

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 80 psig (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: Sizes 25 to 600: Anodized and polyurethane powder coated
Size 12 and 950 to 4000: Chromate and polyurethane powder coated
- Pistons: Chromated
- Pinion: Hard Anodized
- Fasteners: Stainless Steel or Deltatone® coated

Lubrication

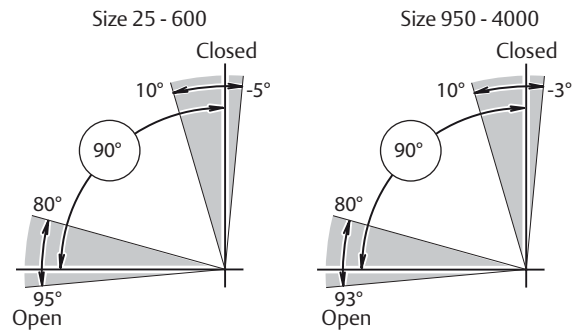
- Castrol High Temperature grease (or equivalent)

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/80 psi
5. Load: with average load
6. Stroke: 90°
7. Temperature: Room temperature

Actuator air volumes and consumption

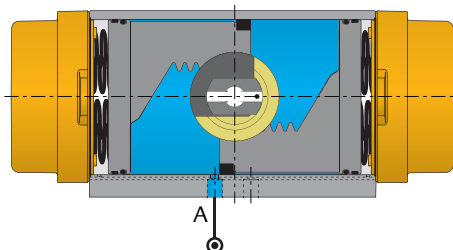
| Actuator model | Actuator volumes | | | Consumption per stroke (nL/stroke, pressure in barg) | | | | | |
|----------------|------------------------------|------------------------------|-------------------------------|--|------|------|--------------------|------|------|
| | Maximum volume (in liters) | | | Outward Stroke | | | Inward Stroke | | |
| | Central ¹ chamber | End cap ² chamber | Displaced ³ volume | Double-Acting and Spring-Return | | | Double-Acting only | | |
| | | | | 2 | 4 | 8 | 2 | 4 | 8 |
| F 12 | 0.05 | 0.06 | 0.04 | 0.15 | 0.25 | 0.35 | 0.18 | 0.30 | 0.53 |
| F 25 | 0.14 | 0.20 | 0.08 | 0.42 | 0.69 | 1.25 | 0.59 | 0.99 | 1.78 |
| F 40 | 0.26 | 0.37 | 0.15 | 0.77 | 1.29 | 2.31 | 1.10 | 1.83 | 3.29 |
| F 65 | 0.40 | 0.56 | 0.22 | 1.2 | 2.0 | 3.6 | 1.7 | 2.7 | 4.9 |
| F 100 | 0.6 | 0.9 | 0.3 | 1.8 | 3.0 | 5.3 | 2.7 | 4.5 | 8.0 |
| F 150 | 1.0 | 0.8 | 0.5 | 3.0 | 4.9 | 8.9 | 2.4 | 4.0 | 7.1 |
| F 200 | 1.3 | 1.0 | 0.7 | 3.9 | 6.4 | 11.6 | 3.0 | 4.9 | 8.9 |
| F 350 | 2.1 | 1.9 | 1.2 | 6.2 | 10.4 | 18.7 | 5.7 | 9.4 | 17 |
| F 600 | 3.6 | 3.3 | 2.1 | 11 | 18 | 32 | 9.8 | 16 | 29 |
| F 950 | 4.9 | 4.6 | 3.2 | 15 | 24 | 44 | 14 | 23 | 41 |
| F 1600 | 7.9 | 7.3 | 5.4 | 23 | 39 | 70 | 22 | 36 | 65 |
| F 2500 | 12.6 | 11.9 | 8.3 | 37 | 62 | 112 | 35 | 59 | 106 |
| F 4000 | 21.7 | 19.0 | 13.5 | 65 | 107 | 193 | 57 | 94 | 169 |

| Actuator model | Actuator volumes | | | Consumption per stroke (Standard cu in./stroke, pressure in psig) | | | | | |
|----------------|------------------------------|------------------------------|-------------------------------|---|------|-------|--------------------|------|-------|
| | Maximum volume (cu in.) | | | Outward Stroke | | | Inward Stroke | | |
| | Central ¹ chamber | End cap ² chamber | Displaced ³ volume | Double-Acting and Spring-Return | | | Double-Acting only | | |
| | | | | 40 | 80 | 120 | 40 | 80 | 120 |
| F 12 | 3.10 | 3.70 | 2.50 | 12 | 20 | 28 | 14 | 24 | 34 |
| F 25 | 8.5 | 12.2 | 4.7 | 32 | 55 | 78 | 45 | 79 | 112 |
| F 40 | 15.9 | 23 | 8.9 | 59 | 102 | 146 | 86 | 148 | 211 |
| F 65 | 24 | 34 | 13.5 | 89 | 155 | 220 | 127 | 219 | 312 |
| F 100 | 36 | 53 | 19.9 | 134 | 232 | 330 | 197 | 342 | 486 |
| F 150 | 58 | 47 | 32 | 216 | 374 | 532 | 175 | 303 | 431 |
| F 200 | 76 | 64 | 44 | 283 | 490 | 697 | 238 | 412 | 587 |
| F 350 | 131 | 115 | 76 | 488 | 844 | 1201 | 428 | 741 | 1054 |
| F 600 | 222 | 201 | 129 | 826 | 1431 | 2035 | 748 | 1295 | 1842 |
| F 950 | 301 | 279 | 196 | 1120 | 1940 | 2759 | 1038 | 1798 | 2557 |
| F 1600 | 484 | 447 | 328 | 1801 | 3119 | 4436 | 1664 | 2880 | 4097 |
| F 2500 | 769 | 728 | 508 | 2862 | 4955 | 7048 | 2710 | 4691 | 6673 |
| F 4000 | 1324 | 1159 | 825 | 4928 | 8531 | 12135 | 4314 | 7468 | 10623 |

