

D^{MM} FORCE

Scotch Yoke Pneumatic Actuators



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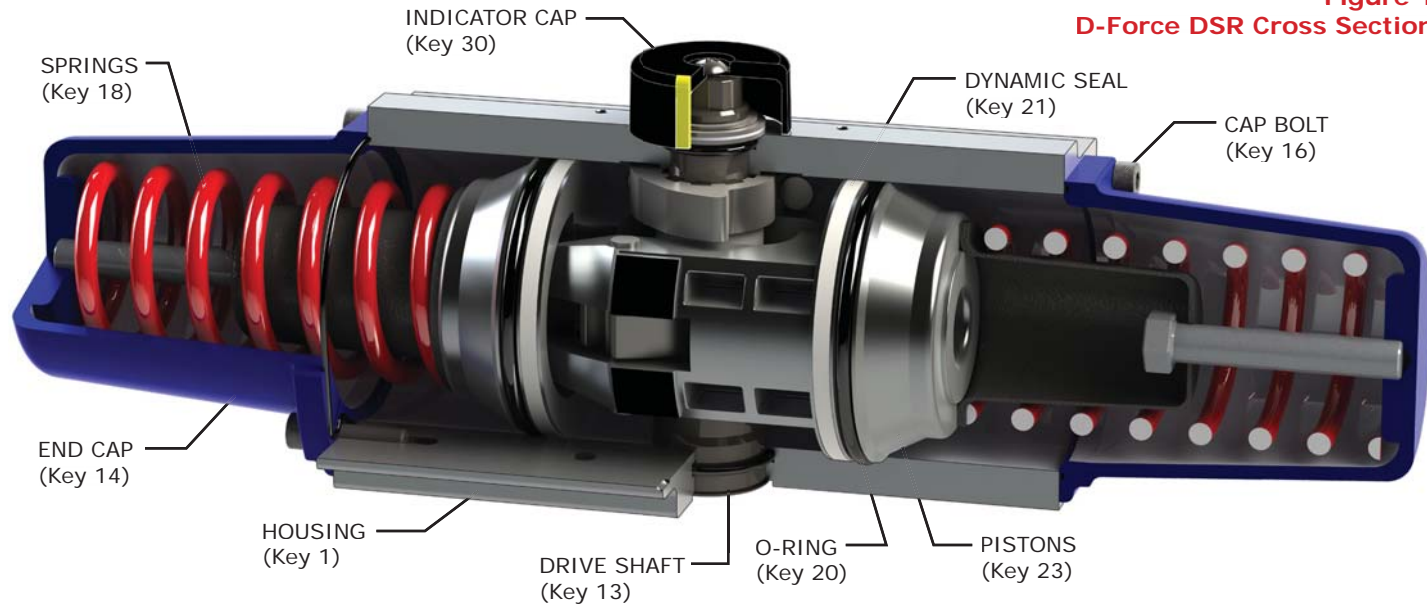


Figure 1
D-Force DSR Cross Section

The Dyna-Flo D-Force actuator is a rugged dual piston scotch yoke actuator designed specifically for automation of quarter turn valves. The torque curve closely matches the requirements of valves that have a lower running torque with higher breakout and re-seat torques. The compact design also makes it a good choice for almost any application where space is limited. Check out the features for more details!

SPECIFICATIONS

Material Temperature Capabilities

Standard: -40 – 230°F (-40 – 110°C)
High Temperature: 32 – 356°F (0 – 180°C)

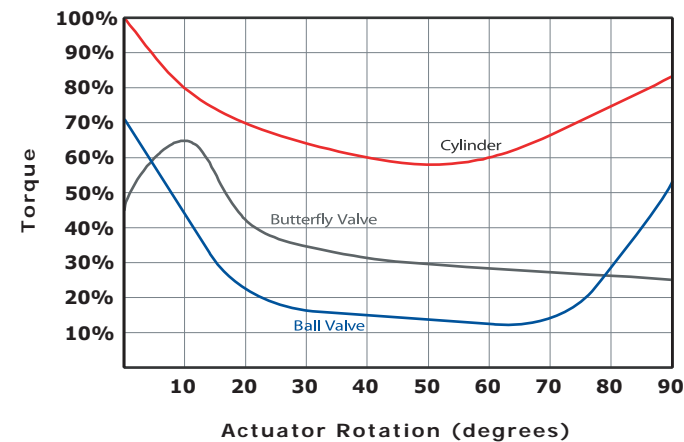
Pressure Range

40 Psi – 143 Psi (276 kPa – 986 kPa)
Maximum Working Pressure: 143 Psi (986 kPa)

Tubing Connection Size

1/4 inch NPT

Figure 2
Torque Curve Chart



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FEATURES

Configuration

D-Force actuators are available in a double acting (DDA) and spring return (DSR) configuration.

Multiple Operating Ranges

The D-Force series of actuator provides for multiple operating ranges from 40 Psi to 143 Psi.

Compact Design

D-Force actuators are smaller than rack and pinion actuators of the same or higher torque.

Superior Construction

These actuators are constructed with hard anodized aluminum housing for long cylinder life and corrosion resistance.

Splined Shaft

D-Force actuators are constructed using one piece splined drive shafts designed for blow-out prevention.

Standard and High Temperature Configurations

Both the double acting (DDA) and spring return (DSR) D-Force models are available in a high temperature configuration. Refer to Page 2 for temperature options.

Externally Adjustable Travel Stops

All D-Force travel stops are easily accessible from the outside of the actuator without the need to remove a panel or cover.

