



Operation, Maintenance & Installation Instructions

Form No.	Section	Issue Date	Rev. Date
F-1031	2320	05/27/09	

Butterfly Valve Pneumatic Actuator - (VPVL250)

Also Refer to the Following:

SPL82743: For Repair Parts Available from Waterous

F-1031, Section 2318: Butterfly Valve Installation, Operation and Maintenance

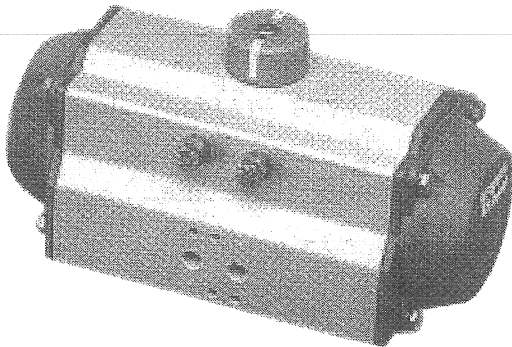
Visit us at www.waterousco.com

Waterous Company 125 Hardman Avenue South South St. Paul, Minnesota 55075 USA (651) 450-5000

Instructions subject to change without notice.

IMO - 528EN Issue Date: 2/07

INSTALLATION, MAINTENANCE, AND
OPERATING INSTRUCTIONS



VALV-POWR® VPVL MOD C VALUE-LINE® DOUBLE-OPPOSED PISTON ACTUATORS

Read entire instructions carefully before installation or servicing

TABLE OF CONTENTS

1	GENERAL	2
	1.1 Warning	2
2	TECHNICAL DATA	2
3	INSTALLATION	3
	3.1 General	3
	3.2 Operation	3
4	MAINTENANCE	3
	4.1 General	3
	4.2 Disassembly	3
	4.3 Assembly	4
5	SAFETY LOCKOUT DEVICE	9
6	ACTUATOR STORAGE	10
7	REPAIR KITS/SPARE PARTS	10
8	EXPLODED VIEW	10
	Parts List	11

1 GENERAL

This instruction manual contains important information regarding the installation, operation, and troubleshooting of the Jamesbury® Valv-Powr VPVL Mod C Value-Line Double-Opposed Piston Actuators. Please read these instructions carefully and save them for further reference.

6. OPERATING THE ACTUATOR OVER TEMPERATURE LIMITS MAY DAMAGE INTERNAL AND EXTERNAL COMPONENTS (DISASSEMBLY OF SPRING RETURN ACTUATORS MAY BE DANGEROUS).
7. OPERATING OVER PRESSURE LIMITS MAY RESULT IN PREMATURE FAILURE AS WELL AS DAMAGE TO THE HOUSING.

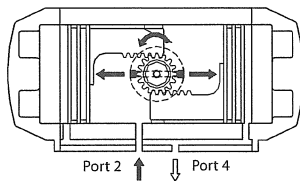
1.1 WARNING

1. KEEP HANDS AND CLOTHING AWAY FROM THE VALVE PORTS AND ACTUATOR PINION AT ALL TIMES.
2. DO NOT ATTEMPT TO DISASSEMBLE INDIVIDUAL SPRING CARTRIDGES. DISASSEMBLY OF THE CARTRIDGE MAY RESULT IN SERIOUS PERSONAL INJURY. IF MAINTENANCE OF THE CARTRIDGE IS NECESSARY, IT MUST BE RETURNED TO METSO AUTOMATION.
3. SHUT OFF AND BLEED ALL SUPPLY LINES BEFORE INSTALLATION OR SERVICING. DO NOT REMOVE END CAPS WHILE THE ACTUATOR IS PRESSURIZED.
4. BEFORE INSTALLING THE VALVE AND ACTUATOR, BE SURE THAT THE INDICATOR ON TOP OF THE ACTUATOR CORRECTLY SHOWS THE VALVE POSITION. FAILURE TO ASSEMBLE THESE PRODUCTS TO INDICATE THE CORRECT VALVE POSITION COULD RESULT IN PERSONAL INJURY.
5. AN ACTUATOR MUST BE SIZED ACCURATELY FOR PROPER OPERATION. REFER TO INFORMATION ON ACTUATOR OUTPUT TORQUES IN THIS BULLETIN AND VALVE TORQUE REQUIREMENTS IN THE APPROPRIATE VALVE BULLETIN.

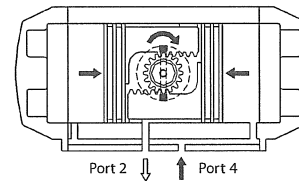
2 TECHNICAL DATA

1. **Operating Media:** Dry or lubricated air, non-corrosive and inert gas, or light hydraulic oil.
2. **Air Supply:** 116 psi (8 bar) Maximum.
3. **Temperature:**
 Standard – NBR; -4° to 175°F (-20° to 80°C)
 HT – Viton O-rings: -4° to 300°F (-20° to 150°C)
 LT – Silicon O-rings: -40° to 175°F (-40° to 80°C)
 LX – Silicon O-rings + Low Temp. Grease:
 -60° to 175°F (-50° to 80°C)
4. **Lubrication:** Factory lubricated for the life of the actuator under normal operating conditions.
5. **Construction:** Suitable for indoor and outdoor use.
6. **External Travel Stops:** ±4 degree adjustment on 90 degree stroke.

Double-Acting (Top View)



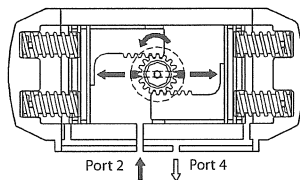
Air supplied to **Port 2** forces pistons apart and toward end positions with exhaust air exiting at **Port 4** (a counterclockwise rotation is obtained).



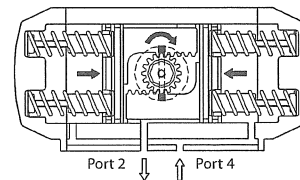
Air supplied to **Port 4** forces pistons toward center with exhaust air exiting at **Port 2** (a clockwise rotation is obtained).

Figure 1

Spring-Return (Top View) Spring-to-Close



Air supplied to **Port 2** forces pistons apart and toward end position, compressing springs. Exhaust air exits at **Port 4** (a counterclockwise rotation is obtained).



Loss of air pressure allows springs to force pistons toward center position with exhaust air exiting at **Port 2** (a clockwise rotation is obtained).

Figure 2

3 INSTALLATION

3.1 General

1. Check to see that the desired failure mode is correct (**Figures 1 & 2**). In the spring-to-close mode, the actuator will cycle clockwise to close upon loss of pressure. If the spring-return actuator is not set up in the configuration desired, follow the disassembly procedure section 4.2. Reverse the orientation of the pistons, then reassemble following the assembly procedure, section 4.3.
2. Mount the actuator to the valve, following the direction in the linkage AMI or valve IMO.
3. Connect a regulated air supply to the NPT fitting in the actuator housing. **CAUTION: The maximum operating pressure is 116 psi (8 bar).**
4. Adjust the stop screws following **ASSEMBLY** Section 4.3.5. Stops can be adjusted by up to ± 4 degrees.

