Model 215 Wafer Sphere Digital Valve

Service Manual

Bulletin MN03007 Issue/Rev 0.0 (11/83)

Contents

The 215 Valve is a wafer-sphere pneumatically actuated valve that must be installed between two pipe flanges. The 215 Valve is typically used in conjunction with a Smith Meter® AccuLoad®, MiniLoad, or SS1 Controller and preset counter.

When installing the 215 Valve in place of another style valve with greater flange-to-flange dimensions, a spool piece can be installed to compensate for the dimensional differences. The 215 Valve may be installed in any attitude (vertical or horizontal), providing the valve is installed with the product flowing in the direction of the flow arrow on the valve.

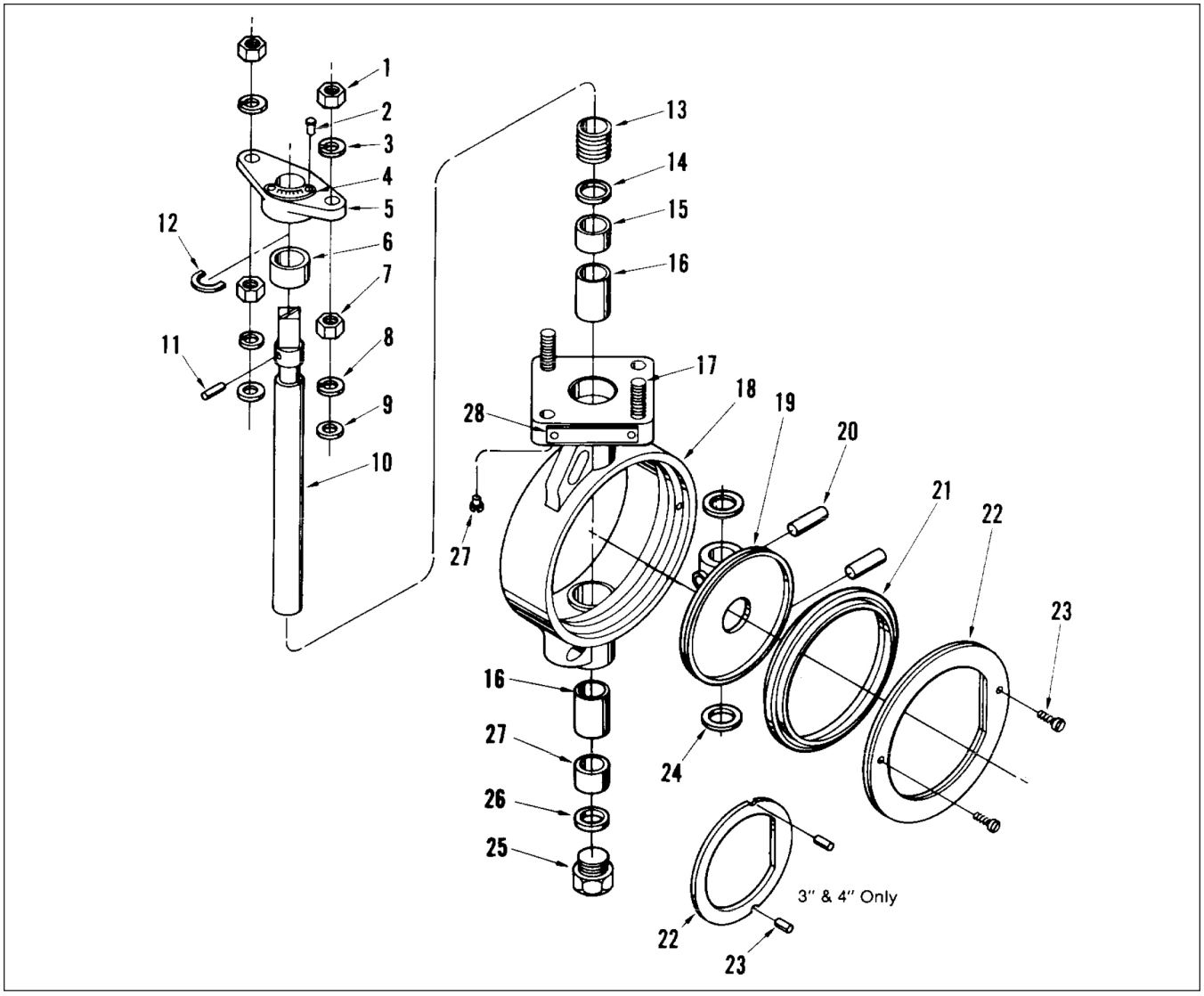


Figure 1 – Wafer Sphere Valve

Item No.	No. Required	Part Name
1	4	Nut
2	2	Drive Screw
3	4	Lock Washer
4	1	Indicator Plate
5	1	Compression Plate
6	1	Compression Ring
7	4	Jam Nut
8	4	Lock Washer
9	2	Flat Washers
10	1	Shaft
11	1	Indicator Pointer
12	1	Retainer Ring
13	1	Shaft Packing
14	1	Spacer

Item No.	No. Required	Part Name
15	1	Top Bearing Spacer
16	2	Shaft Bearing
17	2	Stud
18	1	Body
19	1	Disk
20	2	Disk Pan
21	1	Seat
22	1	Insert
23	*	Cap Screw (all valves except 3" and 4" Series 815W and 830W)
24	2	Thrust Bearings
25	1	Pressure Plug
26	1	Plug Seal
27	1	Bottom Bearing Spacer

Routine maintenance consists of tightening of the compression plate (Figure 1 - 5) occasionally to compensate for shaft seal wear. The valve must be closed during tightening. Do not overtighten the compression plate because this will severely limit seal life. For more extensive service such as seat, seal, and bearing replacement, refer to the following instructions.

