skoflo
Industries

Surface, Back Pressure Regulator
15000 psi

BPR15000D

Operations and
Maintenance Manual

DOC-04194 Rev B

Pioneering an Industry

Table of Contents

Table of Figures

Table of Tables

About SkoFlo

Our experience and track record speak for themselves. SkoFlo has delivered over 20,000 valves since 1988. We are the only company that proves our products by testing in surface applications before deploying them subsea. The result is that SkoFlo valves have amassed over 25 million continuous operating hours. This level of experience is unparalleled and provides the basis for being the solution provider to our served market.

SkoFlo Surface Back Pressure Regulator (BPR) is the industry leader in the oil and gas marketplace and regulating pump discharge pressure in chemical injection systems.

General Information

Product Overview

The BPR is designed to maintain a constant set pressure in pump discharge lines feeding the chemical injection system. As pressure rises in the pump discharge line, the BPR will maintain pressure levels at a Set Point while allowing the unused fluid to return to the chemical holding tank.

BPRs should be used in any pump discharge line where the pressure must remain at a constant level and unused fluid can be routed back to the fluid holding tank.

BPRs are not designed to be used as pressure safety devices.

BPRs provide a constant pressure to the system with continuous spill-off to the chemical tank that is independent of the flow rate. The BPR15000D has a maximum operating pressure of 15,000psi and supports flow ranges of 0 - 800 GPD and 100 - 2000 GPD.

Guidelines for Using this Manual

The following instructions are provided to ensure a safe and proper installation.

- Read all instructions prior to installation and operation of this product.
- Follow all warning and caution notes.
- Install this product as specified in the instructions provided by SkoFlo.
- Prior to use, educate personnel in the proper installation, operation, and maintenance of this product.
- Only use replacement parts specified by SkoFlo.

Warning, Caution, Notice

Throughout this manual there are steps and procedures which, if not followed, may result in a hazard. The following flags are used to identify the level of potential hazard.

! WARNING

WARNING IS USED TO INDICATE THE PRESENCE OF A HAZARD WHICH CAN CAUSE SEVERE INJURY, DEATH, OR SUBSTANTIAL PROPERTY DAMAGE IF THE WARNING IS IGNORED.

! CAUTION

CAUTION IS USED TO INDICATE THE PRESENCE OF A HAZARD WHICH CAN CAUSE INJURY OR PROPERTY DAMAGE IF THE WARNING IS IGNORED.

! NOTICE

NOTICE IS USED TO NOTIFY PEOPLE OF INSTALLATION, OPERATION, OR MAINTENANCE INFORMATION, WHICH IS IMPORTANT BUT NOT HAZARD RELATED.

Abbreviations and Acronyms

BOM	Bill Of Materials
BPR	Back Pressure Regulator
GA	General Assembly
GPD	Gallons Per Day
Kg/m	Kilograms per Meter
LPH	Liters Per Hour
NPT	National Pipe Thread
P/N	Part Number
psi	Pounds per Square Inch

Hydraulic Ratings

! WARNING

REFER TO THE GENERAL SECTION OF THE PRODUCT DATASHEET FOR DESIGN PRESSURE DETAILS.

Max Working Pressure: 15,000 psi (1034 bar)

Hydro-Pressure: 22,5000 psi (1551 bar)

Pressure range: 4,000 to 15,000 psi (276 to 1034 bar)

Flow Ranges:

- 0 to 800 GPD (0 to 126 LPH)
- 100 to 2000 GPD (16 to 315 LPH)

Storage

! NOTICE

IT IS RECOMMENDED TO STORE THE ASSEMBLIES IN THE SHIPPING CRATE, IF POSSIBLE.

The BPR15000D should be stored in a shelter and be protected from moisture and particulates. Storage temperatures shall be between –50°F and 158°F (–45°C and 70°C).

Any open hydraulic connections will be furnished with plastic blanking plugs.

It is important not to store the BPR15000D with production chemicals in the unit. These chemicals can settle, possibly resulting in damage to the unit. SkoFlo recommends that the valve be stored with a glycol-water mixture as the preservation fluid.

Installation

! WARNING

WEAR PROPER PERSONAL PROTECTIVE EQUIPMENT (PPE) AS REQUIRED BY SITE SAFETY PERSONNEL WHEN INSTALLING AND TESTING.

MAINTAIN SAFE WORKING DISTANCES AS DETERMINED BY SITE SAFETY PERSONNEL WHEN TESTING.

CONSULT SKOFLO IF ANY PRODUCT CONCERNS ARISE DURING HANDLING.

! WARNING

CHEMICAL COMPATIBILITY SHALL BE DONE AND CHECKED BEFORE USE, EXCEPT FOR MEG AND WATER MIXTURES.

! WARNING

THE BPR15000D SHALL NOT BE INSTALLED SUBSEA.

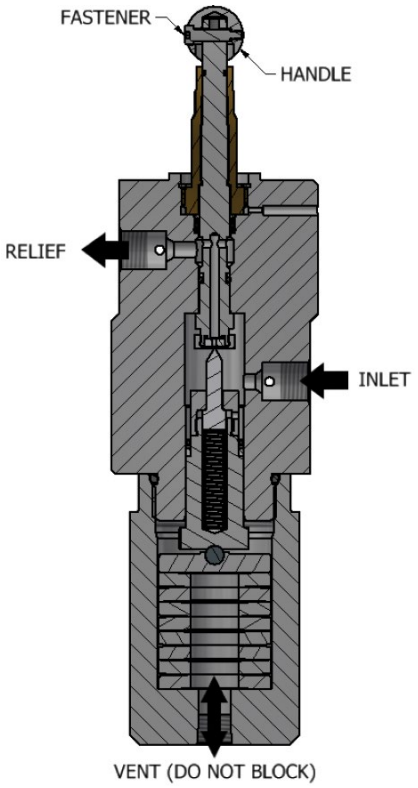


Figure 1 – Cross Section

1. Mounting

1.1 The BPR15000D can be panel mounted in any orientation. See Appendix B for more details.

1.2 If panel mounting, remove the handle fastener and then the handle. Mount the valve, then reinstall the handle and the fastener. See Figure 1. – *2mm Hex Key*

2. Hydraulic Installation

! CAUTION

THE VENT FROM THE SPRING CHAMBER MUST NOT BE BLOCKED. LEAVE OPEN TO ATMOSPHERE, OR ROUTE TO A DRAIN COLLECTION POINT AT ATMOSPHERIC PRESSURE. THIS VENT WILL ONLY HAVE FLUID IN THE EVENT OF A LEAKING PISTON SEAL.

