

## CVS Type 656 Diaphragm Actuator

Sizes 30, 40 and 60

The CVS Type 656 actuator is a direct action, spring opposed diaphragm actuator, with a long stroke for either throttling or on/off operation.

The valve plug action can be set for PDTO (push down to open), or PDTC (push down to close), and can operate to either open or close the control valve upon failure of the loading pressure.

Travel range for the CVS Type 656 actuator can provide 2.125" through 4.125" accordingly.

Typical applications include operation of butterfly valves, V ball valves, louvers and other related equipment.



CVS 656-40 Diaphragm Actuator

## SPECIFICATIONS

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### Operating Temperature:

-40°F to 180°F (-40°C to 82°C) Nitrile

-40°F to 300°F (-40°C to 149°C) Silicone Diaphragm

### Maximum Casing Operating Pressure – Recommended:

35 psig (2.4 bar)

### Pressure Inlet Connection:

1/4" NPT

### Maximum Casing Pressure:

Size	Maximum Casing Pressure, psig (bar) for sizing actuator	Maximum Excess Diaphragm Pressure psig (bar)	Maximum Diaphragm Casing Pressure, psig (bar)
30	125 (8.6)	15 (1.0)	140 (9.7)
40	65 (4.5)	10 (0.69)	75 (5.2)
60	40 (2.8)	10 (0.69)	50 (3.4)

### Maximum Travel: Standard Travel Stop

Size 30 – 2.125 inches (54mm)

Size 40 – 3.5 inches (89mm)

Size 60 – 4.125 inches (105mm)

### Approximate Shipping Weights:

Size 30 – 50 lbs (23kg)

Size 40 – 70 lbs (32kg)

Size 60 – 160 lbs (73kg)

Optional: Top Mount Handwheel

### Operation:

For a CVS 656 direct acting actuator, an increase in the loading pressure will move the stem down, compressing the spring. When pressure is decreased, the spring tension will move the actuator stem upwards. Fail of supply pressure will move the stem upwards to the top position.

**NOTE:**

**Do not exceed maximum pressure ratings and limitations. Personal injury and or damage to the equipment may be caused by exceeding these specifications.**

**Pressure Limitations:**

The CVS 656 casings and diaphragm are pressure operated. Supply pressure compresses the spring in order to stroke the actuator and seat the valve. Refer to the actuator nametag for specifications, or page two of this manual. Do not exceed the pressures indicated.

- **Maximum Excess Diaphragm Pressure:** Additional supply pressure may be added while the actuator is at full travel. Exceeding the Maximum Excess Diaphragm Pressure may cause damage to the diaphragm, diaphragm casing and its components.
- **Maximum Casing Pressure for Actuator Sizing:** This describes the maximum pressure that can be applied at less than full travel of the actuator. Exceeding this pressure limit before the upper diaphragm plate reaches the travel stop may cause damage to the stem or other related components.
- **Maximum Diaphragm Casing Pressure:** Exceeding the pressure rating may cause damage to the actuator, diaphragm or diaphragm casing.

**INSTALLATION**

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\*Prior to installation inspect components for any damage or debris. Always follow proper safety and lockout procedures to avoid any personal injury.

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When ordered from CVS Controls as part of a complete package, the actuator will normally be mounted and fully function tested prior to shipping. Refer to proper valve installation instructions and procedures when installed as a complete package. If the actuator is shipped separately, or requires removal for maintenance, the actuator may be removed from the installation via the four mounting holes (3/8" for sizes 30 and 40, and 1/2" for size 60).

Use proper piping/tubing practices to connect the 1/4" NPT loading pressure connection, or valve positioner input at the top of the diaphragm case. When supplied with a positioner as part of a complete assembly the loading pressure connection will already be connected when manufactured prior to delivery. In order to avoid transmission lag of the control signal, keep tubing connection run lengths as short as possible.

## **ADJUSTMENTS**

Upon complete installation of the CVS 656 actuator check to verify for correct travel, as well as proper Push-Down-To Close, or Push-Down-To Open actions. Ensure the actuator operates freely.

## **MAINTENANCE**

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- \*Follow proper safety and lockout procedures prior to doing maintenance if required.
  - \*Do not uninstall the actuator from the valve until all pressure has been relieved from the valve
  - \*Disconnect operating lines to ensure the actuator cannot suddenly open or close
  - \*Shut off and isolate process from the valve to relieve process pressure
  - \*Vent/relieve loading pressure to the actuator to remove spring compression
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**Disassembly:** (Refer to assembly drawings for part number reference according to size of actuator used)

1. Isolate and or bypass the control valve if the CVS 656 Actuator is installed on a control valve. Relieve all process pressure.
2. Ensure diaphragm loading pressure has been shut off, remove tubing from the loading pressure connection on the top of the upper diaphragm lid.
3. Relieve spring compression by turning the Lower Bearing Seat away from the Spring Case
4. Should the complete actuator assembly require removal, disconnect the Stem from the Stem Connector and Clevis, and remove the Hex Jam Nuts. Remove the cap screws which secure the Yoke to the bracket or mounting plate. The complete actuator assembly may now be removed.
5. Remove the Diaphragm Case Cap Screws and Hex Nuts to allow for removal of the Upper Diaphragm Casing. The Diaphragm may now be removed and inspected for signs of wear or damage.
6. The Diaphragm Plate and Stem may be lifted out of the Actuator Assembly. Separate the diaphragm plate from the stem by removing the Cap Screw.
7. The Actuator Spring can be lifted out for inspection
8. If required, the Lower Diaphragm Case may be removed by loosening the travel stops and cap screws
9. The Lower Spring Seat and Thrust Bearing can now be removed for inspection. Unscrew the Lower Bearing Seat from the Adjusting Screw
10. Remove the Set Screw and complete the disassembly by removing the Adjusting Screw if required.