Valve Removal

Warning

Before beginning any disassembly or before removing the valve from the line:

1. *Be sure of the type of fluid that is in the line and take the necessary precautions to protect yourself.*
2. *Wear protective clothing or other safety equipment deemed necessary for the fluid to be handled.*
3. *Depressurize the line and drain the system fluid.*

Caution

The wafer-sphere valve, because of its offset shaft, tends to open when pressurized on the inlet side unless the shaft is held in place by a handle or an actuator.

4. *When removing or installing the valve in the line, be sure it is cycled closed. This will prevent damage to the sealing edge of the disc.*
5. *Shut off service pressure and bleed and service lines to the actuator before beginning any removal or disassembly.*
6. *Do not attempt to disassemble the spring cartridge. The spring cartridge must be returned to TechnipFMC, Erie, Pennsylvania for servicing.*

Seat Replacement

1. Remove valve from line, place on a work bench and cycle the valve open.

Caution

Be careful not to damage the sealing edge of the valve.

2. Remove the insert screws or pin (23). Remove the insert (22).

Warning

If insert does not remove easily, it may be tapped out with a wooden or plastic bar and hammer. Do not strike the valve directly with the hammer.

3. Remove the seat (21) and discard.
4. Clean the valve thoroughly.
5. Clean and polish the disk sealing surface. The sealing surface should be free from defects and scratches.
6. If the disk is only slightly blemished, it may be possible to remove to imperfection with crocus cloth, a fine stone or equivalent. If deep scratches are present, replace the disk or return the valve to TechnipFMC, Erie, Pennsylvania for service.
7. Cycle the valve closed.
8. Install the new seat into the insert.
9. Replace the insert and seat as one unit. Reinstall insert screws.
10. Place the valve into the line.
11. Tighten the flange bolts sequentially according to the appropriate diagram in Figure 2. See Table 1, Figure 2 for torque values.
12. Set the actuator stops according to the instructions in Section 3, "Setting Adjustments."

Shaft Packing Replacement

(Figure 1)

1. Remove actuator.
2. Remove the indicator pointer (11) from the shaft by pulling it straight out with pliers.
3. Remove the nuts (1) and washers (3) from above the compression plate (5). Remove the compression plate. The studs (17) do not have to be removed.
4. Slide the retainer ring (12) off the shaft.
5. Remove the compression ring (6).
6. Remove the old shaft packing (13) with a packing tool.
7. The spacer (14) does not have to be removed for shaft packing replacement.
8. Install the new packing.

Note: *If the new packing is of the TFE chevron type, keep the packing rings stacked in the same order as they were removed from the replacement kit.*

9. Reinstall:
   a. Compression ring (6).
   b. Retainer ring (12).
   c. Compression plate (5).
   d. Lock washers (3).
   e. Nuts (1).

Note: *If the compression ring sits too high to permit installation of the retainer ring, the packing may have to be precompressed by:*

   a. Installing the compression plate and tightening the nuts to compress the packing.
   b. Removing compression plate, installing retainer ring, and completing the reassembly.

10. Close the valve (seat and insert should be installed).
11. Tighten the nuts (1) evenly until the packaging is compressed enough to prevent leakage. This should only require tightening the nuts about 1-1/2 to 2 full turns after "finger tight" position.

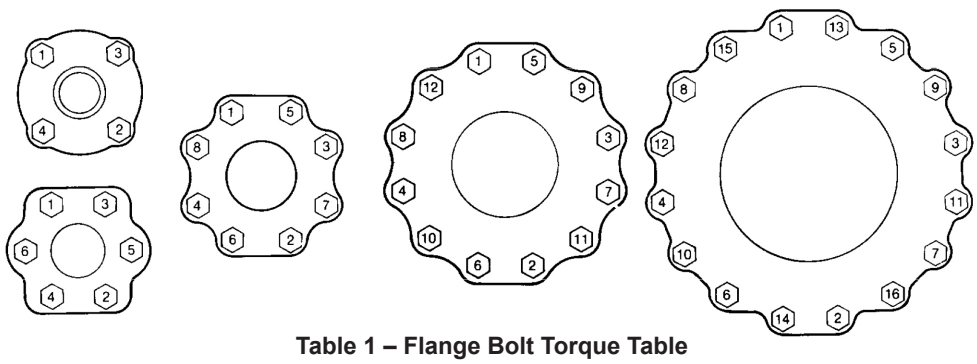


Table 1 – Flange Bolt Torque Table

ANSI	Bolt Dia. Inches	Torque Ft. Lbs.
3" - Class 150	5/8	135
3" - Class 300	3/4	225
3" - Class 600	3/4	225
4" - Class 150	5/8	135
4" - Class 300	3/4	225
4" - Class 600	7/8	335
6" - Class 150	3/4	225
6" - Class 300	3/4	225
6" - Class 600	1	520

ANSI	Bolt Dia. Inches	Torque Ft. Lbs.
8" - Class 150	3/4	225
8" - Class 300	7/8	335
8" - Class 600	1-1/8	700
10" - Class 150	7/8	335
10" - Class 300	1	520
10" - Class 600	1-1/4	990
12" - Class 150	7/8	335
12" - Class 300	1-1/8	700
12" - Class 600	1-1/4	990

Figure 2 – Flange Bolt Tightening Sequence

Valve Disassembly

1. Remove actuator.
2. Place the valve on a workbench or other suitable work area.
3. For seat replacement follow Steps 2, 3, 4 in the "Seat Replacement" Section.

Note: *It is recommended that the seat (and body seal in 3" and 4" valves) be replaced any time that a valve is rebuilt.*

4. Remove the shaft packing compression hardware. See Steps 1-5 in "Shaft Packing Replacement" Section. The packing material can be easily removed after the shaft has been removed from the valve.
5. Grind or machine away from the disk pin welds. Drive the pins (20) out in the direction shown in Figure 1.
6. File or grind off the tack weld that locks the pressure plug (25). Remove the plug and its seal (26).
7. Tap the bottom of the shaft (10) with soft rod and hammer. Remove the shaft through the top of the valve. (Disk and upper and lower thrust bearings will be free. Retain thrust bearings.)

