

## ELASTOMER O-RING SHAFT SEAL

Installation, Operation & Maintenance Instructions

### Foreword

This instruction manual is provided to familiarise 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 seat 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 manual supplied with the seat and the instruction manuals for both 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, John Crane must be contacted before its installation and use.

Any warranty may be affected by improper handling, installation, or use of this seal: contact the Company 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 seats 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.**

2. Installation, removal, and maintenance of the seal must be carried out only by qualified personnel who have read and understood this instruction manual.
3. 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.

4. The seal must only be used in technically perfect condition and in conjunction with a suitable seat, and must be operated within the recommended performance limits in accordance with its designated use and the instructions set out in this manual.
5. 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 installation.
6. PTFE and fluorocarbon components should never be burned or incinerated as the fumes are highly toxic. If fluorocarbons are accidentally heated above 400°C 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 seats are given in the John Crane Instruction Sheet ref. I-Storage-E, available on request.

### Operating Conditions

The Type 8-1/Type 8-1T is a general duty, elastomeric O-ring, multiple spring seal supplied in inch sizes.

These instructions apply to the seal as installed in a pump and lubricated by the pumped fluid in accordance with the application information contained in the John Crane Seal Specification Sheet ref. S-8-1/8-1T-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.

#### Temperatures:

-40°C to 260°C/-40°F to 500°F (depending on materials used)

#### Pressures:

Type 8-1: 22.76 Bar g/3348 PSI g

Type 8-1T: 14.14 Bar g/205 PSI g

#### Speed:

Up to 25m/s or 5000 FPM

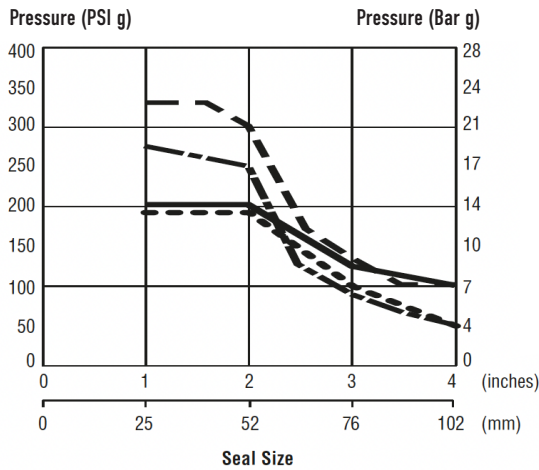
#### NOTE

For applications with speeds greater than 25 m/s/ 5000 fpm, a rotating seat (RS) arrangement is recommended.

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### Type 8-1 Pressure/Velocity (PV) Limits



- Type 8-1 Carbon vs. Silicon Carbide (1800 rpm)
- Type 8-1 Carbon vs. Silicon Carbide (3600 rpm)
- Type 8-1T Carbon vs. Silicon Carbide (1800 rpm)
- Type 8-1T Carbon vs. Silicon Carbide (3600 rpm)

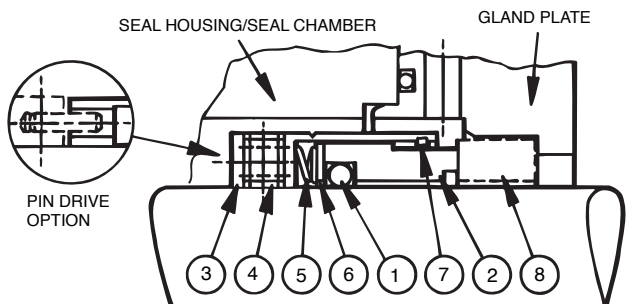
To determine the maximum pressure for a Type 8-1 or 8-1T, multiply the maximum pressure by the Multiplier Factors to obtain the maximum operating pressure.

### Type 8-1T Pressure/Velocity (PV) Limits

The maximum operating pressures shown apply under the following conditions: carbon graphite face running against a silicon carbide or tungsten carbide seat at 1800 rpm, with a lubricating sealed fluid at 80°C/175°F.

Maximum static/test pressures should be taken as the relevant maximum operating pressure multiplied by a factor of 1.5.