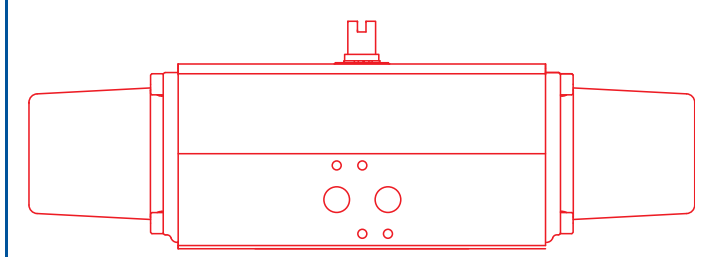
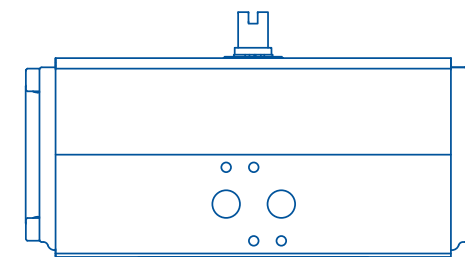
Torque Ranges

DDA and DSR model actuators offer a wide variety of torque ranges. For more information on torque ranges, see pages 8 and 9.

High Quality Standards

All D-Force actuators are manufactured to the same quality standards that can be expected from all Dyna-Flo products.

AVAILABLE MODELS AND SIZES



Model DDA50	Model DDA125	Model DSR50	Model DSR125
Model DDA65	Model DDA140	Model DSR65	Model DSR140
Model DDA80	Model DDA160	Model DSR80	Model DSR160
Model DDA100	Model DDA210	Model DSR100	Model DSR210
Model DDA250		Model DSR250	

Table 1

D-Force Double Acting (DDA) and Spring Return (DSR) Approximate Actuator Weight lb (kg)

Model	Actuator Size								
	50	65	80	100	125	140	160	210	250
DDA	3.1 (1.4)	5.1 (2.3)	8.6 (3.9)	14.8 (6.7)	24.9 (11.3)	36.2 (16.4)	52.2 (23.7)	100.3 (45.5)	145.1 (65.8)
DSR	3.5 (1.6)	6.6 (3.0)	11.7 (5.3)	20.9 (9.5)	38.8 (17.6)	52.7 (23.9)	80.7 (36.6)	170.2 (77.2)	263.7 (119.6)

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Table 2

Actuator Air Consumption in³/Stroke

Double Acting (DDA) $V = \frac{(B + A) \times (P + 14.7)}{14.7}$	Formula Breakdown V = Air Consumption (in ³) P = Supply Air Pressure (Psig) A = Volume "A" (in ³) B = Volume "B" (in ³)
Spring Return (DSR) $V = \frac{B \times (P + 14.7)}{14.7}$	

