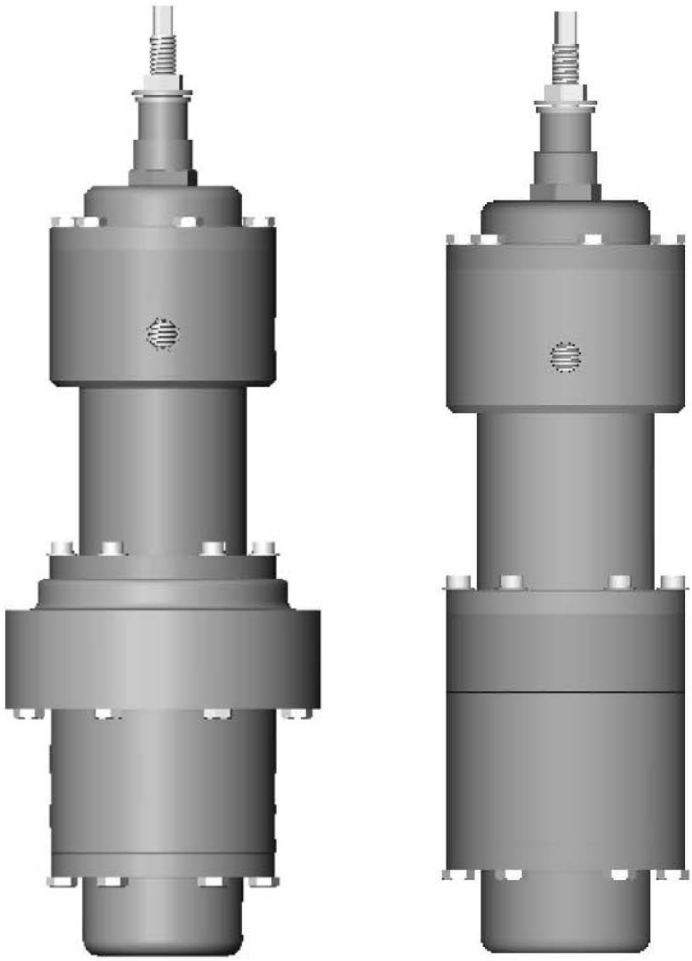
Becker

a Baker Hughes business

FEP-175/600-CH Series

Flexible Element Pilot

Instruction Manual (Rev. B)



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Introduction

Becker's FEP-CH Series single-acting pilot represents a breakthrough in valve control technology for the natural gas industry. Built to exacting specifications, this easily maintained unit offers highly accurate control characteristics over a wide range of operating environments.

Description

The Becker FEP-CH single-acting pilot provides pressure control when utilized with a boot or diaphragm style regulator. The FEP-CH measures downstream sensing pressure and positions the control element of the regulator to maintain the desired downstream pressure. The FEP-CH pilot may be utilized for pressure control applications with setpoints ranging from 3 psig to 600 psig. The FEP-CH design pilot represents commitment to continually develop new products and update existing ones to increase their performance while retaining simple operation and low maintenance.

Scope of Manual

This manual provides information on the installation, operation, adjustment, and maintenance of the Becker FEP-CH single acting pilot. For information concerning valves and accessories, refer to the instruction manuals provided with the specific product.

Model Number explanation

The FEP-CH pilot is available in two different models to cover sensing pressures from 3 psig to 600 psig. The number expressed in the FEP model designation is the maximum sensing pressure, for example, a FEP-600-CH has a maximum sensing pressure of 600 psig.

To find your FEP model number, refer to the stainless steel tag attached to your pilot by the 7/16 hex head cap screws.

Note: Only those qualified through training or experience should install, operate, or maintain Becker positioners. If there are any questions concerning these instructions, contact your Baker Hughes sales representative, sales office, or manufacturer before proceeding.

Technical Information

Advantages of the Combination Chamber FEP-CH Pilot

1. Control spring surrounded by the natural gas media is protected against corrosion caused by exposure to the outside weather conditions and condensation (specifically critical for vault installation).
2. The Sensing Pressure and the Control Spring forces in the FEP-CH are combined in the same “CH” combined chamber so that only the “small net force” is transmitted to the FEP-CH Pilot Body. In all other brands, the forces have a “sandwich” effect over the pilot body and the resulting force is “crushing” pilots. This feature contributes for a much higher sensitivity and smaller Lock-Up. See figure 1 below.
3. Larger measured variable chamber volume dampens control pressure signal, helping to compensate for vibration induced by poor location of sensing tap in area of flow pulsation and turbulence.
4. Control springs can be replaced without disturbing any diaphragms.
5. Springs are guided by the outside resulting in better alignment and higher sensitivity.
6. Totally friction free design.

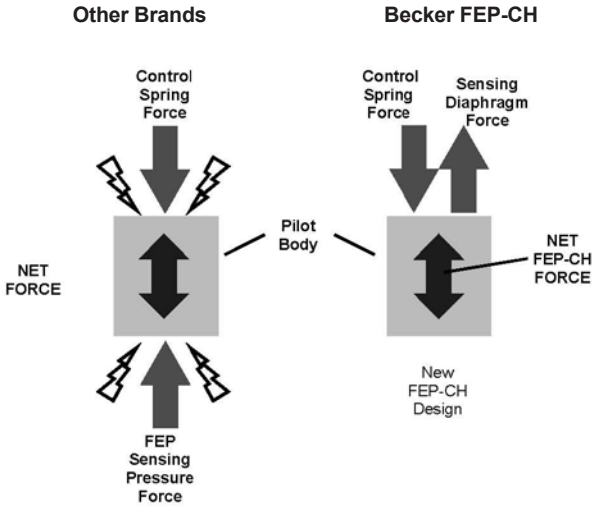


Figure 1. Schematic for the net force

Materials of Construction	
External Parts	Anodized 2024 Aluminum/316 SS Available
Internal Parts	316 Stainless Steel and 2024 Anodized Aluminum
Springs	Alloy Steel
Diaphragm	Buna-N with nylon reinforcement
Seats and O-Rings	Buna-N

Technical Specifications	
Supply Gas	Dry, Filtered (100 micron gas)
Maximum Flow Capacity	See Cv Tables
Maximum Supply Pressure Inlet	1480 psig (10204 kPa)
Maximum ΔP	600 psig (4137 kPa)
Maximum Sensing Pressure	600 psig (4137 kPa)
Maximum Discharge Pressure Outlet	600 psig (4137 kPa)
Maximum Bottom Chamber (for remote loading)	600 psig (4137 kPa)
Operative Ambient Temperature Range	-20 to 160°F -29 to 71°C
Approximate Weight	6 pounds (2.7 kg)
Setpoint Range	3 psig - 600 psig (21 kPa - 4137 kPa)
Installation Orientation	Vertical position recommended

Applications

- Primary Pressure Control
- Overpressure Protection (Monitor)
- Underpressure Protection (Standby)
- Relief Valve
- Backpressure Control
- Power Plant Type Applications

Compatible Regulators

- Redq *Flexflo*™
- American Meters Axialflow
- Fisher 399
- Mooney *Flowgrid*™

Principles of Operation

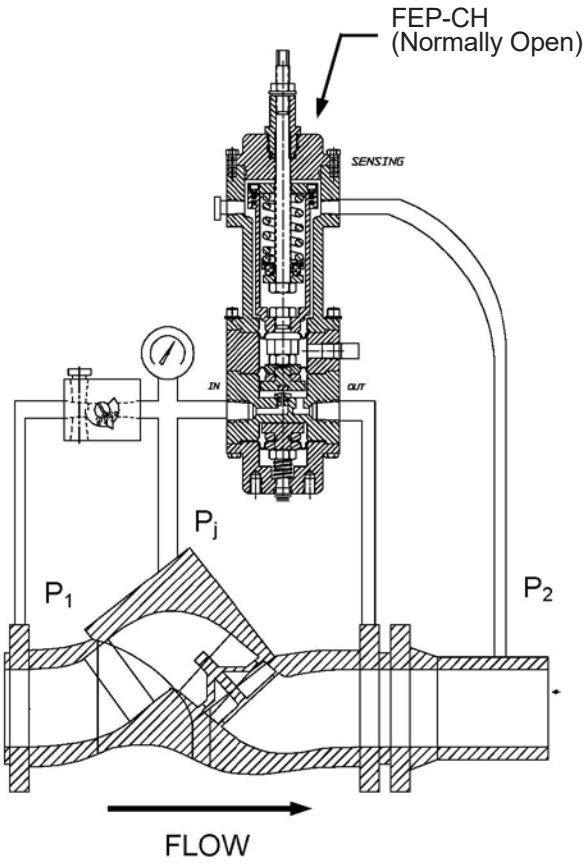


Figure 2. FEP-CH in Pressure Reducing

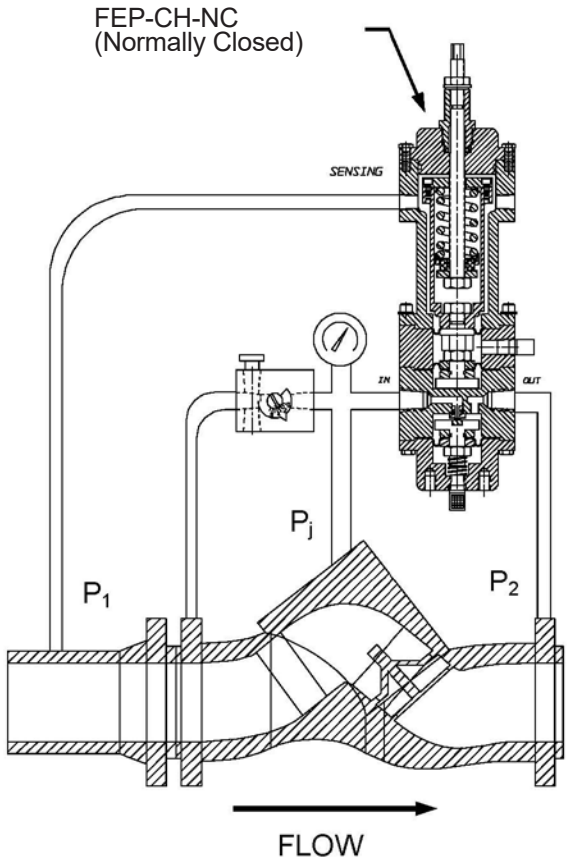


Figure 3. FEP-CH in Backpressure

Pressure Reducing Regulator Mode (Figure 2):

When outlet line pressure (P_2) is above the set pressure of the pilot, the pilot remains closed. The closed pilot seals the Flexflo jacket from the downstream line, so the jacket pressure (P_j) equalizes with the inlet pressure (P_1), closing the Flexflo. When outlet line pressure (P_2) falls below the set pressure of the pilot, the pilot opens and allow the gas in the jacket to flow out to the downstream line. At the same time, the pressure in the regulator jacket drops. This causes the regulator to open so that flow can pass through.

Backpressure Regulator Mode (Figure 3):

When inlet line pressure (P_1) is below the set pressure of the pilot, the pilot remains closed. The closed pilot seals the Flexflo jacket from the downstream line, so the jacket pressure (P_j) equalizes with the inlet pressure (P_1), closing the Flexflo. When inlet line pressure (P_1) rises above the set pressure of the pilot, the pilot opens and allow the gas in the jacket to flow out to the downstream line. At the same time, the pressure in the regulator jacket drops.This causes the regulator to open so that flow can pass through.

Ordering Information

The Customer should specify model number, variable orifice assembly, spring range and type of nozzle. See tables below for part numbers.