3.2 Operation

1. The actuator series, size, operating pressure, output torque, spring directions, and drive type is determined by the actuator designation.
2. The label lists the actuator series, size, operating pressure, maximum pressure, and serial number. Actuator designation example, VPVL300 SR6 B F07-N-L-19, is a spring-return series, VPVL300 double-opposed piston actuator that has 80-psi (5.5-bar) springs, a Teflon[®]-coated anodized housing (protection B), an end-of-stroke output torque of 41.1 FT•LBS (55.7 N•m), mounts via an F07 pattern, and uses a 19-mm female parallel square to drive the valve.

4 MAINTENANCE

4.1 General

NOTE: All VPVL actuator fasteners are metric. Under normal operating conditions the actuator requires only periodic observation to ensure proper adjustment. Service kits are available to replace seals and bearings (soft parts). These parts are identified in (**Figure 23**) and listed in (**Table 3**). (**Table 1**) below lists kit part numbers.

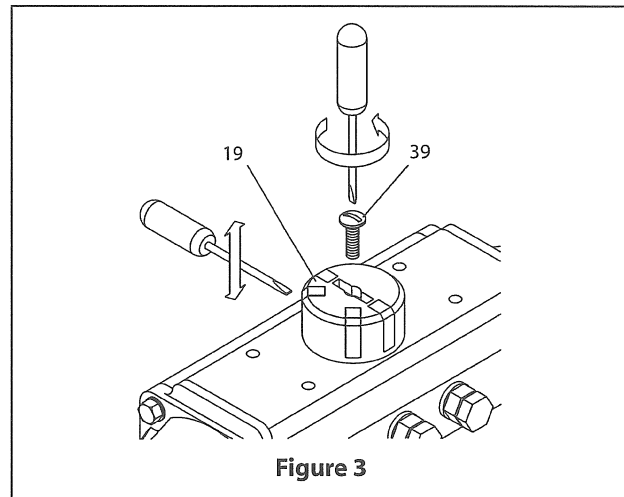
4.2 Disassembly

When disassembly of the actuator is required for maintenance, remove the actuator from the valve. Ensure proper lifting procedures are followed when moving or carrying actuators. (**Table 4**) lists the approximate weights of the VPVL actuators and provides outline dimensions for the double acting and spring return actuators. **CAUTION: Do not use the M5 VDE/VDI mounting holes or the M6 hole in the pinion for lifting the actuator.**

When disassembling VPVL actuators, use caution and be certain that the actuator is free from accessories and the air supply is disconnected. When the actuator is a spring-return unit, make sure that the actuator is in the failed position before disassembling.

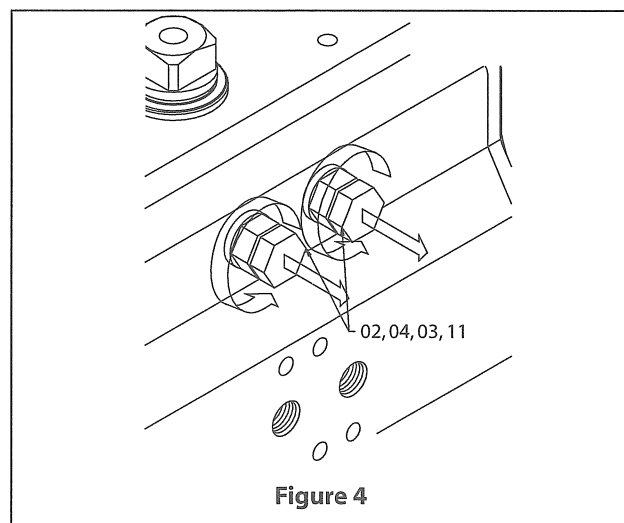
TABLE 1			
Complete Service Kit			
Actuator	Standard	High Temp.	Low Temp.
VPVL-01/011	RKP-152	RKP-232	RKP-247
VPVL-050/051	RKP-153	RKP-233	RKP-248
VPVL-100	RKP-154	RKP-234	RKP-249
VPVL-200	RKP-155	RKP-235	RKP-250
VPVL-250	RKP-156	RKP-236	RKP-251
VPVL-300	RKP-157	RKP-237	RKP-252
VPVL-350	RKP-158	RKP-238	RKP-253
VPVL-400	RKP-159	RKP-239	RKP-254
VPVL-450	RKP-160	RKP-240	RKP-255
VPVL-500	RKP-161	RKP-241	RKP-256
VPVL-550	RKP-162	RKP-242	RKP-257
VPVL-600	RKP-163	RKP-243	RKP-258
VPVL-650	RKP-164	RKP-244	RKP-259
VPVL-700	RKP-165	RKP-245	RKP-260
VPVL-800	RKP-166	RKP-246	RKP-261

1. Removal of Position Indicator (19,20), (Figure 3):



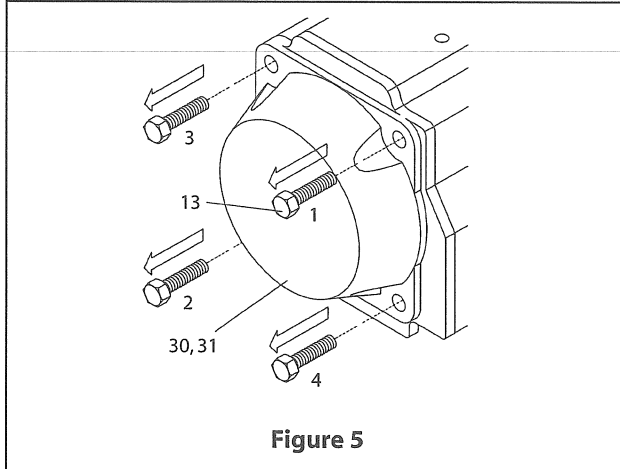
- A. Remove cap screw if fitted (39).
- B. Lift position indicator (19) off shaft; it may be necessary to pry gently with a screwdriver.