Figure 3 - Cylinder Volume Diagrams

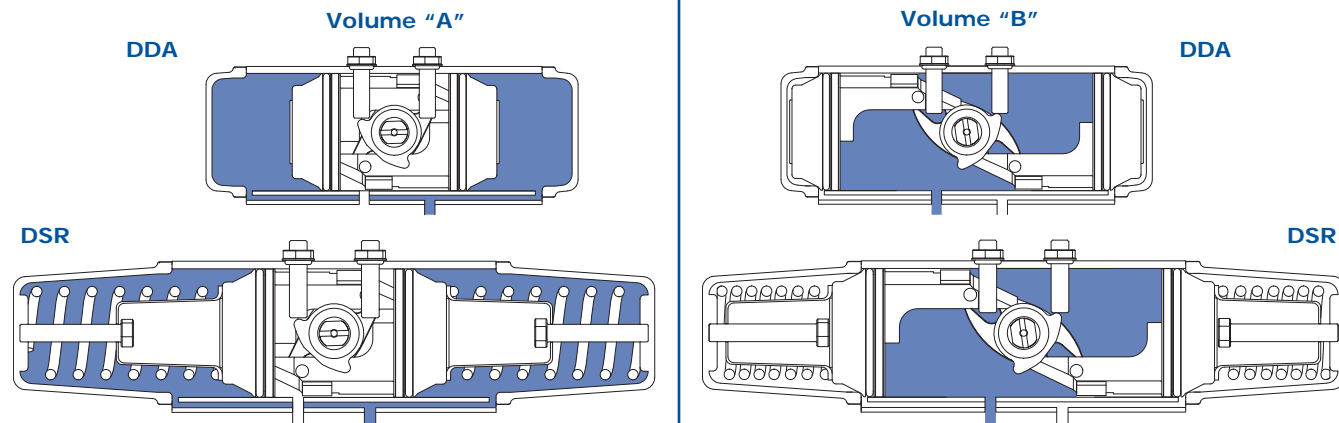


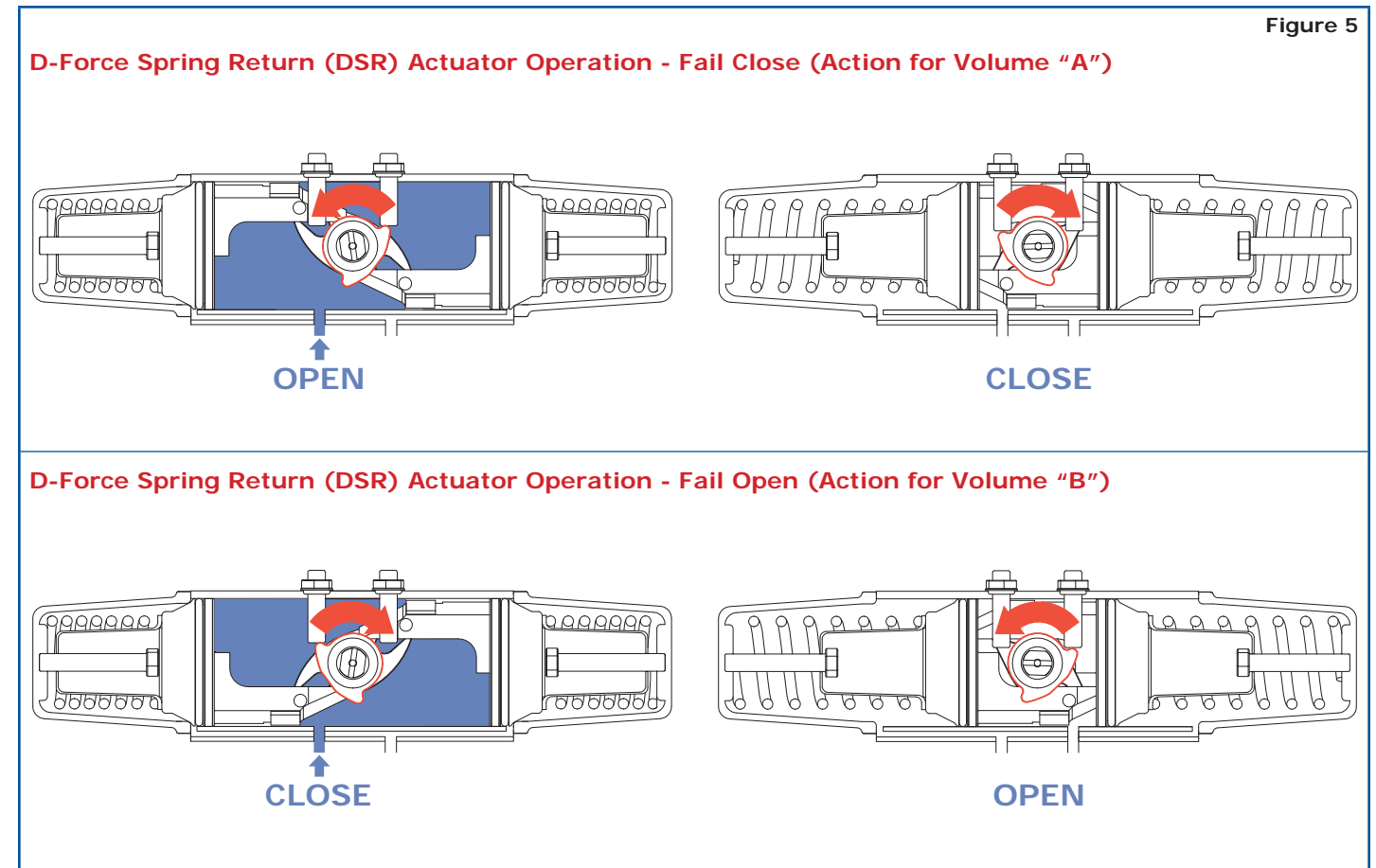
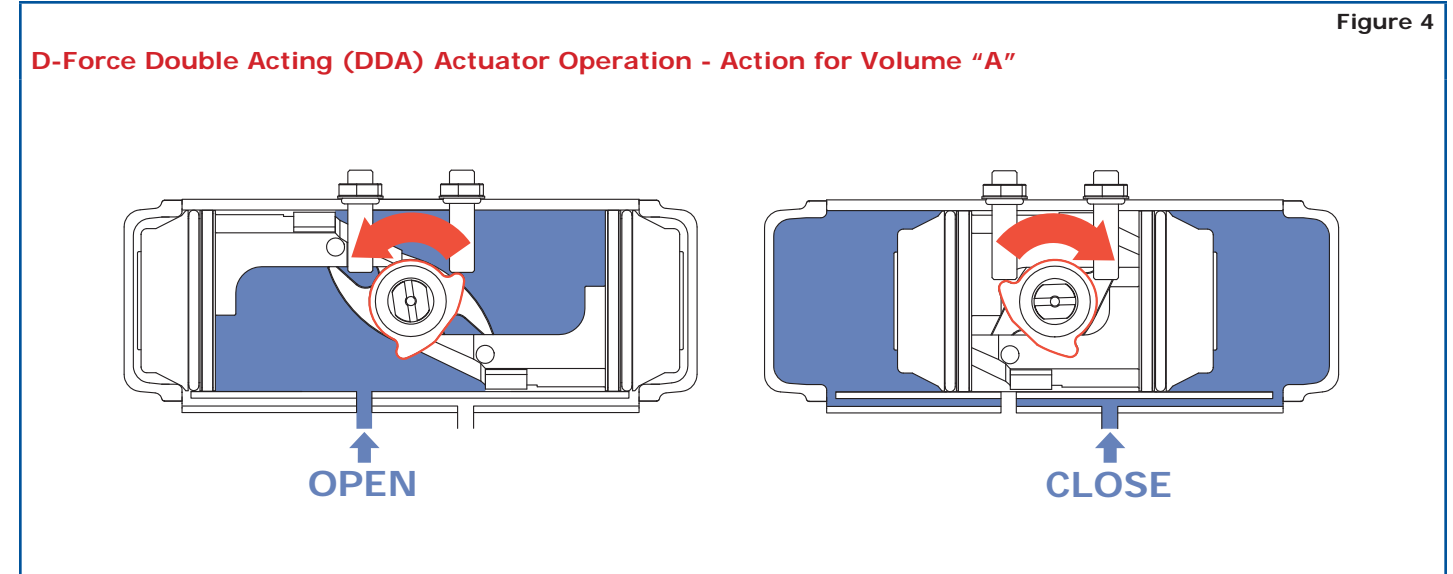
Table 3

D-Force Air Volume Per Stroke at 14.7 PSIA (101.3 kPa)
 For compressed air volume consumption use the above formula.

