

# EL-O-Matic F-Series

## Rack and Pinion Pneumatic Actuators

- High quality and economical actuator
- Improve plant and operator safety
- Reliable and flexible in process control
- Increase serviceability





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## General Specifications

### Torque Range

- Double-Acting: 119 to 38510 lbf.in (13.4 to 4338 Nm) at 80psig (5.5 barg)
- Spring-Return: 41 to 15867 lbf.in (5 to 1793 Nm) spring end torque at maximum spring set.

### Pressure Range

- Double-Acting:
  - 2.9 to 120 psig (0.2 to 8.3 barg)
- Spring-Return:
  - 87 to 120 psig (6 to 8.3 barg), with maximum spring set
  - 43.5 to 120 psig (3 to 8.3 barg), reduced spring quantity

### Pressure Media

- Air, dry or lubricated and inert gases
- Dew point at least 10K below ambient temperature
- For sub-zero applications, take appropriate measures
- Mentioned pressure levels are "gauge pressures". Gauge pressure is equal to absolute pressure minus atmospheric pressure.

### Cycle life

- Normal working life is 500,000 cycles according EN15714-3, where 1 cycle is 1 open stroke and 1 close stroke.

### Finish

- Body: Chromated and polyurethane powder coated
- End caps: Chromated and polyurethane powder coated
- Pistons: Chromated
- Pinion: Hard Anodized
- Fasteners: Stainless steel or Deltatone® coated

### Lubrication

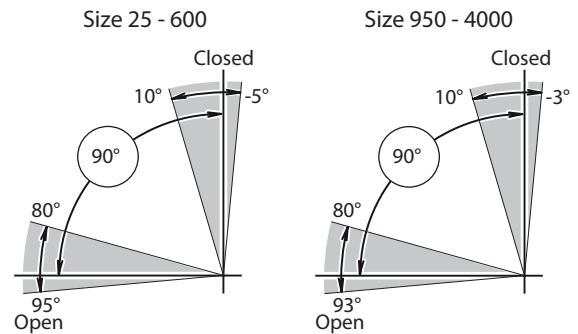
- Castrol High Temperature grease (or equivalent)

### Temperature Range

- Standard: -4°F to 176°F (-20°C to +80°C)
- Option:
  - Low temperature: -40°F to 176°F (-40°C to +80°C)
  - High temperature: +14°F to 250°F (-10°C to +120°C)

### Angle of Rotation

- Factory set at 90°
- Adjustable range:
  - Size 25 to 600: -5° to +10° and +80° to 95°
  - Size 950 to 4000: -3° to +10° and +80° to 93°



### Compliance to International Standards

- Valve flange: ISO 5211/DIN3337
- Solenoid flange: VDE/VDI 3845 (NAMUR)
- Accessory flange: VDE/VDI 3845 (NAMUR)
- European Directives: ATEX, PED and Machinery Directive.
- For RoHS2 compliance contact your nearest Emerson representative.
- SIL 3 rated according to IEC 61508-1-7:2010
- EAC Customs union: Compliance to Russian TR010 and TR012

**Actuator Weight**

Actuator Model	Double Acting		Spring Return Springset N=6	
	lbs	Kg	lbs	Kg
F 12	1.3	0.6	1.5	0.7
F 25	3.1	1.4	3.5	1.6
F 40	4.6	2.1	5.1	2.3
F 65	6.2	2.8	7.3	3.3
F 100	7.7	3.5	9.5	4.3
F 150	10.8	4.9	14.6	6.6
F 200	13.2	6.0	18.3	8.3
F 350	22	10.2	32	14.5
F 600	44	20	57	26
F 950	58	26	89	41
F 1600	91	41	137	62
F 2500	141	64	221	100
F 4000	226	103	325	147

**Cycle time in seconds**

Actuator Model	Spring Return		Double acting	
	Opening Stroke	Closing Stroke	Opening Stroke	Closing Stroke
F 12	0.4	0.4	0.4	0.4
F 25	0.5	0.4	0.5	0.4
F 40	0.6	0.5	0.6	0.5
F 65	0.7	0.5	0.6	0.6
F 100	0.8	0.6	0.8	0.7
F 150	1.0	0.8	0.9	0.8
F 200	1.3	0.9	1.0	1.0
F 350	1.9	1.3	1.4	1.5
F 600	3.2	1.9	2.2	2.2
F 950	6.6	2.2	2.4	2.0
F 1600	10.6	3.5	3.6	3.3
F 2500	16.9	5.7	5.8	5.2
F 4000	29.1	9.2	9.2	9.0

Test conditions:

1. Solenoid with flow capacity: 0.6 m3/hr
2. Pipe diameter: 6 mm
3. Medium: clean air
4. Supply pressure: 5.5 bar/80psi
5. Load: with average load
6. Stroke: 90°
7. Temperature: Room temperature

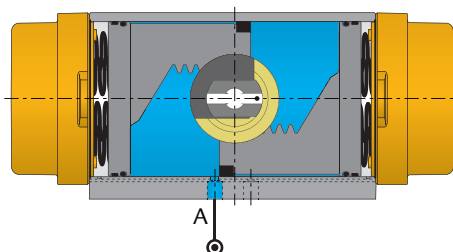
Actuator air volumes and consumption

Actuator model	Actuator volumes:			Consumption per stroke ( in liters, pressure in barg)					
	Maximum volume ( in liters )			Outward Stroke			Inward Stroke		
	Central1	End cap2	Displace3	Double acting and Spring Return			Double acting only		
	chamber	chamber	volume	2.0 barg	4.0 barg	8.0 barg	2.0 barg	4.0 barg	8.0 barg
F 12	0.05	0.06	0.04	0.14	0.24	0.44	0.16	0.28	0.52
F 25	0.14	0.20	0.08	0.36	0.64	1.2	0.48	0.88	1.7
F 40	0.26	0.37	0.15	0.67	1.2	2.2	0.89	1.6	3.1
F 65	0.40	0.56	0.22	1.02	1.8	3.4	1.3	2.4	4.7
F 100	0.6	0.9	0.3	1.5	2.7	5.0	2.0	3.8	7.2
F 150	1.0	0.8	0.5	2.4	4.3	8.1	2.1	3.6	6.7
F 200	1.3	1.0	0.7	3.2	5.7	11	2.8	4.9	9.1
F 350	2.1	1.9	1.2	5.5	9.8	18	5.0	8.8	16
F 600	3.6	3.3	2.1	9.4	17	31	8.7	15	28
F 950	4.9	4.6	3.2	13	23	43	12	22	40
F 1600	7.9	7.3	5.4	21	37	69	20	35	64
F 2500	12.6	11.9	8.3	34	59	109	32	56	104
F 4000	21.7	19.0	13.5	57	100	187	52	89	165

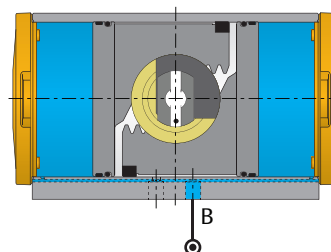
Actuator model	Actuator volumes:			Consumption per stroke ( in Cu.in., pressure in psig)					
	Maximum volume ( Cu.in. )			Outward Stroke			Inward Stroke		
	Central1	End cap2	Displace3	Double acting and Spring Return			Double acting only		
	chamber	chamber	volume	40 psig	80 psig	120 psig	40 psig	80 psig	120 psig
F 12	3.1	3.7	2.5	11	19	28	13	23	33
F 25	8.5	12.2	4.7	28	52	75	38	72	106
F 40	15.9	23	8.9	53	96	140	71	133	196
F 65	24	34	13.5	81	148	215	107	200	294
F 100	36	53	19.9	118	216	314	165	310	455
F 150	58	47	32	192	352	512	163	293	424
F 200	76	64	44	255	466	676	220	397	573
F 350	131	115	76	436	796	1157	392	709	1025
F 600	222	201	129	742	1354	1967	683	1237	1790
F 950	301	279	196	1025	1854	2682	966	1735	2505
F 1600	484	447	328	1662	2997	4331	1560	2792	4024
F 2500	769	728	508	2630	4751	6873	2515	4523	6530
F 4000	1324	1159	825	4477	8130	11782	4022	7219	10416

- Notes:
1. For Double-acting and Spring-return. Pistons at 90° outward position
2. Only for Double-acting. Pistons at 0° inward position
3. Stroke is 90°

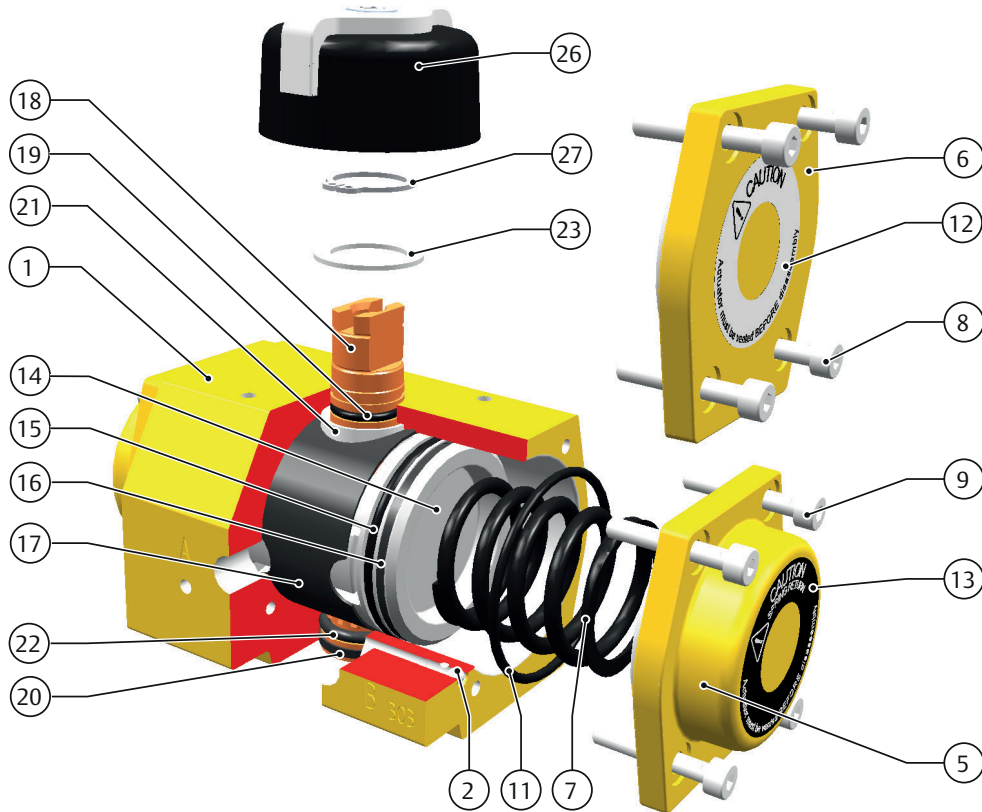
Central air chamber volume  
Double-Acting and Spring-Return



End cap air chamber volume  
Double-Acting only



## Construction, Parts and Materials F12

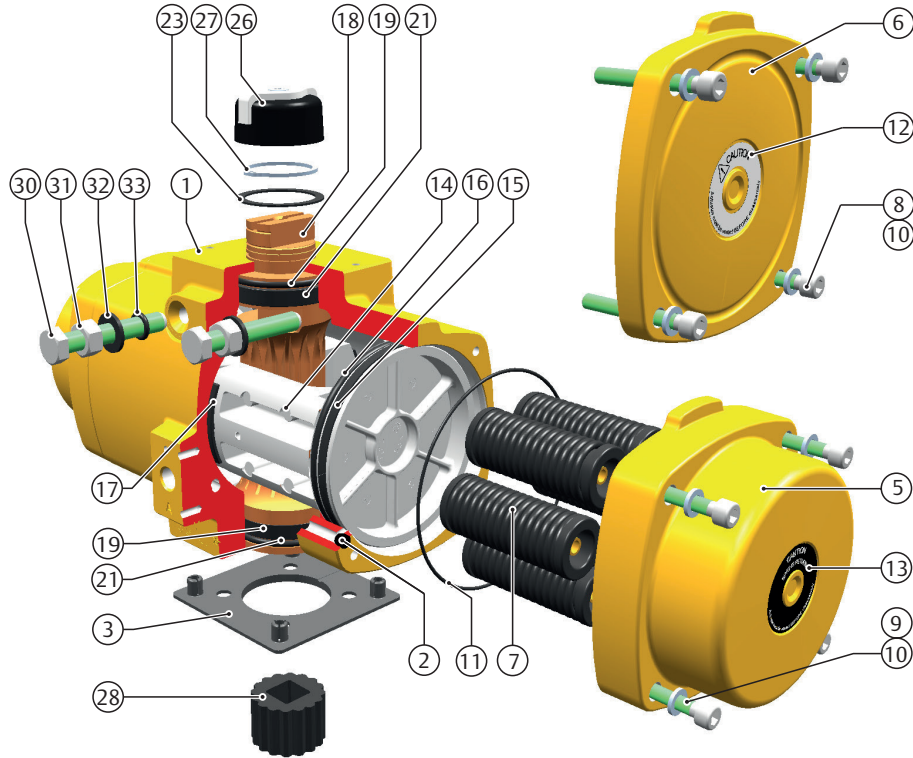


**Notes:**

- 1 Included in Service Kit.
- 2 Chromated and polyurethane powder coated.
- 3 Chromated
- 4 Hard anodized
- 5 Electrophoretic coated
- 6 Deltatone® coated

Pos.	Qty	Notes	Description	Material
1	1	2	House	Extruded aluminium alloy
2	2	1	B-port ball	Steel
5	2	2	End cap SR	Cast Aluminium alloy
6	2	2	End cap DA	Cast Aluminium alloy
7	Max. 2	5	Springs	Spring steel
8	8		End cap screw DA	Stainless Steel
9	8		End cap screw SR	Stainless Steel
11	2	1	O-ring end cap	Nitrile rubber
12	2		Warning sticker DA	Polyester
13	2		Warning sticker SR	Polyester
14	2	3	Piston	Cast Aluminium alloy
15	2	1	Bearing piston	PTFE 25% carbon-filled
16	2	1	O-ring piston	Nitrile rubber
17	1	1	Guide band	Nylatron
18	2	4	Pinion	High grade aluminium
19	1	1	Bearing pinion top	POM
20	1	1	Bearing pinion bottom	POM
21	1	1	O-ring pinion top	Nitrile rubber
22	1	1	O-ring pinion bottom	Nitrile rubber
23	1	1	Thrust bearing pinion	POM, black UV stabilized
26	1		Indicator assembly	ABS + stainless steel screw
27	1	1, 6	Circlip	Spring steel

## Construction, Parts and Materials F25-F600



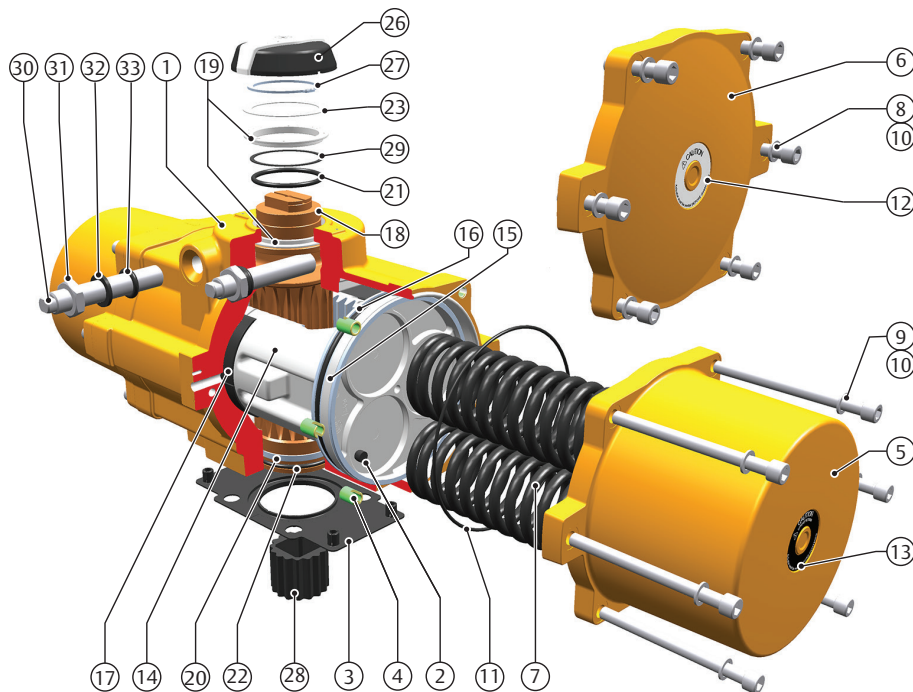
Notes:

- |                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>1 Included in Service Kit.</li> <li>2 Chromated and polyurethane powder coated.</li> <li>3 Chromated</li> <li>4 Hard anodized</li> <li>5 Electrophoretic coated</li> </ul> | <ul style="list-style-type: none"> <li>6 Deltatone® coated</li> <li>7 Anodized</li> <li>8 High end caps for double-acting and spring-return models up to size F100. Low end caps for double-acting models for sizes F150 and larger.</li> </ul> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Pos.	Qty	Notes	Description	Material
1	1	2	House	Cast Aluminium alloy
2	2	1	B-port seal	Silicon rubber
3	1		Center plate (option)	Nylon PA6, Black
5	2	2, 8	End cap SR (DA)	Cast Aluminium alloy
6	2	2, 8	End cap DA	Cast Aluminium alloy
7	Max. 12	5	Spring cartridge	Spring steel
8	8		End cap screw DA	Stainless Steel
9	8		End cap screw SR	Stainless Steel
10	8		End cap screw washer	Stainless Steel
11	2	1	O-ring end cap	Nitrile rubber
12	2		Warning sticker DA	Polyester
13	2		Warning sticker SR	Polyester
14	2	3	Piston	Cast Aluminium alloy
15	2	1	Bearing piston	PTFE 25% carbon-filled
16	2	1	O-ring piston	Nitrile rubber
17	2	1	Bearing strip piston rack	POM
18	2	4	Pinion	High grade aluminium
19	2	1	Bearing pinion	POM
21	2	1	O-ring pinion	Nitrile rubber
23	1	1	Thrust bearing pinion	POM, black UV stabilized
26	1		Indicator assembly	ABS + stainless steel screw
27	1	1, 6	Circlip	Spring steel
28	1	7	Drive insert	Aluminium
30	2		Limit stop screw	Stainless steel
31	2		Limit stop nut	Stainless steel
32	2	1	Limit stop washer	PA66
33	2	1	O-ring limit stop	Nitrile rubber



## Construction, Parts and Materials F950-F2500

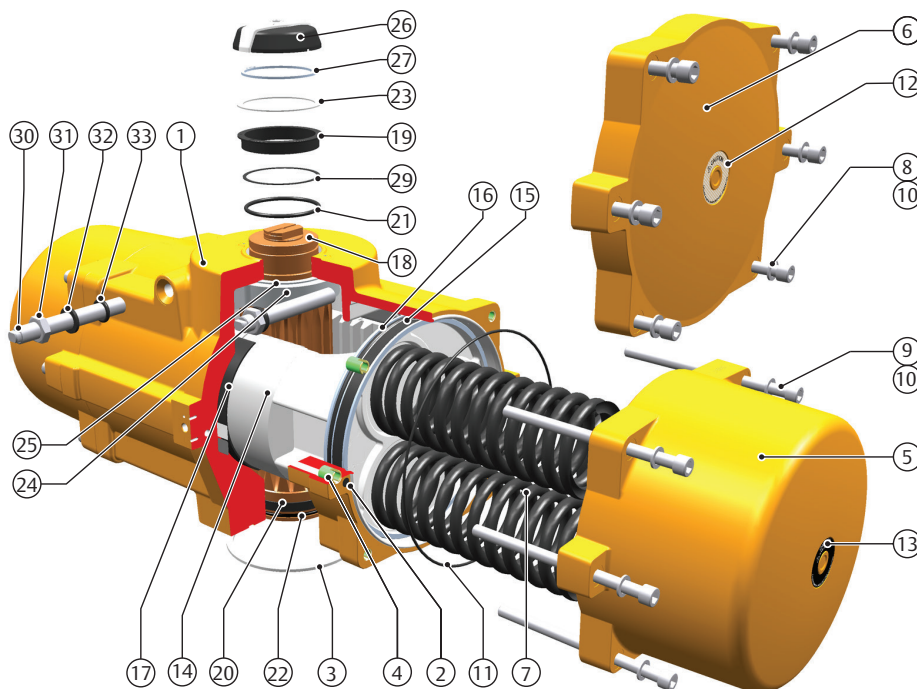


Notes:

- 1 Included in Service Kit.
- 2 Chromated and polyurethane powder coated.
- 3 Chromated
- 4 Hard anodized
- 5 Electrophoretic coated
- 6 Deltatone® coated
- 7 Anodized
- 8 8x for Size 950

Pos.	Qty.	Notes	Description	Material
1	1	2	House	Cast Aluminium alloy
2	2	1	B-port seal	Silicon rubber
3	1		Center plate (option)	Nylon PA6, Black
4	8/12	8	Thread insert	Steel
5	2	2	End cap SR	Cast Aluminium alloy
6	2	2	End cap DA	Cast Aluminium alloy
7	Max. 6	5	Springs	Spring steel
8	8/12	8	End cap screw DA	Stainless Steel
9	8/12	8	End cap screw SR	Stainless Steel
10	8/12	8	End cap screw washer	Stainless Steel
11	2	1	O-ring end cap	Nitrile rubber
12	2		Warning sticker DA	Polyester
13	2		Warning sticker SR	Polyester
14	2	3	Piston	Cast Aluminium alloy
15	2	1	Bearing piston	PTFE 25% carbon-filled
16	2	1	O-ring piston	Nitrile rubber
17	2	1	Bearing strip piston rack	POM
18	1	4	Pinion	High grade aluminium
19	2	1	Bearing pinion top	POM
20	1	1	Bearing pinion bottom	POM
21	1	1	O-ring pinion top	Nitrile rubber
22	1	1	O-ring pinion bottom	Nitrile rubber
23	1	1	Thrust bearing pinion	POM, black UV stabilized
26	1		Indicator assembly	ABS + stainless steel screw
27	1	1, 6	Circlip	Spring steel
28	1	7	Drive insert	Aluminium
29	1	1	Backup ring	POM
30	2		Limit stop screw	Stainless steel
31	2		Limit stop nut	Stainless steel
32	2	1	Limit stop washer	PA66
33	2	1	O-ring limit stop	Nitrile rubber

## Construction, Parts and Materials F4000



Notes:

- 1 Included in Service Kit.
- 2 Chromated and polyurethane powder coated.
- 3 Chromated
- 4 Hard anodized
- 5 Electrophoretic coated
- 6 Deltatone® coated

Pos.	Qty.	Notes	Description	Material
1	1	2	House	Cast Aluminium alloy
2	2	1	B-port seal	Silicon rubber
3	1		Center ring	Stainless Steel AISI 304
4	12		Thread insert	Steel
5	2	2	End cap SR	Cast Aluminium alloy
6	2	2	End cap DA	Cast Aluminium alloy
7	Max. 6	5	Springs	Spring steel
8	12		End cap screw DA	Stainless Steel
9	12		End cap screw SR	Stainless Steel
10	12		End cap screw washer	Stainless Steel
11	2	1	O-ring end cap	Nitrile rubber
12	2		Warning sticker DA	Polyester
13	2		Warning sticker SR	Polyester
14	2	3	Piston assembly	Cast Aluminium alloy
15	2	1	Bearing piston	PTFE 25% carbon-filled
16	2	1	O-ring piston	Nitrile rubber
17	2	1	Bearing strip piston rack	POM
18	1	4	Pinion	High grade aluminium
19	1	1	Bearing pinion top	POM
20	1	1	Bearing pinion bottom	POM
21	1	1	O-ring pinion top	Nitrile rubber
22	1	1	O-ring pinion bottom	Nitrile rubber
23	1	1	Thrust washer pinion	POM, black UV stabilized
24	1		Cam stroke adjustment	Steel
25	1	1	Cam thrust washer	POM, black UV stabilized
26	1		Indicator assembly	ABS + stainless steel screw
27	1	1, 6	Circlip	Spring steel
29	1	1	Backup ring	POM
30	2		Limit stop screw	Stainless steel
31	2		Limit stop nut	Stainless steel
32	2	1	Limit stop washer	PA66
33	2	1	O-ring limit stop	Nitrile rubber

## EL-O-Matic F-Series Corrosion Protection System

### Description

The corrosion protection system of a standard EL-O-Matic F-Series pneumatic actuator consists of the following treatments or materials:

### Electrophoretic finish on springs

Springs are protected from corrosion using an electrophoretic finish.

