DL 84 IOM

DL 84

Diaphragm Actuators

Installation, Operation & Maintenance Instructions

WARREN CONTROLS

A company of the ARI-Armaturen Group

TABLE OF CONTENTS

OVERVIEW 1
ACTUATOR SPECIFICATIONS 2
DIMENSIONS & WEIGHTS 2
INSTALLATION AND MOUNTING IN PIPING 3
OPERATION 4
MAINTENANCE 4-23
- Parts Kits & Instructions 5
- Actuator Assembly Drawings
  - Direct Acting Actuator 6
  - Direct Acting Handwheel 7
  - Reverse Acting Actuator 8
  - Reverse Acting Handwheel 9
- Changing Actuator Orientation 10
- Actuator Removal 10
- Removal & Installation Drawing 10
- Actuator Disassembly/ Re-Assembly
  - Direct Acting 11-12
  - Direct Acting with Handwheel 12-15
  - Reverse Acting 15-17
  - Reverse Acting with Handwheel 17-19
- Actuator Installation on Valve
  - Direct Acting Actuator on 2-Way Valve 20
  - Direct Acting Actuator on 3-Way Valve 21
  - Reverse Acting Actuator on 2-Way Valve 22
  - Reverse Acting Actuator on 3-way Valve. 23

OVERVIEW

This document covers the installation, operation and maintenance of Industrial DL84 Diaphragm Actuators installed on Series 1800, 2800, 2900, or 5800 Valves. DL84 actuators are powerful and compact featuring a multiple-spring, rolling-diaphragm, low hysteresis design. The actuator is available direct acting (air-to-extend) and reverse acting (air-to-retract).

Steel diaphragm chambers and a ductile iron yoke with an acrylic enamel finish along with a stainless steel shaft and fasteners make this actuator durable, rugged, and corrosion resistant. A top-mounted handwheel is available for a manual override. The spring range of factory installed actuators is pre-set.

ACTUATOR SPECIFICATIONS

EFFECTIVE AREA:

84 Sq In

TRAVEL:

DL84 3/4, 1/8 & 1-1/2 In

DL84XR 3/4 In

SPRINGS:

Multiple

MAX AIR SUPPLY:

30PSIG.

AIR CONNECTIONS:

¼ NPT

DIAPHRAGM:

Buna-N Fabric Reinforced

DIAPHRAGM CHAMBERS:

Steel

YOKE:

Ductile Iron

ACTUATOR SHAFT:

300 Series

Stainless Steel

SHAFT SEAL:

Nitrile

STEM CONNECTOR:

Split / Bolted

FINISH:

Acrylic Enamel

AMBIENT TEMPERATURE:

-40 to 180 ºF.

MOUNTING:

Vertical Above (preferred)

(See page 3 for details)

HANDWHEEL:

Optional Top-mounted only

REVERSIBLE:

No

POSITION INDICATION

Travel Indicator Pointer

(On Stem Connector)

Travel Scale (On Yoke)

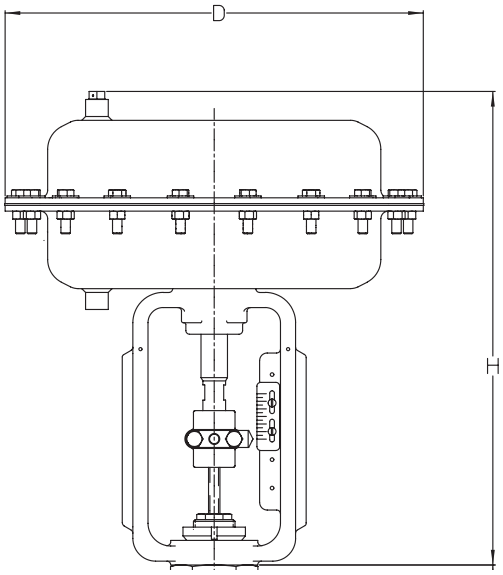
(See diagram on page 10)

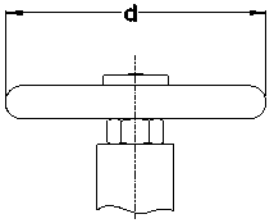
SIZE	ACTION	SPRING RANGE (PSI)			
		LOW	FULL	HIGH	XTRA-HIGH
DL84	Direct	3-9	3-15	9-15	N/A
DL84	Reverse	3-9	3-15	9-15	N/A
DL84XR	Direct	N/A	N/A	N/A	See Note
DL84XR	Reverse	N/A	N/A	N/A	See Note

Note: 1. Spring Ranges are Fixed for each model and the starting point is NOT adjustable.

2. The spring range of XR (eXtended Range) actuators varies with travel. These actuators require positioners or I/P's for modulating control

DIMENSIONS & WEIGHTS





ACTUATOR	D (IN) ACTUATOR	d (IN) ACTUATOR	H MAX (IN)		WEIGHT (LB)	
			STD*	WITH HAND WHEEL	STD	WITH HAND WHEEL
DL84 Direct	13-7/8	8-1/8	16-3/4	24-1/8	48-1/2	55-1/2
DL84 84XR Reverse	13-7/8	8-1/8	15-3/4	24	48-1/2	55-1/2

* Includes 1-3/8 inch for air fitting on direct acting diaphragm actuators

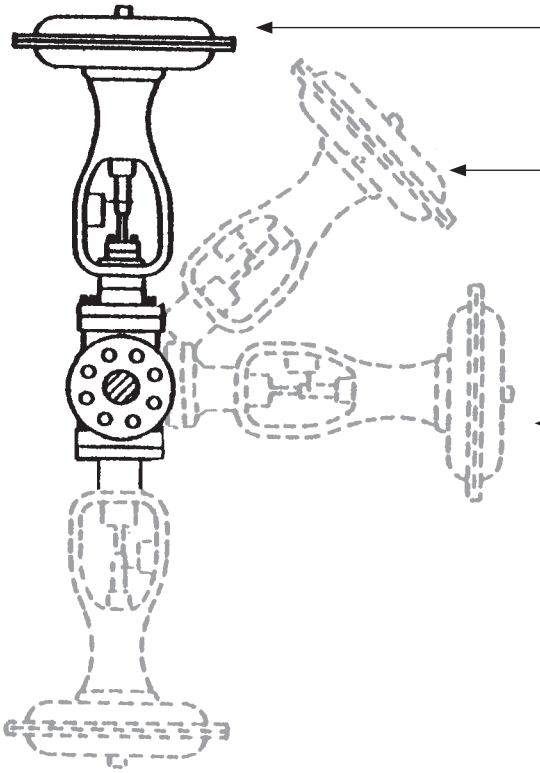
Exceeding the maximum air supply pressure of 30 PSIG will damage the actuator and valve and voids the warranty. Rotating the actuator shaft will damage the diaphragm, can cause springs to fall over, and voids the warrenty. Rotating the valve stem while the plug is in contact with the seat will damage the seating surfaces and voids the warranty. Recommended actuator mounting is vertical above or below the valve.

Ambient temperature must be kept within the actuator's limits of –40 to 180F.

Do not insulate actuator.

SEE SEPARATE VALVE INSTALLATION OPERATION & MAINTENANCE MANUAL FOR:

- Additional control valve roughing dimensions and weights
- Actuator removal clearance.
- Additional installation guidelines.



VERTICAL ABOVE PIPING IS CORRECT MOUNTING POSITION.

All other positions reduce service life of equipment.

NEXT BEST POSITION

45º from vertical above piping on either side.
Valve must have an 8 Bolt Flange.

A non-vertical mounting position may be necessary to protect actuator in high temperature applications, but may reduce packing life.

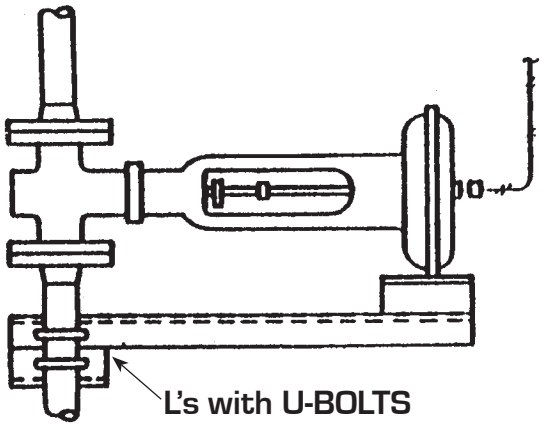
WORST POSITION

(Horizontal on either side).

Actuators mounted in any position other than vertical **MUST** be supported independent of the valve.

VERTICAL BELOW PIPING

Position is suitable for gases, but NOT for liquids or steam.



Method for supporting actuator mounted in non-vertical position.

OPERATION

DL84 actuators feature a multiple-spring, rolling-diaphragm, low hysteresis design. The spring range is fixed when the actuator is installed on a valve and cannot be adjusted while the actuator shaft is connected to the valve stem. The actuator does not have an adjustable travel limit stop. A NAMUR mounting boss for accessories is present on each leg of the actuator yoke. The actuator is securely connected to the valve by a yoke locknut and a split stem connector. DL 84 actuators are not field reversible.

Direct acting (air-to-extend) actuators provide air-to-close operation on direct acting 2-way (stem in to close) valves and fail open on loss of air supply. On 3-way valves operation is air-to-close the lower port, and the upper port fails closed on loss of air supply. Direct acting actuators have a ¼ inch NPT air connection on the upper diaphragm chamber and a vent plug on the lower diaphragm chamber (do not discard the vent plug).

Reverse acting (air-to-retract) actuators provide air-to-open operation on direct acting 2-way (stem in to close) valves and fail closed on loss of air supply. On 3-way valves operation is air-to-close the upper port, and the lower port fails closed on loss of air supply. Reverse acting actuators have a ¼ inch NPT air connection on the lower diaphragm chamber and a vent plug on the upper diaphragm chamber (do not discard the vent plug).

CAUTION! Exceeding the maximum air supply pressure of 30 PSIG will damage the actuator and void the warranty.

HANDWHEEL OPERATION (for actuators equipped with handwheels)

The DL 84 Actuator handwheel is used to manually operate the actuator on loss of air pressure to the diaphragm chamber. Its clutchless design features a large 8 inch diameter wheel, heavy duty shaft and bearings for smooth operation.

When air pressure is restored, the handwheel must be returned to its standby position to return the actuator to normal operation.

To operate the handwheel,

Loosen large hex nut at base of handwheel shaft. Thread hex nut to top of shaft. Operate handwheel to desired position.

For direct acting actuators: Turn the handwheel clockwise (looking down on actuator) to extend the actuator shaft.

For reverse acting actuators: Turn the handwheel counterclockwise (looking down on actuator) to retract the actuator shaft.

Thread hex nut to base of shaft and tighten to bonnet to lock handwheel in place.

To return handwheel to stand-by position:
Loosen large hex nut at base of handwheel shaft. Thread hex nut to top of shaft.

For direct acting actuators: Turn the handwheel counterclockwise (looking down on actuator) to retract the actuator shaft until the handwheel shaft reaches the stop in the bonnet. Thread hex nut to base of shaft and tighten to bonnet to lock handwheel in place.

For reverse acting actuators: Turn the handwheel clockwise (looking down on actuator) to extend the actuator shaft until the hex nut makes contact with the handwheel bonnet. Tighten hex nut to bonnet to lock handwheel in place.

