



**LESLIE**  
**CONTROLS, INC.**

A subsidiary of CIRCOR International, Inc.

12501 Telecom Drive, Tampa Florida 33637

**Installation, Operating and  
Maintenance Instructions  
Supplement**

**10/0.5.1  
Rev. 1**

# **DIAPHRAGM ACTUATOR**

## **35(R), 55(R), 85(R), 135(R)**

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# SCOPE

## **CAUTION!**

All warnings and instructions from equipment IOM that Actuator is mounted to **must** be followed.

The following instructions cover installation, operation and maintenance of Leslie's diaphragm actuators.

# INSTALLATION

## **CAUTION!**

Keep all body parts away from any moving parts of actuator to prevent injury/death. Since air is being used to move actuator proper safety equipment (i.e. safety glasses) must be worn. Actuator contains a very powerful spring, extreme caution must be used when operating actuator. When supplying air to actuator do not exceed 60 psig.

Before starting installation of the actuator assembly, units should be unpacked and checked against packing list and/or the approved customer drawing.

1. Actuator is designed to be mounted in the vertical position. For other than vertical installations piping supports may be required. Consult factory.

## **Assemble Direct (Spring to retract) Actuator to Equipment**

1. Ensure that there is no spring tension on actuator by "unscrewing" spring adjusting nut (35). (see Fig 1)
2. Connect air supply to the top of the actuator until the stem is fully extended.
3. Ensuring that the thread size of the actuator and the control valve stem (refer to Fig 2 dimension **x**) is the same, and after lifting valve plug screw the actuator onto the stem about 1 diameter of thread.
4. Remove air supply and secure actuator to equipment. (NEED TO PUT BOLT TORQUE VALUES FOR STUDS TO HOLD ACTUATOR DOWN)

5. See Stroke adjustments section for final setting of actuator.

## **Assemble Reverse (Spring to extend) Actuator to Equipment**

1. Ensure that there is no spring tension on actuator by "unscrewing" spring adjusting nut (40). (See Fig 3)
2. Ensuring that thread size of actuator and control valve stem (refer to Fig 4 dimension **x**) is the same, and after lifting valve plug screw actuator onto equipment about 1 diameter of thread.
3. Connect air supply to bottom of actuator and allow actuator to come to rest on valve stem. Secure actuator to stem.
4. See stroke adjustments section for final setting of actuator.

## **Setting Actuator Stroke**

1. Apply air to either bottom (Reverse) or top (Direct) of actuator and note the total travel distance of actuator.
2. To adjust stroke of actuator, retract actuator stem by removing air from actuator (Direct) or applying air to actuator (Reverse). Screw equipment stem further into actuator and then stroke actuator again.
3. Repeat step 2 until desired stroke is reached.
4. Secure Travel indicator (42) to actuator yoke (4) by fastening screw (43) as shown. (See Fig 3)

## **Setting the Actuator Spring Load**

1. To adjust load given by failure mode (Direct/Reverse) of actuator, first remove all air pressure from actuator.
2. Hold actuator stem in place with a wrench.
3. Using a steel bar (see Table 1), turn spring adjusting nut (40) one half turn. (See Fig 3)
4. Measure force output of spring to see if at desired load. (This can be done by slowly applying air to actuator and recording at what air pressure actuator

starts to move. Take that air pressure and multiply it by area of actuator (see Table 1) in order to obtain the force output of spring.

5. Repeat steps 1-4 until desired load is reached.

### **NOTE**

Spring loads will vary if the actuator is mounted on equipment that does not fully utilize the entire stroke length of the actuator.

Actuator Size	Stroke (in)	Area (in <sup>2</sup> )	Spring Adjustor Rod Dia. (in)
35	3/4	34	3/4
35R	3/4	31	
55	1	57	7/8
55R	1	54	
85	2	90	0.745
85R	2	87	
135	3	135	0.995
135R	3	131	

**Table 1- Actuator Load Parameters**

## **OPERATION**

Once actuator stroke and spring load have been adjusted, equipment can be placed into operation. Route air supply from control system to actuator. Ensure that instrument air is being used to operate actuator. See equipment instructions for proper operation of assembly.

## **MAINTENANCE**

### **General**

1. Remove all air and accessories from actuator prior to removal from equipment.
2. Support actuator prior to removing mounting bolts. For reverse acting actuators apply air to top of actuator before removing mounting bolts.
3. Remove actuator mounting bolts.
4. For direct acting actuators, air may need to be applied to actuator before removing actuator from equipment shaft. For reverse acting actuators, air may need to be removed from actuator. Unscrew

actuator from equipment shaft by either spinning actuator or unscrewing the shaft. (**NOTE: If actuator is mounted to a valve the valve shaft must not be turned unless valve plug is lifted off valve seat!**)

5. Remove all air pressure from actuator and unload spring tension by grasping actuator stem with a wrench and unscrewing spring adjustment nut (40). (see Fig 3)
6. Actuator is now ready for disassembly.

## **Direct Actuator Disassembly**

(see Fig 1)

### **CAUTION!**

Spring load must be completely removed before proceeding or injury/death can occur.

1. Remove nuts/bolts (22/23), upper diaphragm case (20) and diaphragm (21).
2. To remove the other components, lift out diaphragm disc (24) and entire diaphragm disc and spring (28) assembly will lift out.
3. Unscrew diaphragm disc nut (16 only showing in Fig 3) and remove springs (28,29) from the assembly.
4. Remove spring adjustment nut (35).
5. Remove lower diaphragm case screws (26).

## **Direct Actuator Reassembly**

(see Fig 1)

### **NOTE**

Ensure that all the components being installed are free from any nicks burrs or defects prior to assembly.

See Torque Values in Table 2

1. Install lower diaphragm case bolts (26) and torque to the values given in Table 2.

2. Install spring adjusting nut (35) and thread it all the way down as shown.
3. Install springs (28,29).
4. Install diaphragm disc nut (16 only showing in Fig 3) and diaphragm disc (24). (See table 2)
5. Slide diaphragm plate/assembly into yoke (32) as shown.
6. Install diaphragm (21) and align holes with those in diaphragm case (For sizes 35, 55 and 85). For 135 actuators place the bead of diaphragm (21) in the recess of lower diaphragm case (25).
7. For 35 actuators and where flat stock diaphragm material is used as an emergency measure see special "performing" instructions in step 8. Install upper diaphragm case (20) and install (4) nuts and bolts (22/23) (90° apart) and finger tighten. Install remaining bolts and nuts and torque to the values given in Table 2.
8. Special "Performing" Instructions - Flat stock material is used for 35 diaphragms and *emergency* measure diaphragms. First finger tightens all diaphragm case bolts. Then compress actuator spring sufficiently to move diaphragm through its full travel. This performs diaphragm and permits full movement through rated travel without resistance from a taut diaphragm.

Act. Size (see Fig 1)	Lower Dia. Casing Bolts (26)	Upper Dia. Casing Bolts (22,23)
35	15-20	15-20
55	30-36	15-20
85	30-36	15-20
135	45-50	15-20

**Table 2 - Torque Values (ft-lbs)**

Size	1	5	17
35	15-20	2-5	50-80
55, 55A, 85, 85A	15-20	2-5	50-80
135	30-36	2-5	50-80

**Table 3 – Torque Values Hand Operating Device (ft-lbs)**

## Direct Actuator HOD Disassembly

(see Fig 1)

### **CAUTION!**

Spring load must be completely removed before proceeding or injury/death can occur.

1. Remove nut (1), lock washer (2), and handwheel (3).
2. Remove packing gland (5), packing ring(s) (6), washer (7), and O-Ring (8) from bonnet (9).
3. Screw handscrew (4) down into bonnet (9) until stem bottoms on bonnet threads.
4. Remove handscrew disc (15) after removing retaining ring and half rings above it.
5. Remove handscrew (4) through upper end of bonnet (9).

## Direct Actuator HOD Reassembly

(see Fig 1)

### **NOTE**

Ensure that all components being installed are free from any nicks burrs or defects prior to assembly.