## **MAINTENANCE, Continued**

### **Assembly:**

1. Using a lithium-based lubricant, apply to the Adjusting Screw threads, and screw into the yoke. Install Set Screw.
2. Screw the Lower Bearing Seat down to the Adjusting Screw
3. Use a lithium-based lubricant on the Thrust Bearing, place the Thrust Bearing on the Lower Bearing Seat. Then you may lay the Lower Bearing Seat on the Thrust Bearing.
4. Install the Lower Diaphragm Case to the top of the Actuator Yoke using the Travel Stops and Cap Screws. For size 30 and 40 actuators alternate Cap Screws and Travel Stops. For size 60 actuator, the travel stops should be installed at 1, 5, 7 and 11 o'clock positions with the mounting boss of the actuator yoke place at 12 and 6 o'clock.
5. Place the Actuator Spring on the Lower Spring Seat
6. Reattach the Diaphragm Plate to the Actuator Stem with the Cap Screw. Apply a lithium-based lubricant to the Stem. Install the Diaphragm Plate and Stem into the Yoke, the stem through the Spring Adjuster.
7. Place the Diaphragm on the Diaphragm Plate, aligning the holes in the Diaphragm to the hole in the Lower Diaphragm Case. Install the Upper Diaphragm Case on top of the Diaphragm and fasten using the Cap Screws and Nuts.
8. Torque the first four Cap Screws opposing to 10 ft lbs. Torque the remaining Cap Screws in a clockwise cross pattern to 20 ft lbs.
9. Repeat torque procedure of the first four Cap Screws, torque to 27ft lbs.
10. Repeat torque procedure for the remaining Cap Screw in a clockwise cross pattern, this time torquing to 27ft lbs
11. Verify all Cap Screws are torqued to 27ft lbs one final time.

If the Actuator was removed from the valve assembly for service or maintenance it may now be reinstalled to the Valve Assembly and mounting bracket, fastening with the Cap Screws,

12. Attach the pressure tubing back onto the loading pressure connection on the top of the Upper Diaphragm Case
13. Attach the Actuator Stem back on the Stem Connector and adjust as required for proper travel.

## **Travel Adjustments:**

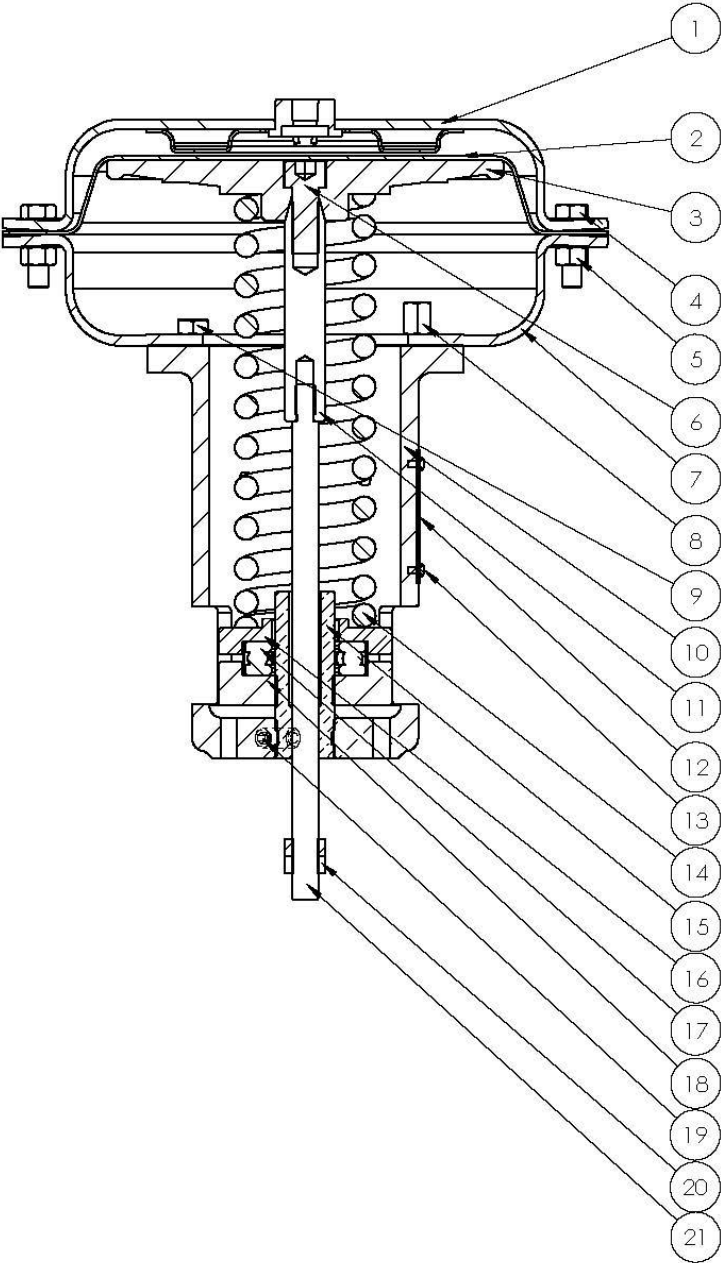
### **PDTO – Push Down to Open Condition**

