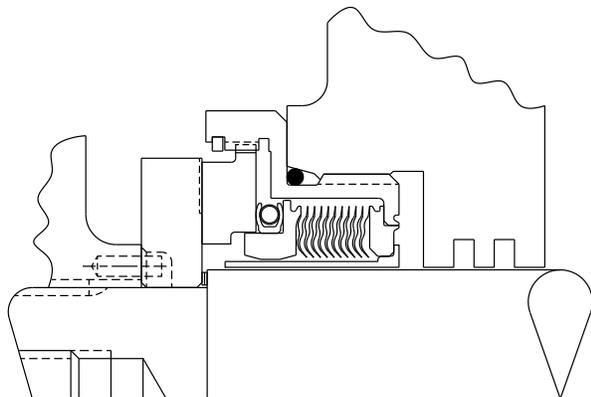


## METAL BELLOWS SEAL ASSEMBLY

Installation, Operation & Maintenance Instructions

### 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 seal as used in rotating equipment and will help to avoid danger and increase reliability. The information required may change with other types of equipment or installation arrangements. These instructions must be read in conjunction with 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 John Crane for information as to exclusive product warranty and limitations of liability.

If questions or problems arise, contact your local John Crane representative or the original equipment manufacturer, as appropriate.

#### ATTENTION

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

### Safety Instructions

- The following designations are used in the installation instructions 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 toward 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, removal and maintenance of the seal must be carried out only by qualified personnel who have read and understood these installation instructions.
- 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 must be operated within the recommended performance limits stated in the published technical data sheet and the instructions in this manual. Copies of the technical data sheet are available from John Crane.
- 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.
- Fluorocarbon components should never be burned or incinerated as the fumes and residues are highly toxic. If fluorocarbons are accidentally heated above 400°C/750°F, they can decompose. Protective gloves should be worn as hydrofluoric acid may be present.
- PTFE components should never be burned or incinerated as the fumes are highly toxic.

### Before Starting the Equipment

- Check the pump at the coupling for proper alignment of the driver or motor.
- Ensure the gland plate nut/bolts are securely tightened according to the pump manual instructions, and that all screws are securely fastened.
- Complete the assembly of the pump. Turn the shaft (by hand if possible) to ensure free rotation.
- Consult all available equipment operating instructions to check for correctness of all piping and connections, particularly regarding seal recirculation/flush, heating or cooling requirements, and services external to the seal.
- Ensure that the seal chamber is properly vented and filled with liquid. Refer to the pump instruction manual.



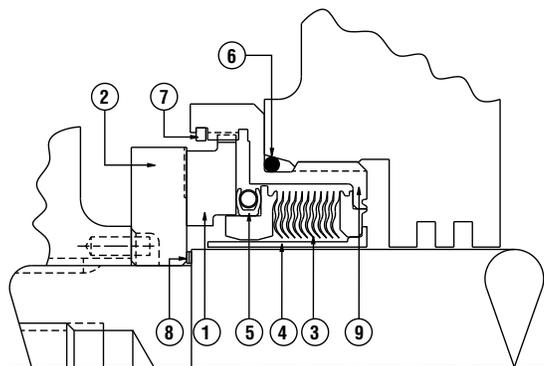
**Before start-up, ensure that all personnel and assembly equipment have been moved to a safe distance so there is no contact with rotating parts on the pump, seal, coupling or motor.**

**WARNING:** Seal installation should be handled only by qualified personnel. If questions arise, contact the local John Crane representative. Improper use and/or installation of this product could result in injury to the person and/or harmful emissions to the environment, and may affect any warranty on the product. Please contact the company for information as to exclusive product warranty and limitations of liability.

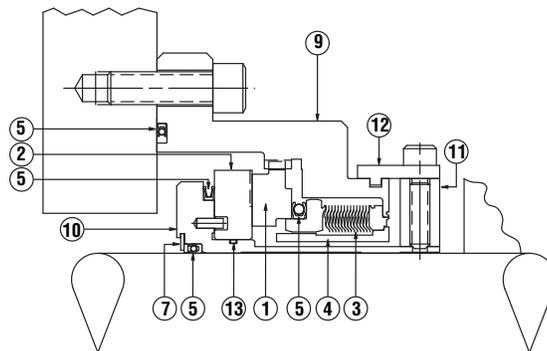
### General Instructions

- Study the engineering layout drawing to confirm the proper seal arrangement for the pump being used. Be sure to read all instructions carefully before installing the seal.
- To assure satisfactory operation, handle the seal with care. Take particular caution to see that the lapped sealing faces are not scratched or damaged.

