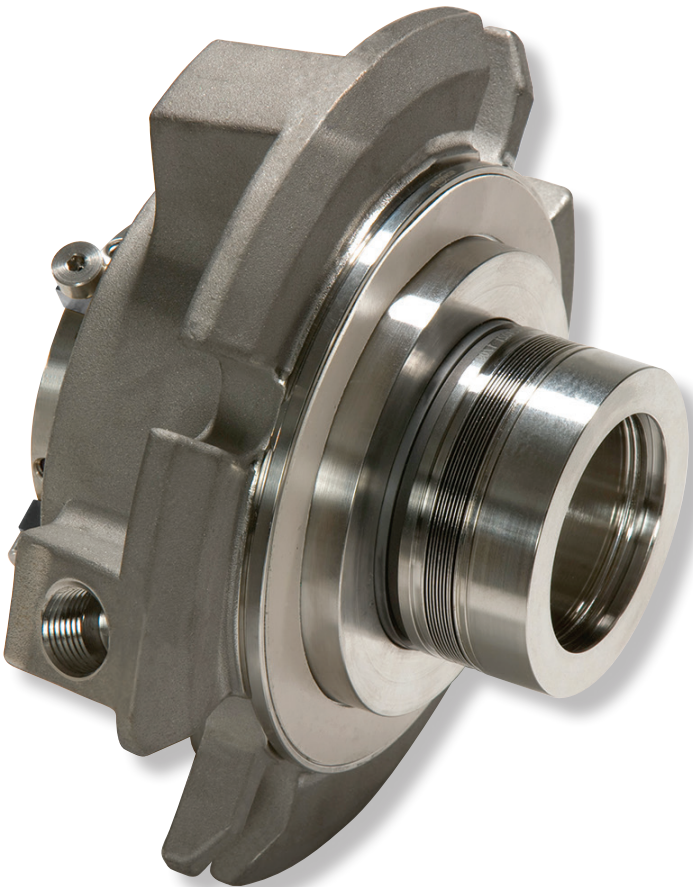




# *Repair Instructions*

## *ISC2*

Dual metal bellows seal



# 1 Nomenclature

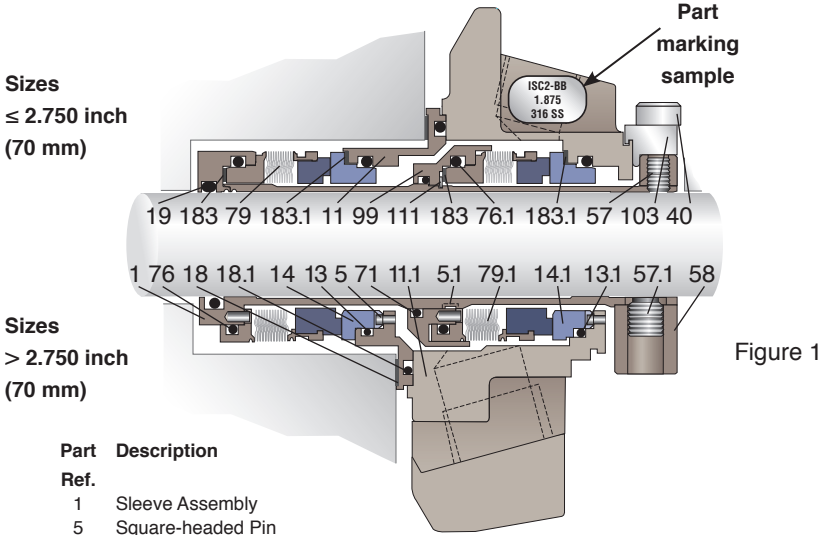


Figure 1

Part Ref.	Description
1	Sleeve Assembly
5	Square-headed Pin
5.1	Drive Pin
11	Inner Gland
11.1	Outer Gland
13	Seat Gasket O-ring
13.1	Seat Gasket O-ring
14	Inboard Stationary Face
14.1	Outboard Stationary Face
18	Gland Gasket
18.1	Inner Gland O-ring
19	Sleeve Gasket O-ring
40	Cap Screw
57	Cup-point Set Screw
57.1	Quarter-dog Set Screw
58	Drive Collar
71	Rotating Face Support O-ring
76	Inboard Bellows O-ring
76.1	Outboard Bellows O-ring
79	Inboard Bellows Assembly
79.1	Outboard Bellows Assembly
99	Rotating Face Support
103	Setting Device
111	Snap Ring
183	Vibration Dampener
183.1	Bellows Vibration Dampener