Caution

When freeing the shaft, be careful not to scratch the sealing surface of the disk.

8. Remove the packing (13) and the spacer (14 and 15).
9. Remove the upper bearing (16) through the top of the valve or through the valve body opening.
10. Remove the lower bearing (16) through the bottom of the valve or through valve body opening.

Valve Assembly

1. Clean all the valve components.
2. Before starting assembly, check all components for wear and/or damage. Check the sealing areas of the disk, shaft, and body for damage and wear in the bearing areas of the shaft and body of the valve.
3. Clean and polish the disk sealing surfaces, be sure it is free of all grooves and scratches.
4. If the disk sealing surface is scratched, it can be polished with crocus cloth, a fine stone, or equivalent material. If the disk sealing surface is scratched deeply, the disk will have to be replaced.
5. Install the bearings (16) into their respective bores.
6. Lightly coat the shaft and disk bore with a lubricant that is compatible with the fluid to be handled by the valve.
7. Position the disk (19) in the body between the thrust bearings (24); slide the shaft (10) through the body and disk. Use caution to prevent damage to the bearings. Observe correct orientation of disk with the compression plate (5) revealed by an arrow and the word "bonnet" on disk.
8. Drive the disk pins (20) into place. Both pins must be driven to the same depth, within 1/16". The arrow cast on the disk back indicates proper pin insertion direction. Be sure pins are installed from the direction shown in Figure 1. If the disk pins have been properly installed, the indicator pointer (11) will point parallel with the face of the disk (Figure 1). Weld both ends of the pins, small end first. Clean the welds with a wire brush after they cool.

Caution

Be careful to keep contaminants such as metal chips, weld shot, slag, or other debris, out of the valve.

9. Install the upper bearing spacer (15) (not on 8" valves), the spacer (14), the packing (13), the compression ring (6) and the retainer ring (12) where applicable.
10. Reinsall the studs (17), if removed, into the holes as shown in Figure 1.
11. If the actuator base plate was removed from the valve, reinstall it as shown in Figure 3. Install lockwashers and screws in the two bonnet holes not used by the studs; install the lower lockwashers (Figures 1-8) and nuts (1) on the studs. **Do not tighten the screws and nuts until the stops are set (see Section 3, "Setting Adjustments").**
12. Place compression plate (5) over the shaft (10) an studs (17). Orient the compression plate so that the indicator pointer will be over the indicator plate. Install the lockwashers (8) and nuts (1). **Do not tighten.**
13. Place the plug seal (26) in the recess at the bottom of the valve; install the plug (25). Tighten the plug until it is flush with the body. Place a small (1/16") tack weld on the corner of the body of the plug.

Caution

A larger tack weld my damage the seal.

14. Close the valve completely. If the seat and body seal are to be replaced, do so now. See "Seat Replacement," Section 2.
15. Install the insert and insert screws as shown in Figure 1. The 3" and 4" valves do not have insert screws. The 3" an 4" valves have pins (23) that locate and hold the insert.
16. Tighten the nuts (1), with valve closed, on the compression plate evenly until the packing is compressed enough to prevent leakage (1-1/2 to 2 full turns past "finger tight").
17. Set the actuator stops as described in "Setting Adjustments," Section 3.

Actuator Quadrant Reorientation

To reorient actuator quadrant (Figure 3):

1. Loosen valve/actuator coupling by loosening the coupling screws.
2. Remove the four bolts that hold the actuator bracket to the actuator base plate (Figure 3). Remove actuator and bracket.

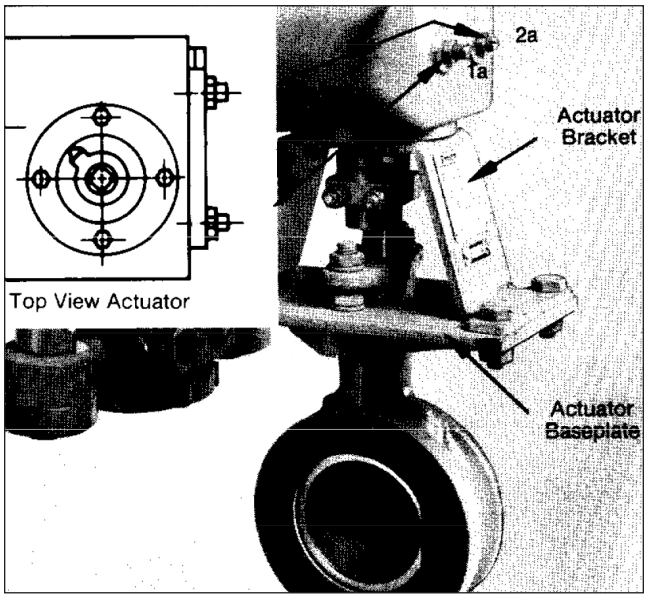


Figure 3 – Actuator Bracket

3. Remove the four screws that hold the actuator bracket to the actuator.
4. Reposition the actuator to the desired quadrant.
5. Reinstall and tighten the four screws that hold the actuator bracket to the actuator.
6. Be sure that the actuator and valve positions coincide (e.g., actuator at "closed" end of stroke with valve closed). This ensures that the valve opens in a counterclockwise direction.

Note: *Actuators are* ***spring-to-close*** *only and cannot be reoriented for* ***spring-to-open****.*

7. Reinstall the bracket on the baseplate and use the four bolts and nuts to hold the two components together. Only tighten the nuts finger tight and be sure that all four bolts holes are aligned.