### Chromate pre-treatment

The housing and end caps get a chromate pre-treatment prior to painting. The pre-treatment takes care of a perfect bonding of the paint layer to the aluminium housing and gives additional corrosion protection to the bore of the housing.

### Powder coat

- Polyurethane powder coating for exterior use.
- The powder coating is applied cold using automatic electrostatic spray equipment and is cured for about 10 minutes at a minimum of 200°C (392°F) offering excellent light and weather resistance.
- The powder coating thickness is between 80 and 160 microns (3.15 and 6.3 mils).
- Good chemical resistance against most bases, acids, solvents, alkalis and oils at normal temperatures.
- Excellent exterior mechanical durability.
- The coating has passed a salt spray test according to ASTM B117 for 1,000 hours.

The powder coating is virtually solvent free, and therefore environmentally friendly.

### High grade & hard anodized aluminium pinion

Actuators with high grade & hard anodized aluminium pinions, passed a 1,000 hours salt spray test. Optional stainless steel pinions are available for a higher corrosion resistance.

### Stainless steel or Deltatone treated external steel parts

External parts are stainless steel or steel alloy with a Deltatone® treatment for optimum protection and durability.

### The chemical and durability assessment

All these components, treatments and finishes, including the durable pinion design, anodized surface finish, standard powder coat paint and Stainless steel treated external fasteners shows no decline of actuator functions after 1,000 hours salt spray test.

### Technical Data

Coating :	Polyurethane powder coating for exterior use.
Salt spray test :	ASTM B117: 1,000 hours
Color :	Yellow (RAL 1007)
Materials: Housing:	Chromated aluminium alloy
Endcaps:	Chromated aluminium alloy
Pistons:	Chromated aluminium alloy
Pinion:	High grade aluminium alloy, hard anodized (Option: Stainless steel)
Springs:	Electrophoretic finish
Fasteners:	Stainless steel or alloy steel with Deltatone® treatment
Type Sticker:	Nylon
Application:	Standard EL-O-Matic F-Series pneumatic actuators

**Table 1. Test result polyurethane powder coating**

No	Item	Standard	Specification
1	Hardness	ASTM D3363 Pencil (Mitsubishi Uni)	H
2	Adhesion	ISO 2409, ASTM D3359 Cross hatch test (2 mm)	Gt (0) 100% Adhesion
3	Impact test	ASTM D2794 5/8" Ball (direct)	Min. 60 lb.in without detachment
4	Bend test	DIN 53152, ISO1519, ASTM D522	Min 3.2 mm without cracking
5	Resistance to humid atmospheres	ASTM D543 3% H2SO4, 4 hours	No Blistering
6	Alkali resistance	ASTM D543 10% NaOH, 4 hours	No Blistering
7	Water resistance	DIN 50017, min.	No Blistering
8	UV resistance	ASTM G 154 (UVB-313)	Excellent color and gloss retention

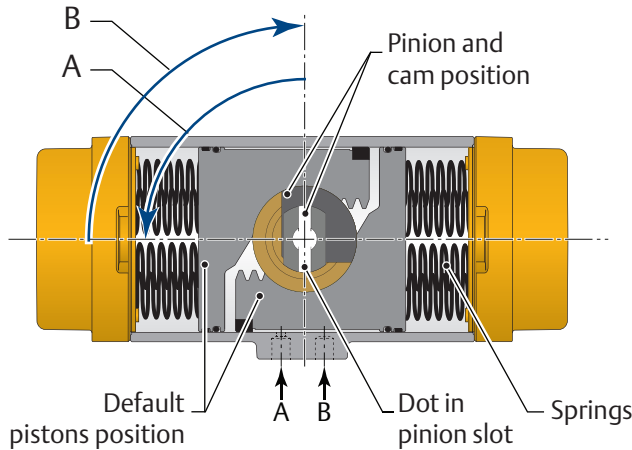
1. This data sheet contains general information as supplied by the paint supplier and describes typical properties for the coating.

## Assembly Codes EL-O-Matic F-Series actuators

### Spring-return actuators

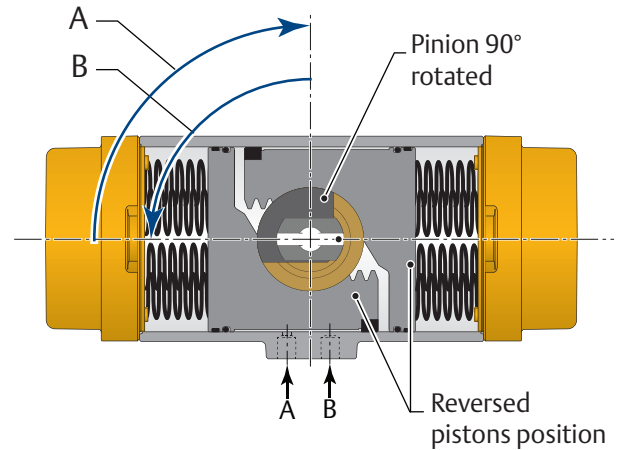
#### Assembly code: CW

= Standard, Clockwise-to-Close rotation  
= Fail-to-Close



#### Assembly code: CC

= Reverse, Counterclockwise-to-Open  
= Fail-to-Open

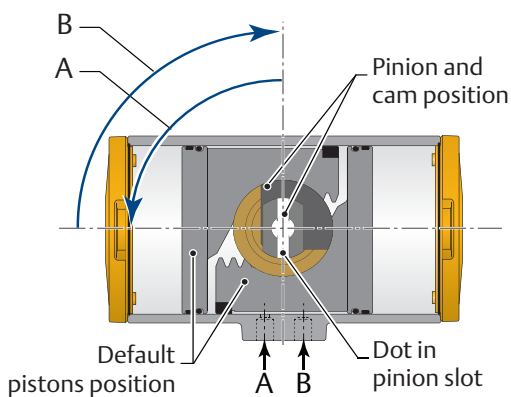


A = Central air chamber pressurized  
B = Spring stroke

### Double-acting actuators

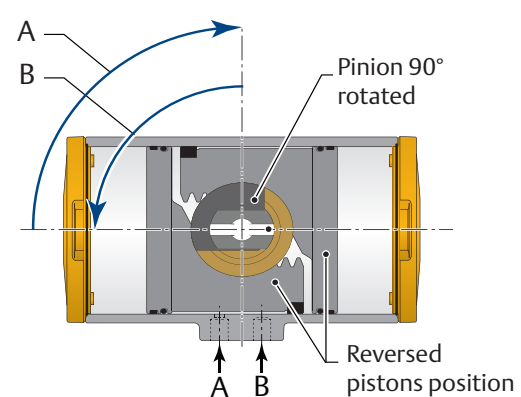
#### Assembly code: CW

= Standard, Clockwise-to-Close rotation



#### Assembly code: CC

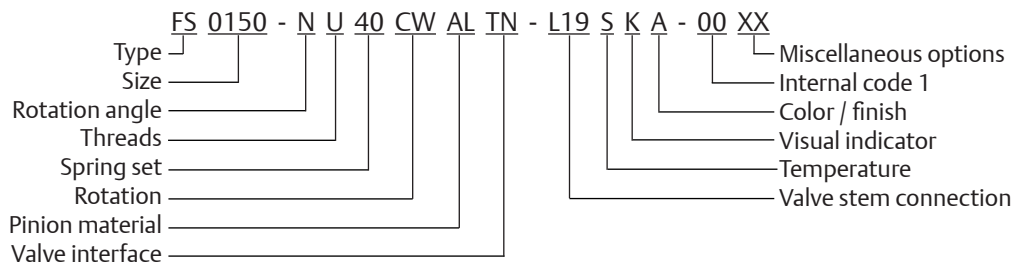
= Reverse, Counterclockwise-to-Open



A = Central air chamber pressurized  
B = End cap air chambers pressurized

All views are from above. Pistons are shown in inward position.

## Product configuration code



Type			
FD	Double Acting		
FS	Spring Return		
Size			
0012	Size 0012	0350	Size 0350
0025	Size 0025	0600	Size 0600
0040	Size 0040	0950	Size 0950
0065	Size 0065	1600	Size 1600
0100	Size 0100	2500	Size 2500
0150	Size 0150	4000	Size 4000
0200	Size 0200		
Rotation angle			
N	90° rotation angle		
Threads			
M	Metric ISO 5211		
U	UNC/NPT/Imperial		
Spring Set			
00	Double Acting (no springs)		
10	Spring Set 10	40	Spring Set 40
20	Spring Set 20	50	Spring Set 50
30	Spring Set 30	60	Spring Set 60
Rotation direction			
CW	Spring to Close/Clock Wise		
CC	Spring to Open/Counter Clock Wise		
Pinion Material			
AL	High Grade Aluminium, Hard anodized		
SS	Stainless steel ASI 316 (+ A4-70 SS fasteners)		
Valve Interface <sup>(2)</sup>			
TN	Standard ISO 5211 interface		
SY	Small interface with center plate (DIN3337)		
LY	Large interface with center plate (DIN3337)		

Valve Stem Connection				
Actuator size	Square	Aluminum		Stainless Steel <sup>(4)</sup>
		Parallel drive ■	Diagonal drive ◆	Star drive ⚙
No insert		000		Not applicable
0012 <sup>(3)</sup>	9mm / 0.354"	L09	D09	Q09
0025	11mm / 0.433"	L11	D11	Q11
0040 & 0065	14mm / 0.551"	L14	D14	Q14
0100	17mm / 0.669"		D17	Q19
	19mm / 0.748"	L19		
0150	17mm / 0.669"		D17	Q22
	19mm / 0.748"	L19		
0200	22mm / 0.866"	L22	D22	Q22
0350	22mm / 0.866"		D22	Q27
600	27mm / 1.063"	L27		
950	36mm / 1.417"	L36	D36	Q36
1600 & 2500	46mm / 1.811"	L46	D46	Q46
4000 <sup>(3)</sup>	55mm / 2.165"	Q55	Q55	Q55
Temperature Range				
S	Standard: -20°C to +80°C (-4°F to +176°F)			
H	High: -10°C to +120°C (+14°F to +250°F)			
L	Low: -40°C to +80°C (-40°F to +176°F)			
G <sup>(6)</sup>	Standard: -20°C to +80°C (-4°F to +176°F) PED Group 1 Label			
Visual Indication Code				
K	Standard (Knob)			
N	No Visual Indication			
Finish				
A	Standard coating (EL-O-Matic Yellow)			
G	CSR Coating			
Internal code 1				
00	Standard			
Miscellaneous options				
XX	Standard			
H1	1/2" High Flow plate			
P1	1/2" Porting according EN 15714-3 (only sizes 950-4000)			
FS	Full stroke adjustment (only sizes 25 to 600)			

Notes:  
See next page.

**Notes:**

1. The options, listed here, are all options available. Not all options apply to all configurations.
2. Valve Interface:
  - Size 0012 has no center plate option.
  - Option "S"; Small Interface with Center Plate (DIN3337) is not available for sizes 0025, 0950 and 4000.
  - Option "L"; Large Interface with Center Plate (DIN33337) is not available for sizes 1600 and 2500
  - Option "L" for size 4000 is a stainless steel ring, mounted in a groove in the valve flange.
3. Size 0012 does not have inserts but has the inner square directly in the bottom of the pinion.
  - Size 4000 does not have inserts but has two inner squares (diagonally and parallel oriented) directly in the bottom of the pinion.
4. Actuators with stainless steel pinions do not have inserts but have two inner squares (diagonally and parallel oriented aka "Star Drive") directly in the bottom of the pinion.
5. Contact your local EL-O-Matic representative for additional insert options.
6. PED Group 1 Label only available up to size 950.

## Actuator Torque - Spring-Return (Nm)

Actuator Size	Spring set nr.	Spring Stroke Torque (Nm)		Air Stroke Torque (Nm)																	
				SUPPLY PRESSURE																	
				3.0 barg		3.5 barg		4.0 barg		4.5 barg		5.0 barg		5.5 barg		6.0 barg		7.0 barg		8.0 barg	
Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End		
FS 12	20	7	5	2	-	4	1	5	2	6	3	8	5	9	6	10	7	13	10	15	12
FS 25	10	4	2	12	10	14	13	17	15	19	17	21	20	24	22	26	25	31	29	36	34
	20	7	4	9	6	12	9	14	11	16	13	19	16	21	18	24	21	28	25	33	30
	30	11	7	7	2	9	4	11	7	14	9	16	12	19	14	21	17	26	21	31	26
	40	14	9	-	-	-	-	9	3	11	5	14	8	16	10	18	12	23	17	28	22
	50	18	11	-	-	-	-	-	-	9	1	11	4	14	6	16	8	21	13	26	18
60	21	13	-	-	-	-	-	-	-	-	-	-	11	2	13	4	18	9	23	14	
FS 40	10	7	4	22	19	26	24	31	28	36	33	40	37	45	42	49	46	58	55	67	64
	20	13	8	17	12	22	16	26	21	31	25	35	30	40	34	44	39	53	48	62	57
	30	20	12	12	4	17	9	21	13	26	18	31	22	35	27	40	31	49	40	58	49
	40	26	17	-	-	12	1	17	6	21	10	26	15	30	19	35	24	44	33	53	42
	50	33	21	-	-	-	-	-	-	17	3	21	7	26	12	30	16	39	25	48	34
60	39	25	-	-	-	-	-	-	-	-	-	-	21	4	25	9	34	18	43	27	
FS 65	10	10	6	33	29	40	36	47	43	54	50	61	57	68	63	75	70	88	84	102	98
	20	20	13	26	17	33	24	40	31	47	38	53	45	60	52	67	59	81	72	95	86
	30	31	19	19	5	25	12	32	19	39	26	46	33	53	40	60	47	74	61	87	74
	40	41	26	-	-	-	-	25	8	32	14	39	21	46	28	52	35	66	49	80	63
	50	51	32	-	-	-	-	-	-	24	3	31	10	38	17	45	23	59	37	73	51
60	61	39	-	-	-	-	-	-	-	-	-	-	31	5	38	12	52	25	65	39	
FS 100	10	15	9	49	43	60	53	70	64	80	74	90	84	100	94	111	104	131	125	151	145
	20	30	19	39	26	49	36	59	47	69	57	79	67	90	77	100	87	120	108	141	128
	30	44	28	28	9	38	19	48	30	59	40	69	50	79	60	89	70	109	91	130	111
	40	59	37	-	-	27	2	38	13	48	23	58	33	68	43	78	53	99	74	119	94
	50	74	47	-	-	-	-	-	-	37	6	47	16	57	26	68	36	88	57	108	77
60	89	56	-	-	-	-	-	-	-	-	-	-	47	9	57	19	77	40	98	60	
FS 150	10	24	15	79	69	96	86	112	102	128	118	145	135	161	151	177	167	210	200	243	233
	20	47	30	62	42	79	59	95	75	111	91	128	108	144	124	160	140	193	173	226	206
	30	71	44	45	15	62	32	78	48	94	64	111	81	127	97	143	113	176	146	209	179
	40	94	59	-	-	45	5	61	21	77	37	94	54	110	70	126	86	159	119	192	152
	50	118	74	-	-	-	-	-	-	60	10	77	26	93	43	109	59	142	92	175	124
60	141	89	-	-	-	-	-	-	-	-	-	-	76	16	92	32	125	65	158	97	
FS 200	10	33	21	108	94	131	117	153	139	175	161	198	184	220	206	242	228	287	273	332	318
	20	65	41	85	57	107	79	129	102	152	124	174	146	196	169	219	191	263	236	308	280
	30	98	62	61	19	83	42	106	64	128	86	150	109	173	131	195	153	240	198	284	243
	40	131	82	-	-	-	-	82	26	104	49	127	71	149	93	171	116	216	161	261	205
	50	163	103	-	-	-	-	-	-	81	11	103	34	125	56	148	78	192	123	237	168
60	196	124	-	-	-	-	-	-	-	-	-	-	102	18	124	41	169	85	213	130	
FS 350	10	56	35	189	165	227	204	266	243	305	281	344	320	383	359	422	398	499	476	577	553
	20	112	70	148	101	187	139	226	178	265	217	303	256	342	295	381	334	459	411	537	489
	30	168	106	108	36	146	75	185	114	224	153	263	192	302	231	341	269	418	347	496	425
	40	224	141	-	-	106	11	145	50	184	89	222	127	261	166	300	205	378	283	455	360
	50	280	176	-	-	-	-	-	-	143	24	182	63	221	102	260	141	337	218	415	296
60	335	211	-	-	-	-	-	-	-	-	-	-	180	38	219	77	297	154	374	232	
FS 600	10	96	60	320	279	386	345	452	411	518	477	584	543	650	609	716	675	848	807	980	939
	20	192	121	251	169	317	235	383	301	449	367	515	433	581	499	647	565	779	697	911	829
	30	287	181	181	59	247	125	313	191	379	257	445	323	511	389	577	455	709	587	841	719
	40	383	241	-	-	178	15	244	81	310	147	376	213	442	279	508	345	640	477	772	609
	50	479	302	-	-	-	-	-	-	241	37	307	103	373	169	439	235	571	367	703	499
60	575	362	-	-	-	-	-	-	-	-	-	-	303	59	369	125	501	257	633	389	

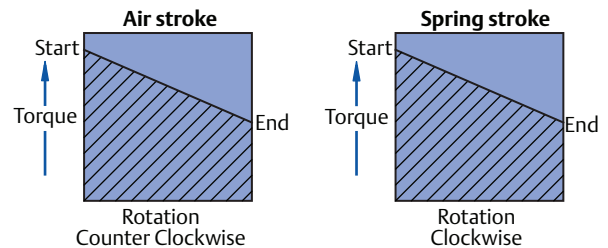
## Actuator Torque - Spring-Return (Nm)

Actuator Size	"Spring set"	Spring Stroke Torque (Nm)		Air Stroke Torque (Nm)																	
				SUPPLY PRESSURE																	
		Start	End	3.0 barg		3.5 barg		4.0 barg		4.5 barg		5.0 barg		5.5 barg		6.0 barg		7.0 barg		8.0 barg	
FS 950	10	121	77	481	427	579	525	677	623	775	721	873	819	971	917	1069	1015	1265	1211	1461	1407
	20	242	155	385	276	483	374	581	472	679	570	777	668	875	766	973	864	1169	1060	1365	1256
	30	363	232	288	125	386	223	484	321	582	418	680	516	778	614	876	712	1072	908	1268	1104
	40	484	309	-	-	289	71	387	169	485	267	583	365	681	463	779	561	975	757	1171	953
	50	605	387	-	-	-	-	-	-	389	116	487	214	585	312	683	410	879	606	1075	802
	60	726	464	-	-	-	-	-	-	-	-	390	63	488	161	586	259	782	455	978	651
FS 1600	10	207	129	808	710	972	874	1136	1038	1300	1202	1465	1367	1629	1531	1793	1695	2122	2023	2450	2352
	20	415	258	647	450	811	615	975	779	1139	943	1304	1107	1468	1271	1632	1436	1960	1764	2289	2093
	30	622	387	486	191	650	355	814	520	978	684	1142	848	1307	1012	1471	1176	1799	1505	2128	1833
	40	830	516	-	-	489	96	653	260	817	425	981	589	1146	753	1310	917	1638	1246	1967	1574
	50	1037	644	-	-	-	-	-	-	656	165	820	330	984	494	1149	658	1477	986	1806	1315
	60	1244	773	-	-	-	-	-	-	-	-	659	70	823	234	988	399	1316	727	1644	1056
FS 2500	10	295	180	1276	1133	1530	1388	1785	1642	2039	1896	2294	2151	2548	2405	2803	2660	3312	3169	3820	3678
	20	589	361	1050	765	1305	1019	1559	1274	1814	1528	2068	1783	2323	2037	2577	2292	3086	2801	3595	3309
	30	884	541	825	397	1079	651	1334	905	1588	1160	1843	1414	2097	1669	2352	1923	2860	2432	3369	2941
	40	1178	722	-	-	854	283	1108	537	1363	792	1617	1046	1871	1301	2126	1555	2635	2064	3144	2573
	50	1473	902	-	-	-	-	883	169	1137	423	1391	678	1646	932	1900	1187	2409	1696	2918	2205
	60	1768	1083	-	-	-	-	-	-	911	55	1166	310	1420	564	1675	819	2184	1327	2693	1836
FS 4000	10	473	299	2063	1846	2476	2259	2889	2672	3302	3085	3715	3498	4128	3911	4541	4324	5367	5150	6193	5976
	20	945	598	1690	1255	2103	1668	2516	2081	2929	2494	3342	2907	3755	3320	4168	3733	4994	4559	5820	5385
	30	1418	896	1316	664	1729	1077	2142	1490	2555	1903	2968	2316	3381	2729	3794	3142	4620	3968	5446	4794
	40	1891	1195	943	73	1356	486	1769	899	2182	1312	2595	1725	3008	2138	3421	2551	4247	3377	5073	4203
	50	2363	1494	-	-	-	-	1395	309	1808	722	2221	1135	2634	1548	3047	1961	3873	2787	4699	3613
	60	2836	1793	-	-	-	-	-	-	1435	131	1848	544	2261	957	2674	1370	3500	2196	4326	3022

**Note:**

- Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
- Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
- If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson's Actuation Technologies representative.