! NOTICE

INSTALL RELIEF VALVE AND/OR BURST PLATE UPSTREAM OF THE SKOFLO BACK PRESSURE REGULATOR AS REQUIRED.

! NOTICE

INSTALL A PULSATION DAMPENER BETWEEN THE PUMP DISCHARGE AND THE SKOFLO BACK PRESSURE REGULATOR AS REQUIRED TO AVOID POSSIBLE DAMAGE AND NOISE FROM HARMONIC PULSATIONS.

Install the valve so that the flow is in the proper direction. The "INLET" and "RELIEF" connections are indicated in the general arrangement drawing in Appendix B. See Section 9 for hub installation. The connections offered include the following:

- 3/8" MP Autoclave
- 1/2" FKO

If the BPR15000D uses FKO hub connections, the hubs are shipped separately from the valve and will need to be installed in the inlet and outlet ports prior to use.

The tightening torque for the hubs is 90 ft-lb [122 Nm]. This torque value applies to all hub types.

The "VENT" connection is 1/4" NPT and may be routed to a drain or atmospheric container if desired. The "VENT" *must* remain free and unrestricted and should be visible.

Start Up Procedures

! WARNING

ENSURE THE BPR IS FULLY OPEN (TURN THE HANDLE COUNTER-CLOCKWISE) BEFORE SUPPLYING PRESSURE.

! CAUTION

DO NOT ADJUST THE VALVE FROM OPEN TO CLOSED POSITION UNLESS VALVE IS PRESSURIZED TO AVOID THE POSSIBILITY OF DISLODGING THE STEM SEAL.

2.1 Apply pressure to the BPR.

2.2 Turn the BPR pressure adjustment handle clockwise until the desired pressure is reached. Always start at a pressure below the set pressure and increase to the desired setting.

2.3 The BPR is now set, and further adjustments are not required.

3. Operation Notes and Warnings:

The SkoFlo BPR is not designed to provide complete "bubble-tight" shut off. Overtightening the handle will not further reduce flow. If the back pressure does not increase when turning the handle clockwise, see "Troubleshooting Improper Valve Performance".

! CAUTION

DO NOT FLOW BACKWARDS THROUGH THE SKOFLO VALVE. INTERNAL SEALS ARE DESIGNED FOR ONE DIRECTION ONLY AND COULD POSSIBLY BECOME DISLODGED.

MAINTENANCE

! WARNING

ANY SERVICE REPAIR SHALL BE PERFORMED BY TRAINED PERSONNEL.

! NOTICE

IF ANY ABNORMALITIES ARE FOUND THROUGHOUT THE MAINTENANCE, PLEASE REPORT TO THE RESPECTIVE ENGINEERS.

4. General

Spare kits available for typical maintenance items are listed in Table 1.

Table 1 – Recommended Spare Parts

ITEM	PART NUMBER
Complete Rebuild Kit	31829-15-X-X-XXXX-XX-XX
Seal Kit	31830-15-XXXX-XX
Stem Assembly Kit	31831-15-X-XXXX-XX-XX
Piston Assembly Kit	31836 OR 31837
Tool Kit	31624
Washer Spring Stack	10179

Table 2 – Rebuild Kit Number Guide

31829	-	X	-	X	-	X	-	XXXX	-	XX	-	XX

WORKING PRESSURE	CODE
15 KSI	15
10 KSI	10
5 KSI	5

SPRING STACK PRESSURE RANGE	
0 - 2,500 PSI	1
2,000 - 5,000 PSI	2
4,000 - 8,500 PSI	3
4,000 - 10,000 PSI	4
10,000 - 15,000 PSI	6