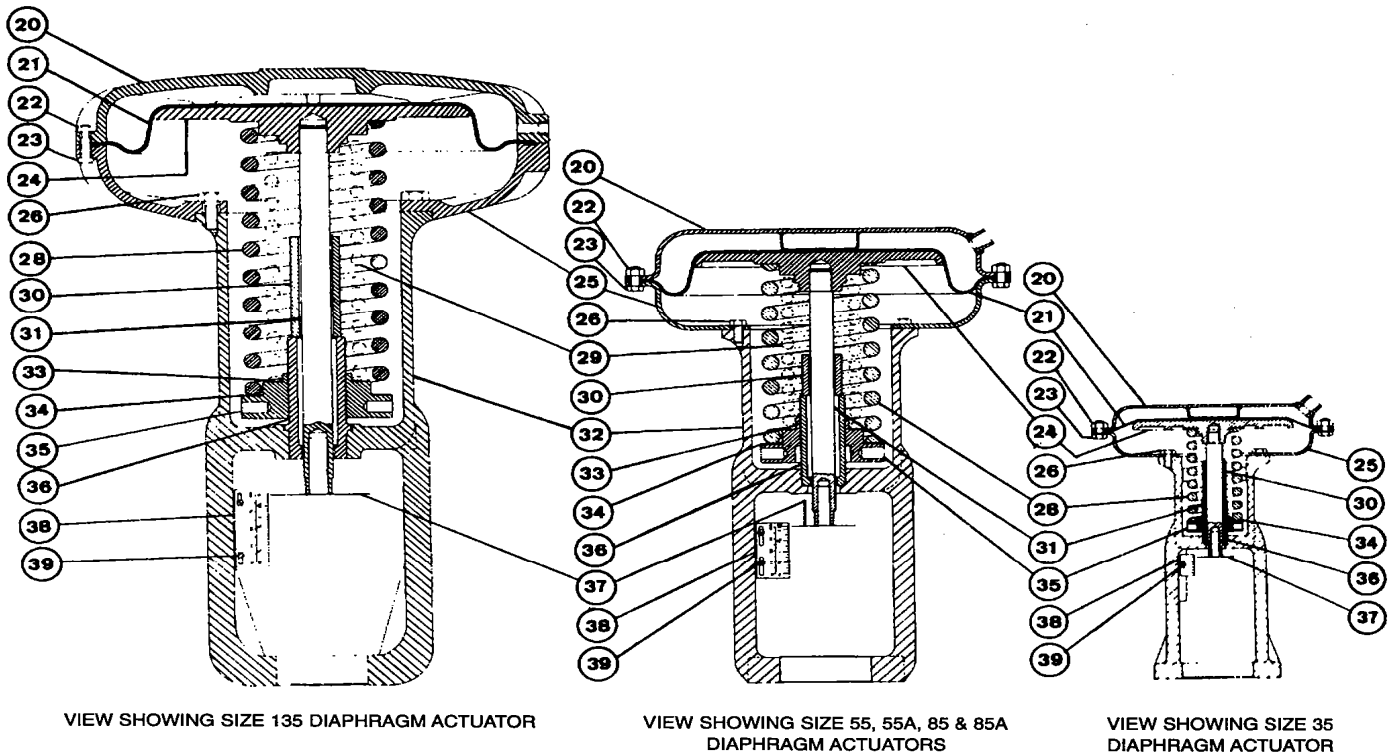
1. Insert handscrew (4) in top of bonnet (9) and screw down through bonnet threads.
2. Place retaining ring over handscrew thread. Insert half rings in the handscrew groove with wide face of rings upward toward bonnet (9). Install handscrew disc (15) over half rings and fit retainer ring into groove of disc making sure it enters groove.
3. Screw handscrew (4) up through bonnet (9). Place O-Ring (8) over handscrew (4) stem and into bonnet (9) followed by washer (7) and packing ring(s) (6). Screw packing gland (5) into bonnet (9) and tighten sufficiently to prevent handwheel (3)

from turning due to vibration, etc. install bonnet (9) on upper diaphragm case.

4. Place handwheel (3) over stem. Install lock washer (2) and tighten nut (1).

5. Reinstall HOD assembly on actuator.

## DIAPHRAGM ACTUATOR



## HAND OPERATING DEVICE

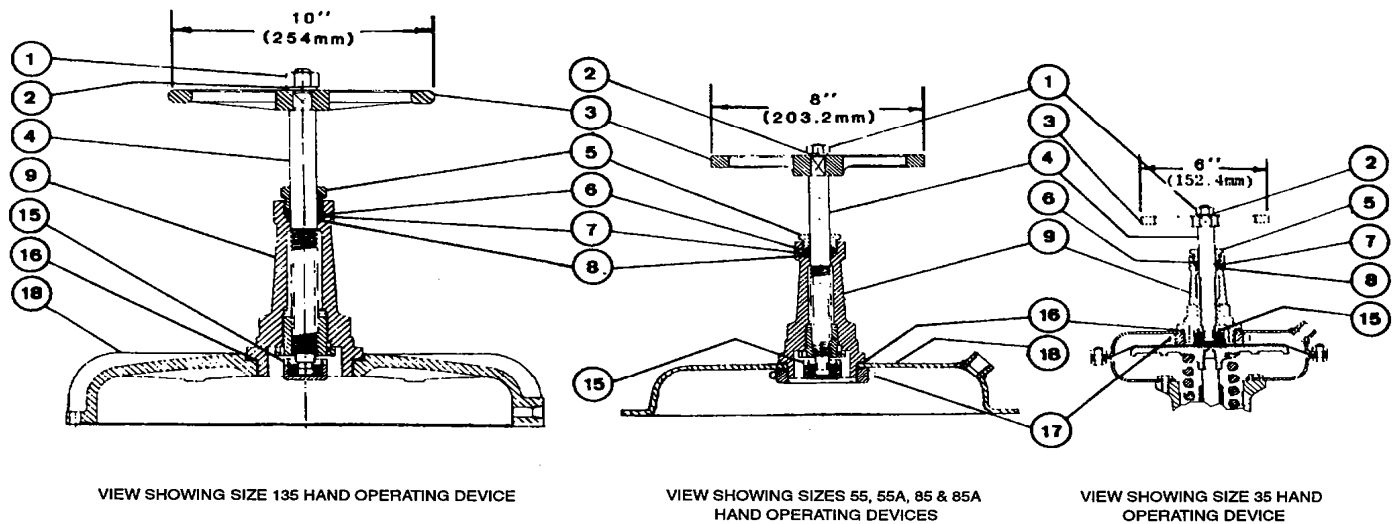


Figure 1 - Direct Diaphragm Actuator/ HOD

# DIRECT ACTING PARTS LIST

WHEN ORDERING PARTS, PLEASE GIVE PART NAME AND PART REFERENCE NUMBER FROM TABLE BELOW. USE PART NUMBER ONLY TO LOCATE PART ON DRAWING.

## HAND OPERATING DEVICE

PART NO.	PART NAME	MATERIAL	QTY. PER UNIT	REFERENCE NUMBER - EACH SIZE			
				35	55 & 55A	85 & 85A	135
1	Nut	Steel	1	13243	13243	13243	3677
2	Lock Washer	Steel	1	10392	10392	10392	7049
3	Handwheel	Cast Aluminum	1	43064	23649	23649	31470
4	Handscrew	Stainless Steel	1	43016	49228	49228	42140
5	Packing Gland	(NOTE 1)	1	38644	34859	34859	34860
6 †	Packing Ring	Teflon	1	69609	A69597	A69597	69608
7	Washer	(NOTE 1)	1	38658	35760	35760	35761
8 †	O-Ring	Synthetic Rubber	1	38664-94	27293-94	27293-94	27251-94
9	Bonnet, Complete, Iron Actuator	(NOTE 2)	1	38635	42228	42228	42229
9	Bonnet, Complete, Aluminum Actuator	(NOTE 3)	1	39069	42228	42228	42229
15	Handscrew Disc, Complete	(NOTE 6)	1	43008	42077	42077	42152
16 †	Gasket	Sheet Packing	1	38657-95	37845-95	37845-95	16513-67
17	Lock Nut, Iron Actuator	(NOTE 2)	1	38655	37710	37710	--
17	Lock Nut, Aluminum Actuator	(NOTE 3)	1	39070	37710	37710	--
18	Diaphragm Case, Upper	Pressed Steel	1	38661	37764	37770	--
18	Diaphragm Case, Upper	(NOTE 4)	1	--	--	--	36224
18	Diaphragm Case, Upper	(NOTE 5)	1	--	--	--	36220