MAINTENANCE

DL84 actuators are, for the most part, maintenance free when properly selected and installed. Rebuilding of the actuator should not be necessary under normal operating conditions. For best operation, maintain the ambient temperature within the limits of –40ºf to 180ºF; maintain a clean dry oil-free air supply; maintain the stem free of deposits, dirt, and scratches.

CAUTION! Exceeding the maximum air supply pressure of 30 PSIG will damage the actuator and void the warranty.

A worn or damaged gasket or shaft seal can cause poor response to the air signal, and increase hysteresis, by allowing air pressure to leak from the actuator. A worn or damaged gasket or shaft seal can cause poor operation, increase hysteresis, and shorten the life of the diaphragm, bushing, shaft, and springs by allowing dirt and contaminants inside the actuator. Should the actuator become worn or damaged, parts kits are available. Parts kits contain the most commonly needed repair parts. **Note: the actuator shaft and bushing are not included in the parts kits and must be obtained separately.** Inspect the shaft for damage before disassembling the actuator. If damaged, replace the shaft and bushing. **To ensure getting the correct parts, please provide the valve's serial number.**

PARTS KITS

(Contact factory with valve serial number)

SOFT GOODS KIT FOR DIRECT OR REVERSE ACTING DL84 ACTUATOR WITHOUT HANDWHEEL
KIT P/N K5D084XXXXX00
For Direct Acting Actuator see Assembly Drawing on Page 6 • For Reverse Acting Actuator see Assembly Drawing on Page 8

ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION
5	1	DIAPHRAGM	14	1	SHAFT SEAL
6	18	5/16-18X1 HEX HEAD CAPSCREW	21	3	PRELOAD NUT
8	18	5/16-18 HEX NUT	22	3	5/16-18X3 HEX HEAD CAPSCREW
12	1	GASKET	24	1	TUBE STEM LUBE

INSTRUCTIONS FOR KIT P/N K5D084XXXXX00: See Page 10 for Actuator Removal
For Direct Acting Actuator See: Page 11 & 12 for Actuator Disassembly/Re-assembly
Page 20-21 for Actuator Installation on Valve
For Reverse Acting Actuator See:Page 15 & 17 for Actuator Disassembly/Re-assembly
Page 22-23 for Actuator Installation on Valve

SOFT GOODS KIT FOR DIRECT ACTING DL84 ACTUATOR WITH HANDWHEEL
KIT P/N K5D084XXXXX01
See Assembly Drawings on Page 6 & 7

ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION
5	1	DIAPHRAGM	24	1	TUBE STEM LUBE
6	18	5/16-18X1 HEX HEAD CAPSCREW	26	1	½ -20 SELF LOCKING NUT
8	18	5/16-18 HEX NUT	32	1	POLYPAK SEAL
12	1	GASKET	33	1	THRUST BEARING
14	1	ACTUATOR SHAFT SEAL	35	1	RETAINING RING
21	3	PRELOAD NUT	36	1	HANDWHEEL BONNET GASKET
22	3	5/16-18X3 HEX HEAD CAPSCREW	42	1	TUBE AEROSHELL GREASE 6

INSTRUCTIONS FOR KIT P/N K5D084XXXXX01 SEE: Page 10 for Actuator Removal
Page 12 - 15 for Actuator Disassembly/Re-assembly
Page 20 & 21 for Actuator Installation on Valve

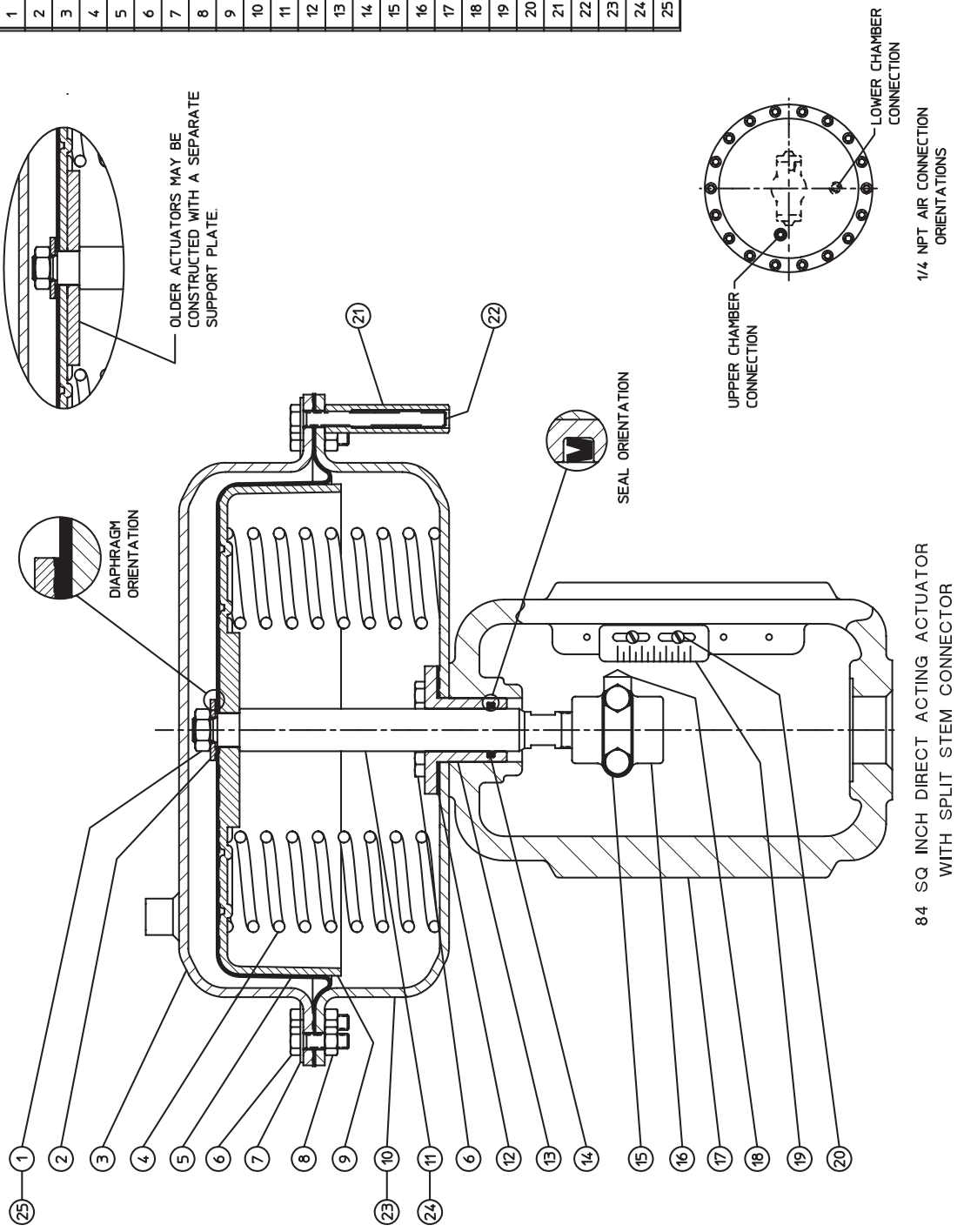
SOFT GOODS KIT FOR REVERSE ACTING DL84 ACTUATOR WITH HANDWHEEL
KIT P/N K5D0 84XXXXX02 AND KIT P/N K5D84NXXXXX01
See Assembly Drawings on Page 8 & 9

ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION
5	1	DIAPHRAGM	24	1	TUBE STEM LUBE
6	18	5/16-18X1 HEX HEAD CAPSCREW	27	1	½ -20 SELF LOCKING NUT
8	18	5/16-18 HEX NUT	37	1	THRUST BEARING
12	1	GASKET	42	1	RETAINING RING
14	1	ACTUATOR SHAFT SEAL	43	1	HANDWHEEL SHAFT SEAL
21	3	PRELOAD NUT	45	1	TUBE AEROSHELL GREASE 6
22	3	5/16-18X3 HEX HEAD CAPSCREW			

Instructions for Kit P/N K5D084XXXX00 and P/N K5D84NXXXX01 See: Page 10 for Actuator Removal
Page 17-20 for Actuator Disassembly/Re-assembly
Page 21-24 for Actuator Installation on Valve

DL84 DIRECT ACTING

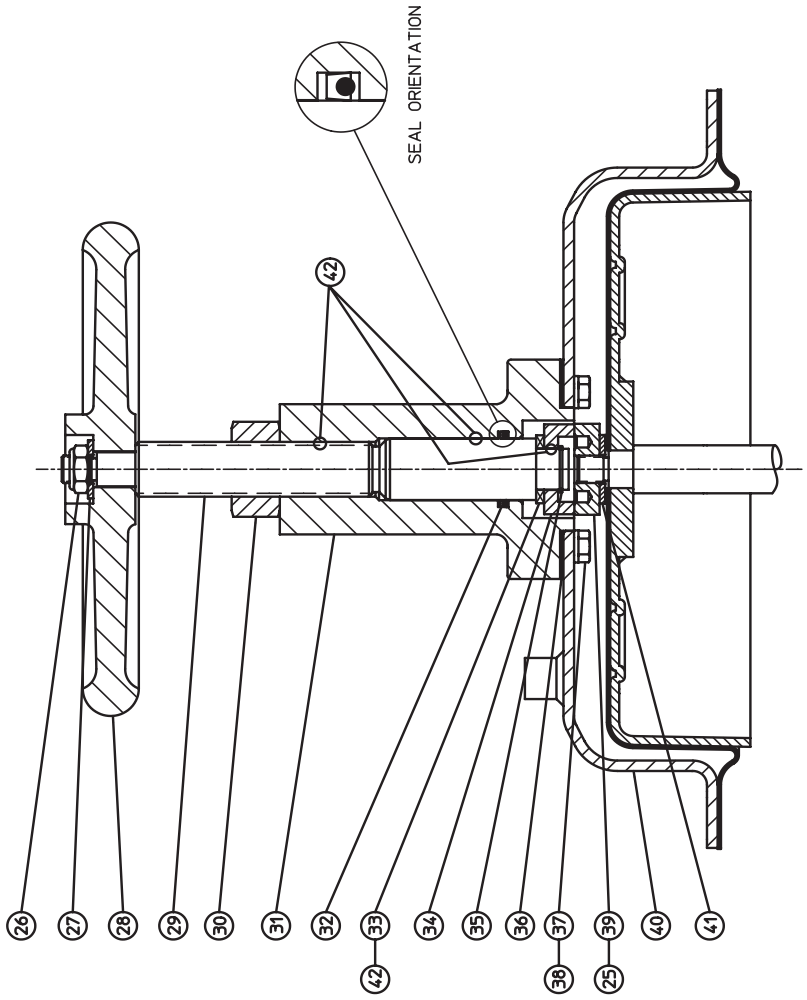
ITEM	DESCRIPTION
1	1/2-20 HEX JAMNUT
2	1/2 FLAT WASHER TYPE B REGULAR
3	UPPER DIAPHRAGM CHAMBER
4	SPRING
5	DIAPHRAGM
6	5/16-18 x 1 HEX HD CAPSCREW
7	5/16 FLAT WASHER TYPE B REGULAR
8	5/16-18 HEX NUT
9	PRESSURE PLATE
10	LOWER DIAPHRAGM CHAMBER
11	SHAFT
12	GASKET
13	BUSHING
14	SHAFT SEAL
15	5/16-18 x 1 1/2 HEX HD CAPSCREW
16	SPLIT STEM CONNECTOR
17	YOKE
18	TRAVEL INDICATOR POINTER
19	TRAVEL SCALE
20	#6 x 1/4 SELF TAPPING SCREWS
21	PRELOAD NUT
22	5/16-18 x 3 FULL THD HEX HD CAPSCREW
23	1/4 NPT VENT PLUG
24	STEM LUBE
25	LOCTITE 272