Model Size	Double Acting (DDA)		Spring Return (DSR)
	Volume "A"	Volume "B"	Volume "B"
50	12.2 (0.2)	12.2 (0.2)	12.2 (0.2)
65	18.3 (0.3)	18.3 (0.3)	18.3 (0.3)
80	30.5 (0.5)	36.6 (0.6)	36.6 (0.6)
100	67.1 (1.1)	73.2 (1.2)	73.2 (1.2)
125	134.3 (2.2)	152.6 (2.5)	152.6 (2.5)
140	213.6 (3.5)	238.0 (3.9)	238.0 (3.9)
160	262.4 (4.3)	292.9 (4.8)	292.9 (4.8)
210	604.1 (9.9)	378.3 (6.2)	378.3 (6.2)
250	781.1 (12.8)	488.2 (8.0)	488.2 (8.0)

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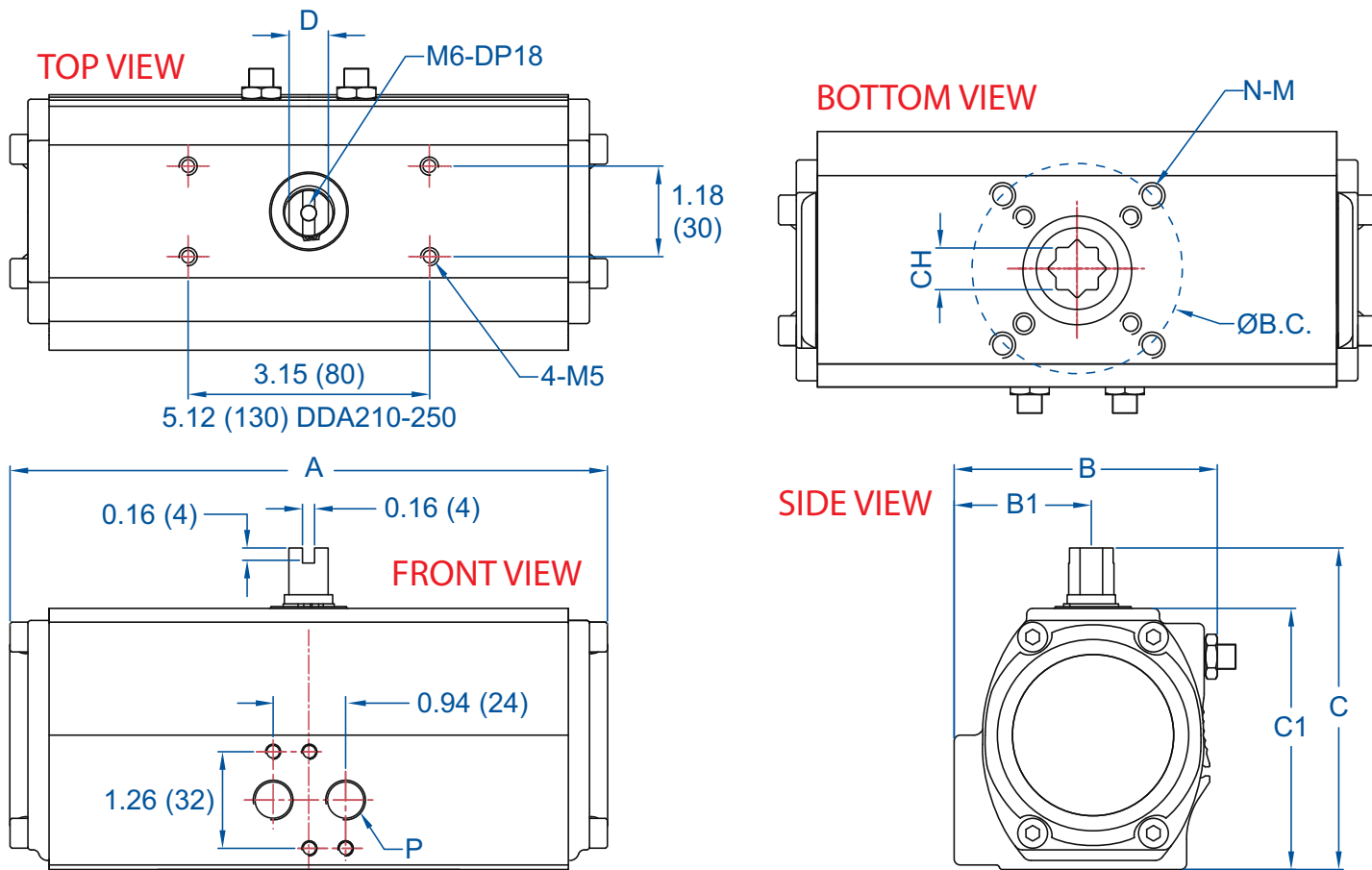


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Figure 6 - Double Acting (DDA) Actuator Dimensions