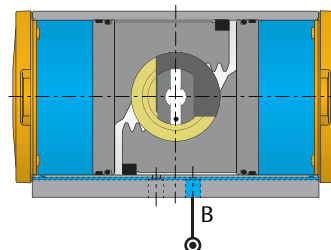
Notes:

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°

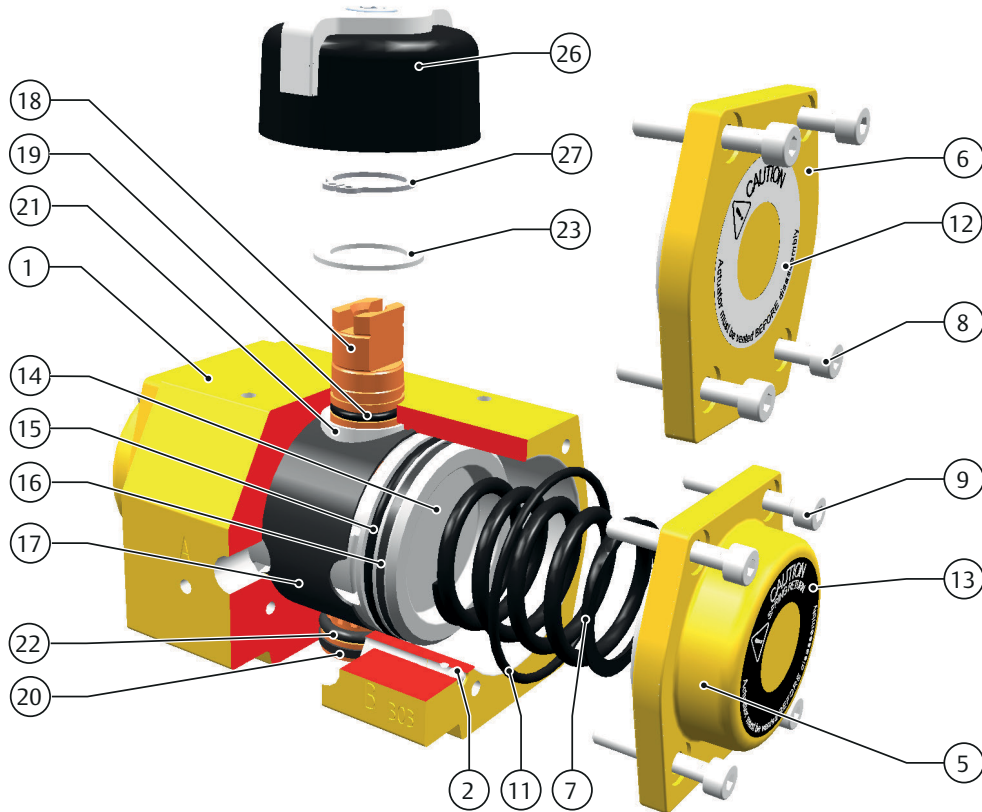
Central air chamber volume
Double-Acting and Spring-Return



End cap air chamber volume
Double-Acting only



Construction, Parts and Materials F12



| 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 |

Notes:

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

Default temperature range:

-20 °C to +80 °C (-4 °F to 176 °F)