Note: *Excessive tightening will prevent proper alignment of the actuator drive shaft and valve stem. Failure to tighten snugly will cause the shaft and disk to be pushed downward and away from optimum seat contact when final tightening is accomplished.*

8. Install the coupling and tighten the coupling bolts. **Be sure that the actuator drive shaft and valve stem are rigidly held together and properly aligned**.
9. Slightly loosen the four nuts and bolts that join the bracket and baseplate to allow the coupling, actuator drive shaft, and valve shaft better alignment. Fully tighten the four nuts and bolts.
10. Set the actuator stops as described in "Setting Adjustments" Section to follow. Do not install the valve in the line until the actuator stops are properly adjusted.

Setting Actuator Stops
(Valve in Line)

Note: *It is recommended that the actuator stops be adjusted before installing the valve in the line so the disk position can be verified visually.*
If the unit is installed in line, it is possible to adjust the actuator stops according to the information that follows for "Valve out of the line," by ignoring reference to measured clearance to disk.

Caution

There must be no pressure across the valve while the actuator stops are being set. After the adjustments have been made, check all linkage and coupling bolts for tightness. Torque coupling bolts follow Table 1.

Setting Actuator Stops
(Valve Out of Line)

Be sure:

1. The insert (Figures 1-22) is clamped into the position it will take when installed.
2. Insert must be flush with the face of the body (Figure 1-18) (within 1/64" maximum).

Note:
(a.) The installed seat tends to lift the insert unless it is clamped into place.
(b.) It may be more convenient to adjust the stops with the seat removed from the valve. In this case, the seat and insert must be reinstalled as described in the "Seat Replacement," Section 2.

3. Disk travel is controlled with the "closed" travel stop set screw (Figure 3) (1a) and by the "open" travel stop set screw (2a) in the actuator.
4. Adjust the "shut" stop set screw until the disk just touches the insert when the actuator is at the end of its stroke.

Caution

If pressure is applied to the actuator while the valve is exposed, keep hands and tools away from the disk.

5. Then turn the stop set screw in about 1/8 turn to get the disk 0.010" to 0.040" off the insert.
6. Cycle the actuator open and closed several times to verify that the disk returns to the same position each time it is cycled.

Warning

Keep hands and tools away from the disk. Be careful not to scratch the disk sealing edge.

7. Cycle the valve to the open position. Adjust the "open" stop set screw (2a), if necessary, until the pointer (3a) is approximately 90º from the "closed" position. This is the full "open" position.
8. Cycle the valve closed and when it is closed, tighten the stop set screw jam nut, while air pressure (or spring pressure) is being applied.
9. Cycle the valve open and closed three times with full air pressure. The disk should return to the same position each time. Check to be sure that the disk is within the 0.010" to 0.040" tolerance of the insert stop. Also be sure that the disk is not lifting the insert.

Warning

Do not attempt to disassemble the spring cartridge. If maintenance is required, return the entire assembled spring cartridge to TechnipFMC.

Under normal operating conditions the actuator requires only periodic observation to ensure proper adjustment. Standard replacement of "soft" parts in the pneumatic actuator consists of items numbered 6, 9, 14, 18, 28, 31, 50, 51, and 52.

Diaphragm Replacement

Caution

Check to be sure that the service line to the actuator is disconnected.

1. Remove the hex bolts (Figures 6, 7, or 8 as applicable) (27) and nuts (29) holding the upper (15) and lower (13 or 32) diaphragm casings together.
2. Lift off the upper casings (15) and diaphragm (14).
3. Inspect the inside of the upper and lower diaphragm casing for rough spots or foreign material that may cause abrasion to the diaphragm.
4. Place the new diaphragm (14) on the diaphragm plate (10).
5. Place the upper casing on - line up **all** holes. **Do not pinch or stretch the diaphragm.**

Note: *If any of the bolts (27) show signs of corrosion or wear - replace them.*

6. Insert the hex bolts (27) through all the holes. Do not force the bolts through the diaphragm.
7. Install the nuts (29) on the bolts and tighten them uniformly. Use the standard practice of tightening diametrically opposite bolts in sequence. Tighten to approximately 20 ft. lbs.

Actuator Disassembly

Caution

Be sure that the service line to the actuator is disconnected.

1. Remove the actuator from the valve by first loosening the coupling bolts. Then remove the four hex head bolts that hold the actuator to the bracket.

Caution

These actuators weigh up to 250 pounds.

2. Remove the actuator to a clean, well-lit area and obtain the following tools:
   a. Two (2) 9/16" wrenches, one should be a ratchet.
   b. One (1) screwdriver.
   c. External snap ring pliers.
   d. Two (2) C-clamps with 4" minimum throat.
   e. One (1) plastic faced mallet.
   f. One (1) steel bar, at least 1" square and longer than the diameter of the diaphragm casing.
3. Remove the hex head bolts (27) and nuts (29) that hold the upper and lower diaphragm casings together.