### Typical Type 285 Component Seal Arrangement



### Typical Type 285 Cartridge Seal Arrangement



#### Part Names for 285 Component and Cartridge Seal

1 Stator/Primary Ring	6 Gasket/O-Ring	11 Collar
2 Spiral Grooved Rotor/Mating Ring	7 Retaining Ring	12 Spacer/Shipping Clip
3 Metal Bellows Assembly	8 Shims	13 Spring
4 Anti-Spark Sleeve	9 Housing	
5 Spring-Energized Seal	10 Cartridge Sleeve	

## METAL BELLOWS SEAL ASSEMBLY

Installation, Operation & Maintenance Instructions

### Safety Instructions for Liquid Oxygen Service (LOX)



Personnel handling liquid oxygen must be qualified and trained properly.

Seal components intended for oxygen service must be handled carefully to maintain their cleanliness. Insufficient cleanliness can result in ignition of the contaminants or components. The environment should be clean and dust-free. Seal components should not be allowed to stand for any unreasonable length of time without covered protection.

Seal component surfaces that will be in direct oxygen service should not be touched except with clean gloves or clean handling devices.

Harmful contamination would include both organic and inorganic materials, such as oils, greases, paper fiber, rags, wood chips, solvents, weld slag, dirt, and sand, which could cause a combustion reaction in an oxygen-enriched environment.

Oxygen can react with nearly all materials that are not already fully oxidized.

Wear protective clothing and use protective equipment when working with liquid oxygen to avoid cryogenic burns or frostbite (freezing of the skin).

No smoking or open flames are allowed within 20m/65' of an oxygen system.

Clothing saturated with oxygen vapor is an extreme fire hazard. Persons who have been in an oxygen-enriched environment should not smoke until they have been in a safe area for at least 20 minutes.

### Shape and Positional Tolerances

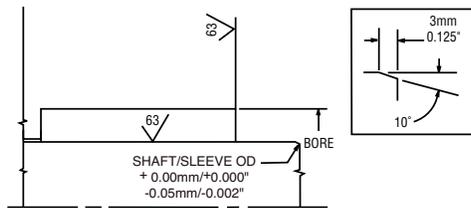
Component	Type	Tolerance
Seal Chamber Face to Shaft	Squareness Concentricity	0.001mm per mm*/0.001" per inch* 0.15mm/0.006"
Shaft End Play	Axial	0.13mm/0.005" T.I.R. max.
Shaft or Sleeve	Ovality	0.05mm/0.002"
Shaft	Radial Runout	0.001mm per mm**/0.001" per inch**
Seal Shoulder	Face Runout	0.001mm/0.0005"

\*Of indicated diameter T.I.R. max.

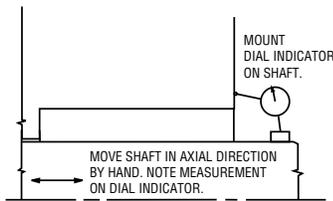
\*\*Of shaft diameter T.I.R. max.

### Preparing the Equipment

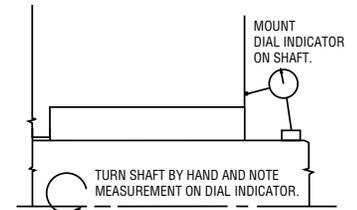
1. Check seal chamber dimensions and finishes.



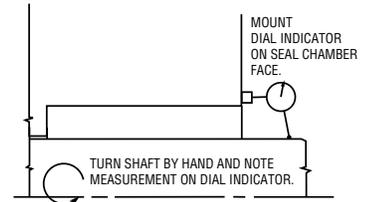
2. Measure axial end play (0.13mm/.005" T.I.R. max.).