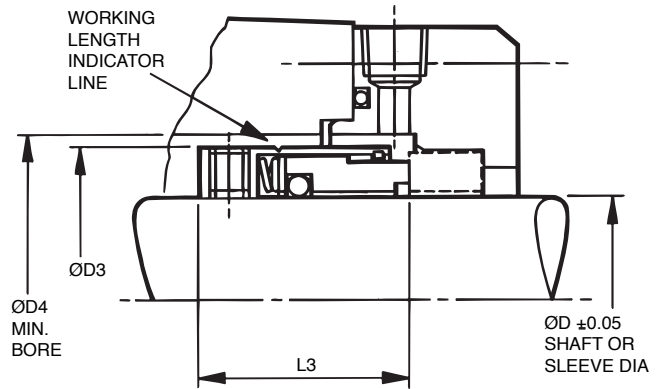
### Typical Type 8-1/Type 8-1T Seal Arrangement



Part Name		Part Name	
1	O-Ring	5	Spring
2	Face	6	Thrust Ring
3	Retainer	7	Snap Ring
4	Set Screw	8	Seat and Seat Ring*

\* Refer to seat instruction manual

### Type 8-1/Type 8-1T Seal Installation Dimensions



### Type 8-1 Dimensional Data (mm)

Seal Size (inches)	Seal Size Code	D	D3	D4	L3
0.500	0127	12.70	26.7	30	21.0
0.625	0158	15.87	30.7	34	19.0
0.750	0190	19.05	34.0	37	22.0
0.875	0222	22.22	37.2	40	24.0
1.000	0254	25.40	40.3	43	25.0
1.125	0285	28.57	43.5	46	27.0
1.250	0317	31.75	48.3	51	27.0
1.375	0349	34.92	51.5	54	29.0
1.500	0381	38.10	54.6	58	29.0
1.625	0412	41.27	61.0	64	35.0
1.750	0444	44.45	64.2	67	35.0
1.875	0476	47.62	67.3	70	35.0
2.000	0508	50.80	70.5	73	35.0
2.125	0539	53.97	76.9	80	43.0
2.250	0571	57.15	80.0	83	43.0
2.375	0603	60.32	83.2	86	43.0
2.500	0635	63.50	86.4	89	43.0
2.625	0666	66.67	89.6	92	43.0
2.750	0698	69.85	92.7	96	43.0
2.875	0730	73.02	95.9	99	43.0
3.000	0762	76.20	97.5	100	43.0
3.125	0793	79.37	100.7	104	43.0
3.250	0825	82.55	105.4	108	43.0
3.375	0857	85.72	108.6	111	43.0
3.500	0889	88.90	111.8	115	43.0
3.625	0920	92.07	115.0	118	43.0
3.750	0952	95.25	118.1	121	43.0
3.875	0984	98.42	121.3	124	43.0
4.000	1016	101.60	124.5	127	43.0
4.125	1047	104.77	130.2	134	42.9
4.250	1079	107.95	133.4	137	42.9
4.375	1111	111.12	136.6	140	42.9
4.500	1143	114.30	139.7	143	42.9
4.625	1174	117.47	142.9	146	42.9
4.750	1206	120.65	146.1	149	42.9
4.875	1238	123.82	149.2	153	42.9
5.000	1270	127.00	152.4	156	42.9
5.125	1301	130.17	155.6	159	42.9
5.250	1333	133.35	165.1	168	50.8
5.375	1365	136.52	168.8	172	50.8
5.500	1397	139.70	171.5	175	50.8
5.625	1428	142.87	174.6	178	50.8
5.750	1460	146.05	177.8	181	50.8
5.875	1492	149.22	181.0	184	50.8
6.000	1524	152.40	184.2	188	50.8

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### Type 8-1T Dimensional Data (mm)