Table 1. Nozzle Part Numbers

Diameter	Part No.
3/32”	25-1029
1/8”	25-1030

Table 2. Power Plant Recommendations

Application	Orifice	Nozzle
Start-up	Standard	3/32”
Main	M	1/8”

Table 3. Variable Orifice and Orifice Only Part Numbers

Identification Stamp	Variable Orifice Assembly	Orifice Only Part Number
Standard (no stamp)	(25-1559)	(25-1040)
“M”	(25-8162)	(25-8075)
“L”	(25-8163)	(25-8076)

Figure 4. FEP-175-CH

Figure 5. FEP-600-CH

Table 4. FEP-175/600-CH Stock Numbers and Spring Ranges

FEP-CH Model No. (Stock No.)	Control Range (psig/kPa)	Spring Color (Part No.)	Setpoint per Revolution of Setpoint Screw (psig/kPa)	Repair Kit Part No.	Setpoint Range Discrete Remote Control (SM-1100)	Setpoint Range Analog (4-20 mA) Remote Control (SM-1000)
FEP-175-CH (30-0030) **FEP-175-CH-NC[1] (30-0031)**	3 - 10 psig 20 - 69 kPa	Gold (25-8236)	0.57 psig 3.9 kPa	30-9025	3.1 psig 21 kPa	9 psig 62.1 kPa
	7 - 30 psig 48 - 207 kPa	Beige (25-8238)	2.0 psig 13.7 kPa	30-9025	11 psig 75.8 kPa	23 psig 159 kPa
	15 - 50 psig 103 - 345 kPa	Burgundy (25-8239)	3.0 psig 21 kPa	30-9025	16.5 psig 114 kPa	35 psig 241 kPa
	20 - 85 psig 138 - 596 kPa	Pink (25-8240)	6.4 psig 44 kPa	30-9025	35.2 psig 243 kPa	65 psig 448 kPa
	50 - 175 psig 345 - 1207 kPa	Yellow (25-1306)	23 psig 157 kPa	30-9025	125 psig 862 kPa	125 psig 448 kPa
FEP-600-CH (30-0023) **FEP-600-CH-NC[1] (30-0024)**	5 - 40 psig 34 - 246 kPa	Gold (25-8236)	2.1 psig 14.6 kPa	30-9024	11.5 psig 79 kPa	35 psig 241 kPa
	25 - 140 psig 172 - 965 kPa	Beige (25-8238)	7.4 psig 51 kPa	30-9024	41 psig 283 kPa	115 psig 793 kPa
	50 - 175 psig 345 - 1207 kPa	Burgundy (25-8239)	11.3 psig 78 kPa	30-9024	62 psig 427 kPa	125 psig 862 kPa
	135 - 300 psig 931 - 2069 kPa	Pink (25-8240)	24 psig 164 kPa	30-9024	132 psig 910 kPa	165 psig 1138 kPa
	275 - 600 psig 1896- 4137 kPa	Yellow (25-1306)	85 psig 586 kPa	30-9024	425 psig 2930 kPa	425 psig 2930 kPa

Ordering Example

Specify Model part number and name:
BPE model FEP-175-CH, gold Spring, range 3-10 psig (25-8236), 3/32 nozzle (25-1029), “M “ orifice assembly (25-8162)

[1] NC = Normally Closed, for backpressure control.

Pilot Performance

Lock-Up factor: This factor represents the increase in the output pressure (P2) when the output is suddenly closed. The values in the table show the lock-up pressure for every spring and as a function of the pressure differential (ΔP) between P1 and P2. The reported values are conservative based on the standard 3/32 nozzle using the small orifice at a position #3. See table below.

Table 5. Lock-up Pressure for Different Pressure Values. FEP 600-CH in Pressure Reducing Mode and Small Orifice Set at 3.

Spring Type	ΔP (psig)					
	100	200	300	400	500	600
Gold	0.5	1	1.5	2	2.4	2.9
Beige	0.6	1.1	1.5	2	2.5	2.9
Burgundy	0.7	1.1	1.6	2.1	2.5	3
Pink	0.8	1.3	1.7	2.2	2.6	3.1
Yellow	1.6	1.9	2.2	2.5	2.82	3.1

Table 6. Orifice's Flow Factor (C_v) vs. Opening Number

Orifice	Flow Direct	Opening Number							
		0	1	2	3	4	5	6	7
"STD"	Forward	0.003	0.004	0.009	0.026	0.042	0.071	0.099	0.122
	Reverse	0.043	0.045	0.055	0.069	0.083	0.109	0.135	0.154
"M"	Forward	0.043	0.046	0.063	0.090	0.135	0.173	0.212	0.250
	Reverse	0.093	0.097	0.112	0.135	0.173	0.212	0.250	0.289
"L"	Forward	0.043	0.062	0.173	0.327	0.462	0.577	0.635	0.674
	Reverse	0.099	0.154	0.250	0.366	0.462	0.597	0.674	0.674

Table 7. Nozzle Flow Factor (C_v)

Nozzle	3/32	1/8
C_v	0.404	0.635

Accessories

The following accessories are available to enhance the operation or provide additional features to your FEP-CH Series single-acting pilot control system. For additional information regarding a specific accessory, contact Baker Hughes.

FSP Series Setpoint Change Pump:

Provides a simple and accurate method of applying false signal pressure during initial adjustment of the FEP pilot. The pump can provide a false signal pressure of 10%-20% in excess of working pipeline pressure which eliminates the need for nitrogen bottles or electronic calibration devices.

RSM Series Remote Setpoint Module:

The Remote Setpoint Module provides remote adjustment of FEP-CH Pilot setpoint via an electrical input signal. All Remote Setpoint Motors are equipped with internal limit switches to prevent over-travel of setpoint. 4-20 mA feedback of Remote Setpoint Module is standard. All Becker RSM Series remote Setpoint Modules are rated Explosion Proof Class1, Div 1 for use in hazardous locations. Standard RSM input signals are:

Digital Input: 24 VDC and 120 VAC Analog Current Input: 4-20 mA command signal/24VDC Supply Power and 4-20 mA Command signal/120 VAC Supply Power.

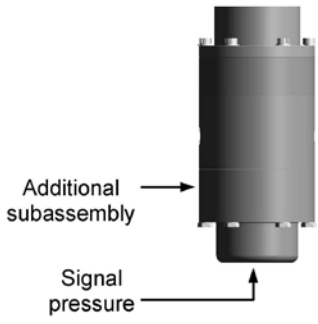
Setpoint change indicator:

Provides a visual indication of the setpoint change from a known reference setpoint. This device reduces the time required to vary setpoint occasionally such as “winter” and “summer” setpoints for high and low pipeline system demand.

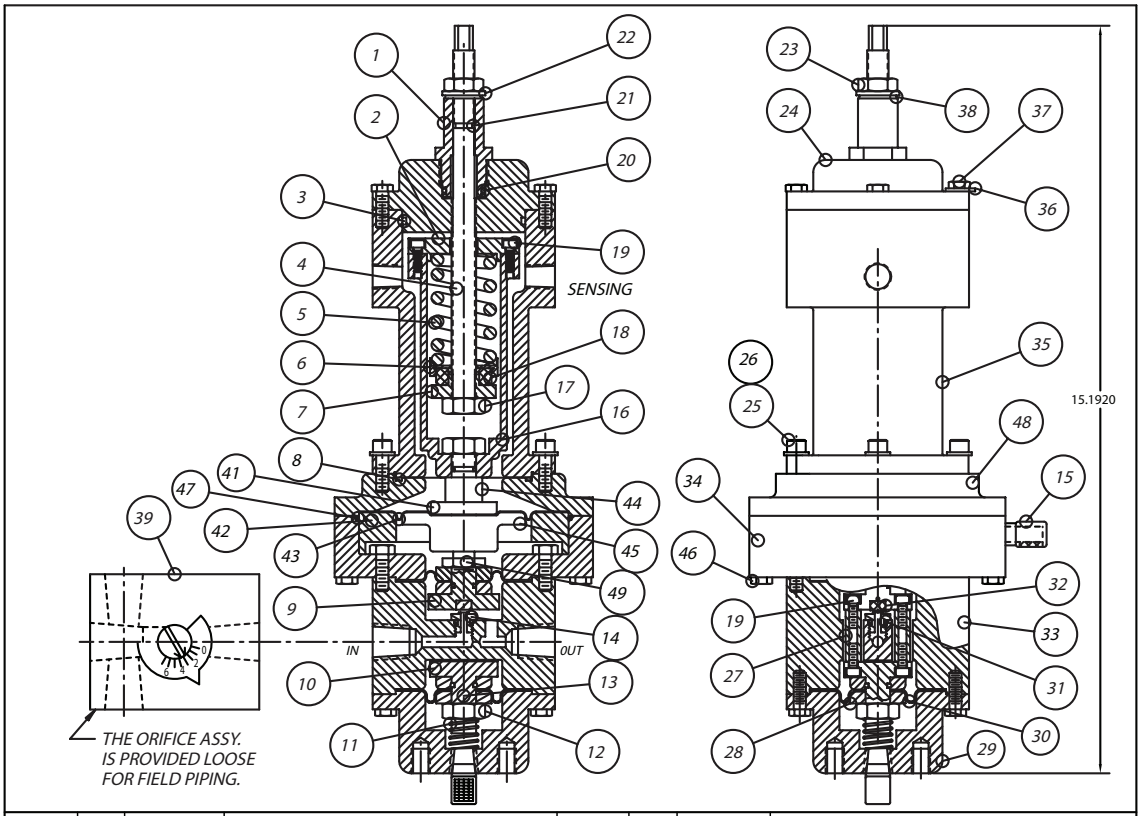
Pneumatic Remote Loading:

Provides ability to change setpoint by remote pneumatic pressure.

Also, can be used to control differential pressure.



Drawings



ITEM	QTY	PART NO.	DESCRIPTION	ITEM	QTY	PART NO.	DESCRIPTION
1.	1	30-7009	SEAL NECK	26.	1	98-3227	1/4" F.G. WASHER
2.	1	30-7007	TUBE CAP	27.	2	25-1023	PILOT POST
3.	1	95-2671	O-RING-141	28.	4	25-1016	WASHER
4.	1	30-7022	ADJUSTING SCREW	29.	1	25-1022	PRESSURE CARTRIDGE
5.	1		CONTROL SPRING	30.	3	25-1027	DIAPHRAGM W/CONVOLUTE
6.	1	30-7006	BEARING CASE	31.	1	95-2609	O-RING-010
7.	1	30-7001	BEARING NUT	32.	1	25-1031	BUNA-N-SEAT
8.	1	95-2665	O-RING-145	33.	1	25-1039	SP-BODY
9.	1	25-1018	PISTON W/SEAT	34.	1	35-1548	BOTTOM FLANGE
10.	1	25-1019	PISTON W/O SEAT	35.	1	30-7002	SPRING CARTRIDGE
11.	1	25-1217	BOTTOM SPRING	36.	1	25-1061	SS CONTROL TAG
12.	1	98-3056	1/2-20 HEX JAM NUT	37.	18	98-3137	1/4-20 X 3/4 HHCS SS
13.	3	95-2625	O-RING-012	38.	1	30-7017	7/16 THREAD SEAL
14.	1		3/32 OR 1/8 NOZZLE	39.	1		SINGLE ORIFICE ASSY.
15.	2	01-2572	1/4 NPT VENT ELBOW	40.	1	25-1065	1/2-20 SPECIAL NUT
16.	1	30-7003	INNER TUBE	41.	1	30-7020	WASHER
17.	1	98-3213	LH. 1/2-20 JM NUT	42.	1	35-1549	SPACER
18.	1	25-1062	THRUST BEARING	43.	1	30-7012	DIAPGHRAGM W/HOLE
19.	8	98-3269	8-32 X 1/2 SHCS ALLOY	44.	1	30-7015	THREAD EXTENSION
20.	1	95-2670	O-RING-115	45.	1	30-7025	PISTON
21.	1	95-2672	O-RING-108	46.	8	98-3153	1/4-20 X 1/2 HHCS
22.	1	98-3181	7/16 FT WASHERS SS	47.	1	95-2666	O-RING-046
23.	1	98-2500	7/16-20 JAM NUT	48.	1	30-7024	SPRING CARTRIDGE SPACER
24.	1	30-7008	CARTRIDGE CAP	49.	1	25-1076	SPRING NUT
25.	6	98-3228	1/4-20 X 2" SHCS				

TECHNICAL DATA

MATERIALS:
DIAPHRGMS -BUNA-N AND NYLON
SEATS -BUNA-N
NOZZLES, POSTS
CAP SCREWS -316 SS
BODY, POSITION,
WASHERS ETC. -2024-T351 ALUMINUM
(ANODIZED)

CONNECTIONS:

ALL PORTS -1/4 NPT FEMALE

OVERALL SIZE:

LENGTH - 14 5/8"
DIAMETER - 5-1/4"

PRESSURE RATINGS:

"0UT" & "SENSING"
PORTS - 600 PSIG MAX.
"IN" PORT -1480 PSIG MAX.

NOTES:

1) ITEMS NO. 14,17,19,25 AND 37 ARE TORQUED TO 95-100 in. lbs.

2) ALL FASTNERS ARE STAINLESS STEEL.

3) FOR REPAIR KIT SEE #30-9025

DESCRIPTION

THE bpe FEP-175-CH IS A NORMALLY OPEN PILOT CONTROLLED BY A DIAPHRAGM AND SPRING. THE SET POINT IS ADJUSTABLE BY VARYING THE SPRING FORCE.