FLOW CODE	FLOW RATE RANGE
3	100-2000 GPD
2	0-800 GPD

SEAL MATERIAL	
EPDM	
FFKM	
FKM	

ACTUATION TYPE	ACTUATION CODE
MANUAL	MA
ACTUATED VALVE ONLY	ACT

MATERIAL CODE	BODY MATERIAL
N5	NITRONIC 50 HS
SD	SUPER DUPLEX 2507

Table 3 – Seal Kit Number Guide

31830	-	X	-	XXXX	-	XX

CODE	WORKING PRESSURE
15	15 KSI
10	10 KSI
5	5 KSI

XXXX
EPDM
FFKM
FKM
SEAL MATERIAL

XX	
N5	NITRONIC 50 HS
SD	SUPER DUPLEX 2507
MATERIAL CODE	BODY MATERIAL

Table 4 – Stem Kit Number Guide

31831	-	X	-	X	-	XXXX	-	XX	-	XX

WORKING PRESSURE	CODE
15 KSI	15
10 KSI	10
5 KSI	5

FLOW CODE	FLOW RATE RANGE
3	100-2000 GPD
2	0-800 GPD

ACTUATION TYPE	ACTUATION CODE
MANUAL	MA
ACTUATED VALVE ONLY	ACT

XXXX
EPDM
FFKM
FKM
SEAL MATERIAL

XX	
N5	NITRONIC 50 HS
SD	SUPER DUPLEX 2507
MATERIAL CODE	BODY MATERIAL

Table 5 – Maintenance Tool Requirements

Tools and Parts	Quantity
Brass Pick	1
Brass Rod (3.5mm diameter)	1
Dynatex Anti-Seize Lubricating Compound (or equivalent)	1
Locking Pliers	1
Loctite 222 Low Strength (or equivalent)	1
Loctite 271 High Strength (or equivalent)	1
Molykote G-4700 Lithium/Moly Grease (or equivalent)	1
Seal Installation Tool Kit (P/N 31624)	1
Parker Super Lube (or equivalent)	1
Circlip Pliers	1
Socket Extension	1
Vise	1
20mm Deep Socket (or Crowfoot Wrench)	1
20mm Wrench	1
13mm Socket	1
12mm Socket	1
2mm Hex Key	1
2 Inch Wrench	1
5/8 Inch Socket	1
5/8 Inch Wrench	1
150 ft.lb [205 Nm] Torque Wrench	1
50 ft.lb [70 Nm] Torque Wrench	1

5. Replacing Base O-Ring

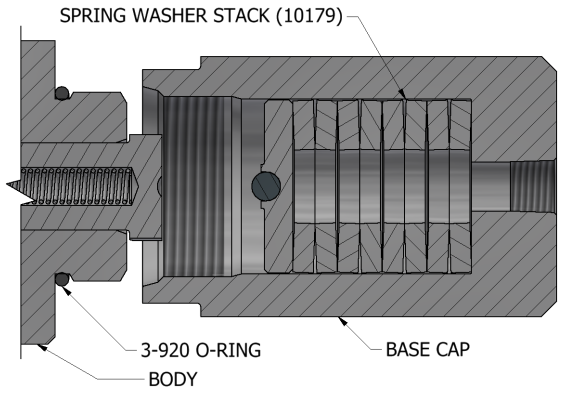


Figure 2 – Base Cap Assembly

5.1 Remove the SkoFlo valve from system.

5.2 Secure the valve facing upwards in a *Vise*.

5.3 Unscrew and remove the base cap (20234) by hand. – *2" Wrench, if needed*

5.4 Take care not to drop the spring washer stack within.

5.5 Remove old O-ring (3-920).

5.6 Lubricate new O-ring. - *Parker Super Lube*

5.7 Place new seal onto base of threads on body. See Figure 2.

5.8 Screw base cap (20234) onto body, hand tight.

6. Replacing Piston Assembly Seal and Pin

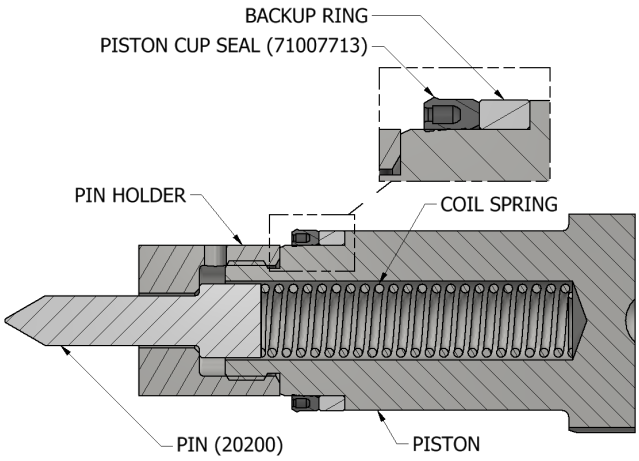


Figure 3 – Piston Assembly

6.1 Follow steps 5.1 - 5.4 to remove the base.

6.2 Remove piston assembly by hand. – *Locking Pliers, if needed*

6.3 Secure the piston in a *vise*.

6.4 Unscrew the pin holder from the piston. Be careful not to drop the pin (20200) and coil spring (71006349) inside. – *5/8" Wrench*

6.5 Remove the old piston cup seal and pin.

6.6 Lubricate the replacement seal (71007713) - *Parker Super Lube*

6.7 Slide the cup seal (71007713) onto the piston and make sure to orient the seal correctly with the spring end facing towards the pin; see Figure 3.

6.8 Place the pin spring (71006349) into the piston.

6.9 Place the replacement pin (20200) into the pin holder.

6.10 Apply *High Strength Loctite* to the pin holder threads, and screw onto the piston wrench tight. – *5/8" Wrench*

6.11 Carefully slide the complete piston assembly into the valve body. Using thumb pressure with a slight wiggle motion will ease the seal into the body cavity. Push the piston into the body as far as it will go.

7. Replacing Stem Assembly

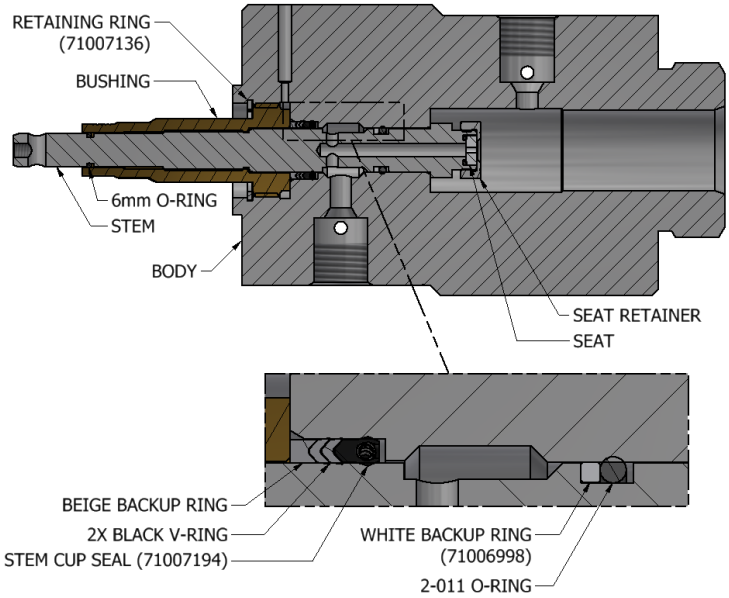


Figure 4 – Stem Assembly

7.1 Follow steps 6.1 - 6.2 to remove the base and piston assembly.

7.2 Remove the handle fastener and then the handle. See Figure 1. – *2mm Hex Key*

7.3 Place a 12mm socket over the seat retainer and rotate counter-clockwise until you can withdraw the old stem assembly from the body. See Figure 4. – *12mm Socket, Socket Extension*

! NOTICE

USE CARE WHEN REMOVING THE STEM TO AVOID DAMAGING THE INTERNAL SEALING SURFACES OF THE BPR.