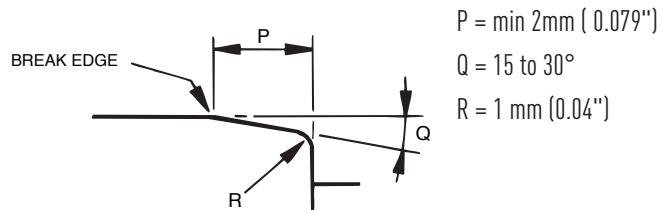
Seal Size (inches)	Seal Size Code	D	D3	D4	L3
0.500	0127	12.70	23.8	27.0	23.8
0.625	0158	15.88	27.0	30.2	23.8
0.750	0190	19.05	30.2	33.3	23.8
0.875	0222	22.23	33.3	36.5	23.8
1.000	0254	25.40	36.5	39.7	25.4
1.125	0285	28.58	39.7	42.9	25.4
1.250	0317	31.75	42.9	46.0	25.4
1.375	0349	34.93	49.2	52.4	34.9
1.500	0381	38.10	49.2	52.4	28.6
1.625	0412	41.28	57.2	60.3	29.4
1.750	0444	44.45	58.7	61.9	34.9
1.875	0476	47.63	63.5	66.7	34.9
2.000	0508	50.80	66.7	69.9	34.9
2.125	0539	53.98	71.4	74.6	42.9
2.250	0571	57.15	72.2	75.4	34.9
2.375	0603	60.33	76.2	79.4	42.9
2.500	0635	63.50	79.4	82.6	34.9
2.625	0666	66.68	82.6	85.7	42.9
2.750	0698	69.85	85.7	88.9	42.9
2.875	0730	73.03	88.9	92.1	42.9
3.000	0762	76.20	92.1	95.3	42.9
3.125	0793	79.38	95.3	98.4	42.9
3.250	0825	82.55	98.4	101.6	42.9
3.375	0857	85.73	101.6	104.8	42.9
3.500	0889	88.90	104.8	108.0	42.9
3.625	0920	92.08	108.0	111.1	42.9
3.750	0952	95.25	111.1	114.3	42.9
3.875	0984	98.43	114.3	117.5	42.9
4.000	1016	101.60	117.5	120.7	42.9

### NOTE

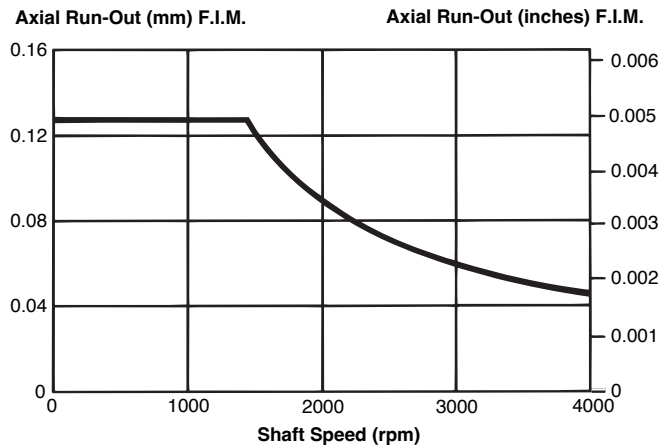
If the measured dimensions exceed those values given, correct the equipment to meet the specifications prior to installing the seal. If the seal is installed on a sleeve, the sleeve must be liquid- and pressure-tight through its bore. The thickness of the gland plate must be sufficient to retain the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

### Lead-On Chamfer

For ease of installation, the lead-on edge of the shaft or sleeve should be chamfered as shown.



### Housing Squareness to Shaft



### Checking the Equipment

Successful operation and life of this seal is dependent on acceptable equipment dimensions and alignments. Before installation of the seal, the following dimensional checks should be made with respect to the seal housing/shaft alignments, finish and lead-on. Normal equipment to measure these features would be a micrometer and dial indicator.

#### Shaft/Sleeve Outside Diameter

Refer to Dimension Tables

#### Seal Chamber Bore Diameter

Refer to Dimension Tables

#### Shaft/Sleeve Finish Under the Seal Unit

0.3 to 0.6  $\mu$ m Ra (Polished)

#### Shaft/Sleeve Ovality/ Out-of-Roundness

< 0.05 mm / 0.002 in.

#### Shaft End Play/Axial Float

< 0.08 mm / 0.003 in. F.I.M.

#### Seal Housing End Face Squareness to Shaft/Sleeve

Refer to Housing Squareness Graph

#### Concentricity of the Seal Chamber to the Shaft/Sleeve

< 0.15 mm / 0.006 in. F.I.M.