**Figure 1. Spring-return torque diagram**





## Actuator Torque - Spring-Return (lbf.in)

Actuator Size	Spring set nr.	Spring Stroke Torque (lbf.in)		Air Stroke Torque (lbf.in)															
				SUPPLY PRESSURE															
		Start	End	40 psig		50 psig		60 psig		70 psig		80 psig		90 psig		100 psig		120 psig	
FS 12	20	64	41	-	-	31	5	47	21	63	37	79	53	95	69	111	84	142	116
FS 25	10	31	20	93	80	123	109	152	139	181	168	211	198	240	227	270	257	329	315
	20	63	39	70	44	100	73	129	103	159	132	188	162	218	191	247	221	306	280
	30	94	59	48	8	77	37	107	67	136	96	166	126	195	155	224	185	283	244
	40	125	79	-	-	-	-	84	31	113	60	143	90	172	119	202	149	261	208
	50	156	99	-	-	-	-	-	-	91	24	120	54	150	83	179	113	238	172
60	188	118	-	-	-	-	-	-	-	-	98	18	127	47	157	77	215	136	
FS 40	10	58	37	175	150	230	206	285	261	341	316	396	371	451	427	506	482	617	592
	20	116	73	133	84	188	139	243	194	299	250	354	305	409	360	464	415	575	526
	30	174	110	91	17	146	73	201	128	256	183	312	238	367	294	422	349	533	459
	40	231	146	-	-	-	-	159	61	214	117	270	172	325	227	380	282	491	393
	50	289	183	-	-	-	-	-	-	172	50	228	105	283	161	338	216	449	326
60	347	220	-	-	-	-	-	-	-	-	186	39	241	94	296	149	406	260	
FS 65	10	90	57	265	227	349	311	433	395	518	479	602	563	686	648	770	732	939	900
	20	181	114	200	123	284	207	368	291	452	375	536	460	621	544	705	628	873	796
	30	271	171	134	19	218	103	303	187	387	272	471	356	555	440	639	524	808	692
	40	361	228	-	-	-	-	237	84	321	168	406	252	490	336	574	420	742	589
	50	452	285	-	-	-	-	-	-	256	64	340	148	424	232	508	316	677	485
60	542	342	-	-	-	-	-	-	-	-	275	44	359	128	443	213	611	381	
FS 100	10	131	83	394	338	518	463	643	587	767	712	892	836	1016	961	1140	1085	1389	1334
	20	262	166	299	188	423	313	547	437	672	561	796	686	921	810	1045	935	1294	1184
	30	393	248	203	38	328	162	452	287	577	411	701	536	826	660	950	784	1199	1033
	40	523	331	-	-	-	-	357	136	482	261	606	385	731	510	855	634	1104	883
	50	654	414	-	-	-	-	-	-	386	110	511	235	635	359	760	484	1009	733
60	785	497	-	-	-	-	-	-	-	-	416	84	540	209	665	333	914	582	
FS 150	10	208	131	632	543	832	743	1031	942	1230	1141	1430	1341	1629	1540	1828	1739	2227	2138
	20	416	262	482	304	681	503	881	703	1080	902	1279	1101	1478	1301	1678	1500	2076	1899
	30	625	393	331	65	531	264	730	463	929	663	1129	862	1328	1061	1527	1261	1926	1659
	40	833	524	-	-	-	-	580	224	779	423	978	623	1178	822	1377	1021	1776	1420
	50	1041	655	-	-	-	-	-	-	628	184	828	383	1027	583	1226	782	1625	1181
60	1249	785	-	-	-	-	-	-	-	-	677	144	877	343	1076	543	1475	941	
FS 200	10	289	182	862	739	1135	1012	1408	1285	1680	1558	1953	1830	2226	2103	2499	2376	3044	2922
	20	578	364	653	407	925	680	1198	953	1471	1225	1744	1498	2017	1771	2289	2044	2835	2589
	30	867	547	443	75	716	348	989	620	1261	893	1534	1166	1807	1439	2080	1712	2625	2257
	40	1156	729	-	-	-	-	779	288	1052	561	1325	834	1598	1107	1870	1379	2416	1925
	50	1445	911	-	-	-	-	-	-	843	229	1115	501	1388	774	1661	1047	2207	1593
60	1734	1093	-	-	-	-	-	-	-	-	906	169	1179	442	1452	715	1997	1260	
FS 350	10	495	312	1503	1293	1977	1767	2451	2241	2925	2715	3399	3189	3873	3663	4347	4137	5295	5085
	20	990	624	1145	724	1619	1198	2093	1672	2567	2146	3041	2620	3515	3094	3989	3568	4937	4516
	30	1485	936	786	155	1260	629	1734	1103	2208	1577	2682	2051	3156	2525	3630	2999	4578	3947
	40	1980	1248	-	-	-	-	1375	534	1849	1008	2323	1482	2798	1956	3272	2430	4220	3378
	50	2475	1560	-	-	-	-	-	-	1491	439	1965	913	2439	1387	2913	1861	3861	2810
60	2969	1872	-	-	-	-	-	-	-	-	1606	345	2080	819	2554	1293	3502	2241	
FS 600	10	848	534	2550	2189	3356	2995	4161	3800	4967	4606	5772	5411	6578	6217	7383	7022	8994	8633
	20	1696	1068	1936	1215	2742	2020	3548	2826	4353	3631	5159	4437	5964	5242	6770	6048	8381	7659
	30	2543	1602	1323	240	2128	1046	2934	1851	3739	2657	4545	3462	5350	4268	6156	5074	7767	6685
	40	3391	2135	-	-	-	-	2320	877	3126	1683	3931	2488	4737	3294	5542	4099	7153	5710
	50	4239	2669	-	-	-	-	-	-	2512	708	3318	1514	4123	2319	4929	3125	6540	4736
60	5087	3203	-	-	-	-	-	-	-	-	2704	539	3510	1345	4315	2150	5926	3761	

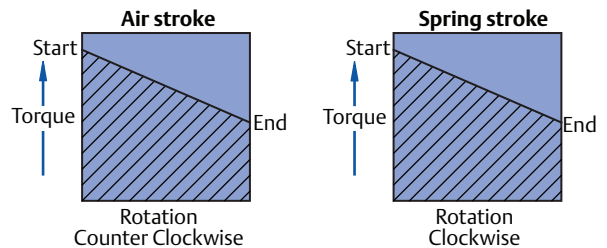
## Actuator Torque - Spring-Return (lbf.in)

Actuator Size	Spring set nr.	Spring Stroke Torque (lbf.in)		Air Stroke Torque (lbf.in)															
				SUPPLY PRESSURE															
		Start	End	40 psig		50 psig		60 psig		70 psig		80 psig		90 psig		100 psig		120 psig	
FS 950	10	1071	685	3841	3359	5037	4555	6233	5751	7429	6946	8625	8142	9821	9338	11017	10534	13408	12926
	20	2141	1369	2985	2020	4181	3216	5377	4412	6573	5608	7769	6804	8965	8000	10161	9196	12553	11588
	30	3212	2054	2129	682	3325	1878	4521	3074	5717	4270	6913	5466	8109	6662	9305	7858	11697	10250
	40	4282	2739	-	-	2470	540	3665	1736	4861	2932	6057	4128	7253	5324	8449	6519	10841	8911
	50	5353	3423	-	-	-	-	2810	398	4006	1594	5201	2789	6397	3985	7593	5181	9985	7573
	60	6424	4108	-	-	-	-	-	-	3150	255	4346	1451	5542	2647	6737	3843	9129	6235
FS 1600	10	1836	1141	6446	5577	8450	7581	10454	9586	12458	11590	14463	13594	16467	15598	18471	17602	22480	21611
	20	3671	2281	5020	3283	7024	5287	9028	7291	11033	9295	13037	11299	15041	13304	17045	15308	21054	19316
	30	5507	3422	3594	988	5598	2992	7602	4997	9607	7001	11611	9005	13615	11009	15619	13013	19628	17022
	40	7342	4563	-	-	4172	698	6177	2702	8181	4706	10185	6710	12189	8715	14194	10719	18202	14727
	50	9178	5703	-	-	-	-	4751	407	6755	2412	8759	4416	10763	6420	12768	8424	16776	12433
	60	11014	6844	-	-	-	-	-	-	-	-	7333	2121	9338	4126	11342	6130	15350	10138
FS 2500	10	2608	1597	10201	8938	13307	12044	16413	15150	19519	18255	22624	21361	25730	24467	28836	27573	35047	33784
	20	5215	3194	8205	5679	11311	8784	14416	11890	17522	14996	20628	18102	23734	21207	26839	24313	33051	30524
	30	7823	4791	6209	2419	9314	5525	12420	8630	15526	11736	18632	14842	21737	17948	24843	21053	31054	27265
	40	10431	6388	-	-	7318	2265	10424	5371	13529	8477	16635	11582	19741	14688	22847	17794	29058	24005
	50	13038	7985	-	-	-	-	8427	2111	11533	5217	14639	8323	17745	11429	20850	14534	27062	20746
	60	15646	9583	-	-	-	-	-	-	9537	1958	12642	5063	15748	8169	18854	11275	25065	17486
FS 4000	10	4184	2645	16491	14568	21532	19608	26573	24649	31613	29690	36654	34730	41695	39771	46735	44812	56817	54893
	20	8367	5290	13185	9338	18226	14379	23267	19420	28307	24460	33348	29501	38389	34542	43429	39582	53511	49664
	30	12551	7934	9879	4109	14920	9149	19961	14190	25001	19231	30042	24271	35083	29312	40123	34353	50205	44434
	40	16734	10579	-	-	11614	3920	16655	8961	21695	14001	26736	19042	31777	24083	36817	29123	46899	39205
	50	20918	13224	-	-	-	-	13349	3731	18389	8772	23430	13813	28471	18853	33511	23894	43593	33975
	60	25101	15869	-	-	-	-	-	-	15083	3542	20124	8583	25165	13624	30205	18664	40287	28746

**Note:**

1. Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
2. Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
3. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson's Actuation Technologies representative.

**Figure 1. Spring-return torque diagram**



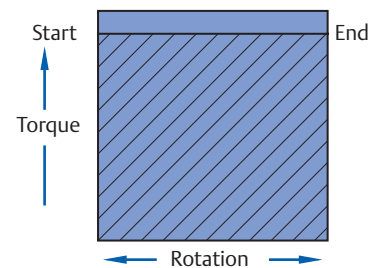
## Actuator Torque - Double-Acting (Nm)

Actuator Size	Torque in Nm Supply Pressure (barg)										
	2	3	3.5	4	4.5	5	5.5	6	6.5	7	8
FD 12	4.8	7.3	8.5	9.7	10.9	12.2	13.4	14.6	15.9	17.1	19.6
FD 25	9	13	16	18	20	23	25	27	29	32	36
FD 40	17	25	29	34	38	42	47	51	55	59	68
FD 65	25	38	45	51	58	64	71	77	84	90	103
FD 100	38	57	66	76	86	95	105	115	124	134	153
FD 150	60	91	106	122	137	153	168	183	199	214	245
FD 200	82	124	146	167	188	209	230	251	272	293	335
FD 350	143	216	253	290	326	363	400	436	473	510	583
FD 600	243	368	430	492	554	617	679	741	804	866	991
FD 950	368	557	651	746	840	935	1029	1124	1218	1312	1501
FD 1600	617	934	1092	1250	1408	1566	1725	1883	2041	2199	2516
FD 2500	956	1447	1692	1937	2182	2427	2673	2918	3163	3408	3899
FD 4000	1552	2348	2746	3144	3542	3940	4338	4736	5134	5532	6327

**Note:**

1. Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
2. Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
3. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson's Actuation Technologies representative.

**Figure 1. Double-acting torque diagram**



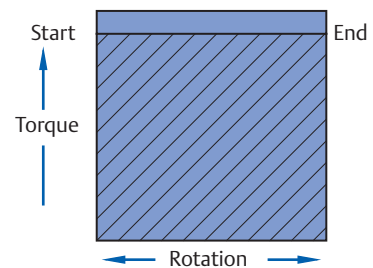
## Actuator Torque - Double-Acting (lbf.in)

Actuator Size	Torque in lbf.in Supply pressure (psig)												
	30	35	40	45	50	55	60	70	75	80	90	100	120
FD 12	44	51	59	66	74	81	89	104	111	119	134	149	179
FD 25	81	95	109	123	137	151	165	193	207	220	248	276	332
FD 40	153	179	205	231	257	283	309	361	387	413	465	518	622
FD 65	233	272	312	352	391	431	471	550	590	630	709	789	948
FD 100	344	403	461	520	579	638	696	814	873	931	1049	1166	1401
FD 150	551	645	739	833	927	1021	1115	1303	1397	1491	1680	1868	2244
FD 200	754	883	1011	1140	1269	1398	1526	1784	1912	2041	2299	2556	3071
FD 350	1310	1533	1757	1981	2205	2428	2652	3099	3323	3547	3994	4442	5336
FD 600	2226	2606	2986	3366	3746	4127	4507	5267	5647	6027	6788	7548	9069
FD 950	3373	3950	4526	5102	5678	6254	6830	7983	8559	9135	10287	11440	13744
FD 1600	5653	6619	7585	8550	9516	10481	11447	13378	14344	15309	17240	19172	23034
FD 2500	8760	10257	11753	13249	14745	16242	17738	20730	22227	23723	26715	29708	35693
FD 4000	14218	16647	19075	21504	23932	26361	28789	33646	36075	38503	43360	48217	57931

**Note:**

1. Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
2. Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
3. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson's Actuation Technologies representative.

**Figure 2. Double-acting torque diagram**



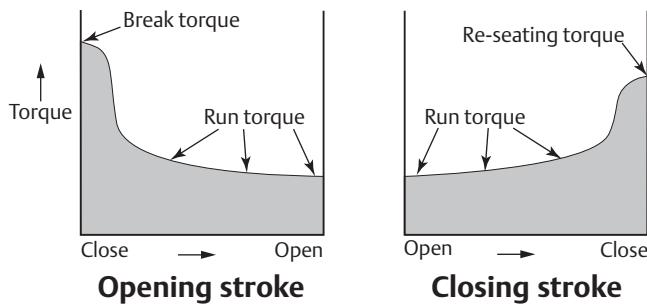
## Sizing of Rack & Pinion actuators

Sizing is the selection procedure to select the right size of actuator on a valve with a given torque characteristic. This data sheet gives brief samples on how to size actuators and which data is needed.

### Torque characteristics of valves

EL-O-Matic F-Series actuators are commonly used to operate butterfly-, ball- and plug valves. The below instructions are intended for these valve applications, but can also be used for other quarter turn applications.

**Figure 1. Generic torque characteristic of a valve**



### Valve torque values and safety factors

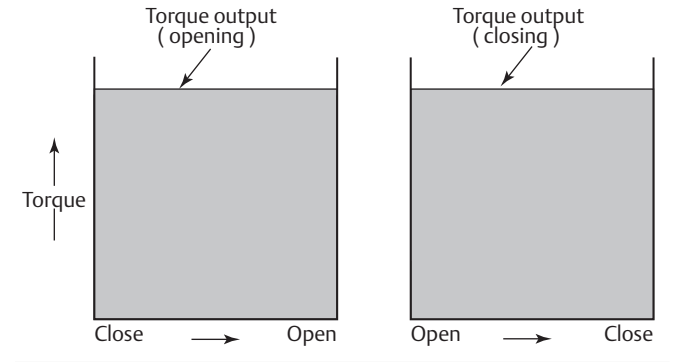
Emerson Process Management recommends that the valve manufacturer supply the maximum required and allowed torque values (Including any adjustments or suggested safety factors for valve service conditions or application).

Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.

If in doubt or if you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson's Actuation Technologies representative.

### Sizing Double-acting actuators

**Figure 2. Double-acting torque characteristic-**



### Sample calculation of double-acting sizing

- Publish valve break torque: 40 Nm 354 lbf.in
- Publish maximum stem torque: 105 Nm 929 lbf.in
- Recommended safety factor: 1.2 (20%)
- Minimum supply pressure: 5.5 bar 80 psi
- Maximum supply pressure: 6.5 bar 94 psi

#### Calculation:

1. Because the recommended safety factor is 1.2 the sizing torque will be  $40 \times 1.2 = 48 \text{ Nm}$  ( $354 \times 1.2 = 425 \text{ lbf.in}$ ).
2. Lookup in the double-acting torque table, in the 5.5 bar column (or 80 psi column), from top down, the first actuator size that generates more than 48 Nm (or 425 lbf.in).
3. Size FD65 is the first actuator that supplies more than
  - a. 48 Nm (71 Nm) at 5.5 bar.
  - b. 425 lbf.in (630 lbf.in) at 80 PSI.
4. The maximum torque output of a FD65 is 84 Nm (743 lbf.in). This is lower than the maximum stem torque of 105Nm.

#### Conclusion

Because FD65 supplies more torque than the sizing torque (see point 3) and less than the maximum stem torque (see point 4), size FD65 is suitable to operate this valve.

## Sizing spring-return actuators

Figure 3. Spring-to-Close configuration

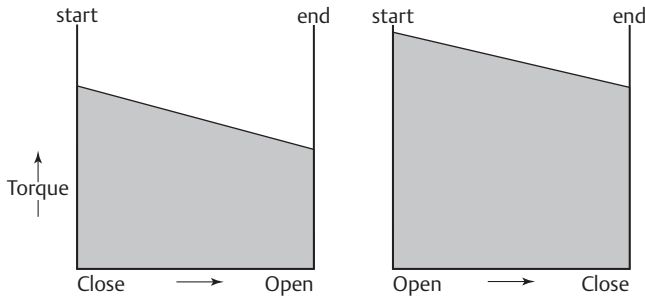


Table 1. For Fail-to Close actuators applies:

Actuator stroke:	Valve Stroke:
Air-Start torque	> Break torque and
Air-End torque	> Run open torque and
Spring-Start torque	> Run open torque and
Spring-End torque	> Re-seat torque

Table 2. For Fail-to Open actuators applies:

Actuator stroke:	Valve Stroke:
Spring-Start torque	> Break torque and
Spring-End torque	> Run torque and
Air-Start torque	> Run torque and
Air-End torque	> Re-seat torque

### Sample calculation spring-return sizing for a Spring-to-Close application

- Published valve torques
  - Break torque: 150 Nm 1328 lbf.in
  - Run torque opening: 45 Nm 398 lbf.in
  - Run torque closing: 45 Nm 398 lbf.in
  - Re-seating torque; 90 Nm 797 lbf.in
- Publish maximum stem torque: 375 Nm 3496 lbf.in
- Recommended safety factor: 1.5 (50%)
- Minimum supply pressure: 5.5 bar 80 psi
- Maximum supply pressure: 6.0 bar 87 psi

### Calculation:

1. Because the recommended safety factor is 1.5 the sizing torques will be:
  - Break 150 Nm x 1.5 = 225 Nm 1991 lbf.in
  - Run open 45 Nm x 1.5 = 67.5 Nm 597 lbf.in
  - Run close 45 Nm x 1.5 = 67.5 Nm 597 lbf.in
  - Re-seat 90 Nm x 1.5 = 135 Nm 1195 lbf.in
2. Lookup in the spring-return torque table, in the "spring end" torque column, from top down, the first actuator size that generates more than 135 Nm (or 1195 lbf.in) of re-seat torque.
3. Size FS350 with spring set 4 is the first actuator that supplies more spring end torque (149 Nm or 1655 lbf.in).
4. Check now for the other three positions whether the actuator torque exceeds the valve torques.

Actuator stroke:	Valve Stroke:
Air-Start: 252 Nm	> Break open: 225 Nm
Air-End: 157 Nm	> Run open: 67.5 Nm
Spring-Start: 232 Nm	> Run close: 67.5 Nm
Spring-End: 149 Nm	> Re-seat: 135 Nm

5. The maximum torque output of a FS350 with springset 4 at maximum pressure of 6 bar is 291 Nm (2575 lbf.in). This is lower than the maximum stem torque of 375 Nm (3496 lbf.in).

### Conclusion

Because FS350 n=40 supplies more torque than the sizing torque (see point 3) and less than the maximum stem torque (see point 5), size FS350 n=40 is suitable to operate this valve.

### Note:

- If the first found actuator does not exceed the valve torque at all the positions, check the next size actuator.
- If the next size actuator does exceed the valve torque at all the positions, but fails at maximum stem torque check whether the same actuator but with a higher springset (i.e. 50 instead of 40) does meet this requirement.

## Spring (Cartridge) placement

EL-O-Matic F-Series Spring return actuators are supplied with springs on each side of the actuator.

Throughout the F-Series size range, there are three different spring designs:

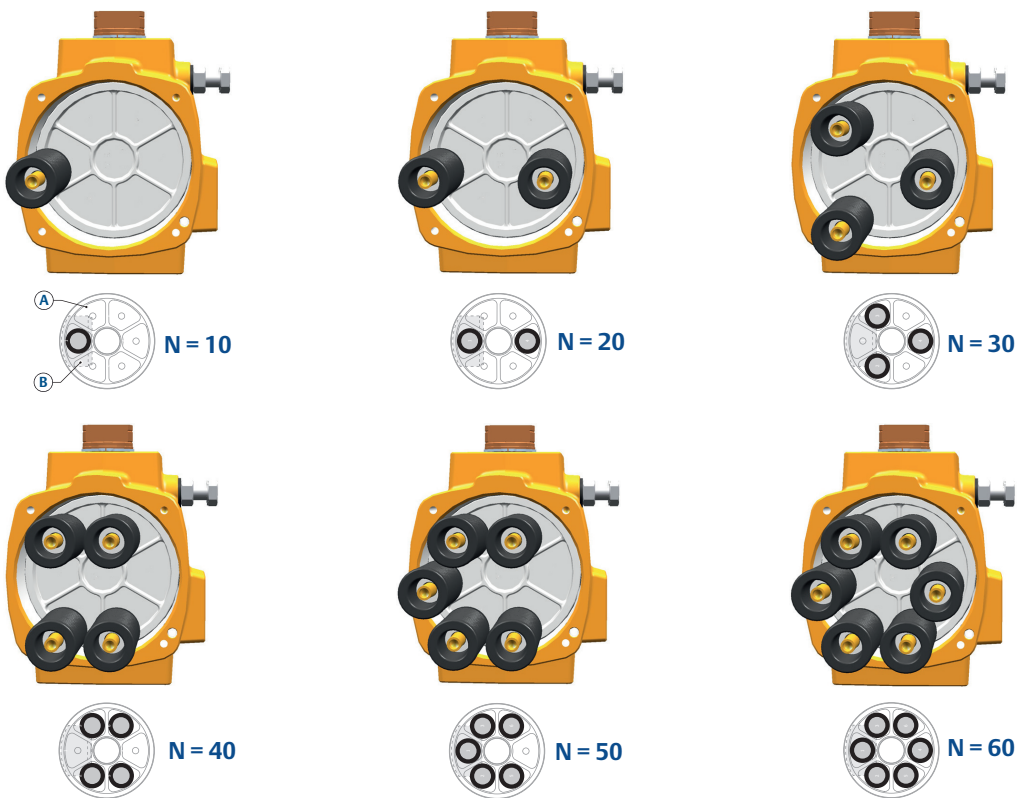
- Size F12 has only 1 spring on each side.
- Sizes F25 to F600 have 6 springs on each side (see figure 1).
- Sizes F950 to F4000 have 3 springs on each side (see figure 2).

Check below figures to see where to place the spring cartridges in case of spring set conversion.

When replacing spring cartridges in a spring-return actuator, ensure that the cartridges are replaced in their identical position from where they were removed.