2. Removal of Stop Cap Screws (02), (Figure 4):



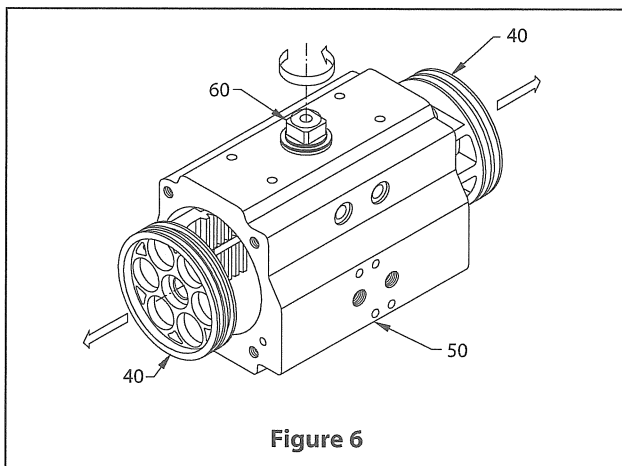
- A. Remove both stop cap screws (02) together with nut (04) and washer (03).
- B. Remove stop screw o-rings (11) and discard if replacing all soft parts.

3. End Cap (30, 31) Disassembly, (Figure 5):



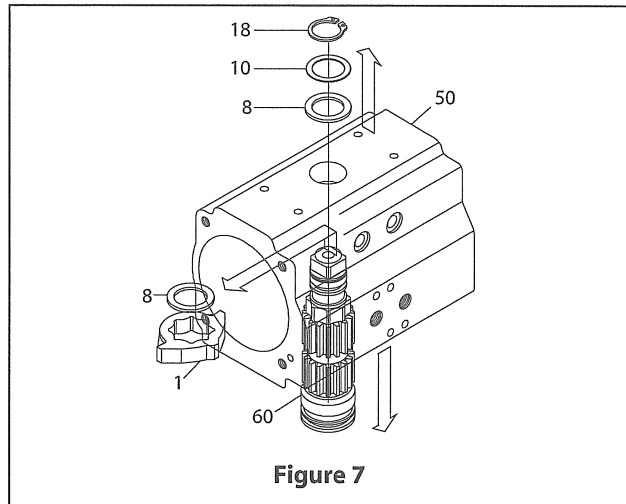
- A. Remove the end cap bolts (13) in the sequence shown in (Figure 5). **CAUTION: When disassembling a spring return actuator, the end cap (30, 31) should be loose after unscrewing end cap bolts (13) 4-5 turns. If there is still force on the end cap (30, 31) after 4-5 turns of the end cap bolt (13), this may indicate a damaged spring cartridge and any further disassembly should be discontinued. Further disassembly of the end-caps may result in serious personal injury. Return actuator to Metso Automation for further maintenance.**
- B. For spring return actuators, remove spring cartridges (17).
- C. Remove end-cap o-rings (14) and discard if replacing all soft parts.

4. Piston (40) Disassembly, (Figure 6):



- A. Holding the body (50) in a vice (or similar device), rotate the drive shaft (60) until the pistons (40) are released. **CAUTION: Air Pressure should not be used to remove the pistons from the body.** Clean and inspect the piston teeth for signs of wear. Replace piston if wear seems excessive.
- B. Remove piston o-ring seal (16) using a screwdriver. Remove the piston head (15) and piston back (5) bearings. Discard bearings if replacing all soft parts.

5. Drive Shaft (60) and Bearing (6, 7) Disassembly, (Figure 7):



- A. Remove spring clip (18) carefully, using snap-ring pliers. Remove external thrust bearing (8) and thrust washer (10).
- B. Apply downward force to top of drive shaft (60) until it is partially out of the bottom of the body (50) and the octi-cam (1) and internal thrust bearing (8) can be removed. Remove the octi-cam (1) and internal thrust bearing (8). Push the drive shaft (60) completely out of the bottom of the body (50). If the shaft (60) does not move freely, gently tap with a plastic mallet.
- C. Remove the top and bottom shaft bearings (6, 7) and top and bottom shaft o-rings (21, 22). Discard if replacing all soft parts.

6. Cleaning and Inspection.

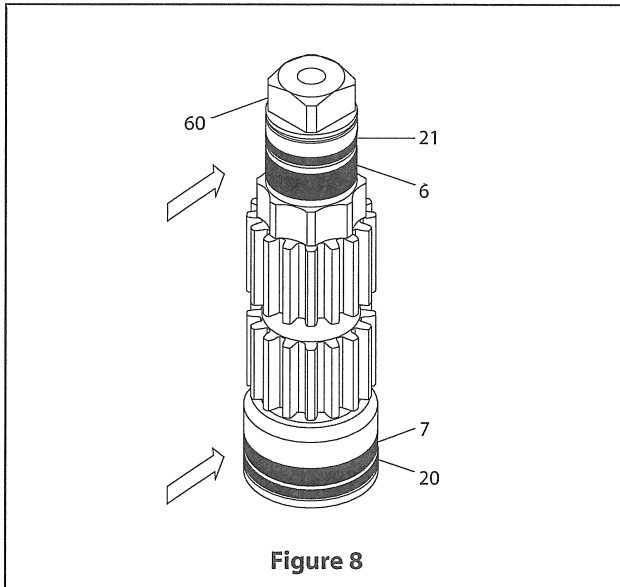
- A. When all components are disassembled, those not being replaced should be properly cleaned and inspected for wear prior to re-assembly.

4.3 Assembly

Prior to assembly, ensure that all components are clean and undamaged.

NOTE: (Table 2) lists the recommended Valv-Powr lubricants.

TABLE 2	
Recommended VPVL Lubricants	
General Use	Kluber UniGear LA 02 Grease
	Esso (Exxon) Beacon EP2
	Fina Marson EP L2
	Shell Alvania EP2
	Mobilux EP2
	Dyrdene Pyroplex EP2
	Oilsum Multiplex
O-Ring Areas	Dow-Corning Silicone 111
	Parker Super-O-Lube

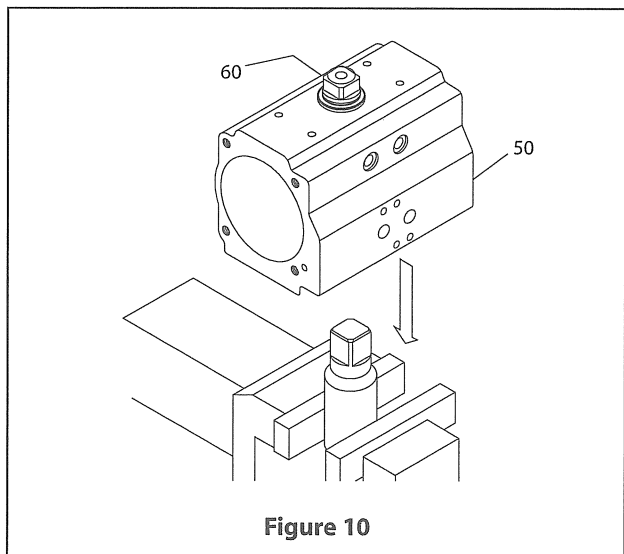
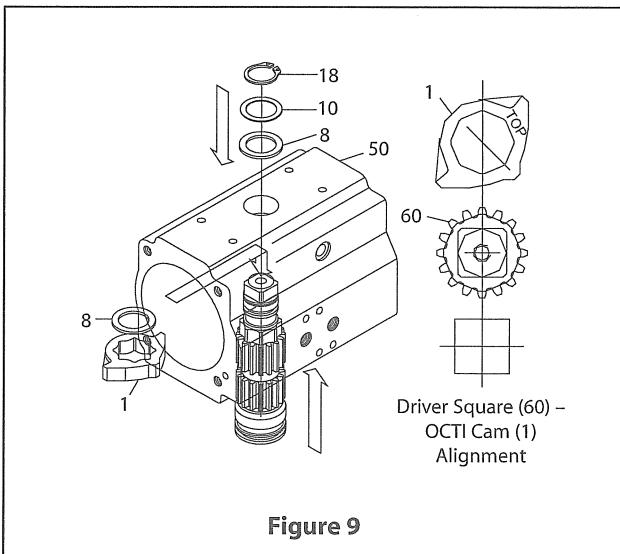