CONTROL RANGE

RANGE (PSIG)	SPRING COLOR	PART NUMBER
7 - 30	BEIGE	25-8238
15 - 50	BURGUNDY	25-8239
20 - 85	PINK	25-8240
	YELLOW	25-1306

REP#	BY	DATE	REVISION
E010-03	TRD	3-10-05	(d) ADD ITEM 49
N/A	RM	11-6-02	(c) GOLD SPRING REMOVED
N/A	RM	2-12-02	(b) ITEM 19. 98-3269 WAS 98-2614
N/A	TS	5-2-00	(a) NEW PILOT DESIGN

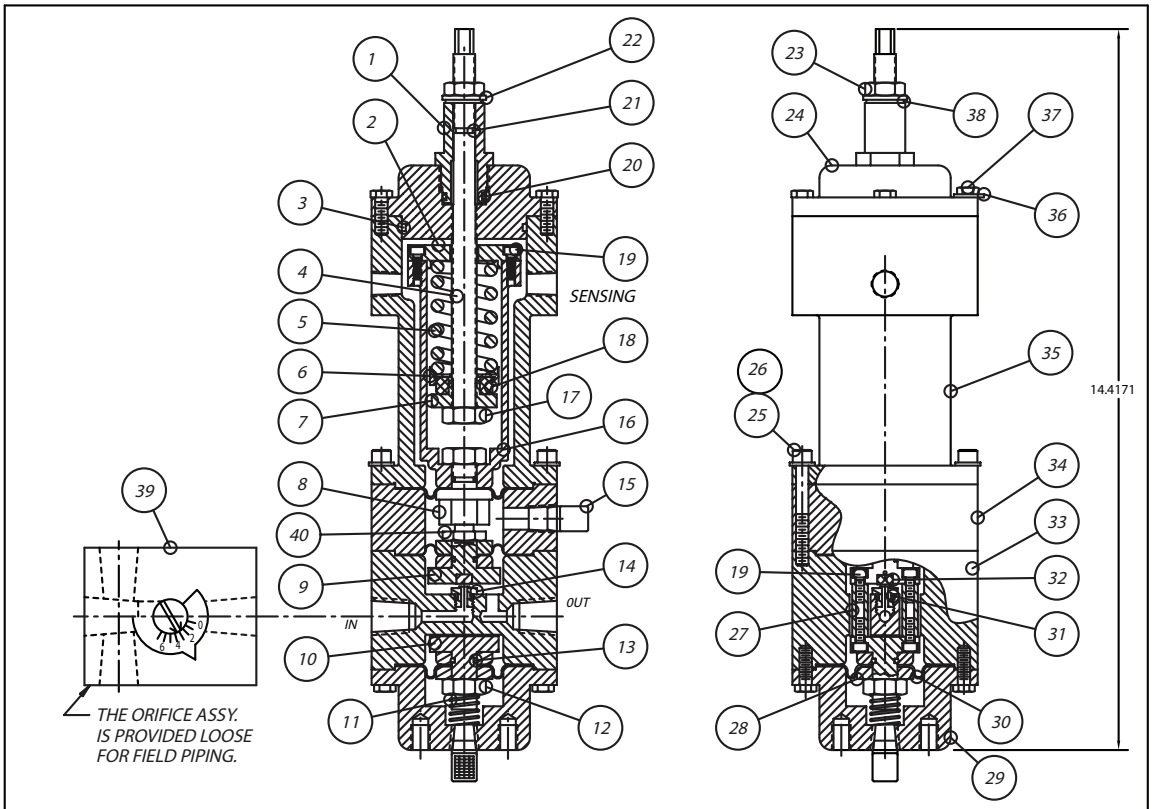
DRESSER
Flow Solutions
Becker Operations

APPROVED BY:
DWG. SIZE B
DRAWN BY TS
DATE: 5-4-00
REVISED BY: TRD
SCALE: 1:7/16
REVISED DATE: 3-10-05

FLEXIBLE ELEMENT PILOT

FEP-175-CH

DRAWING NUMBER 30-0030



ITEM	QTY	PART NO.	DESCRIPTION	ITEM	QTY	PART NO.	DESCRIPTION
1.	1	30-7009	SEAL NECK	21.	1	95-2672	O-RING-108
2.	1	30-7007	TUBE CAP	22.	1	98-3181	7/16 FT WASHERS SS
3.	1	95-2671	O-RING-141	23.	1	98-2500	7/16-20 JAM NUT
4.	1	30-7022	ADJUSTING SCREW	24.	1	30-7008	CARTRIDGE CAP
5.	1		CONTROL SPRING	25.	6	98-3230	1/4-20 X 2" SHCS
6.	1	30-7006	BEARING CASE	26.	6	98-3227	1/4" F.G. WASHER
7.	1	30-7001	BEARING NUT	27.	2	25-1023	PILOT POST
8.	1	25-1177	BOTTOM PISTON	28.	4	25-1016	WASHER
9.	1	25-1018	PISTON W/SEAT	29.	1	25-1022	PRESSURE CARTRIDGE
10.	1	25-1019	PISTON W/O SEAT	30.	3	25-1027	DIAPHRAGM W/CONVOLUTE
11.	1	25-1217	BOTTOM SPRING	31.	1	95-2609	O-RING-010
12.	2	98-3056	1/2-20 HEX JAM NUT	32.	1	25-1031	BUNA-N-SEAT
13.	3	95-2625	O-RING-012	33.	1	25-1039	SP-BODY
14.	1		3/32 OR 1/8 NOZZLE	34.	1	35-1548	BOTTOM FLANGE
15.	2	01-2572	1/4 NPT VENT ELBOW	35.	1	30-7002	SPRING CARTRIDGE
16.	1	30-7003	INNER TUBE	36.	1	25-1061	SS CONTROL TAG
17.	1	98-3213	LH. 1/2-20 JM NUT	37.	12	98-3137	1/4-20 X 3/4 HHCS SS
18.	1	25-1062	THRUST BEARING	38.	1	30-7017	7/16 THREAD SEAL
19.	8	98-3269	8-32 X 1/2 SHCS ALLOY	39.	1		SINGLE ORIFICE ASSY.
20.	1	95-2670	O-RING-115	40.	1	25-1065	1/2-20 SPECIAL NUT

TECHNICAL DATA

CONNECTIONS:
ALL PORTS -1/4 NPT FEMALE

MATERIALS:

DIAPHRGMS -BUNA-N AND NYLON
SEATS -BUNA-N
NOZZLES, POSTS
CAP SCREWS -316 SS
BODY, POSITION,
WASHERS ETC. -2024-T351 ALUMINUM
(ANODIZED)

OVERALL SIZE:

LENGTH - 14 5/8"
DIAMETER - 3-3/4"

PRESSURE RATINGS:

"0UT" & "SENSING"
PORTS - 600 PSIG MAX.
"IN" PORT -1480 PSIG MAX.

DESCRIPTION

THE bpe FEP-600-CH IS A NORMALLY OPEN PILOT CONTROLLED BY A DIAPHRAGM AND SPRING. THE SET POINT IS ADJUSTABLE BY VARYING THE SPRING FORCE.

NOTES:

1) ITEMS NO. 14,17,19,25 AND 37 ARE TORQUED TO 95-100 in. lbs.

2) ALL FASTNERS ARE STAINLESS STEEL.

3) FOR REPAIR KIT SEE #30-9024

CONTROL RANGE

RANGE (PSIG)	SPRING COLOR	PART NUMBER
5 - 40	GOLD	25-8236
25 - 125	BEIGE	25-8238
50 - 175	BURGUNDY	25-8239
135 - 300	PINK	25-8240
275 - 600	YELLOW	25-1306

REP#	BY	DATE	REVISION
N/A	RM	9-18-03	(d) 25-1076 WAS 25-1065
N/A	DB	10-1-01	(c) 98-3269 WAS 98-2614
N/A	TS	1-5-00	(b) 25-1217 WAS 251033, #40 25-1065 WAS ADDED #12 QTY.-2 WAS 3
N/A	TS	7-15-99	(a) NEW PILOT DESIGN

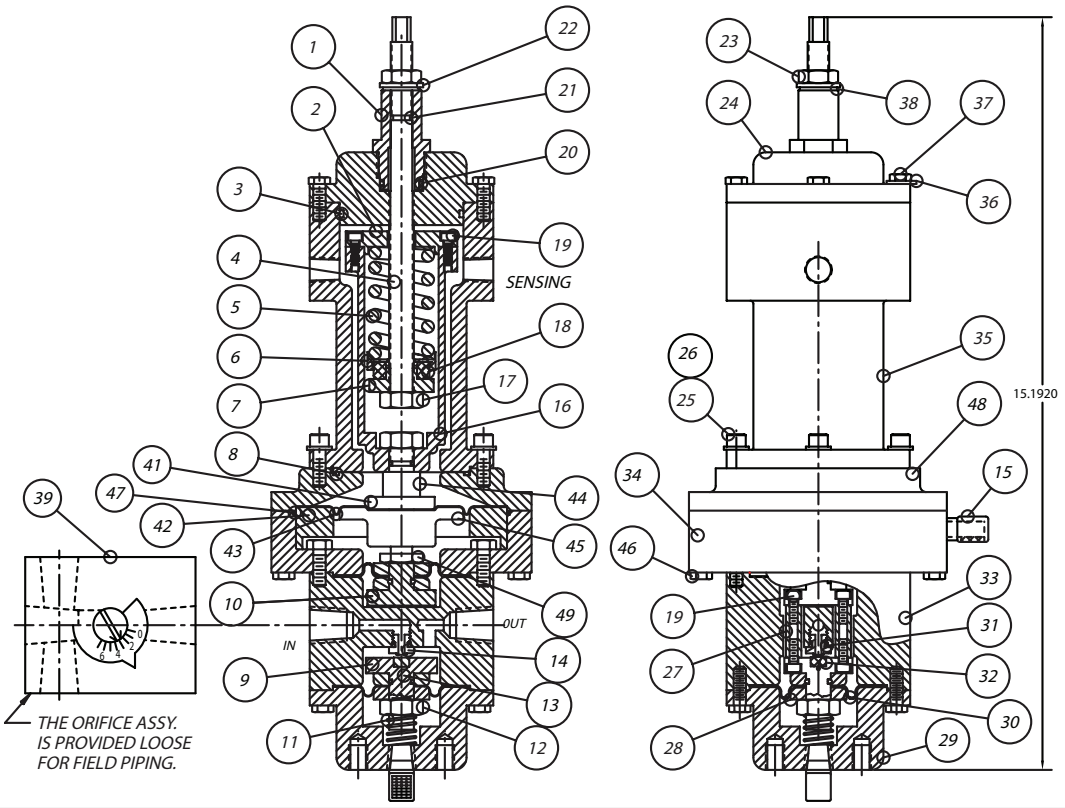
DRESSER
Flow Solutions
Becker Operations

APPROVED BY:
DWG. SIZE: B
DRAWN BY: TS
DATE: 7-15-99
REVISED BY: RM
REVISED DATE: 9-18-03
SCALE: 7/16

FLEXIBLE ELEMENT PILOT

FEP-600-CH

DRAWING NUMBER 30-0023



ITEM	QTY	PART NO.	DESCRIPTION	ITEM	QTY	PART NO.	DESCRIPTION
1.	1	30-7009	SEAL NECK	25.	6	98-3228	1/4-20 X 2" SHCS
2.	1	30-7007	TUBE CAP	26.	6	98-3227	1/4 F.G. WASHER
3.	1	95-2671	O-RING-141	27.	2	25-1023	PILOT POST
4.	1	30-7022	ADJUSTING SCREW	28.	4	25-1016	WASHER
5.	1		CONTROL SPRING	29.	1	25-1022	PRESSURE CARTRIDGE
6.	1	30-7006	BEARING CASE	30.	3	25-1027	DIAPHRAGM W/CONVOLUTE
7.	1	30-7001	BEARING NUT	31.	1	95-2609	O-RING-010
8.	1	98-2655	O-RING-038	32.	1	25-1031	BUNA-N-SEAT
9.	1	25-1018	PISTON W/SEAT	33.	1	25-1039	SP-BODY
10.	1	25-1019	PISTON W/O SEAT	34.	1	35-1548	BOTTOM FLANGE
11.	1	25-1217	BOTTOM SPRING	35.	1	30-7002	SPRING CARTRIDGE
12.	1	98-3056	1/2-20 HEX JAM NUT	36.	1	25-1061	SS CONTROL TAG
13.	3	95-2615	O-RING-012	37.	12	98-3137	1/4-20 X 3/4 HHCS SS
14.	1		3/32 OR 1/8 NOZZLW	38.	1	30-7017	7/16 THREAD SEAL
15.	2	01-2572	1/4 NPT VENT ELBOW	39.	1		SINGLE ORIFICE ASSY.
16.	1	30-7003	INNER TUBE	40.	1	25-1065	1/2-20 SPECIAL NUT
17.	1	98-3213	LH. 1/2-20 JM NUT	41.	1	30-7020	WASHER
18.	1	25-1062	THRUST BEARING	42.	1	35-1549	SPACER
19.	8	98-3269	8-32 X 1/2 SHCS	43.	1	30-7012	DIAPGHRAGM W/HOLE
20.	1	95-2670	O-RING-115	44.	1	30-7015	THREAD EXTENSION
21.	1	95-2672	O-RING-108	45.	1	30-7025	PISTON
22.	1	98-3181	7/16 FT WASHERS SS	46.	8	98-3153	1/4-20 X 1/2 HHCS
23.	1	98-2500	7/16-20 JAM NUT	47.	1	95-2666	O-RING-046
24.	1	30-7008	CARTRIDGE CAP				

TECHNICAL DATA

MATERIALS:
DIAPHRGMS -BUNA-N AND NYLON
SEATS -BUNA-N
NOZZLES, POSTS
CAP SCREWS -316 SS
BODY, POSITION,
WASHERS ETC. -2024-T351 ALUMINUM
(ANODIZED)

CONNECTIONS:

ALL PORTS -1/4 NPT FEMALE

OVERALL SIZE:

LENGTH - 14 5/8"
DIAMETER - 5-1/4"

PRESSURE RATINGS:

"0UT" & "SENSING"
PORTS - 600 PSIG MAX.
"IN" PORT -1480 PSIG MAX.

