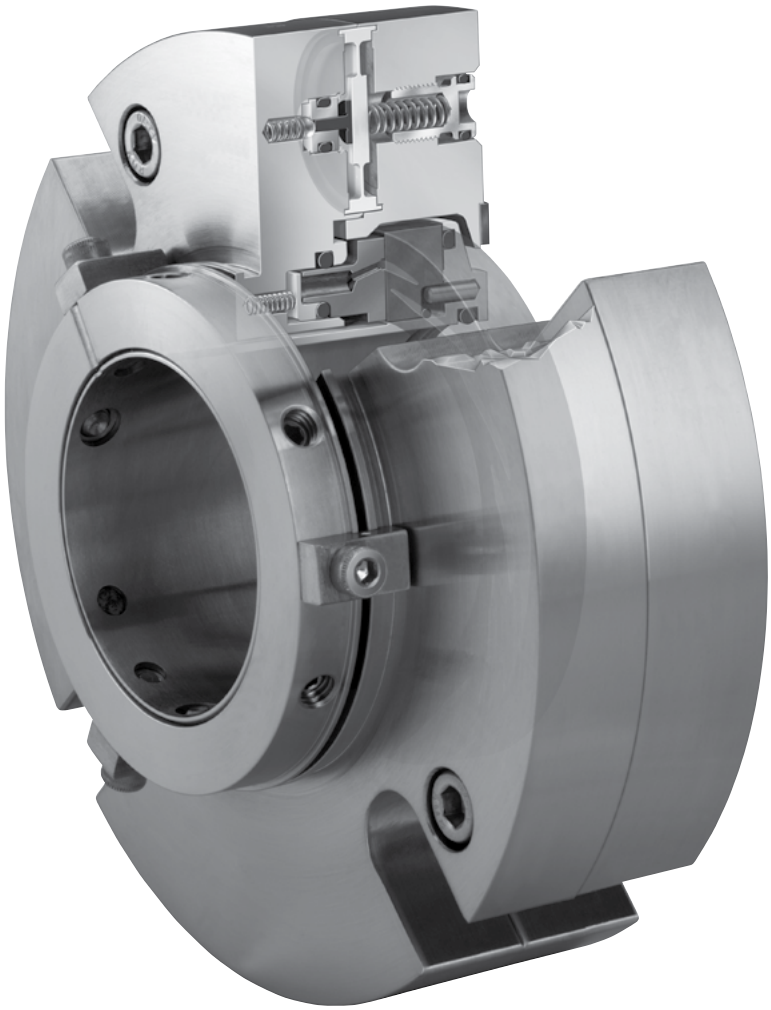
4400H TwinHybrid™ Gas Seal

Installation, Operation and Rebuild Instructions



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Seal Data Reference

(Insert seal and equipment data here for future reference)

ITEM # _____

SEAL _____

(Example: 4400H – 50 mm SSC/CB/FKM/S)

INSTALLATION DATE _____

1.0 CAUTIONS

These instructions are general in nature. It is assumed that the installer is familiar with seals and certainly with the requirements of their plant for the successful use of mechanical seals. If in doubt, get assistance from someone in the plant who is familiar with seals or delay the installation until a seal representative is available. All necessary auxiliary arrangements for successful operation (heating, cooling, flushing) as well as safety devices must be employed. These decisions are to be made by the user. The decision to use this seal or any other Chesterton seal in a particular service is the customer's responsibility.

Do not touch the mechanical seal for any reason while it is operating. Lockout or uncouple the driver prior to personal contact with the seal. Do not touch the mechanical seal while it is in contact with hot or cold fluids. Ensure that all the mechanical seal materials are compatible with the process fluid. This will prevent possible personal injury.

2.0 TRANSPORT AND STORAGE

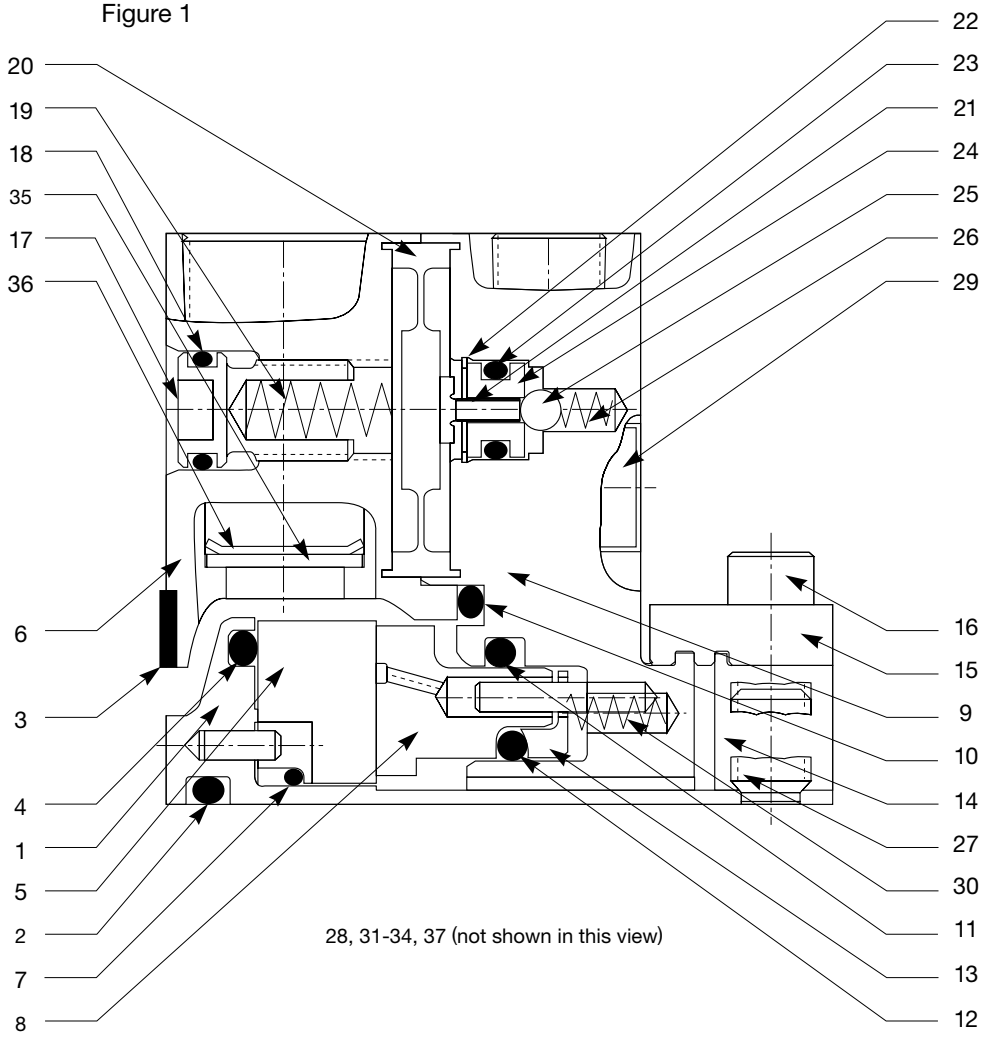
Transport and store seals in their original packaging. Mechanical seals contain components that may be subject to alteration and ageing. It is therefore important to observe the following conditions for storage:

- Dust free environment
- Moderately ventilated at room temperature
- Avoid exposure to direct sunlight and heat.
- For elastomers, storage conditions according to ISO 2230 should be observed.

3.0 DESCRIPTION

3.1 Parts Identification

Figure 1



KEY

1 – Sleeve Assembly
2 – Shaft O-Ring
3 – Gasket
4 – Rotary O-Ring
5 – Rotary Seal Ring
6 – Adapter
7 – Rotary Cushion O-Ring
8 – Stationary Seal Ring
9 – Gland
10 – Inter Gland O-Ring
11 – OD Stationary O-Ring
12 – ID Stationary O-Ring
13 – Pusher Plate
14 – Lock Ring
15 – Centering Clip
16 – Socket Head Cap Screw
17 – Adjusting Screw
18 – Screw O-Ring
19 – Inboard Spring
20 – Diaphragm
21 – Actuator
22 – Snap Ring
23 – Seat O-Ring
24 – Seat
25 – Ball
26 – Outboard Spring
27 – Dog Point Set Screw
28 – Cup Point Set Screw
29 – Gland Screws
30 – Spring
31 – 1/4" Pipe Plug
32 – 1/8" Pipe Plug
33 – 3/8" Pipe Plug
34 – Cap Plug
35 – Filter Disk
36 – Retaining Clip
37 – Support Gasket

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3.2 Operating Parameters*

Speed Limits:

25 m/s (5000 fpm) Maximum

1,3 m/s (250 fpm) Minimum

Pressure Limits:

710 Torr (28" Hg) to 20 bar g (300 psig)
25 mm – 65 mm (1.000" -2.625")

510 Torr (20" Hg) to 17 bar g (250 psig)
70 mm – 90 mm (2.750" – 3.625")

Temperature Limits:

To 260°C (500°F) Maximum (elastomers)

** Consult Chesterton Mechanical Seal Application Engineering for higher operating conditions.*

3.3 Standard Materials

Faces:

Carbon Stationary Seal Ring

Sintered Silicon Carbide Rotary Seal Ring

Elestomers:

FKM, EPDM, FEPM, FFKM

Metal Parts:

316SS body

Alloy C-276 springs and drive pins

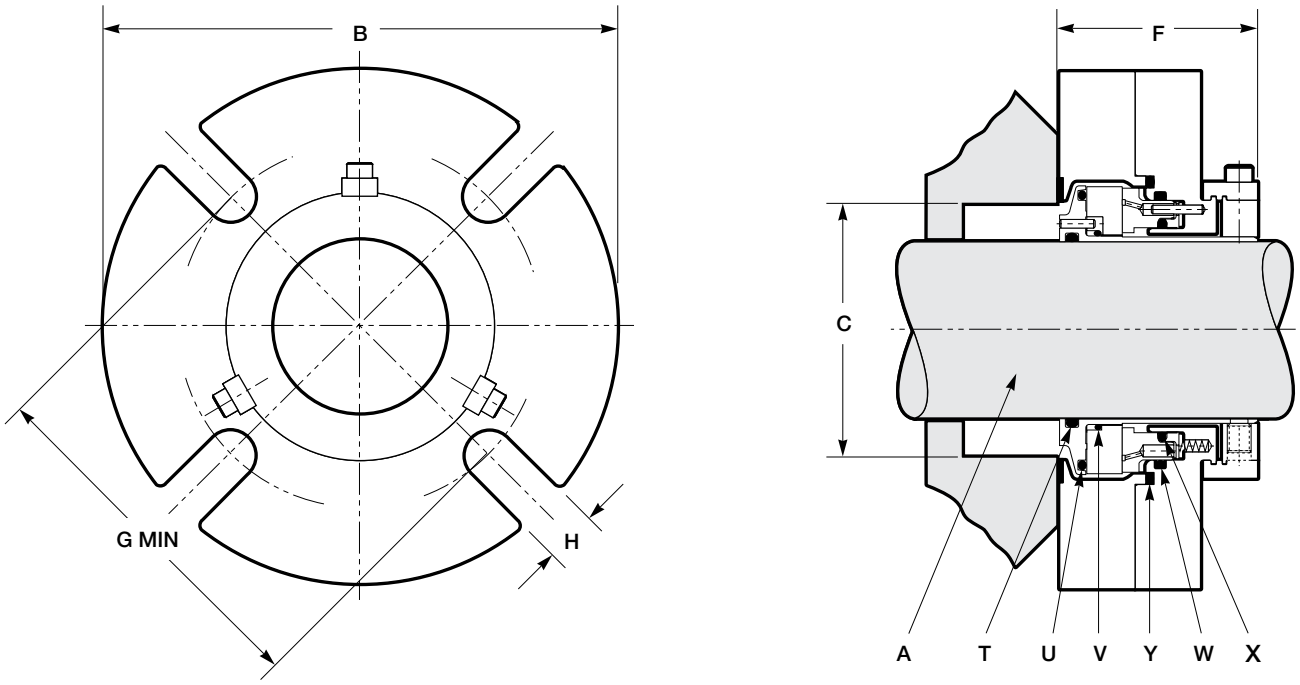
Hardened set screws (standard)