1. Drive Shaft (60) Assembly, (Figures 8 & 9):

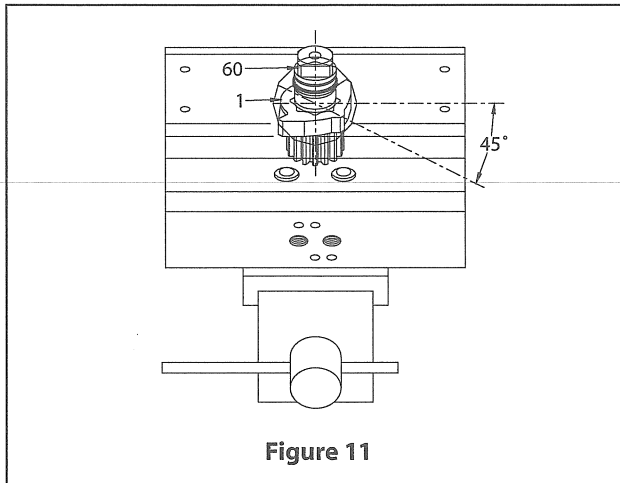
- A. Install the top and bottom shaft bearings (6, 7) and o-rings (21, 22) onto the shaft (60).
- B. Apply grease to the shaft bearings (6, 7), using a general purpose grease listed in **(Table 2)**. Apply silicone grease to the shaft o-rings (21, 22) using the recommended o-ring-area grease listed in **(Table 2)**.
- C. Partially Insert the shaft (60) into the body (50). Install the octi-cam (1) onto the shaft in the orientation shown in **(Figure 9)**. The edges of the octi-cam (1) should align with the edges of the square in the bottom of the shaft (60). Insert the internal thrust bearing (8) over the octi-cam (1). Fully insert the shaft into the body (50).
- D. Install the external thrust bearing (8), thrust washer (10), and the spring clip (18).

2. Piston (40) Assembly, (Figures 10 through 13):

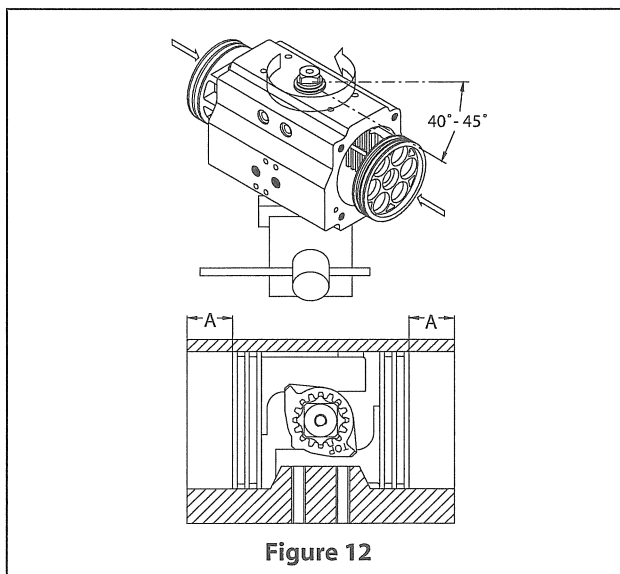
- A. Install the piston o-ring seal (16) and the piston head (15) and piston back (5) bearings.
- B. Apply silicone grease to the internal bore of the body (50) using a recommended o-ring area grease listed in **(Table 2)**. Apply grease to the piston (40) rack teeth using a recommended general-purpose grease listed in **(Table 2)**.
- C. Hold the body (50) in a horizontal position by inserting the top of the shaft in a vice, or inserting the bottom of the shaft connection into a male drive fitted into a vice as shown by **(Figure 10)**.



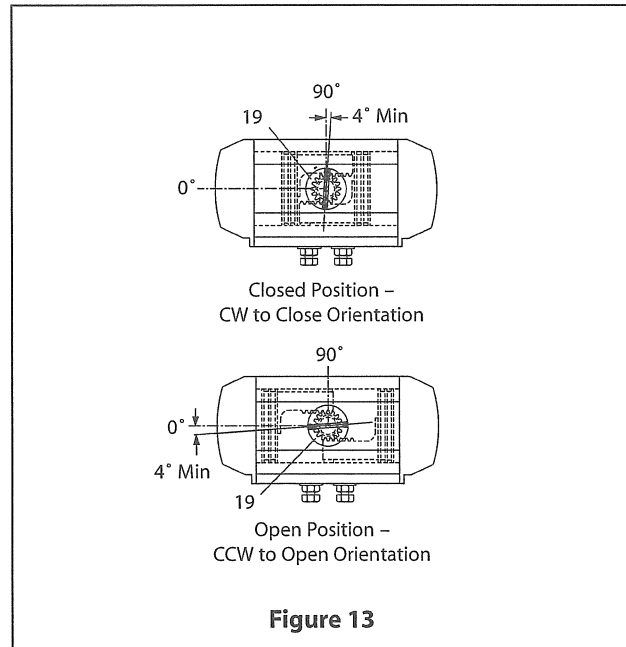
- D. Ensure that the octi-cam (1) is in the correct position as shown by (Figure 11).



- E. For standard-rotation assembly (clockwise to close) rotate the body (50) 40 – 45° counterclockwise (if viewing the bottom of the actuator), or clockwise (if viewing the top of the actuator) as shown in (Figure 12).
- F. Press the two pistons (40) simultaneously into the body (50) until the piston racks are engaged and rotate the body clockwise (if viewing the bottom of the actuator), or counter-clockwise (if viewing the top of the actuator), until the stroke is completed.
- G. To ensure that the piston (40) teeth are evenly engaged, fully compress both pistons (40) inward and measure the distance from the edge of the body to the piston (40) face on each side, shown as dimension "A" in (Figure 12). If a different value is obtained on each side, remove the pistons and repeat from step 2d.