2600 Emrick Blvd • Bethlehem, PA 18020 • USA •800-922-0085 • www.warrencontrols.com

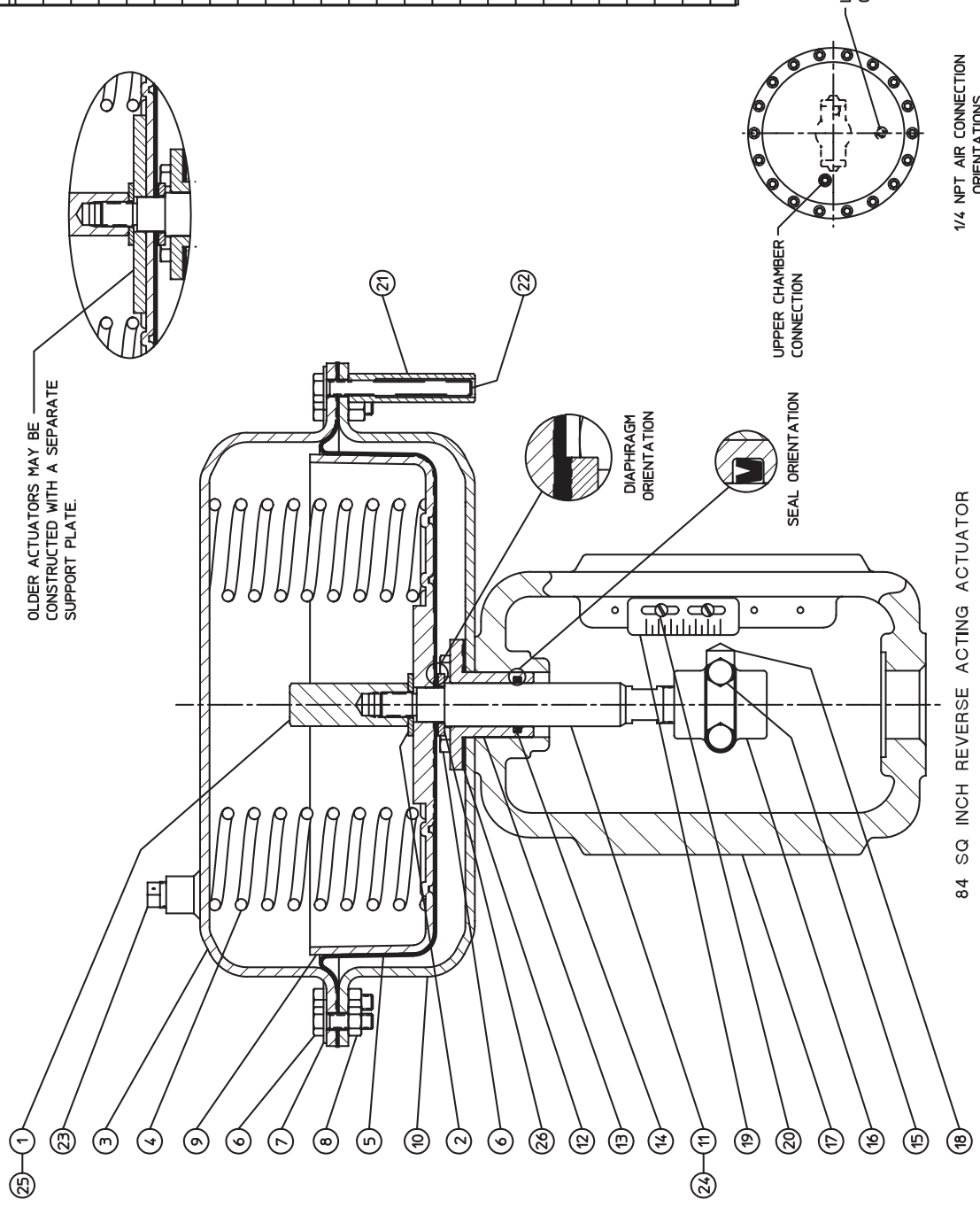
DIRECT ACTING HANDWHEEL

ITEM	DESCRIPTION
25	LOCTITE 272
26	1/2-20 SELF LOCKING NUT
27	FLAT WASHER
28	Ø8 HANDWHEEL
29	HANDWHEEL SHAFT
30	1-8 HEX NUT
31	HANDWHEEL BONNET
32	POLYPAK SEAL
33	ROLLER THRUST BEARING
34	HANDWHEEL PRESSURE PLATE
35	RETAINING RING
36	GASKET
37	5/16-18 x 3/4 HEX HD CAPSCREW
38	5/16 REGULAR LOCKWASHER
39	DIAPHRAGM RETAINER
40	UPPER DIAPHRAGM CHAMBER
41	DIAPHRAGM WASHER
42	AEROSHELL GREASE 6



DL84 REVERSE ACTING

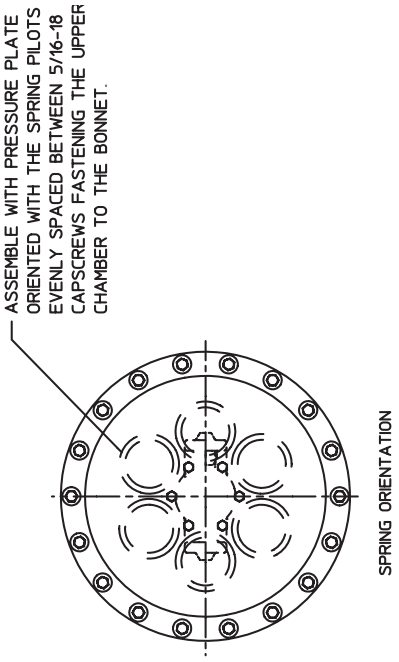
ITEM	DESCRIPTION
1	TRAVEL STOP
2	1/2 FLAT WASHER TYPE B REGULAR
3	UPPER DIAPHRAGM CHAMBER
4	SPRING
5	DIAPHRAGM
6	5/16-18 x 1 HEX HD CAPSCREW
7	5/16 FLAT WASHER TYPE B REGULAR
8	5/16-18 HEX NUT
9	PRESSURE PLATE
10	LOWER DIAPHRAGM CHAMBER
11	SHAFT
12	GASKET
13	BUSHING
14	SHAFT SEAL
15	5/16-18 x 1 1/2 HEX HD CAPSCREW
16	SPLIT STEM CONNECTOR
17	YOKE
18	TRAVEL INDICATOR POINTER
19	TRAVEL SCALE
20	#6 x 1/4 SELF TAPPING SCREWS
21	PRELOAD NUT
22	5/16-18 x 3 FULL THD HEX HD CAPSCREW
23	1/4 NPT VENT PLUG
24	STEM LUBE
25	LOCTITE 272
26	LOWER WASHER