PART NO.	PART NAME	MATERIAL	UNIT	QTY. PER 35	REFERENCE NUMBERS - EACH SIZE					
					55	55A	85	85A	85* (135)	135
20	Diaphragm Case, Upper	Pressed Steel	1	38369	37795	37795	37791	37791	37791	--
20	Diaphragm Case, Upper (NOTE 4)	Cast Iron	1	--	--	--	--	--	--	36195
20	Diaphragm Case, Upper (NOTE 5)	Cast Aluminum	1	--	--	--	--	--	--	36191
21 †	Diaphragm	Synthetic Rubber	1	38399-94	37810-94	37810-94	37819-94	37819-94	37819-94	36027-94
22	Nut	Steel	(NOTE 7)	13901	26585	26585	26585	26585	26585	26585
23	Bolt	Steel	(NOTE 7)	38420	37797	37797	37797	37797	37797	24313
24	Diaphragm Disc (NOTE 4)	Cast Iron	1	38393	37838	37838	37843	37843	37843	23947
24	Diaphragm Disc (NOTE 5)	Cast Aluminum	1	38877	37839	37839	37844	37844	37844	34636
25	Diaphragm Case, Lower	Pressed Steel	1	38345	37672	37672	37678	37678	37678	--
25	Diaphragm Case, Lower (NOTE 4)	Cast Iron	1	--	--	--	--	--	--	31624
25	Diaphragm Case, Lower (NOTE 5)	Cast Aluminum	1	--	--	--	--	--	--	34629
26	Cap Screw	Steel	(NOTE 8)	38420	37796	37796	23400	23400	23400	9130
28	Adjusting Spring	Steel, Plated	1	--	--	--	--	--	--	SEE TABLE
29	Inner Adjusting Spring	Steel, Plated	1	--	--	--	--	--	--	SEE TABLE
30	Limit Stop	Steel	1	--	--	--	--	--	--	SEE TABLE
31	Upper Stem	Stainless Steel	1	38398	23263	61386	24273	57521	24273	23949
32	Yoke (NOTE 10) (NOTE 4)	Cast Iron	1	38335	37693	37693	37995	57554	37822	34855
32	Yoke (NOTE 10) (NOTE 5)	Cast Aluminum	1	38876	37692	37692	37994	57553	37821	34702
33	Washer, Inner Spring (NOTE 9)	Stainless Steel	1	--	--	--	--	25393	25393	25393
34	Washer	Stainless Steel	1	38401	23260	23260	24271	24271	24271	23951
35	Adjusting Nut (NOTE 4)	Cast Iron	1	38394	23262	23262	24274	24274	24274	23948
35	Adjusting Nut (NOTE 5)	Cast Bronze	1	38349	27978	27978	30081	30081	30081	30070
36	Adjusting Sleeve	Stainless Steel	1	38397	37694	37694	37766	37766	37766	34655
37	Travel Indicator	Stainless Steel	1	38405	38920	15672	38921	58012	38921	38922
38	Travel Indicator Scale	Aluminum	1	38404	--	--	--	--	--	SEE TABLE
39	Screw	Steel, Cad. Plated	(NOTE 11)	34728	34728	34728	34728	34728	34728	34728

### † RECOMMENDED SPARE PARTS

- NOTE 1 - Material is Brass for size 35 Actuator and Aluminum for 55, 85, 85A and 135 Actuators.  
 NOTE 2 - Material is Cast Iron for 35 Actuator and Cast Aluminum for 55, 55A, 85, 85A and 135 Actuators.  
 NOTE 3 - Material is Cast Bronze for 35 Actuator and Cast Aluminum for 55, 55A, 85, 85A, and 135 Actuators.  
 NOTE 4 - Used on Cast Iron Actuators only.  
 NOTE 5 - Used on Cast Aluminum Actuators only.  
 NOTE 6 - Includes one each, Handscrew Disc, Retainer Insert, and two each Split Ring.  
 NOTE 7 - Quantities are: Twelve (12) for the 35 size, Fourteen (14) for the 55 & 55A sizes, Sixteen (16) for the 85 & 85A sizes and Twenty-four (24) for the 135 size Actuator.  
 NOTE 8 - Quantities are: Eight (8) for the 35, 55, & 55A sizes and Six (6) for the 85, 85A and 135 size Actuators.  
 NOTE 9 - Used only when Inner Adjusting Spring, Part No. 29 is used.  
 NOTE 10 - Yoke, Part No. 32, is furnished complete with Adjusting Sleeve, Part No. 36.  
 NOTE 11 - Quantities are: One (1) for 35 Actuator and Two (2) for all other sizes.

PART NO. 28 ADJUSTING SPRING **					
VALVE TRAVEL		ACTUATOR SIZE			
		35	55 & 55A	85 & 85A	135
5/8 in	15.9 mm	38422	41969	35014	--
3/4 in	19.1 mm	38422	41968	37719	--
7/8 in	22.2 mm	--	23239	24299	42489
1 in	25.4 mm	--	24296	35014	23996
1-1/8 in	28.6 mm	--	43078	41970	--
1-1/4 in	31.8 mm	--	24297	24299	41971
1-1/2 in	38.1 mm	--	24298	24300	24303
2 in	50.8 mm	--	--	24301	42489
2-1/8 in	54.0 mm	--	--	42488	41972
2-1/4 in	57.2 mm	--	--	--	24303
2-3/4 in	69.9 mm	--	--	--	23996
3 in	76.2 mm	--	--	--	23996

\*\* Springs listed are based on Standard Spring that will give the nearest range to 3-15 psi for the travel indicated. This is based on zero pressure drop through valve. For various pressure drops or ranges, these Springs can be interchanged any way in each particular size. Consult Leslie Co. when special range is required.

PART NO. 30 LIMIT STOP					
VALVE TRAVEL		ACTUATOR SIZE			
		35	55 & 55A	85 & 85A	135
5/8 in	15.9 mm	38403	44077	24482	--
3/4 in	19.1 mm	--	23393	46890	36349
7/8 in	22.2 mm	--	23393	24482	36349
1 in	25.4 mm	--	23394	24483	36349
1-1/8 in	28.6 mm	--	23395	23366	--
1-1/4 in	31.8 mm	--	23395	23366	30908
1-1/2 in	38.1 mm	--	23997	23367	25396
2 in	50.8 mm	--	--	23368	36350
2-1/8 in	54.0 mm	--	--	23368	25399
2-1/4 in	57.2 mm	--	--	--	25399
2-3/4 in	69.9 mm	--	--	--	36351
3 in	76.2 mm	--	--	--	23993

PART NO. 29 INNER ADJUSTING SPRING			
VALVE TRAVEL		ACTUATOR SIZE	
		85 & 85A	135
5/8 in	15.9 mm	37718	--
7/8 in	22.2 mm	24481	25389
1 in	25.4 mm	--	25389
1-1/4 in	31.8 mm	--	25390
1-1/2 in	38.1 mm	--	25390

PART NO. 38 TRAVEL INDICATOR SCALE INDICATOR SCALES SUBJECT TO ACTUATOR MAXIMUM TRAVEL LIMIT		
VALVE TRAVEL		REF. NO.
1/4 in	6.4 mm	48224
3/8 in	9.5 mm	48048
1/2 in	12.7 mm	48047
5/8 in	15.9 mm	38904
3/4 in	19.1 mm	38905
7/8 in	22.2 mm	38906
1 in	25.4 mm	38907
1-1/8 in	28.6 mm	38908
1-1/4 in	31.8 mm	38909
1-1/2 in	38.1 mm	38910
1-3/4 in	44.5 mm	49641
2 in	50.8 mm	38911
2-1/8 in	54.0 mm	38912
2-1/4 in	57.2 mm	38913
2-3/4 in	69.9 mm	38914
3 in	76.2 mm	38915