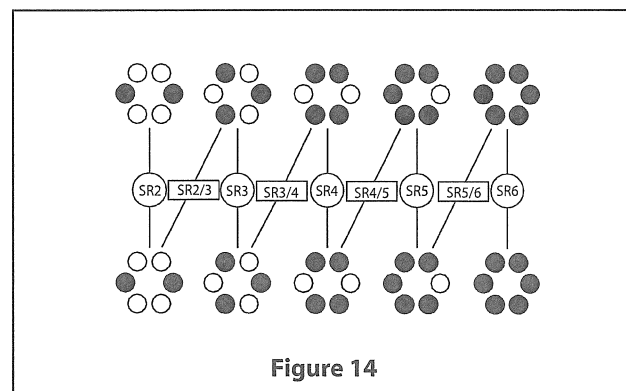
- H. Temporarily install the position indicator (19) onto the shaft (60) to determine whether the correct stroke is obtained, Verify that the slot in the top of the position indicator (19) will rotate a minimum of 4° beyond the 90° vertical centerline of the actuator body (50) and a minimum of 4° beyond the 0° horizontal centerline of the actuator body as shown in (Figure 13). If the proper stroke is not obtained, remove the pistons and repeat from step 2d. Once the proper stroke is verified, remove the position indicator (19).



3. End Cap (30, 31) and Spring Cartridge (17) Assembly, (Figures 14 through 16):

NOTE: In Models VPVP550 through 800 the end caps are symmetrical and use two item (30)s.

- A. For spring-return actuators, insert the proper quantity of spring cartridges (17) according to the pattern shown in (Figure 14) (referring to the total number of springs). Insert spring cartridges (17) as shown in (Figure 15).



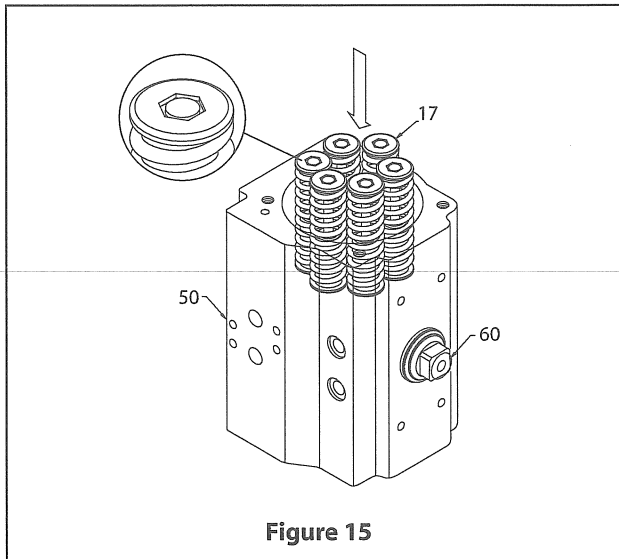


Figure 15

- B. Apply silicone grease to the end-cap o-ring seals, using the recommended o-ring-area grease listed in **(Table 2)**. Fit the end-cap o-ring seals (14) into the groove in each end cap (30, 31).
- C. Fit the end caps (30, 31) onto the body (50), verifying that the o-ring seals (14) remain in the grooves.
- D. Insert all end-cap screws (13) and hand tighten. Complete tightening by following the sequence indicated in **(Figure 16)**.

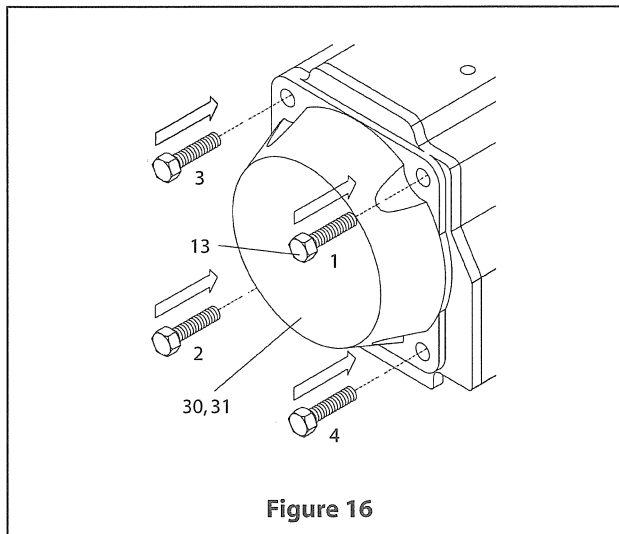


Figure 16

4. Assembly of Stop Screws (2) and Stroke Adjustment. (Figure 17):

- A. Insert the nut (4), washer (3), and o-ring (11) onto the stop screws (2).
- B. Screw the stop screws (2) into the body (50).

5. External Travel Stop Adjustment, (Figure 17):

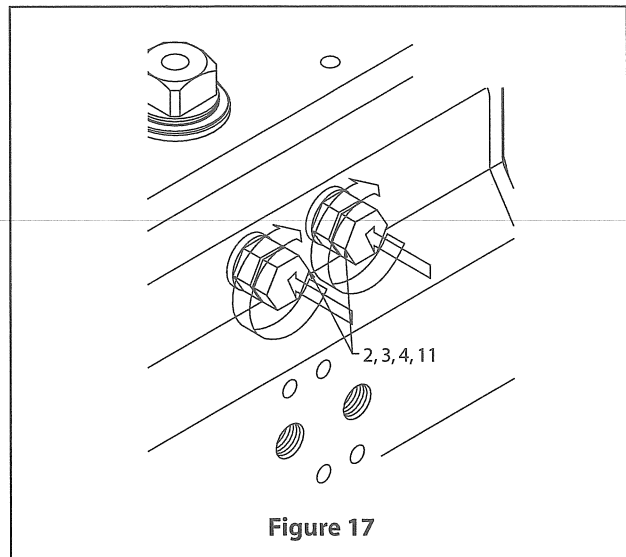


Figure 17

The stop adjustment screw (2) to the right controls the clockwise end of travel. The stop adjustment screw (2) to the left controls the counter-clockwise end of travel.

- A. Cycle the actuator/valve to the clockwise end of travel and measure to determine if the valve is in the proper position. (In most applications this will be fully closed.)
- B. If the valve is not in the correct clockwise position, turn the right stop adjustment screw (2) IN to reduce actuator travel, or OUT to increase actuator travel.
- C. When the correct clockwise position is obtained, hold the adjusting screw (2) stationary while tightening the lock nut (4).
- D. Cycle the actuator/valve to the counter-clockwise end of travel and measure to determine if the valve is in the proper position. (In most applications this will be fully opened.)
- E. If the valve is not in the correct counter-clockwise position, turn the left stop adjustment screw (2) IN to reduce actuator travel, or OUT to increase actuator travel.
- F. When the correct counter-clockwise position is obtained, hold the adjusting screw (2) stationary while tightening the lock nut (4).