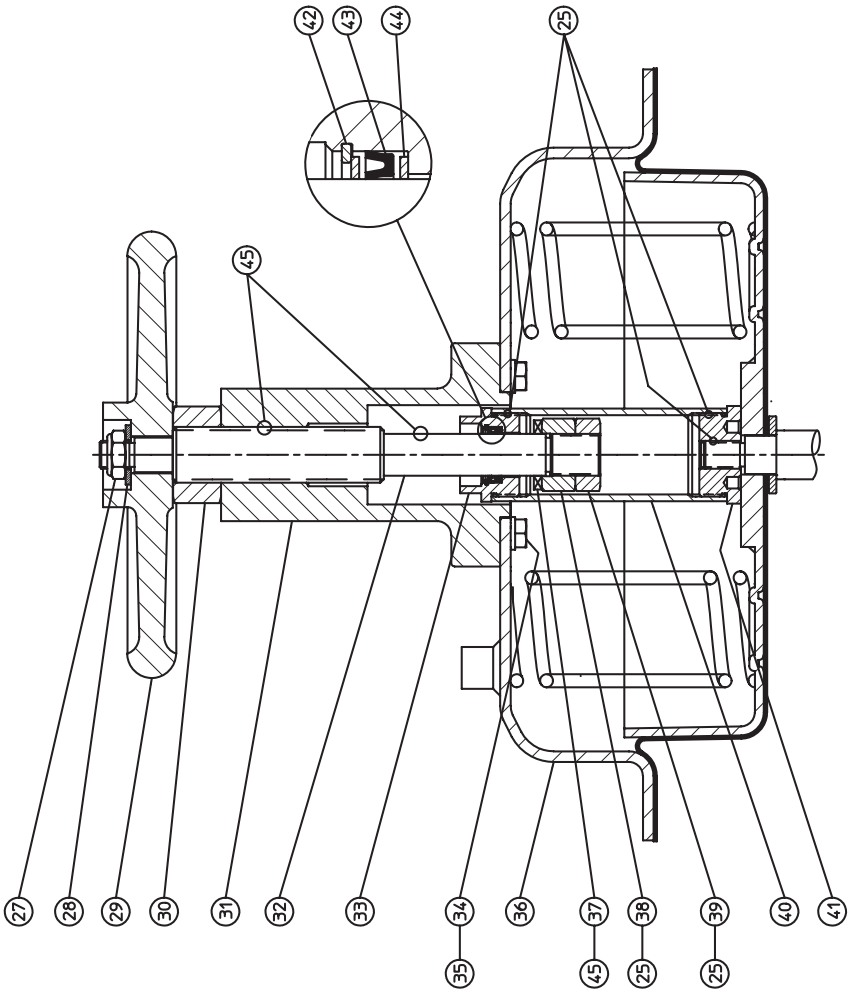


2600 Emrick Blvd • Bethlehem, PA 18020 • USA •800-922-0085 • www.warrencontrols.com

REVERSE ACTING HANDWHEEL

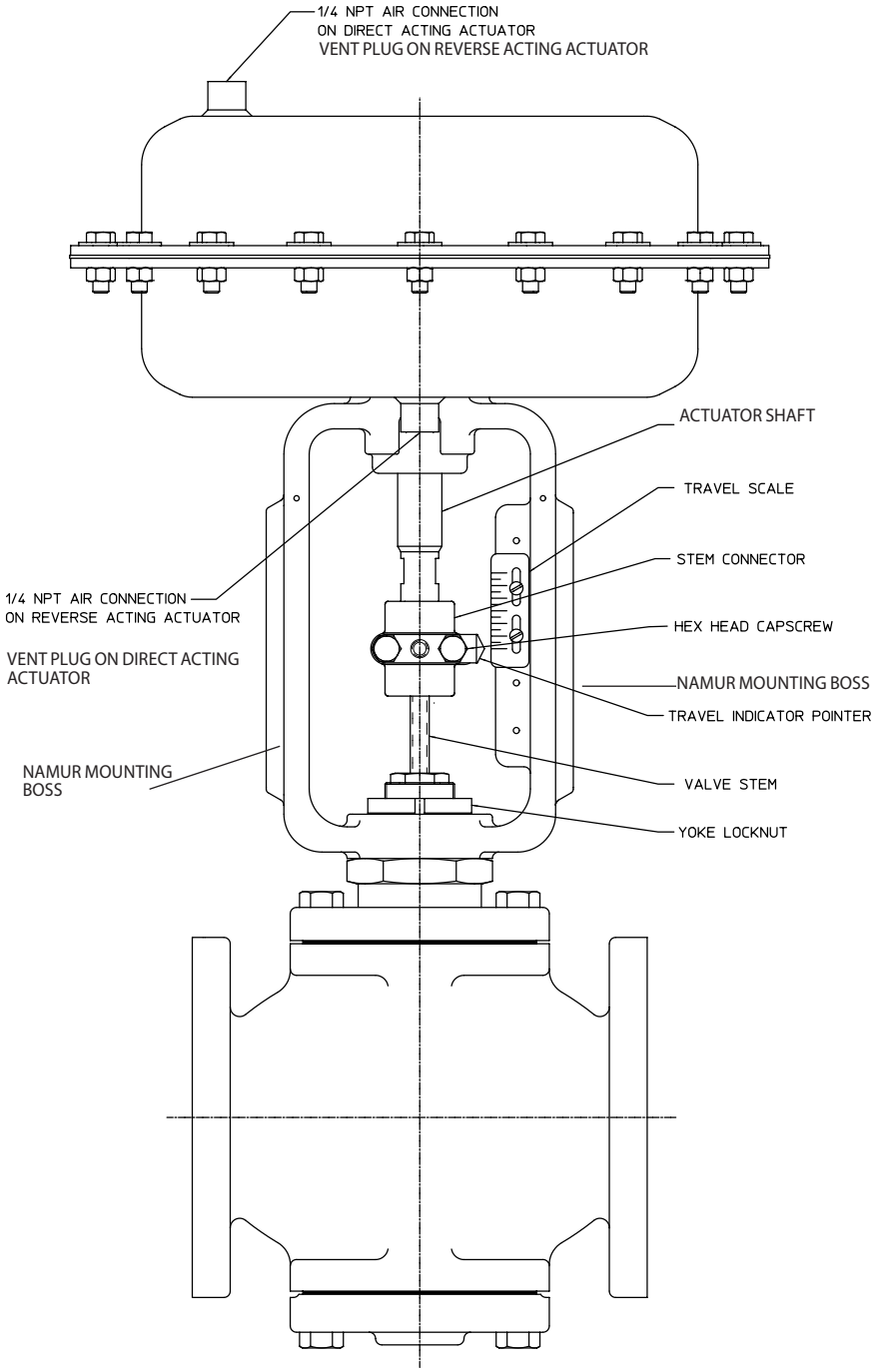
ITEM	DESCRIPTION
25	LOCTITE 272
27	1/2-20 SELF LOCKING NUT
28	FLAT WASHER
29	Ø8 INCH HANDWHEEL
30	1-8 HEX NUT
31	HANDWHEEL BONNET
32	HANDWHEEL SHAFT
33	UPPER CAGE BUSHING
34	5/16-18 x 3/4 LG HEX HD CAPSCREW
35	5/16 REGULAR LOCKWASHER
36	UPPER DIAPHRAGM CHAMBER
37	ROLLER THRUST BEARING
38	3/4-16 RECESSED JAMNUT
39	3/4-16 PRECISION JAMNUT
40	CAGE
41	LOWER CAGE BUSHING
42	RETAINING RING
43	SHAFT SEAL
44	SEAL WASHER
45	AEROSHELL GREASE 6





CHANGING THE ACTUATOR ORIENTATION

Looking down on the valve stem, the actuator can be rotated 360º to change its orientation with respect to the centerline of the valve. Changing the actuator's orientation changes the position of the travel scale, air connections, and accessories and may be necessary for clearance and accessibility in the piping.



1) Isolate valve body if already installed in piping.

2) Temporarily install a flexible air hose directly to the actuator air connection so the actuator may be turned freely.

3) Apply air pressure to actuator so plug is off seat(s) or travel stop in valve. The valve stem should never be turned while the plug is in contact with the seat otherwise the seating surfaces will be damaged.

4) Use a blunt chisel and hammer to loosen yoke locknut.

5) Rotate actuator to desired orientation. Rotating the actuator shaft will damage the diaphragm, can cause springs to fall over and voids the warranty.

6) Tighten yoke locknut securely. Use a blunt chisel and hammer for final tightening.

7) Restore fixed air connection to the actuator air connection.

8) If isolated, return line pressure to valve and check operation.

ACTUATOR REMOVAL

DL84 ACTUATOR REMOVAL FROM A VALVE

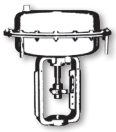
1) Isolate valve body if already installed in piping.

2) Apply signal to actuator so plug is off seat(s) or travel stop in valve.

3) Remove the hex head capscrews holding the two halves of the split stem connector together, then remove the travel indicator pointer and split stem connector.

4) Remove yoke locknut from valve body assembly.

5) Remove actuator from valve



Disassembly Direct Acting DL84 Actuator Without Handwheel

SEE DRAWING PAGE 6

1) Remove actuator from valve. See separate actuator removal instructions on page 10.

2) Mark edge of both diaphragm chambers to aid in orienting the chambers to each other and the yoke during reassembly.

3) Alternately loosen then remove the 5/16-18 hex nuts **(Item 8)**, the 5/16-18 x 1 hex head capscrews **(Item 6)**, and washers **(Item 7)** along the circumference of the diaphragm chambers. Replace with **new** hex nuts and **new** hex head capscrews during reassembly.

4) If the actuator uses the three (3) preload nuts **(Item 21)** there is significant preload on the springs. Alternately loosen the preload nuts approximately ¼ inch. The upper diaphragm chamber **(Item 3)** and diaphragm **(Item 5)** should separate from the lower diaphragm chamber **(Item 10)**. If the upper diaphragm chamber and diaphragm do not separate from the lower diaphragm chamber, pry them apart. Be careful not to damage the diaphragm sealing surfaces on the diaphragm chambers. After the diaphragm chambers are separated, alternately loosen the preload nuts in small increments, approximately ¼ inch at a time, then remove the preload nuts, the three (3) 5/16-18 x 3 hex head capscrews **(Item 22)**, and washers **(Item 7)**. Replace with **new** preload nuts and **new** hex head capscrews.

5) Remove the upper diaphragm chamber **(Item 3)**.

6) Remove the shaft **(Item 11)**, pressure plate **(Item 9)**, diaphragm **(Item 5)**, ½ flat washer **(Item 2)**, and ½ - 20 hex jamnut **(Item 1)**, as an assembly from the lower diaphragm chamber **(Item 10)** and yoke **(Item 17)** assembly of the actuator.

7) Remove the springs **(Item 4)** from the actuator.

8) Remove the ½ - 20 hex jamnut and ½ flat washer from the shaft. Use flats provided on shaft to hold it from turning. The remainder of the shaft is a close tolerance fine finish bearing and sealing surface.

9) Remove diaphragm, and pressure plate from the shaft. Some actuators have a separate support plate under the pressure plate. If a support plate is present remove it from the shaft. Clean bearing and sealing surfaces on shaft. Inspect diaphragm and shaft, if damaged or worn replace with **new** diaphragm and shaft during reassembly.

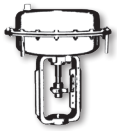
10) Remove the 5/16-18 x1 hex head capscrews **(Item 6)** from bushing **(Item 13)** and yoke.

11) Remove bushing and shaft seal **(Item 14)** from lower diaphragm chamber as an assembly.

12) Remove lower diaphragm chamber from yoke.

13) Remove gasket **(Item 12)** from lower diaphragm chamber. Clean gasket surfaces on bushing and lower diaphragm chamber. Replace with **new** gasket during reassembly.

14) Remove shaft seal from bushing. Replace with **new** shaft seal. Clean bushing bearing and sealing surfaces. Inspect bushing, if damaged or worn replace with **new** bushing during reassembly.



ASSEMBLY DIRECT ACTING DL84 ACTUATOR WITHOUT HANDWHEEL

SEE DRAWING PAGE 6

1) Apply light coat of stem lube DC111 **(Item 24)** to **new** shaft seal **(Item 14)**. Install shaft seal in bushing **(Item 13)**. Watch orientation.

2) Place the lower diaphragm chamber **(Item 10)** on the yoke **(Item 17)** in the orientation shown on the drawing. Refer to drawing on page 6. Line up the holes in the base of the diaphragm chamber with the mounting holes in the yoke.

3) Install **new** gasket **(Item 12)** in lower diaphragm chamber. Line up holes in gasket with holes in base of lower diaphragm chamber.

4) Install bushing and shaft seal as an assembly in lower diaphragm chamber. Line up holes in bushing with holes in gasket.

5) Install four (4) 5/16-18 x 1 hex head capscrews **(Item 6)** through the bushing, gasket, and lower diaphragm chamber into the yoke, then gradually tighten the capscrews to 30ft-lbs in 5ft - lb increments in a criss cross pattern. At no point should a portion of the gasket bolt hole be squeezed past the bushing flange OD.

6) If the actuator has a separate support plate install it on the shaft.

7) Install the pressure plate **(Item 9)** on the shaft.

8) Install the diaphragm **(Item 5)** on the shaft in the orientation shown on the drawing. Refer to drawing on page 6. Fabric side of diaphragm assembled against pressure plate. Raised diameter in center of diaphragm assembled against ½ flat washer **(Item 2)**.

9) Install the ½ flat washer **(Item 2)** on the shaft. The side of the washer having the rounded edge must be facing the diaphragm.

10) Apply Loctite 272 **(Item 25)** to the threads on the shaft. Do not get Loctite 272 on the diaphragm or seals.

Assembly Direct Acting DL84 Actuator Without Handwheel CONT.

11) Center the 1/2 flat washer on the shaft. Center the raised diameter of the diaphragm on the 1/2 flat washer. Install the ½ - 20 hex jamnut **(Item 1)** on the shaft and tighten it to 35 ft-lbs torque. Use flats provided on shaft to hold it from turning. The remainder of the shaft is a close tolerance fine finish bearing and sealing surface. The 1/2 flat washer must remain centered on the shaft. The raised diameter of the diaphragm must remain centered on the washer.

12) Mask threads on shaft with paper or tape to protect shaft seal when reinserting shaft.

13) Invert the upper diaphragm chamber **(Item 3)** and place on flat surface.

14) Invert the shaft, diaphragm, pressure plate, support plate, ½ flat washer, and ½-20 hex jamnut as an assembly and install in the upper diaphragm chamber. The flats on the shaft must be oriented so they can be accessed with a wrench when the actuator is fully assembled. Flats should be in same relation to air connection in upper chamber as before the actuator was disassembled. Refer to drawing on page 6.

15) Line up the holes in the diaphragm with the holes in the upper diaphragm chamber.

16) Apply stem lube DC111 **(Item 24**) to the shaft.

17) Install the springs **(Item 4)** centered over the raised spring pilots on the pressure plate. Refer to drawing on page 6.

18) Install the lower diaphragm chamber and yoke as an assembly on the springs in the orientation shown on the drawing. Refer to drawing on page 6. Line up the marks made on the diaphragm chambers in Step 2 of the disassembly instructions. Center the shaft in the bushing. Line up the holes in the lower diaphragm chamber with the holes in the upper diaphragm chamber. Be careful not to change the orientation of the springs. The lower diaphragm chamber should not be moved sideways or rotated while resting on the springs. If the chamber must be moved to align it with the upper chamber holes, lift it up, align, then lower straight down. Springs installed tilted will eventually fall over in operation.