1. Check that the Control Valve or alternate controlling element is in the Closed position
2. Adjust the Lower Bearing Seat towards the Spring Case, ensure the Actuator Stem is at the top position of its stroke
3. Complete the Actuator Stem Connection. There should be full engagement of the actuator stem threads. Tighten the stem connection slightly.
4. Supply loading pressure to the diaphragm case to place the Control Valve in its fully open position. Screw the controlling element linkage to the Actuator Stem. The linkage to the Stem Connection should be far enough to move the control element to its closed position 1/8". Secure the stem connection and tighten the jam nuts. The connection above makes certain the control valve or alternate control element will fully close before the actuator stem reaches the top of its stroke. The travel stops in the lower diaphragm case dictate correct travel of the control valve in the open direction.
5. Adjustments to the Lower Bearing Seat may be required as needed should travel start at a lower or higher pressure than is required.

### **PDTC – Push Down to Open Condition**

1. Check that the Control Valve or alternate controlling element is in the fully open position
2. Adjust the Lower Bearing Seat towards the Spring Case, ensure the Actuator Stem is at the top position of its stroke
3. Complete the Actuator Stem Connection. There should be full engagement of the actuator stem threads. Tighten the stem connection slightly.
4. Supply loading pressure to the diaphragm case to place the Control Valve in its fully closed position. Screw the controlling element linkage to the Actuator Stem. The linkage to the Stem Connection should be far enough to move the control element to its open position 1/8". Secure the stem connection and tighten the jam nuts. The connection above makes certain the control valve or alternate control element will fully open before the actuator stem reaches the top of its stroke.
5. Adjustments to the Lower Bearing Seat may be required as needed should travel start at a lower or higher pressure than is required.

ASSEMBLY: CVS Series 656 Size 30

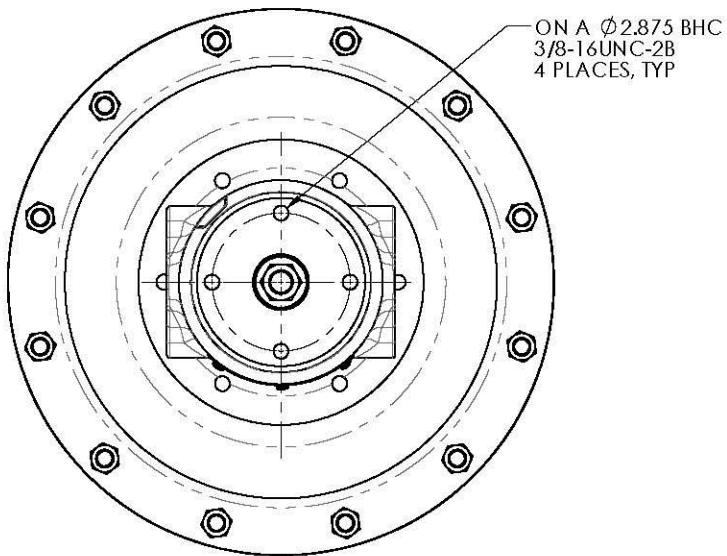
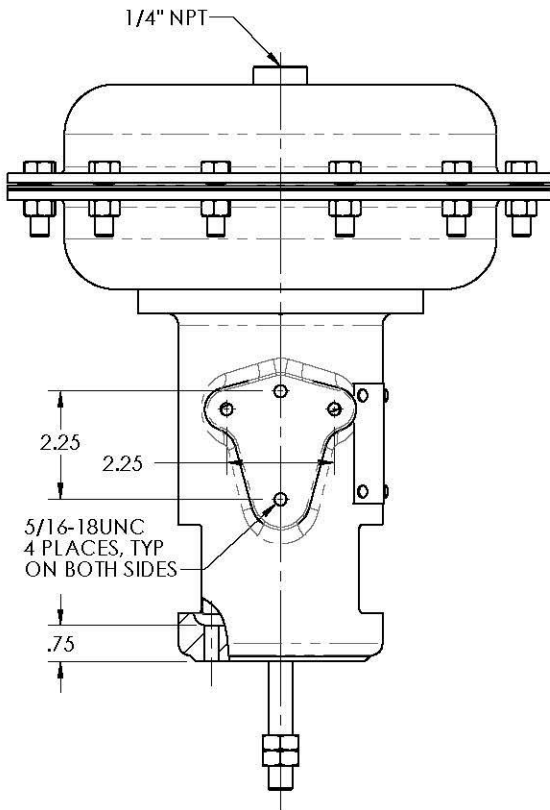
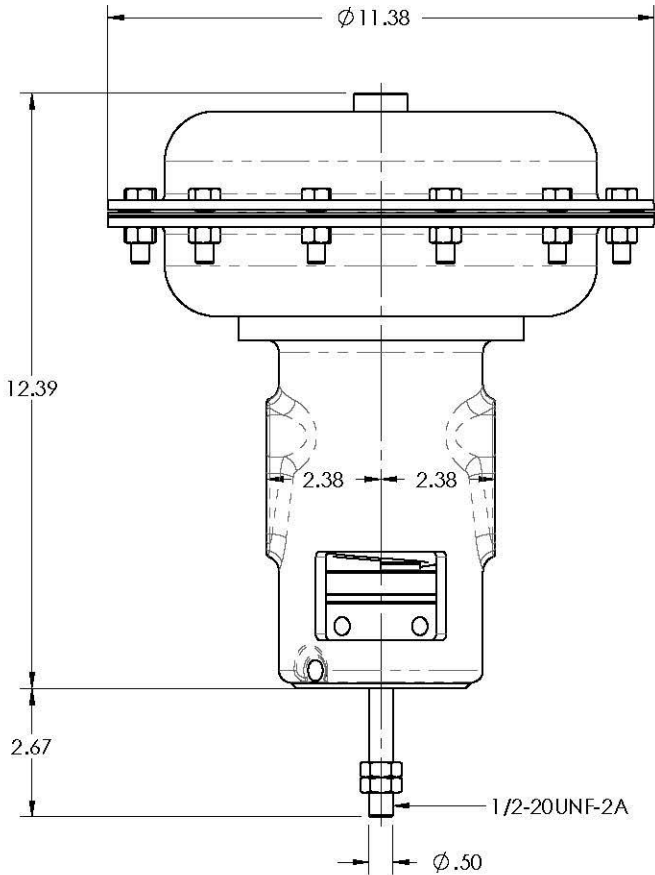