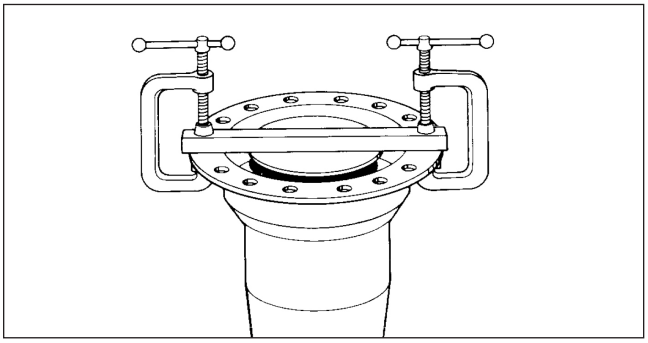


Figure 4 – Remove Spring Preload Pressure with Bar and C-clamps

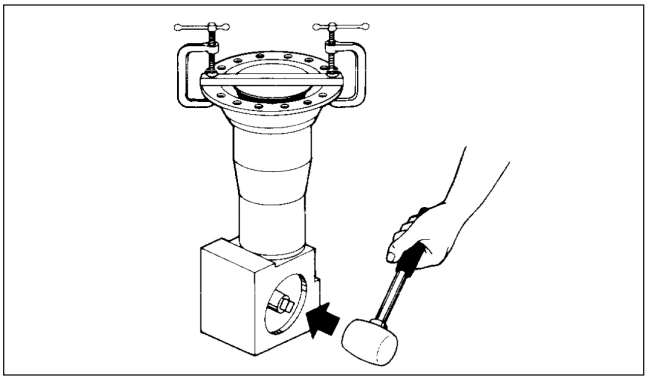


Figure 5 – Tap the Driver Out of the Bearings

4. Lift off the upper casing (15) and diaphragm (14).
5. Inspect the diaphragm for signs of wear, holes, or any mechanical damage.
6. Inspect the inside of both the upper and lower diaphragm casing for rough spots or foreign matter that may cause abrasion of the diaphragm.
7. From the shaft end of the actuator, remove the three snap rings (28), indicator pointer (24), and thrust washers (31).
8. Attach the bar across the center of the diaphragm plate (10) with two C-clamps (Figure 4).
9. Tighten the C-clamps sufficiently to remove spring preload pressure from the driver. Arm (3) will move off stop (19). Travel to accomplish this is about 3/16".
10. Loosen the hex head bolt (25) that clamps the driver arm (3) to the driver (2). (Do not remove this bolt.)
11. Using the plastic faced mallet, lightly tap the driver out of the bearings (Figure 5).
12. Remove C-clamps and bar.
13. Lift the entire spring cartridge out of the unit.
14. Remove one retaining ring (9) and nylon washer (6) from the drive pin (8) that holds that driver arm (3) to the two connecting plates (7).

Warning

Disassembly of the spring package should never be attempted. Special equipment is required. Disassembly of the spring package may result in serious personal injury. If maintenance is required, ship the entire assembled spring cartridge to TechnipFMC.

15. It is not necessary to detach the lower diaphragm casing (13) from the housing (1) (Series "C"), or the driver housing from the spring housing (Series "B"). Cap screws (38) must be torqued to 25 ft. lbs. on Series B actuators.
16. All bearings should be removed and replaced.
17. Inspect and clean all components.

Assembly

1. To aid assembly, spread light oil or grease on the new bearing O.D.
2. Press the pivot pin bearing (52) into the driver arm (3). This is best done in an arbor press, but a vise can be used if care is taken not to damage the bearing.
3. Press the top and bottom driver bearings (50) and (51) into the housing (1) flush with the surface.
4 Apply grease to the inside of all bearings. Molybdenum disulfide grease is recommended.
5. Assemble retaining ring (9) to pivot pin (8). Slide on new nylon washer (6) and insert through connector plates (7) and driver arm (3). Be sure that the clamp bolt (25) is on the side of the connecting plates with the circular cut out. Slide on washer (6). Then fasten with retaining ring (9).
6. Apply a good grade of grease to the O.D. of the spring. Lower the spring cartridge assembly into the main housing. Make sure that the driver arm is in the proper position with bolt head facing as shown in the drawing. On adjustable actuators insert the thrust washer (18) into the housing before lowering the spring cartridge.
7. Rotate the spring cartridge slightly until the driver arm is perpendicular to the bearing center line.
8. Attach C-clamps and bar as shown (Figure 4) and tighten until the splined hole (square hold on Series B) in the driver arm (3) has been positioned in line with the bearing bores.
9. Insert the driver (2) through the larger bearing (50). Insert driver through driver arm (3). Insert driver into the smaller bearing. Rotate the driver until the aligning pin at the edge slips into its slot near the pivot pin.

Note: *This pin should not be fitted into the clamping slot.*

10. Once the square has been properly aligned, the driver can be tapped into the spline with a plastic faced mallet.
11. Install a nylon thrust washer (31) on each end of the driver (2) and secure with retaining rings (28).
12. Tighten hex head screw (25) to clamp driver arm. Apply a torque of 8 ft. lbs. on Series B actuators; 15 ft. lbs. on Series C actuators.
13. Release C-clamps.
14. Install the indicator pointer (24) and hold in place with a retaining ring (28).
15. Replace nameplate cover(s) (5).
16. Place new diaphragm (14) on diaphragm plate (10). Place upper casing (15) on and line up all the holes. Do no pinch or stretch the diaphragm.

Note: *If bolts are corroded, replace them at this time.*

17. Insert hex head bolts (27) in all holes. Do not force the bolts through the diaphragm.
18. Install nuts (29) on bolts and tighten uniformly using the standard practice of tightening diametrically opposite bolts in sequence. Tighten to approximately 20 ft. lbs. Tighten to 6-8 ft. lbs. on Series B actuators.