3.4 Intended Use

The mechanical seal is specifically designed for the intended application and is to be operated within the operating parameters as specified. For use beyond the intended application and/or outside the operating parameters, consult Chesterton Mechanical Seal Application Engineering to confirm the suitability of the mechanical seal prior to putting the mechanical seal in operation.

3.5 Dimensional Data (Drawings)

Figure 2



KEY (chart)

A – Shaft Size
B – Maximum Gland Diameter
C – Stuffing Box Inside Diameter
F – Outboard Seal Length
G – Maximum Bolt Circle by Bolt Size
H – Slot Width
T – Shaft O-Ring
U – Rotary Seal O-Ring
V – Rotary Cushion O-Ring
W – Stationary Seal O-Ring (outside diameter)
X – Stationary Seal O-Ring (inside diameter)
Y – Gland Adaqpter O-Ring

3.5 Dimensional Data (cont.) – Table 1

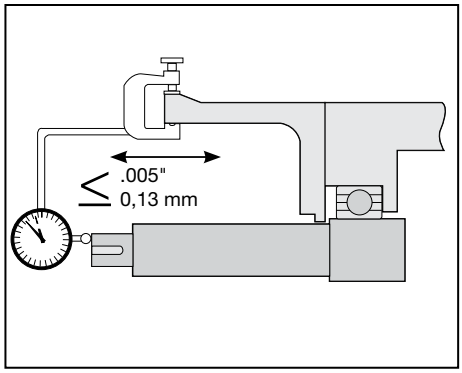
METRIC - Millimeters

SEAL SIZE	SHAFT SIZE	GLAND OD	STUFFING BOX BORE	OB LENGTH	BY BOLT CIRCLE				SLOT WIDTH	O-RINGS					
										SHAFT	ROTARY	CUSHION	STAT. OD	STAT. ID	GLAND ADPT.
	A	B	C	F	G MIN				H	T	U	V	W	X	Y
		MAX	MAX	MAX	10 mm	12 mm	16 mm	20 mm							
25 mm	25	102	52	54	73				11	-120	-134	-024	-134	-124	-139
28 mm	28	102	52	54	76				11	-122	-136	-026	-136	-126	-141
30 mm	30	102	58	54	80				11	-123	-138	-028	-138	-128	-143
32 mm	32	111	62	54	83	85			14	-124	-140	-029	-140	-130	-145
35 mm	35	111	62	54	83	85			14	-126	-140	-029	-140	-130	-145
38 mm	38	114	67	54	86	88			14	-128	-142	-030	-142	-132	-147
40 mm	40	127	69	54	89	91			14	-129	-144	-031	-144	-134	-149
43 mm	43	139	72	54	92	94			14	-131	-146	-032	-146	-136	-150
45 mm	45	139	75	54	95	97			14	-133	-148	-033	-148	-138	-151
48 mm	48	139	82	54	101	103			14	-134	-150	-034	-150	-140	-152
50 mm	50	139	82	54	101	103			14	-136	-150	-034	-150	-140	-152
55 mm	55	152	91	54	111	113	117		18	-139	-151	-036	-152	-144	-153
60 mm	60	152	92	54	112	114	118		18	-142	-152	-037	-152	-146	-153
65 mm	65	164	103	57	123	125	129		18	-145	-153	-040	-154	-151	-155
70 mm	70	196	113	64		135	139		18	-232	-242	-151	-242	-235	-246
75 mm	75	202	119	64		141	145		18	-234	-244	-152	-244	-237	-248
80 mm	80	208	125	64		149	152		18	-236	-246	-153	-246	-239	-250
85 mm	85	211	129	64		151	155	159	21	-237	-247	-153	-247	-240	-251
90 mm	90	216	135	64		158	162	166	21	-239	-249	-154	-249	-242	-253