Part references in this document are denoted in square parenthesis, e.g. [79]

**Refer to the Bill of Material** for proper placement of material-specific components.

*Notes for sizes ≤ 2.750 inch (70 mm):*

- Inboard and outboard bellows assemblies [79] and [79.1] are interchangeable.
- Inboard and outboard stationary faces [14] are interchangeable.
- O-rings [76.1], [13.1], [76] and [13] are interchangeable.

*Notes for sizes > 2.750 inch (70 mm):*

- Inboard and outboard bellows assemblies [79] and [79.1] are interchangeable.
- Inboard and outboard stationary faces [14] and [14.1] are **not** interchangeable.
- O-rings [76.1] and [76] are interchangeable.
- O-rings [13.1] and [13] are interchangeable.

## 2 Disassembly

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When disassembling the seal, inspect for conditions which may have caused the seal to be removed from service. If seal was removed due to premature failure, determine what conditions caused that failure and correct any problems prior to returning the repaired seal to service. For assistance with seal failure analysis, please contact your Flowserve representative.

## 3 Repair or Replace Guide

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### *Seal parts that are always replaced*

- Inboard and outboard bellows assemblies [79] and [79.1]
- Inboard and outboard stationary faces [14] and [14.1]
- All O-rings [19], [18.1], [76], [76.1], [14], [14.1] and [71]
- Gland gasket [18]
- Vibration dampeners [183.1]
- Bellows vibration dampeners [183]
- Snap ring [111]
- Setting devices [103] and cap screws [40]
- Cup-point [57] and quarter-dog set screws [57.1]
- Square-headed pin [5]
- Drive pin [5.1]

### *Seal parts that are reconditionable*

- Inner gland [11]
- Outer gland [11.1]
- Sleeve assembly [1]
- Rotating face support [99]
- Drive collar [58]

## 4 Inspection and Reconditioning

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There are certain critical areas of each part where special attention should be paid to the condition. If any of the listed areas show signs of wear, corrosion, or other defects that cannot be removed without affecting the dimensional size of the surfaces by more than 0.001 - 0.002 inch (0.025 - 0.05 mm), then the respective part should be replaced. If grit blasting is performed, polish the O-ring surfaces to achieve the required surface finish (see critical area listings for finish requirements). If any parts require machining to correct damage, please contact your Flowserve representative for dimensional requirements, or for any other questions regarding repair.

4.1 **Outer gland assembly** [11.1] see Figures 2a and 2b.

- A** Stationary face O-ring surfaces - Inspect for wear, nicks, scratches or corrosion. Required surface finish: 63 RMS
- B** Gasket surface - Remove the old gasket and clean the gasket surface. Inspect for nicks, scratches or corrosion.
- C** Pipe ports and lifting holes - Inspect for damaged threads or corrosion. Re-tap as necessary.
- D** Drive flats (sizes  $\leq 2.750$  inch, 70 mm) - Inspect for wear or corrosion.