NOTES:

1) ITEMS NO. 14,17,19,25 AND 37 ARE TORQUED TO 95-100 in. lbs.

2) ALL FASTNERS ARE STAINLESS STEEL.

3) FOR REPAIR KIT SEE #30-9025

DESCRIPTION

THE bpe FEP-175-CH-NC IS A NORMALLY CLOSED PILOT CONTROLLED BY A DIAPHRAGM AND SPRING. THE SET POINT IS ADJUSTABLE BY VARYING THE SPRING FORCE.

CONTROL RANGE		
RANGE (PSIG)	SPRING COLOR	PART NUMBER
7 - 30	BEIGE	25-8238
15 - 50	BURGUNDY	25-8239
20 - 85	PINK	25-8240
50 - 175	YELLOW	25-1306

REP#	BY	DATE	REVISION
E010-03	TRD	3-11-05	(d) ITEM #12 WAS 3;ADD ITEM #50
N/A	RM	11-6-02	(C) GOLD SPRING REMOVED
N/A	RM	2-12-02	(b) ITEM 19. 98-3269 WAS 98-2614
N/A	TS	7-9-00	(a) NEW PILOT DESIGN

DRESSER
Flow Control
Becker Operations

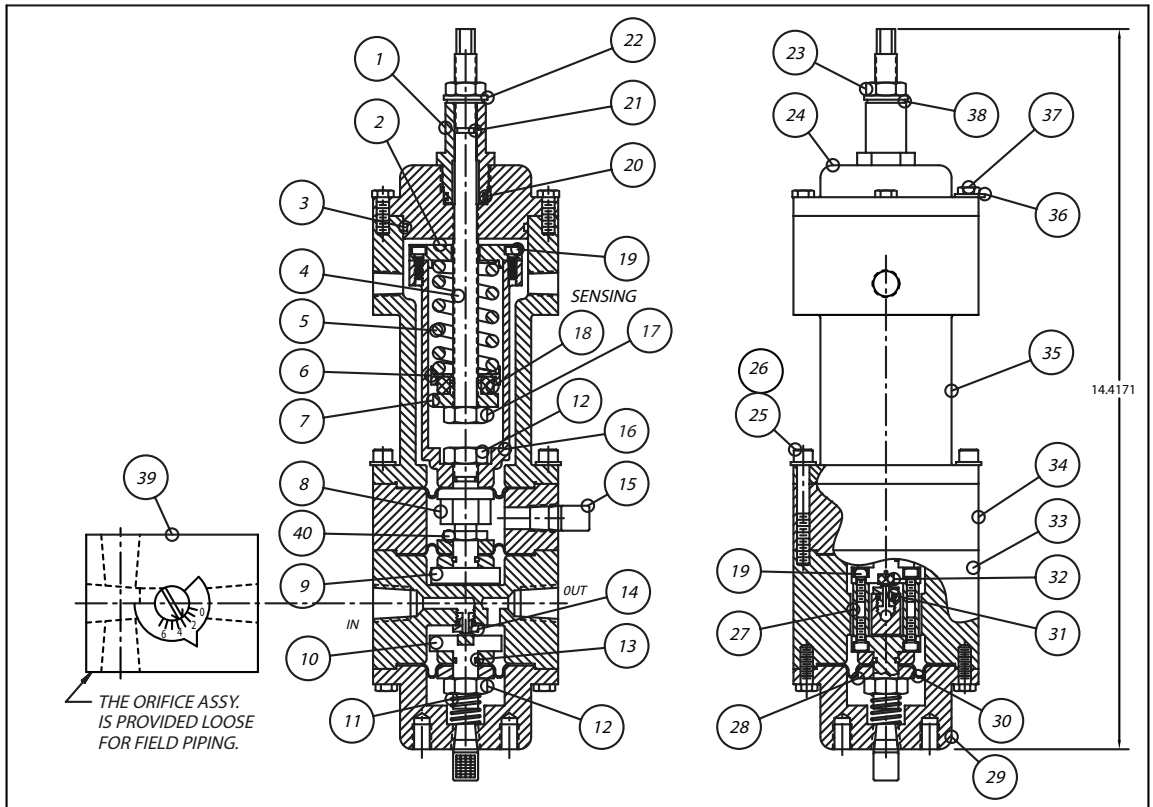
APPROVED BY:
SCALE: 1:7/16

DWG. SIZE: B
DRAWN BY: TS
DATE: 7-14-00
REVISED BY: TRD
REVISED DATE: 3-11-05

FLEXIBLE ELEMENT PILOT

FEP-175-CH-NC

DRAWING NUMBER 30-0031



ITEM	QTY	PART NO.	DESCRIPTION	ITEM	QTY	PART NO.	DESCRIPTION
1.	1	30-7009	SEAL NECK	21.	1	95-2672	O-RING-108
2.	1	30-7007	TUBE CAP	22.	1	98-3181	7/16 FT WASHERS SS
3.	1	95-2671	O-RING-141	23.	1	98-2500	7/16-20 JAM NUT
4.	1	30-7022	ADJUSTING SCREW	24.	1	30-7008	CARTRIDGE CAP
5.	1		CONTROL SPRING	25.	6	98-3230	1/4-20 X 2" SHCS
6.	1	30-7006	BEARING CASE	26.	6	98-3227	1/4" F.G. WASHER
7.	1	30-7001	BEARING NUT	27.	2	25-1023	PILOT POST
8.	1	25-1177	BOTTOM PISTON	28.	4	25-1016	WASHER
9.	1	25-1018	PISTON W/SEAT	29.	1	25-1022	PRESSURE CARTRIDGE
10.	1	25-1019	PISTON W/O SEAT	30.	3	25-1027	DIAPHRAGM W/CONVOLUTE
11.	1	25-1217	BOTTOM SPRING	31.	1	95-2609	O-RING-010
12.	3	98-3056	1/2-20 HEX JAM NUT	32.	1	25-1031	BUNA-N-SEAT
13.	3	95-2625	O-RING-012	33.	1	25-1039	SP-BODY
14.	1		3/32 OR 1/8 NOZZLE	34.	1	35-1548	BOTTOM FLANGE
15.	2	01-2572	1/4 NPT VENT ELBOW	35.	1	30-7002	SPRING CARTRIDGE
16.	1	30-7003	INNER TUBE	36.	1	25-1061	SS CONTROL TAG
17.	1	98-3213	LH. 1/2-20 JM NUT	37.	12	98-3137	1/4-20 X 3/4 HHCS SS
18.	1	25-1062	THRUST BEARING	38.	1	30-7017	7/16 THREAD SEAL
19.	8	98-3269	8-32 X 1/2 SHCS ALLOY	39.	1		SINGLE ORIFICE ASSY.
20.	1	95-2670	O-RING-115				

TECHNICAL DATA

CONNECTIONS:

ALL PORTS -1/4 NPT FEMALE

MATERIALS:

DIAPHRGMS -BUNA-N AND NYLON
SEATS -BUNA-N
NOZZLES, POSTS
CAP SCREWS -316 SS
BODY, POSITION,
WASHERS ETC. -2024-T351 ALUMINUM
(ANODIZED)

OVERALL SIZE:

LENGTH - 14 5/8"
DIAMETER - 3-3/4"

PRESSURE RATINGS:

"OUT" & "SENSING"
PORTS - 600 PSIG MAX.
"IN" PORT -1480 PSIG MAX.

DESCRIPTION

THE bpe FEP-600-CH-NC IS A NORMALLYCLOSED PILOT CONTROLLED BY A DIAPHRAGM AND SPRING. THE SET POINT IS ADJUSTABLE BY VARYING THE SPRING FORCE.

NOTES:

1) ITEMS NO. 14,17,19,25 AND 37 ARE TORQUED TO 95-100 in. lbs.

2) ALL FASTNERS ARE STAINLESS STEEL.

3) FOR REPAIR KIT SEE #30-9024

CONTROL RANGE

RANGE (PSIG)	SPRING COLOR	PART NUMBER
5 - 40	GOLD	25-8236
25 - 125	BEIGE	25-8238
50 - 175	BURGUNDY	25-8239
135 - 300	PINK	25-8240
275 - 600	YELLOW	25-1306

REP#	BY	DATE	REVISION
E010-03	TRD	3-11-05	(b) ITEM #12 WAS 3;ADD ITEM #40
N/A	TS	7-15-99	(a) NEW PILOT DESIGN

DRESSER
Flow Solutions
Becker Operations

APPROVED BY:
SCALE: 1:7/16

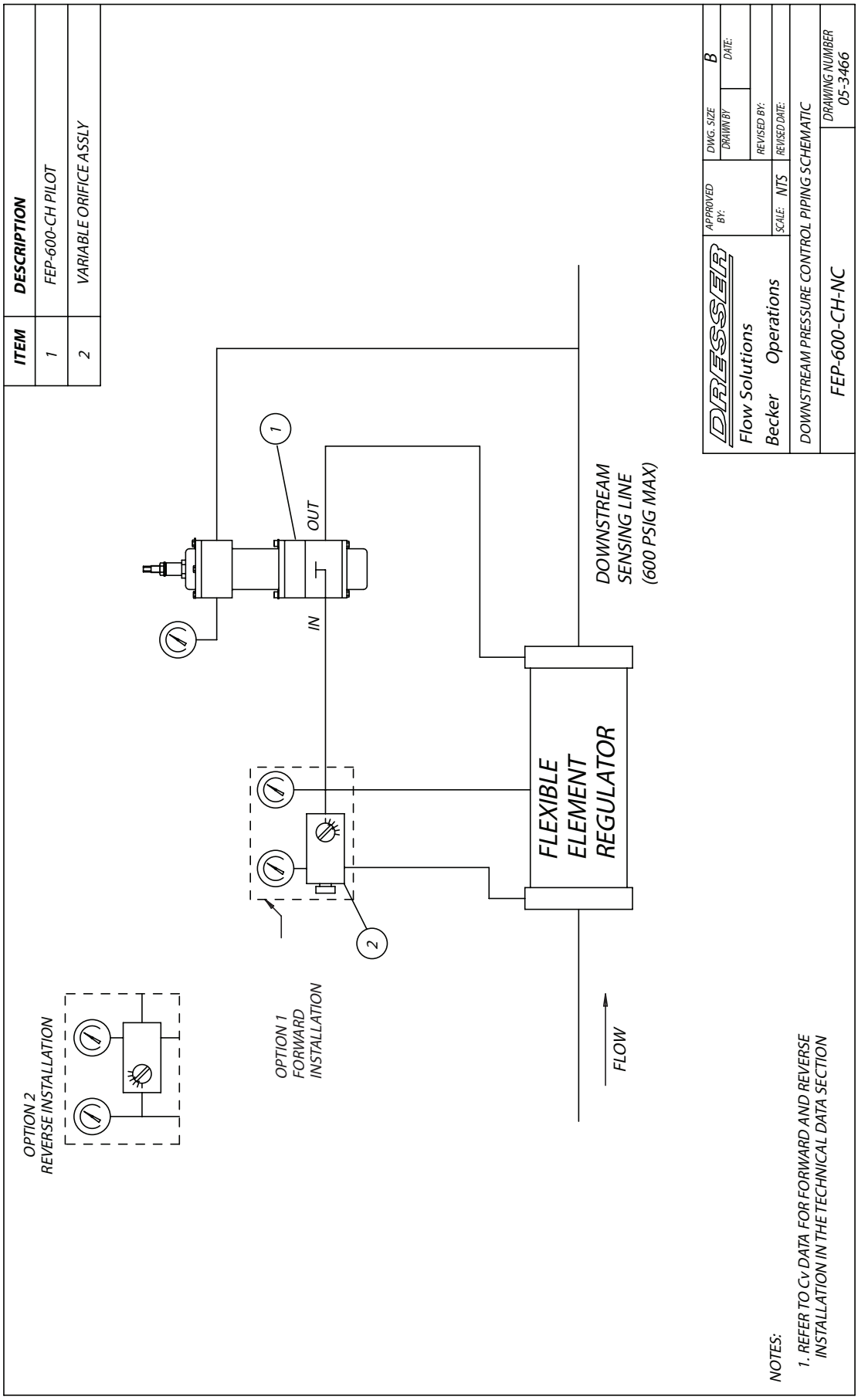
DWG. SIZE B
DRAWN BY TS
DATE: 7-15-00
REVISED BY: TRD
REVISED DATE: 3-11-05