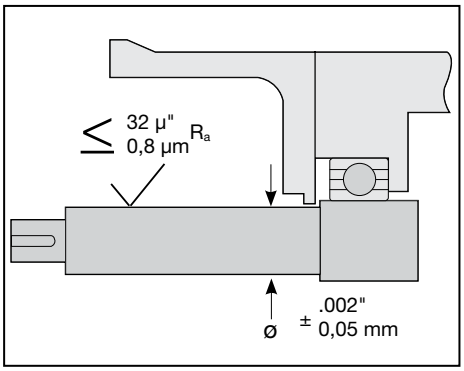
INCH

DASH NO.	SHAFT SIZE	GLAND OD	STUFFING BOX BORE	OB LENGTH	BY BOLT CIRCLE				SLOT WIDTH	O-RINGS					
										SHAFT	ROTARY	CUSHION	STAT. OD	STAT. ID	GLAND ADPT.
	A	B	C	F	G MIN				H	T	U	V	W	X	Y
		MAX	MAX	MAX	3/8"	1/2"	5/8"	3/4"							
-8	1.000	4.000	2.03	2.125	2.86				.44	-120	-134	-024	-134	-124	-139
-9	1.125	4.000	2.06	2.125	2.99				.44	-122	-136	-026	-136	-126	-141
-10	1.25	4.000	2.29	2.125	3.11				.44	-124	-138	-028	-138	-128	-143
-11	1.375	4.360	2.45	2.125	3.24	3.36			.57	-126	-140	-029	-140	-130	-145
-11 OS	1.375	5.385	3.27	2.125	3.98	4.11			.44	-126	-140	-029	-140	-130	-150
-12	1.500	4.485	2.65	2.125	3.36	3.49			.57	-128	-142	-030	-142	-132	-147
-13	1.625	4.985	2.71	2.125	3.49	3.61			.57	-130	-144	-031	-144	-134	-149
-14	1.750	5.485	2.83	2.125	3.61	3.74			.57	-132	-146	-032	-146	-136	-150
-14 OS	1.750	6.635	3.90	2.125	5.36	5.48	5.61		.57	-132	-146	-032	-146	-136	-153
-15	1.875	5.485	2.96	2.125	3.74	3.86			.57	-134	-148	-033	-148	-138	-151
-15 OS	1.875	5.985	3.96	2.125	4.86	4.98	5.11		.57	-134	-148	-033	-148	-138	-153
-16	2.000	5.485	3.21	2.125	3.97	4.10			.57	-136	-150	-034	-150	-140	-152
-17	2.125	5.985	3.46	2.125	4.22	4.34	4.47		.69	-138	-151	-035	-151	-142	-152
-17 OS	2.125	6.985	4.40	2.125	5.74	5.86	5.99		.69	-138	-151	-035	-151	-142	-154
-18	2.250	5.985	3.58	2.125	4.35	4.48	4.60		.69	-140	-151	-036	-152	-144	-153
-19	2.375	5.985	3.61	2.125	4.41	4.53	4.66		.69	-142	-152	-037	-152	-146	-153
-20	2.500	6.485	3.83	2.125	4.59	4.72	4.84		.69	-144	-152	-038	-153	-148	-154
-20 OS	2.500	7.760	5.40	2.125	6.49	6.61	6.74		.69	-144	-152	-038	-153	-148	-157
-21	2.625	6.445	4.06	2.227	4.85	4.98	5.10		.69	-146	-153	-040	-154	-151	-155
-21 OS	2.625	6.980	4.92	2.227	5.73	5.86	5.98		.69	-146	-153	-040	-154	-151	-157
-22	2.750	7.710	4.46	2.500		5.37	5.50		.69	-232	-242	-151	-242	-235	-246
-23	2.875	7.830	4.59	2.500		5.47	5.60		.69	-233	-243	-151	-243	-236	-247
-24	3.000	7.940	4.71	2.500		5.60	5.73		.69	-234	-244	-152	-244	-237	-248
-25	3.125	7.990	4.84	2.500		5.75	5.87		.69	-235	-245	-152	-245	-238	-249
-26	3.250	8.190	4.96	2.500		5.87	6.01		.69	-236	-246	-153	-246	-239	-250
-27	3.375	8.310	5.09	2.500		5.97	6.10	6.22	.81	-237	-247	-153	-247	-240	-251
-28	3.500	8.440	5.21	2.500		6.14	6.25	6.38	.81	-238	-248	-154	-248	-241	-252
-29	3.625	8.490	5.34	2.500		6.27	6.38	6.52	.81	-239	-249	-154	-249	-242	-253

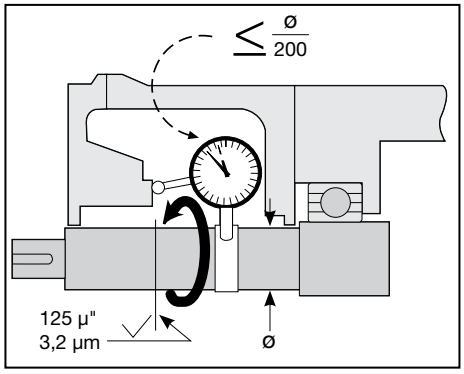
4.1 Equipment



1 If practical, place the dial indicator tip on the end of the shaft sleeve or on a step in the shaft to measure end play. Alternately push and pull the shaft in the axial direction. If the bearings are in good condition, end play should not exceed 0,13 mm (.005").

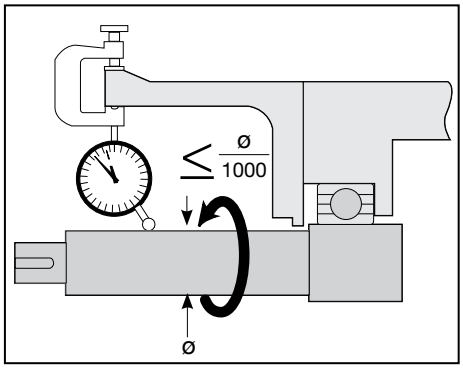


3 Remove all sharp corners, burrs, and scratches on the shaft, especially in areas where the O-Ring will slide, and polish if necessary to achieve a 0,8 micron (32 microinch) Ra finish. Make sure the shaft or sleeve diameter is within 0,05 mm (.002") of nominal.



2 If possible, attach a base dial indicator to the shaft and rotate both the indicator and shaft slowly while reading the runout of the stuffing box face. Misalignment of the stuffing box face relative to the shaft should not exceed 0,005 mm TIR per mm (.005 in per inch) of shaft diameter.

