be present inside the seal chamber. The pump instruction manual should be consulted to check for any special precautions.

2. Ensure that the pump is isolated by the appropriate valves. Check that the fluid is drained and pressure is fully released.

Removing the Seal

NOTE Dismantle with care; some seal components may be suitable for reconditioning after duty, if otherwise undamaged.

1. Referring to the pump instruction manual, dismantle the equipment sufficiently to expose the gland plate and seal housing.
2. Evenly slacken and remove the gland plate nuts, and carefully slide the plate off the studs to rest on the shaft.
3. Remove the seal housing, clean and oil the shaft, and then complete the removal of the seal and the gland plate assembly in the reverse order to installation.

NOTE Although the original seal position may be marked on the shaft as a reference point before seal removal, the location must be checked even if the same seal and seat/mating ring specification is intended as a replacement.

A seal unit should always be serviced after removal from duty. It is recommended that used seals are returned to the John Crane Service Center, since rebuilding to as-new specification must be carried out by qualified personnel.



It is the responsibility of the equipment user to ensure that any parts being sent to a third party have appropriate safe-handling instructions externally attached to the package.



TYPE 515E

FORMED BELLOWS SEAL

Installation, Operation & Maintenance Instructions



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 Fax: 44-1753-224224

Latin America
 Brazil
 Tel: 55-11-3371-2500
 Fax: 55-11-3371-2599

Middle East & Africa
 United Arab Emirates
 Tel: 971-481-27800
 Fax: 971-488-62830

Asia Pacific
 Singapore
 Tel: 65-6518-1800
 Fax: 65-6518-1803

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