7.4 Remove and discard the retaining ring (71007136) that retains the stem bushing. – *Circlip Pliers*

7.5 Unscrew the bushing from the body. – *13mm Socket*

7.6 Remove stem cup seal. – *Brass Rod*

7.7 Remove the stem's old O-Rings and backup rings. Take care not to scratch any surface. – *Brass Rod or Pick*

7.8 Thread *Stem O-Ring Tool* onto the stem. See Figure 5.

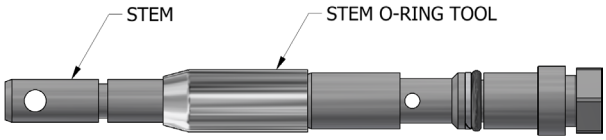


Figure 5 – O-Ring Tool

7.9 Apply O-Ring lube to the 2-011 O-Ring.

7.10 Carefully slide the 2-011 O-Ring over the stem into the O-Ring groove. Minimize stretching.

7.11 Carefully slide the backup ring over the stem into the O-Ring groove. Reform the backup ring into the gland as needed. See Figure 4.

7.12 Remove O-Ring installation tool.

7.13 Apply O-Ring lube to 6mm O-Ring (71006956).

7.14 Slide the 6mm O-Ring over the stem into the O-Ring groove. See Figure 4.

7.15 Apply O-Ring lube to new stem cup seal (71007194) and stem seal tool (31644).

7.16 Insert stem seal tool fully into body.

7.17 While holding stem seal tool in place, install new cup seal onto tool. See Figure 4 and Figure 6 for orientation of the cup seal.

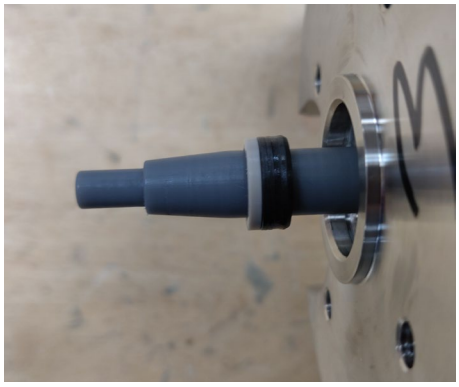


Figure 6 – Cup Seal on Stem Tool

7.18 Use the O-Ring Press Tool to push seals fully into gland. Screw in hand tight. See Figure 7.

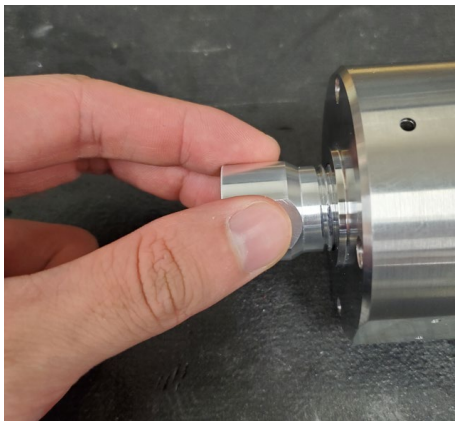


Figure 7 – O-Ring Press Tool

7.19 Remove O-Ring Press Tool and check that the cup seal is correctly installed and not cut.

7.20 Apply a small amount of *Low Strength Loctite* to the *external* threads of the stem bushing.

7.21 Screw in bushing hand tight. Note: the body must be held in a horizontal position during this step to allow the stem seal tool to move out of the way as the bushing is screwed in.

7.22 Remove the stem seal tool.

7.23 Torque bushing to 45 ft.lbf [60 Nm]. – *13mm Socket, Torque Wrench*

7.24 Install new retaining ring (71007136) – *Circlip Pliers*

! WARNING

THE RETAINING RING MUST BE REINSTALLED TO PREVENT THE STEM BUSHING FROM BACKING OUT, WHICH COULD LEAD TO A HIGH-PRESSURE LEAK.

7.25 Apply generous coating of lithium grease to stem threads.

7.26 Apply O-Ring lube to stem sealing surface. See Figure 8

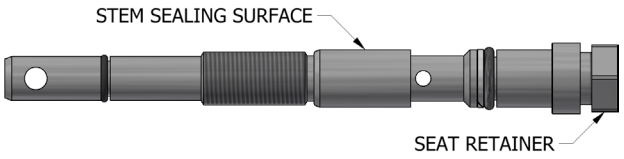


Figure 8 – Stem Sealing Surface

7.27 Pushing on the seat retainer, insert stem fully into body. Avoid contact with piston bore in body.

7.28 Screw stem clockwise via seat retainer until you reach the top stop. Once the handle hole emerges from the bushing you can use a rod through the handle hole to finish screwing in the stem. – *12mm Socket, Ø3.5mm Rod*