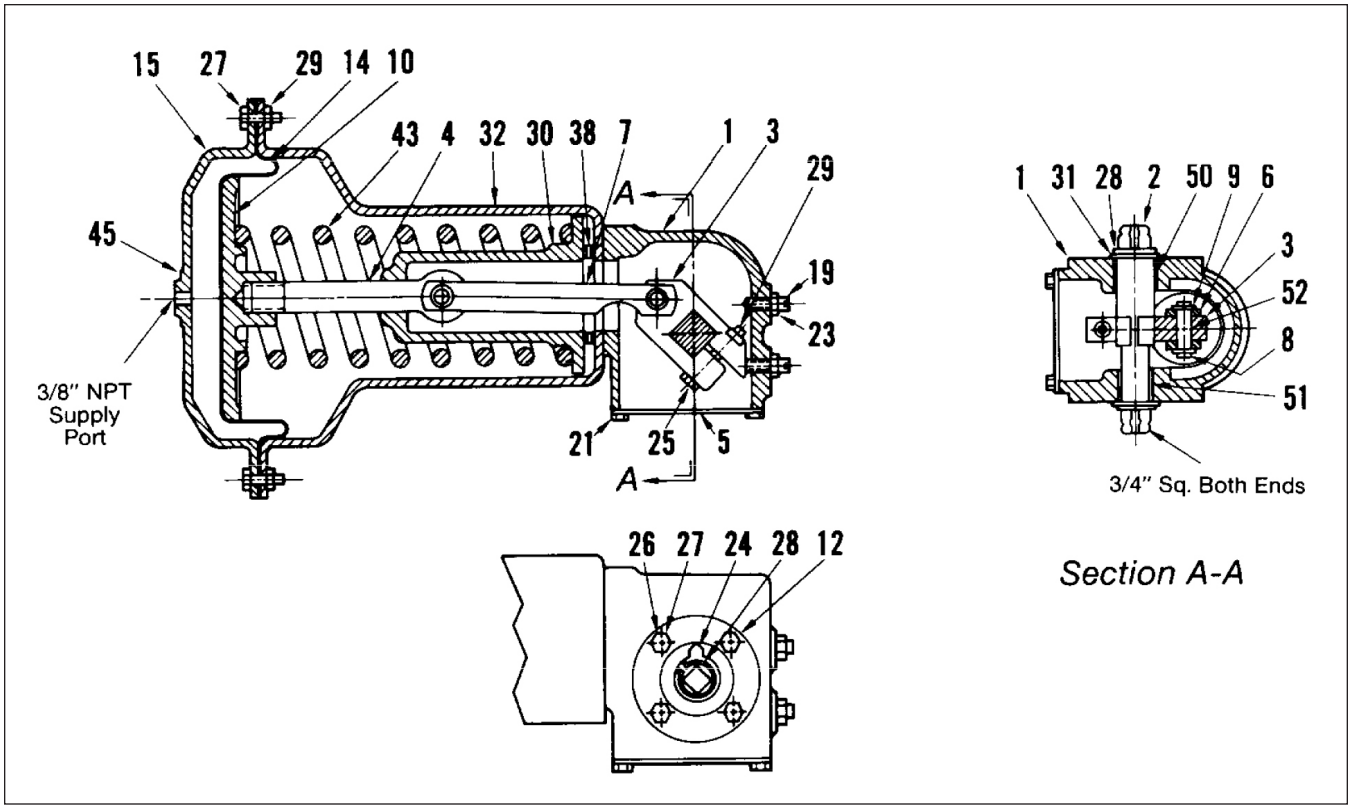


Figure 6 – Series C Actuators

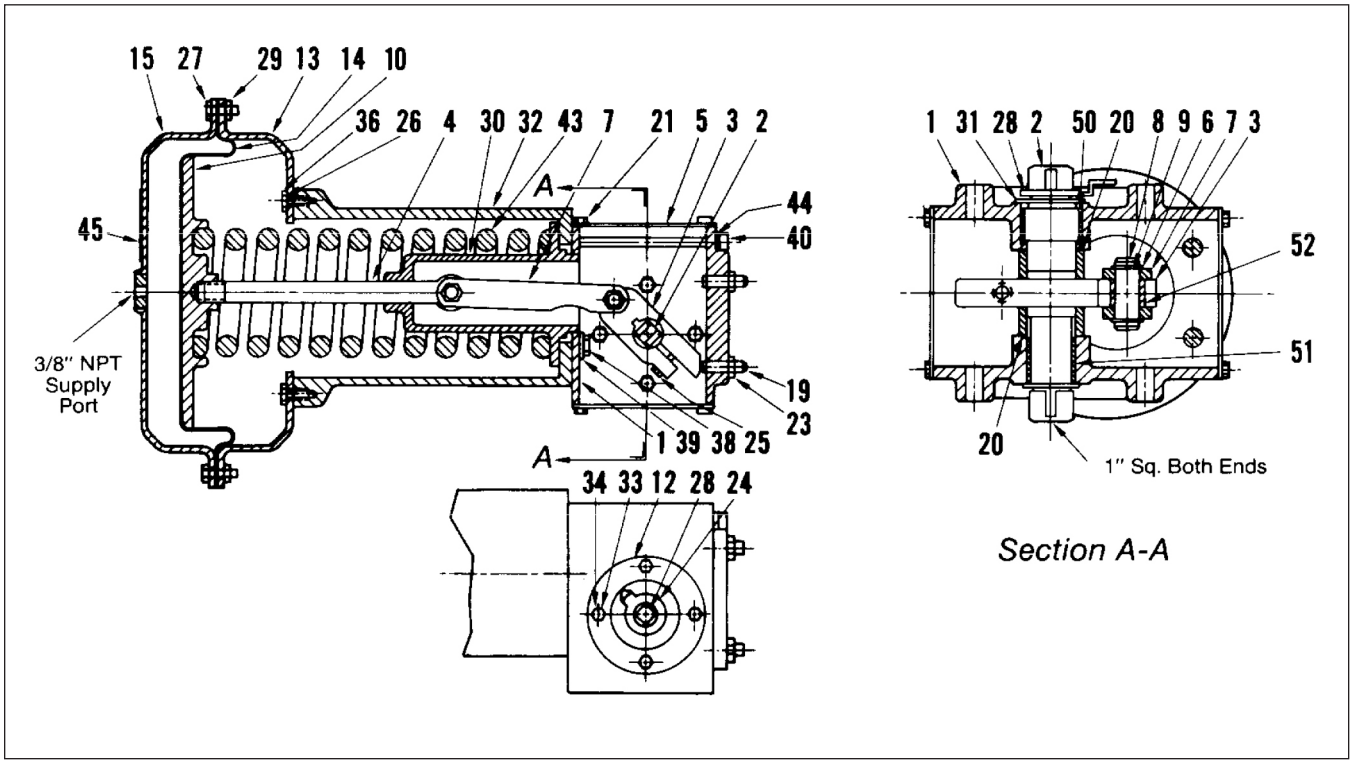
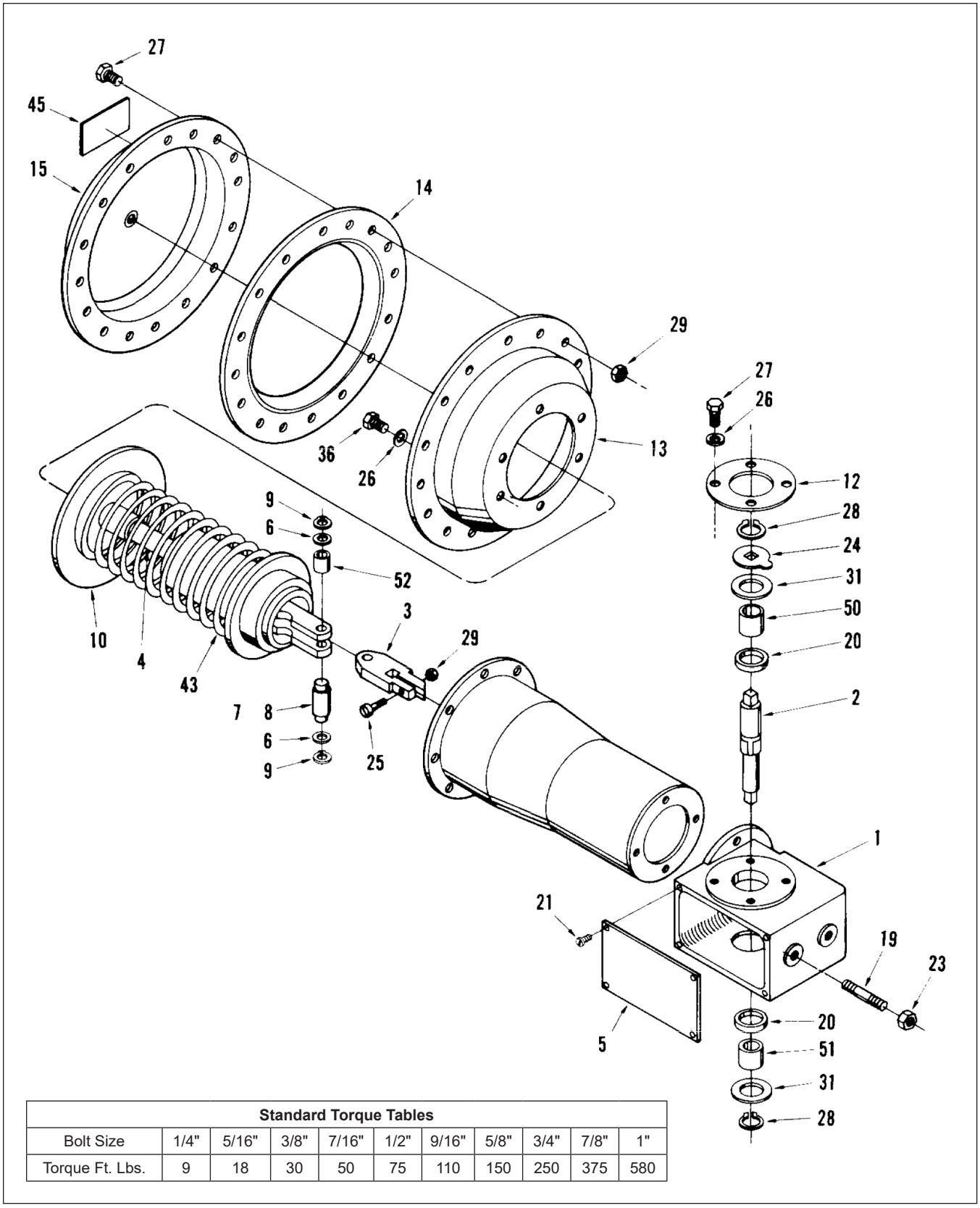


Figure 7 – Series D Actuators



Standard Torque Tables										
Bolt Size	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"
Torque Ft. Lbs.	9	18	30	50	75	110	150	250	375	580

Figure 8 – Series B Actuators

Materials and Parts List – Reference Figures 6, 7, and 8

Part Number	Name	Materials	Series C Types C30S C40S C50S C60S	Series D Types D30S D40S D50S D60S
			Quantity	Quantity
1	Housing	Cast Iron	1	1
2	Driver	Stainless Steel	1[3]	1
3	Driver Arm	Carbon Steel	1	1
4	Actuator Rod*	Carbon Steel	1	1
5	Cover	Stainless Steel	1	2
6	Pivot Pin Washer*	Nylon	4	4
7	Connector Plate*	Carbon Steel	2	2
8	Pivot Pin*	Stainless Steel	2	2
9	Pivot Pin Retainer*	Stainless Steel	4	4
10	Diaphragm Plate*	Cast Iron	1	1
12	Position Indicator Plate	Stainless Steel	1	1
13	Lower Casing	Carbon Steel	N/A	1