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	CVS 2J713828992	UPPER DIAPHRAGM CASE	1
2	CVS 2E791902202	DIAPHRAGM	1
3	CVS 2F6493	DIAPHRAGM PLATE	1
4	CVS 1E760324052	HEX SCREW, 3/8-16UNC, 1.30" LONG	12
5	CVS 1A346524122	HEX NUT, 3/8-16UNC	12
6	CVS 1E760432992	CAP SCREW, 1/2-20UNF x 1.25	1
7	CVS 2E792225062	LOWER DIAPHRAGM CASING	1
9	CVS 1A368424052	SCREW, 3/8-16UNC, .75" LONG	3
8	CVS 1F842924092	TRAVEL STOP	3
10	CVS 2F998619042	SERIES 656 ACTUATOR - YOKE, SIZE 30	1
11	CVS 1F999424102	SERIES 656 ACTUATOR - STEM	1
12	CVS 12B6508X012	NAME PLATE	1
13	CVS 1A368228982	3/32 RIVET PIN	6
14	SEE TABLE	SPRING, RATE SEE FOLLOWING TABLE	1
15	CVS 1J992414102	SERIES 656 ACTUATOR - ADJUSTING SCREW	1
16	CVS 15A9864X012	TYPE 656 - LOWER SPRING SEAT	1
17	CVS 15A0384X012	THRUST BEARING, NICE 616-V	1
18	CVS 15A9866X012	TYPE 656 - LOWER BEARING SEAT	1
19	CVS 1H199928992	SET SCREW, 3/8-16UNC x 3/4	1
20	CVS 1A353724122	1/2-20, HEX NUT	2
21	CVS 1J992524102	SERIES 656 ACTUATOR - VALVE STEM	1

KEY 14 SPRING, STEEL

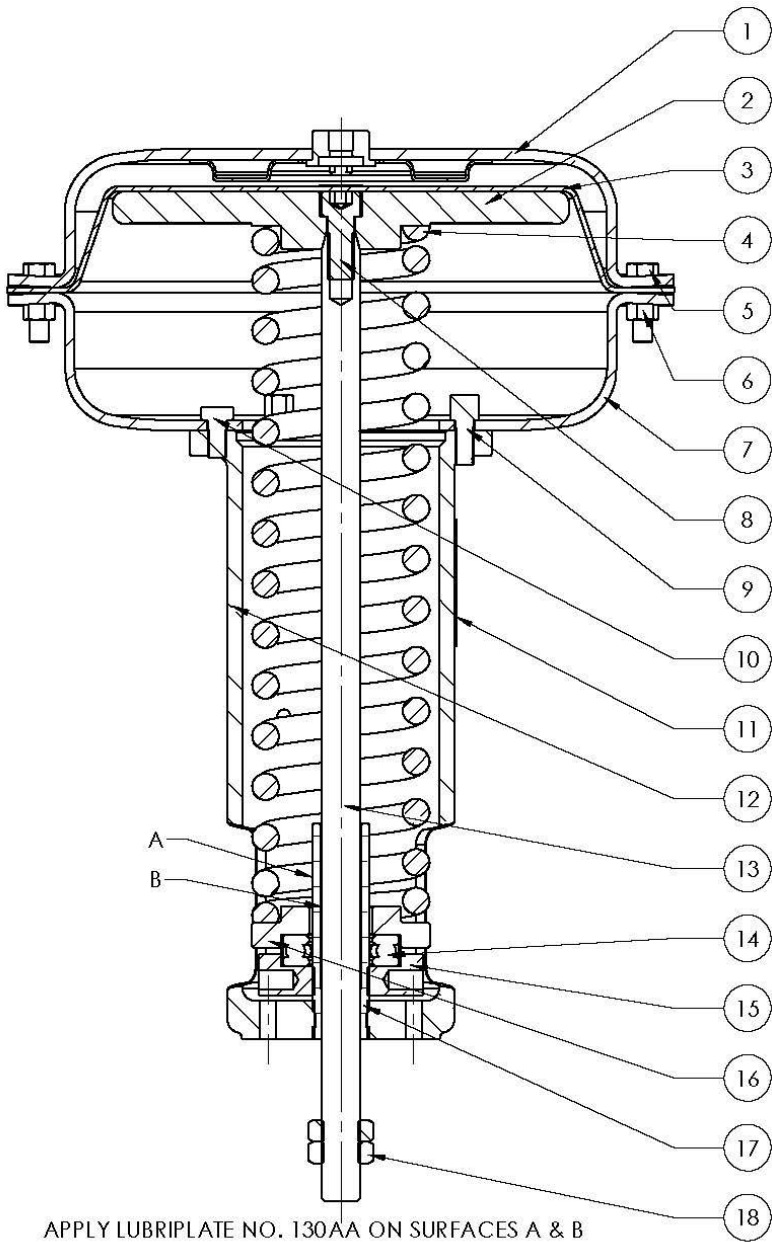
SIZE 30	SPRING RATE LB-IN	SPRING COLOR CODE	PART NUMBER
	40	ALUMINUM & LT.BLUE	CVS 1H826227032
	80	ALUMINUM & PURPLE	CVS 1H826127032
	125	ALUMINUM & ORANGE	CVS 1F361627032
	170	ALUMINUM & DARK GREEN	CVS 1K509827032
	238	ALUMINUM & RED	CVS 1N751527032
	275	TAN	CVS 1F177027092
	370	BROWN	CVS 1F177127092
	460	PINK	CVS 1F177227092