19) If the actuator uses three (3) 5/16-18 x 3 hex head capscrews **(Item 22)** place a washer **(Item 7)** on each of three (3) **new** 5/16-18 x 3 hex head capscrews, if not go to Step 22. The function of the washer is to protect the paint on chamber from the rotating tool used to tighten the chamber fasteners. The capscrews may point up or down. The washer shall be on the same side of the joint as the fastener that rotates relative to the chamber during assembly.

20) Insert the three (3) **new** 5/16-18 x 3 hex head capscrews through the holes along the circumference of the upper diaphragm chamber, so the capscrews are equally spaced 5 holes apart, and through the holes in the diaphragm and lower diaphragm chamber.

21) Install three (3) **new** preload nuts **(Item 21)** on the three (3) 5/16-18 x 3 hex head capscrews. Tighten the capscrews alternately in increments not exceeding ¼ inch until the upper and lower diaphragm chambers are approximately 1/16 inch apart. Be careful not to change the orientation of the springs. Not keeping the upper and lower chambers parallel while loading the springs will result in the shaft being pulled off center, the shaft binding in the bushing, premature wear, or springs fall over.

22) Place washers **(Item 7)** on **new** 5/16-18 x 1 hex head capscrews **(Item 6)**. The function of the washer is to protect the paint on chamber from the rotating tool used to tighten the chamber fasteners. The capscrews may point up or down. The washer shall be on the same side of the joint as the fastener that rotates relative to the chamber during assembly.

23) Install the **new** 5/16-18 x 1 hex head capscrews through the holes along the circumference of the upper diaphragm chamber and through the holes in the diaphragm and lower diaphragm chamber. Be careful not to change the orientation of the springs.

24) Install **new** 5/16-18 hex nuts **(Item 8)** on the 5/16-18 x 1 hex head capscrews. Tighten, in an alternating pattern, all capscrews along the circumference of the upper diaphragm chamber to 200 in-lbs torque.

25) Remove masking from shaft.

26) Apply air pressure to verify actuator strokes smoothly and check for air leaks.

27) Install actuator on valve. See instructions on page 20 or 21.

DISASSEMBLY OF DIRECT ACTING DL84 ACTUATOR WITH HANDWHEEL

SEE DRAWING PAGE 6 & 7

1) Remove actuator from valve. See separate actuator removal instructions on page 10.

2) Mark edge of both diaphragm chambers to aid in orienting the chambers to each other and the yoke during reassembly.

3) Loosen 1-8 hex nut **(Item 30**).

4) Operate handwheel **(Item 28**) until actuator shaft **(Item 11**) is fully retracted.

5) Alternately loosen then remove the 5/16-18 hex nuts **(Item 8)**, the 5/16-18 x 1 hex head capscrews **(Item 6)**, and washers **(Item 7)** along the circumference of the diaphragm chambers. Replace with **new** hex nuts and **new** hex head capscrews during reassembly.

6) If the actuator uses the three (3) preload nuts **(Item 21)** there is significant preload on the springs. Alternately loosen the preload nuts approximately ¼ inch. The upper diaphragm chamber **(Item 3)** and diaphragm **(Item 5)** should separate from the lower diaphragm chamber **(Item 10)**. If the upper diaphragm chamber and diaphragm do not separate from the lower diaphragm chamber, pry them apart. Be careful not to damage the diaphragm sealing surfaces on the diaphragm chambers. After the diaphragm chambers are separated, alternately loosen the preload nuts in small increments, approximately ¼ inch at a time, then remove the preload nuts, the three (3) 5/16-18 x 3 hex head capscrews **(Item 22)**, and washers **(Item 7)**. Replace with **new** preload nuts and **new** hex head capscrews.

7) Remove the upper diaphragm chamber **(Item 40)** and handwheel as an assembly.

8) Remove the actuator shaft **(Item 11)**, pressure plate **(Item 9)**, diaphragm **(Item 5)**, diaphragm washer **(Item 41)**, and diaphragm retainer **(Item 39)**, as an assembly from the lower diaphragm chamber **(Item 10)** and yoke **(Item 17)** assembly of the actuator.

9) Remove the springs **(Item 4)** from the actuator.

10) Remove the diaphragm retainer and diaphragm washer from the actuator shaft. Use flats provided on shaft to hold it from turning. The remainder of the shaft is a close tolerance fine finish bearing and sealing surface.

11) Remove diaphragm and pressure plate from the actuator shaft. Clean bearing and sealing surfaces on shaft. Inspect diaphragm and shaft, if damaged or worn replace with **new** diaphragm and shaft during reassembly.

12) Remove 5/16-18 x 3/4 hex head capscrews **(Item 37)** and lockwashers **(Item 38)** from handwheel bonnet **(Item 31)**.

13) Remove upper diaphragm chamber **(Item 40)** from handwheel bonnet.

14) Remove handwheel bonnet gasket **(Item 36)** from handwheel bonnet. Clean gasket surfaces on handwheel bonnet and upper diaphragm chamber. Replace with **new** gasket during reassembly.

15) Remove ½ -20 self locking nut **(Item 26)** from handwheel shaft **(Item 29)**. Replace with **new** ½ -20 self locking nut during reassembly.

16) Remove washer **(Item 27)** from handwheel shaft.

17) Remove handwheel **(Item 28)** from handwheel shaft.

18) Remove 1-8 hex nut **(Item 30)** from handwheel shaft.

19) Thread handwheel shaft out of bottom of handwheel bonnet.

20) Remove polypak seal **(Item 32)** from handwheel bonnet. Replace with **new** polypak seal during reassembly. Clean sealing and bearing surfaces in handwheel bonnet.

21) Remove retaining ring **(Item 35)** from handwheel shaft. Inspect retaining ring, if worn or damaged replace with **new** retaining ring during reassembly.

22) Remove handwheel pressure plate **(Item 34)** from handwheel shaft.

23) Remove roller thrust bearing **(Item 33)** from handwheel shaft. Clean sealing and bearing surfaces on handwheel shaft. Inspect roller thrust bearing and handwheel shaft, if worn or damaged replace with **new** roller thrust bearing and handwheel shaft during reassembly.

24) Remove the 5/16-18 x1 hex head capscrews **(Item 6)** from bushing **(Item 13)** and yoke.

25) Remove bushing and shaft seal **(Item 14)** from lower diaphragm chamber as an assembly.

26) Remove lower diaphragm chamber from yoke.

27) Remove gasket **(Item 12)** from lower diaphragm chamber. Clean gasket surfaces on bushing and lower diaphragm chamber. Replace with **new** gasket during reassembly.

28) Remove shaft seal from bushing. Replace with **new** shaft seal during reassembly. Clean bushing bearing and sealing surfaces. Inspect bushing, if damaged or worn replace with **new** bushing during reassembly.

ASSEMBLY OF DIRECT ACTING DL84 ACTUATOR WITH HANDWHEEL

SEE DRAWING PAGE 6 & 7

1) Apply light coat of stem lube DC111 **(Item 24)** to **new** shaft seal **(Item 14)**. Install shaft seal in bushing (Item 13). Watch orientation.

2) Place the lower diaphragm chamber **(Item 10)** on the yoke **(Item 17)** in the orientation shown on the drawing. Line up the holes in the base of the diaphragm chamber with the mounting holes in the yoke.

3) Install **new** gasket **(Item 12)** in lower diaphragm chamber. Line up holes in gasket with holes in base of lower diaphragm chamber.

4) Install bushing and shaft seal as an assembly in lower diaphragm chamber. Line up holes in bushing with holes in gasket.

Assembly of Direct Acting DL84 Actuator with Handwheel cont.

5) Install four (4) 5/16-18 x 1 hex head capscrews **(Item 6)** through the bushing, gasket, and lower diaphragm chamber into the yoke, then gradually tighten the capscrews to 30ft-lbs in 5ft - lb increments in a criss cross pattern. At no point should a portion of the gasket bolt hole be squeezed past the bushing flange OD.

6) Apply light coat of Aeroshell Grease 6 **(Item 42)** to sealing and bearing surfaces of handwheel shaft **(Item 29)**.

7) Apply light coat of Aeroshell Grease 6 to roller thrust bearing **(Item 33)**. Install roller thrust bearing on handwheel shaft,keeping roller assembly sandwiched in between the two races.

8) Install handwheel pressure plate **(Item 34)** on handwheel shaft.

9) Install retaining ring **(Item 35)** on handwheel shaft.

10) Install **new** polypak seal **(Item 32)** in handwheel bonnet **(Item 31)**. Orient seal with o-ring facing toward chamber mounted end of bonnet.

11) Insert handwheel shaft into bottom of handwheel bonnet. Thead shaft into handwheel bonnet until fully extended through top of bonnet.

12) Install 1-8 hex nut **(Item 30)** on handwheel shaft and tighten to 70 ft-lbs torque.

13) Install handwheel **(Item 28)** on handwheel shaft.

14) Install washer **(Item 27)** on handwheel shaft.

15) Install **new** ½ -20 self locking nut **(Item 26)** on handwheel shaft and tighten to 40 ft-lbs torque.

16) Install handwheel bonnet gasket **(Item 36)** on handwheel bonnet.

17) Install upper diaphragm chamber **(Item 40)** on handwheel bonnet.

18) Install lockwashers **(Item 38)** on 5/16-18 x 3/4 hex head capscrews **(Item 37) .**

19) Install the 5/16-18 x 3/4 hex head capscrews with lockwashers in handwheel bonnet. Tighten capscrews to 88 in-lbs torque to secure upper diaphragm chamber to handwheel bonnet.

20) Install the pressure plate **(Item 9)** on the actuator shaft.

21) Install the diaphragm **(Item 5)** on the shaft in the orientation shown on the drawing. Refer to drawing on page 6. Fabric side of diaphragm assembled against pressure plate. Raised diameter in center of diaphragm assembled against diaphragm washer **(Item 41)**.

22) Install the diaphragm washer **(Item 41)** on the shaft. The side of the washer having the rounded edge must be facing the diaphragm.

23) Apply Loctite 272 **(Item 25)** to the threads on the shaft. Do not get Loctite 272 on the diaphragm or seals.

24) Center the diaphragm washer on the shaft. Center the raised diameter of the diaphragm on the diaphragm washer.Install the diaphragm retainer **(Item 39)** on the shaft and tighten it to 35 ft-lbs torque. A four-pin spanner wrench is required to torque the retainer. A drawing of the spanner wrench is available by contacting Warren Controls Sales Dept. (ask for drawing B6038401). The diaphragm washer must remain centered on the shaft. The raised diameter of the diaphragm must remain centered on the diaphragm washer.

25) Mask threads on shaft with paper or tape to protect shaft seal when reinserting shaft.

26) Invert the upper diaphragm chamber **(Item 40)** and place on flat surface.

27) Invert the shaft, diaphragm, pressure plate, diaphragm washer, and diaphragm retainer as an assembly and install in the upper diaphragm chamber. The flats on the shaft must be oriented so they can be accessed with a wrench when the actuator is fully assembled. Flats should be in same relation to air connection in upper chamber as before the actuator was disassembled. Refer to drawing on page 6.

28) Line up the holes in the diaphragm with the holes in the upper diaphragm chamber.