14	Diaphragm	Buna-N	1	1
15	Upper Casing	Carbon Steel	1	1
19	Stop Screw	Stainless Steel	2	2
20	Spacer	Nylon	N/A	1
21	Cap Screw	Carbon Steel	4	8
23	Jam Nut	Stainless Steel	2	2
24	Indicator Pointer	Aluminum	1	1
25	Cap Screw	Carbon Steel	1	1
26	Lock Washer	Carbon Steel	4	10
27	Cap Screw	Carbon Steel	20	18
28	Driver Retainer	Stainless Steel	3	3
29	Lock Nut	Carbon Steel	17	18
30	Spring Retainer*	Cast Iron	1	1
31	Thrust Washer	Nylon	2	2
32	Spring Housing	Cast Iron	1[1]	1
33	Cap Screw	Carbon Steel	N/A	4
34	Lock Washer	Carbon Steel	4	4
36	Cap Screw	Carbon Steel	N/A	10
38	Cap Screw	Carbon Steel	6	2
39	Lock Washer	Carbon Steel	N/A	2
40	Cap Screw	Carbon Steel	N/A	2
43	Compression Spring*	Carbon Steel	1	1
44	Lock Washer	Carbon Steel	N/A	2
45	Caution Plate	Stainless Steel	1	1
50	Top Driver Bearing	Metal-Backed Acetal Resin	1	1
51	Bottom Driver Bearing	Metal-Backed Acetal Resin	1	1
52	Pivot Pin Bearing	Metal-Backed Acetal Resin	4	2