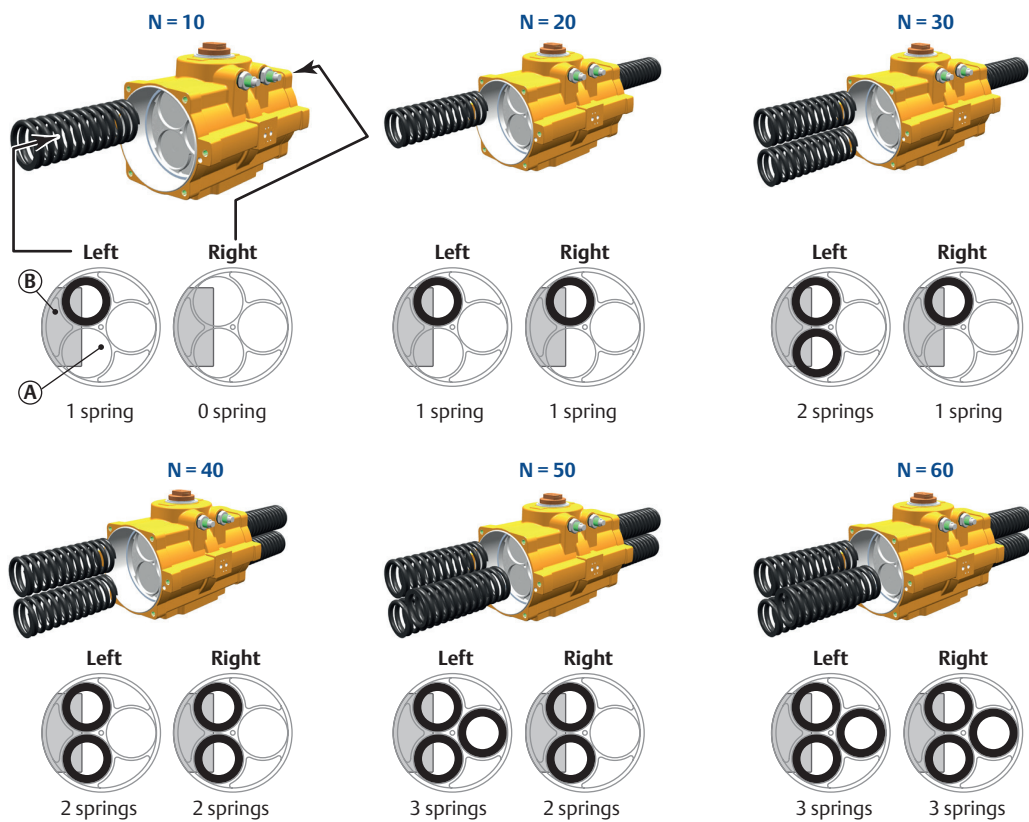
Before assembling the spring cartridges and end caps, make sure that the pistons are completely inwards.

Figure 1. Spring placement sizes F25 to F600



A = Piston top view  
B = Position of piston gear rack

**Figure 2. Spring placement sizes F950 to F4000**

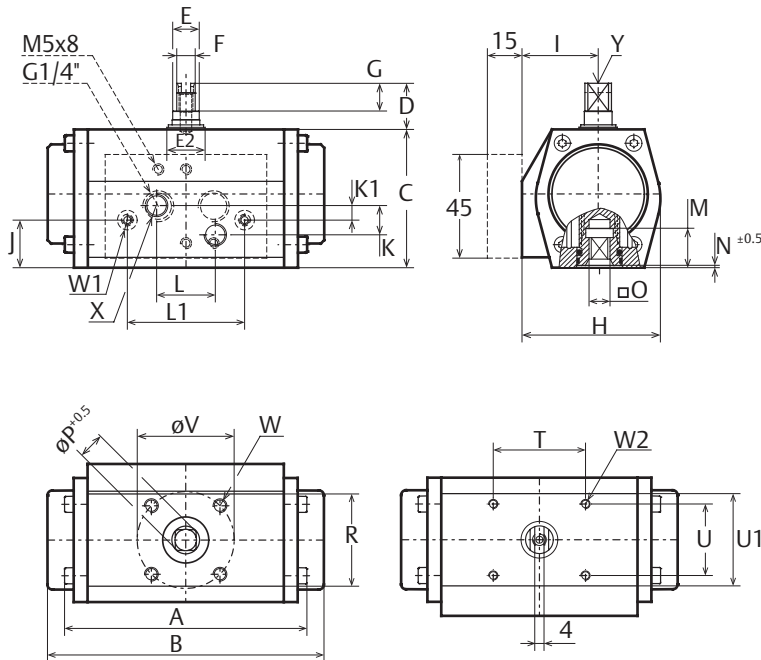


A = Piston top view  
 B = Position of piston gear rack



# Data sheet F12

## Metric - ISO5211



Dim in mm.		Size 12																	
A	FD	B	FS	C	D	E	E2	F	G	H	I								
103	118	60	20	16	23	10	12	60	33	J	K	K1	L	L1	M	N	O max.	O min.	P
21	12.7	6.4	25.4	50.8	16.5	1	9.14	9.05	12.1	R	R1	T	U	V	W	W1	W2	X	Y
40	40	40	31	42	M6x8	M4x7	M4x7	G1/8"	M6x12										

Principle			
Pneumatic rack & pinion actuator			
General data			
Bore		46	mm
Stroke		12.6	mm
Weight	SR	0.6	kg
	DA	0.7	kg
Volume	Port A	0.05	L
	Port B	0.06	L
Air connection		2x 1/8"	BSP
Pressure range	MOP	8	barg
	SR	3-8	barg
	DA	0.2 - 8	barg
Pressure media		Clean, dry or lubricated air or inert gas	
Cycle speed DA	Open	0.4	Sec.
	Close	0.4	Sec.
Cycle speed SR	Open	0.4	Sec.
	Close	0.4	Sec.
Temperature range		-20°C to +80°C	
Lubrication		Lubricated for life (1)	
Stroke		90°	
Finish		Polyurethane powder coat	

1. According to EN 15714-3
2. Test conditions:  
Solenoid with flow capacity: 0.6 m³/hr  
Pipe diameter: 6 mm  
Medium: clean air  
Supply pressure: 5.5 barg ~ 80psig  
Load: with average load  
Stroke: 90°  
Temperature: Room temperature

Torque Output																				
Spring-return																				
Spring set	Spring Stroke Torque		Air Stroke Torque (Nm)																	
			3.0 barg		3.5 barg		4.0 barg		4.5 barg		5.0 barg		5.5 barg		6.0 barg		7.0 barg		8.0 barg	
	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End		
2	7.2	4.6	-	-	3.8	1	5.1	2.3	6.4	3.6	7.7	4.9	9.0	6.2	10.3	7.5	12.9	10.1	15.6	12.8
<b>Double-acting</b>			7.3		8.5		9.7		11.0		12.2		13.4		14.6		17.1		19.6	

**Notes:**

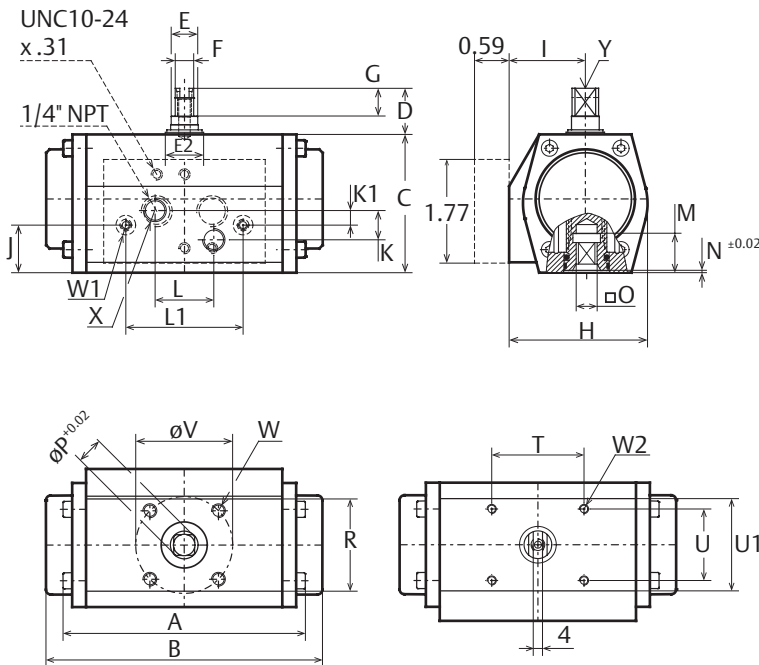
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO 5211
- Option: Solenoid mounting interface according to VDI/VDE 3845 (NAMUR). See dotted image.
- For further information regarding options, materials, certifications and additional execution please contact your regional sales office

**European Directives:**

- PED : suitable for use with group 2 gases according to Pressure Equipment Directive 97/23/EC
- ATEX : suitable for use in hazardous areas classified as II 2 GD, zones 1 or 2 (gases) and 21 or 22 (dust).

# Data sheet F12

## Imperial - ISO5211



Principle	
Pneumatic rack & pinion actuator	
General data	
Bore	1.811 inch
Stroke	0.496 inch
Weight	SR 1.3 lb
	DA 1.5 lb
Volume	Port A 3.1 cu.in.
	Port B 3.7 cu.in.
Air connection	2x 1/4" NPT
Pressure range	MOP 120 psig
	SR 43 - 120 psig
	DA 3 - 120 psig
Pressure media	Clean, dry or lubricated air or inert gas
Cycle speed DA <sup>(2)</sup>	Open 0.4 Sec.
	Close 0.4 Sec.
Cycle speed SR <sup>(2)</sup>	Open 0.4 Sec.
	Close 0.4 Sec.
Temperature range	-4°F to +176°C
Lubrication	Lubricated for life <sup>(1)</sup>
Stroke	90°
Finish	Polyurethane powder coat

1. According EN 15714-3.
2. Test conditions:
3. Solenoid with flow capacity: 21 ft<sup>3</sup>/hr; Pipe diameter: 1/4"; Medium: clean air, Supply pressure: 5.5 barg / 80psig; Load: with average load; Stroke: 90°; Temperature: Room temperature

Dim. in inch		Size 12																														
A	FD	B	F	S	C	D	E	E2	F	G	H	I	J	K	K1	L	L1	M	N	O max.	O min.	P	R	R1	T	U	V	W	W1	W2	X	Y
4.06		4.65			2.36	0.79	0.63	0.91	0.39	0.47	2.36	1.30	0.83	0.50	0.25	1.00	2.00	0.65	0.039	0.360	0.356	0.476	1.57	1.57	1.57	1.22	1.654	M6 x.48"	10-24 x.24"	10-24 x.24"	10-24 x.24"	M6 x.48"

Torque Output		Spring Return																	
Spring set	Spring Stroke Torque	Air Stroke Torque (lbf.in)																	
		40 psig		50 psig		60 psig		70 psig		80 psig		90 psig		100 psig		120 psig			
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End		
20	64 41	-	-	31	5	47	21	63	37	79	53	95	69	111	84	142	116		
<b>Double acting</b>		59		74		89		104		119		134		149		179			

**Notes:**

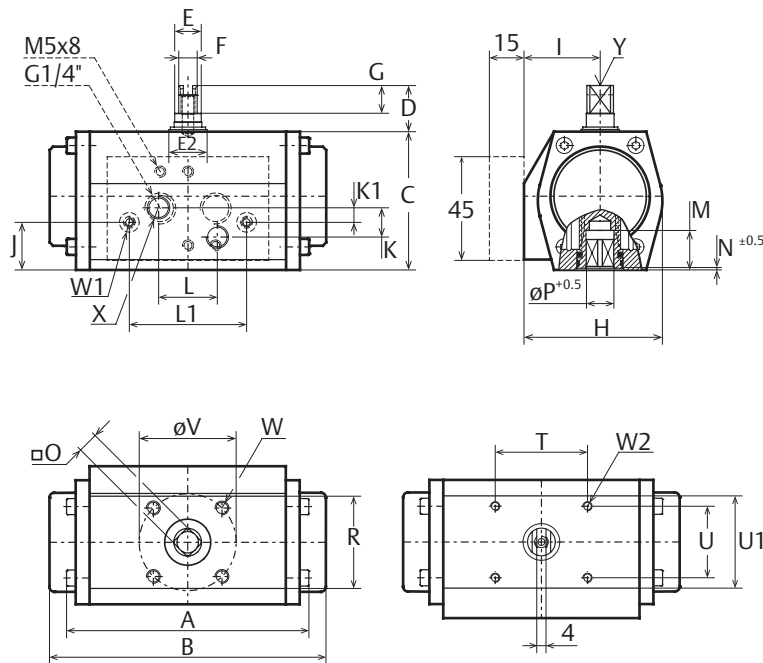
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO 5211
- Solenoid mounting interface according to VDI/VDE 3845 (NAMUR)
- For further information regarding options, materials, certifications and additional execution please contact your regional sales office

**European Directives:**

- Suitable for use with group 2 gases according to Pressure Equipment Directive (PED) 2014/68/EU
- Suitable for use in hazardous areas classified II 2 GD, zones 1 or 2 (gases) and 21 or 22 (dust) according to ATEX Directive 2014/34/EU
- For the configuration code please consult EFG.02.01.EN

# Data sheet F12

## Metric - DIN3337



Dim in mm.		Size 12										
A	F	B	F	S	C	D	E	E2	F	G	H	I
103	118	60	20	16	23	10	12	60	33			
J	K	K1	L	L1	M	N	O max.	O min.	P			
21	12.7	6.4	25.4	50.8	16.5	1	9.14	9.05	12.1			
R	R1	T	U	V	W	W1	W2	X	Y			
40	40	40	31	42	M6x8	M4x7	M4x7	G1/8"	M6x12			

Principle			
Pneumatic rack & pinion actuator			
General data			
Bore		46	mm
Stroke		12.6	mm
Weight	SR	0.6	kg
	DA	0.7	kg
Volume	Port A	0.05	L
	Port B	0.06	L
Air connection		2x 1/8"	BSP
Pressure range	MOP	8	barg
	SR	3-8	barg
	DA	0.2 - 8	barg
Pressure media		Clean, dry or lubricated air or inert gas.	
Cycle speed DA	Open	0.4	Sec.
	Close	0.4	Sec.
Cycle speed SR	Open	0.4	Sec.
	Close	0.4	Sec.
Temperature range		-20°C to +80°C	
Lubrication		Lubricated for life (1)	
Stroke		90°	
Finish		Polyurethane powder coat	

- According to EN 15714-3
- Test conditions:  
Solenoid with flow capacity: 0.6 m³/hr  
Pipe diameter: 6 mm  
Medium: clean air  
Supply pressure: 5.5 barg ~ 80psig  
Load: with average load  
Stroke: 90°  
Temperature: Room temperature

Torque Output																					
Spring-return																					
Spring set	Spring Stroke Torque		Air Stroke Torque (Nm)																		
			3.0 barg		3.5 barg		4.0 barg		4.5 barg		5.0 barg		5.5 barg		6.0 barg		7.0 barg		8.0 barg		
	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	Start	Start	End	Start	End	
2	7.2	4.6	-	-	3.8	1	5.1	2.3	6.4	3.6	7.7	4.9	9.0	6.2	10.3	7.5	12.9	10.1	15.6	12.8	
<b>Double-acting</b>			7.3		8.5		9.7		11.0		12.2		13.4		14.6		17.1		19.6		

**Notes:**

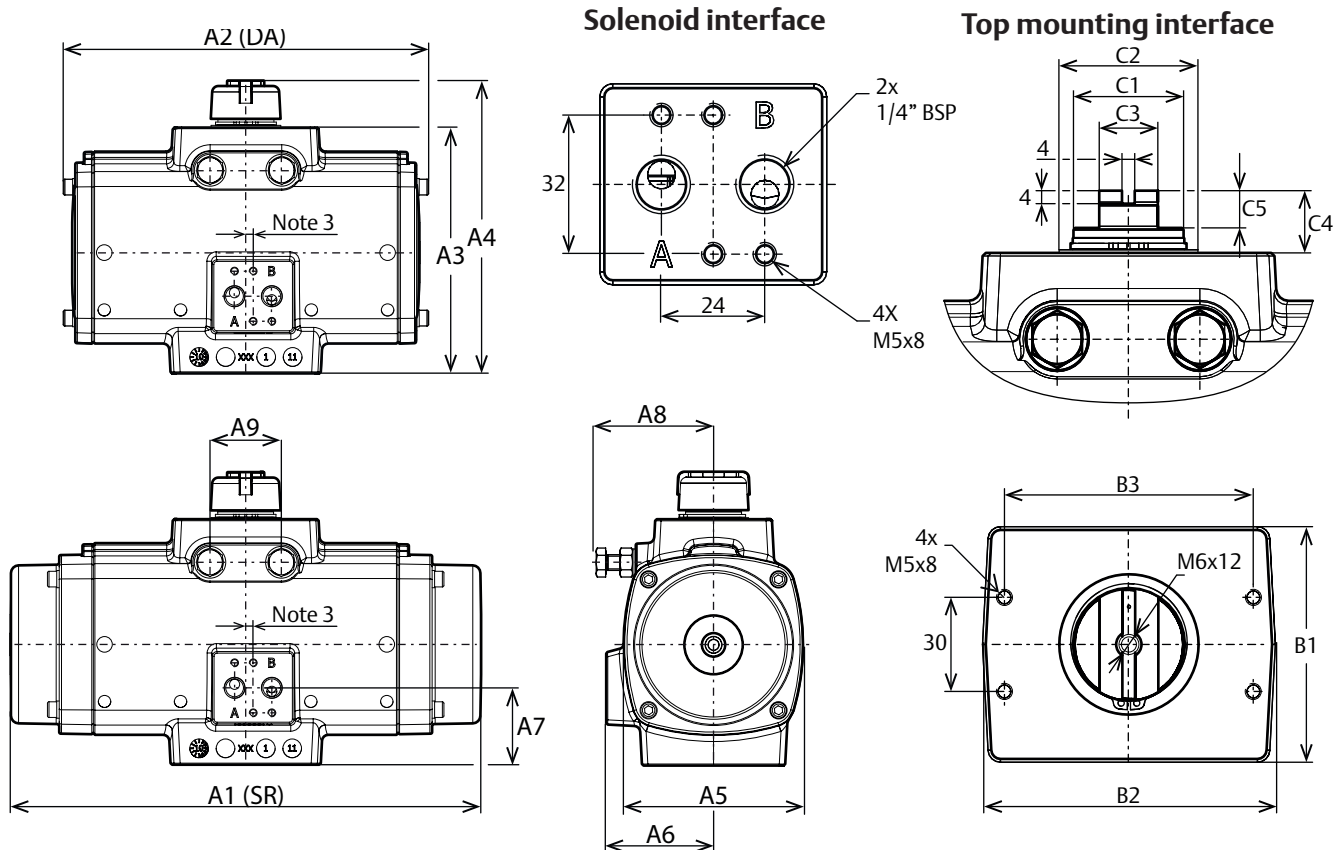
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO 5211
- Option: Solenoid mounting interface according to VDI/VDE 3845 (NAMUR). See dotted image.
- For further information regarding options, materials, certifications and additional execution please contact your regional sales office

**European Directives:**

- PED : suitable for use with group 2 gases according to Pressure Equipment Directive 97/23/EC
- ATEX : suitable for use in hazardous areas classified as II 2 GD, zones 1 or 2 (gases) and 21 or 22 (dust).

## Dimensions - Metric (ISO5211)

### Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 25 - 350



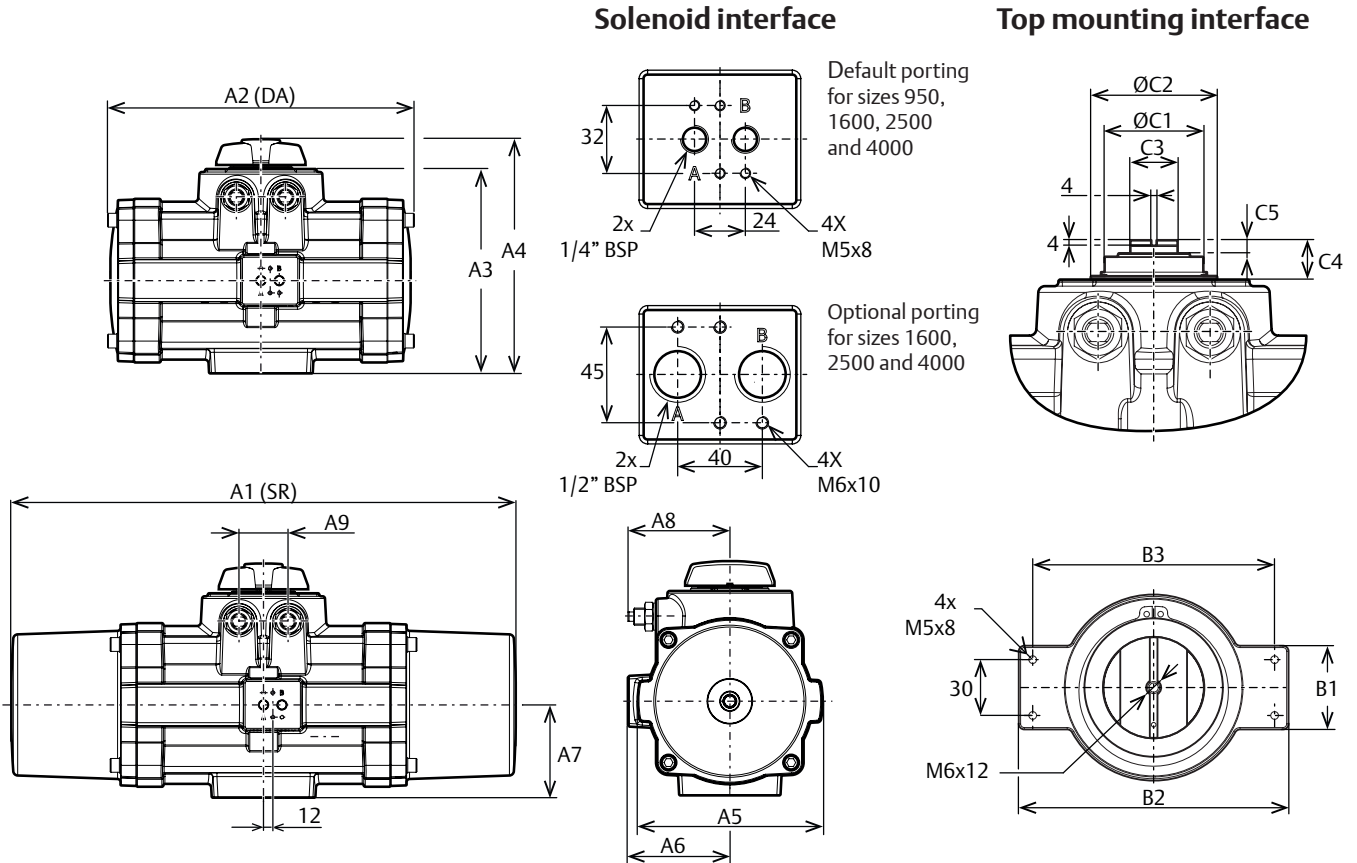
**Note:**

1. DA = Double-Acting, SR = Spring-Return
2. Solenoid interface and top mounting interface according to VDI/VDE3845 (NAMUR)
3. The solenoid drilling pattern is shifted 4 mm for size 0025 and 2 mm for size 0040 vs the centerline of the actuator.