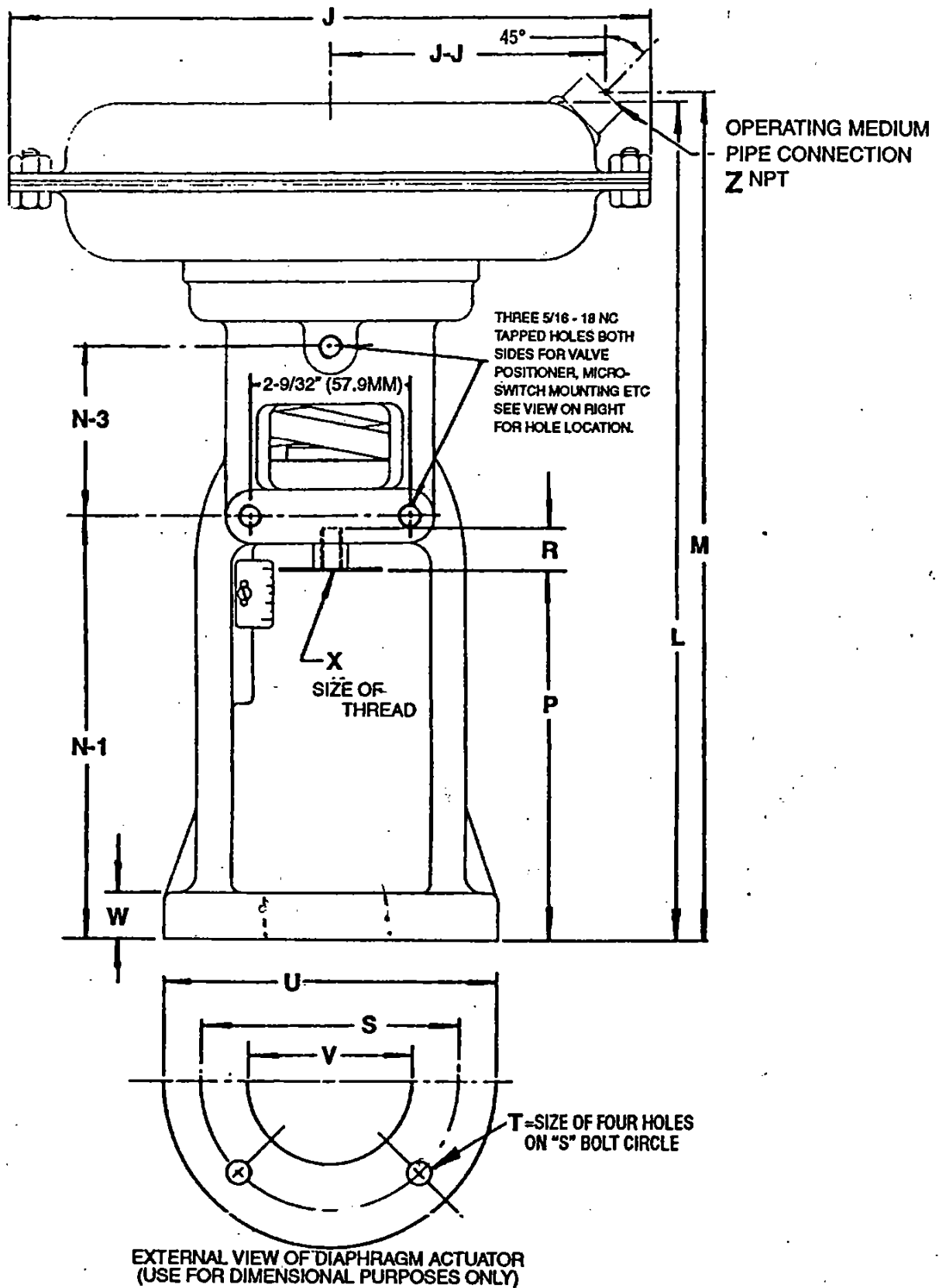


Figure 2 - External View of Direct Acting Diaphragm Actuator



## DIAPHRAGM ACTUATORS – DIRECT ACTING

DIMENSIONS IN INCHES AND MILLIMETERS																				
SIZE DIAPHRAGM ACTUATOR		MAX TRAV EL	J	J-J	L	M	N-1	N-2	N-3	P	R	S	T	U	V	W	X	Z	NET WT. Lb/kg**	
																			ALUM.	CAST IRON
35	in mm	¾ 19.0	9-1/4 235.0	3-15/16 100.0	12-3/8 314.3	12-3/8 314.3	6-1/4 158.8	2-1/2 63.5	2-1/2 63.5	5-1/2 139.7	1-3/8 34.9	3-13/16 96.8	9/16 14.3	4-13/16 122.2	2.687 68.2	11/16 17.5	3/8-24	¼ NPT	20 lb 9.1 kg	35 lb 15.9 kg
55	in mm	1-1/2 38.1	12 304.8	5-1/16 128.6	15-1/4 387.4	15-1/4 387.4	7 177.8	2-1/2 63.5	3 76.2	5-1/2 139.7	1-3/8 34.9	3-13/16 96.8	9/16 14.3	4-13/16 122.2	2.687 68.2	1 25.4	3/8-24	¼ NPT	23 lb 10.4 kg	50 lb 22.7 kg
55A	in mm	1-1/2 38.1	12 304.8	5-1/16 128.6	15-1/4 387.4	15-1/4 387.4	7 177.8	2-1/2 63.5	3 76.2	5-1/2 139.7	1-3/8 34.9	3-13/16 96.8	9/16 14.3	4-13/16 122.2	2.687 68.2	1 25.4	½-20	¼ NPT	23 lb 10.4 kg	50 lb 22.7 kg
85	in mm	2-1/8 54.0	14-3/4 374.7	6-1/4 158.8	19-5/8 498.5	19-5/8 498.5	8-1/2 215.9	2-1/2 63.5	4-1/8 104.8	6-7/16 163.5	1-3/4 44.5	3-13/16 96.8	9/16 14.3	4-13/16 122.2	2.687 68.2	1-1/4 31.8	½-20	¼ NPT	43 lb 19.5 kg	96 lb 43.5 kg
85A	in mm	2-1/8 54.0	14-3/4 374.7	6-1/4 158.8	22-1/4 565.2	22-1/4 565.2	11-1/8 282.6	2-1/2 63.5	4-1/8 104.8	8-9/16 217.5	2-1/2 63.5	4-3/4 120.7	11/16 17.5	6 152.4	3,500 88.9	1-5/16 33.3	¾-16	¼ NPT	48 lb 21.8 kg	116 lb 52.6 kg
85*	in mm	2-1/8 54.0	14-3/4 374.7	6-1/4 158.8	20-1/4 514.4	20-1/4 514.4	9-1/8 231.8	2-1/2 63.5	4-1/8 104.8	7-1/16 179.4	1-3/4 44.5	4-3/4 120.7	11/16 17.5	6 152.4	3,500 88.9	1-5/16 33.3	½-20	¼ NPT	45 lb 20.4 kg	113 lb 51.3 kg
135	in mm	3 76.2	18 457.2	9 228.6	27-3/8 695.3	24-5/8 625.5	11-1/8 282.6	2-1/2 63.5	5-5/8 142.9	8-9/16 217.5	2-1/2 63.5	4-3/4 120.7	11/16 17.5	6 152.4	3,500 88.9	1-15/16 33.3	¾-16	3/8 NPT	104 lb 47.2 kg	187 lb 84.8 kg
135(1-1/4) Dia. Stem	in mm	3 76.2	18 457.2	9 228.6	27-3/8 695.3	24-5/8 625.5	11-1/8 282.6	2-1/2 63.5	5-5/8 142.9	8-9/16 217.5	2-1/2 63.5	5-3/4 146.1	11/16 17.5	7 177.8	4,500 114.3	1-5/16 33.3	¾-16	3/8 NPT	104 lb 47.2 kg	187 lb 84.8 kg

DIMENSIONS IN INCHES AND MILLIMETERS														
ACTUATOR SIZE	MAX TRAVEL	N-1	N-2	N-3	P	R	S	T	U	V	W	X	NET WT** Lb/kg	NET WT** W/H.O.D. lb/kg
270 (in)	3	11-1/16	2-1/2	5-5/8	8-9/16	2-1/2	4-3/4	11/16	6	3,500	1-5/16	¾-16	210 lb	225 lb
270 (mm)	76.2	281.0	63.5	142.9	217.5	63.5	120.7	17.5	152.4	88.9	33.3	NPT	95.3 kg	102.1 kg

**Table 4 - Direct Acting Actuators Dimensions**

\*Mounting Flange Dimensions same as 135 ( R ) Yoke.