**DIMENSIONS: CVS Series 656 Size 30 – (Inches)**





ASSEMBLY: CVS Series 656 Size 40

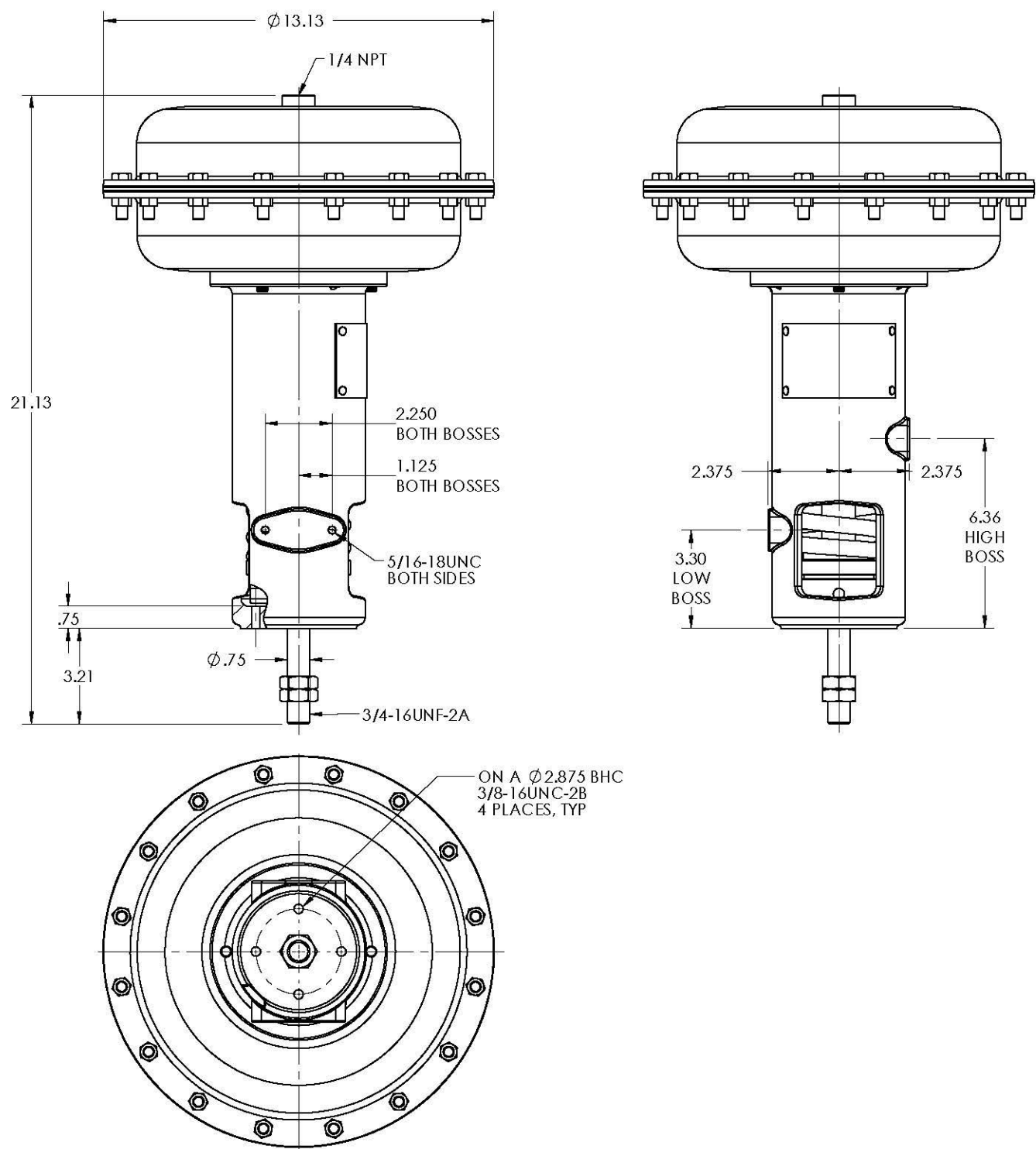


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	CVS 2L441828992	DIAPHRAGM CASING, UPPER	1
2	CVS 2V939919042	DIAPHRAGM PLATE	1
3	CVS 2E670002202	DIAPHRAGM	1
4	SEE FOLLOWING TABLE	SPRING, RATE SEE FOLLOWING TABLE	1
5	CVS 1E760324052	CAP SCREW, 3/8-16UNC x 1.25"	16
6	CVS 1A346524122	HEX NUT, 3/8-16UNC	16
7	CVS 2E806325062	DIAPHRAGM CASING, LOWER	1
8	CVS 1E760432992	CAP SCREW, 1/2-20UNF x 1.25	1
9	CVS 1H591724092	DOWN TRAVEL STOP	3
10	CVS 1A368424052	CAP SCREW, 3/8-16UNC x 3/4	3
11	CVS 1U961538982	NAME PLATE	1