Dim in. mm	Actuator size						
	0025	0040	0065	0100	0150	0200	0350
A1	166	192	217	247	304	362	385
A2	166	192	217	247	235	265	284
A3	91	112	124	131	157	163	201
A4	119	139	151	158	185	191	230
A5	68	82	92	103	116	124	161
A6	49	55	58	64	69	72	85
A7	30	34	38	38	49	49	42
A8	48	58	69	69	75	87	109
A9	18	25	27	28	46	46	46
B1	43	45	50	60	75	75	85
B2	94	94	94	97	94	94	100
B3	80	80	80	80	80	80	80
C1	16	22	22	22	34	36	36
C2	23	30	30	35	45	45	45
C3	14	14	14	14	19	19	19
C4	20	20	20	20	20	20	20
C5	12	12	12	12	12	12	12

## Dimensions - Metric (ISO5211)

### Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 600 - 4000



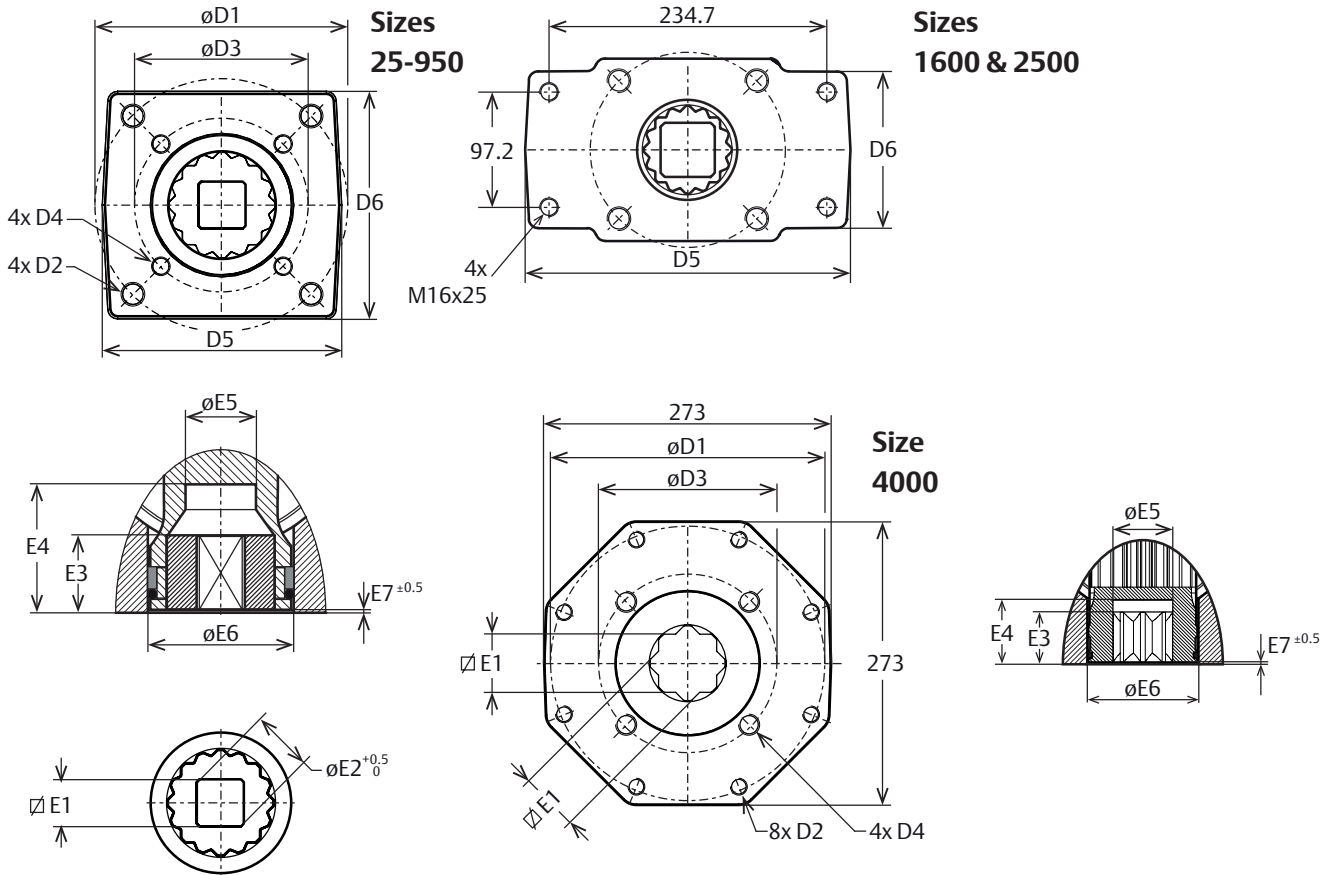
**Note:**

1. DA = Double-Acting, SR = Spring-Return
2. Solenoid interface and top mounting interface according to VDI/VDE3845 (NAMUR)
3. The solenoid drilling pattern is shifted 12 mm for sizes 0950 to 4000 vs the centerline of the actuator.
4. The numbers in brackets are for actuators with 1/2" ports.

Dim in. mm	Actuator size				
	0600	0950	1600	2500	4000
A1	476	658	732	877	959
A2	356	400	462	550	649
A3	248	268	302	354	389
A4	292	305	339	392	427
A5	195	239	306	350	400
A6	102	131	149	170	196
A7	67	121	137 (140) <sup>4</sup>	157 (160) <sup>4</sup>	184 (186) <sup>4</sup>
A8	132	131	156	181	175
A9	60	64	85	102	184
B1	98	45	45	45	45
B2	148	145	145	145	145
B3	130	130	130	130	130
C1	55	65	75	95	96
C2	65	83	96	118	115
C3	36	36	36	36	36
C4	30	30	30	30	30
C5	10	10	10	10	10

## Dimensions - Metric (ISO5211)

### Valve Flange and Drive Details Sizes 25 - 4000



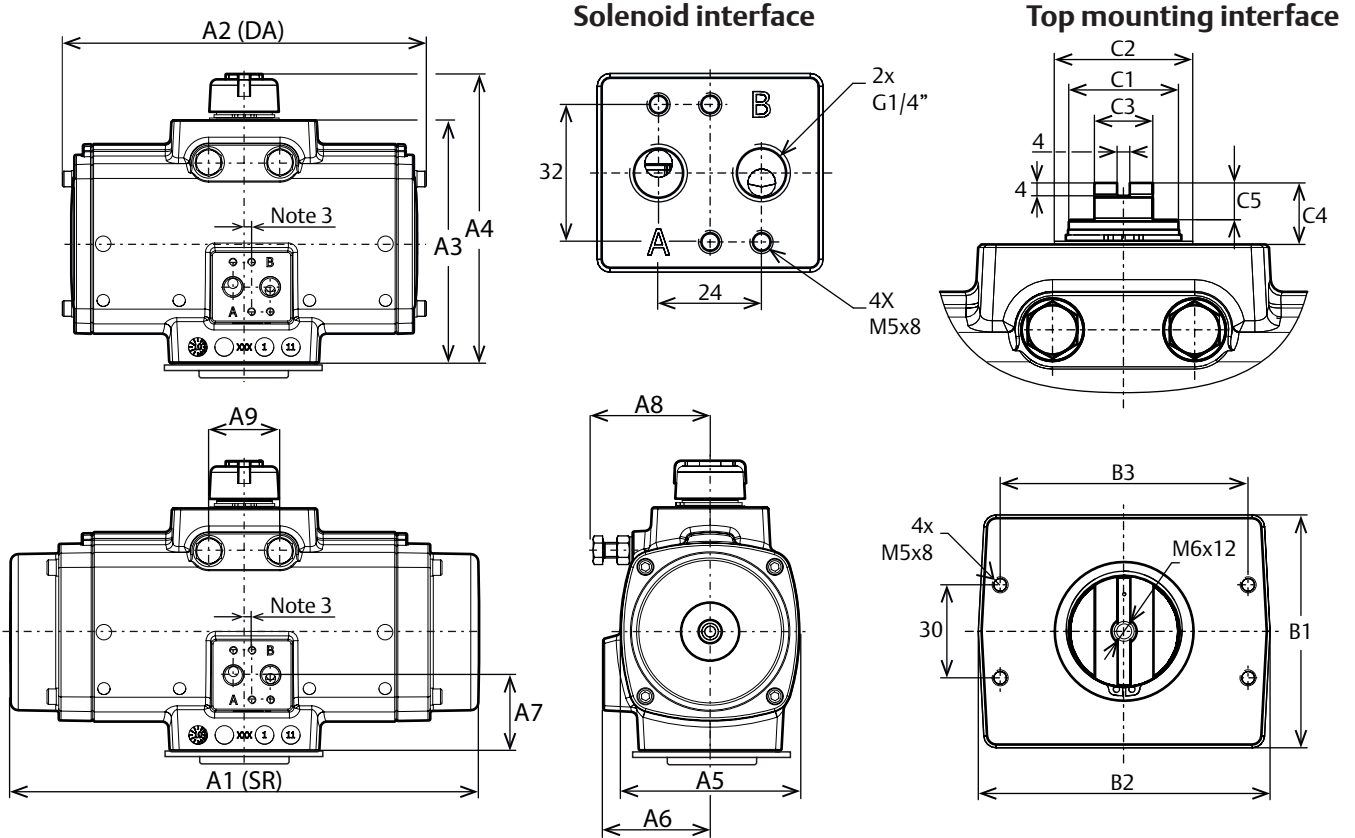
**Notes:**

1. Flange and square drive according to ISO 5211
2. F25\* = For sizes 1600 and 2500 drilling pattern 234.7 x 97.2 represent 4 holes of a F25 drilling pattern.
3. Size 4000 has 2x inner square E1 in the pinion bottom instead of inserts

Dim in. mm	Actuator size											
	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
ISO 1	F05	F07	F07	F07	F10	F10	F10	F12	F14	F16	F16	F25
D1	50	70	70	70	102	102	102	125	140	165	165	254
D2	M6x10	M8x13	M8x13	M8x13	M10x15	M10x15	M10x15	M12x18	M16x25	M20x20	M20x20	M16x25
ISO 2	F03	F05	F05	F05	F07	F07	F07	F10	F10	F25*	F25*	F16
D3	36	50	50	50	70	70	70	102	102	-/-	-/-	165
D4	M5x8	M6x10	M6x10	M6x10	M8x13	M8x13	M8x13	M10x16	M10x16	-/-	-/-	M20x20
D5	50	68	68	66	97	94	94	118	135	280	280	273
D6	48	65	65	63	92	90	94	113	130	132	132	269
E1 Max.	11.08	14.08	14.08	19.08	19.08	22.10	27.11	27.11	36.16	46.16	46.16	55.24
E1 Min.	11.00	14.00	14.00	19.00	19.00	22.00	27.00	27.00	36.00	46.00	46.00	55.00
E2	14.1	18.1	18.1	25.2	25.5	28.2	36.2	36.2	58.2	60.2	60.2	72.2
E3	15	15	15	18	27.5	27.5	27.5	27.5	48.5	59.5	59.5	61.5
E4	34	34	34	34	50	50	50	50	65.5	81.5	81.5	76.75
E5	14.1	18.1	21.1	23.5	28.5	32.1	32.1	36.5	48	60	60	73
E6	24.5	34.5	34.5	38	56.5	56.5	56.5	67.5	86	104	125	133
E7	0.5	1	1	1	1.2	1.2	1.2	1.2	1	1	1	1

## Dimensions - Metric (DIN3337)

### Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 25 - 350



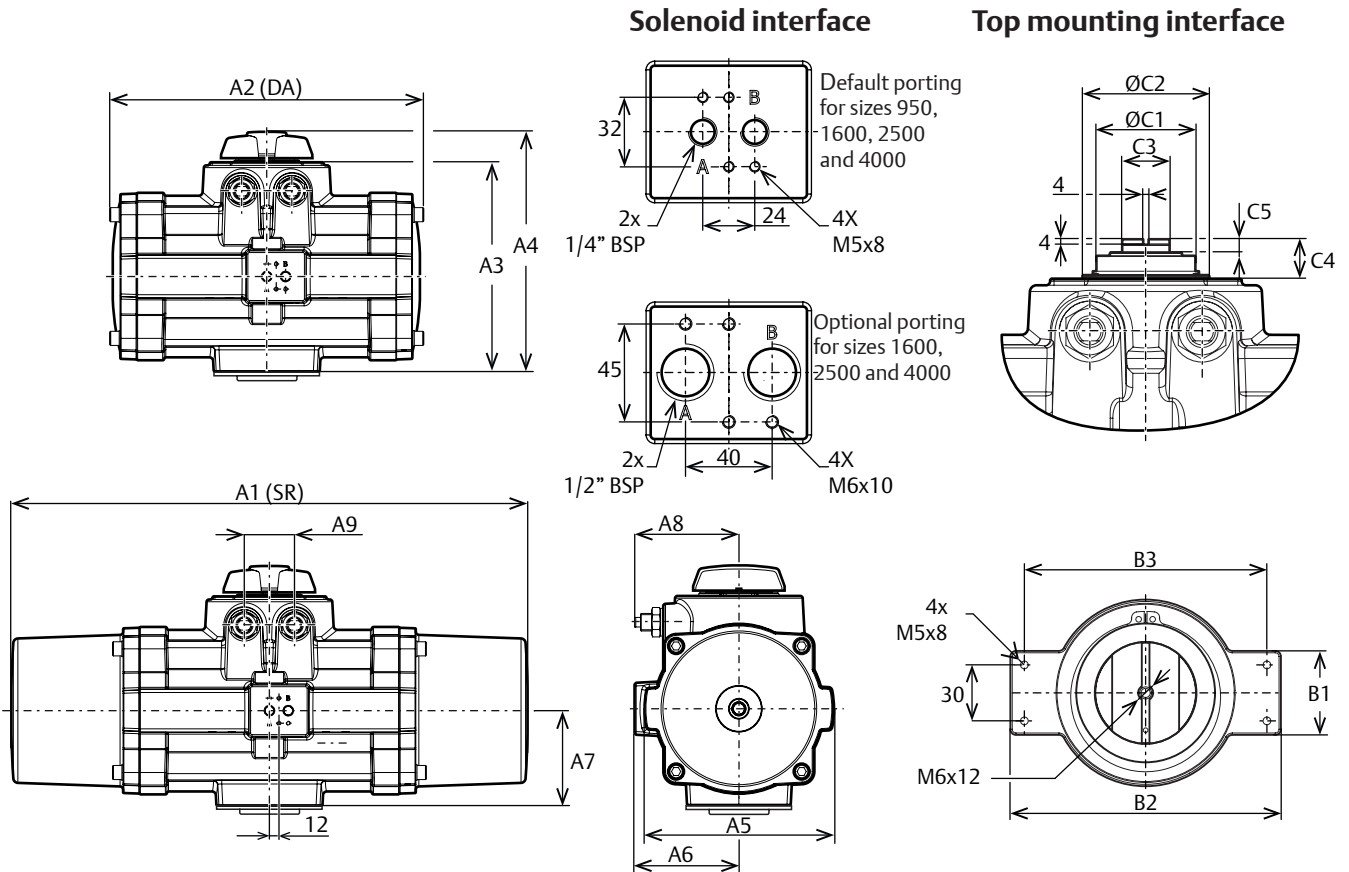
**Note:**

1. DA = Double-Acting, SR = Spring-Return
2. Solenoid interface and top mounting interface according to VDI/VDE3845 (NAMUR)
3. The solenoid drilling pattern is shifted 4 mm for size 0025 and 2 mm for size 0040 vs the centerline of the actuator.

Dim in. mm	Actuator size						
	0025	0040	0065	0100	0150	0200	0350
A1	166	192	217	247	304	362	385
A2	166	192	217	247	235	265	284
A3	91	112	124	131	157	163	201
A4	119	139	151	158	185	191	230
A5	68	82	92	103	116	124	161
A6	49	55	58	64	69	72	85
A7	30	34	38	38	49	49	42
A8	48	58	69	69	75	87	109
A9	18	25	27	28	46	46	46
B1	43	45	50	60	75	75	85
B2	94	94	94	97	94	94	100
B3	80	80	80	80	80	80	80
C1	16	22	22	22	34	36	36
C2	23	30	30	35	45	45	45
C3	14	14	14	14	19	19	19
C4	20	20	20	20	20	20	20
C5	12	12	12	12	12	12	12

## Dimensions - Metric (DIN3337)

### Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 25 - 350



**Note:**

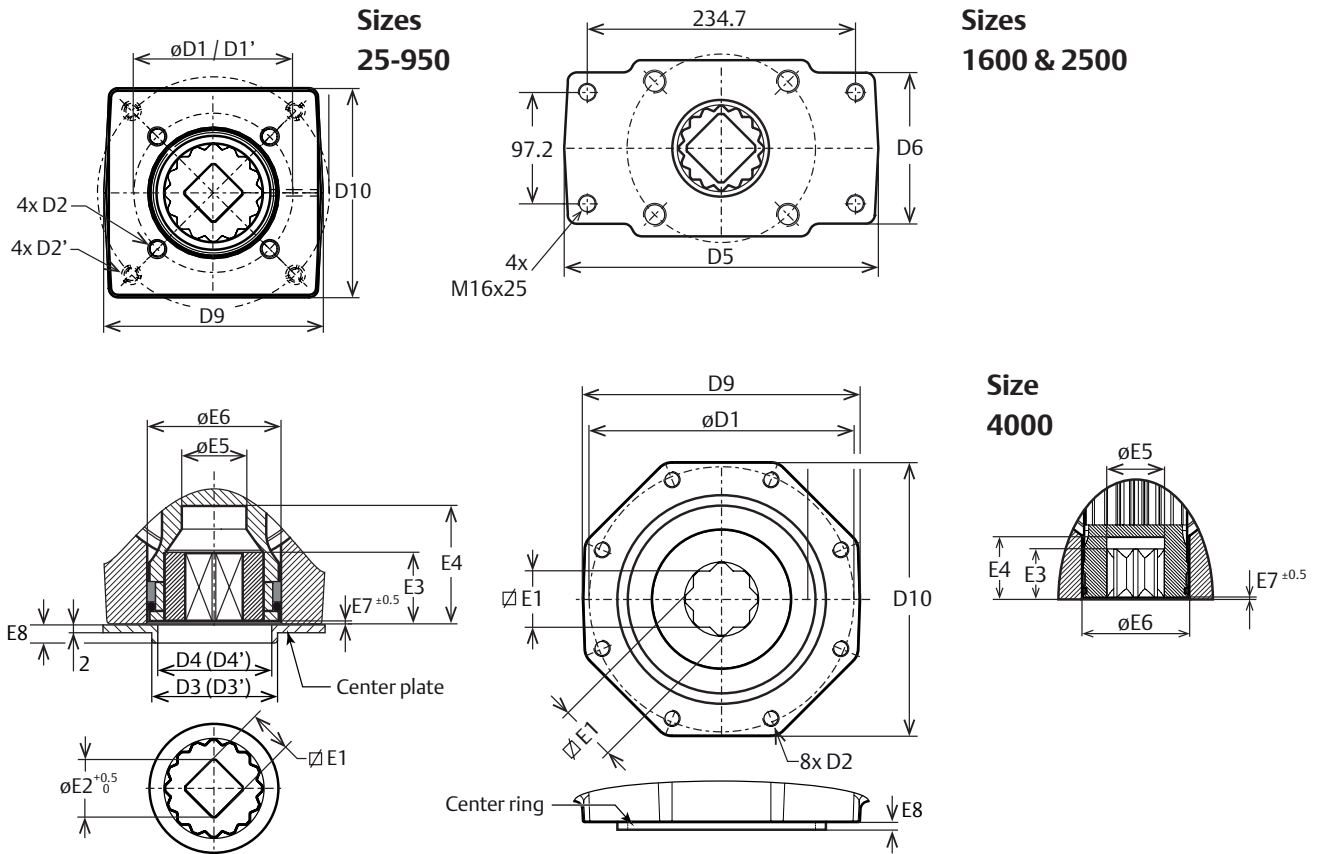
1. DA = Double-Acting, SR = Spring-Return
2. Solenoid interface and top mounting interface according to VDI/VDE3845 (NAMUR)
3. The solenoid drilling pattern is shifted 12 mm for sizes 0950 to 4000 vs the centerline of the actuator.
4. The numbers in brackets are for actuators with 1/2" ports.

Dim in. mm	Actuator size				
	0600	0950	1600	2500	4000
A1	476	658	732	877	959
A2	356	400	462	550	649
A3	248	268	302	354	389
A4	292	305	339	392	427
A5	195	239	306	350	400
A6	102	131	149	170	196
A7	67	121	137 (140) <sup>4</sup>	157 (160) <sup>4</sup>	184 (186) <sup>4</sup>
A8	132	131	156	181	175
A9	60	64	85	102	184
B1	98	45	45	45	45
B2	148	145	145	145	145
B3	130	130	130	130	130
C1	55	65	75	95	96
C2	65	83	96	118	115
C3	36	36	36	36	36
C4	30	30	30	30	30
C5	10	10	10	10	10



## Dimensions - Metric (DIN3337)

### Valve Flange and Drive Details Sizes 25 - 4000



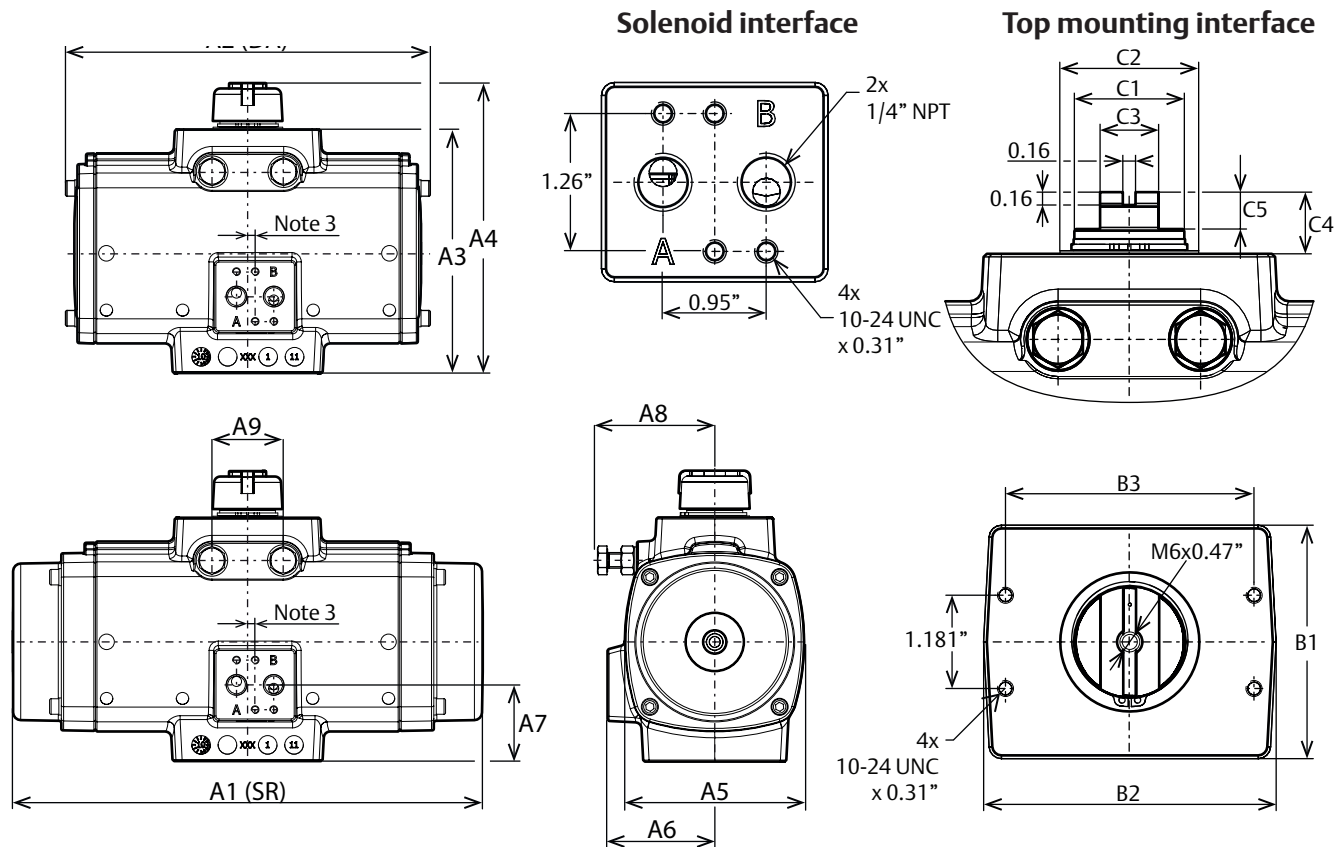
**Notes:**

1. Flange and square drive according to ISO 5211
2. F25\* = For sizes 1600 and 2500 drilling pattern 234.7 x 97.2 represent 4 holes of a F25 drilling pattern.
3. Size 4000 has 2x inner square E1 in the pinion bottom instead of inserts
4. Drilling patterns DIN 1 are standard. Drilling patterns DIN 2 are optional.