29) Apply stem lube DC111 **(Item 24)** to the shaft.

30) Install the springs **(Item 4)** centered over the raised spring pilots on the pressure plate. Refer to drawing on page 6.

31) Install the lower diaphragm chamber and yoke as an assembly on the springs in the orientation shown on the drawing. Refer to drawing on page 6. Line up the marks made on the diaphragm chambers in Step 2 of the disassembly instructions. Center the shaft in the bushing. Line up the holes in the lower diaphragm chamber with the holes in the upper diaphragm chamber. Be careful not to change the orientation of the springs. The lower diaphragm chamber should not be moved sideways or rotated while resting on the springs. If the chamber must be moved to align it with the upper chamber holes, lift it up, align, then lower straight down. Springs installed tilted will eventually fall over in operation.

32) If the actuator uses three (3) 5/16-18 x 3 hex head capscrews **(Item 22)** place a washer **(Item 7)** on each of three (3) **new** 5/16-18 x 3 hex head capscrews, if not go to Step 36. The function of the washer is to protect the paint on chamber from the rotating tool used to tighten the chamber fasteners. The capscrews may point up or down. The washer shall be on

the same side of the joint as the fastener that rotates relative to the chamber during assembly.

33) Insert the three (3) **new** 5/16-18 x 3 hex head capscrews through the holes along the circumference of the upper diaphragm chamber, so the capscrews are equally spaced 5 holes apart, and through the holes in the diaphragm and lower diaphragm chamber.

34) Install three (3) **new** preload nuts **(Item 21)** on the three (3) 5/16-18 x 3 hex head capscrews. Tighten the capscrews alternately in increments not exceeding ¼ inch until the upper and lower diaphragm chambers are approximately 1/16 inch apart. Be careful not to change the orientation of the springs. Not keeping the upper and lower chambers parallel while loading the springs will result in the shaft being pulled off center, the shaft binding in the bushing, and premature wear.

35) Place washers **(Item 7)** on **new** 5/16-18 x 1 hex head capscrews (Item 6). The function of the washer is to protect the paint on chamber from the rotating tool used to tighten the chamber fasteners. The capscrews may point up or down. The washer shall be on the same side of the joint as the fastener that rotates relative to the chamber during assembly.

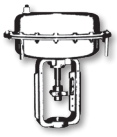
36) Install the **new** 5/16-18 x 1 hex head capscrews through the holes along the circumference of the upper diaphragm chamber and through the holes in the diaphragm and lower diaphragm chamber. Be careful not to change the orientation of the springs.

37) Install **new** 5/16-18 hex nuts **(Item 8)** on the 5/16-18 x 1 hex head capscrews. Tighten all capscrews along the circumference of the upper diaphragm chamber to 200 in-lbs torque.

38) Remove masking from shaft.

39) Apply air pressure to verify actuator strokes smoothly and check for air leaks.

40) Install actuator on valve. See instructions on page 20 or 21.



DISASSEMBLY REVERSE ACTING DL84 ACTUATOR WITHOUT HANDWHEEL

SEE DRAWING PAGE 8

1) Remove actuator from valve. See separate actuator removal instructions on page 10.

2) Mark edge of both diaphragm chambers to aid in orienting the chambers to each other and the yoke during reassembly.

3) Alternately loosen then remove the 5/16-18 hex nuts **(Item 8)**, the 5/16-18 x 1 hex head capscrews **(Item 6)**, and washers **(Item 7)** along the circumference of the diaphragm chambers. Replace with **new** hex nuts and **new** hex head capscrews during reassembly.

4) If the actuator uses the three (3) preload nuts **(Item 21)** there is significant preload on the springs. Alternately loosen the preload nuts approximately ¼ inch. The upper diaphragm chamber **(Item 3)** should separate from the lower diaphragm chamber **(Item 10)** and diaphragm **(Item 5)**. If the upper diaphragm chamber does not separate from the lower diaphragm chamber and diaphragm, pry them apart. Be careful not to damage the diaphragm sealing surfaces on the diaphragm chambers. After the diaphragm chambers are separated, alternately loosen the preload nuts in small increments, approximately ¼ inch at a time, then remove the preload nuts, the three (3) 5/16-18 x 3 hex head capscrews **(Item 22)**, and washers **(Item 7)**. Replace with **new** preload nuts and **new** hex head capscrews.

5) Remove the upper diaphragm chamber **(Item 3)**.

6) Remove the springs **(Item 4)** from the actuator.

7) Remove the travel stop **(Item 1)**, pressure plate **(Item 9)**, diaphragm **(Item 5)**, ½ flat washer **(Item 2)**, lower washer **(Item 26)**, and shaft **(Item 11)** as an assembly from the lower diaphragm chamber **(Item 10)** and yoke **(Item 17)** assembly of the actuator.

8) Remove the travel stop and ½ flat washer from the shaft. Use flats provided on shaft to hold it from turning. The remainder of the shaft is a close tolerance fine finish bearing and sealing surface.

9) Some actuators have a separate support plate above the pressure plate. If a support plate is present remove it from the shaft.

10) Remove pressure plate, diaphragm, and lower washer from the shaft. Clean bearing and sealing surfaces on shaft. Inspect diaphragm and shaft, if damaged or worn replace with **new** diaphragm and shaft during reassembly.

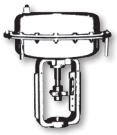
11) Remove the 5/16-18 x1 hex head capscrews **(Item 6)** from bushing **(Item 13)**.

12) Remove bushing and shaft seal **(Item 14)** from lower diaphragm chamber as an assembly.

13) Remove lower diaphragm chamber from yoke.

14) Remove gasket **(Item 12)** from lower diaphragm chamber. Clean gasket surfaces on bushing and lower diaphragm chamber. Replace with **new** gasket during reassembly.

15) Remove shaft seal from bushing. Replace with **new** shaft seal. Clean bushing bearing and sealing surfaces. Inspect bushing, if damaged or worn replace with **new** bushing during reassembly.



ASSEMBLY REVERSE ACTING DL84 ACTUATOR WITHOUT HANDWHEEL

SEE DRAWING PAGE 8

1) Apply light coat of stem lube DC111 **(Item 24)** to **new** shaft seal **(Item 14)**. Install shaft seal in bushing **(Item 13)**. Watch orientation.

2) Place the lower diaphragm chamber **(Item 10)** on the yoke **(Item 17)** in the orientation shown on the drawing. Line up the holes in the base of the diaphragm chamber with the mounting holes in the yoke.

3) Install **new** gasket **(Item 12)** in lower diaphragm chamber. Line up holes in gasket with holes in base of lower diaphragm chamber.

4) Install bushing and shaft seal as an assembly in lower diaphragm chamber. Line up holes in bushing with holes in gasket.

5) Install four (4) 5/16-18 x 1 hex head capscrews **(Item 6)** through the bushing, gasket, and lower diaphragm chamber into the yoke, then gradually tighten the capscrews to 30ft-lbs in 5ft - lb increments in a criss cross pattern. At no point should a portion of the gasket bolt hole be squeezed past the bushing flange OD.

6) Install the lower washer **(Item 26)** on the shaft **(Item 11)**. The side of the washer having the rounded edge must be facing the diaphragm.

7) Install the diaphragm **(Item 5)** on the shaft in the orientation shown on the drawing. Refer to drawing on page 8. Fabric side of diaphragm assembled against pressure plate. Raised diameter in center of diaphragm assembled against lower washer **(Item 26)**. The side of the washer having the rounded edge must be facing the diaphragm.

8) Install the pressure plate **(Item 9)** on the shaft.

9) If the actuator has a separate support plate install it on the shaft.

10) Install the ½ flat washer **(Item 2)** on the shaft.

11) Apply Loctite 272 **(Item 25)** to the threads on the shaft. Do not get Loctite 272 on the diaphragm or seals.

12) Center the lower washer on the shaft. Center the raised diameter of the diaphragm on the lower washer. Install the travel stop **(Item 1)** on the shaft and tighten it to 35 ft-lbs torque. Use flats provided on shaft to hold it from turning. The remainder of the shaft is a close tolerance fine finish bearing and sealing surface. The lower washer must remain centered on the shaft. The raised diameter of the diaphragm must remain centered on the lower washer.

13) Mask thread on shaft with paper or tape to protect shaft seal when reinserting shaft.

14) Apply stem lube DC111 to the shaft.

15) Install the shaft, diaphragm, pressure plate, ½ flat washer, and travel stop as an assembly in the lower diaphragm chamber. Center the shaft in the bushing. The flats on the shaft must be oriented so they can be accessed with a wrench when the actuator is fully assembled. Flats should be in same relation to air connection in lower chamber as before the actuator was disassembled. Refer to drawing on page 8.

16) Line up the holes in the diaphragm with the holes in the lower diaphragm chamber.

17) Install the springs **(Item 4)** centered over the raised spring pilots on the pressure plate. Refer to drawing on page 8.

18) Install the upper diaphragm chamber on the springs in the orientation shown on the drawing. Refer to drawing on page 8. Line up the marks made on the diaphragm chambers in Step 2 of the disassembly instructions. Line up the holes in the upper diaphragm chamber with the holes in the lower diaphragm chamber. Be careful not to change the orientation of the springs. The upper diaphragm chamber should not be moved sideways or rotated while resting on the springs. If the chamber must be moved to align it with the lower chamber holes, lift it up, align, then lower straight down. Springs installed tilted will eventually fall over in operation.

19) If the actuator uses three (3) 5/16-18 x 3 hex head capscrews **(Item 22)** place a washer **(Item 7)** on each of three (3) **new** 5/16-18 x 3 hex head capscrews, if not go to Step 22. The function of the washer is to protect the paint on chamber from the rotating tool used to tighten the chamber fasteners. The capscrews may point up or down. The washer shall be on the same side of the joint as the fastener that rotates relative to the chamber during assembly.

20) Insert the three (3) **new** 5/16-18 x 3 hex head capscrews through the holes along the circumference of the upper diaphragm chamber, so the capscrews are equally spaced 5 holes apart, and through the holes in the diaphragm and lower diaphragm chamber.

21) Install three (3) **new** preload nuts **(Item 21)** on the three (3) 5/16-18 x 3 hex head capscrews. Tighten the capscrews alternately in increments not exceeding ¼ inch until the upper and lower diaphragm chambers are approximately 1/16 inch apart. Be careful not to change the orientation of the springs. Not keeping the upper and lower chambers parallel while loading the springs will result in the shaft being pulled off center, the shaft binding in the bushing, and premature wear.

22) Place washers **(Item 7**) on **new** 5/16-18 x 1 hex head capscrews **(Item 6)**. The function of the washer is to protect the paint on chamber from the rotating tool used to tighten the chamber fasteners. The capscrews may point up or down. The washer shall be on the same side of the joint as the fastener that rotates relative to the chamber during assembly.

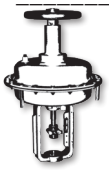
23) Install the **new** 5/16-18 x 1 hex head capscrews through the holes along the circumference of the upper diaphragm chamber and through the holes in the diaphragm and lower diaphragm chamber. Be careful not to change the orientation of the springs.

24) Install **new** 5/16-18 hex nuts **(Item 8)** on the 5/16-18 x 1 hex head capscrews. Tighten all capscrews along the circumference of the upper diaphragm chamber to 200 in-lbs torque.

25) Remove masking from the shaft.