7.29 Install handle and secure with handle fastener. – *2mm Hex Key*

8. BPR Reassembly

8.1 Install stem assembly. See Section 7.8 through 7.29 for reference.

8.2 Install piston assembly. See section 6.6 through 6.11 for reference.

8.3 Install Base Cap assembly. See section 5.6 through 5.8 for reference.

8.4 Reference Section 2, Hydraulic Installation, to commission the BPR.

9. Hub Seal Replacement

9.1 For FKO hubs:

9.1.1 Unscrew FKO hub (31025) – *20mm Wrench*

9.1.2 Remove old O-Ring.

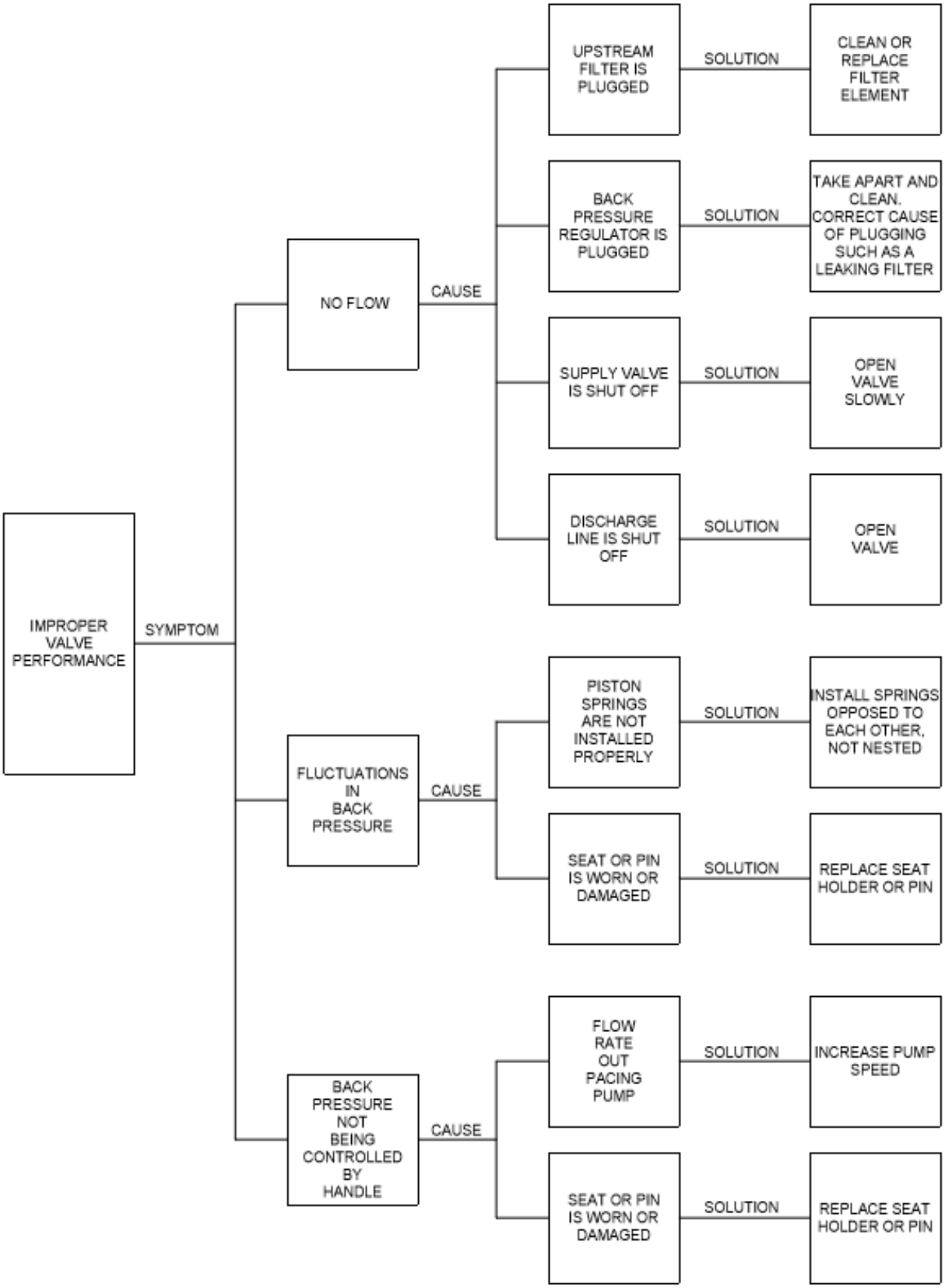
9.1.3 Apply O-Ring lube to the new 2-014 O-Ring.