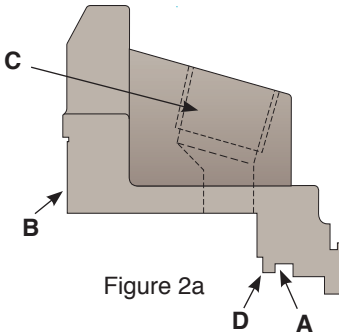


Figure 2a

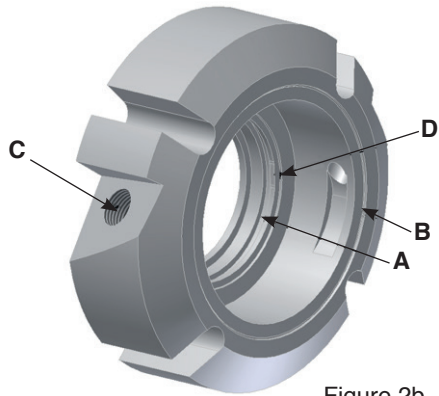


Figure 2b

4.2 **Sleeve assembly** [1] see Figures 3 and 4.

- A** O-ring surfaces - Inspect for wear, nicks, scratches or corrosion. Required surface finish: 63 RMS.
- B** Drive flats or drive pin - Inspect for wear or corrosion. Replace pins as necessary.
- C** Drive end roundness - No greater than 0.001 inch (0.025 mm) TIR (Total Indicated Reading) at point C.
- D** Inspect ID of sleeve at weld point for corrosion.

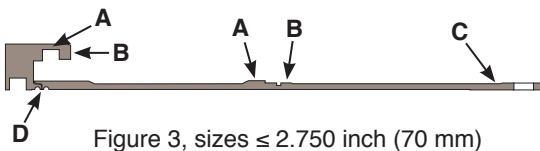
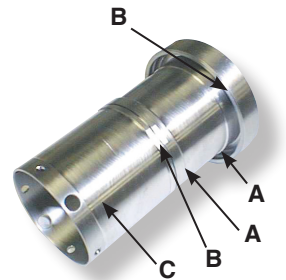


Figure 3, sizes  $\leq 2.750$  inch (70 mm)



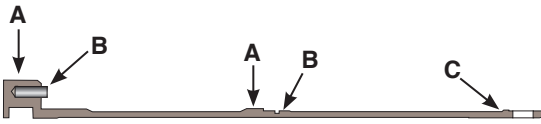
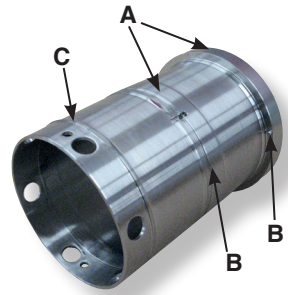


Figure 4, sizes > 2.750 inch (70 mm)



4.3 **Inner gland** [11] see Figures 5 and 6.

- A** O-ring surfaces - Inspect for wear, nicks, scratches or corrosion. Required surface finish: 63 RMS
- B** Gasket surface - Remove old gasket and clean surface. Inspect for nicks, scratches or corrosion.
- C** Drive flats - Inspect for damage, wear or corrosion.

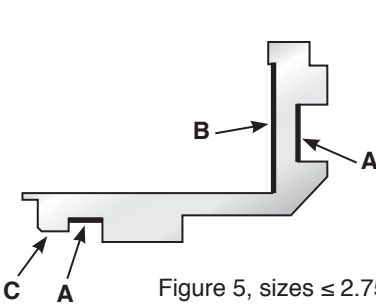


Figure 5, sizes ≤ 2.750 inch (70 mm)

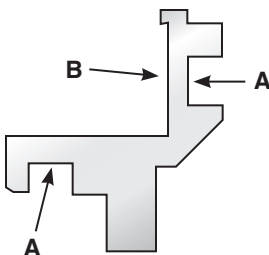
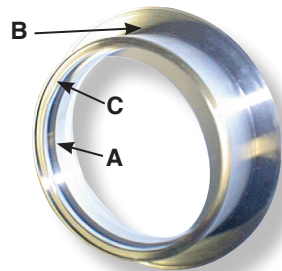
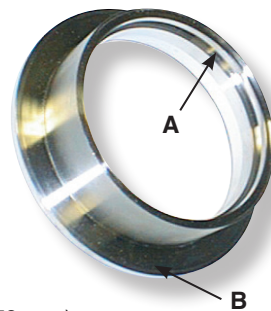


Figure 6, sizes > 2.750 inch (70 mm)



4.4 **Rotating face support** [99] see Figures 7 and 8.