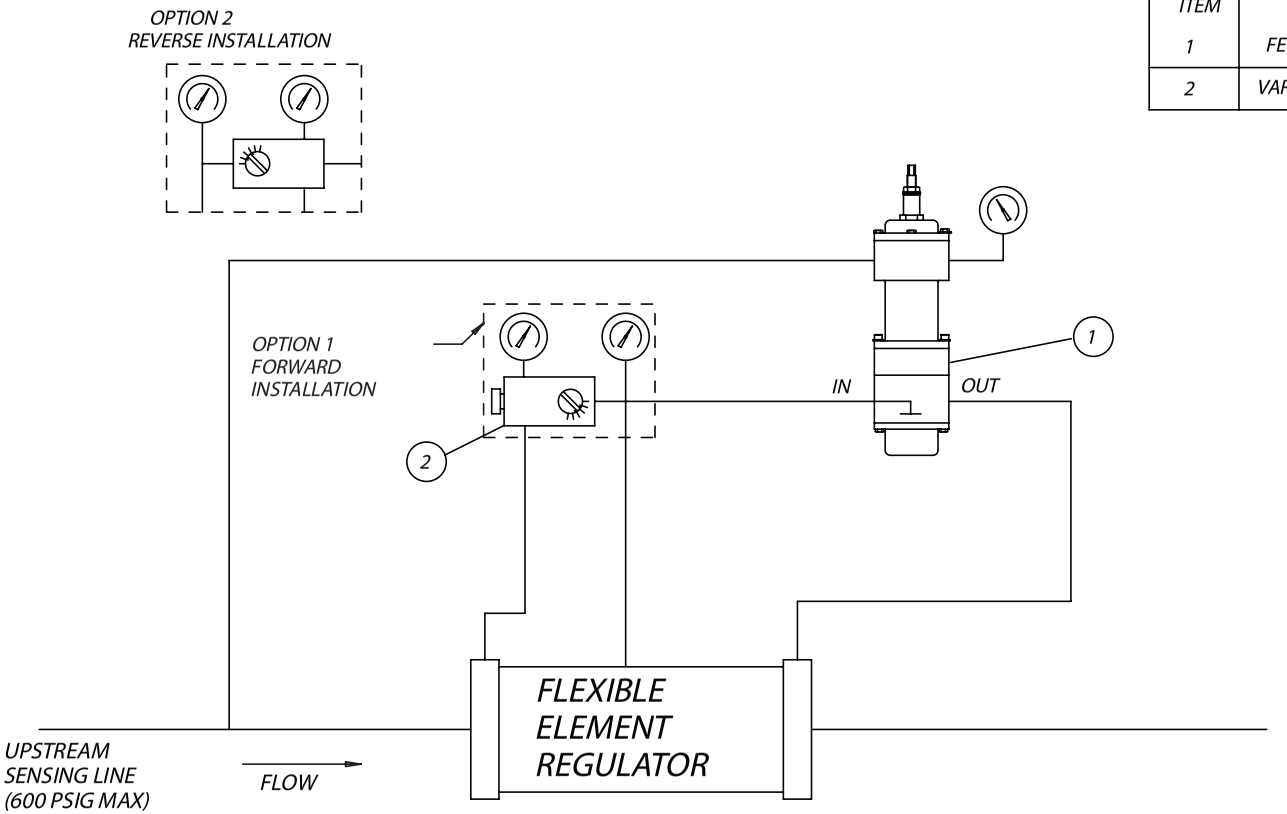
FLEXIBLE ELEMENT PILOT

FEP-600-CH-NC

DRAWING NUMBER 30-0024

Piping Schematics





ITEM	DESCRIPTION
1	FEP-600-CH PILOT
2	VARIABLE ORIFICE ASSLY

NOTES:

1. REFER TO Cv DATA FOR FORWARD AND REVERSE INSTALLATION IN THE TECHNICAL DATA SECTION

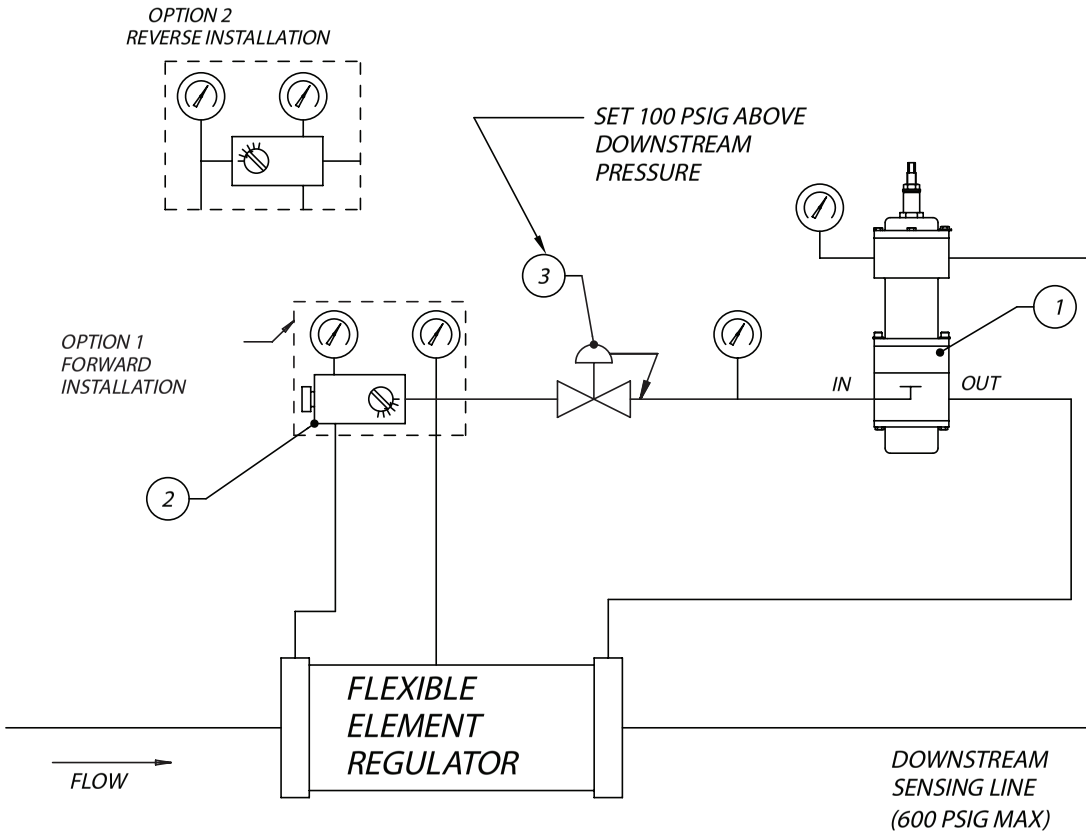
DRESSER
Flow Solutions
Becker Operations

APPROVED BY:
SCALE: NTS
DWG. SIZE B
DRAWN BY FRH
DATE: 10-2-00
REVISED BY:
REVISED DATE:

BACKPRESSURE CONTROL PIPING SCHEMATIC

FEP-600-CH-NC

DRAWING NUMBER 05-3467



ITEM	DESCRIPTION
1	FEP-600-CH PILOT
2	VARIABLE ORIFICE ASSLY
3	FIRST STAGE CUT REGULATOR

NOTES:

1. REFER TO Cv DATA FOR FORWARD AND REVERSE INSTALLATION IN THE TECHNICAL DATA SECTION

DRESSER
Flow Solutions
Becker Operations

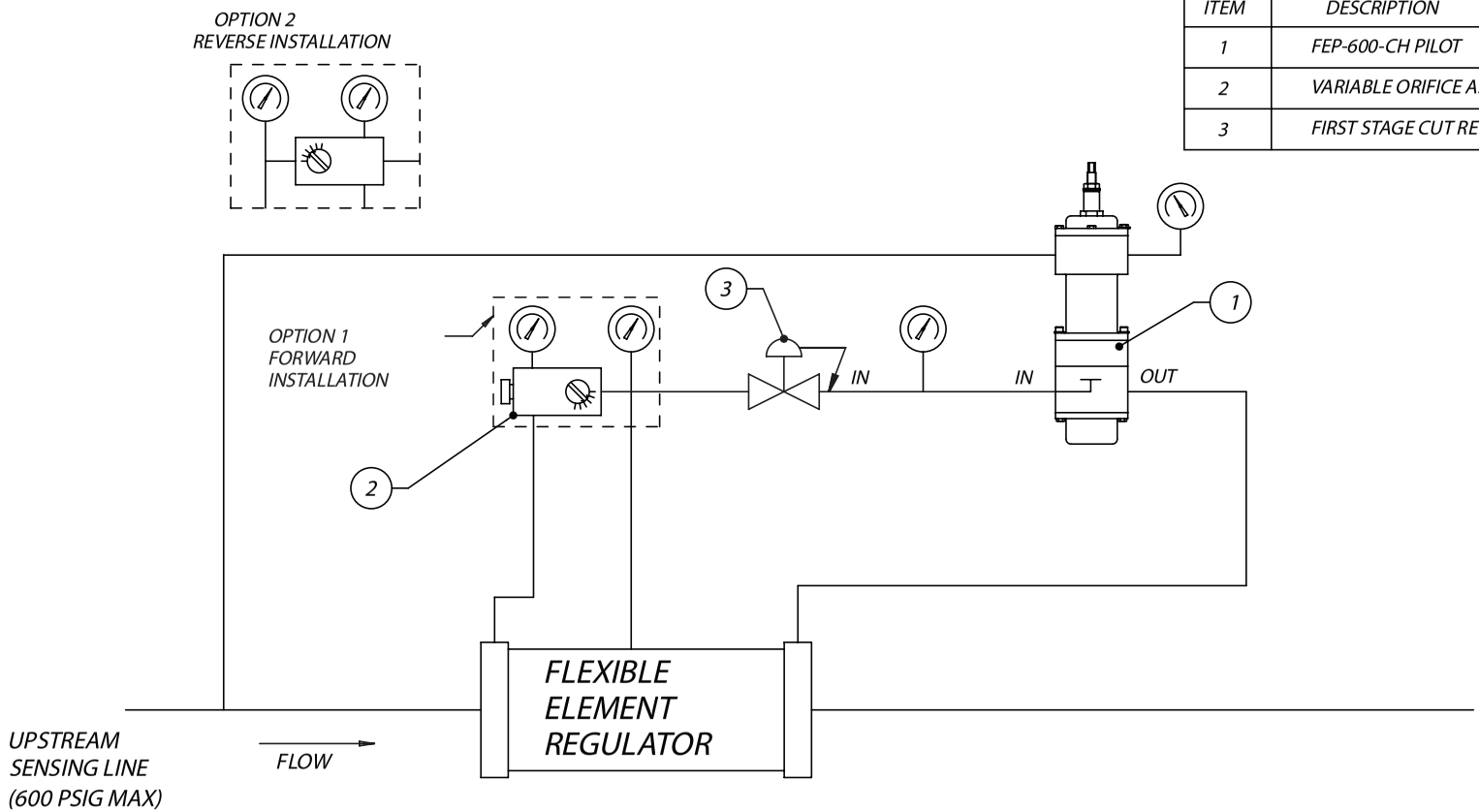
APPROVED BY:
SCALE: NTS
DWG. SIZE B
DRAWN BY
DATE:
REVISED BY:
REVISED DATE:

DOWNSTREAM PRESSURE CONTROL PIPING SCH (REG)

FEP-600-CH-NC

DRAWING NUMBER
05-3468

ITEM	DESCRIPTION
1	FEP-600-CH PILOT
2	VARIABLE ORIFICE ASSLY
3	FIRST STAGE CUT REGULATOR



NOTES:

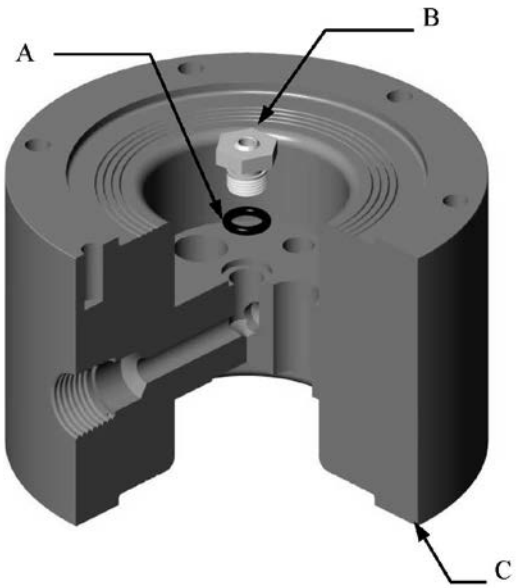
1. REFER TO Cv DATA FOR FORWARD AND REVERSE INSTALLATION IN THE TECHNICAL DATA SECTION

DRESSER Flow Solutions Becker Operations	APPROVED BY:	DWG. SIZE: B
		DRAWN BY: / DATE:
	SCALE: NTS	REVISED BY: / REVISED DATE:
DOWNSTREAM PRESSURE CONTROL PIPING SCH (REG)		
FEP-600-CH-NC		DRAWING NUMBER 05-3469

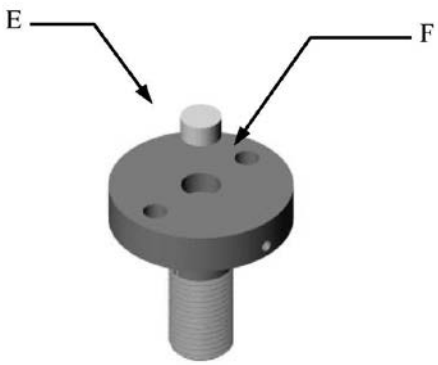
Assembly Procedures

Note: During assembly moisten all O-rings, threads, thrust bearings and the recess in spring seat with a light weight silicone grease. HOWEVER, care should be taken to avoid applying grease to diaphragm sealing surfaces, as this may compromise diaphragm sealing.