Model	P
DDA50 - DDA210	PT 1/4
DDA250	PT 1/4 (Std.)
	PT 3/8
	PT 1/2

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Table 4

Double Acting (DDA) Actuator Dimensions Inch (mm)											
Model	A	B	B1	C	C1	D	ISO	N-M	Ø B.C.	CH	CH DEPTH
50	6.38 (162)	2.95 (75)	1.57 (40)	3.54 (90)	2.76 (70)	0.35 (9)	F03/F05/F07*	4-M5/M6/M8*	1.42/1.97/2.76* (36/50/70)	0.43 (11)	0.51 (13)
										0.55 (14)	0.55 (14)
										0.59 (15)	0.55 (14)
65	7.95 (202)	3.50 (89)	1.81 (46)	4.21 (107)	3.43 (87)	0.51 (13)	F05/F07*	4-M6/M8*	1.97/2.76* (50/70)	0.55 (14)	0.67 (17)
										0.67 (17)	0.67 (17)
										0.59 (15)	0.55 (14)
80	10.31 (262)	3.98 (101)	1.95 (49.5)	4.96 (126)	4.17 (106)	0.51 (13)	F07	4-M8	2.76 (70)	0.67 (17)	0.75 (19)
										0.75 (19)	0.79 (20)
100	12.24 (311)	5.08 (129)	2.42 (61.5)	5.83 (148)	5.04 (128)	0.75 (19)	F07/F10*	4-M8/M10*	2.76/4.02* (70/102)	0.87 (22)	1.02 (26)
125	15.35 (390)	5.94 (151)	2.81 (71.5)	6.85 (174)	6.06 (154)	0.75 (19)	F07/F10*	4-M8/M10*	2.76/4.02* (70/102)	0.87 (22)	1.02 (26)
140	16.97 (431)	6.46 (164)	3.03 (77)	7.56 (192)	6.77 (172)	0.94 (24)	F10/F12*	4-M10/M12*	4.02/4.92* (102/125)	1.06 (27)	1.18 (30)
										0.87 (22)	
160	19.92 (506)	7.40 (188)	3.50 (89)	8.50 (216)	7.72 (196)	0.94 (24)	F14 (Std.)	4-M16	5.51 (140)	1.42 (36)	1.18 (30)
							F10/F12*	4-M10/M12*	4.02/4.92* (102/125)	1.06 (27)	
210	23.82 (605)	9.09 (231)	4.53 (115)	11.18 (284)	9.99 (254)	1.42 (36)	F16	4-M20	6.50 (165)	1.81 (46)	2.36 (60)
										1.42 (36)	1.97 (50)
250	29.72 (755)	11.38 (289)	5.98 (152)	12.76 (324)	11.57 (294)	1.42 (36)	F16	4-M20	6.50 (165)	1.81 (46)	2.36 (60)

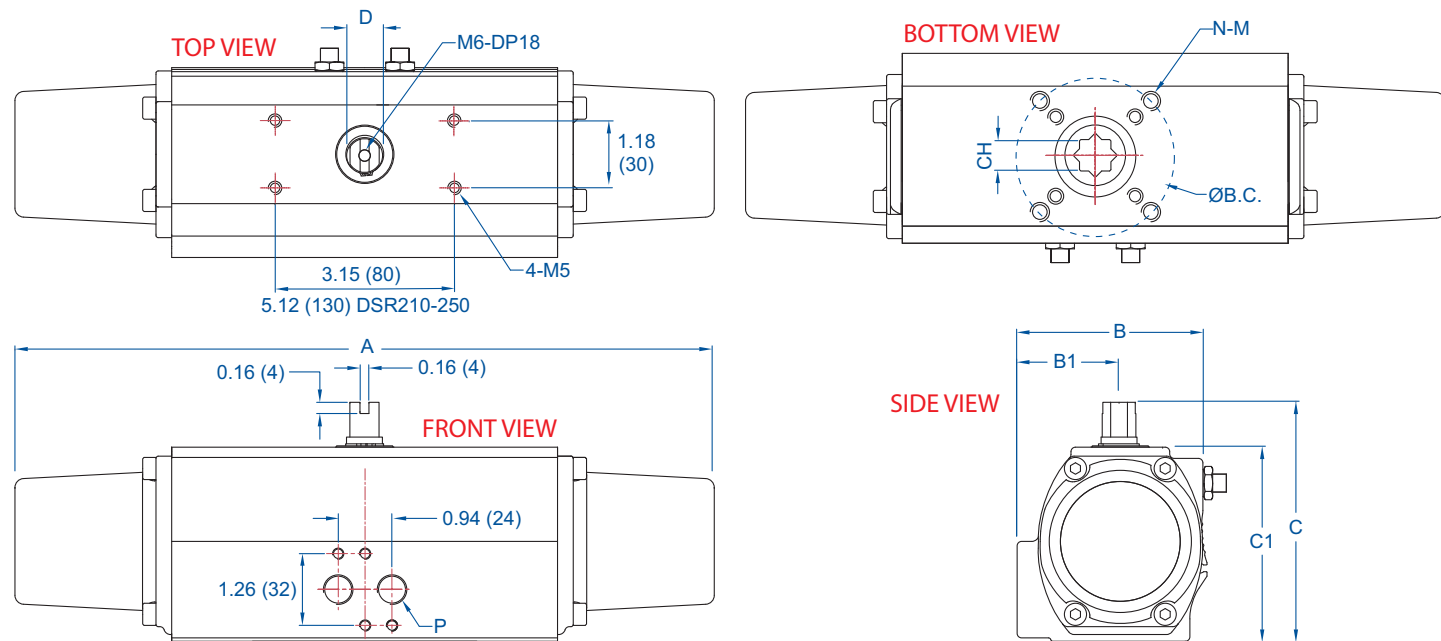
* - These multiple dimensions for mounting holes are all present on the same actuator.

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Figure 7 - Spring Return (DSR) Actuator Dimensions



Model	P
DDA50 - DDA210	PT 1/4
DDA250	PT 1/4 (Std.)
	PT 3/8
	PT 1/2

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Table 5

Spring Return (DSR) Actuator Dimensions Inch (mm)