The stuffing box face must be flat and smooth enough to seal the gland. Surface roughness should be 3,2 microns (125 microinch) Ra maximum for gaskets and 0,8 micron (32 microinch) Ra for O-Rings. Steps between halves of split case pumps should be machined flat. Make sure the stuffing box is clean and clear along its entire length.



4 Use a dial indicator to measure the shaft runout in the area where the seal will be installed. Runout should not exceed 0,001 mm TIR per millimeter (.001 inch TIR per inch) of shaft diameter.

5 Protect the shaft O-Ring by lubricating the shaft with a clean silicone based lubricant, such as that provided with the seal.

6 ***Check availability of clean dry barrier gas.*** The seal uses gas (Nitrogen) to seal the product from the environment and lubricate the seal faces. 2,4 lpm (5 SCFH) of barrier gas must be available at 2 bar (30 psi) over the maximum stuffing box pressure and filtered to a maximum particle size of 3 microns with a dew point of <-29°C (-20°F). Alternate gas can be used for barrier gas supply if it is compatible with the product and the environment.

4.2 4400H TwinHybrid™ Gas Seal

1 Review seal packaging ensuring no damage or shortage has occurred to the contents.

2 Review the seal fit dimensions in Table 1 to ensure the equipment to be sealed has the required dimensions.

3 Record the seal Item Number and Name found on the label for referencing when contacting AW Chesterton Application Engineering.

4 Check the chemical listing to determine if the O-Rings installed in this seal are compatible with the fluids being sealed.

IMPORTANT:

5 ***Check the rotation of the pump and the rotation arrow on the gland OD (and/or gland face) ensuring both are the same direction.***

6 ***Make sure all set screws are engaged in the sleeve but do not protrude into the inside diameter of the seal sleeve.***

5.0 SEAL INSTALLATION

1 Slide the seal onto the shaft.

2 Reassemble the pump and make necessary shaft alignments and impeller adjustments. The impeller can be reset at any time, as long as the centering clips are in place and the seal set screws are loosened while the shaft is being moved.

3 The 1/4 dog point set screws (marked 1, 2, 3) go into the small holes in the sleeve. ***Do not disengage these screws from the sleeve when positioning the seal.***

4 The centering clips have been preset at the factory. If for any reason you loosen or remove the centering clip cap screws, re-tighten each cap screw finger tight (approximately 1,7 N-m [15 inch-pounds] of torque).

CAUTION:
Make sure the lip on the end of the gland is inside the inner centering clip groove and the lock ring lip engages the outer centering clip groove.

5 Orient the gas barrier supply and flush connections to the location required.

TABLE 2 – Gland Port Functions

"B"	Barrier Gas Supply
"F"	Flush - Environmental
"M"*	Monitor Port
"X"	Manufacturing Port (Do Not Use)

*Previously identified as "BG"

CAUTION:
All ports are plugged prior to shipping. These plugs prevent dirt and contaminants from entering the seal. When plugs are removed ensure that dirt, liquid and contamination, which could cause seal malfunction, do not enter the seal ports.

6 Tighten the stuffing box bolts evenly to the recommended torque value in TABLE 3.

**Stuffing box bolts vary per application. Actual torque required is based on bolt size and bolt manufacturers' recommended torque.

TABLE 3 – Recommended Torque Values

Seal Size	Dog Point & Cup Point Set Screws	Gland Screws	Stuffing Box Bolts**
up to 65 mm (up to 2.625")	5,7 - 6,8 N-m (50 - 60 in-lbf)	12,2 N-m (9 ft-lbf)	27 - 40 N-m (20 - 30 ft-lbf)
>65 mm up to 90 mm (>2.625" up to 3.625")	7,3 - 8,3 N-m (65 - 75 in-lbf)	12,2 N-m (9 ft-lbf)	34 - 48 N-m (25 - 35 ft-lbf)

IMPORTANT:
The stuffing box bolts must be tightened before tightening the set screws onto the shaft or seal port connections.

7 Tighten 1/4 dog point set screws (marked 1, 2, 3) in two steps: Step 1 – snug to finger tight; Step 2 - retighten 1/4 dog point set screws evenly with the hex key provided and to the recommended torque value in TABLE 3.

IMPORTANT:
All three 1/4 dog point set screws must be tightened FIRST.

8 Evenly tighten the cup point set screws (marked 4, 5, 6) to the shaft using recommended torque value in TABLE 3. If rotation of the lock ring is required for tightening set screw, loosen but do not remove centering clips.

IMPORTANT:
The cup point set screws installed in the lock ring are hardened steel and have metric threads: for 25 mm – 65 mm (1.000" thru 2.625") seals use a 3 mm hex key; for 70 mm – 90 mm (2.750" thru 3.625") seal use a 4 mm hex key. Stainless steel cup point set screws are provided in the seal accessory kit, which may be used for low pressure, non-hardened shaft/ shaft sleeve applications.

9 Remove socket head cap screws and centering clips from the lock ring and retain for later use.

10 Ensure that the gland is properly centered over the sleeve. To do this, turn the shaft toward the directional arrow by hand to ensure the seal turns freely. I metal to metal contact is detected within the seal it is improperly centered. Replace centering clips finger tight, loosen gland bolts, tighten clips, re-tighten gland bolts and remove clips. If metal to metal contact is still detected, check concentricity of the shaft to the stuffing box.

THE BARRIER GAS SUPPLY AND FLUSH CONNECTIONS ARE 1/4" NPT.

11 If a flush/recirculation port is required, remove the shipping plug and connect the pump discharge/ suction to the flush port marked "F" using a recirculation line (bleed from discharge [API Plan 11] or connected to suction [API Plan 13]). This is recommended in seal applications where the barrier gas supply may be disrupted during operation. This connection may also be used to monitor stuffing box pressure by installing a connection to a gauge or pressure transducer.