\*\* Approximate

## Reverse Actuator Disassembly

(see Fig 3)

### **CAUTION!**

Spring load must be completely removed before proceeding or injury/death can occur.

1. Remove nuts/bolts (18,19), upper diaphragm case (15) and diaphragm (20).
2. Insert (3/4, 7/8, 0.745, 0.995) in diameter rod through the hole in Yoke (34) and actuator stem (35) to prevent stem from rotating. **NOTE: If this step is not done then permanent damage will occur to lower stem boot.** For 35 actuator use a wrench on wrench flats to prevent stem from rotating.
3. Remove actuator stem nut (16), diaphragm disc (17), diaphragm (20), and collar (22). Remove actuator stem (35), springs (36,37), spring seat (30), washers (38,39), spacer (33) for 135R, and stem seal collar (31). Remove spring adjustment nut (40).
4. Remove stem seal (29) as follows: In 35R, remove capscrews (23) and disassemble lower diaphragm disc (21) from yoke (34) and lift out stem seal (29). In 55R and 85R, remove screws (28), seal ring (27) and stem seal (29), then remove lower diaphragm bolts, lower diaphragm case (21) and gasket (26). For 135R, remove capscrews (23) and disassemble lower diaphragm case (21) from yoke (34) and lift out stem seal (29).

## Reverse Actuator Reassembly

(see Fig 3)

### **NOTE**

Ensure that all components being installed are free from any nicks burrs or defects prior to assembly.

1. Assemble spring adjusting nut (40) washer(s) (38,39), spacer (33) for 135R, stem seal collar (31), springs (36,37), and spring seat (30).

2. Position stem seal (29) on stem seal collar (31), in sizes 55R, 85R, and 135R place bead of stem seal in recess of stem seal collar.
3. In 35R actuators, install stem seal (29) and collar (31) over actuator stem (35) in yoke (34). Install lower diaphragm base (21) to yoke (34). Insert cap screws (23) through holes in diaphragm lower case (21) and stem seal (29) and tighten as described below.
4. In 55R and 85R actuators, install stem seal (29) and seal ring (27) and torque per Table 2. What about the base plate?
5. In 135R actuator, install stem seal (29) and collar (31) over actuator stem (35) in yoke (34). Install lower diaphragm base (21) to yoke (34). Insert studs and nuts (24) through holes in diaphragm case (21) and stem seal (29) and tighten as described below.
6. Pre-setting stem seal (55R, 85R & 135R) - Place collar (22) on stem seal (29) making sure the bead on stem seal enters recess in collar. Reassemble diaphragm (20) over actuator stem (35). Fit center hole in diaphragm around raised face of collar (22). Replace diaphragm disc (17) and nut (16). Hold actuator stem steady with rod through yoke and stem or on wrench flats. Failure to do so may result in stem seal failure. Then tighten nut. Replace upper diaphragm case (15) and nuts/bolts (18/19) and torque to requirements in Table 2.
7. Presetting stem seal 35R - Place collar (22) on stem seal (29), assemble nut (16) to actuator stem (35) and tighten. Then press actuator stem downward to make stem seal move to taut position. Tighten capscrews to the requirements of Table 2 and remove nut (16).

## Reverse Actuator HOD Disassembly

(see Fig 3)

### **CAUTION!**

Spring load must be completely removed before proceeding or injury/death can occur.

1. Remove nut (1), lockwasher (2), and handwheel (3).

2. Screw handscrew (4) into the bonnet as far as it will go.
3. Remove nuts and bolts (18,19 see Fig 3) from upper diaphragm case (14).
4. Lift diaphragm case (14) while moving the case to one side so that handscrew disc assembly can be disengaged from diaphragm nut (8) by passing it through the slot in the diaphragm nut. (see Fig 4)
5. Remove handscrew (4) from bonnet (7).

NOTE: Clean all parts and replace any that are worn or damaged.

## Reverse Actuator HOD Reassembly

(see Fig 3)

### ***NOTE***

Ensure that all components being installed are free from any nicks burrs or defects prior to assembly.

1. Insert handscrew (4) into bonnet (7) and screw down through bonnet threads.
2. Insert diaphragm case (14) making sure that handscrew disc assembly is engaged to diaphragm nut (8). (see Fig 4)

3. Tighten nuts and bolts (18,19 see Fig 3) into upper diaphragm case (14).
4. Screw handscrew (4) up through bonnet (7).
5. Place handwheel (3) over stem. Install lockwasher (2) and tighten nut (1).

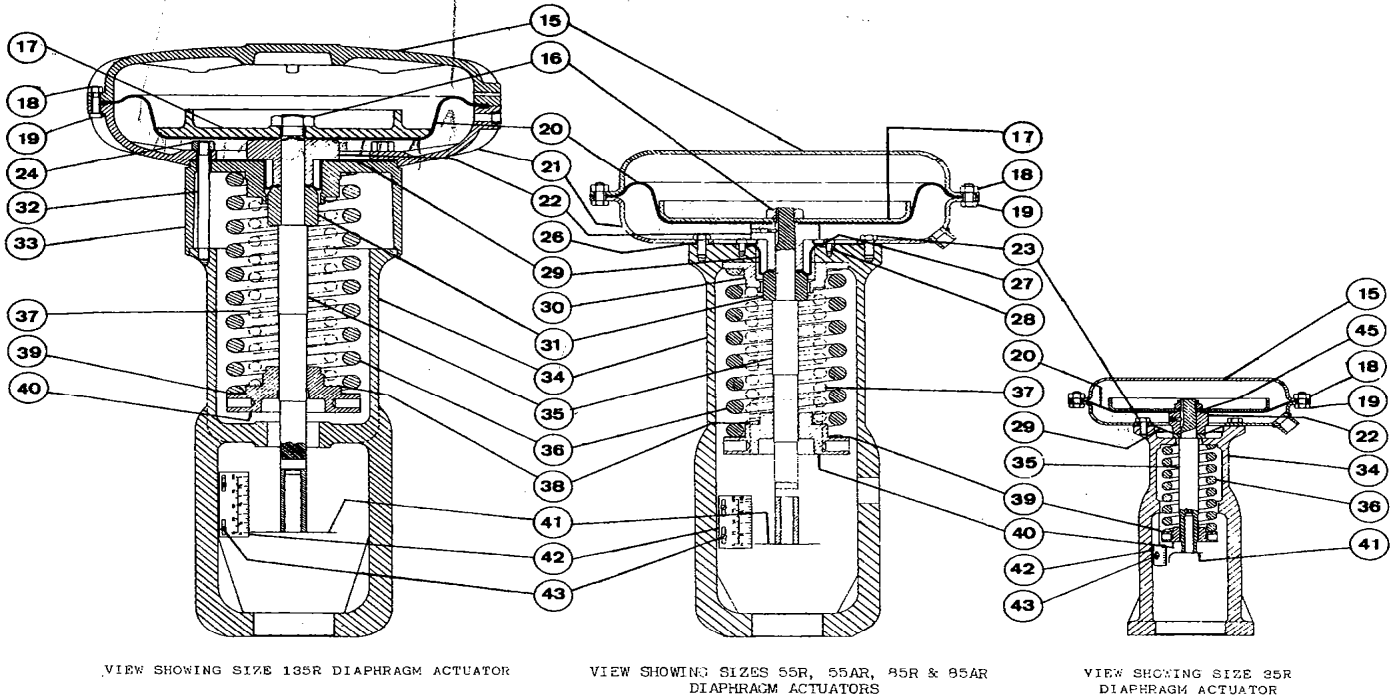
Act. Size (see Fig 1)	Lower Dia. Casing Bolts (23,24)	Upper Dia. Casing Bolts (18,19)
35R	15-20	15-20
55R/55AR	30-36	15-20
85R/85AR	30-36	15-20
135R	45-50	15-20