#### Shaft/Sleeve Run-Out with Respect to the Seal Chamber

< 0.08 mm / 0.003 in. F.I.M. < 1800 rpm

< 0.05 mm / 0.002 in. F.I.M. > 1800 rpm

### Setting the Seal

The seal must be installed to its correct working length L3. Setting procedure is described with respect to the shaft, but is equally applicable to a fitted sleeve.

### ATTENTION

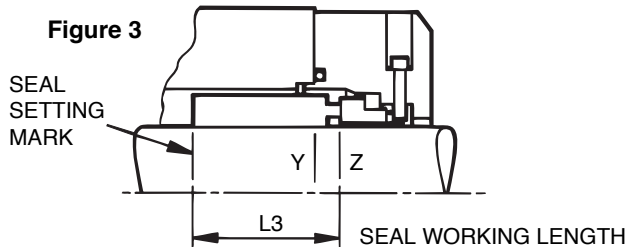
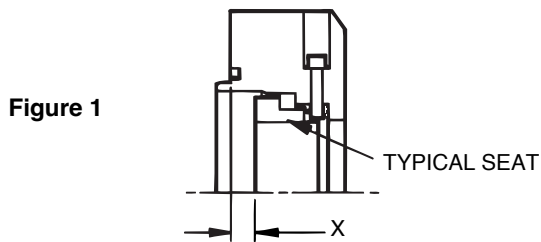
If L3 is overlength, the seal will be undercompressed and will leak: If L3 is underlength, the seal will be overcompressed and this will cause dry running and high wear of the seal faces.

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Find the true seal position as follows:

1. Refer to the appropriate seat instruction manual to obtain dimension 'X' from the face of the gland plate to the seat mating surface (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.
3. From the dimension tables find the dimension L3 for the size of 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.



### 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.

1. Remove the protective packaging from the seal; check for damage, and wipe clean.
2. Fit the seat into the gland plate as described in the seat instructions. Check that the gland plate O-ring or gasket is in position and will not be displaced during fitting, and then position the gland plate on the shaft, clear of the seal location.

#### 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 and sparingly lubricate the shaft or sleeve.

#### NOTE

As an alternative to the standard set screw drive, a hole is provided in the end of the seal retainer to engage a pin set in a separate drive collar or abutment. Two holes are provided for seal sizes above 4 inches.

4. **Pin-driven seals:** Remove and discard all the set screws from the retainer. Fit the seal unit onto the shaft/sleeve to abut the drive collar, positively engaging the drive pin(s).

**Set screw driven seals:** Adjust the set screws until clear of the retainer bore. Fit the seal unit onto the shaft or sleeve, making sure that the back of the retainer is in line 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 torque table.

#### ATTENTION

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

5. Wipe the lapped surfaces of the seal and seat perfectly clean. Install the pump 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. Apply the correct torque to the nuts as advised by the pump instruction manual.

#### NOTE

If the seal is visible after installation, a setting length check can be made. The setting is correct if the rear surface of the thrust ring as seen through the holes in the retainer is lined up with the line cut in the retainer wall.

### Type 8-1 Recommended Torques for Set Screws

Seal Size Inches	Set Screw Size	Torque	
		Nm	lbf ft
Up to 0.625 and 1.000	M5	3	2.2
1.125 to 1.500	M6	4	3.0
1.625 to 2.750	M8	11	8.0
2.875 to 6.000	M10	16	12.0

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



# TYPE 8-1/TYPE 8-1T

## ELASTOMER O-RING SHAFT SEAL

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### Type 8-1T Recommended Torques for Set Screws

Seal Size Inches	Set Screw Size	Torque	
		Nm	lbf ft
Up to 1.500	M5	3	2.2
1.625 to 2.250	M6	4	3.0
2.375 to 4.000	M8	11	8.0

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

### Before Commissioning the Equipment

1. Ensure that the gland plate nuts are evenly 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.
3. Consult all available equipment instruction manuals to check for correctness of all 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 shut-down.

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

### 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 are held in stock to allow immediate replacement of a removed seal.

### 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 fully released.

### Removing the Seal

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.
3. Remove the seal housing, 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 or sleeve as a reference point before seal removal, the location must be checked even if the same seal and seat 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 a John Crane Service Centre, 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.**



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