12	CVS 3L440419042	TYPE 656 - YOKE SIZE 40	1
13	CVS 1L450224102	TYPE 656 - STEM	1
14	CVS 15A0384X012	THRUST BEARING, NICE 616-V	1
15	CVS 15A9866X012	TYPE 656 - LOWER BEARING SEAT	1
16	CVS 15A9865X012	TYPE 656 - LOWER SPRING SEAT	1
17	CVS 1L450114012	TYPE 656 - ADJUSTING SCREW	1
18	CVS 1A351124122	HEX NUT, 3/4-16UNF	2
19	CVS 1A368228982	DRIVE SCREW, 302 SST	4
20	CVS 1H199928992	SET SCREW, 3/8-16UNC x 3/4	1

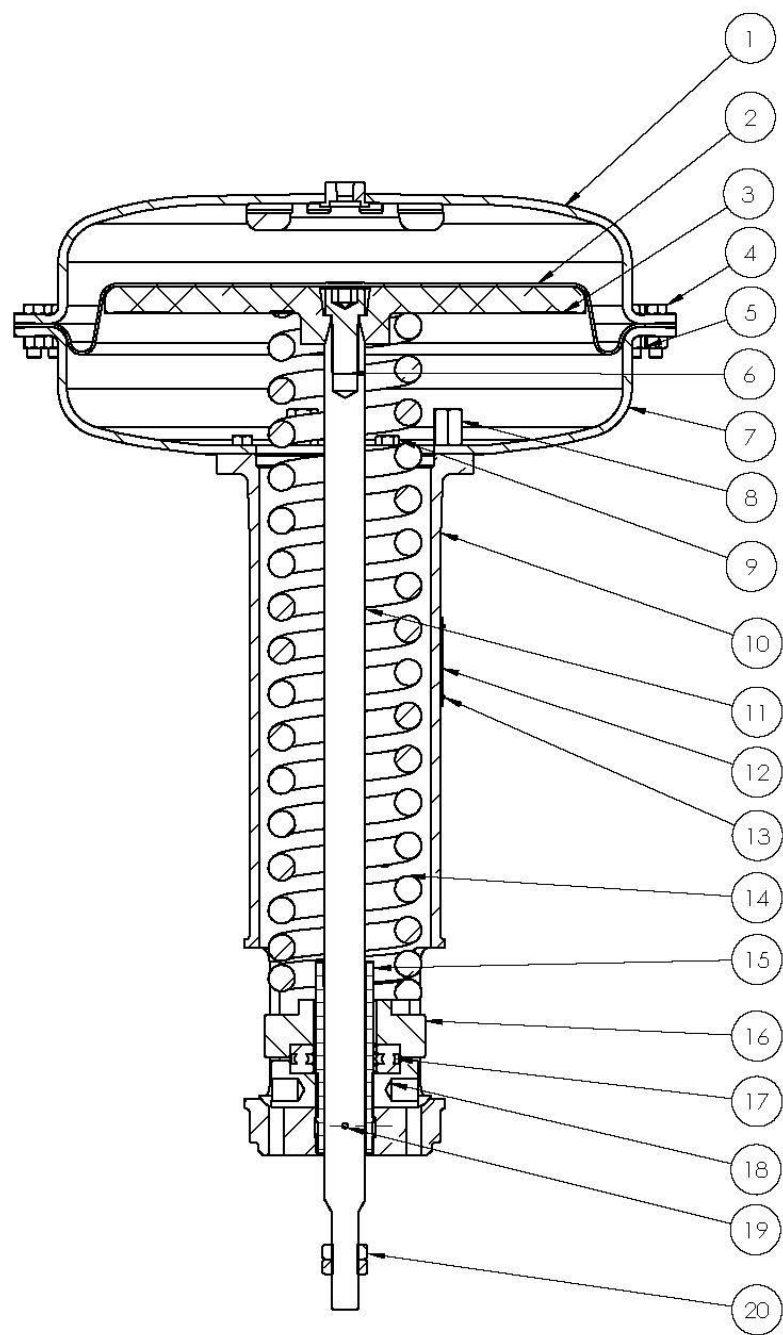
KEY 11 ACTUATOR SPRING FOR SIZE 40

SPRING RATE (LB/IN)	SPRING COLOR CODE	PART NUMBER
145	WHITE	CVS 1L217427042
205	YELLOW	CVS 1P637127082
335	DARK GREEN	CVS 1L217327042
455	NONE	CVS 1N844027082