6. Position Indicator (19, 39) Assembly. (Figure 18):

- A. Fit position indicator (19) on the shaft (60), verifying that it indicates the correct actuator position.
- B. Tighten cap screw (39) to secure the position indicator.

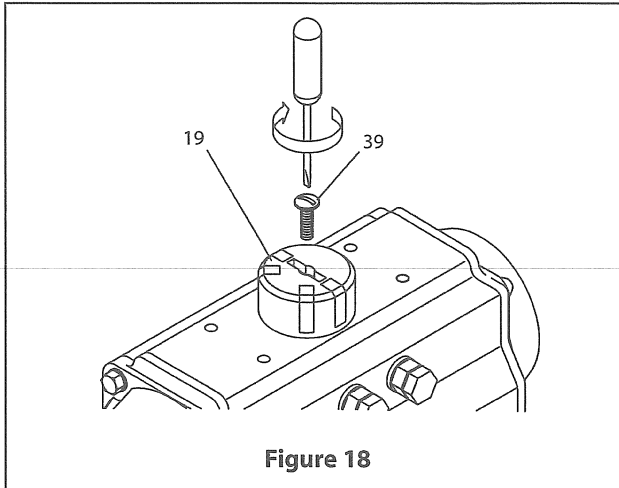


Figure 18

7. Setting 100% Adjustable Stop (If applicable). (Figure 19):

To limit the rotation on the stroke beyond the standard $\pm 4^\circ$ of a VPVL actuator, a stainless steel 100% adjustable travel stop option can be added. The stops, located in the end caps, allow the valve position to be set anywhere between full closed and full open. This option limits travel of only the counter-clockwise stroke for standard double-acting and spring-closed units.

Follow the preceding steps in order to set the 100% adjustable travel stops.

Double Acting Actuators:

- A. Back off one travel stop screw, leaving it partially threaded in the end cap. Entirely remove the other stop screw from the other end cap.
- B. Open valve using air pressure. **NOTE:** Actuator will leak due to removed travel stop.
- C. Use the indicator pointer on top of actuator to determine if valve is open to desired position. If not, repeat steps 1-3, backing off or screwing in stop screw to attain proper open position of valve.
- D. Make sure O-ring is in proper position in counter-sunk area on end cap and the washer is in place. Tighten down nut to set stop position.
- E. Thread in the other travel stop, making sure the O-ring and washer are in the correct place. When the travel stop will not thread any further, tighten nut to set stop position.
- F. The previous steps set the open travel stop. See section 4.3.5 for instructions on setting the close position stop.

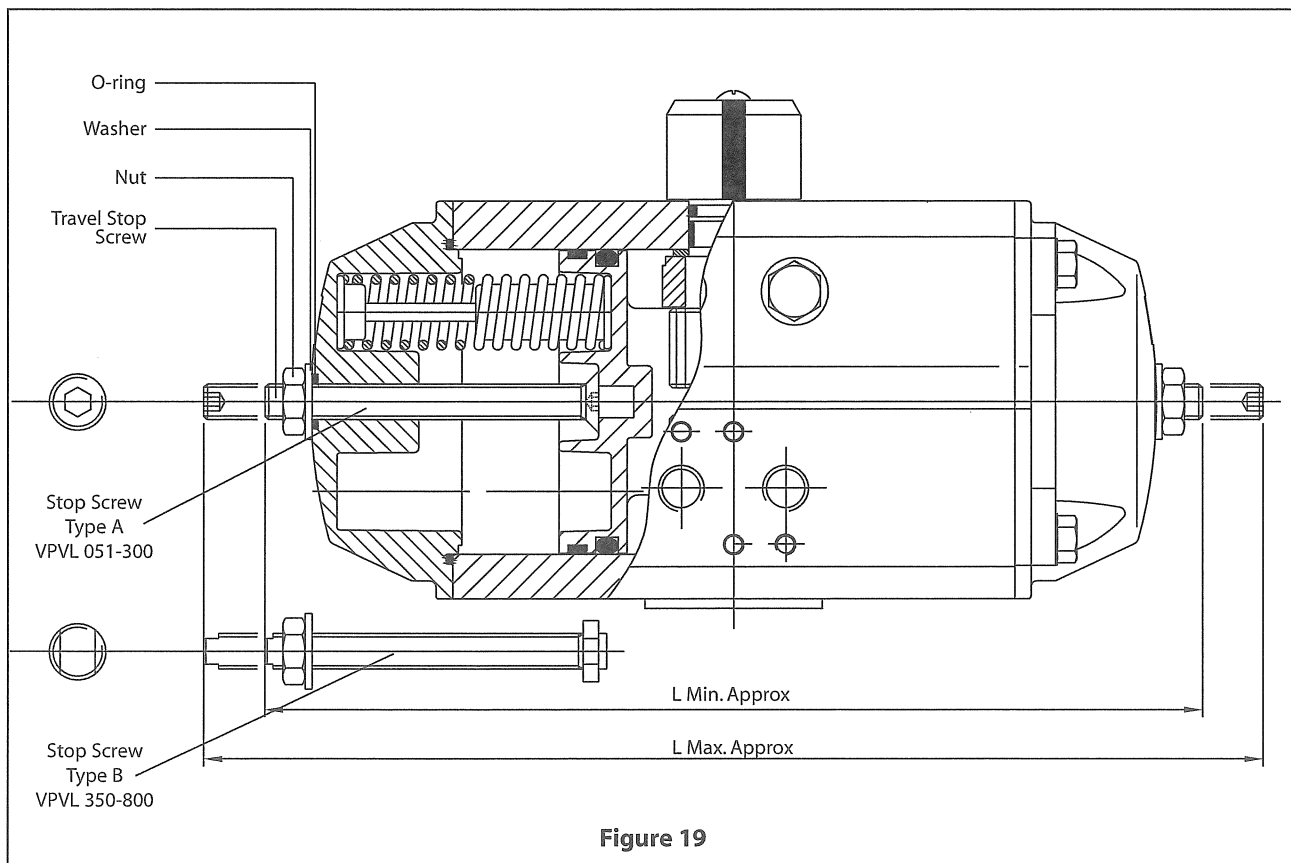


Figure 19

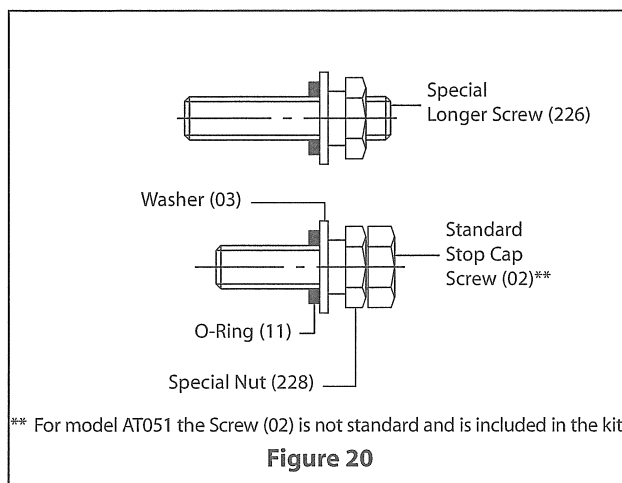
Spring Return Actuators:

- A. Back off one travel stop screw, leaving it partially threaded in the end cap. Entirely remove the other stop screw from the other end cap.
- B. Open valve using air pressure. Note actuator will leak due to removed travel stop.
- C. Keeping air pressure applied to actuator, use the indicator pointer on top of actuator to determine if valve is open to desired position. If not, remove air pressure and repeat steps 1-3, backing off or screwing in stop screw to attain proper open position of valve.
- D. Make sure O-ring is in proper position in countersunk area on end cap and the washer is in place. Tighten down nut to set stop position.
- E. Thread in the other travel stop, making sure the O-ring and washer are in the correct place. When the travel stop will not thread any further, tighten nut to set stop position.
- F. The previous steps set the open travel stop. See section 4.3.5 for instructions on setting the close position stop.

5 SAFETY LOCKOUT DEVICE

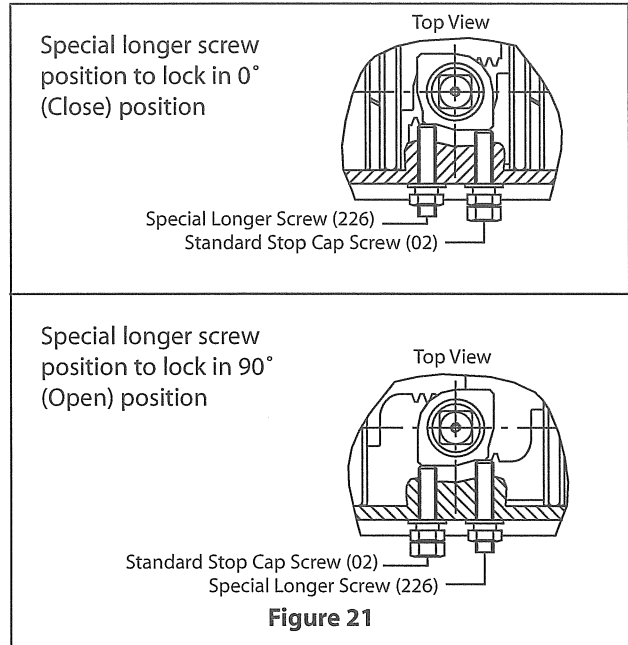
1. Removal of stop cap screws:

- A. Remove from the body both existing standard stop cap screws (02) together with the nut (04), washer (03) and O-ring (11) shown in **(Figure 4)**.
- B. Insert on the special longer screw (226) and standard stop cap screws (02) the special nut (228), the washer (03) and the O-ring (11) shown in **(Figure 20)**.



2. Assembly of stop cap screws:

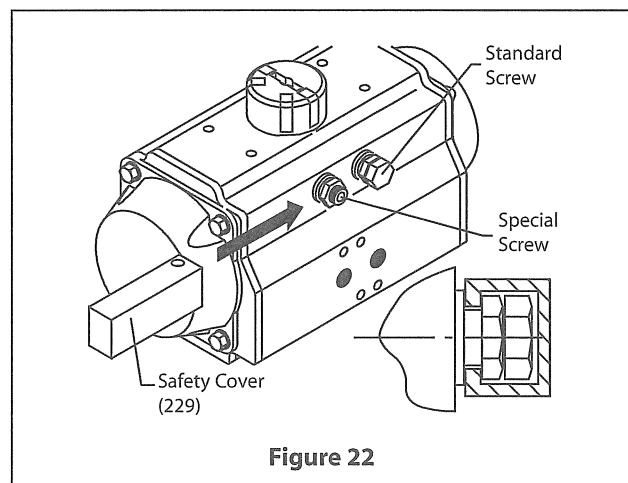
- A. Before inserting the special longer screw (226) or the standard screw (02) into the actuator body, check what stop position is required? If the stop position is fully close (0°) or fully open (90°), see **(Figure 21)**. Note, when the stop screws are inserted into the actuator body, the actuator must be at the desired position.



- B. Insert the special longer screw (226) and the standard screw (02) into the actuator body until the desired lock position is achieved then tighten the special nut (228).

3. Assembly of safety cover and padlock:

- A. Slide the safety cover (229) between the special nut (226) and washer (03) on both the special longer screw (226) and the standard screw (02) as shown in **(Figure 22)**.



- B. Insert the padlock into the hole of the safety cover (229) and lock it. For safety, keep the padlock key in a safe place.

6 ACTUATOR STORAGE

If the actuators are not for immediate use, the following precautions must be taken for storage:

- A. Store in a dry environment
- B. It is recommended that the actuator be stored in its original box.
- C. Do not remove the plastic plugs on the air supply ports.

7 REPAIR KITS/SPARE PARTS

For further information on spare parts and service or assistance visit our web-site at www.jamesbury.com.