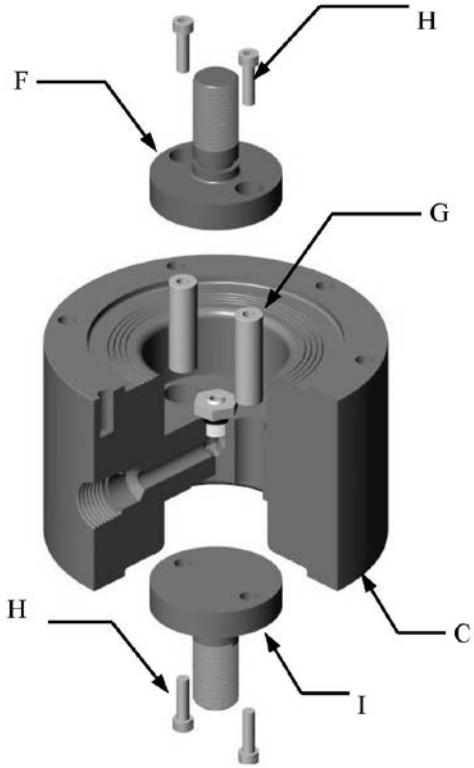
Step 1. Install –010 O-ring (A) on nozzle (B) and install nozzle into the top part the body (C).



Step 2. Press fit seat (E) into outside pistons (F). Make sure the seat is bottomed in the cavity. Tap it down if necessary. The properly installed seat rises 0.005” to 0.020” above the piston surface.

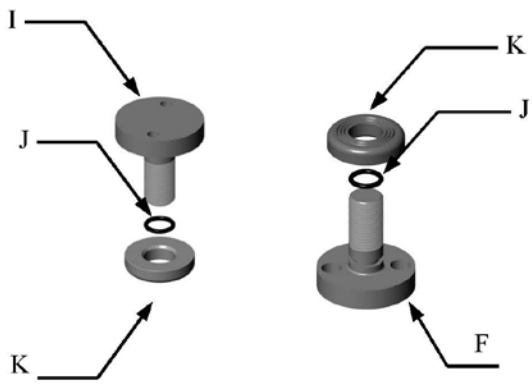


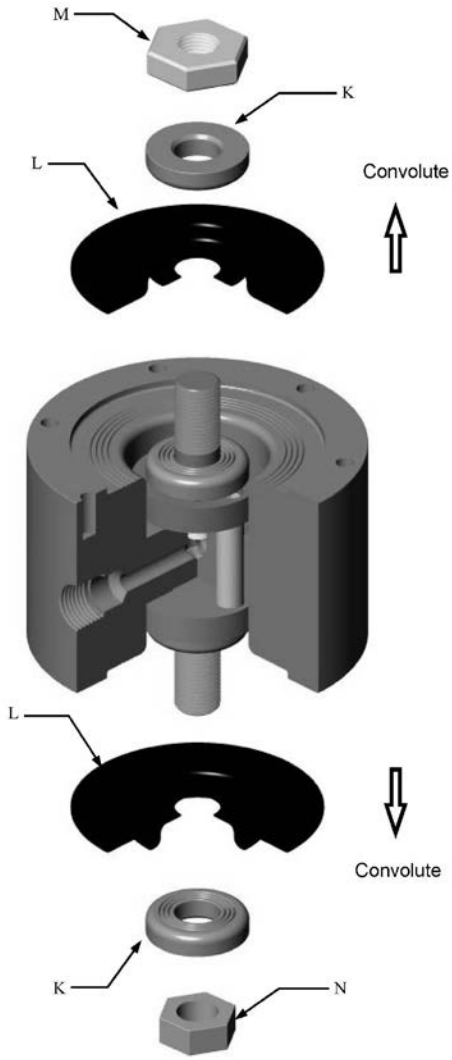
Step 3. Attach outside piston (F) to pilot posts (G) with two 8-32 x 1/2” SHCS (H) and place it into the cavities in the body (C). Connect the inside piston (I) to the posts (G) with two 8-32 x 1/2” SHCS (H).



Step 4. Install all -012 O-rings (J) on inside (I) and outside (F) pistons. Install washers (K) on both pistons.

Note: Grooves on the washers must face the diaphragms.

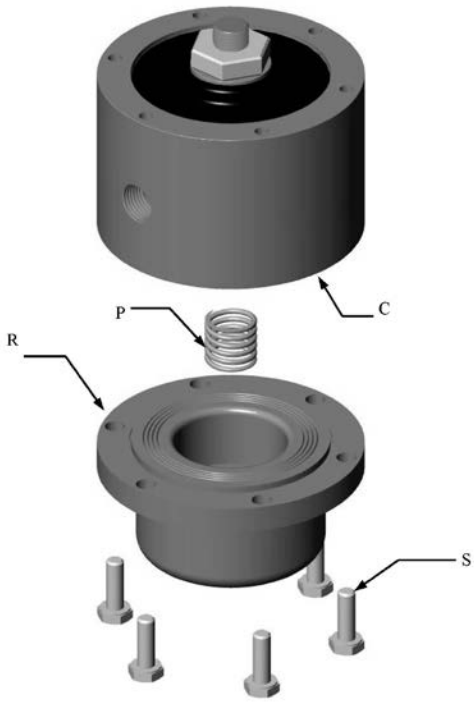




Note: To center the diaphragm, rotate it to the left, mark 1; rotate it to the right, mark 3. Center the diaphragm between 1 and 3, mark 2. Then proceed to step 7.

Step 7. Place bottom spring (P) in the cavity in the pressure cartridge (R).

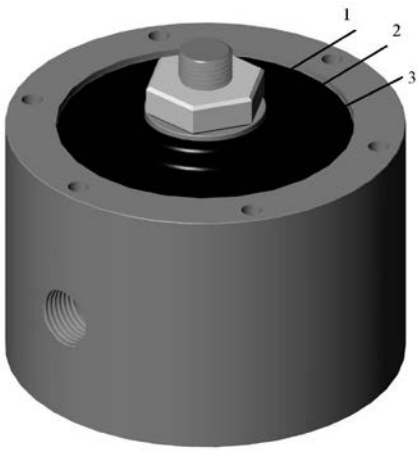
Step 8. Bolt pressure cartridge (R) to the bottom part of the body (C) with 1/4 - 20 x 3/4" screws (S). Make sure the spring (P) fits in the outside of the threaded portion of the inside piston when tightening it.

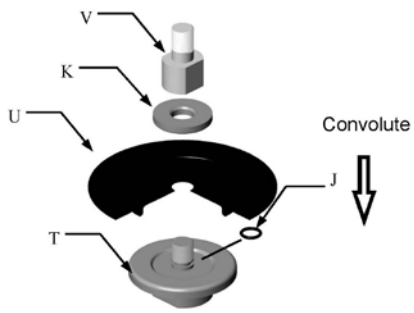


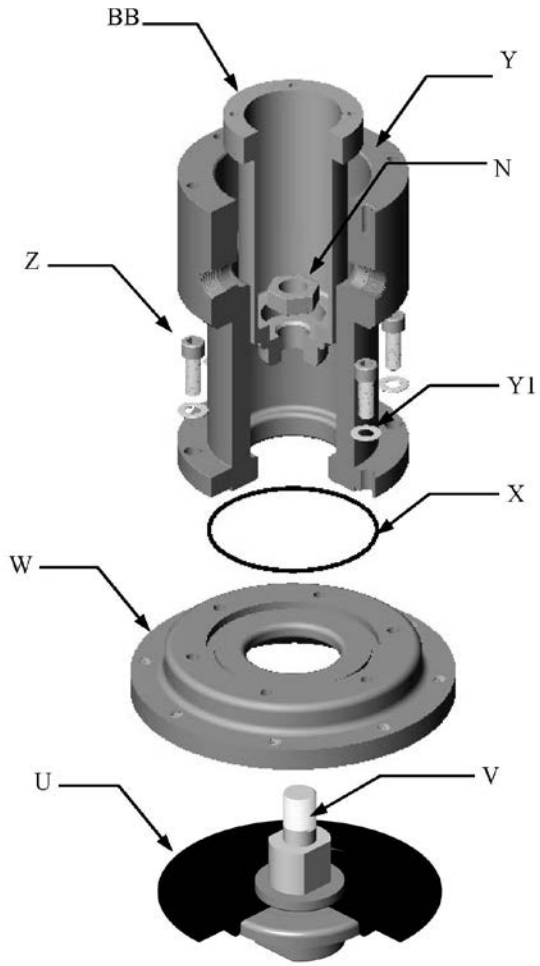
Step 5. Install convoluted diaphragms (L) on the outside and inside pistons. Make sure convoluted diaphragms face the direction shown.

Step 6. Install washers (K) on bottom and top of diaphragms (L) and fasten them with 1/2-20 special nut (M) for the outside piston (F) and 1/2-20 jam nut (N) for the inside piston (I). Torque both nuts to 140-160 in-lb.

Step 9. Diaphragm preassembly.
(for the FEP-175-CH, follow steps 9-13, for the FEP-600-CH, jump to step 14) Place O-ring -012 (J) in piston (T). Place diaphragm with hole (U) on top of piston (T) with convolute facing down as shown. Place washer (K) on top of diaphragm (U) with serations facing the diaphragm (U). Install thread extension (V) in piston (T). Tighten the diaphragm preassembly to 100-110 in-lb.





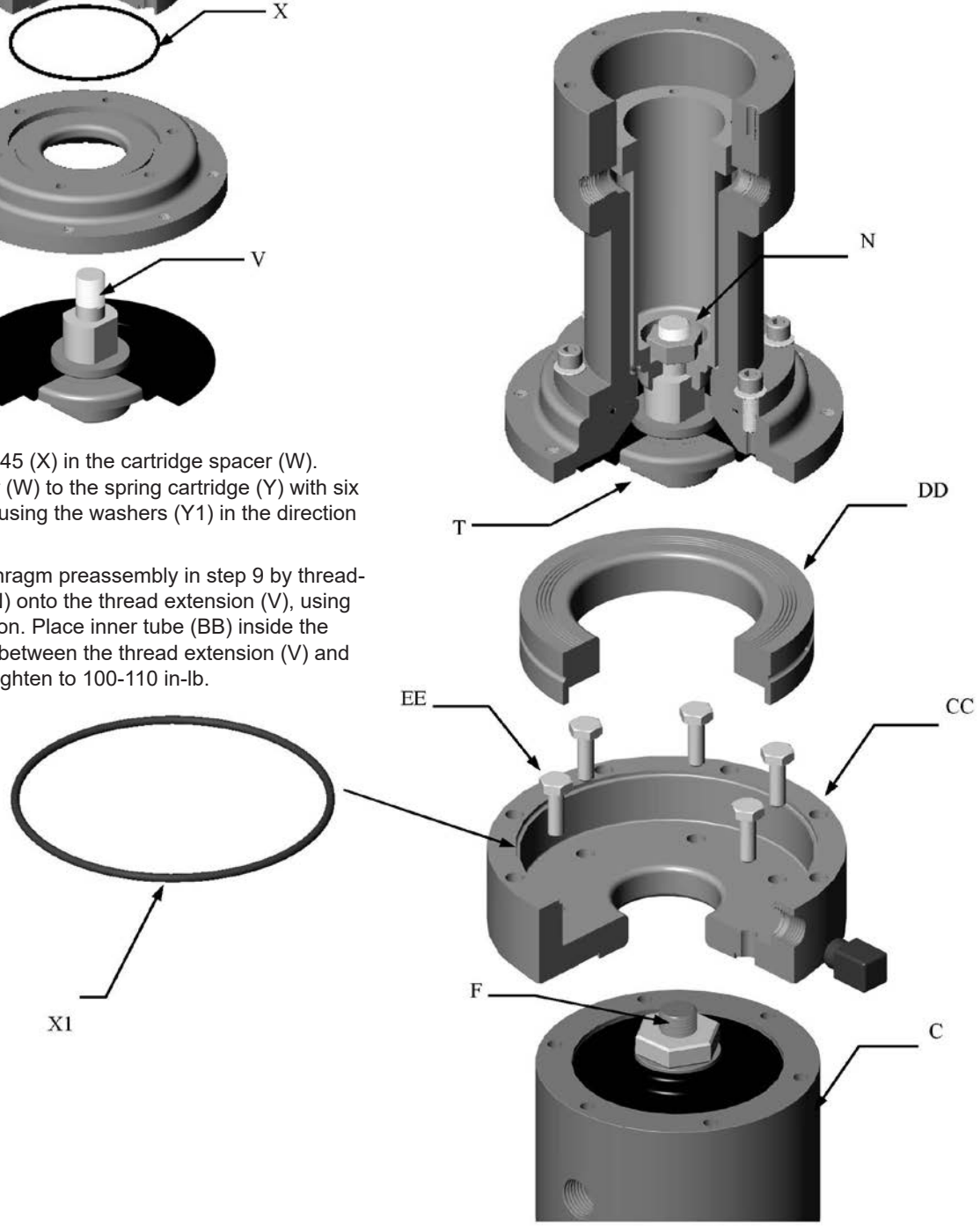


Step 10. Place O-ring -145 (X) in the cartridge spacer (W). Bolt the cartridge spacer (W) to the spring cartridge (Y) with six 1/4 - 20 x 3/4 SHCS (Z) using the washers (Y1) in the direction shown.