**Table 4 - Torque Values (ft-lbs)**

Size	1	6
35R	15-20	3-5
55R/55AR	15-20	15-20
85R/85AR	15-20	15-20
135R	30-36	15-20

**Table 5 – Torque Values Hand Operating Device (ft-lbs)**

## DIAPHRAGM ACTUATOR



## HAND OPERATING DEVICE

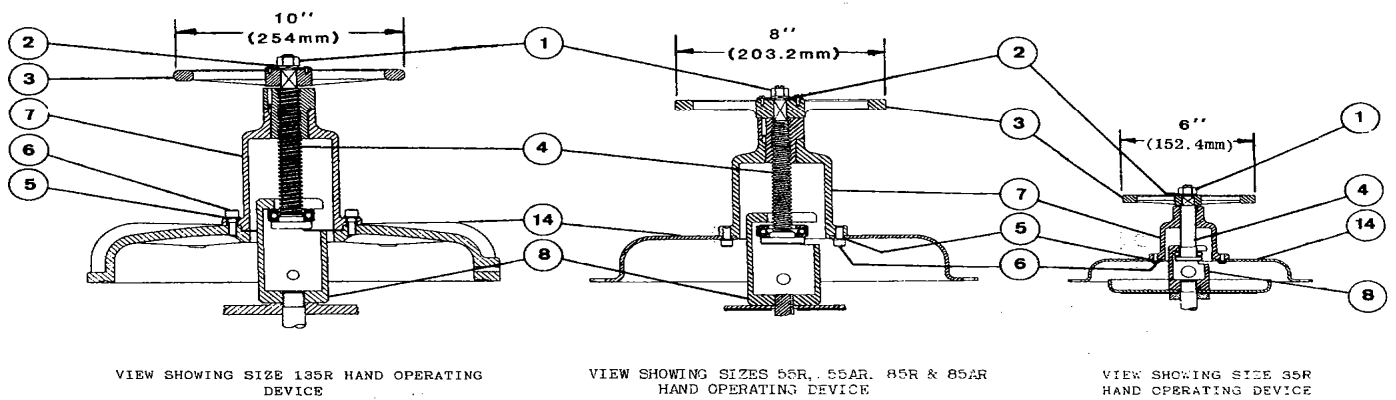


Figure 3 - Reverse Diaphragm Actuator/ HOD

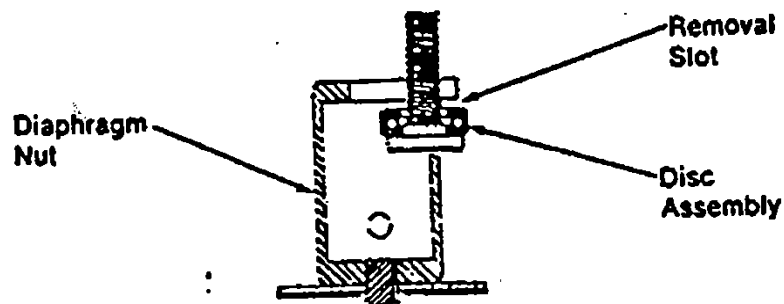


Figure 4 - Disengaging Handscrew Disc from Nut

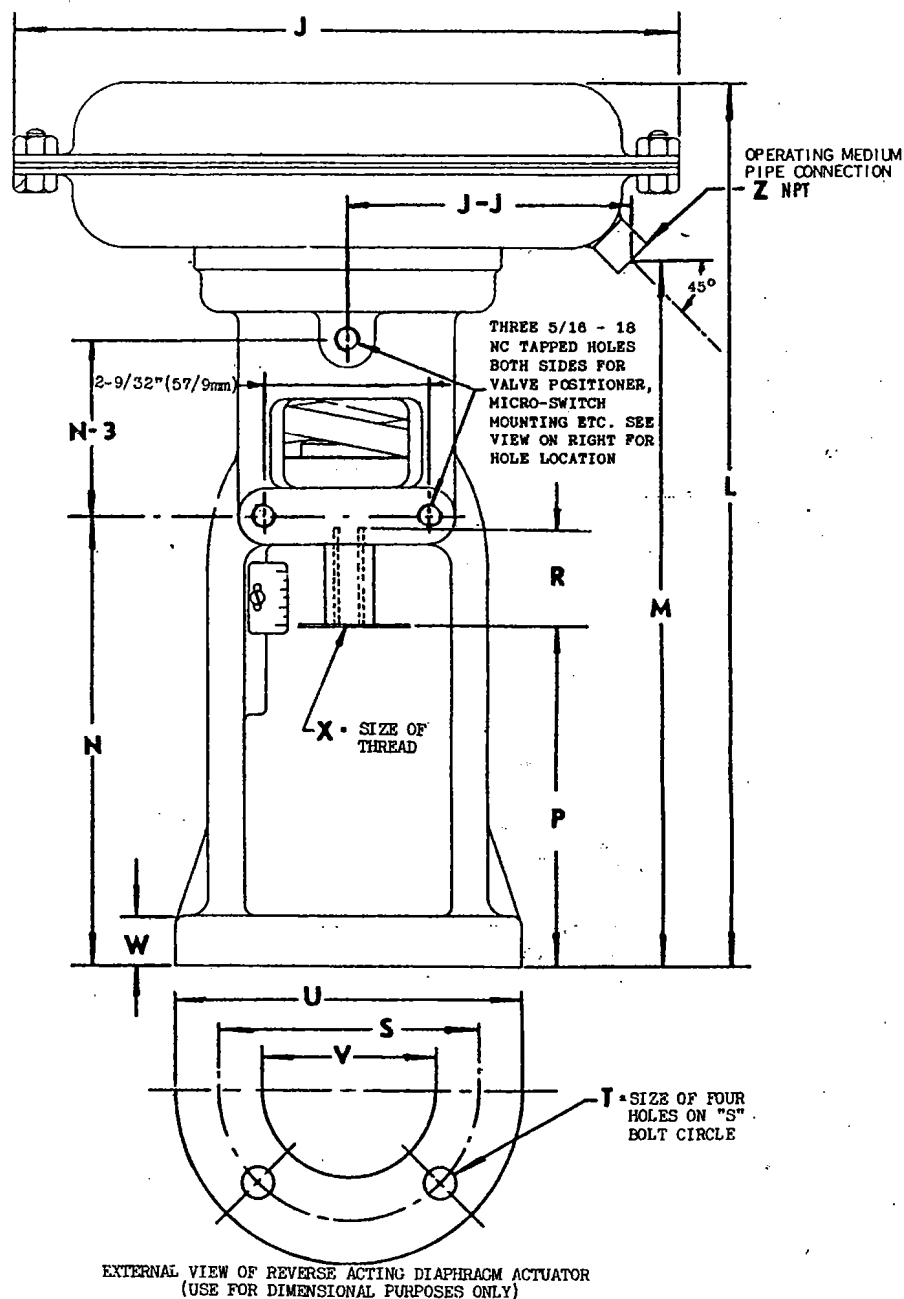


Figure 5 - External View of Reverse Acting Diaphragm Actuator

## DIAPHRAGM ACTUATORS – REVERSE ACTING

DIMENSIONS IN INCHES AND MILLIMETERS																				
ACTUATOR SIZE		MAX TRAVEL	J	L	M	J-J	N	N-2	N-3	P	R	S	T	U	V	W	X	Z	NET WT**	
																			IRON	ALUM.
35R	in	¾	9-1/4	12-3/8	9-7/8	3-15/16	6-1/4	2-1/2	2-1/2	4	1-3/4	3-13/16	9/16	4-13/16	2.687	11/16	3/8-24	¼ NPT	30 lb	20 lb
	mm	19.0	235.0	314.3	250.8	100.0	158.8	63.5	63.5	101.6	44.5	96.8	14.3	122.2	68.2	17.5			15.9 kg	9.1 kg
55R	in	1-1/2	12	18	14-1/4	5-1/16	6-7/8	2-1/2	3	4	1-3/4	3-13/16	9/16	4-13/16	2.687	1	3/8-24	¼ NPT	60 lb	30 lb
	mm	38.1	304.8	457.2	362.0	128.6	174.6	63.5	76.2	101.6	44.5	96.8	14.3	122.2	68.2	25.4			27.2 kg	13.6 kg
55AR	in	1-1/2	12	18	14-1/4	5-1/16	6-7/8	2-1/2	3	4	1-3/4	3-13/16	9/16	4-13/16	2.687	1	½-20	¼ NPT	60 lb	30 lb
	mm	38.1	304.8	457.2	362.0	128.6	174.6	63.5	76.2	101.6	44.5	96.8	14.3	122.2	68.2	25.4			27.2 kg	13.6 kg
85R	in	2-1/8	14-3/4	23-1/4	18-3/4	6-1/4	8-9/16	2-1/2	4-1/8	4-5/16	2-1/4	3-13/16	9/16	4-13/16	2.687	1-1/4	½-20	¼ NPT	117 lb	54 lb
	mm	54.0	374.7	590.6	476.3	158.8	217.5	63.5	104.8	109.5	57.2	96.8	14.3	122.2	68.2	31.8			53.1 kg	24.5 kg
85R*	in	2-1/8	14-3/4	23-7/8	19-3/8	6-1/4	9-3/16	2-1/2	4-1/8	4-15/16	2-1/4	4-3/4	11/16	6	3.500	1-5/16	½-20	¼ NPT	120 lb	56 lb
	mm	54.3	374.7	606.4	492.1	158.8	233.4	63.5	104.8	125.4	57.2	120.7	17.5	152.4	88.9	33.3			54.4 kg	25.4 kg
85AR	in	2-1/8	14-3/4	25-7/8	21-3/8	6-1/4	11-1/8	2-1/2	4-1/8	5-9/16	3-1/8	4-3/4	11/16	6	3.500	1-5/16	¾-16	¼ NPT	123 lb	59 lb
	mm	54.0	374.7	657.2	542.9	158.8	282.6	63.5	104.8	141.3	79.4	120.7	17.5	152.4	88.9	33.3			55.8 kg	26.8 kg
135R	in	3	18	32-1/4	28-3/8	9	11-1/8	2-1/2	5-5/8	5-9/16	3-1/8	4-3/4	11/16	6	3.500	1-5/16	¾-16	3/8 NPT	197 lb	155 lb