3. Determine squareness of seal chamber face to shaft (0.001mm per mm/.001" per inch of indicated diameter T.I.R. max.), and shaft concentricity to the seal chamber



4. Measure shaft runout (0.001mm per mm/.001" per inch of shaft diameter T.I.R. max.).



**NOTE:** If measured dimensions exceed those values given, correct the equipment to meet specifications prior to seal installation.

### Component Style Seal Installing the Seal (For Cartridge Style Seal See Following Section)

1. Ensure that the seal is clean and undamaged. Carefully protect the lapped sealing surfaces of the stator and the rotor during fitting. Minor damages, such as scratches and chips, to sensitive surfaces reduce the sealing effectiveness of the mechanical seal.
2. Verify that the direction of shaft rotation shown on the seal layout drawing matches the actual rotation of the pump shaft.
3. Maintain cleanliness during fitting.
4. Ensure that the seal arrangement is oriented correctly, according to the housing, pipework, and shaft connections (e.g., studs, keyways, pins, and drive holes). Spiral grooves on the rotors should be oriented as shown.
5. If required, apply a compatible lubricant to the gasket and place it onto the seal housing.
6. For seals intended for oxygen service, ensure all safety instructions are followed.

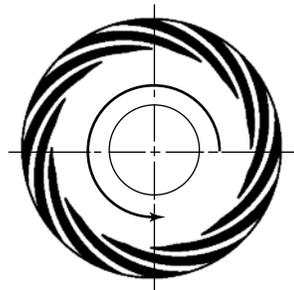
**WARNING:**

**Only use lubricants approved for use in liquid oxygen service.**

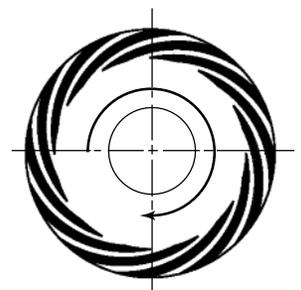
**ATTENTION**

The seal faces should not be lubricated with oil or grease, as this will prevent the correct operation of the spiral grooves on the rotor, leading to overheating and failure.

### Direction of Shaft Rotation



Counter Clockwise Facing Spiral Groove Pattern



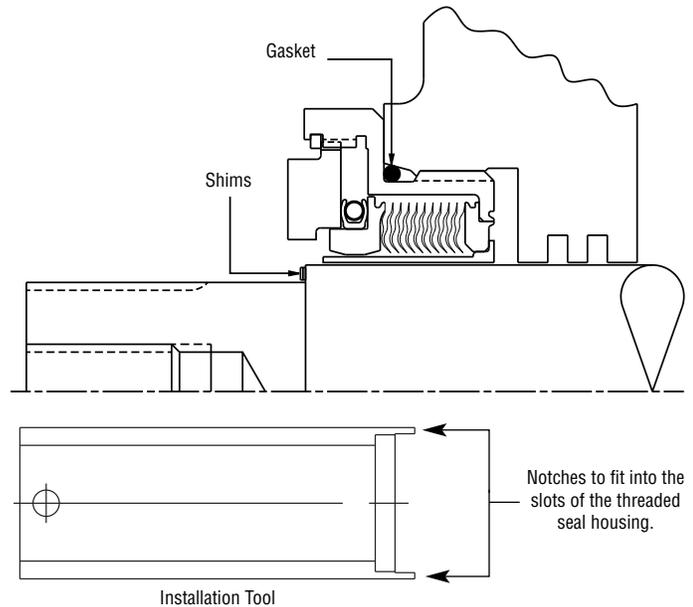
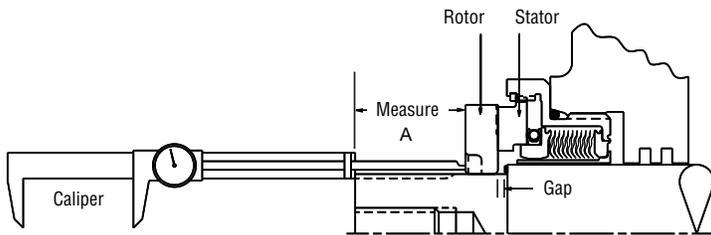
Clockwise Facing Spiral Groove Pattern