* Part of spring cartridge not removable in field. Two of four pivot pin washers (6), one of two pivot pins (8), two of four pivot pin retainers (9), and one of two pivot pin bearings (52) also part of spring cartridge. With Series C two of four pivot pin bearings (52) part of spring cartridge.

Note 1: Carbon Steel.
Note 2: Carbon Steel for E60S only.
Note 3: Nickel Plated Carbon Steel.
Note 4: Ductile Iron.

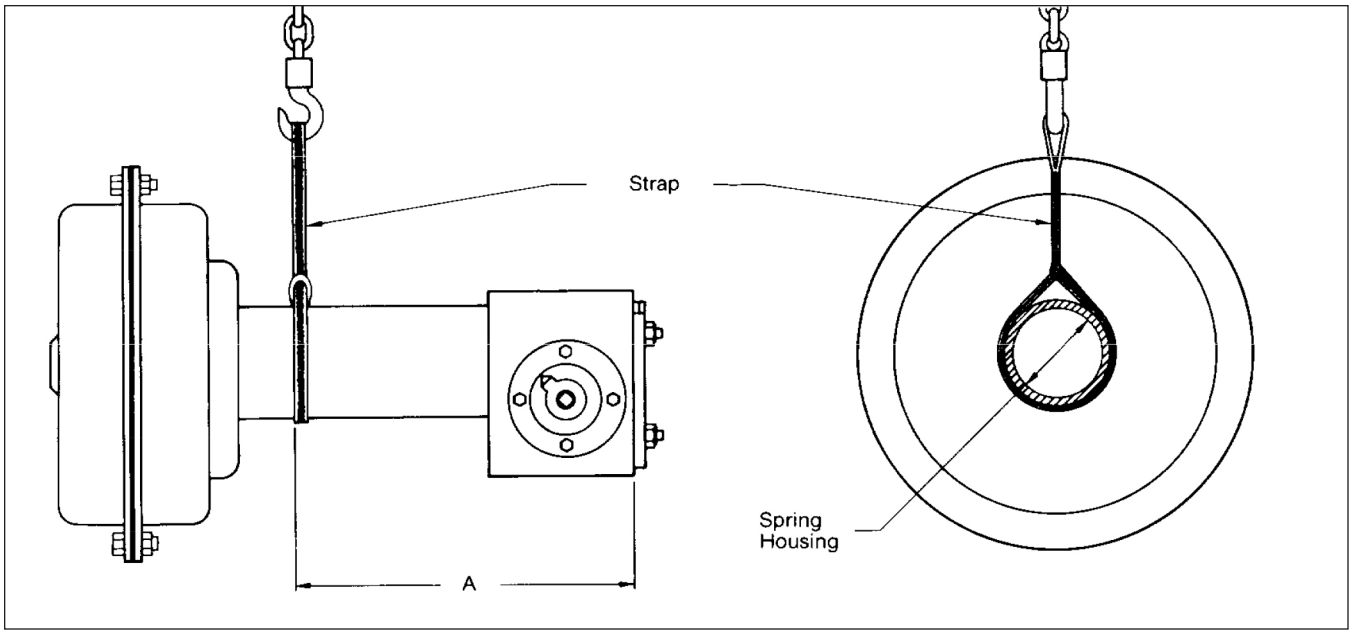
Additional Items for Adjustable Units

16	Spring Seat*	Cast Iron	1	1
17	Spring Adjuster*	Cast Iron	1	1
18	Thrust Washer	Nylon	1	1

The illustration below show the most suitable way to sling pneumatic actuators. The accompanying table shows actuator weights and the dimension for proper sling placement.

Actuator Series	Approximate Weight	Dimension A
C	61 lbs.	9-1/4"
D	135 lbs.	12-1/4"

Note:
When a valve or jackscrew is mounted to the actuator, this dimension will change and vary according to the weight of the valve. Proper sling location should then we found by trial.



Section 6 – Related Publications

The following literature can be obtained from TechnipFMC Measurement Solutions Literature Fulfillment at measurement.fulfillment@technipfmc.com or online at http://info.smithmeter.com/literature/online_index.html.

When requesting literature from Literature Fulfillment, please reference the appropriate bulletin number and title.

Model 215 Wafer Sphere Valve SS03010
Model 215 Wafer Sphere Valve Installation Manual MN03006

Technical Support

Contact Information:
Field Service Response Center
24/7 Technical Support/Schedule a Technician: 1-844-798-3819
System Installation Supervision, Start-Up, Training, and Commissioning Services Available

TechnipFMC.com

 MN03007 Issue/Rev. 0.0 (11/83)

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Measurement Solutions, Inc.
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