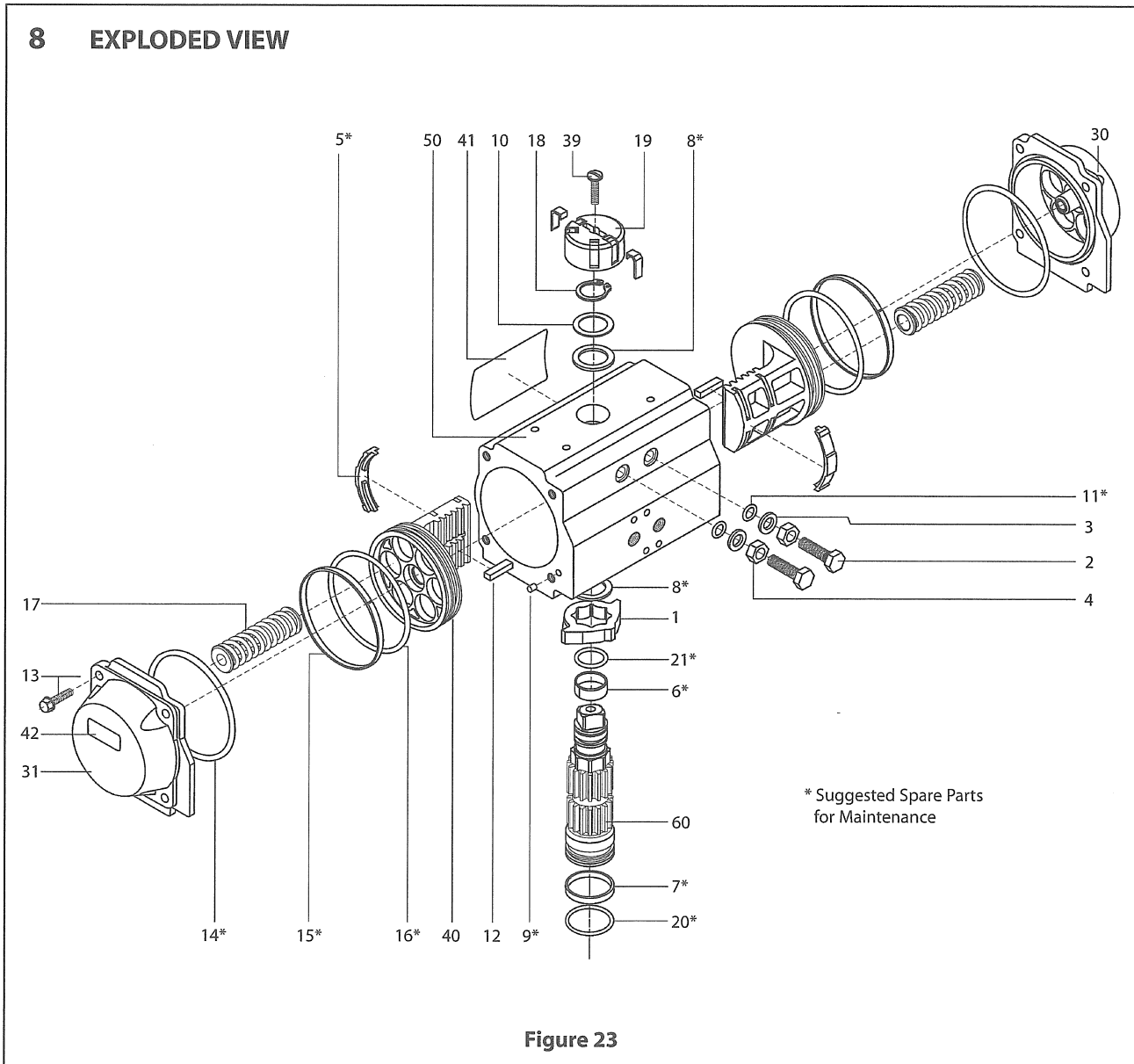


Figure 23

TABLE 3 - PARTS LIST FOR (FIGURE 23)

No.	Unit Qty	Part Description	Material	Specifications	Corrosion Protection
1	1	Octi-Cam (Stop Arrangement)	Stainless Steel ¹	EN 10088-3/ISO 1083 ¹	
2	2	Stop Cap Screw	Stainless Steel	ASTM A193	
3	2	Washer (Stop Cap Screw)	Stainless Steel	ISO 3506	
4	2	Nut (Stop Cap Screw)	Stainless Steel	ISO 3506	
5*	2	Bearing (Piston Back)	Polyphthalamide	Amodel ET1001HS	
6*	1	Bearing (Pinion Top)	Polyetherimide	Stanyl TW300	
7*	1	Bearing (Pinion Bottom)	Polyetherimide	Stanyl TW300	
8*	2	Thrust Bearing (Pinion)	Polyphthalamide	Amodel ET1001HS	
9*	2	Plug (Transfer Port)	Nitrile Rubber	NBR 70Shore A	
10	1	Thrust Washer (Pinion)	Stainless Steel	EN 10088-3	
11*	2	O-ring (Stop Cap Screw Seal)	Nitrile Rubber	NBR 70Shore A	
12	2	Piston Guide	Polyphthalamide GF	Amodel AS1145	
13	8/12 ²	Cap Screw (End Cap)	Stainless Steel	ISO 3506	
14*	2	O-ring (End Cap)	Nitrile Rubber	NBR 70Shore A	
15*	2	Bearing (Piston Head)	Polyphthalamide	Amodel ET1001HS	
16*	2	O-ring (Piston)	Nitrile Rubber	NBR 70Shore A	
17	min. 4/ max.12	Spring (Cartridge)	Alloy Steel	DIN 17223 Part2	Epoxy Coated
18	1	Spring Clip (Pinion)	Carbon Steel	DIN 17222	ENP
19	1	Position Indicator	Polypropylene GF	Hostalen PPN	
20*	1	O-ring (Pinion Bottom)	Nitrile Rubber	NBR 70Shore A	
21*	1	O-ring (Pinion Top)	Nitrile Rubber	NBR 70Shore A	
30	1 ³	Right End Cap ³	Aluminum	UNI 5075	Polyester-Coated
31	1 ³	Left End Cap ³	Aluminum	UNI 5075	Polyester-Coated
39	1	Cap Screw (Indicator)	Stainless Steel	ISO 3506	
40	2	Pistons	Aluminum	UNI 5075	Anodized
41	1	Actuator Identification Label	Polyester Aluminum		
42	2	End Cap Label	Polyester Aluminum		
50	1	Body	Aluminum	ASTM B221	Anodized PTFE-Coated
60	1	Drive Shaft	Carbon Steel Plated	ASTM A105	ENP

* Suggested spare parts for maintenance

Notes: (1) AISI 420 for models VPVL-051 through 300; G5400-15 for models VPVL-350 through 800

(2) Qty 8 pieces for models VPVL-051 through 600; Qty 12 pieces for model VPVL-700

(3) For models VPVL500 through VPVL700, right and left end-caps are symmetric

Metso Automation, Field Systems Division

Europe, Levytie 6, P.O.Box 310, 00811 Helsinki, Finland. Tel. int. +358 20 483 150. Fax int. +358 20 483 151

Europe (UK), 2 Lindenwood, Crockford Lane, Chineham Business Park, Basingstoke, RG24 8QY UK. Tel. int. +44 (0) 8706 061478. Fax int. +44 (0) 1256 707661

North America, 44 Bowditch Drive, P.O.Box 8044, Shrewsbury, Massachusetts, 01545-8044 USA. Tel. int. +1 508 852 0200. Fax int. +1 508 852 8172

Latin America, Av. Independência, 2500- Iporanga, 18087-101, Sorocaba-São Paulo, Brazil. Tel. int. +55 15 3235 9700. Fax int. +55 15 3235 9748/49

Asia Pacific, 238A Thomson Road, #25-09 Novena Square Tower A, 307684 Singapore. Tel. int. +65 6511 1011. Fax int. +65 6250 0830

www.jamesbury.com