26) Apply air pressure to verify actuator strokes smoothly and check for air leaks.

27) Install actuator on valve. See instructions on page 22 or 23.



DISASSEMBLY OF REVERSE ACTING DL84 ACTUATOR WITH HANDWHEEL

SEE DRAWING PAGE 8 & 9

1) Remove actuator from valve. See separate actuator removal instructions on page 10.

2) Mark edge of both diaphragm chambers to aid in orienting the chambers to each other and the yoke during reassembly.

3) Loosen 1-8 hex nut **(Item 30)**.

4) Thread 1-8 hex nut to top of handwheel shaft **(Item 32)**.

5) Operate handwheel **(Item 29)** until 1-8 hex nut makes contact with handwheel bonnet **(Item 31)**.

6) Remove ½ -20 self locking nut **(Item 27)** from handwheel shaft. Replace with **new** ½ -20 self locking nut during reassembly.

7) Remove washer **(Item 28)** from handwheel shaft.

8) Remove handwheel from handwheel shaft.

9) Remove 1-8 hex nut from handwheel shaft.

10) Thread handwheel shaft into handwheel bonnet until threads are no longer engaged.

11) Alternately loosen then remove the 5/16-18 hex nuts **(Item 8)**, the 5/16-18 x 1 hex head capscrews **(Item 6)**, and washers **(Item 7)** along the circumference of the diaphragm chambers. Replace with **new** hex nuts and **new** hex head capscrews during reassembly.

12) If the actuator uses the three (3) preload nuts **(Item 21)** there is significant preload on the springs. Alternately loosen the preload nuts approximately ¼ inch. The upper diaphragm chamber **(Item 3)** should separate from the lower diaphragm chamber **(Item 10)** and diaphragm **(Item 5).** If the upper diaphragm chamber does not separate from the lower diaphragm chamber and diaphragm, pry them apart. Be careful not to damage the diaphragm sealing surfaces on the diaphragm chambers. After the diaphragm chambers are separated, alternately loosen the preload nuts in small increments, approximately ¼ inch at a time, then remove the preload nuts, the three (3) 5/16-18 x 3 hex head capscrews (Item 22), and washers **(Item 7)**. Replace with **new** preload nuts and **new** hex head capscrews.

13) Remove the upper diaphragm chamber **(Item 36)** and handwheel bonnet as an assembly.

14) Remove the springs **(Item 4)** from the actuator.

15) Remove the handwheel shaft assembly, pressure plate **(Item 9)**, diaphragm **(Item 5)**, lower washer **(Item 26)**, and actuator shaft **(Item 11)** as an assembly from the lower diaphragm chamber **(Item 10)** and yoke **(Item 17)** assembly of the actuator.

16) Remove the lower cage bushing **(Item 41)** from the actuator shaft. Use flats provided on shaft to hold it from turning. The remainder of the shaft is a close tolerance fine finish bearing and sealing surface.

17) Remove pressure plate, diaphragm, and lower washer from the shaft. Clean bearing and sealing surfaces on shaft. Inspect diaphragm and shaft, if damaged or worn replace with **new** diaphragm and shaft during reassembly.

18) Remove upper cage bushing **(Item 33)** from cage **(Item 40)**
.

19) Remove ¾-16 precision jamnut **(Item 39)** from handwheel shaft.

20) Remove ¾-16 recessed thread nut **(Item 38)** from handwheel shaft.

21) Remove roller thrust bearing **(Item 37)** from handwheel shaft. Clean and inspect roller thrust bearing, if worn or damaged replace with **new** roller thrust bearing during reassembly.

23) Remove handwheel shaft from upper cage bushing. Clean bearing and sealing and bearing surfaces on handwheel shaft. Inspect handwheel shaft, if worn or damaged replace with **new** handwheel shaft during reassembly.

24) Remove retaining ring **(Item 42)** from upper cage bushing.

Disassembly of Reverse Acting DL84 Actuator with Handwheel cont.

25) Remove two (2) seal washers **(Item 44)** and shaft seal (Item 43) from upper cage bushing. Replace with **new** shaft seal during reassembly. Clean bearing and sealing surfaces on upper cage bearing.

26) Remove the 5/16-18 x1 hex head capscrews **(Item 6)** from bushing **(Item 13)**.

27) Remove bushing and shaft seal **(Item 14)** from lower diaphragm chamber as an assembly.

28) Remove lower diaphragm chamber from yoke.

29) Remove gasket **(Item 12)** from lower diaphragm chamber. Clean gasket surfaces on bushing and lower diaphragm chamber. Replace with **new** gasket during reassembly.

30) Remove shaft seal from bushing. Replace with **new** shaft seal during reassembly. Clean bushing bearing and sealing surfaces. Inspect bushing, if damaged or worn, replace with **new** bushing during reassembly.

ASSEMBLY OF REVERSE ACTING DL84 ACTUATOR WITH HANDWHEEL

SEE DRAWING PAGE 8 & 9

1) Apply light coat of stem lube DC111 **(Item 24)** to **new** shaft seal **(Item 14)**. Install shaft seal in bushing **(Item 13)**. Watch orientation.

2) Place the lower diaphragm chamber **(Item 10)** on the yoke **(Item 17)** in the orientation shown on the drawing. Refer to drawing on page 8. Line up the holes in the base of the diaphragm chamber with the mounting holes in the yoke.

3) Install **new** gasket **(Item 12)** in lower diaphragm chamber. Line up holes in gasket with holes in base of lower diaphragm chamber.

4) Install bushing and shaft seal as an assembly in lower diaphragm chamber. Line up holes in bushing with holes in gasket.

5) Install four (4) 5/16-18 x 1 hex head capscrews **(Item 6)** through the bushing, gasket, and lower diaphragm chamber into the yoke, then gradually tighten the capscrews to 30ft-lbs in 5ft - lb increments in a criss cross pattern. At no point should a portion of the gasket bolt hole be squeezed past the bushing flange OD.

6) Install first seal washer **(Item 44)** in upper cage bushing **(Item 33)**.

7) Install **new** shaft seal **(Item 43)** in upper cage bushing. Watch orientation.

8) Install second seal washer **(Item 44)** in upper cage bushing.

9) Install retaining ring **(Item 42)** in upper cage bushing.

10) The threads and groove on handwheel shaft **(Item 32)** that upper cage bushing will pass over must be covered with a thin layer of acetate tape, spirally wrapped, to prevent seal from being damaged when being installed onto shaft end. Wrap the tape about an inch beyond end of shaft to allow seal to expand over shaft end during installation. Overlap tape edges no more than once and keep amount of overlap to a minimum.

11) Apply a thin coat of Aeroshell Grease 6 **(Item 45)** to sealing and bearing surfaces of handwheel shaft and onto tape wrapped over end to ease installation of upper bushing and seal.

12) Install upper cage bushing over end of handwheel shaft. Watch orientation. After installation, remove all traces of tape from handwheel shaft and upper cage bushing taking care to keep grease off threads on shaft..

13) Install a nonlubricated roller thrust bearing **(Item 37)** onto handwheel shaft keeping roller assembly sandwiched in between the two races.

14) Apply Loctite 272 **(Item 25)** to the threads on handwheel shaft. Do not get Loctite 272 on the diaphragm or seals.

15) Install ¾-16 recessed thread nut **(Item 38)** on handwheel shaft.

16) Install ¾-16 precision jamnut **(Item 39)** on handwheel shaft. Bottom face of ¾-16 precision jamnut must be even with bottom face of handwheel shaft within + or – 0.02 inch. Tighten ¾-16 recessed thread nut to ¾-16 precision jamnut to 60 ft- lbs torque. Apply Aeroshell grease 6 to roller assembly of the thrust bearing.

17) Apply Loctite 272 **(Item 25)** to the threads on upper cage bushing and lower cage bushing **(Item 41)**. Do not get Loctite 272 on the diaphragm or seals.

18) Install cage **(Item 40)** onto upper cage bushing and install lower cage bushing onto cage. Torque both bushings to 100 ft-lbs relative to the cage. A four-pin spanner wrench is required to torque lower bushing cage. A drawing of the spanner wrench is availble by contacting Warren Controls Sales Dept. (ask for drawing B6038401).

19) Install the lower washer **(Item 26)** on the actuator shaft **(Item 11)**. The side of the washer having the rounded edge must be facing the diaphragm.

20) Install the diaphragm **(Item 5)** on the actuator shaft in the orientation shown on the drawing. Refer to drawing on page 8. Fabric side of diaphragm assembled against pressure plate. Raised diameter in center of diaphragm assembled against lower washer.

21) Install the pressure plate **(Item 9)** on the actuator shaft.

22) Apply Loctite 272 to the threads on the shaft. Do not get Loctite 272 on the diaphragm or seals.

23) Center the lower washer on the shaft. Center the raised diameter of the diaphragh on the lower washer. By applying a wrench to flats on upper cage bushing, install lower cage bushing onto actuator shaft with a torque of 35 ft-lbs. Hold actuator shaft by its flats to keep it from turning. Take care to prevent damage to the finely finished bearing and sealing surfaces of the actuator shaft. The raised diameter of the diaphragm must remain centered on the lower washer.

24) Mask threads on actuator shaft with paper or tape to protect shaft seal when reinserting shaft.

25) Apply stem lube DC111 to the actuator shaft.

26) Install the actuator shaft, diaphragm, pressure plate, and handwheel shaft assembly as an assembly in the lower diaphragm chamber. Center the actuator shaft in the bushing. The flats on the shaft must be oriented so they can be accessed with a wrench when the actuator is fully assembled. Flats should be in same relation to air connection in lower chamber as before the actuator was disassembled. Refer to drawing on page 8.

27) Line up the holes in the diaphragm with the holes in the lower diaphragm chamber.

28) Install the springs **(Item 4)** centered over the raised spring pilots on the pressure plate. Refer to drawing on page 8.

29) Install the upper diaphragm chamber and handwheel bonnet assembly on the springs in the orientation shown on the drawing. Refer to drawing on page 8. Insert handwheel shaft into bottom of handwheel bonnet. Line up the marks made on the diaphragm chambers in Step 2 of the disassembly instructions. Line up the holes in the upper diaphragm chamber with the holes in the lower diaphragm chamber. Be careful not to change the orientation of the springs. The upper diaphragm chamber should not be moved sideways or rotated while resting on the springs. If the chamber must be moved to align it with the lower chamber holes, lift it up, align, then lower straight down. Springs installed tilted will eventually fall over in operation. Refer to drawing on page 8 and 9.

30) If the actuator uses three (3) 5/16-18 x 3 hex head capscrews **(Item 22)** place a washer **(Item 7)** on each of three (3) **new** 5/16-18 x 3 hex head capscrews, if not go to Step 33. The function of the washer is to protect the paint on chamber from the rotating tool used to tighten the chamber fasteners. The capscrews may point up or down. The washer shall be on the same side of the joint as the fastener that rotates relative to the chamber during assembly.

31) Insert the three (3) **new** 5/16-18 x 3 hex head capscrews through the holes along the circumference of the upper diaphragm chamber, so the capscrews are equally spaced 5 holes apart, and through the holes in the diaphragm and lower diaphragm chamber.

32) Install three (3) **new** preload nuts **(Item 21)** on the three (3) 5/16-18 x 3 hex head capscrews. Tighten the capscrews alternately in increments not exceeding ¼ inch until the upper and lower diaphragm chambers are approximately 1/16 inch apart. Be careful not to change the orientation of the springs. Not keeping the upper and lower chambers parallel while loading the springs will result in the shaft being pulled off center, the shaft binding in the bushing, and premature wear.