**METAL BELLOWS SEAL ASSEMBLY**

Installation, Operation &amp; Maintenance Instructions

**Installing the Seal (continued)**

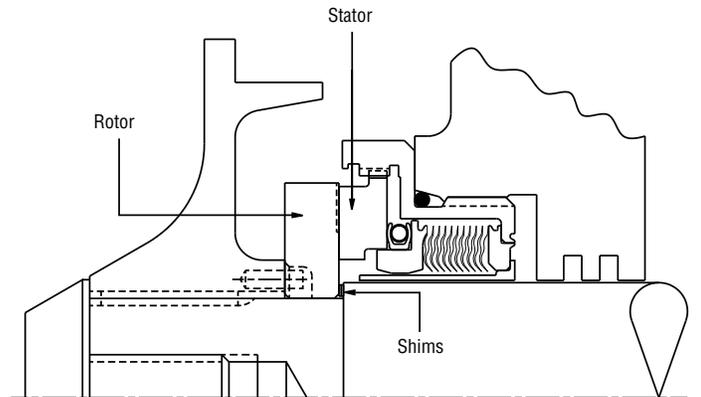
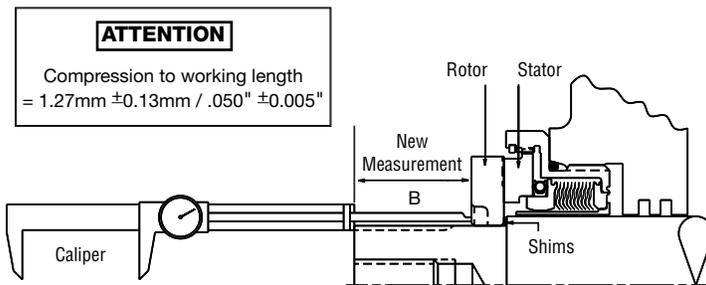
7. If a threaded housing design is used, screw the seal into the seal chamber using a spanner wrench or the installation tool, if provided. If a flange housing design is used, ensure that the seal housing is securely screwed into the pump's seal chamber face.
8. Fit the suggested number of shims against the shaft step (indicated on the seal assembly drawing).
9. Slide the rotor over the shaft until it contacts the stator.
10. Use a caliper or other appropriate measurement device to measure from the shaft end/next shaft step to the back of the rotor. You then obtain data "A".
11. Push the rotor against the shims. (This will compress the seal to working length.)

**Installing the Seal (continued)**

12. Measure from the shaft end/next shaft step to the back of the rotor again. You then obtain data "B".
13. Calculate the seal compression by applying the following formula:  $B - A = \text{Compression}$ .
14. If the calculated compression is not  $1.27\text{mm} \pm 0.13\text{mm} / .050" \pm .005"$ , change the number of shims until this dimension is achieved.

15. Clamp the rotor in position by fitting and securing the pump impeller onto the shaft.
16. If possible, check for freedom of movement by hand-turning the shaft in the proper direction.

**ATTENTION** Turning in the wrong direction may damage the seal faces.

**Cartridge Style Seal**

**ATTENTION** See Safety Instructions for Liquid Oxygen Service (LOX) before proceeding.

Refer to assembly drawing and/or pump manual for piping connections and coupling alignment. Verify shaft rotation matches that shown on assembly drawing. Proceed as indicated.

1. Disassemble the pump according to the manufacturer's instructions and remove the existing seal arrangement. Wipe the shaft/sleeve clean and apply a lubricant that is compatible with the sealed fluid and the gasketing materials.

**WARNING:** Only use lubricants approved for use in liquid oxygen service.

The seal faces should not be lubricated with oil or grease, as this will prevent the correct operation of the spiral grooves on the rotor, leading to overheating and failure.

2. Take the complete cartridge assembly from its package. **DO NOT** disassemble or alter the unit.
3. With the gland gasket in place, slide the complete cartridge assembly as far as possible onto the shaft/sleeve, being careful not to damage the O-ring/gasket inside the cartridge sleeve.