Dim in. mm	Actuator size											
	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
<b>DIN 1</b>	<b>F05</b>	<b>F05</b>	<b>F05</b>	<b>F07</b>	<b>F07</b>	<b>F10</b>	<b>F10</b>	<b>F12</b>	<b>F14</b>	<b>F16</b>	<b>F16</b>	<b>F25</b>
<b>D1</b>	50	50	50	70	70	102	102	125	140	165	165	254
<b>D2</b>	M6x10	M6x10	M6x10	M8x13	M8x13	M10x15	M10x15	M12x18	M16x25	M20x20	M20x20	M16x25
<b>D3</b>	35	35	35	55	55	70	70	85	100	130	130	200
<b>D4</b>	29	32	32	40	50	54	54	68	75	95	95	120
<b>DIN 2</b>	<b>F03</b>	<b>F07</b>	<b>F07</b>	<b>F05</b>	<b>F10</b>	<b>F07</b>	<b>F07</b>	<b>F10</b>	<b>F10</b>	<b>F25*</b>	<b>F25*</b>	<b>F16</b>
<b>D1'</b>	36	70	70	50	102	70	70	102	102	-/-	-/-	-/-
<b>D2'</b>	M5x8	M8x13	M8x13	M6x10	M10x15	M8x13	M8x13	M10x15	M10x15	-/-	-/-	-/-
<b>D3'</b>	-	40	40	32	54	50	50	-/-	-/-	-/-	-/-	-/-
<b>D4'</b>	-	55	55	35	70	55	55	-/-	-/-	-/-	-/-	-/-
<b>D9</b>	50	68	68	66	97	94	94	118	135	280	280	273
<b>D10</b>	48	65	65	63	92	90	94	113	130	132	132	269
<b>E1 Max</b>	11.08	14.08	14.08	17.08	17.08	22.10	22.10	27.11	36.16	46.16	46.16	55.24
<b>E1 Min</b>	11.00	14.00	14.00	17.00	17.00	22.00	22.00	27.00	36.00	46.00	46.00	55.00
<b>E2</b>	14.1	18.1	18.1	25.2	25.5	28.2	36.2	36.2	58.2	60.2	60.2	72.2
<b>E3</b>	15.0	15.0	15.0	18.0	27.5	27.5	27.5	27.5	48.5	59.5	59.5	61.5
<b>E4</b>	34.0	34.0	34.0	34.0	50.0	50.0	50.0	50.0	65.5	81.5	81.5	76.75
<b>E5</b>	14.1	18.1	21.1	23.5	28.5	32.1	32.1	36.5	48	60	60	73
<b>E6</b>	24.5	34.5	34.5	38.0	56.5	56.5	56.5	67.5	86	104	125	133
<b>E7</b>	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1	1	1	1
<b>E8</b>	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6	7	7	2.5

## Dimensions - Imperial (ISO5211)

### Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 25 - 350



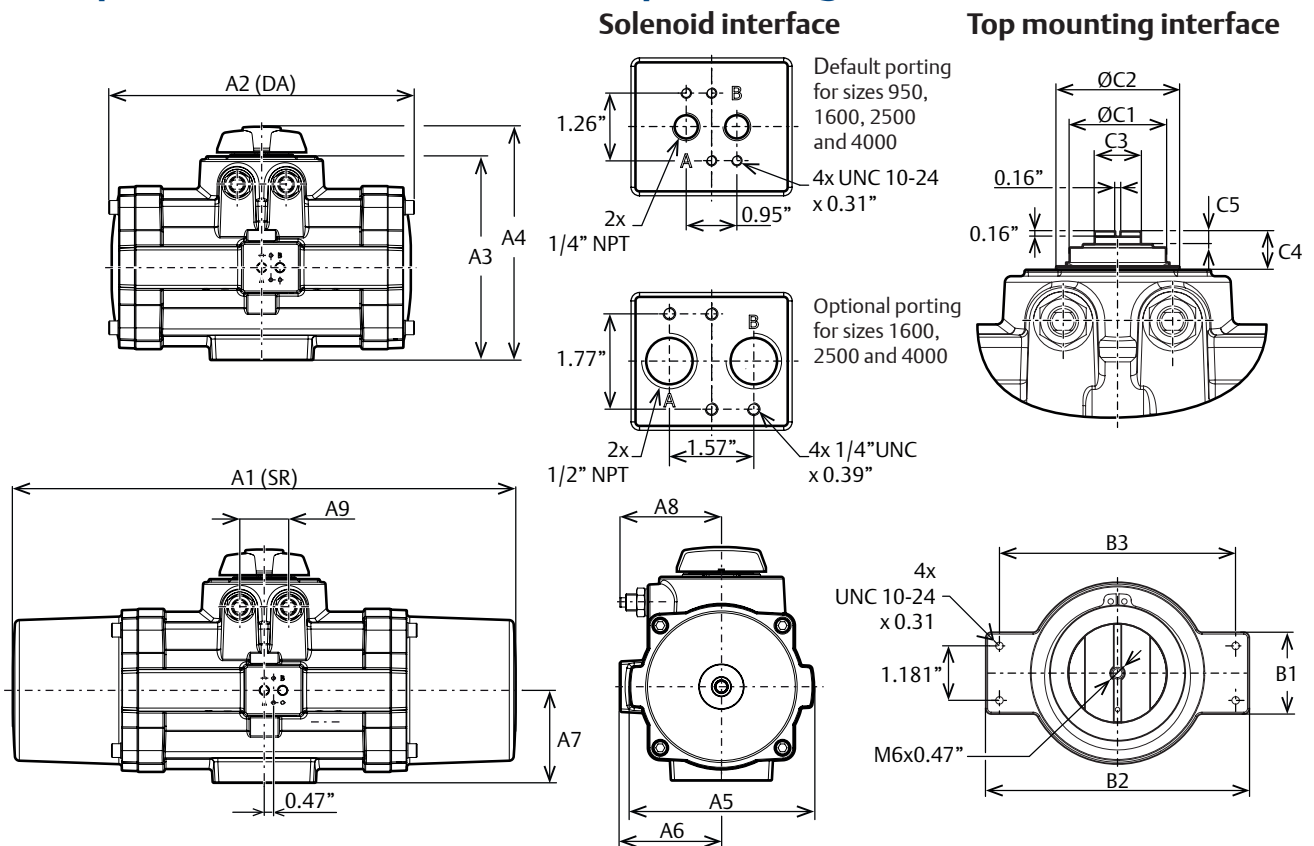
**Note:**

1. DA = Double-Acting, SR = Spring-Return
2. Solenoid interface and top mounting interface according to VDI/VDE3845 (NAMUR)
3. The solenoid drilling pattern is shifted 0.16" for size 0025 and 0.08 mm for size 0040 vs the centerline of the actuator.
4. Imperial threads are UNC for fastener thread holes and NPT for air connection ports.

Dim in. Inches	Actuator size						
	0025	0040	0065	0100	0150	0200	0350
A1	6.54	7.55	8.53	9.72	11.97	14.23	15.15
A2	6.54	7.55	8.53	9.72	9.25	10.43	11.18
A3	3.59	4.39	4.86	5.14	6.19	6.42	7.92
A4	4.69	5.47	5.94	6.22	7.28	7.52	9.06
A5	2.68	3.23	3.62	4.06	4.57	4.88	6.34
A6	1.91	2.15	2.28	2.50	2.72	2.83	3.35
A7	1.16	1.34	1.48	1.50	1.93	1.92	1.65
A8	1.89	2.28	2.72	2.72	2.95	3.43	4.29
A9	0.71	0.98	1.06	1.10	1.81	1.81	1.81
B1	1.69	1.77	1.97	2.36	2.95	2.95	3.35
B2	3.70	3.70	3.70	3.82	3.70	3.70	3.94
B3	3.15	3.15	3.15	3.15	3.15	3.15	3.15
C1	0.63	0.87	0.87	0.87	1.34	1.42	1.42
C2	0.91	1.18	1.18	1.38	1.77	1.77	1.77
C3	0.55	0.55	0.55	0.55	0.75	0.75	0.75
C4	0.79	0.79	0.79	0.79	0.79	0.79	0.79
C5	0.47	0.47	0.47	0.47	0.47	0.47	0.47

## Dimensions - Imperial (ISO5211)

### Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 600 - 4000



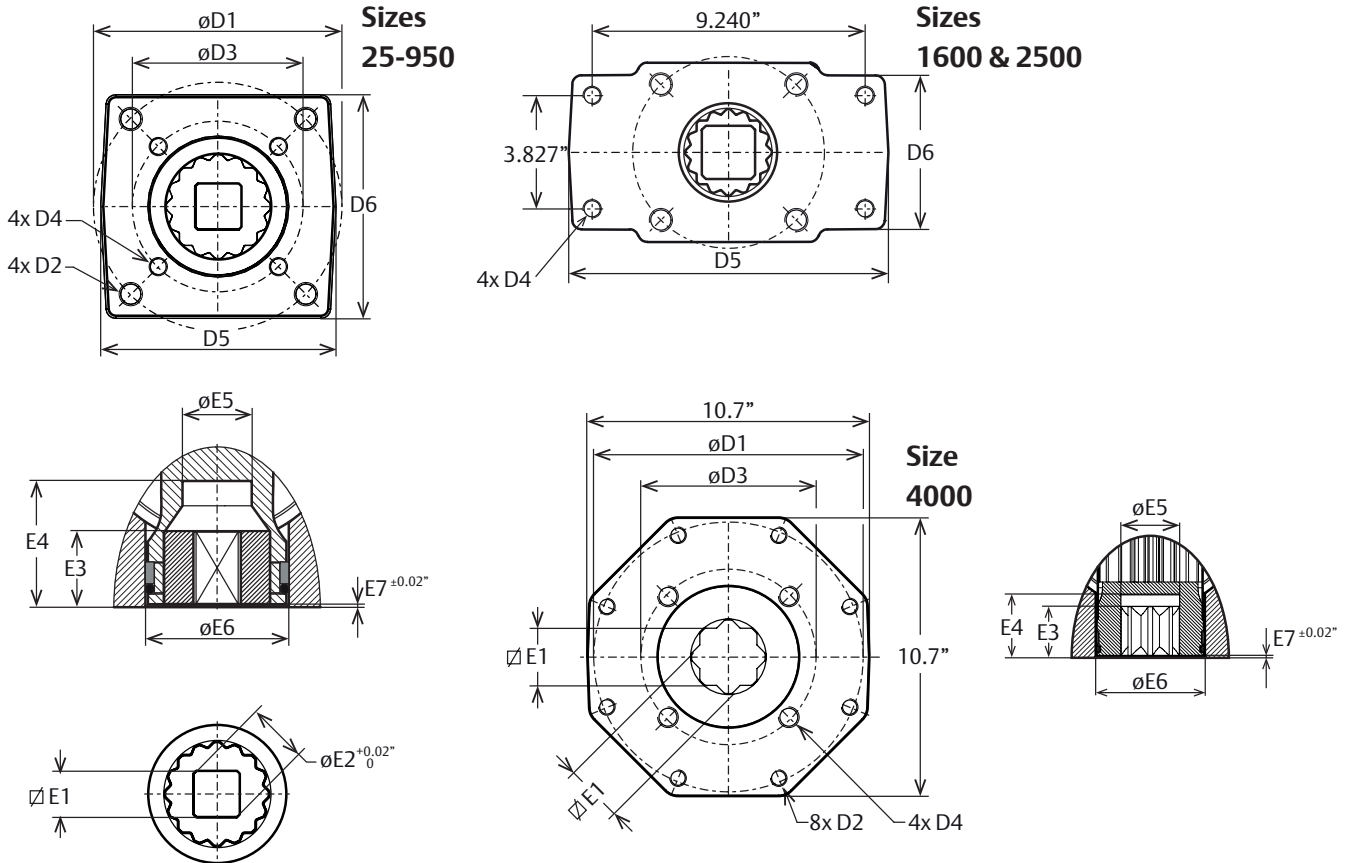
**Note:**

1. DA = Double-Acting, SR = Spring-Return
2. Solenoid interface and top mounting interface according to VDI/VDE3845 (NAMUR)
3. The solenoid drilling pattern is shifted 0.95" for sizes 0950 to 4000 vs the centerline of the actuator.
4. The numbers in brackets are for actuators with 1/2" ports.
5. Imperial threads are UNC for fastener thread holes and NPT for air connection ports.

Dim in. Inches	Actuator size				
	0600	0950	1600	2500	4000
A1	18.73	25.91	28.82	34.53	37.76
A2	14.02	15.75	18.19	21.65	25.55
A3	9.77	10.55	11.89	13.94	15.31
A4	11.50	12.01	13.35	15.43	16.81
A5	7.68	9.41	12.05	13.78	15.75
A6	4.02	5.16	5.87	6.69	7.72
A7	2.64	4.76	5.39 (5.51) <sup>4</sup>	6.18 (6.29) <sup>4</sup>	7.24 (7.32) <sup>4</sup>
A8	5.20	5.16	6.14	7.13	6.89
A9	2.36	2.52	3.35	4.02	7.24
B1	3.86	1.77	1.77	1.77	1.77
B2	5.83	5.71	5.71	5.71	5.71
B3	5.12	5.12	5.12	5.12	5.12
C1	2.17	2.56	2.95	3.74	3.78
C2	2.56	3.27	3.78	4.65	4.53
C3	1.42	1.42	1.42	1.42	1.42
C4	1.18	1.18	1.18	1.18	1.18
C5	0.39	0.39	0.39	0.39	0.39

## Dimensions - Imperial (ISO5211)

### Valve Flange and Drive Details Sizes 25 - 4000



**Notes:**

1. Flange and square drive according to ISO 5211
2. F25\* = For sizes 1600 and 2500 drilling pattern 9.240"x 3.827" represent 4 holes of a F25 drilling pattern.
3. Size 4000 has 2x inner square E1 in the pinion bottom instead of inserts
4. Imperial threads are UNC for fastener thread holes and NPT for air connection ports.

Dim in. Inches	Actuator size											
	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
<b>ISO 1</b>	<b>F05</b>	<b>F07</b>	<b>F07</b>	<b>F07</b>	<b>F10</b>	<b>F10</b>	<b>F10</b>	<b>F12</b>	<b>F14</b>	<b>F16</b>	<b>F16</b>	<b>F25</b>
<b>D1</b>	1.969	2.756	2.756	2.756	4.016	4.016	4.016	4.921	5.512	6.496	6.496	10.000
<b>D2</b>	1/4"-20 x0.35	5/16"-18 x0.47	5/16"-18 x0.47	5/16"-18 x0.47	3/8"-16 x0.59	3/8"-16 x0.59	3/8"-16 x0.59	1/2"-13 x0.71	5/8"-11 x0.94	3/4"-10 x1.18	3/4"-10 x1.18	5/8"-11 x0.94
<b>ISO 2</b>	<b>F03</b>	<b>F05</b>	<b>F05</b>	<b>F05</b>	<b>F07</b>	<b>F07</b>	<b>F07</b>	<b>F10</b>	<b>F10</b>	<b>F25*</b>	<b>F25*</b>	<b>F16</b>
<b>D3</b>	1.417	1.969	1.969	1.969	2.756	2.756	2.756	4.016	4.016	-/-	-/-	6.496
<b>D4</b>	10-24 x0.31	1/4"-20 x0.35	1/4"-20 x0.35	1/4"-20 x0.35	5/16"-18 x0.47	5/16"-18 x0.47	5/16"-18 x0.47	3/8"-16 x0.59	3/8"-16 x0.59	5/8"-11 x0.94	5/8"-11 x0.94	3/4"-10 x1.18
<b>D5</b>	1.97	2.68	2.68	2.62	3.82	3.7	3.7	4.65	5.31	11.02	11.02	10.75
<b>D6</b>	1.89	2.56	2.56	2.48	3.62	3.54	3.7	4.45	5.12	5.2	5.2	10.59
<b>E1 Max.</b>	0.436	0.554	0.554	0.751	0.751	0.87	1.067	1.067	1.424	1.817	1.817	2.175
<b>E1 Min.</b>	0.433	0.551	0.551	0.748	0.748	0.866	1.063	1.063	1.417	1.811	1.811	2.165
<b>E2</b>	0.555	0.713	0.713	0.992	1.004	1.11	1.425	1.425	2.291	2.37	2.37	2.843
<b>E3</b>	0.591	0.591	0.591	0.709	1.083	1.083	1.083	1.083	1.909	2.343	2.343	2.421
<b>E4</b>	1.34	1.34	1.34	1.34	1.97	1.97	1.97	1.97	2.58	3.21	3.21	3.02
<b>E5</b>	0.56	0.71	0.83	0.93	1.12	1.26	1.26	1.44	1.89	2.36	2.36	2.87
<b>E6</b>	0.96	1.36	1.36	1.5	2.22	2.22	2.22	2.66	3.39	4.09	4.92	5.24
<b>E7</b>	0.02	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04

## Drive Inserts

### Key features

- Drive inserts allow actuators to be directly mounted to valves
- Eliminates the need for a bracket and coupling type mounting kit.
- The use of drive inserts significantly cuts the cost of the valve/actuator assembly.
- Standard actuators are fitted with square drive inserts
- Special inserts may have oversized or undersized squares, double-D and shaft key way forms.

### Description

The EL-O-Matic F actuators are fitted with drive inserts. These drive inserts allow actuators to be directly mounted onto suitable valves in accordance with ISO 5211 and eliminates the need for a bracket and coupling type mounting kit. The use of direct mounts significantly cuts the cost of the valve/actuator assembly.

Standard actuators are fitted with square drive inserts in accordance with ISO 5211. The ISO 5211 standard covers parallel and diagonal oriented inner squares (as per old DIN 3337 standard).

Additionally, a wide variety of other inserts are also available. Special inserts may have oversized or undersized squares, double-D and shaft key way forms.

Drive inserts can be supplied on factory built actuators or as loose items and are easily replaceable at distributor or end user level.

Where direct mounts are not possible, for instance on valves with exposed gland packing, the use of inserts often simplifies the design of the mounting kit.

- Material: Aluminium alloy
- Finish : Anodized

### Note:

1. Actuator size F12 does not have inserts. This actuator size has the inner square directly in the bottom of the pinion.
2. Actuator size F4000 does not have inserts. This actuator size has two inner squares (diagonally and parallel oriented) directly in the bottom of the pinion.
3. Page 2 and 3 shows an overview of the default insert sizes and the most common square shaped insert sizes. Please contact your local EL-O-Matic representative for all available insert sizes.

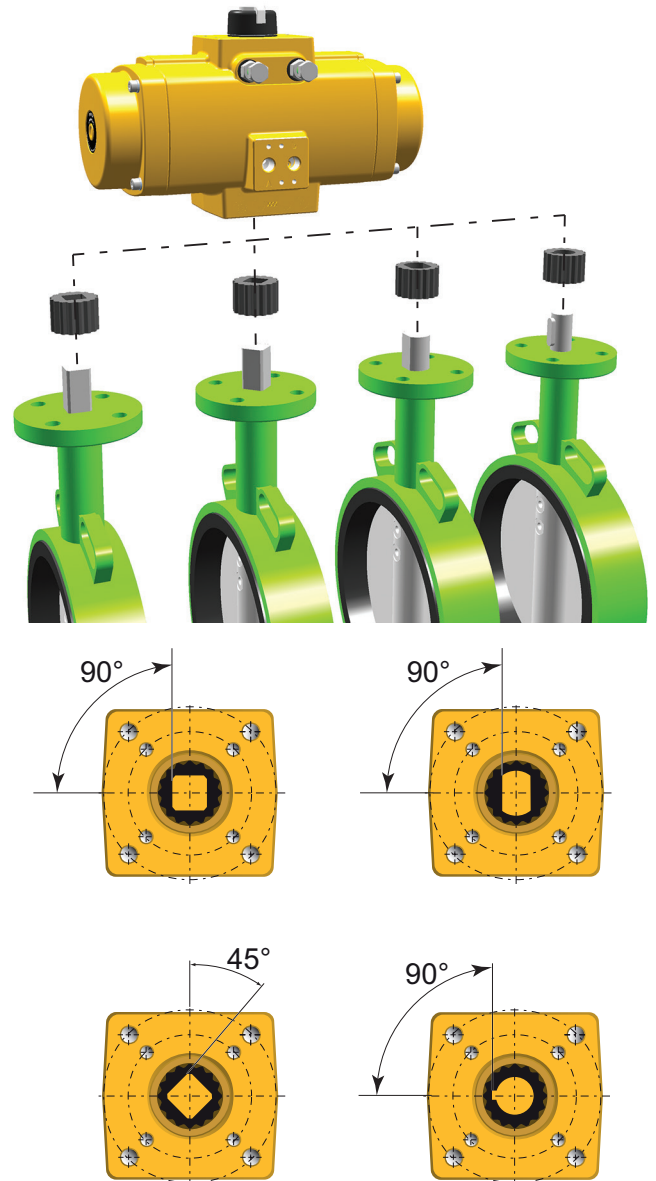


Table 1. Metric drive square overview

Dim. in mm	Inserts with inner-square-dimensions per actuator type											
	0012	0025	0040/ 0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
<b>Standard square drive dimensions</b>												
Type	Square	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Star drive
Parallel ■	9	11	14	19	19	22	27	27	36	46	46	55
Diagonal ◆	9	11	14	17	17	22	22	27	36	46	46	55
<b>Optional square insert dimensions (Note 1)</b>												
No insert		8	8	9	9	9	9	9	14	22	22	No insert
		9	9	10	10	10	10	10	19	27	27	
		10	10	11	11	11	11	11	22	30	30	
			11	12	12	12	12	12	27	36	36	
			12	14	14	14	14	14	30			
			16	16	16	16	16	16				
					22	17	17	17				
					24	19	19	19				
					25	24	24	22				
				27	25	25	24					
					27		25					
<b>Maximum adaptor/valve stem dimensions</b>												
M1	No insert	34.5	34.5	34.5	50	50	50	52	64.5	81	81	No insert
M2		-	-	27.5	-	37	37	-	-	-	-	
P1		14.1	18.1/ 21.2	23.5	28.5	32.2	32.2	36.8	48.3	60.2	60.2	
P2		-	-	25.2	-	36.3	36.3	-	-	-	-	
Sq. max.		11	16	19	27	27	27	27	36	46	46	
D max.		13.8	21	23.6	33.6	33.6	33.6	33.6	45	60	60	

1. Above table shows an overview of the default insert sizes and the most common square shaped insert sizes. Please contact your local EL-O-Matic representative for all available insert sizes.