	mm	76.2	457.2	819.2	720.7	228.6	282.6	63.5	142.9	141.3	79.4	120.7	17.5	153.4	88.9	33.3			89.4 kg	70.3 kg
135R (1-1/4)	in	3	18	32-1/4	28-3/8	9	11-1/8	2-1/2	5-5/8	5-9/16	3-1/8	5-3/4	11/16	7	4.500	1-5/16	¾-16	3/8 NPT	197 lb	155 lb
	mm	76.2	457.2	819.2	720.7	228.6	282.6	63.5	142.9	141.3	79.4	146.1	17.5	177.8	114.3	33.3			89.4 kg	70.3 kg

DIMENSIONS IN INCHES AND MILLIMETERS														
ACTUATOR SIZE	MAX TRAVEL	N-1	N-2	N-3	P	R	S	T	U	V	W	X	NET WT** Lb/kg	NET WT** W/H.O.D. lb/kg
270R (in)	3	11-1/8	2-1/2	5-5/8	5-9/16	3-1/8	4-3/4	11/16	6	3,500	1-5/16	¾-16	288 lb	300 lb
270R (mm)	76.2	282.6	63.5	142.9	141.3	79.4	120.7	17.5	152.4	88.9	33.3	NPT	130.6 kg	136.1 kg

Table 5 - Reverse Acting Actuators Dimensions

\*Mounting Flange Dimensions same as 135 ( R ) Yoke.

\*\* Approximate

# REVERSE ACTING PARTS LIST

WHEN ORDERING PARTS, PLEASE GIVE PART NAME AND PART REFERENCE NUMBER FROM TABLE BELOW.  
USE PART NUMBER ONLY TO LOCATE PART ON DRAWING.

PART NO.	PART NAME	MATERIAL	QTY. PER UNIT	REF. NOS.	EACH SIZE
1	Nut	Steel	1	13248	13248 8676
2	Lockwasher	Steel	1	10392	10392 10513
3	Handwheel, Complete	Cast Aluminum	1	43064	42226 42227
4	Handscrew Bearing Assy.	Stainless Steel	1	48043	51456 42183
5	Lockwasher	Steel	(NOTE 3)	11467	13077 10392
6	Screw	Stainless Steel	(NOTE 3)	17186	41933 40090
7	Bonnet, Complete (NOTE 4)	(NOTE 1)	1	38720	42224 42225
7	Bonnet, Complete (NOTE 5)	(NOTE 2)	1	38077	42224 42225
8	Diaphragm Nut	Steel	1	38696	42220 41793
14	Diaphragm Case, Upper	Pressed Steel	1	38748	41788 41787
14	Diaphragm Case, Upper (4)	Cast Iron	1	-	- 42145
14	Diaphragm Case, Upper (5)	Cast Aluminum	1	-	- 42144

NOTE 1 - Material is Cast Iron for 35R Iron Actuator and Cast Aluminum for 55R, 55AR, 85R, 85AR & 135R Iron Actuators.

NOTE 2 - Material is Cast Bronze for 35R Aluminum Actuator and Cast Aluminum for 55R, 55AR, 85R, 85AR & 135R Aluminum Actuators.

NOTE 3 - Quantities are: Four (4) for 35R Actuator and Six (6) for 55R, 55AR, 85R, 85AR & 135R Actuator.

NOTE 4 - Used on Cast Iron Actuators only.

NOTE 5 - Used on Cast Aluminum Actuators only.