4. Reassemble the pump according to the manufacturer's instructions.
5. Verify that the gland gasket is still in place, slide the complete assembly into position against the face of the seal chamber. Tighten the gland bolts finger-tight. Continue tightening alternately until secure. **DO NOT DISTORT THE GLAND BY OVERTIGHTENING.**
6. Leave the shipping clips or eccentric washers in place to maintain the setting position of the cartridge seal.
7. If the assembly drawing calls for holes or countersinks to be drilled under the cartridge sleeve set screws, remove the set screws and mark their location. Unbolt the cartridge gland, disassemble the pump and remove the cartridge seal. Drill the shaft/sleeve in the position marked. Repeat steps 1 - 5.
8. Tighten the cartridge sleeve set screws evenly. (If the shaft/sleeve has been drilled, ensure that the set screws align with the appropriate drilled holes).
9. Remove the shipping clips, or rotate the eccentric washers 180° to clear the slot in the cartridge sleeve.
10. Turn the shaft by hand in the proper rotation to check for free rotation. Turning the shaft in the wrong direction could result in damage to the seal faces. Consult pump manual if unsure of proper rotation. If the shaft will not turn freely, either the seal has been set incorrectly or the shaft is turning in the wrong direction.

## METAL BELLOWS SEAL ASSEMBLY

Installation, Operation & Maintenance Instructions

### Transportation and Storage

Transport and store the seal in its original package.

To guarantee the seal is operational, it should be stored:

- dry and dust-free
- ventilated at room temperature
- protected from direct effects of heat and ultraviolet light
- elastomers require replacement after 24 months except fluoro- and perfluoro-elastomers, which require replacement after 60 months. (For further information on elastomer storage, refer to ISO 2230).

If used seal parts are to be transported to the manufacturer or a third party, they have to be cleaned, decontaminated, and require safe handling instructions externally attached.

For additional information on transportation and storage, refer to I-Storage-E.

The sealing system does not require any preservatives; it is resistant to all normal environmental conditions.

If any machine with an installed seal has been stored with preservatives, before putting it back into operation, the seal must be removed, cleaned, and dried. Particular attention must be applied to the cleanliness of the faces and condition of the elastomers.

**ATTENTION** Ensure preservatives and cleaning agents do not affect the elastomers.

### Decommissioning the Equipment

1. Ensure that the equipment 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, fluid is often trapped during draining and may exist outside the seal. The equipment instruction manual should be consulted to check for any special precautions.**

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

### Maintenance

No maintenance of a seal is possible while installed. It is recommended that a spare seal unit and rotor be held in stock to allow immediate replacement of a removed seal.

It is recommended that used seals are returned to a John Crane service location, as rebuilding to as-new specifications 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.**

### Quality Assurance

This seal has been assembled in accordance with John Crane quality assurance standards, and with proper maintenance and use will give safe and reliable operation to the maximum recommended performance, as shown in any relevant approved John Crane publication.

### Ordering Information

1. Provide the pump information. Select the seal size.
2. Select seal assembly.
3. For rotor selection, advise your John Crane representative of the pump model to be fitted.
4. For other size considerations, consult your local John Crane representative.

### Materials of Construction - Standard

Stator/Primary Ring	Carbon
Rotor/Mating Ring	Tungsten Carbide
Spring-Energized Seal	Virgin PTFE, Cobalt-Chrome Alloy Spring
Anti-Spark Sleeve	Tin Bronze
Metal Bellows	Alloy 718 (Alloy 625 End Fittings)
Retaining Ring	Nickel-Copper Alloy
Shims	Copper Alloy
Other Metal Parts	316L Stainless Steel

### Operating (non-concurrent) Limits

Process Fluid:	Industrial Liquid Gases (Nitrogen, Oxygen, Argon, etc.)
Pressure:	Up to 7 bar/100 psi
Temperature:	-196°C/-320°F to ambient
Shaft Speed:	Up to 10,000 rpm



**North America**  
United States of America  
Tel: 1-847-967-2400  
Fax: 1-847-967-3915

**Europe**  
United Kingdom  
Tel: 44-1753-224000  
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

If the products featured will be used in a potentially dangerous and/or hazardous process, your John Crane representative should be consulted prior to their selection and use. In the interest of continuous development, John Crane Companies reserve the right to alter designs and specifications without prior notice. It is dangerous to smoke while handling products made from PTFE. Old and new PTFE products must not be incinerated. ISO 9001 and ISO14001 Certified, details available on request.