**DIMENSIONS: CVS Series 656 Size 40 – (Inches)**



**ASSEMBLY: CVS Series 656 Size 60**

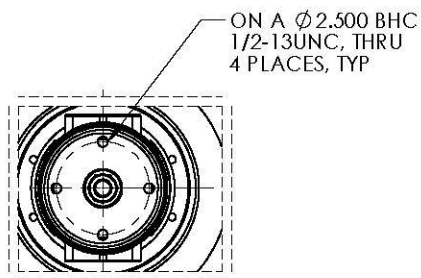
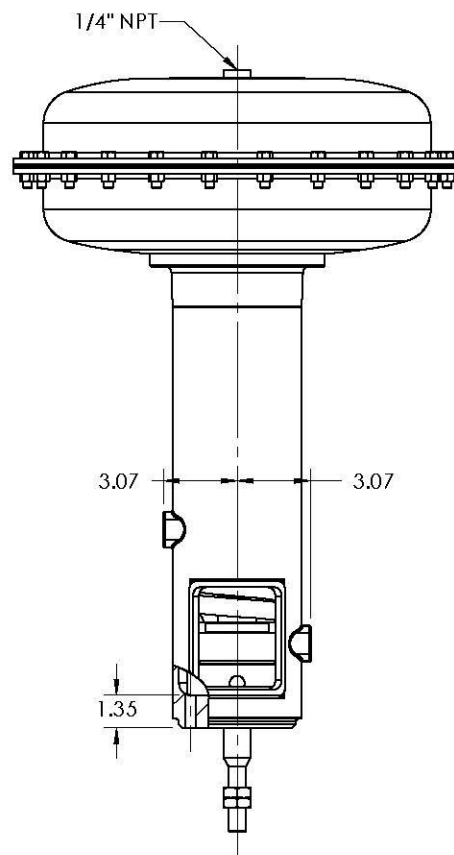
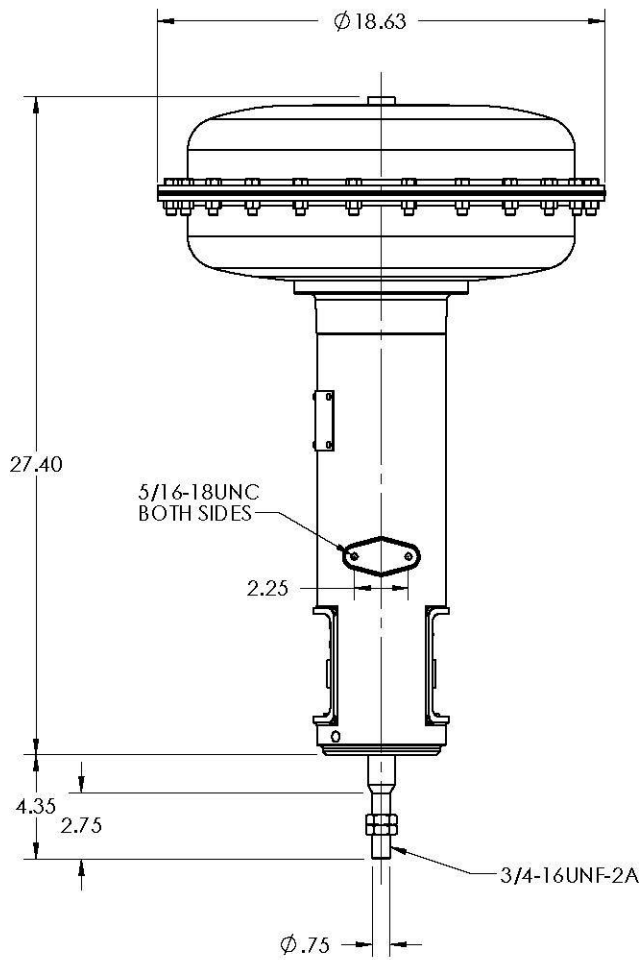


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	CVS 30A0055X01 2		1
2	CVS 2E859702202		1
3	CVS 43B9677X01 2	DIAPHRAGM PLATE 1	1
4	CVS 1 A6751 24052		24
5	CVS 1 A3465241 22	HEX NUT, 3/8-16UNC	24
6	CVS 1 E775432982	3/4-16, RH SCREW, 1.63" LONG	1
7	CVS 2E8474		1
8	CVS 1 E797924092		4
9	CVS 1 A368424052	CAP SCREW, 3/8-16UNC x3/4	4
10	CVS 3L44041 9042	SERIES 656 ACTUATOR - YOKE, SIZE 60	1
11	CVS 1 L450224102	SERIES 656 ACTUATOR - STEM	1
12	CVS 1 2B6508		1
13	CVS 1 A368228982	3/32 RIVET PIN	6
14	SEE TABLE	SPRING, RATE SEE FOLLOWING TABLE	1
15	CVS 1 L45011401 2	SERIES 656 ACTUATOR - ADJUSTING SCREW	1
16	CVS 1 L91 9324272	SERIES 656 ACTUATOR - LOWER SPRING SEAT	1
17	CVS 1 F999228992	THRUST BEARING, AETNA E-21	1
18	CVS 1 L91 9624272	SERIES 656 ACTUATOR - LOWER BEARING SEAT	1
19	CVS 1 H999228992	SET SCREW, 3/8-16UNC x3/4	1
20	CVS 1 A3511 24122	3/4-16, STEM JAM NUT	2