9.1.4 Insert O-Ring into hub's gland.

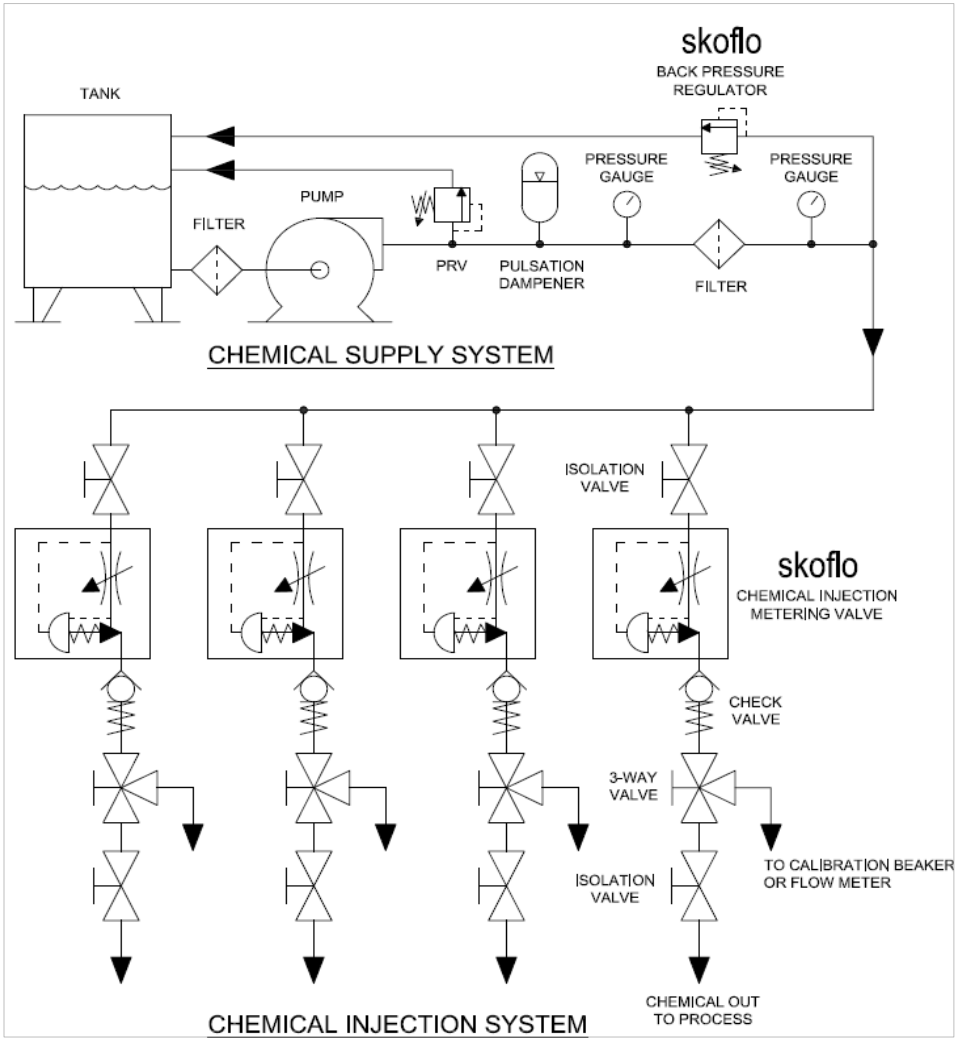
9.1.5 Coat adaptor hub threads with anti-seize.

9.1.6 Screw in hub. Torque to 90 ft.lbf [122 Nm] – *20mm Deep Socket (or equivalent), Torque Wrench*

TROUBLESHOOTING



APPENDIX A – A TYPICAL CHEMICAL INJECTION SYSTEM

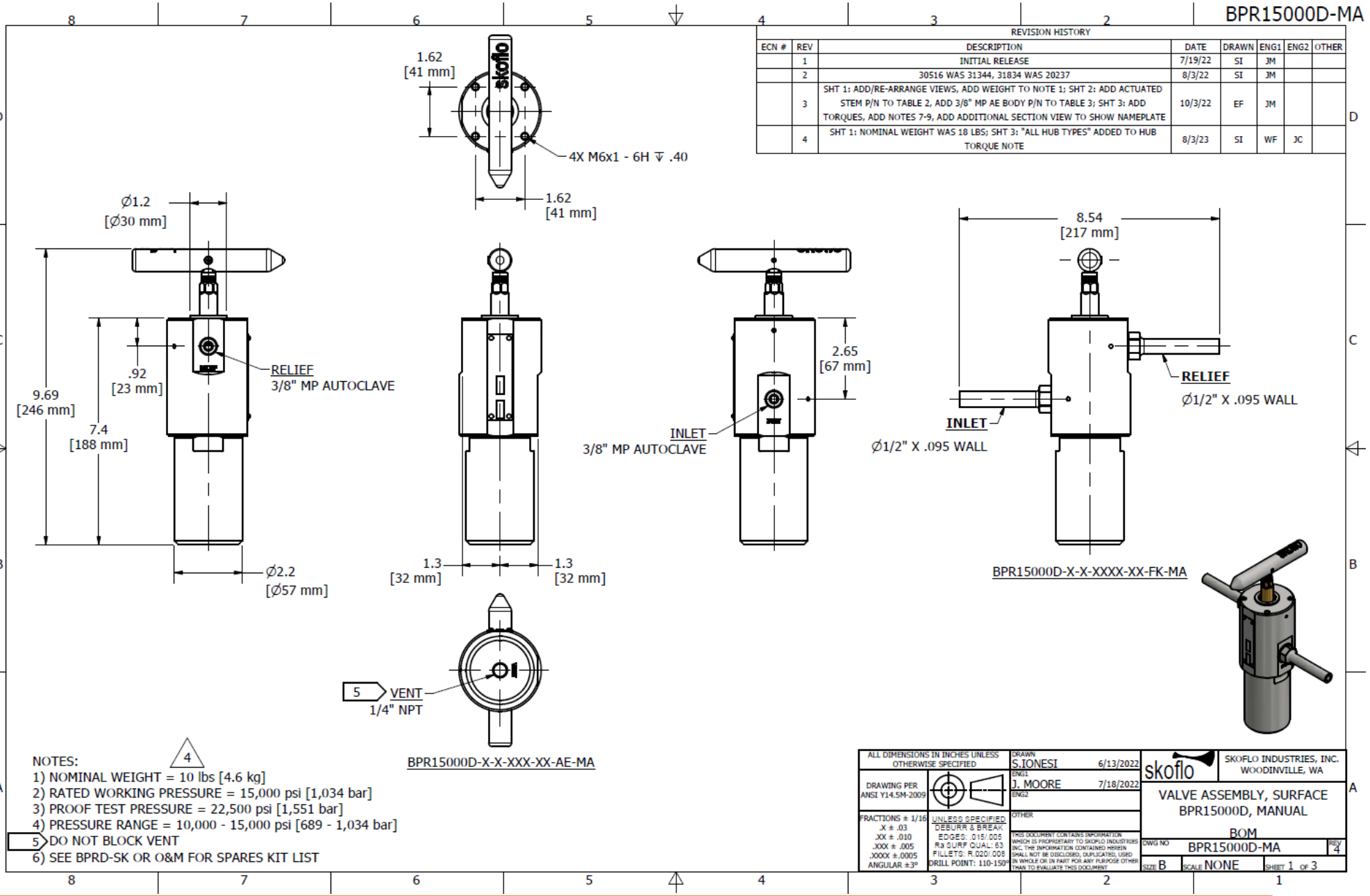


NOTES

Any number of injection points can be served by a single pump and header system. The only limitation is the flow capability of the pump.