PART NO.	PART NAME	MATERIAL	QTY. PER UNIT	REFERENCE NUMBER - EACH SIZE									
				35R	55R	55AR	85R	85AR	85R* (135)	135R	135R WITH 1-1/4 STEM		
15	Diaphragm Case, Upper	Pressed Steel	1	38392	37832	37832	37833	37833	37833	37833	36194	36194	36194
15	Diaphragm Case, Upper	Cast Iron	1	-----	-----	-----	-----	-----	-----	-----	36189	36189	36189
15	Diaphragm Case, Upper	Cast Aluminum	1	-----	-----	-----	-----	-----	-----	-----	36228	36228	36228
16	Nut	Steel	1	24005	36229	36229	36229	36229	36229	36229	36228	36228	36228
17	Diaphragm Disc	Steel	1	13901	26585	26585	26585	26585	26585	26585	26585	26585	26585
18	Nut	(NOTE 6)	1	38420	37707	37707	37707	37707	37707	37707	24313	24313	24313
19	Bolt	Synthetic Rubber	1	38400-94	37809-94	37809-94	37818-94	37818-94	37818-94	37818-94	36026-94	36026-94	36026-94
20	Diaphragm	Pressed Steel	1	38391	37774	37774	38081	38081	38081	38081	-----	-----	-----
21	Diaphragm Case, Lower	Cast Iron	1	-----	-----	-----	-----	-----	-----	-----	23940	23940	23940
21	Diaphragm Case, Lower	Cast Aluminum	1	-----	-----	-----	-----	-----	-----	-----	34713	34713	34713
22	Collar, Comp. (NOTE 4)	(NOTE 11)	1	38412	37760	37760	38113	38113	38113	38113	28268	28268	28268
23	Cap Screw	Steel	1	38420	37796	37796	23400	23400	23400	23400	-----	-----	-----
24	Nut, Spacer Stud	Steel	6	-----	-----	-----	-----	-----	-----	-----	3676	3676	3676
26	Diaphragm Base Gasket	Synthetic Rubber	1	37761	37761	37761	38107	38107	38107	38107	-----	-----	-----
27	Stem Seal Ring	Steel	1	37731	37731	37731	37731	37731	37731	37731	-----	-----	-----
28	Screw	Stainless Steel	6	30501	30501	30501	30501	30501	30501	30501	-----	-----	-----
29	Stem Seal	Synthetic Rubber	1	38417	37740-95	37740-95	37740-95	37740-95	37740-95	37740-95	28135	28135	28135
30	Top Spring Seat	Viton Replacement (NOTE 9)	1	-----	58045	58045	58045	58045	58045	58045	-----	-----	-----
31	Stem Seal Collar	Cold Rolled Steel	1	38416	28177	28177	28177	28177	28177	28177	28270	28270	28270
32	Spacer Stud	Steel	6	-----	-----	-----	-----	-----	-----	-----	28154	28154	28154
33	Spacer	Cast Iron	1	-----	-----	-----	-----	-----	-----	-----	28267	28267	28267
33	Spacer	Cast Aluminum	1	-----	-----	-----	-----	-----	-----	-----	34731	34731	34731
34	Yoke	Cast Iron	1	38343	37728	37728	37973	37973	37973	37973	34855	34855	34855
34	Yoke	Cast Aluminum	1	38940	37727	37727	37972	37972	37972	37972	34702	34702	34702
35	Upper Stem	Stainless Steel	1	38406	37759	37759	38085	38085	38085	38085	30254	30254	30254
36	Adjusting Spring	Steel, Black Japanned	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
37	Inner Adjusting Spring	Steel, Black Japanned	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
38	Washer, Inner Adj. Spring	(NOTE 10)	1	-----	-----	-----	25393	25393	25393	25393	25394	25394	25394
39	Washer	Stainless Steel	1	38401	23260	23260	24271	24271	24271	24271	23951	23951	23951
40	Adjusting Nut	(NOTE 4)	1	38395	31641	31641	28174	28174	28174	28174	28265	28265	28265
40	Adjusting Nut	(NOTE 5)	1	58350	30623	30623	31592	31592	31592	31592	30056	30056	30056
41	Indicator Disc	Stainless Steel	1	38406	38920	15672	38921	38921	38921	38921	38922	38922	38922
42	Indicator Scale	Aluminum	1	38404	-----	-----	-----	-----	-----	-----	-----	-----	-----
43	Screw	Steel, Plated	1	34728	34728	34728	34728	34728	34728	34728	34728	34728	34728
45	Washer	Steel	1	39784	-----	-----	-----	-----	-----	-----	-----	-----	-----

NOTE 4 - Used on Cast Iron Actuators only.

NOTE 5 - Used on Cast Aluminum Actuators only.

NOTE 6 - Material is Steel for the 35R, 55R, 85R and 85AR Iron and Aluminum Actuators and 135R Aluminum Actuator and.

NOTE 7 - Quantities are: Twelve (12) for the 35R size, Fourteen (14) for the 55R & 55AR sizes, Sixteen (16) for the 85R & 85AR sizes and Twenty-four (24) for the 135R size Actuator.

NOTE 8 - Quantities are: Eight (8) for the 35R, 55R & 55AR sizes and Six (6) for the 85R and 85AR size Actuators.

NOTE 9 - Material is Steel for the 55R & 55AR, Ref. No. 37802; Cast Iron for the 85R & 85AR Iron Actuator, Ref. No. 38116 and Cast Aluminum for the 85R & 85AR Aluminum Actuator, Ref. No. 38117.

NOTE 10 - Used only when Inner Adjusting Spring, Part No. 37, is used.

NOTE 11 - Material is Steel for 35R Iron and Aluminum Actuators, Aluminum Alloy for 55R, 55AR, 85R & 85AR Aluminum and Iron Actuators, Cast Iron for 135R Iron Actuator and Stainless Steel for 135R Aluminum Actuator.

NOTE 12 - Quantity is One (1) for 35R size and Two (2) for all other size Actuators.

\*Mounting Flange dimensions same as 135R Yoke. Size 85R is completely interchangeable with 135R Actuator Trim.

## RECOMMENDED SPARE PARTS

PART NO. 17 DIAPHRAGM DISC					
ACTUATOR SIZE					
VALVE TRAVEL	35R	55R & 55AR	85R & 85AR	IRON	ALUM.
5/8	38351	37683	37686	49247	49239
3/4	38351	37683	37686	49247	49239
7/8	-----	37683	37686	49247	49239
1	-----	37683	37686	28264	34637
1-1/4	-----	42950	38699	28264	34637
1-1/2	-----	37684	38699	28263	34645
2	-----	37685	28262	34646	-----
2-1/8	-----	-----	37685	28262	34646
2-1/4	-----	-----	-----	36075	36070
2-3/4	-----	-----	-----	36075	36070
3	-----	-----	-----	36075	36070

PART NO. 36 ADJUSTING SPRING				
ACTUATOR SIZE				
VALVE TRAVEL	35R	55R & 55AR	85R & 85AR	135R
5/8	38422	41969	35014	-----
3/4	38422	41968	37719	42489
7/8	-----	23239	24299	42489
1	-----	24296	35014	23996
1-1/8	-----	43078	41970	-----
1-1/4	-----	24297	24299	41971
1-1/2	-----	24298	24300	24303
2	-----	-----	24301	42489
2-1/8	-----	-----	42488	41972
2-1/4	-----	-----	-----	24303
2-3/4	-----	-----	-----	23996
3	-----	-----	-----	23996

PART NO. 37 INNER ADJUSTING SPRING				
ACTUATOR SIZE				
VALVE TRAVEL	35R	55R & 55AR	85R & 85AR	135R
5/8	-----	-----	37718	-----
7/8	-----	-----	24481	25399
1	-----	-----	-----	25399
1-1/4	-----	-----	-----	25390
1-1/2	-----	-----	-----	25390

\*\*Springs listed are based on Standard Spring that will give the nearest range to 3-15 psi for the travel indicated. This is based on zero pressure drop through valve. For various pressure drops or ranges, these springs can be interchanged any way in each particular size. Consult Leslie Co. when special range is required.

PART NO. 42 INDICATOR SCALE		SUBJECT TO ACTUATOR MAXIMUM TRAVEL LIMIT	
VALVE TRAVEL	REF. NO.	VALVE TRAVEL	REF. NO.
1/4"	48224	1/4"	38907
3/8"	48048	1/2"	38908
1/2"	48047	1/2"	38909
5/8"	38904	1-1/8"	38910
3/4"	38905	1-3/4"	49641
7/8"	38906	2"	38911
1"	38907	2-1/8"	38912
1-1/8"	38908	2-1/4"	38913
1-1/4"	38909	2-3/4"	38914
1-1/2"	38910	3"	38915
1-3/4"	49641		
2"	38911		
2-1/8"	38912		
2-1/4"	38913		
2-3/4"	38914		
3"	38915		

# TROUBLESHOOTING

<b>Problem</b>	<b>Possible Cause</b>
Equipment not shutting off or it does not appear to be enough force when air is removed from the actuator.	Not enough spring load. Check the spring load by following section on "Setting the Actuator Spring Load".
When air is supplied to the actuator the actuator is not fully stroking or giving enough load.	Check air supply pressure to the requirements of the initial actuator sizing. Check for seal leakage by using a "leak detect solution". Make sure you also check the stem boot seal for reverse acting actuators. Replace seals as necessary.
When air is removed from the actuator the actuator does not return to either the open or closed position.	Check for blockage in equipment. Check for a broken spring.
An air control signal is being sent to the actuator but the actuator does not fully stroke?	Check the bench range of the actuator by reviewing the original specifications for the actuator.
Actuator does not move smoothly	Check that valve packing is not over tightened. Check that spring is not rubbing on sides of spring case.





*It is solely responsibility of system designer and user to select products and materials suitable for their specific application requirements and to ensure proper installation, operation and maintenance of these products. Assistance shall be afforded with selection of materials based on technical information supplied to Leslie Controls Inc.; however, system designer and user retain final responsibility. Designer should consider applicable Codes, material compatibility, product ratings and application details in selection and application. Improper selection, application or use of products described herein can cause personal injury or property damage. If designer or user intends to use product for an application or use other than originally specified, he must reconfirm tat selection is suitable for new operating conditions. Life expectancy for this product defaults to warranty period of sales contract.*