Model	A	B	B1	C	C1	D	ISO	N-M	Ø B.C.	CH	CH DEPTH
50	10.12 (257)	2.95 (75)	1.57 (40)	3.54 (90)	2.76 (70)	0.35 (9)	F03/F05/F07*	4-M5/M6/M8*	1.42/1.97/2.76* (36/50/70)	0.43 (11)	0.51 (13)
										0.55 (14)	0.55 (14)
										0.59 (15)	0.55 (14)
65	12.36 (314)	3.50 (89)	1.81 (46)	4.21 (107)	3.43 (87)	0.51 (13)	F05/F07*	4-M6/M8*	1.97/2.76* (50/70)	0.55 (14)	0.67 (17)
										0.67 (17)	0.67 (17)
										0.59 (15)	0.55 (14)
80	16.93 (430)	3.98 (101)	1.95 (49.5)	4.96 (126)	4.17 (106)	0.51 (13)	F07	4-M8	2.76 (70)	0.67 (17)	0.75 (19)
										0.75 (19)	0.79 (20)
100	19.68 (500)	5.08 (129)	2.42 (61.5)	5.83 (148)	5.04 (128)	0.75 (19)	F07/F10*	4-M8/M10*	2.76/4.02* (70/102)	0.87 (22)	1.02 (26)
125	23.86 (606)	5.94 (151)	2.81 (71.5)	6.85 (174)	6.06 (154)	0.75 (19)	F07/F10*	4-M8/M10*	2.76/4.02* (70/102)	0.87 (22)	1.02 (26)
140	26.85 (682)	6.46 (164)	3.03 (77)	7.56 (192)	6.77 (172)	0.94 (24)	F10/F12*	4-M10/M12*	4.02/4.92* (102/125)	1.06 (27)	1.18 (30)
										0.87 (22)	
160	30.75 (781)	7.40 (188)	3.50 (89)	8.50 (216)	7.72 (196)	0.94 (24)	F14 (Std.)	4-M16	5.51 (140)	1.42 (36)	1.18 (30)
							F10/F12*	4-M10/M12*	4.02/4.92* (102/125)	1.06 (27)	
210	38.66 (982)	9.09 (231)	4.53 (115)	11.18 (284)	9.99 (254)	1.42 (36)	F16	4-M20	6.50 (165)	1.81 (46)	2.36 (60)
										1.42 (36)	
250	43.62 (1108)	11.38 (289)	5.98 (152)	12.76 (324)	11.57 (294)	1.42 (36)	F16	4-M20	6.50 (165)	1.81 (46)	2.36 (60)

* - * - These multiple dimensions for mounting holes are all present on the same actuator.

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Table 6

D-Force Spring Return (DSR) Torque Table Ibf-in (N-m)

Model	Spring Set	Spring Torque			Supply Air Pressure								
		Spring Start	Run	Spring End	40 Psi (276 kPa)			60 Psi (414 kPa)			80 Psi (556 kPa)		
					Air Start	Run	Air End	Air Start	Run	Air End	Air Start	Run	Air End
50	WW	177 (20.0)	80 (9.0)	89 (10.0)	132 (15.0)	60 (6.75)	67 (7.5)	-	-	-	-	-	-
	SW	230 (26.0)	106 (12.0)	124 (14.0)	-	-	-	195 (22.1)	90 (10.2)	105 (11.9)	-	-	-
	SS	301 (34.0)	133 (15.0)	150 (17.0)	-	-	-	-	-	-	255 (28.9)	113 (12.7)	127 (14.4)
65	WW	345 (39.0)	159 (18.0)	195 (22.0)	258 (39.0)	119 (13.5)	146 (16.5)	-	-	-	-	-	-
	SW	478 (54.0)	204 (23.0)	310 (35.0)	-	-	-	406 (45.9)	173 (19.6)	264 (29.7)	-	-	-
	SS	620 (70.0)	327 (37.0)	425 (48.0)	-	-	-	-	-	-	527 (59.5)	278 (31.4)	361 (40.8)
80	WW	620 (70.0)	266 (30.0)	354 (40.0)	465 (52.5)	199 (22.5)	265 (30.0)	-	-	-	-	-	-
	SW	885 (100.0)	443 (50.0)	531 (60.0)	-	-	-	752 (85.0)	376 (42.5)	451 (51.0)	-	-	-
	SS	1,151 (130.0)	620 (70.0)	708 (80.0)	-	-	-	-	-	-	978 (110.5)	527 (59.5)	601 (68.0)
100	WW	1,239 (140.0)	443 (50.0)	620 (70.0)	929 (105.0)	332 (37.5)	465 (52.5)	-	-	-	-	-	-
	SW	1,682 (190.0)	708 (80.0)	885 (100.0)	-	-	-	1,429 (161.0)	601 (68.0)	752 (85.0)	-	-	-
	SS	2,124 (240.0)	974 (110.0)	1,151 (130.0)	-	-	-	-	-	-	1,805 (204.0)	828 (93.5)	978 (110.5)
125	WW	2,213 (250.0)	1,151 (130.0)	1,328 (150.0)	1,659 (187.5)	863 (97.5)	996 (1,12.5)	-	-	-	-	-	-
	SW	3,363 (380.0)	1,682 (190.0)	2,036 (230.0)	-	-	-	2,858 (323.0)	1,430 (162.0)	1,730 (195.0)	-	-	-
	SS	4,514 (510.0)	2,301 (260.0)	2,655 (300.0)	-	-	-	-	-	-	3,837 (433.5)	1,955 (221.0)	2,256 (255.0)
140	WW	3,275 (370.0)	1,505 (170.0)	1,770 (200.0)	2,456 (277.5)	1,129 (127.5)	1,328 (150.0)	-	-	-	-	-	-
	SW	4,868 (550.0)	2,567 (290.0)	2,655 (300.0)	-	-	-	4,137 (467.5)	2,181 (246.0)	2,257 (255.0)	-	-	-
	SS	6,461 (730.0)	3,009 (340.0)	3,629 (410.0)	-	-	-	-	-	-	5,492 (620.5)	2,557 (289.0)	3,084 (348.5)
160	WW	4,779 (540.0)	2,567(290.0)	3,540 (400.0)	3,584 (405.0)	1,935 (217.5)	2,665 (300.0)	-	-	-	-	-	-
	SW	6,638 (750.0)	3,717 (420.0)	4,868 (550.0)	-	-	-	5,642 (637.0)	3,159 (357.0)	4,137 (467.0)	-	-	-
	SS	10,177 (1149.9)	4,956 (560.0)	6,814 (769.9)	-	-	-	-	-	-	8,650 (977.5)	4,212 (476.0)	5,792 (654.5)
210	WW	10,620 (1199.9)	4,956 (560.0)	5,930 (670.0)	7,965 (900.0)	3,717 (420.0)	4,447 (502.0)	-	-	-	-	-	-
	SW	14,337 (1619.9)	8,319 (939.9)	9,292 (1049.9)	-	-	-	12,187 (1,376.0)	7,071 (798.0)	7,898 (891.6)	-	-	-
	SS	19,205 (2169.9)	11,151 (1259.9)	12,567 (1419.9)	-	-	-	-	-	-	16,324 (2,170.0)	9,478 (1,071.0)	10,682 (1,207.0)
250	WW	17,524 (1979.9)	8,177 (923.9)	9,784 (1105.4)	13,143 (1,485.0)	6,132 (693.0)	7,338 (829.0)	-	-	-	-	-	-
	SW	23,656 (2672.8)	13,727 (1550.9)	15,333 (1732.4)	-	-	-	20,107 (2,271.8)	11,667 (1,317.5)	13,033 (1,472.4)	-	-	-
	SS	31,688 (3580.3)	18,400 (2078.9)	20,736 (2342.8)	-	-	-	-	-	-	26,934 (3,043.0)	15,640 (1,767.0)	17,635 (1,991.5)