33) Place washers **(Item 7)** on **new** 5/16-18 x 1 hex head capscrews **(Item 6)**. The function of the washer is to protect the paint on chamber from the rotating tool used to tighten the chamber fasteners. The capscrews may point up or down. The washer shall be on the same side of the joint as the fastener that rotates relative to the chamber during assembly.

34) Install the **new** 5/16-18 x 1 hex head capscrews through the holes along the circumference of the upper diaphragm chamber and through the holes in the diaphragm and lower diaphragm chamber. Be careful not to change the orientation of the springs.

35) Install **new** 5/16-18 hex nuts **(Item 8)** on the 5/16-18 x 1 hex head capscrews. Tighten all capscrews along the circumference of the upper diaphragm chamber to 200 in-lbs torque.

36) Remove masking from the shaft.

37) Thead handwheel shaft out of top of handwheel bonnet so 1-8 hex nut **(Item 30)** may be installed in next step.

38) Install 1-8 hex nut **(Item 30)** on handwheel shaft and tighten to 70 ft-lbs torque.

39) Install handwheel **(Item 29)** on handwheel shaft.

40) Install washer **(Item 28)** on handwheel shaft.

41) Install **new** ½ -20 self locking nut **(Item 27)** on handwheel shaft and tighten to 40 ft-lbs torque.

42) Apply air pressure to verify actuator strokes smoothly and check for air leaks.

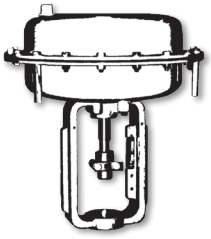
43) Install actuator on valve. See instructions on page 22 or 23.

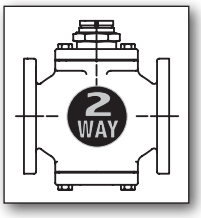
ACTUATOR INSTALLATION

Direct Acting DL84 Actuator
Installation on Direct Acting 2-Way Valve

See Drawing Page 10

IF ACTUATOR IS EQUIPPED WITH HANDWHEEL, OPERATE HANDWHEEL TO STAND-BY POSITION.





1 Push valve stem down until plug is seated. Note stem location.

2 Place actuator and yoke locknut over valve stem and onto bonnet. Do not tighten yoke locknut at this time.

3 Rotate actuator to desired orientation. Factory default is travel scale on downstream side of valve.

4 Tighten yoke locknut securely. Use a blunt chisel and hammer for final tightening.

5 Verify that the plug is against the seat. Refer to the location noted in Step 1.

6 Connect air supply to the actuator and pressurize the actuator to the high end of its bench range, 9 psig for a 3 to 9 psig actuator, 15 psig for a 3 to 15 psig or 9 to 15 psig actuator. Verify that the actuator is pressurized to the high end of its bench range.

7 With the plug on the seat, install the split stem connector, travel indicator pointer, and hex head capscrews on the actuator and valve stems. Valve stem engagement with the stem connector should be a minimum of one valve stem diameter. Actuator shaft engagement with the stem connector should be approximately one actuator shaft diameter. Watch orientation. Tighten capscrews.

8 Apply the low end of the actuator bench range pressure and verify that the valve opens fully.

9 Increase the pressure to the high end of the bench range and verify that the plug is seated at or slightly below the high end of the bench range. If the seating pressure is above the high end of the bench range the valve will not shut off its rated pressure and the stem connection must be adjusted. Reduce pressure so the plug is off the seat, remove the split stem connector, then repeat Steps 5, 6, 7, and 8 until the plug seats at or slightly below the high end of the bench range.

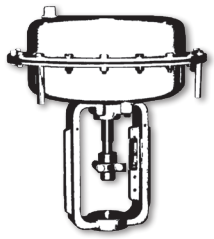
10 Adjust and secure the travel scale.

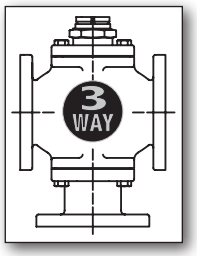
11 If isolated, return line pressure to valve and check operation.

Direct Acting DL84 Actuator Installation on 3-Way Valve

See Drawing Page 10

IF ACTUATOR IS EQUIPPED WITH HANDWHEEL, OPERATE HANDWHEEL TO STAND-BY POSITION.





1 Push valve stem down until plug is seated at lower port. Note stem location.

2 Place actuator and yoke locknut over valve stem and onto bonnet. Do not tighten yoke locknut at this time.

3 Rotate actuator to desired orientation. For a 32 or 52 diverting/mixing valve, the factory default is travel scale on lower port side of valve. For a 30 or 50 mixing/diverting valve, the factory default is travel scale on common port side of valve.

4 Tighten yoke locknut securely. Use a blunt chisel and hammer for final tightening.

5 Verify that the plug is against the lower seat. Refer to the location noted in Step 1.

6 Connect air supply to the actuator and pressurize the actuator to the high end of its bench range; 9 psig for a 3 to 9 psig actuator; 15 psig for a 3 to 15 psig, 9 to 15 psig or XR (12 to 15 psig) actuator. Verify that the actuator is pressurized to the high end of its bench range.

7 With the plug on the lower seat, install the split stem connector, travel indicator pointer, and hex head capscrews on the actuator and valve stems. Valve stem engagement with the stem connector should be a minimum of one valve stem diameter. Actuator shaft engagement with the stem connector should be approximately one actuator shaft diameter. Watch orientation. Tighten capscrews.

8 Apply the low end of the actuator bench range pressure and verify that the plug is seated at upper port.

9 Increase the pressure to the high end of the bench range and verify that the plug is seated at the lower port at or slightly below the high end of the bench range. If the seating pressure is above the high end of the bench range the valve will not shut off its rated pressure and the stem connection must be adjusted. Reduce pressure so the plug is off both seats, remove the split stem connector, then repeat Steps 5, 6, 7, and 8 until the plug seats at or slightly below the high end of the bench range.

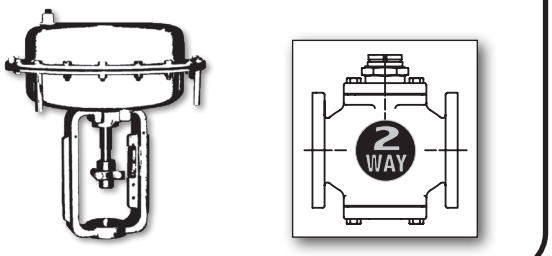
10 Adjust and secure the travel scale.

11 If isolated, return line pressure to valve and check operation.

Reverse Acting DL84 Actuator
Installation on Direct Acting 2-Way Valve

See Drawing Page 10

IF ACTUATOR IS EQUIPPED WITH HANDWHEEL, OPERATE HANDWHEEL TO STAND-BY POSITION.



1. Push valve stem down until plug is seated. Note stem location.

2. Place actuator and yoke locknut over valve stem and onto bonnet. Do not tighten yoke locknut at this time.

3. Connect air supply to the actuator and pressurize the actuator to its starting bench range plus ¼ psi, 9-1/4 psig for a 9 to 15 psig actuator, 3-1/4 psig for a 3 to 15 psig or 3 to 9 psig actuator, 12-1/4 psig for an XR (12 to 15 psig) actuator. Verify that the actuator is pressurized to the low end of its bench range.

4. Rotate actuator to desired orientation. Factory default is travel scale on downstream side of valve.

5. Tighten yoke locknut securely. Use a blunt chisel and hammer for final tightening.

6. Verify that the plug is against the seat. Refer to the location noted in Step 1.

7. With the plug on the seat, install the split stem connector, travel indicator pointer, and hex head capscrews on the actuator and valve stems. Valve stem engagement with the stem connector should be a minimum of one valve stem diameter. Actuator shaft engagement with the stem connector should be approximately one actuator shaft diameter. Watch orientation. Tighten capscrews.

8. Apply the high end of the actuator bench range pressure and verify that the valve opens fully.

9. Reduce the pressure to the low end of the bench range and verify that the plug is seated at or slightly above the low end of the bench range. If the seating pressure is below the low end of the bench range the valve will not shut off its rated pressure and the stem connection must be adjusted. Increase pressure so the plug is off the seat, remove the split stem connector, then repeat Steps 3, 6, 7, and 8 until the plug seats at or slightly above the low end of the bench range.

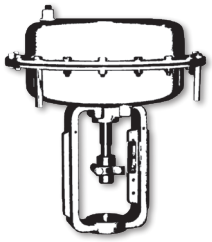
10. Adjust and secure the travel scale.

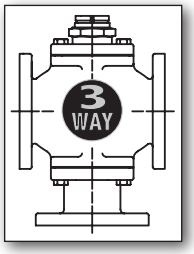
11. If isolated, return line pressure to valve and check operation.

Reverse Acting DL84 Actuator Installation on 3-Way Valve

See Drawing Page 10

IF ACTUATOR IS EQUIPPED WITH HANDWHEEL, OPERATE HANDWHEEL TO STAND-BY POSITION.





1 Push valve stem down until plug is seated at lower port. Note stem location.

2 Place actuator and yoke locknut over valve stem and onto bonnet. Do not tighten yoke locknut at this time.

3 Connect air supply to the actuator and pressurize the actuator to its starting bench range plus ¼ psi, 9-1/4 psig for a 9 to 15 psig actuator, 3-1/4 psig for a 3 to 15 psig or 3 to 9 psig actuator, 12-1/4 psig for an XR (12 to 15 psig) actuator. Verify that the actuator is pressurized to the low end of its bench range.

4 Rotate actuator to desired orientation. For a 32 or 52 diverting/mixing valve, the factory default is travel scale on lower port side of valve. For a 30 or 50 mixing/diverting valve, the factory default is travel scale on common port side of valve.

5 Tighten yoke locknut securely. Use a blunt chisel and hammer for final tightening.

6 Verify that the plug is against the lower seat. Refer to the location noted in Step 1.

7 With the plug on the lower seat, install the split stem connector, travel indicator pointer, and hex head capscrews on the actuator and valve stems. Valve stem engagement with the stem connector should be a minimum of one valve stem diameter. Actuator shaft engagement with the stem connector should be approximately one actuator shaft diameter. Watch orientation. Tighten capscrews.

8 Apply the high end of the actuator bench range pressure and verify that the plug is seated at upper port.

9 Reduce the pressure to the low end of the bench range and verify that the plug is seated at the lower port at or slightly above the low end of the bench range. If the seating pressure is below the low end of the bench range the valve will not shut off its rated pressure and the stem connection must be adjusted. Increase pressure so the plug is off the lower seat, remove the split stem connector, then repeat Steps 3, 6, 7, and 8 until the plug seats at or slightly above the low end of the bench range.

10 Adjust and secure the travel scale.

11 If isolated, return line pressure to valve and check operation.

DL84
DIAPHRAGM ACTUATOR

IOM DL84 F 0316

WARREN CONTROLS

A company of the
ARI-Armaturen Group

2600 EMRICK BLVD • BETHLEHEM, PA 18020 • USA •800-922-0085 • WWW.WARRENCONTROLS.COM

DEPENDABLE, RUGGED, PRECISION CONTROL VALVES AND ACCESSORIES

92500001 Rev F