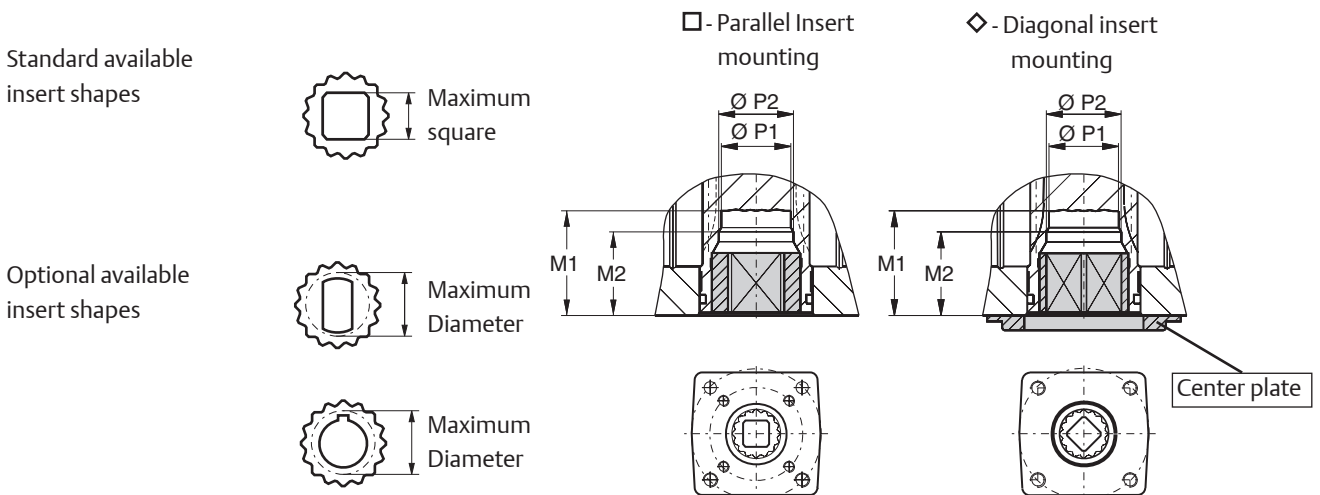
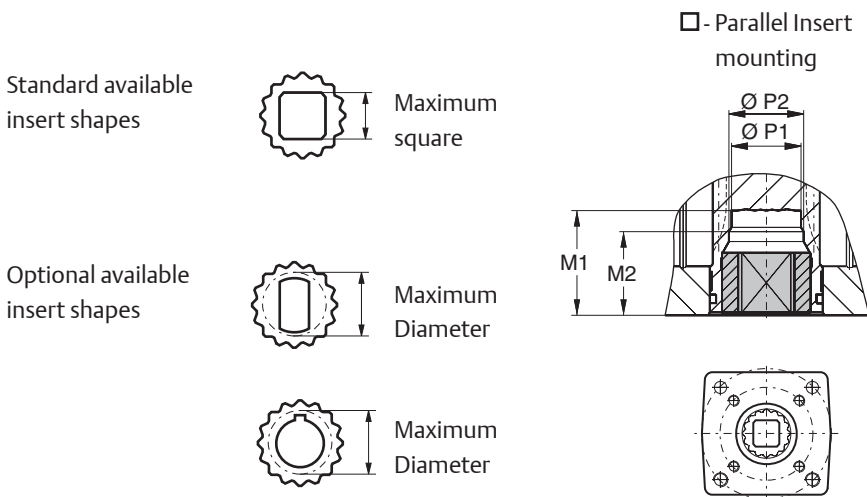


Table 2. Imperial drive square overview

Dim. in inches	Inserts with inner-square-dimensions per actuator type											
	12	25	0040/0065	100	150	200	350	600	950	1600	2500	4000
<b>Standard square drive dimensions</b>												
Type	Square	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Star drive
Parallel ■	0.354	0.433	0.551	0.748	0.748	0.866	1.063	1.063	1.417	1.811	1.811	2.165
Diagonal ◆	0.354	0.433	0.551	0.669	0.669	0.866	0.866	1.063	1.417	1.811	1.811	2.165
<b>Optional square insert dimensions (Note 1)</b>												
No insert		0.315	0.315	0.354	0.354	0.354	0.354	0.354	0.551	0.866	0.866	No insert
		0.354	0.354	0.394	0.394	0.394	0.394	0.394	0.748	1.063	1.063	
		0.394	0.394	0.433	0.433	0.433	0.433	0.433	0.866	1.181	1.181	
			0.433	0.472	0.472	0.472	0.472	0.472	1.063	1.417	1.417	
			0.472	0.551	0.551	0.551	0.551	0.551	1.181			
			0.630	0.630	0.630	0.630	0.630	0.630				
					0.866	0.669	0.669	0.669				
					0.945	0.748	0.748	0.748				
					0.984	0.945	0.945	0.866				
					1.063	0.984	0.984	0.945				
					1.063		0.984					
<b>Maximum adaptor/valve stem dimensions</b>												
M1	No insert	1.358	1.358	1.358	1.969	1.969	1.969	2.047	2.539	3.189	3.189	No insert
M2		-	-	27.5	-	37	37	-	-	-	-	
P1		0.555	0.717/0.835	0.925	1.122	1.268	1.268	1.449	1.902	2.37	2.37	
P2		-	-	0.992	-	1.429	1.429	-	-	-	-	
Sq. max.		0.433	0.630	0.748	1.063	1.063	1.063	1.063	1.417	1.811	1.811	
D max.		0.543	0.827	0.929	1.323	1.323	1.323	1.323	1.772	2.362	2.362	

1. Above table shows an overview of the default insert sizes and the most common square shaped insert sizes. Please contact your local EL-O-Matic representative for all available insert sizes.



## Center Plate / Center ring

### Key features

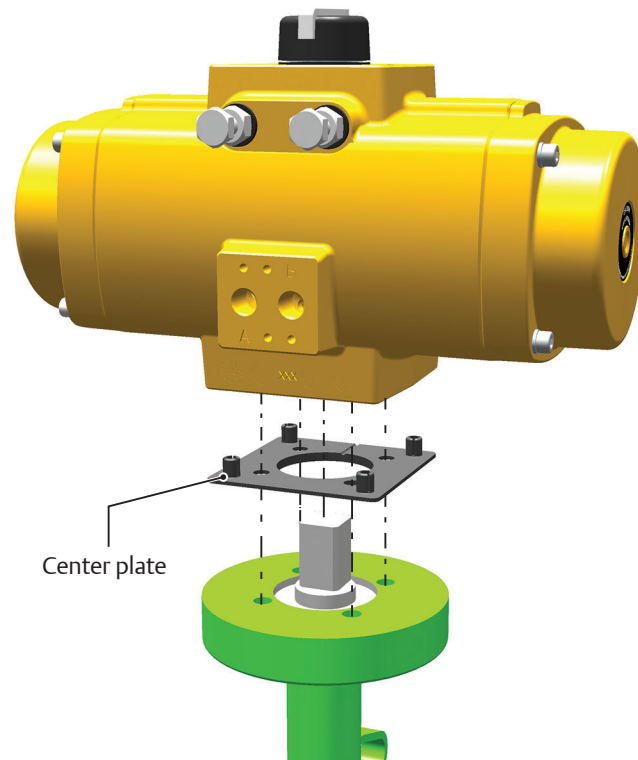
- Durable design allows good alignment of actuator and valve.
- Prevents wear on valve spindle or mounting kit due to misalignment.
- Center plates can easily be added to standard actuator.
- Most actuators are available with two center plates for flexible valve mounting.
- Equipped with slot to release pressure, trapped between valve and actuator.

### Description:

EL-O-Matic F-Series actuators can be equipped with a center plate which takes care that actuator and valve (or valve mounting kit) are aligned when mounted. For most of the actuator sizes two centering plates are available. Size 4000 is available with a stainless steel center ring in a machined groove in the valve flange. Size 12 is not available with a center plate or ring.

### Specifications:

- Material plate: Nylon PA6, Black
- Material ring: Stainless Steel (Size 4000 only)



EL-O-Matic F-Series actuator models <sup>(1)</sup>												
	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000 <sup>(2)</sup>
Default <sup>(1)</sup>	F05	F05	F05	F07	F07	F10	F10	F12	F14	F16	F16	F25
Option	-/-	F07	F07	F05	F10	F07	F07	F10	-/-	-/-	-/-	-/-

### Notes:

1. Default selection if actuator needs to comply to DIN 3337, see dimension sheet EFD.04.01.EN.
2. Size 4000 is available with a stainless steel center ring in a machined groove in the valve flange.



## Visual indicator EL-O-Matic F-Series actuators

### Description:

EL-O-Matic F-Series actuators have a large visual position indicator which allows clear indication of the valve's position at almost any position.

EL-O-Matic F-Series indicator is designed for position indication of actuators mounted "in line" with the pipe line and mounted "cross line" with the pipe line.

Conversion is easily done by turning the indicator 90° and reassemble back in place. Default, the position indicator will be mounted "in line".

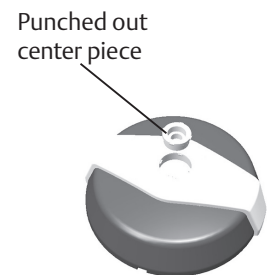
### Specifications:

#### Materials:

- Indicator knob: ABS, Black
- Indicator arrow: ABS, White
- Indicator screw: SS Head cap screw M6x12

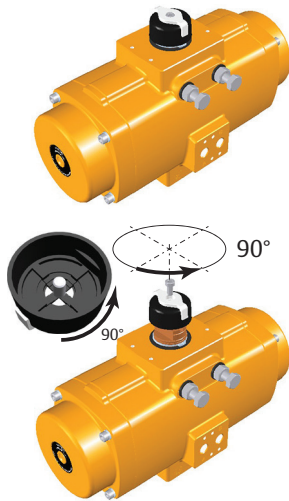
### Center piece of large indicator.

The large indicator, for sizes 600-4000, is designed with a press fitting onto the pinion top. This way, the indicator will stay also on the pinion top without the indicator screw fitted. This press fitting feature together with the option to punch out the center piece of the vane of the large indicator, offers a passageway for a switch box or positioner shaft, up to a diameter of 20mm (0.787").

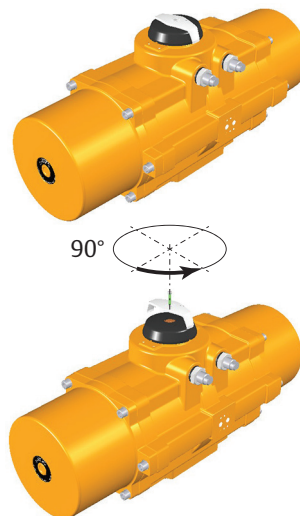


### Indicator mounting "In-line"

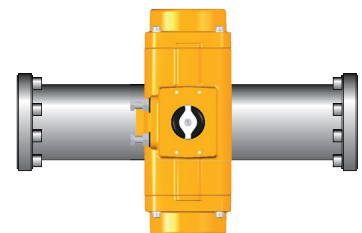
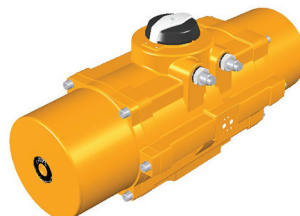
Size 12 - 350



Size 600 - 4000



### Indicator mounting "Across Line"



## EL-O-Matic F-Series with CSR-coating

### Caustic Soda Resistant

#### Key features

- Superior corrosion resistant properties due to special coating and special selected base materials.
- The coating is cured by a temperature of 240°C resulting in a very strong bonding to the aluminium surface.
- Exceeds the requirements of a 1000 hr salt spray test.
- Default available with hard anodized high grade aluminum pinion (no galvanic corrosion).
- Optional available with AISI 316 pinion and A2-70 Stainless steel end cap screws.
- Suitable for corrosive areas where standard uncoated actuators fail, for instance protected areas on off-shore platforms.

#### Description

EL-O-Matic F-Series with CSR-coating offers a superior corrosion resistance in environments where standard aluminium actuators might fail prematurely due to heavy corrosion. As such CSR coated actuators are used in protected areas on off-shore platforms and on bleaching equipment in paper mills.

#### CSR coating

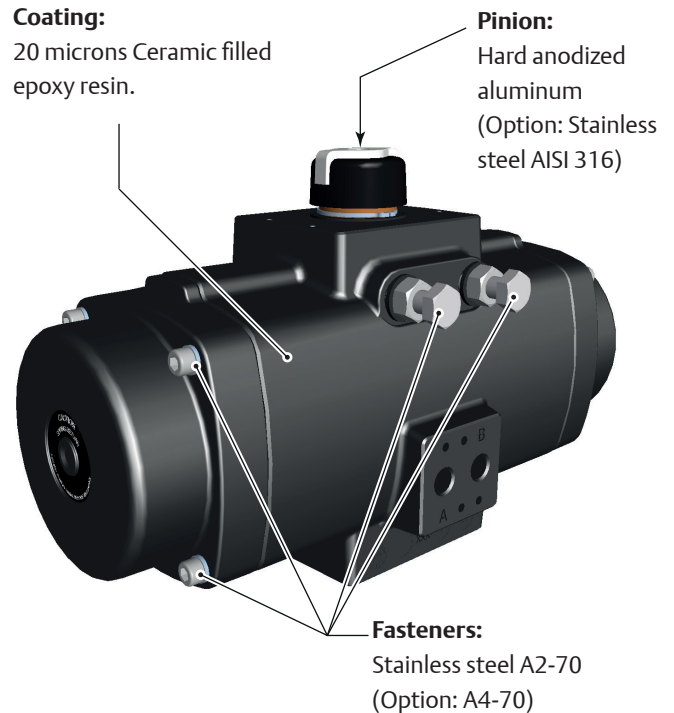
The CSR coating itself is resistant to at least 1000 hours of salt spray test exposure. Together with the excellent mechanical properties, the CSR coating is "the" solution for very harsh and corrosive environments.

CSR actuator housing and caps are coated with a ceramic filled fluoropolymer based epoxy resin, impregnated by a temperature of 240°C into the aluminum surface.

#### Pinion and fasteners.

By default the actuator is equipped with the standard hard anodized high grade aluminium pinion. Because the pinion material is the same as the housing material (aluminum), it prevents galvanic corrosion around the pinion bores of the housing.

For other aggressive or corrosive environments a Stainless Steel pinion (AISI 316) in combination with Stainless Steel A4-70 grade fasteners is available.



#### Technical data:

Coating:	Ceramic filled fluoropolymer based epoxy resin.
Layer thickness:	20 microns
Corrosion resistance:	1000hr, ASTM B117
Max. temperature:	-20° to + 80°C (-4°F to +176°F)
Materials Housing:	Aluminum alloy
Pinion:	Aluminum hard anodized (Option : Stainless Steel AISI 316)
Fasteners:	Stainless steel A2-70 (Option: A4-70)
Type Sticker:	Polyester
Application:	Optional on EL-O-Matic F-Series actuators.
Drive Square:	See page 2

**Dimension for actuators with Stainless Steel pinions.**

Actuators with the stainless steel pinions, as optional available with CSR Coating, are not suitable for the use of drive inserts. The pinions of these actuators are fitted with 2 drive squares (rotated at 45°) in the pinion bottom. These drive squares are according ISO5211.

All the other actuator dimensions are the same. Please refer to:

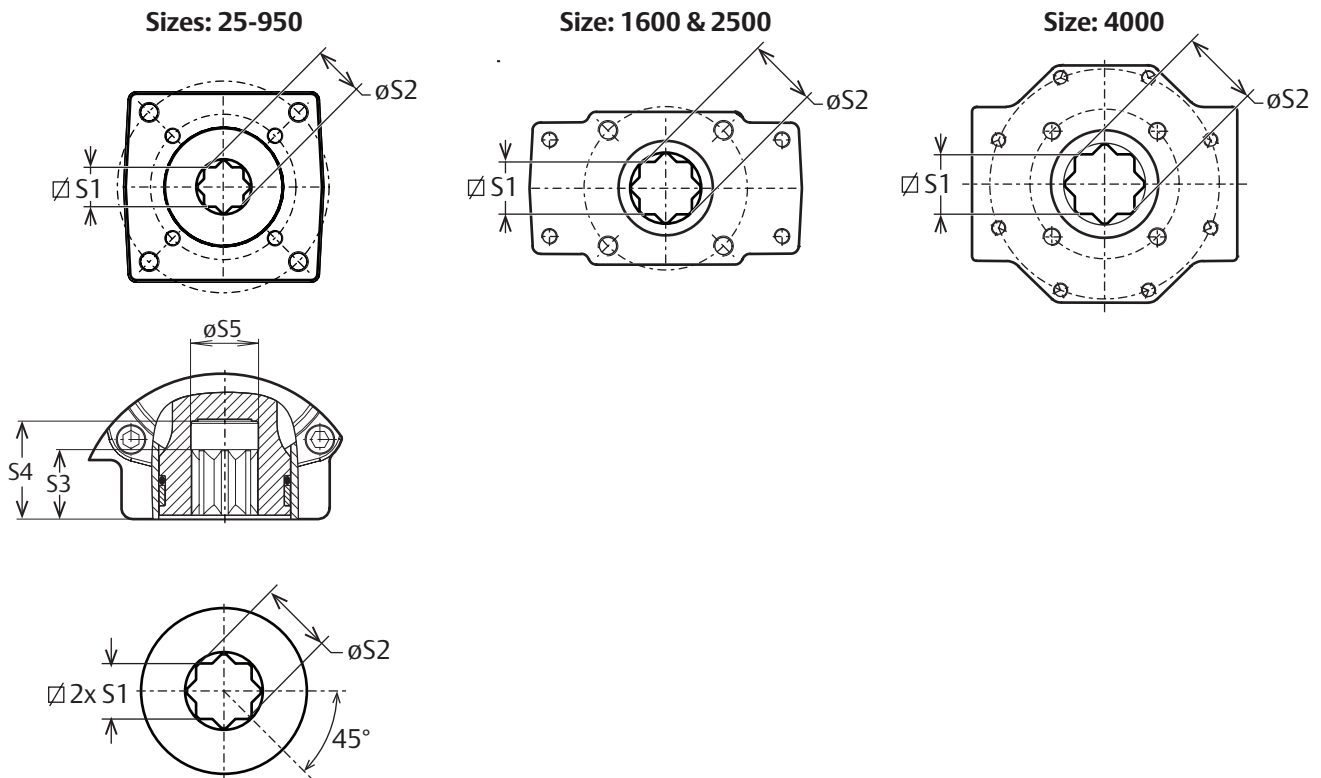
- EFM.04.01.EN for Metric ISO units
- EFD.04.01.EN for Metric DIN units (with center plate)
- EFL.04.01.EN for Imperial ISO units

For the drive square dimensions of the stainless steel pinions, see below drawing and table.

Dim. in mm	Drive square dimensions Stainless Steel pinions											
	25	40	65	100	150	200	350	600	950	1600	2500	4000
<b>S1 Max.</b>	11.08	14.08	14.08	19.13	22.11	22.11	27.11	27.11	36.16	46.16	46.16	55.19
<b>S1 Min.</b>	11.00	14.00	14.00	19.00	22.00	22.00	27.00	27.00	36.00	46.00	46.00	55.00
<b>S2<sup>+0.5</sup></b>	14.4	18.5	18.5	22.5	22.5	28.5	36.5	36.5	48.2	60.2	60.2	72.2
<b>S3</b>	17	17	17	20	28	28	30	31	40.5	53.5	53.5	61.5
<b>S4</b>	27	27	27	27	40	40	38	38	50.5	65.5	65.5	76.5
<b>S5</b>	15	19	19	23	23	29	37	37	48.8	60.8	60.8	72.8

Dim. in inch	Drive square dimensions Stainless Steel pinions											
	25	40	65	100	150	200	350	600	950	1600	2500	4000
<b>S1 Max.</b>	0.436	0.554	0.554	0.753	0.870	0.870	1.067	1.067	1.424	1.817	1.817	2.173
<b>S1 Min.</b>	0.433	0.551	0.551	0.748	0.866	0.866	1.063	1.063	1.417	1.811	1.811	2.165
<b>S2<sup>+0.02</sup></b>	0.57	0.73	0.73	0.89	0.89	1.12	1.44	1.44	1.90	2.37	2.37	2.84
<b>S3</b>	0.67	0.67	0.67	0.79	1.1	1.1	1.18	1.22	1.59	2.11	2.11	2.42
<b>S4</b>	1.06	1.06	1.06	1.06	1.57	1.57	1.50	1.50	1.99	2.58	2.58	3.01
<b>S5</b>	0.59	0.75	0.75	0.91	0.91	1.14	1.46	1.46	1.92	2.39	2.39	2.87



## High Temperature Execution

### Description

A double piston, rack and pinion pneumatic actuator, incorporating an anti-blowout pinion and a piston support system with high duty synthetic bearings at all bearing points.

This version is a standard aluminum actuator, but incorporating grease, O-ring seal and bearing materials, suitable for high temperature operation up to +250°F (120°C).

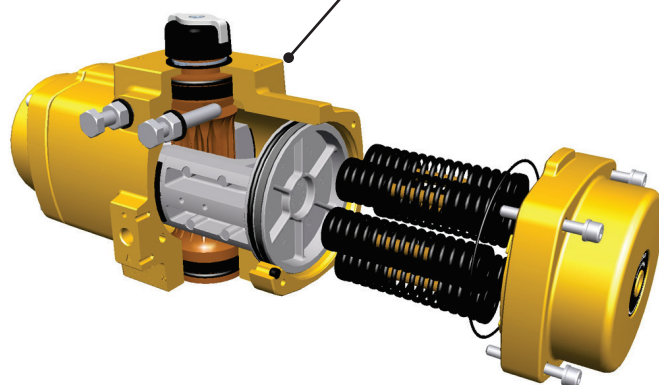
### Specification

Max. pressure: 120 psig (8.3 barg)  
 Torque: Standard  
 Media: Air or non corrosive gas  
 Temperature: +14°F to +250°F (-10°C to +120°C)  
 Finish: Polyurethane powder coating  
 (see data sheet EFG.01.03.EN)

### Spare parts

Dedicated high temperature spare part kits are available for maintenance or to convert a standard actuator into a version suitable for high temperature operation.