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Table 7

D-Force Double Acting (DDA) Torque Table Ibf-in (N-m)

Model	Action	Supply Air Pressure								
		40 Psi (276 kPa)			60 Psi (414 kPa)			80 Psi (552 kPa)		
		Air Start	Run	Air End	Air Start	Run	Air End	Air Start	Run	Air End
50	Air to Open	186 (21.0)	142 (16.0)	221 (25.0)	248 (28.0)	186 (21.0)	336 (38.0)	363 (41.0)	274 (31.0)	460 (52.0)
	Air to Close	257 (29.0)	133 (15.0)	221 (25.0)	327 (37.0)	177 (20.0)	292 (33.0)	372 (42.0)	266 (30.0)	443 (50.0)
65	Air to Open	522 (59.0)	336 (38.0)	460 (52.0)	690 (78.0)	434 (49.0)	637 (72.0)	1,027 (116.0)	646 (73.0)	947 (107.0)
	Air to Close	558 (63.0)	292 (33.0)	478 (54.0)	752 (85.0)	398 (45.0)	637 (72.0)	1,159 (131.0)	602 (68.0)	947 (107.0)
80	Air to Open	929 (105.0)	611 (69.0)	894 (101.0)	1,266 (143.0)	814 (92.0)	1,177 (133.0)	1,859 (210.0)	1,275 (144.0)	1,850 (209.0)
	Air to Close	1,071 (121.0)	575 (65.0)	859 (97.0)	1,452 (164.0)	743 (84.0)	1,151 (130.0)	2,310 (261.0)	1,151 (130.0)	1,752 (198.0)
100	Air to Open	1,646 (186.0)	1,124 (127.0)	1,584 (179.0)	2,186 (247.0)	1,460 (165.0)	2,098 (237.0)	3,257 (368.0)	2,213 (250.0)	3,213 (363.0)
	Air to Close	1,717 (194.0)	974 (110.0)	1,531 (173.0)	2,345 (265.0)	1,301 (147.0)	2,045 (231.0)	3,478 (393.0)	2,098 (237.0)	3,080 (348.0)
125	Air to Open	3,824 (432.0)	2,416 (273.0)	3,319 (375.0)	4,877 (551.0)	3,186 (360.0)	4,346 (491.0)	7,019 (793.0)	4,700 (531.0)	6,479 (732.0)
	Air to Close	3,788 (428.0)	2,257 (255.0)	3,408 (385.0)	5,098 (576.0)	3,000 (339.0)	4,514 (510.0)	7,850 (886.0)	4,540 (513.0)	6,638 (750.0)
140	Air to Open	5,098 (576.0)	2,930 (331.0)	4,629 (523.0)	6,673 (753.9)	4,027 (455.0)	6,373 (720.0)	9,708 (1,096.9)	5,912 (668.0)	8,584 (969.9)
	Air to Close	5,514 (623.0)	2,947 (333.0)	4,602 (520.0)	7,345 (829.9)	3,983 (450.0)	6,098 (689.0)	11,602 (1,310.9)	6,116 (691.0)	9,337 (1,054.9)
160	Air to Open	7,195 (812.9)	5,036 (569.0)	8,664 (978.9)	9,399 (1061.9)	6,708 (757.9)	11,682 (1,319.9)	14,160 (1,599.9)	10,027 (1,132.9)	17,940 (2,026.9)
	Air to Close	8,434 (952.9)	4,779 (540.0)	17,788 (879.9)	10,151 (1146.9)	6,461 (730.0)	10,354 (1,169.9)	15,930 (1,799.9)	9,823 (1,109.9)	15,488 (1,749.9)
210	Air to Open	6,904 (1,909.9)	10,177 (1,149.9)	15,222 (1,719.9)	23,010 (2,599.8)	13,275 (1,499.9)	20,355 (2,299.8)	33,807 (3,819.7)	21,240 (2,399.8)	30,533 (3,449.8)
	Air to Close	9,735 (1,099.9)	9,735 (1,099.9)	14,780 (1,669.9)	12,921 (1,459.9)	12,921 (1,459.9)	20,355 (2,299.8)	34,692 (3,919.7)	20,355 (2,299.8)	29,648 (3,349.8)
250	Air to Open	39,601 (4,474.3)	16,664 (1,882.8)	27,095 (3,061.3)	52,298 (5,908.9)	22,010 (2,486.8)	36,508 (4,124.8)	78,442 (8,862.8)	33,005 (3,729.1)	54,757 (6,186.7)
	Air to Close	37,294 (4,213.7)	15,694 (1,773.2)	28,771 (3,250.7)	50,247 (5,677.1)	21,146 (2,389.2)	37,998 (4,293.2)	75,366 (8,515.2)	31,711 (3,582.9)	56,993 (6,439.3)