12 Connect the barrier gas supply port marked "B". Purge the barrier gas supply line from the barrier gas supply manifold or system. Prior to connecting to the seal port ensure the supply line is free of contamination, dirt and liquid and no burrs, restrictions or liquid legs are present. Full pressure barrier gas supply can be piped directly to the barrier supply port.

The seal In-Gland Control System (IGCS) will maintain a factory preset differential pressure between the barrier gas at the seal interface and the product pressure in the stuffing box.

13 All ports must either be connected to piping or have a metal pipe plug installed. Use Chesterton recommended PTFE tape to install piping or plugs.

It is recommended to monitor barrier gas pressure. Use the gauge port connection marked "M"* (located opposite the barrier gas supply port).

IMPORTANT:
All plastic shipping plugs must be replaced.

CAUTION:
Operation without sufficient barrier gas supply can cause a loss in seal performance or failure. The barrier gas supply must be on whenever the pump is pressurized or contains liquid product. The seal will regulate the usage of barrier gas; do not limit the flow by use of flow restrictors or valves.

6.0 COMMISSIONING / EQUIPMENT START UP

1. If possible, turn the shaft by hand to ensure free rotation with no shaft binding. A slight drag may be found due to the seal faces but the shaft should rotate freely.
2. Ensure the pump is primed and all piping connections are correctly fitted and fittings are leak-free. Fill and vent the equipment in accordance with the instructions of the equipment manufacturer. Ensure barrier gas is connected and available to the 4400H gas seal. Confirm correct shaft rotation direction for the installed seal.
3. Before starting the equipment, ensure all nuts and screws are securely fastened.
4. Take all necessary precautions and follow normal safety procedures before starting the equipment.

7.0 DECOMMISSIONING / EQUIPMENT SHUT DOWN

Ensure that the equipment is de-energized and de-pressurized. 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. Ensure that the pump is isolated and check that the stuffing box is drained from any fluid and pressure is fully released. Dismantle the equipment according to the equipment instruction manual and remove the seal in the reverse order to installation. In case of disposal, ensure the local regulations and requirement for disposal or recycling of the different components in the seal are adhered to.

8.0 SPARE PARTS

Use only Chesterton original spare parts. Use of non-original spare parts represents risk of failure, danger to persons/equipment and voids the product warranty.

Spare Parts Kit can be purchased from Chesterton, referencing the recorded seal data from cover page.

In Gland Control System Rebuild/Spare Parts Kit must be ordered separate from 4400H TwinHybrid™ Gas Seal Rebuild/Spare Parts Kit. Reference the recorded seal data from cover page when ordering IGCS Rebuild/Spare Parts Kit.

9.0 SEAL MAINTENANCE AND REBUILD

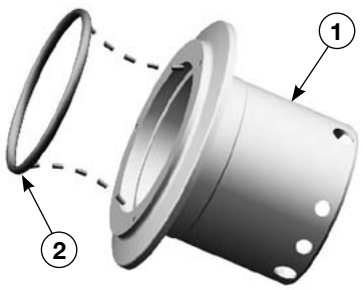
9.1 4400H Trouble Shooting

TABLE 4 – 4400H Trouble Shooting

Problem	Check IGCS Pressure Differential	Solution
High gas usage reading	If “M”* Monitor of Face Pressure - “F” Stuffing Box Pressure =	
	<2,4 bar (35 psi)	IGCS is dirty and cleaning or rebuild is required. IGCS may be purged through the “M” port via a quick actuation of a ¼ turn valve.
	>2,1 bar (30 psi)	Ensure seal is square to the pump shaft. Check barrier gas supply line downstream of flow meter for leaks. Check “M”* port and instrumentation for leaks. Plan to rebuild seal - most commonly an O-Ring issue.
Low gas usage reading	If “M”* pressure - “F” Stuffing Box pressure =	
	<1,2 bar (18 psi)	Restore Barrier gas pressure
	>1,5 bar (22 psi)	OK and ensure seal gland is not hot.
Product leaking out	If “B” Barrier gas pressure is:	
	>1,7 bar (25 psi) over “F” Stuffing Box pressure	Check shaft O-Ring, stuffing box gasket
	<1,4 bar (20 psi) over “F” Stuffing Box pressure	Restore Barrier gas pressure and dry out seal
Pump loses prime	Gas Usage is:	
	High	Vent stuffing box to lower pressure
	Normal	Operate to right of BEP

9.2 4400H TwinHybrid™ Gas Seal Rebuild Instructions

1



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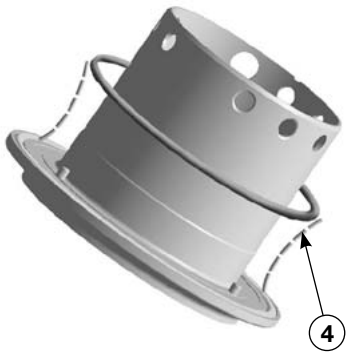

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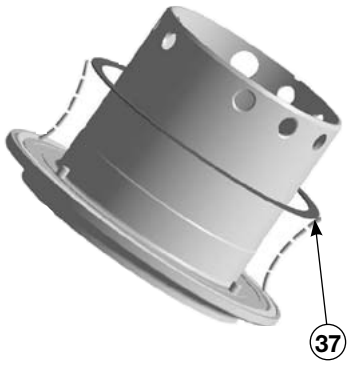

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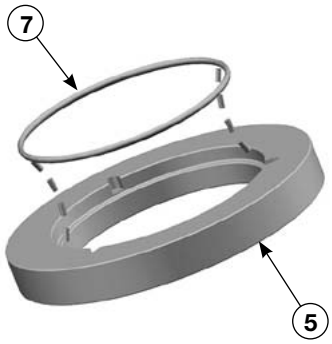