- A** O-ring surfaces - Inspect for wear, nicks, scratches or corrosion. Required surface finish: 63 RMS.
- B** Pumping vanes - Inspect for wear, damage or corrosion.
- C** Drive flats or pin - Inspect for wear, indentation or corrosion.

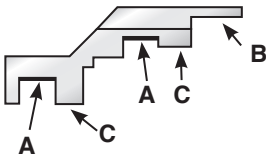


Figure 7, sizes  $\leq 2.750$  inch (70 mm)

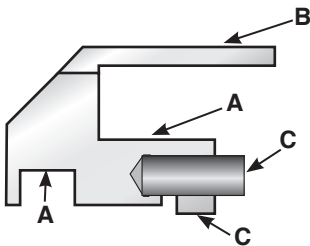
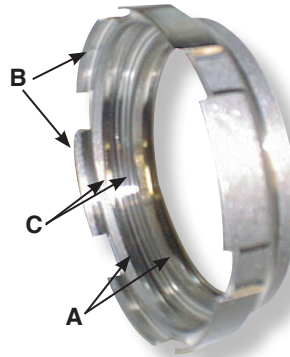
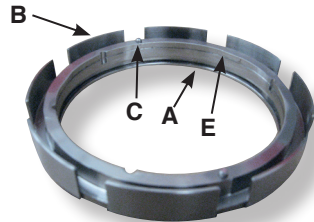


Figure 8, sizes  $> 2.750$  inch (70 mm)



4.5 **Drive collar** [58] see Figure 9.

- A** Threaded holes - Inspect for thread damage and re-tap as necessary.
- B** ID bore roundness - No greater than 0.002 inch (0.05 mm) TIR.
- C** Set screws - Replace cup-point and quarter-dog set screws with those included with the repair kit. Make sure the same threaded holes are used.

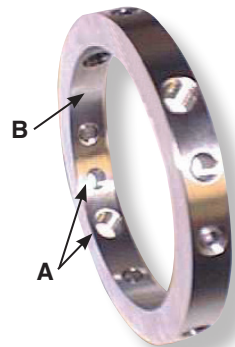


Figure 9

## 5 Seal Assembly Preparation

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### Tools Needed:

- Sizes  $\leq 2.750$ " : 3/16", 1/8" hex key wrenches
- Sizes  $> 2.750$ " : 1/8", 3/16" and/or 7/32" hex key wrenches
- Sizes  $\leq 65$  mm : 3 mm hex key wrench
- Sizes  $> 65$  mm : 5 mm hex key wrench for standard bore
- Sizes  $> 65$  mm : 6 mm hex key wrench for enlarged bore
- Silicone grease (included in repair kit)
- Ethyl alcohol and clean, lint-free towel for cleaning seal faces
- Needle nose pliers or tweezers

## 6 Seal Assembly Instructions

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Some assembly steps include blind fits of pins and drive flats. Mark the locations of the pins or drive flats with a felt tip marker, or align the feature with another visible feature on the seal to assist with assembly. All seal faces should be cleaned with ethyl alcohol prior to placing the faces together at each respective step in the assembly process.

6.1 Arrange all O-rings by diametrical size. For most seals there are four sizes total: quantity 1 of the largest size O-ring [18.1], quantity 4 of the 2nd largest size O-rings [14], [14.1], [76] and [76.1], quantity 1 of the 2nd smallest size O-ring [19] and quantity 1 of the smallest size O-ring [71]. If the seal has six different size O-rings, the 3rd smallest size [76] and [76.1] has quantity 2. Prior to installing each O-ring at its respective step, lightly lubricate with silicone grease and stretch slightly.