High temperature components:  
 - Castrol High temperature grease  
 - Viton (FPM) O-ring seals  
 - PTFE 25% carbon filled piston bearings  
 - Nylon 66 resin containing Aramid Fibre & PTFE for bearing strip piston rack and pinion bearings.



Description	Material
House	Cast Aluminium alloy
End cap	Cast Aluminium alloy
Piston	Cast Aluminium alloy
Pinion	High grade aluminium
Spring cartridge	Spring steel
Bearing strip piston rack	Nylon 66 resin containing Aramid Fibre & PTFE
Bearing piston	PTFE 25% carbon filled
Bearing pinion	Nylon 66 resin containing Aramid Fibre & PTFE
Thrust washer	POM, black UV stabilized
End cap screw	Stainless Steel
Circlip	Spring steel
O-ring seal pinion	Viton FPM
O-ring seal piston	Viton FPM
O-ring seal end cap	Viton FPM
O-ring seal limit stop	Viton FPM
B-port seal	Silicon rubber
Limit stop screw	Stainless steel
Limit stop nut	Stainless steel
Limit stop washer	PA66
Warning sticker	Polyester
Indicator assembly	ABS + stainless steel screw
Center plate (option)	Nylon PA6, Black
Insert drive	Aluminium alloy
Grease	Castrol High temperature grease

## Low Temperature Execution

### Description

A double piston, rack and pinion pneumatic actuator, incorporating an anti-blowout pinion and a piston support system with high duty synthetic bearings at all bearing points.

This version is a standard aluminum actuator, but incorporating grease and O-ring seal materials, suitable for low temperature operation down to -40°F (-40°C).

### Note:

When operating actuators in sub-zero temperatures (< 0°C or < 32°F) care should be taken to counter the effects of freezing condensate inside the actuator.

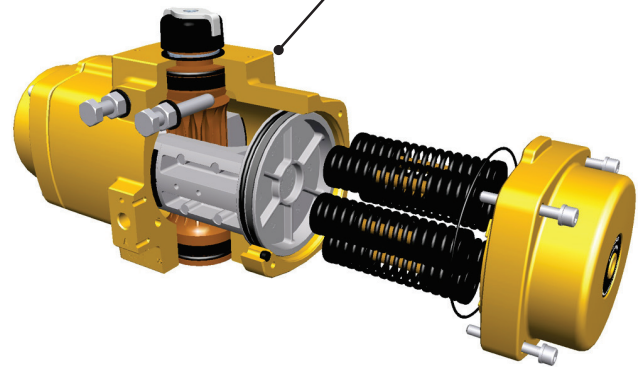
### Specification

Max. pressure:	120 psig (8.3 barg)
Torque:	Standard
Media:	Air or non corrosive gas
Temperature:	-40°C to +80°C (-40°F to +176°F)
Finish:	Polyurethane powder coating (see data sheet EFG.01.03.EN)
Cycle life:	Replace the seals after 250.000 cycles

### Spare parts

Dedicated low temperature spare part kits are available for maintenance or to convert a standard actuator in to a version suitable for low temperature operation.

Low temperature components:  
- Castrol Optitemp TT1 grease  
- Silicone (MVQ70 rubber) O-ring seals



Description	Material
House	Cast Aluminium alloy
End cap	Cast Aluminium alloy
Piston	Cast Aluminium alloy
Pinion	High grade aluminium
Spring cartridge	Spring steel
Bearing strip piston rack	POM
Bearing piston	PTFE 25% carbon filled
Bearing pinion	POM
Thrust washer	POM, black UV stabilized
End cap screw	Stainless Steel
Circlip	Spring steel
O-ring seal pinion	Silicone MVQ70
O-ring seal piston	Silicone MVQ70
O-ring seal end cap	Silicone MVQ70
O-ring seal limit stop	Silicone MVQ70
B-port seal	Silicon rubber
Limit stop screw	Stainless steel
Limit stop nut	Stainless steel
Limit stop washer	PA66
Warning sticker	Polyester
Indicator assembly	ABS + stainless steel screw
Center plate (option)	Nylon PA6, Black
Insert drive	Aluminium alloy
Grease	Castrol Optitemp TT1 grease

## EL-O-Matic F-Series with Stainless Steel pinion

### AISI 316 Stainless Steel Pinion + Fasteners (A4-70)

#### Key features

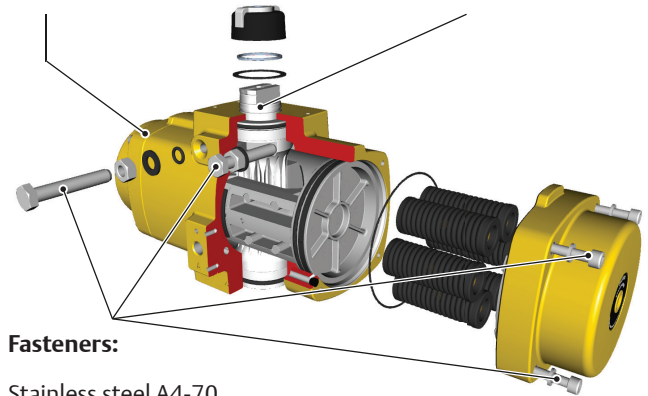
- Extended corrosion resistant properties for applications where the standard pinion material is not sufficient.
- AISI 316 grade stainless steel pinion material.
- A4-70 grade stainless steel fasteners.
- Available with parallel and diagonal square drive for ISO5211 or DIN3337 valve mounting.
- Typically suitable for areas where standard aluminum pinions fail prematurely due to heavy corrosion, for instance protected areas on off-shore platforms.

#### Coating:

Polyurethane powder coating for exterior use (= default coating).

#### Pinion:

Stainless steel  
AISI 316



#### Fasteners:

Stainless steel A4-70

#### Description

EL-O-Matic F-Series with AISI 316 stainless steel pinion and fasteners (A4-70) offers an extended corrosion resistance in environments where standard actuators with aluminium pinions might fail prematurely due to higher corrosion levels.

#### AISI 316 grade stainless steel

Stainless steel 316 has excellent corrosion resistance when exposed to a range of corrosive environments and media. It is usually regarded as “marine grade” stainless steel. As such actuator with stainless steel pinions and fasteners can be used in near sea shore plants or protected areas on off-shore platforms.

#### Technical data:

Coating:	Polyurethane powder coating for exterior use (= default coating).
Color:	Yellow (RAL 1007)
Corrosion resistance:	1000hr, ASTM B117
Max. Temperature:	-20° to + 80°C (-4°F to +176°F)
Materials Housing:	Aluminum alloy, chromated
Pinion:	Stainless Steel AISI 316
Fasteners:	Stainless steel A4-70
Type Sticker:	Polyester
Application:	Optional on EL-O-Matic F-Series actuators.
Dimensions:	See page 2

**Dimension for actuators with Stainless Steel pinions.**

Actuators with the stainless steel pinions are not suitable for the use of drive inserts. The pinions of these actuators are fitted with 2 drive squares (rotated at 45°) in the pinion bottom. These drive squares are according ISO5211.

All the other actuator dimensions are the same. Please refer to:

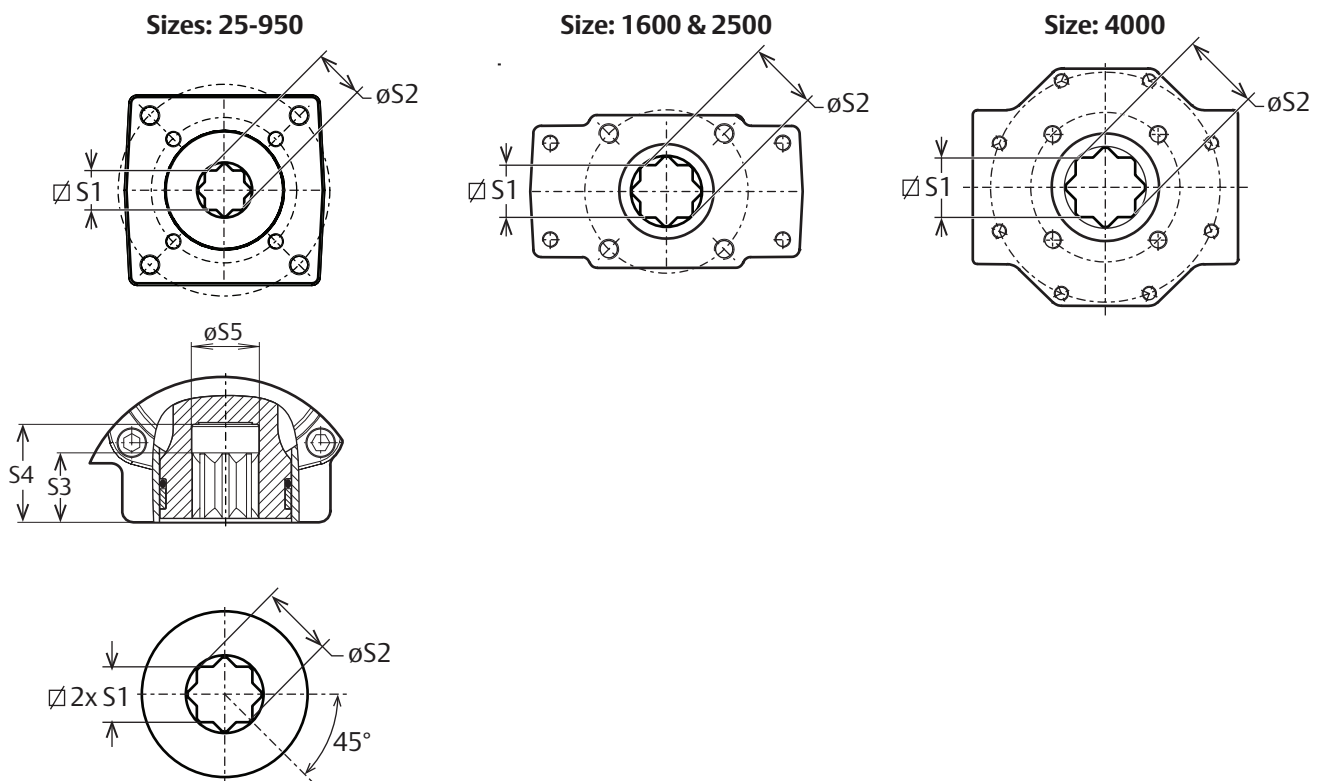
- EFM.04.01.EN for Metric ISO units
- EFD.04.01.EN for Metric DIN units (with center plate)
- EFL.04.01.EN for Imperial ISO units

For the drive square dimensions of the stainless steel pinions, see below drawing and table.

Dim. in	Drive square dimensions Stainless Steel pinions											
mm	25	40	65	100	150	200	350	600	950	1600	2500	4000
<b>S1 Max.</b>	11.08	14.08	14.08	19.13	22.11	22.11	27.11	27.11	36.16	46.16	46.16	55.19
<b>S1 Min.</b>	11.00	14.00	14.00	19.00	22.00	22.00	27.00	27.00	36.00	46.00	46.00	55.00
<b>S2</b>	14.4	18.5	18.5	22.5	22.5	28.5	36.5	36.5	48.2	60.2	60.2	72.2
<b>S3</b>	17	17	17	20	28	28	30	31	40.5	53.5	53.5	61.5
<b>S4</b>	27	27	27	27	40	40	38	38	50.5	65.5	65.5	76.5
<b>S5</b>	15	19	19	23	23	29	37	37	48.8	60.8	60.8	72.8

Dim. in	Drive square dimensions Stainless Steel pinions											
inch	25	40	65	100	150	200	350	600	950	1600	2500	4000
<b>S1 Max.</b>	0.436	0.554	0.554	0.753	0.870	0.870	1.067	1.067	1.424	1.817	1.817	2.173
<b>S1 Min.</b>	0.433	0.551	0.551	0.748	0.866	0.866	1.063	1.063	1.417	1.811	1.811	2.165
<b>S2</b>	0.57	0.73	0.73	0.89	0.89	1.12	1.44	1.44	1.90	2.37	2.37	2.84
<b>S3</b>	0.67	0.67	0.67	0.79	1.1	1.1	1.18	1.22	1.59	2.11	2.11	2.42
<b>S4</b>	1.06	1.06	1.06	1.06	1.57	1.57	1.50	1.50	1.99	2.58	2.58	3.01
<b>S5</b>	0.59	0.75	0.75	0.91	0.91	1.14	1.46	1.46	1.92	2.39	2.39	2.87



## Fast Cycling F-Series actuators

### Increase the cycle speed of actuators

#### Cycle speed:

In general pneumatic EL-O-Matic F-series actuators are equipped with large internal air porting that allows adequate cycling under normal circumstances and when using generic solenoid valves to operate the actuator, the achieved cycle speed is normally sufficient.

In order to increase the cycle speed of the EL-O-Matic F-Series two options are available:

- High Flow plates
- Actuators with 1/2" air connection porting (only available for sizes F950 to F4000)

#### High Flow plates on Standard actuators

If faster cycle times are required (<0.5 or <1 second), 1/4" solenoid valves or pneumatic fitting material can become a problem. These components will then function as a throttle, reducing the potential maximum air flow and as such the limiting the maximum cycle speed.

In order to use the maximum cycle speed potential of a standard actuator, the 1/2" High Flow adaptor plate allows the fitting of larger solenoid valves and pneumatic fitting material and as such the increase the maximum cycle speed.

#### Construction:

The High Flow Plate is a aluminum plate which can be mounted directly to solenoid interface on actuators which are designed according VDI/VDE 3845 (NAMUR). The plate is supplied with fasteners and seals.

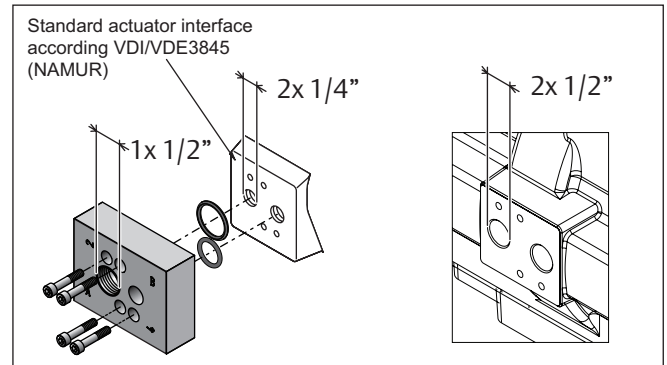
The customer side of the plate is equipped with one larger 1/2" NPT or BSP air connection (A-port) for piped solenoid control.

#### Materials:

- Block: Aluminium alloy, black anodized (10-15µm)
- Fasteners: Stainless steel
- O-ring seals: NBR Rubber

**Table 1. High Flow plates**

Part nr:	Execution:
VA306.00.310	1/2" NPT
VA306.00.320	1/2" BSP



#### Actuators with 1/2" air connection porting.

In order to increase the cycle speed of actuator of the larger sizes F950 to F4000, these actuators are available with 1/2" BSP or NPT air connections for both the A and B port and comply with the 1/2" pneumatic connection specification of EN15714-3.

Additionally the internal air channels of the housing are larger than on the standard housing. Together with the mounting of 1/2" solenoid and or quick exhaust this allows very fast cycle speeds.

#### Maximum cycle speed

In order to select the correct actuator configuration, please find below a table of maximum cycle speeds that can be achieved for the standard 1/4" ported houses and the optional 1/2" ported houses.

1. For practical considerations follow the next recommendations.
2. Consult the nearest EL-O-Matic representative of Emerson office for technical support.



Table 2. Maximum cycle speeds (seconds)

Actuator size	House with 1/4" ports	House with 1/2" ports
12	0.31	Not available
25	0.32	Not available
40	0.33	Not available
65	0.36	Not available
100	0.36	Not available
150	0.42	Not available
200	0.44	Not available
350	0.6	Not available
600	0.8	Not available
F0950	1	0.7
F1600	1.2	0.8
F2500	1.8	1.1
F4000	3.2	1.8

Recommendations

- The High Flow Plate or the 1/2" ported housing on its own do not make the cycle time of an actuator faster. Take care that there is sufficient air supply capacity at actuator:
  - Air supply capacity must be larger than the Cv or Kv value of the control solenoid valve.
  - Use tubing and fittings with sufficient large diameter.
  - Make tubing from the main air supply to the actuator as short as possible.
- Consider the use of Quick Exhaust valves in combination with High Flow Plate or the 1/2" ported housing.
- In general the actuators life cycle is reduced when cycling very fast.

Table 3. Port dimension options F950 to F4000

Dim	Metric Units		Imperial Units	
	1/4"	1/2"	1/4"	1/2"
S	1/4" BSP	1/2" BSP	1/4" NPT	1/2" NPT
S1	32	45	1.26"	1.77"
S2	24	40	0.94"	1.57"
S3	M5x8	M6x10	UNC 10-24 x 0.31"	1/4"-20 x 0.39"

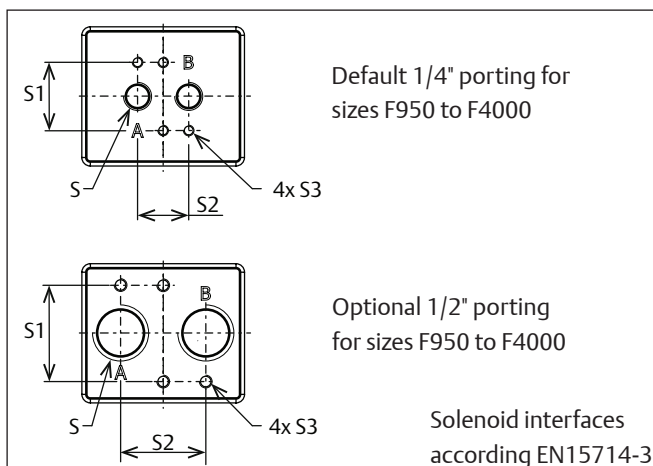
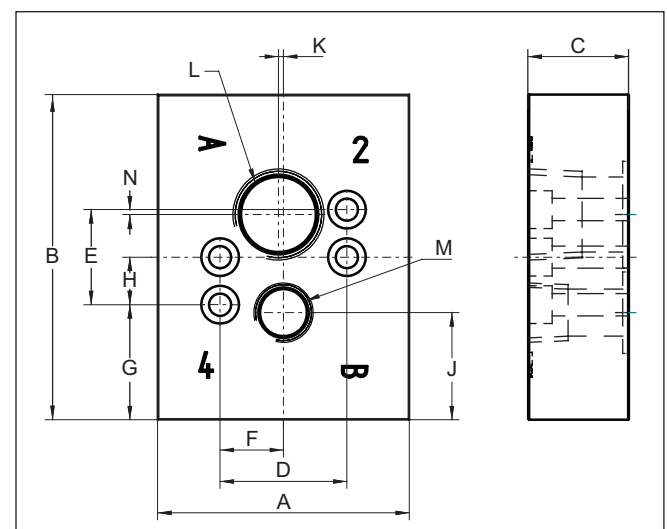


Table 4. High Flow Plate Dimensions:

Dimension in:	mm	Inch
A	63.5	2.50
B	82	3.23
C	25.2	0.99
D	32	1.26
E	24	0.94
F	16	0.63
G	29	1.14
H	12	0.47
J	27	1.06
K	1.27	0.05
L	1/2" BSP	1/2" NPT
M	1/4" BSP	1/4" NPT
N	1.25	0.05



## Actuator Operating Media Specification

For use with natural gas

### Description

The standard EL-O-Matic F-Series actuator can be operated with natural gas. The natural gas should be qualified as "Sweet" and "Dry" (a.k.a. "Pipeline quality").

### Sweet natural gas:

- Contains < 2 volume % of CO<sub>2</sub>
- Contains < 1 volume % of H<sub>2</sub>S

If the natural gas contains more than 2 volume % of CO<sub>2</sub> and more than 1 volume % of H<sub>2</sub>S it is regarded as Sour Natural Gas and is not suitable as operating medium for the standard F-Series actuator.

### "Dry" natural gas:

The natural gas should be as dry as possible. The pressure dew point of the natural gas should be at least 10°C less than the lowest ambient temperature expected.

### Note:

1. Care should be taken that fittings, tubing and controlling valves are also compatible to the media.
2. Natural gas is according Pressure Equipment Directive (PED) 2014/68/EU rated as a Group 1 gas (flammable, explosive or poisonous gasses). A limited range of the standard EL-O-Matic actuator sizes are suitable for PED Group 1 gasses. For these sizes special product labeling is required and available.

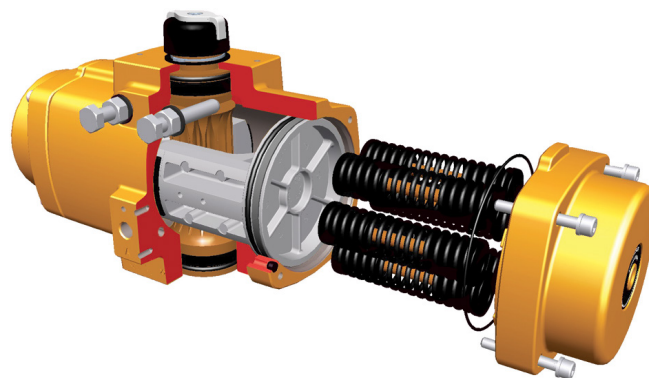
### EL-O-Matic F-Series

The standard aluminium actuator, is utilizing materials which overcome the problems associated with the use of natural (sweet) gas as an operating media, these are:

1. Sulfide stress cracking of metallic parts
2. The chemical attack by hydrogen sulfide and organic sulphur compounds.
3. No brass or bronze components.

### Warning:

- Natural gas is a flammable, explosive and poisonous gas
- Take appropriate measures to prevent ignition and poisoning during installation, commissioning and operation, according local or national law.



### General specifications:

Pressure:	8.3 bar max. (120 psi)		
Torque:	See data sheet:		
	Spring return:	Nm:	EFM.03.01.EN
		Lbf.in:	EFI.03.01.EN
	Double acting:	Nm:	EFM.03.02.EN
		Lbf.in:	EFI.03.02.EN
Dimensions:	See data sheet:		
	Imperial ISO5211	EFI.04.01.EN	
	Metric ISO5211	EFM.04.01.EN	
	Metric DIN3337	EFD.04.01.EN	
Operating Media:	"Sweet" and "Dry" natural gas (a.k.a. "Pipeline quality")		
Dew Point:	At least 10°C less than the lowest ambient temperature expected.		
Coating :	Polyurethane powder coating for exterior use.		
Salt spray test :	ASTM B117: 1000 hours		
Color :	Yellow (RAL 1007)		
Materials:	Housing: Chromated aluminium alloy		
Endcaps:	Chromated aluminium alloy		
Pistons:	Chromated aluminium alloy		
Pinion:	High grade aluminium alloy, hard anodized.		
Fasteners:	Stainless steel or alloy steel with Deltatone® treatment		
Type Sticker:	Polyester		



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