Check valve shall be installed within 6 inches of the SkoFlo CIMV.

APPENDIX B – BPR15000D GA AND BOM DRAWING



BPR15000D-MA

PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	PRESSURE CONTAINING
1	1	10179	ASSY, WASHER, SPRING STACK, BPR, LF, SURFACE	ASSY	NO
2	1	20200	PIN, Ø.207, LONG	ZIRCONIA	NO
3	1	20234	BASE, BPR, LF, SURFACE	NITRONIC 60	YES
4	1	71001833	SL, ORING, 3-920	EPDM	NO
5	4	71002116	U-DRIVE SCREW, RH, #2X1/4	302 SS	NO
6	1	71002143	NAMEPLATE, BPR15000	316L SS	NO
7	8	71005992	SPRING, WASHER, Ø1.480 OD x Ø.625 ID, .177 TH	INCONEL X-750	NO
8	1	71006349	SPRING, COIL, Ø.304 X 1.94, PIN, BPR LF	ELGILOY	NO
9	1	71006956	SL, O-RING, 1.2mm CS X 6mm ID	EPDM	NO
10	1	71006998	SL, BU RING, .304 ID X .053W X .050T	PTFE	NO
11	1	71007136	SLRG, INTERNAL, Ø.875, FHL-94-HAS	HASTELLOY C-276	NO
12	1	71007194	SL, CUP W. VRING, .533 OD	GFP, PEEK	YES
13	1	71007713	SL, CUP, PISTON, .750" OD, SURFACE	GFP, PEEK	YES
14	2	SEE TABLE 1	HUB	SD 2507	YES
15	2	SEE TABLE 1	SL, O RING, 2-014	SEE TABLE 1	NO
16	1	SEE TABLE 2	SEAT, BPR LF, SURFACE	ALUMINA	NO
17	1	SEE TABLE 2	STEM, BPR, SURFACE	SEE TABLE 2	YES
18	1	SEE TABLE 2	RETAINER, SEAT, BPR, SURFACE	SEE TABLE 2	NO
19	1	SEE TABLE 2	SL, O-RING, SEAT	SEE TABLE 2	NO
20	1	SEE TABLE 2	BUSHING, STEM, COATED, LF BPR	TOUGHMET 3	NO
21	1	SEE TABLE 2	HANDLE, BPR, SURFACE	316 SS OR AL-NI-BR	NO
22	1	SEE TABLE 2	SHSS, M4x0.7x3LG, FLAT TIP	18-8 SS	NO
23	1	SEE TABLE 2	HANDLE FASTENER, SEE TABLE 2	18-8 SS OR N60	NO
24	1	SEE TABLE 2	SL, O-RING, 2-011	SEE TABLE 2	NO
25	1	SEE TABLE 3	BODY, BPR, LF, SURFACE	SEE TABLE 3	YES
26	1	SEE TABLE 3	PISTON, BPR, LF, SURFACE	SEE TABLE 3	YES
27	1	SEE TABLE 3	HOLDER, PIN, BPR, LF, SURFACE	SEE TABLE 3	NO

TABLE 1: ADAPTER SELECTION

ITEM	DESCRIPTION		3/8"MP AE	1/2" FKO
14	HUB		N/A	31025
15	SL, O RING, 2-014	FFKM	N/A	71007392
		FKM	N/A	71001754
		EPDM	N/A	71001753

TABLE 2: STEM ASSEMBLY SELECTION

ITEM	DESCRIPTION		MATERIAL & FLOW RATE		
			N50		SD 2507
			800 GPD	2000 GPD	2000 GPD
16	SEAT		31344	30516	30516
17	STEM	MANUAL	31752		31796
		ACTUATED	31853		N/A
18	SEAT RETAINER		31409		31797
19	SL, O-RING, SEAT	FFKM	71006953		71006318
		FKM	71006922		N/A
		EPDM	71006954		N/A
20	BUSHING	MANUAL	31859-1		
		ACTUATED	31859-2		
21	HANDLE	MANUAL	30435		
		ACTUATED	30991		
22	PIN FASTENER	MANUAL	N/A		
		ACTUATED	71007417		
23	BOLT, SLDR	MANUAL	71007037		
	PIN, DOWEL	ACTUATED	31629		
24	SL, O-RING, 2-011	FFKM	71001744		
		FKM	71006921		
		EPDM	71006952		

TABLE 3: MATERIAL SELECTION

ITEM	DESCRIPTION	ADAPTOR TYPE	MATERIAL	
			N50	SD 2507
25	BODY	3/8" MP AE	31852	N/A
		1/2" FKO	31754	31798
26	PISTON		31834	31800
27	PIN HOLDER		20238	31799