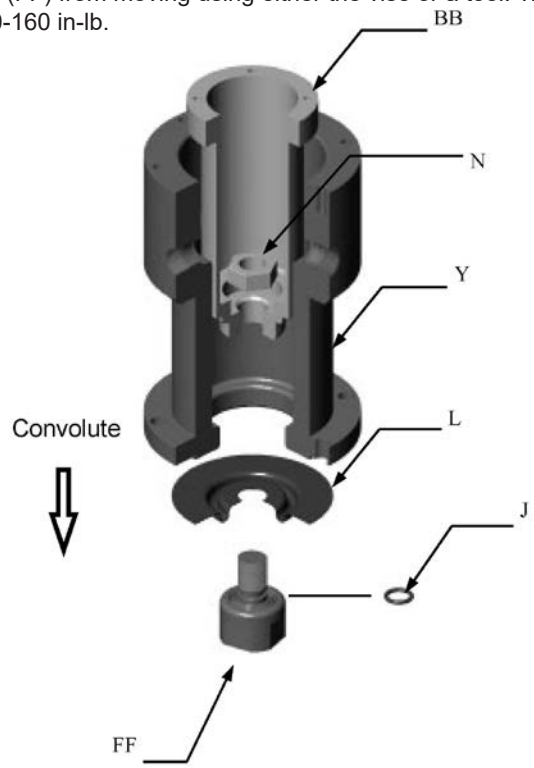
Step 11. Install the diaphragm preassembly in step 9 by threading the 1/2-20 jam nut (N) onto the thread extension (V), using a socket wrench extension. Place inner tube (BB) inside the spring cartridge (Y) and between the thread extension (V) and the nut (N), as shown. Tighten to 100-110 in-lb.

Step 12. Bolt bottom flange (CC) to the pilot body (C) using six 1/4- 20 x 3/4 H.H.C.S (EE) and O-ring -046 (X1) in the o-ring groove in the bottom flange (CC) as shown. Then, place spacer (DD) on top of bottom flange (CC).

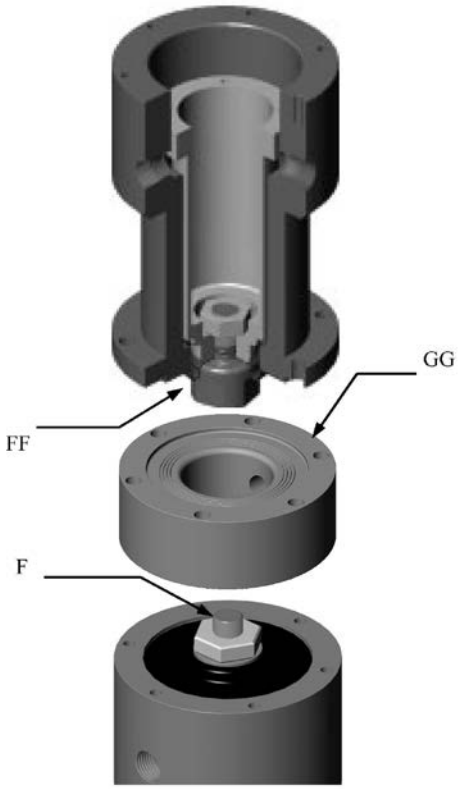
Step 13. Placing a socket wrench extension in 1/2-20 jam nut (N), thread bottom part of piston (T) to the outside piston (F), until is just hand tight, do not force it. **(jump to step 16)**

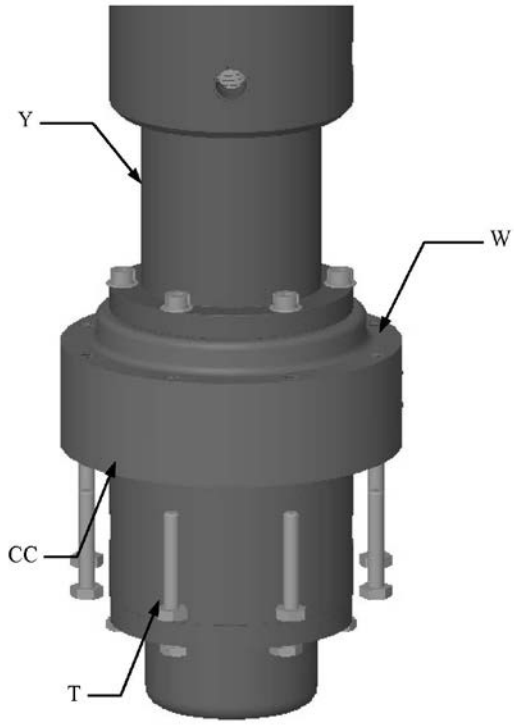


Step 14. (For the FEP-600-CH) Slide O-ring –012 (J) into the bottom piston (FF). Place diaphragm (L) with convolute facing away from threads (as shown). Place inner tube (BB) inside spring cartridge (Y) and on top of diaphragm (L) as shown. Tighten assembly with one 1/2 - 20 nut (N). When placing the nut (N), use a socket wrench extension and keep the bottom piston (FF) from moving using either the vise or a tool. Tighten to 140-160 in-lb.



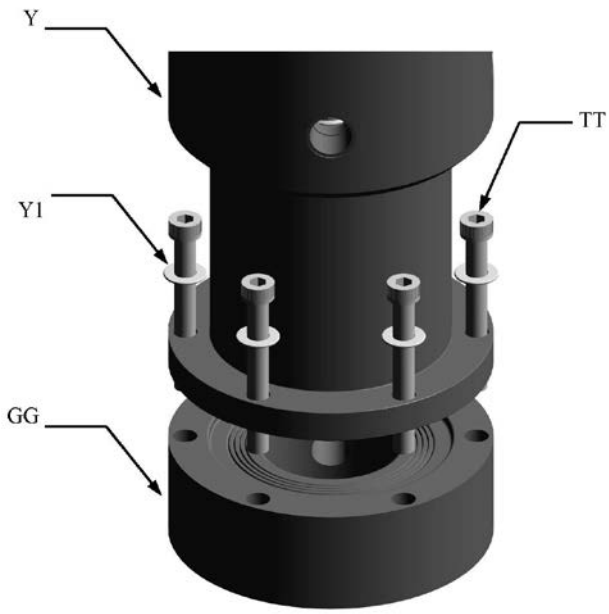
Step 15. Placing a socket wrench extension on top of 1/2-20 jam nut (N), thread bottom of piston (FF) to outside piston (F) placing the spacer (GG) in between them, until is just hand tight, do not force it, as shown.



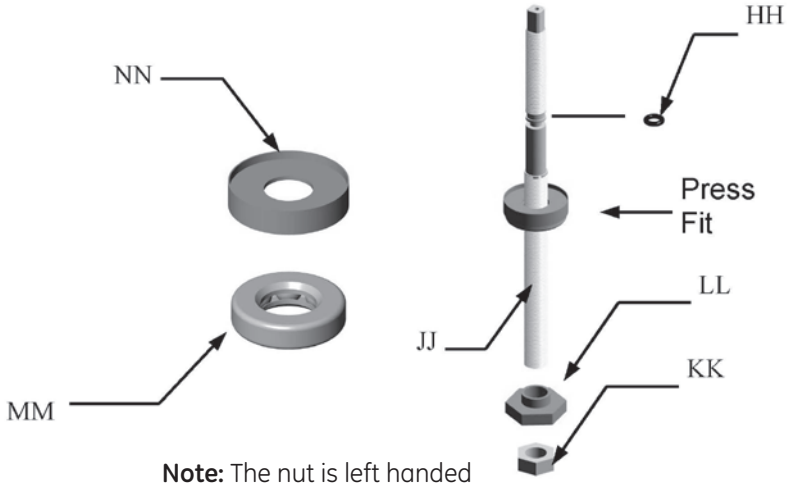


Step 16. For the FEP-175-CH, bolt bottom flange (CC) to cartridge spacer (W) using eight 1/4-20 x 1 H.H.C.S (T) as shown.

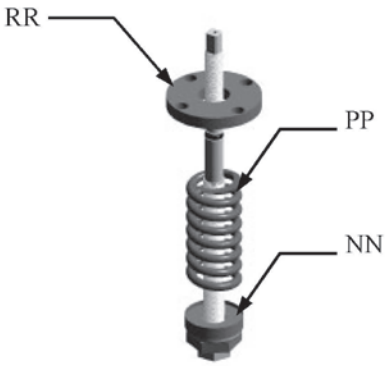
Step 17. For the FEP-600-CH, bolt spring cartridge (Y) to spacer (GG) using six 1/4-20 x 1-1/2 S.H.C.S (TT) and the washers (Y1), as shown.

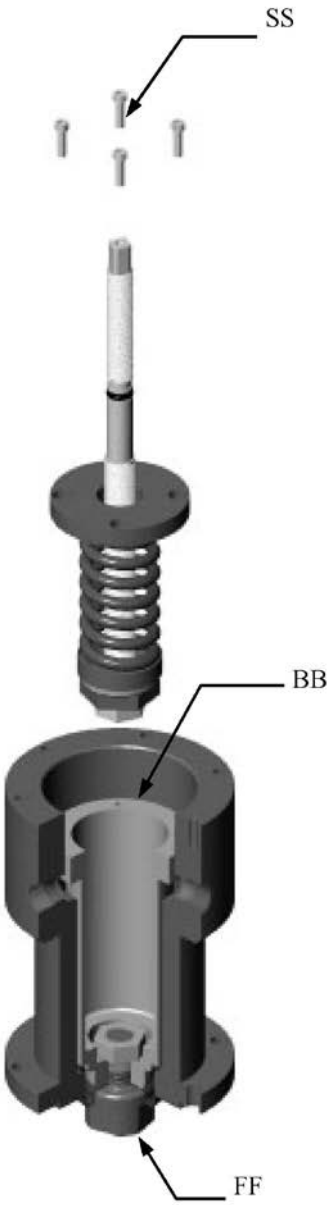


Step 18. Slide O-ring –108 (HH) in adjusting screw (JJ). Place left hand nut (KK) at the bottom part of the adjusting screw (JJ). Install spring nut (LL) on top of nut (KK) and tight one against each other. Press fit bearing (MM), in bearing case (NN) and place the assembly on top of the spring nut (LL) as shown.