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Table 9

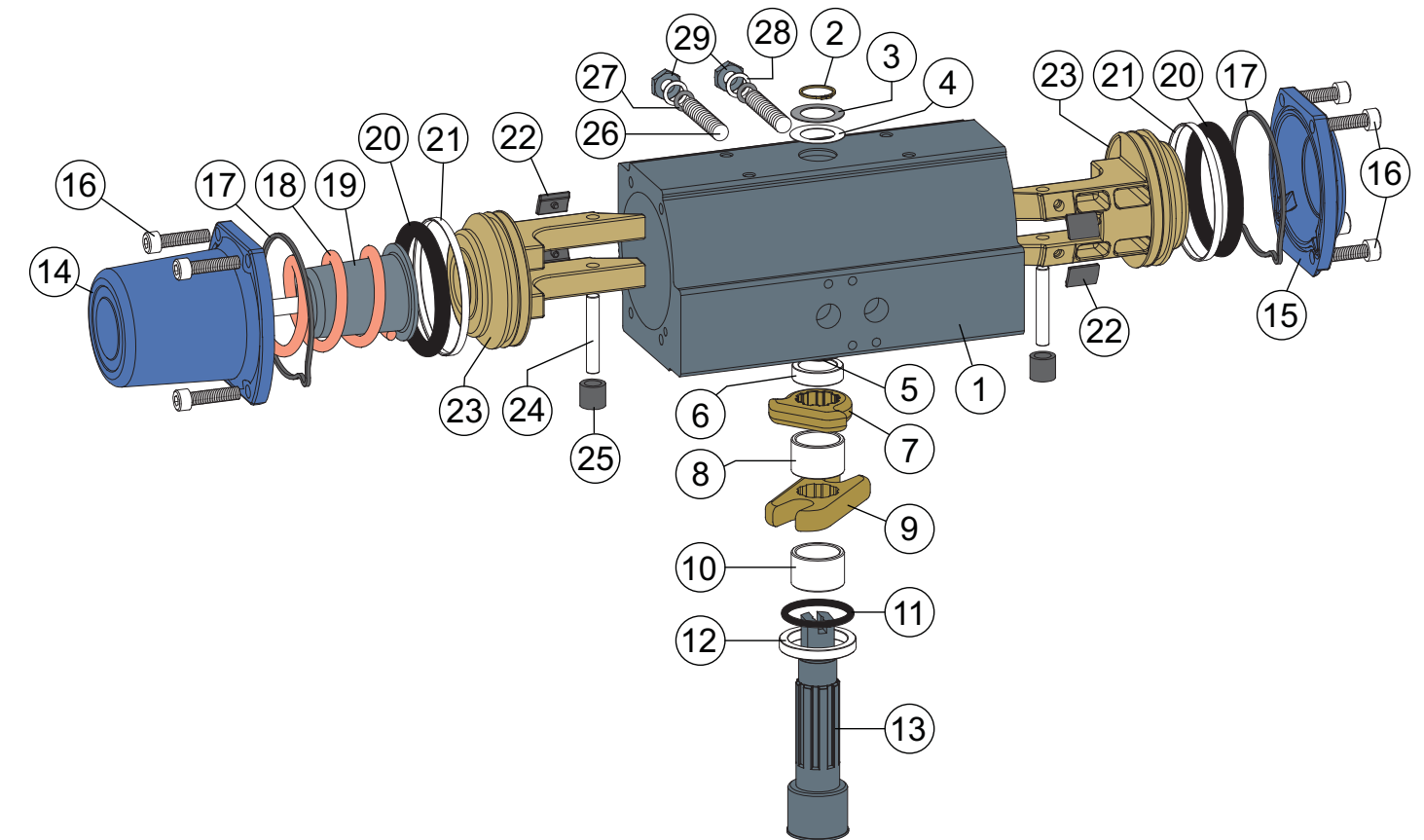
D-Force Model DDA and DSR Parts and Materials

Key	Description	Material
1	Housing	Extruded Aluminum Alloy (Hard Anodized)
2	Body Snap Ring	Zinc Plated Steel Alloy
3	Top Washer (Housing)	Zinc Plated Steel Alloy
4	Bottom Washer (Housing)	Zinc Plated Steel Alloy
5	Top O-Ring (Housing)	NBR (Buna) Std. / EPDM / Viton
6	Top Bearing (Housing)	Engineering Plastic
7	Stopper	Steel Alloy
8	Top Shaft Roller	Engineering Plastic
9	Crank	Steel Alloy
10	Bottom Shaft Roller	Engineering Plastic (Cast Aluminum for DDA 100 to 160)
11	Bottom O-Ring (Housing)	NBR (Buna) / EPDM / Viton
12	Bottom Bearing (Housing)	Engineering Plastic
13	Shaft	Steel Alloy
14	End Cap (DSR)	Cast Aluminum
15	End Cap (DDA)	Cast Aluminum
16	Cap Bolt	Steel Alloy
17	Cap O-Ring	NBR (Buna) / EPDM / Viton
18	Spring (DSR)	High Alloy Spring Steel
19	Spring Cap (DSR)	Engineering Plastic
20	Piston O-Ring	NBR (Buna) / EPDM / Viton
21	Piston Guide Ring	Engineering Plastic
22	Piston Pad	Engineering Plastic
23	Piston	Cast Aluminum
24	Piston Pin	Steel Alloy
25	Piston Roller	Steel Alloy
26	Adjustment Bolt	Steel Alloy
27	Adjustment O-Ring	NBR (Buna) / EPDM / Viton
28	Adjustment Washer	Stainless Steel
29	Adjustment Nut	Stainless Steel
30	Indicator Cap	Plastic

Scotch Yoke Pneumatic Actuators

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Figure 8
Model DDA and DSR
Exploded View Valve Assembly





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