CONFIGURATION NUMBER GUIDE

BPR15000D	-	X	-	X	-	XXXX	-	XX	-	XX	-	XX
10,000-15,000 psi		6										
SPRING STACK PRESSURE RANGE												

FLOW CODE	FLOW RATE RANGE
3	100-2000 gpd
2	0-800 gpd

ADAPTOR CODE	HUB TYPE
AE	3/8" MP AUTOCLAVE
FK	1/2" FKO

XXXX	
EPDM	
FFKM	
FKM	
SEAL MATERIAL	

XX	
N5	NITRONIC 50
SD	SUPER DUPLEX 2507
MATERIAL CODE	BODY MATERIAL

XX	
MA	MANUAL
SV	ACTUATED VALVE ONLY
ACTUATION CODE	ACTUATION TYPE

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED

DRAWING PER ANSI Y14.5M-2009

FRACTIONS ± 1/16
.X ± .03
.XX ± .010
.XXX ± .005
.XXXX ±.0005
ANGULAR ±3°

UNLESS SPECIFIED
DEBURR & BREAK EDGES: .015/.005
Ra SURF QUAL: 63
FILLETS: R.020/.008
DRILL POINT: 110-150°

DRAWN S.IONESI 6/13/2022
ENG1 J. MOORE 7/18/2022
ENG2
OTHER

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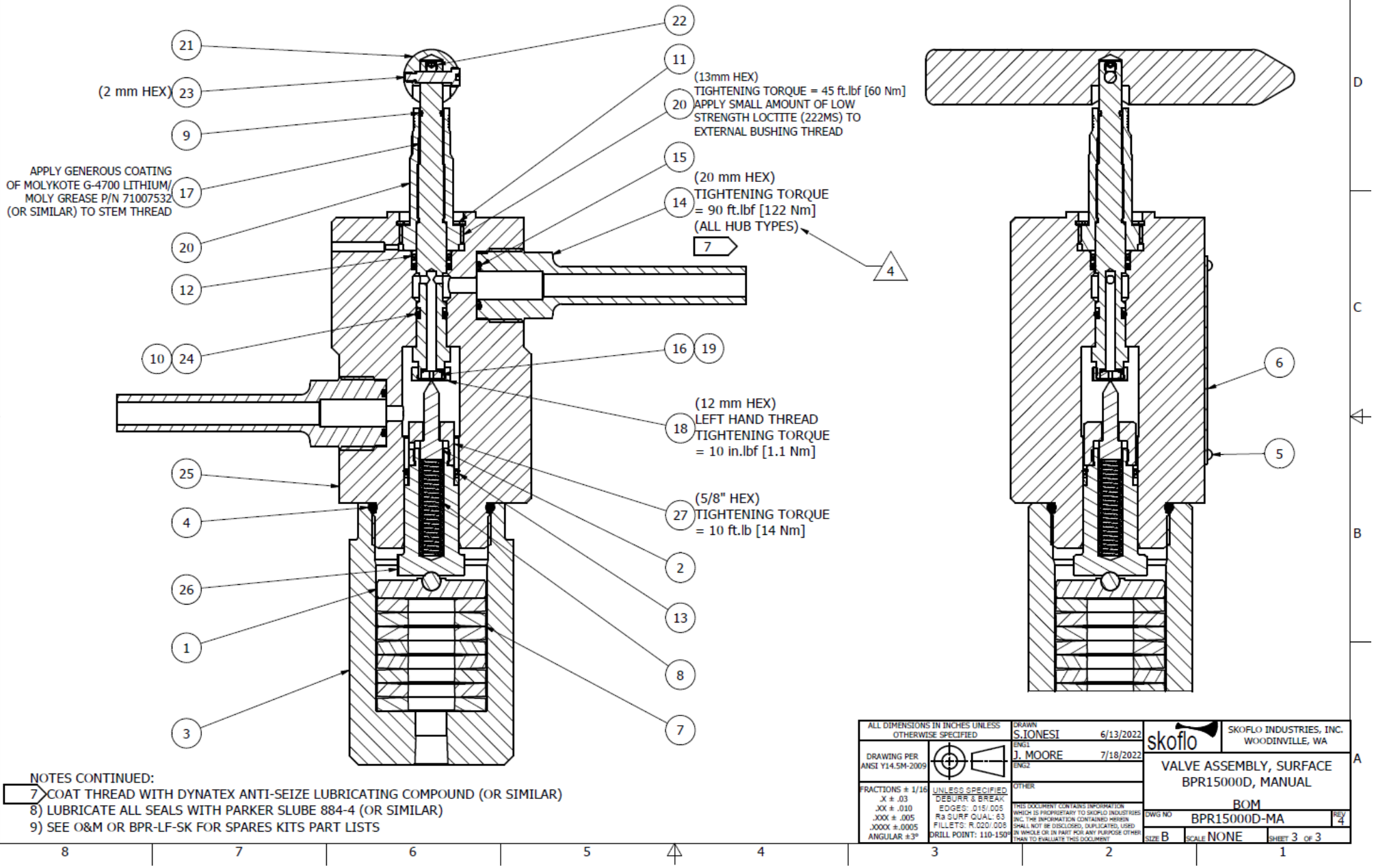
skoflo SKOFLO INDUSTRIES, INC. WOODINVILLE, WA

VALVE ASSEMBLY, SURFACE
BPR15000D, MANUAL
BOM

DWG NO BPR15000D-MA REV 4

SIZE B SCALE NONE SHEET 2 OF 3

BPR15000D-MA



NOTES CONTINUED:

7 COAT THREAD WITH DYNATEX ANTI-SEIZE LUBRICATING COMPOUND (OR SIMILAR)

8) LUBRICATE ALL SEALS WITH PARKER SLUBE 884-4 (OR SIMILAR)

9) SEE O&M OR BPR-LF-SK FOR SPARES KITS PART LISTS

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED	DRAWN S.IONESI 6/13/2022	skoflo	SKOFLO INDUSTRIES, INC. WOODINVILLE, WA
DRAWING PER ANSI Y14.5M-2009	ENG1 J. MOORE 7/18/2022	VALVE ASSEMBLY, SURFACE BPR15000D, MANUAL BOM	
FRACTIONS ± 1/16 .X ± .03 .XX ± .010 .XXX ± .005 .XXXX ±.0005 ANGULAR ±3°	UNLESS SPECIFIED DEBURR & BREAK EDGES: .015/.005 Ra SURF QUAL: 63 FILLETS: R.020/.005 DRILL POINT: 110-150°	ENG2 OTHER	DWG NO BPR15000D-MA REV 4
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