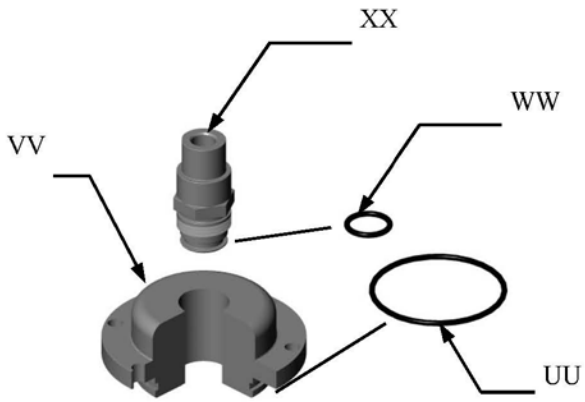
Note: The nut is left handed



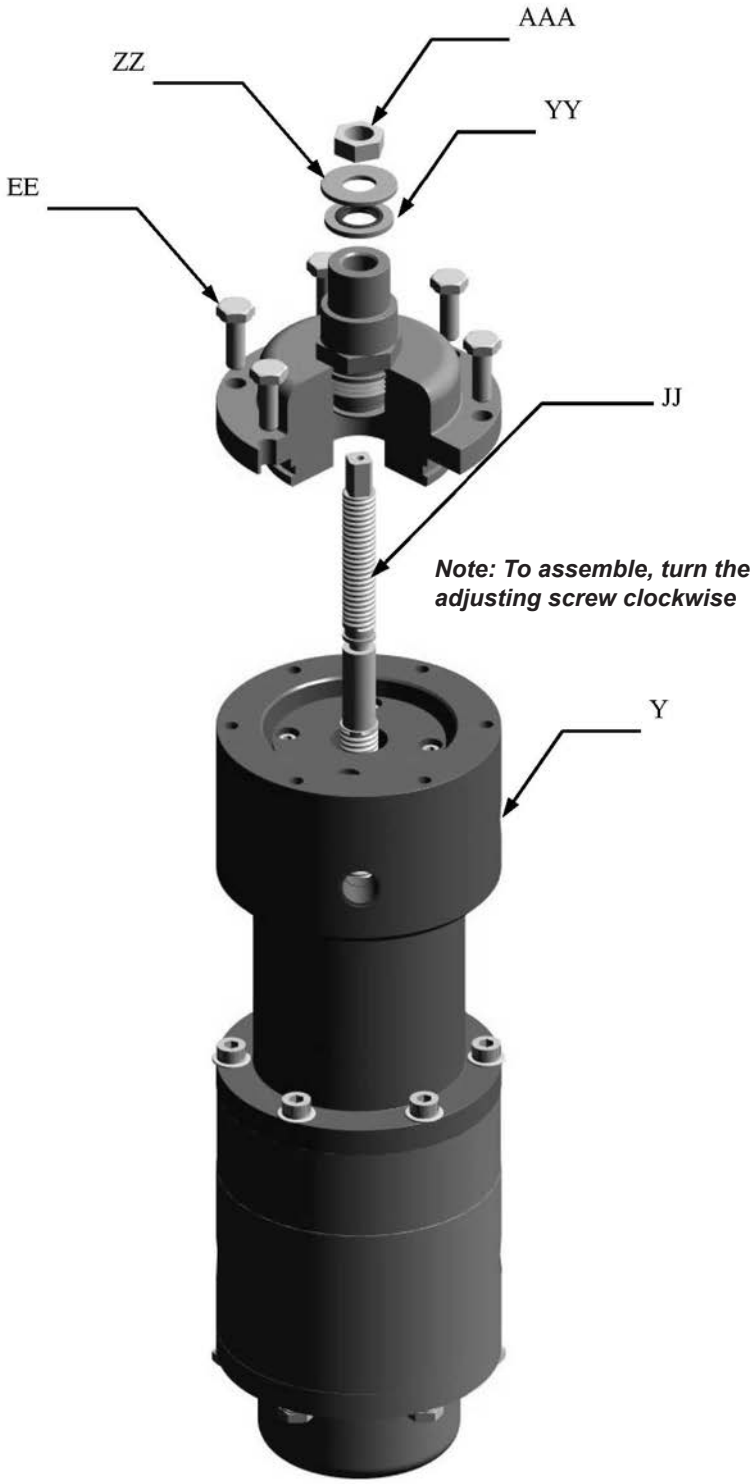


Step 19. Using the assembly in step 16, place control spring (PP) on top of the bearing case (NN) and place tube cap (RR) on top of the control spring (PP).

Step 20. Secure the assembly from step 18 inside the inner tube (BB) using four 8-32 x ½" SHCS (SS).



Step 21. Place O-ring-141 (UU) in the cartridge cap (VV) and place O-ring -115 (WW) in seal neck (XX). Tighten the seal neck (XX) in the cartridge cap (VV) as shown.



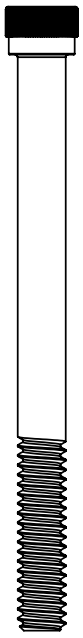
Step 22. Thread the assembly in step 21 into the adjusting screw (JJ) by rotating it counterclockwise until adjusting screw (JJ) is fully exposed. Then rotate adjusting screw (JJ) clockwise until cartridge cap (VV) is fully seated in the spring cartridge (Y). Rotate cartridge cap (VV) to align the mounting holes. Bolt together using six 1/4-20 x ¾" HHCS (EE).

Step 23. Place 7/16 thread seal (YY) and washer (ZZ) on top of the seal neck (XX) and tighten the 7/16 nut (AAA) as shown.

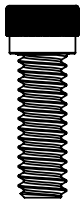
List of Recommended Tools

1. Allen Wrenches — 9/64”, 3/16”, 1/8”
2. Open Wrenches — 7/16”, 3/4”, 11/16”, 5/16”
3. Socket Wrenches — 3/8” Drive, 7/16”, 3/4” (Deepwell 12 Pt.)
4. Adjustable Wrenches — 6”
5. Screwdrivers — Phillips Head, Standard
6. Soft Blow Hammer
7. O-Ring Pik
8. Pen (Centering Of Diaphragm)
9. Genreal Assembly Grease
10. 3/8” Drive Torque Wrench

Parts Silhouettes
Fasteners, Nuts, & Washers (1:1 Scale)

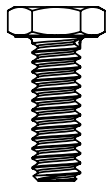


98-3231
1/4-20 x 3 SHCS
316 SS

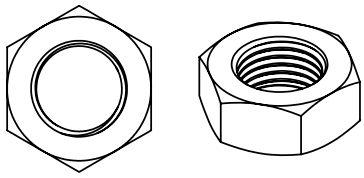


98-3285
1/4-20 x 3/4 SHCS
ALLOY

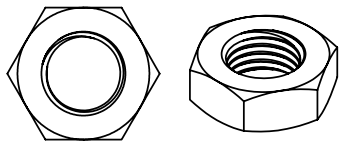
98-3269
8-32 x 1/2 SHCS
ALLOY



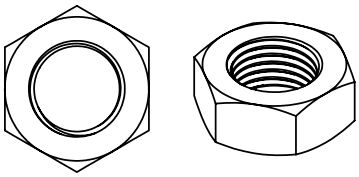
98-3137
1/4-20 x 3/4 HHCS
316 SS



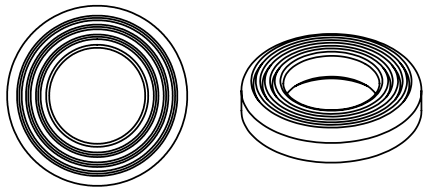
98-3056
1/2-20 HEX JAM NUT
316 SS



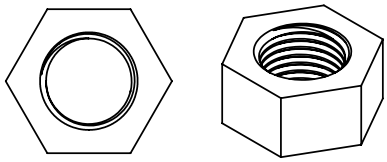
98-2500
7/16-20 JAM NUT
316 SS



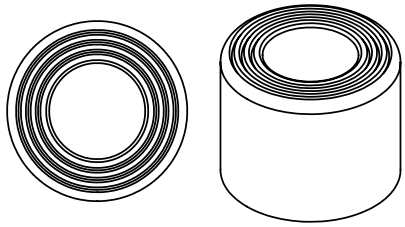
98-3213
LH 1/2-20 HEX JAM NUT
316 SS



30-7014
SMALL WASHER
ALUMINUM 2024-T351

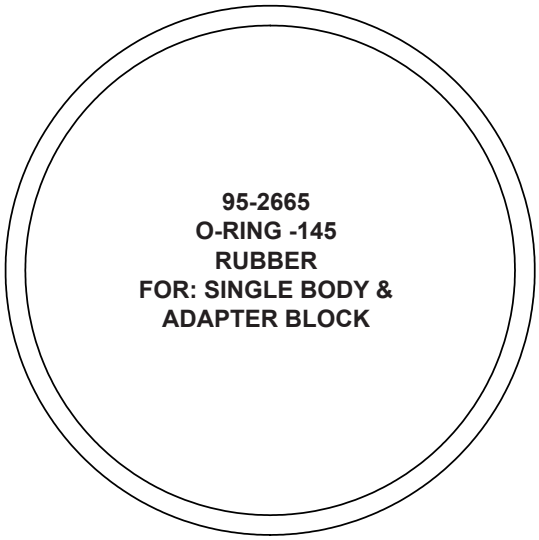


30-7081
1/2-20 SPECIAL NUT
ALUMINUM 2024-T351



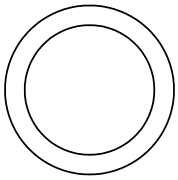
30-7080
PISTON SPACER
ALUMINUM 2024-T351

Parts Silhouettes (Continued)
Washers and Nuts

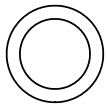


95-2665
O-RING -145
RUBBER
FOR: SINGLE BODY &
ADAPTER BLOCK

95-2671
O-RING -141
RUBBER
FOR: CARTRIDGE CAP



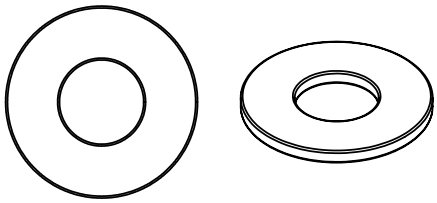
95-2670
O-RING -115
RUBBER
FOR: SEAL NECK



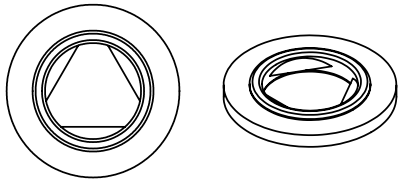
95-2615
O-RING -012
RUBBER
FOR: SMALL PISTON &
PISTONS W/SEAT

95-2672
O-RING -108
RUBBER
FOR: ADJUSTING
SCREW

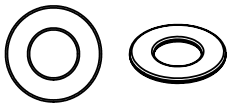
95-2609
O-RING -010
RUBBER
FOR: NOZZLE



98-3181
7/16 FLAT WASHER
316 SS



30-7017
7/16 THREAD SEAL
PLATED STEEL W/
RUBBER INSERT



98-3227
1/4 I.D. X 1/2 O.D. WASHER
FIBERGLASS

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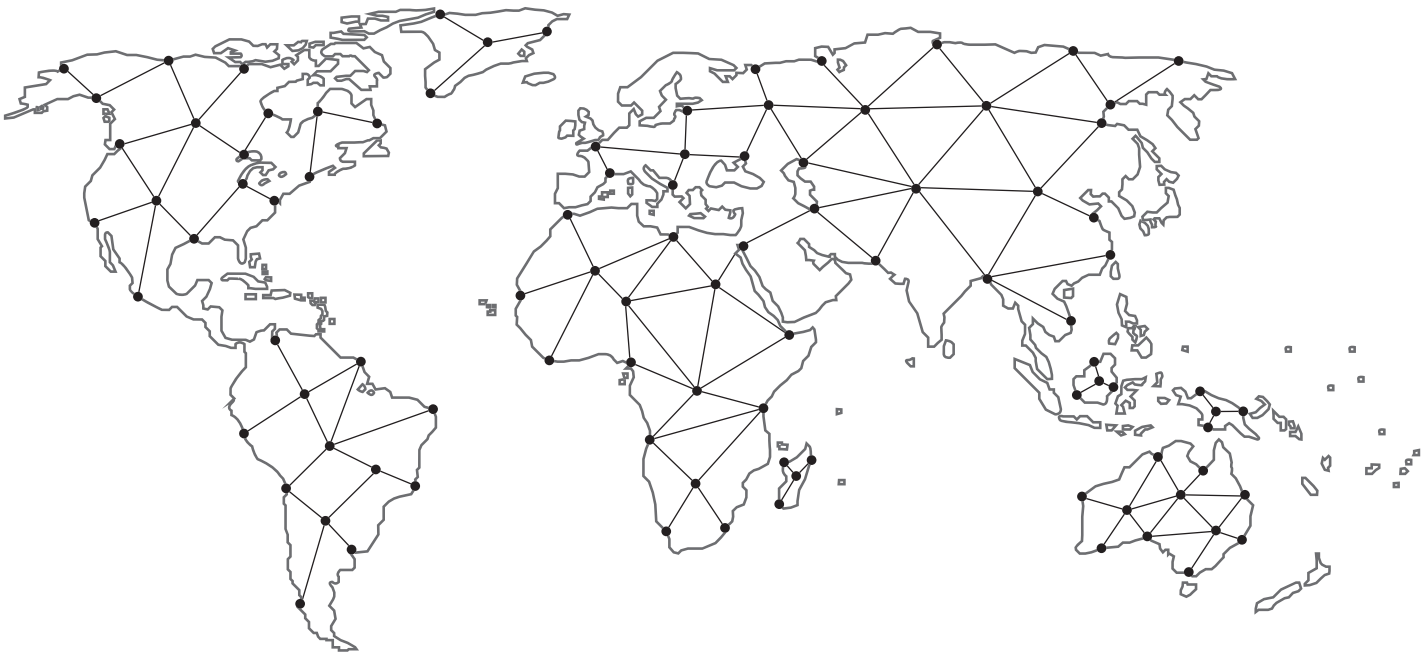

Tech Field Support & Warranty:

Phone: +1-866-827-5378

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