6.2 Place sleeve assembly [1] on a flat surface with the drive end (set screw holes) positioned upward.

*For sizes  $\leq 2.750$  inch (70 mm) install the bellows vibration dampener [183] into the back counterbore of the sleeve assembly and place inboard bellows O-ring [76] in the groove behind the drive ring in the sleeve. See Figure 10.*



Figure 10

*For sizes  $> 2.750$  inch (70 mm) install the O-ring [76] into the bellows assembly. See Figure 11.*



Figure 11

6.3 *For sizes  $\leq 2.750$  inch (70 mm) align the 2 flats on the inboard bellows assembly [79] with the 2 flats on the inside of the drive ring in the sleeve end housing, and press the*

bellows assembly into place using finger pressure only. See Figure 12.

*For sizes > 2.750 inch (70 mm) align the drive pin on the sleeve with the drive slot on the bellows assembly and press the bellows assembly into place using finger pressure only.*

**Caution:** Do not over-compress the bellows assembly.



Figure 12

- 6.4 Clean the sealing face of the bellows assembly [79] to remove any dirt, dust, fingerprints, grease or any other residue using alcohol on a clean cloth or tissue.



Figure 13

- 6.5 Place the inboard stationary face O-ring [13] into the inner gland [11]. See Figure 13.

- 6.6 *For sizes  $\leq 2.750$  inch (70 mm)* install the vibration dampener [183.1] onto the inner gland surface where the stationary face [14] will be installed. See Figure 14.

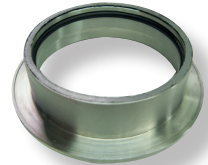


Figure 14

*For sizes > 2.750 inch (70 mm)* install the square-headed pin [5] into the hole on the inner gland where the stationary face [14] will be located. Cut a 0.250 inch (6 mm) slot in the vibration dampener [183]. See Figure 15. Install onto the inner gland surface where the stationary face will be installed with the slot positioned where the drive pin is located.

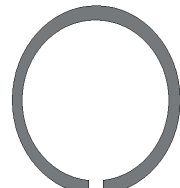


Figure 15

- 6.7 *For sizes  $\leq 2.750$  inch (70 mm)* align the flats on the inboard stationary face [14] with the flats on the inside of the inner gland [11], and press the stationary face in place using finger pressure only. See Figure 16.

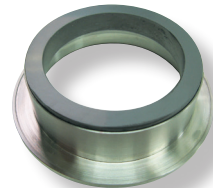


Figure 16

*For sizes > 2.750 inch (70 mm)* ensure that the slot on the stationary face [14] and the square-headed pin [5] are aligned and install into the inner gland [11] using finger pressure only.

- 6.8 Clean the sealing face of the stationary face [14] to remove any dirt, dust, finger prints, grease or any other residue using ethyl alcohol on a clean cloth or tissue.

- 6.9 Place the inner gland assembly face down onto the sleeve assembly. See Figure 17.



Figure 17



6.10 Install the inner gland O-ring [18.1] into the groove on the inner gland. See Figure 18.



Figure 18

6.11 Place the rotating face support O-ring [71] in the smallest diameter groove of the rotating face support [99]. See Figure 19.



Figure 19

6.12 *For sizes  $\leq 2.750$  inch (70 mm)* place the outboard bellows O-ring [76.1] in the O-ring surface of the rotating face support, which is behind the surface with two drive flats. See Figure 20.



Figure 20

6.13 Align the flats on the rotating face support with the flats on the sleeve and slide the rotating face support onto the sleeve with the pumping vanes facing up. See Figure 21.



Figure 21

6.14 *For sizes  $\leq 2.750$  inch (70 mm)* install the snap ring [111] onto the sleeve assembly into the sleeve groove beneath the rotating face support.

**Note:** Fully seating the rotating face support [99] on the sleeve assembly [1] will require compressing the bellows assembly [79] of the inner seal by pressing down on the inner gland [11.1]. Make sure the snap ring is fully engaged in the groove in the sleeve. See Figure 22.



Figure 21

*For sizes  $> 2.750$  inch (70 mm)* rotate the rotating face support [99] to align the slots on the sleeve with the slots on the inner diameter of the rotating face support. Once the slots are aligned to form a hole, insert the straight pins [5.1]. See Figure 23.