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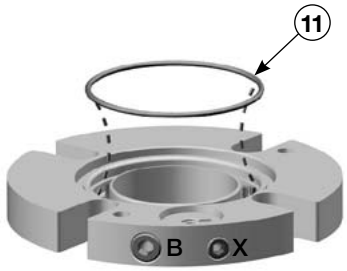

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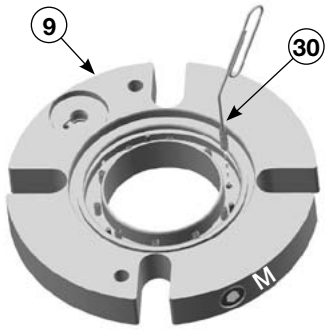

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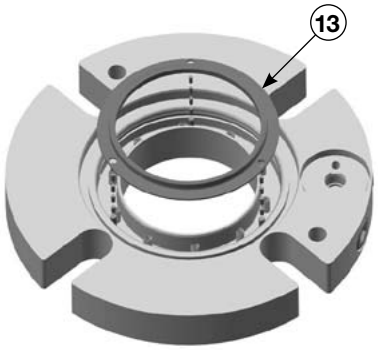

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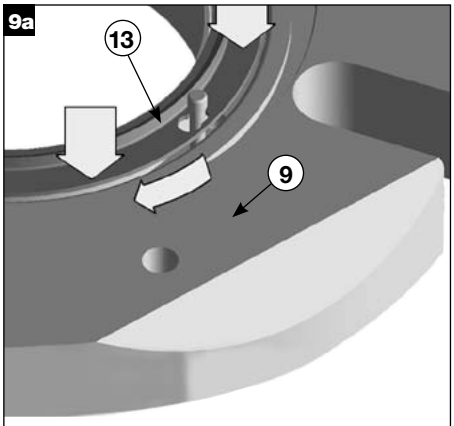

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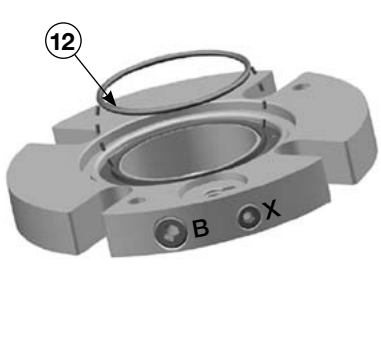

9.2 4400H TwinHybrid™ Gas Seal Rebuild Instructions (cont.)

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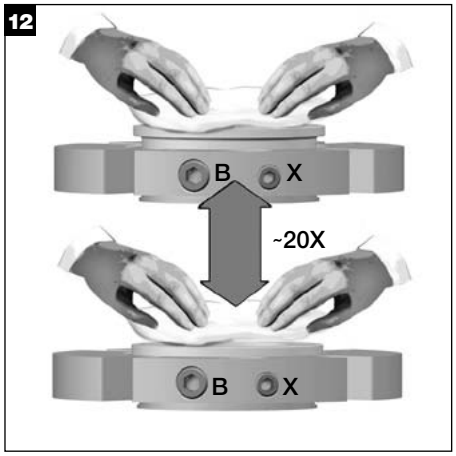

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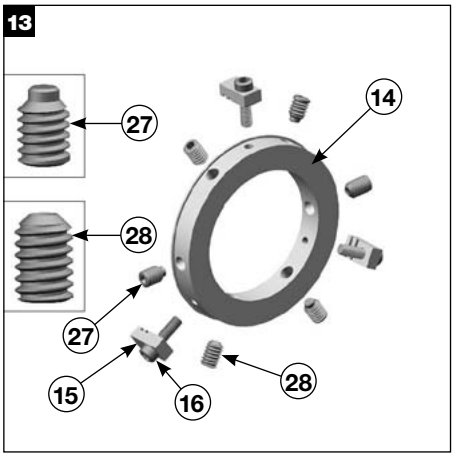

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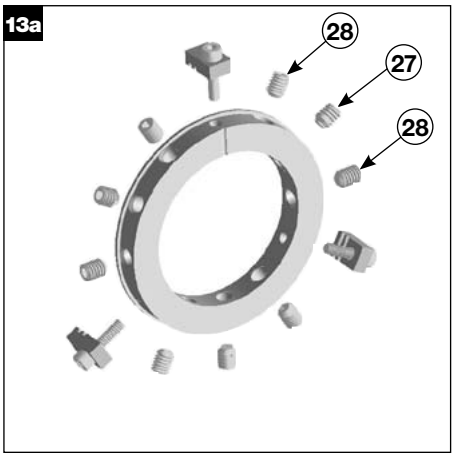

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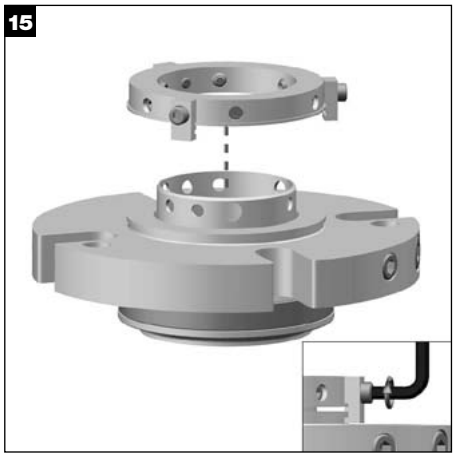