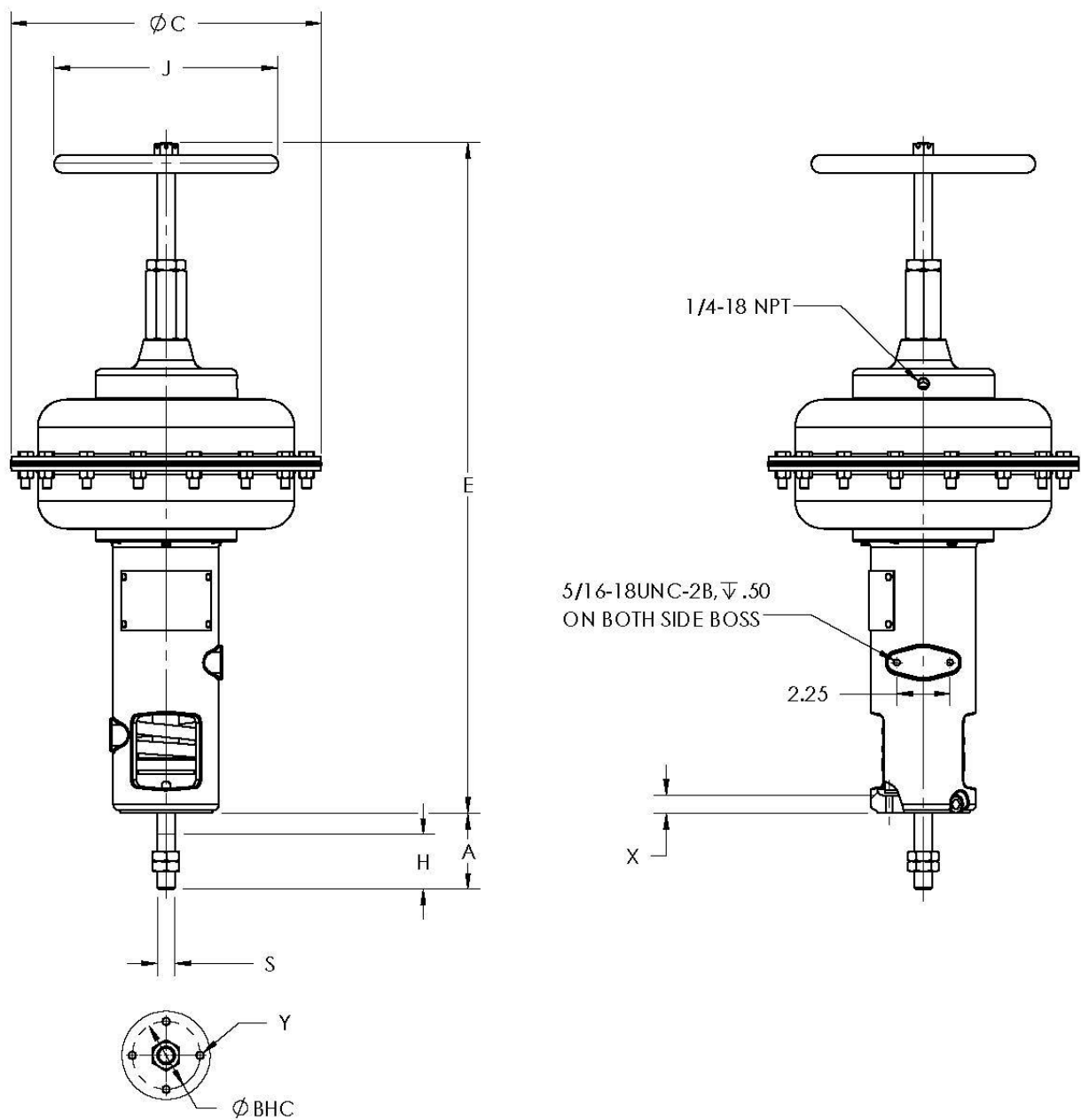
KEY 14 SPRING, STEEL

SIZE 60	SPRING RATE LB-IN	SPRING COLOR CODE	PART NUMBER
	280	NONE	CVS 1 K162727082
	400	NONE	CVS 1 N937327082
	610	NONE	CVS 1 K162827082
	860	NONE	CVS 1 P270227042

**DIMENSIONS: CVS Series 656 Size 60 – (Inches)**



**DIMENSIONS: CVS Series 656 with optional Handwheel: Dimensions**



ACTUATOR SIZE	DIMENSION									
	A	C	E		H	J	S (STEM THREAD)	X	Y (4 HOLES)	
			WITHOUT HANDWHEEL	WITH HANDWHEEL					BHC	THREAD
30	2.62	11.38	12.38	19.32	2.12	8.75	1/2-20	.75	2.88	3/8-16UNC
40	3.12	13.12	17.88	28.38	2.25	8.75	3/4-16	.75	2.88	3/8-16UNC
60	3.12	18.62	27.25	39.94	2.50	8.75	3/4-16	1.25	3.88	1/2-13UNC
mm										
30	67	289	314	490	54	222	US THREADS	19	73	US THREADS
40	79	333	454	723	57	222		19	73	
60	79	473	692	1014	64	222		32	32	

**Notes:**

**Notes:**

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