Figure 22

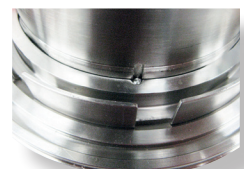


Figure 23

6.15 For sizes  $\leq 2.750$  inch (70 mm) insert the bellows vibration dampener [183] into the rotating face support. Make sure that the vibration dampener is fully seated at the bottom of the rotating face support. See Figure 24.



Figure 24

6.16 Repeat steps 6.3 through 6.6 to assemble the outboard bellows assembly [79.1] into the sleeve/rotating face support assembly and outboard stationary face O-ring [13.1], outboard vibration dampeners [183.1] and [183] and outboard stationary face [14.1] into the outer gland assembly [11.1].

6.17 Place the outer gland assembly face down onto the sleeve assembly. See Figure 25.

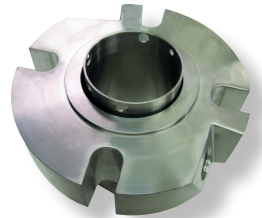


Figure 25

6.18 Thread set screws and quarter-dog set screws in proper, equally spaced locations in drive collar [58].

**Note:** Some sizes  $> 2.750$  inch (70 mm) do not utilize quarter-dog set screws.

6.19 Install the drive collar [58] onto the sleeve assembly [1]. The drive collar may need to be rotated so that the set screws [57] line up with the large holes and quarter-dog set screws [57.1] line up with the two smaller holes.



Figure 26

6.20 Install the setting devices [103] and cap screws [40] into the collar, engaging in the gland [11]. See Figure 26.

6.21 Compress the collar to be even with the end of the sleeve assembly. This will also compress the gland and inner gland simultaneously. While holding the collar in compression, tighten the quarter-dog set screws [57.1] into the holes in the sleeve until snug. If the seal does not contain quarter-dog set screws then tighten the set screws [57] into the sleeve [1]. See Figure 27.

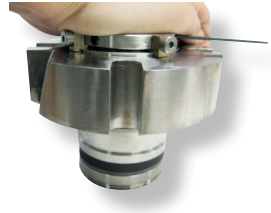


Figure 27

**Caution:** Over tightening will cause distortion of the sleeve assembly [1]. Check integrity of the sleeve with a plug of the appropriate size to ensure no distortion has occurred.

6.22 Install the sleeve O-ring [19] into the ID groove of the sleeve assembly. See Figure 28.



Figure 28

6.23 The cartridge seal assembly is now ready for testing.

6.24 Adhere the gland gasket [18] to the inner gland gasket surface with a spray adhesive such as 3M Super 77®. See Figure 29.

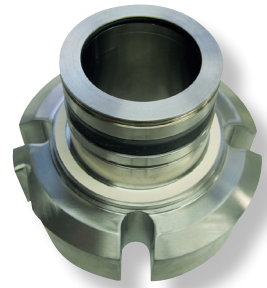


Figure 29

6.25 Permanently mark the seal type ISC2-BB, seal size and gland ring material clearly on the gland surface. See Figure 1 for placement location.

**ISC2-BB**  
**1.875**  
**316 SS**

Example  
inch  
marking

**ISC2-BB**  
**M060**  
**C-276**

Example  
metric  
marking



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## 7 Static Testing

The ISC2 single rotating bellows seal may be static tested at pressures up to 200 psi (13.7 bar) prior to installation on the equipment. Flowserve manufacturing typically tests the ISC2 at 25 psig (1.7 bar). To static test the seal, bolt it to a single seal test barrel or to the equipment. Secure the cup-point set screws to the stub shaft or equipment shaft to prevent deformation of the setting devices due to axial loads. The seal can be pressurized through the tangential flush port. If the seal does not pass, according to QP-B.28, the static pressure test, disassemble the seal and inspect for O-ring damage, as this is the most common cause of static test failure.

## 8 Installation

For installation instructions, reference FIS190eng ISC2 Series.

FIS194eng REV 09/2018 Printed in USA

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