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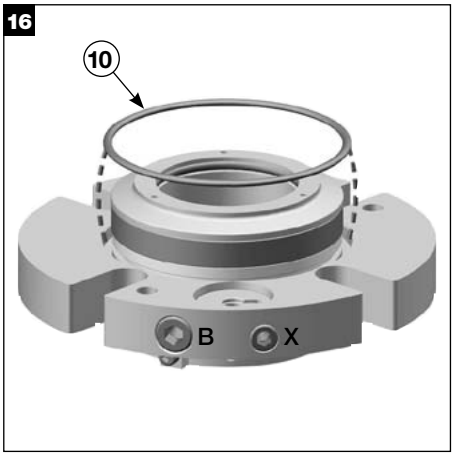

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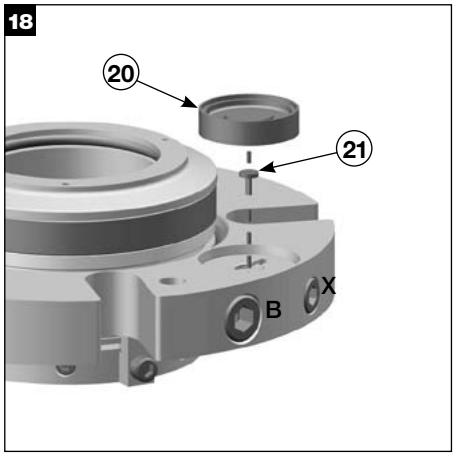

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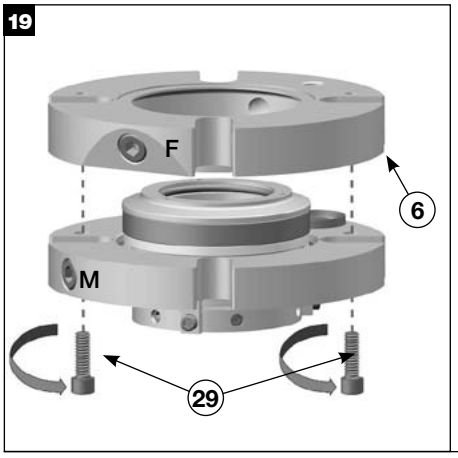

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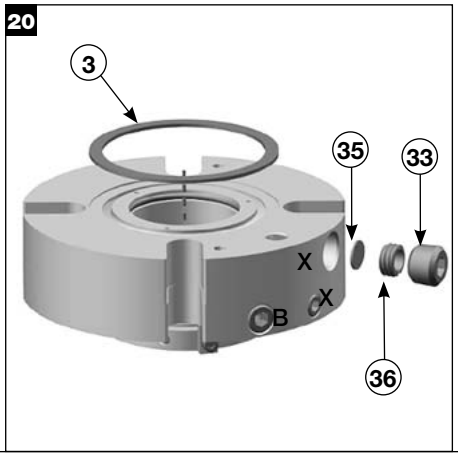

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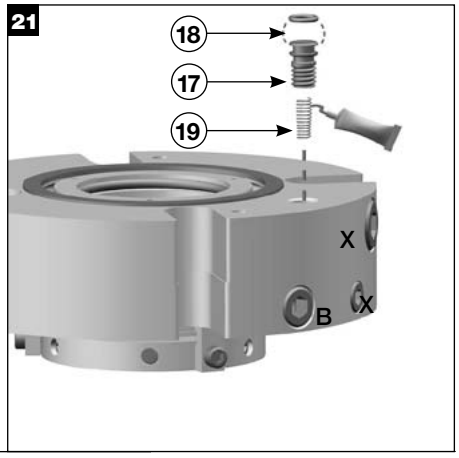

9.2 4400H TwinHybrid™ Gas Seal Rebuild Instructions (cont.)

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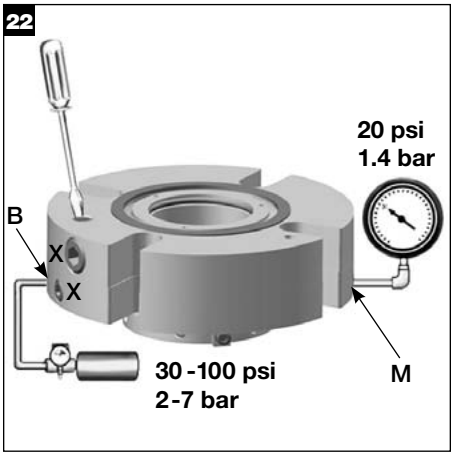

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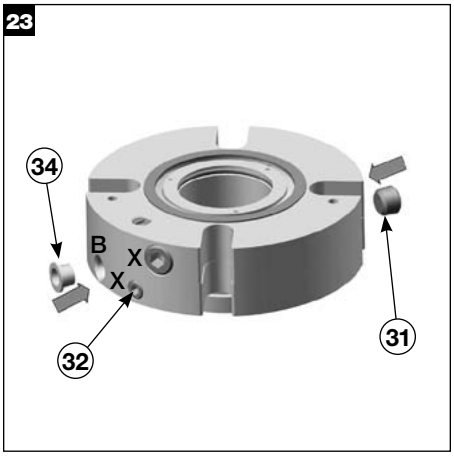

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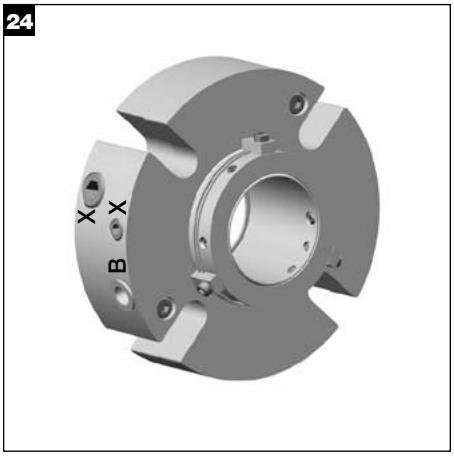

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