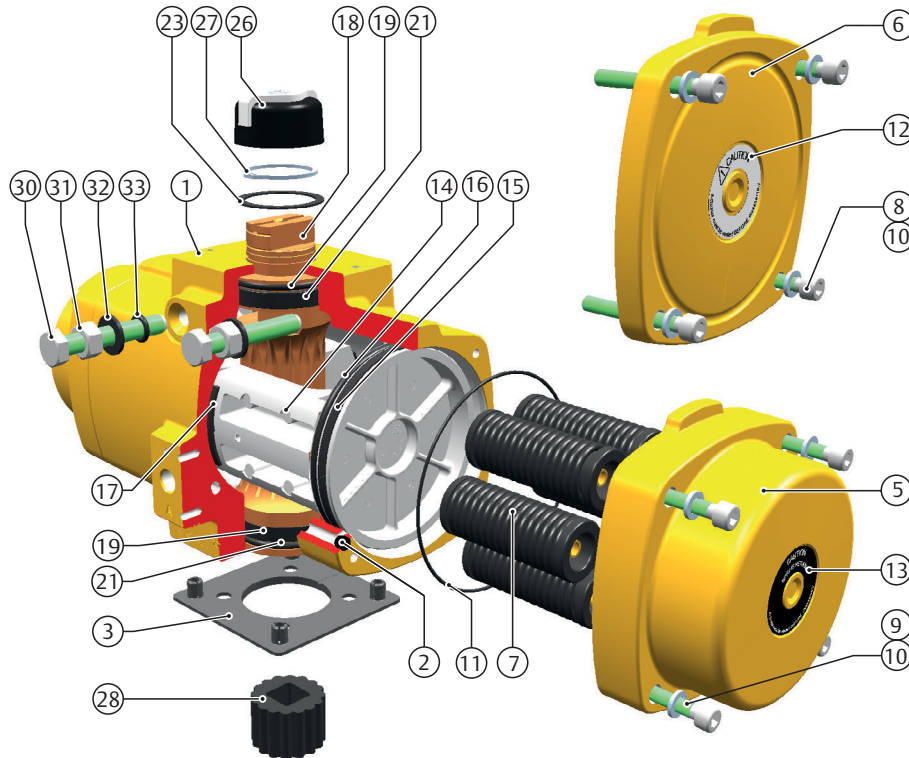
Suitable greases:

- Castrol High Temperature (Formerly called Castrol LMX)
- Rocol Sapphire Premier (Formerly called Sapphire HI-TEMP 2)
- Castrol Spheerol EPL 2 (Formerly called BP Energrease LS-EP2)
- Total Ceran XM 220 (Formerly called Total Ceran WR2)

Optional temperature ranges:

- High temperature range: -10 °C to +120 °C / -14 °F to +248 °F see Data Sheet EFG.05.05.EN
- Low temperature range: -40 °C to +100 °C / -40 °F to +212 °F see Data Sheet EFG.05.06.EN

Construction, Parts and Materials F25-F600



| 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 |

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 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.

Default temperature range:

-20 °C to +80 °C (-4 °F to 176 °F)

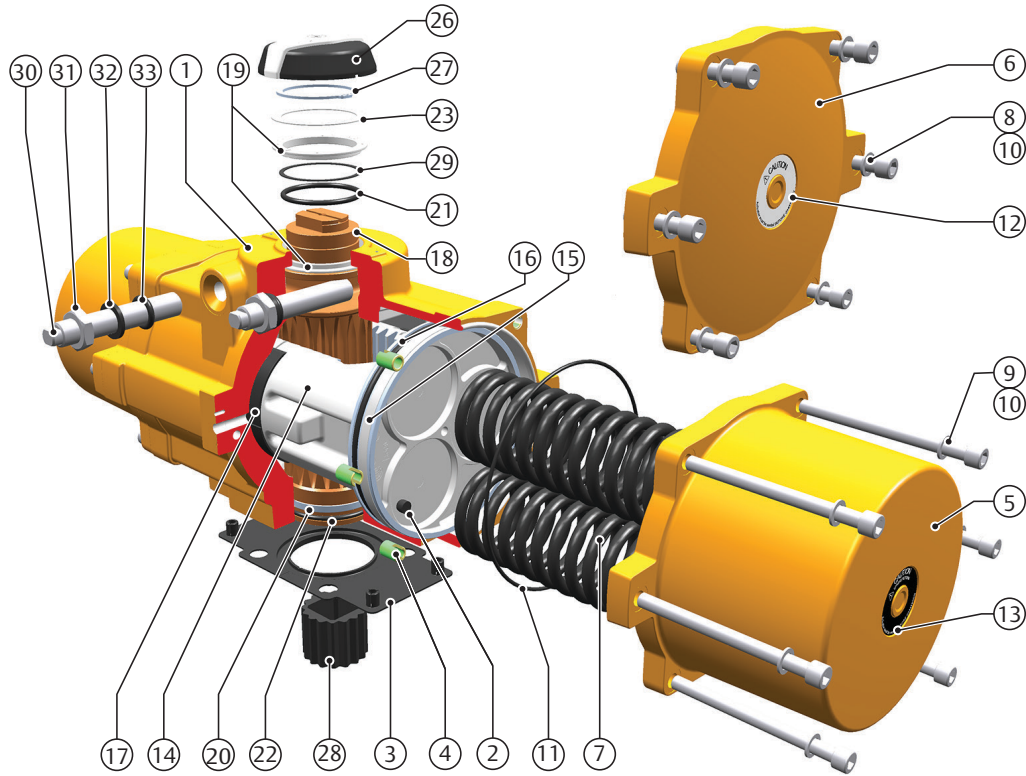
Suitable greases:

- Castrol High Temperature (Formerly called Castrol LMX)
- Rocol Sapphire Premier (Formerly called Sapphire HI-TEMP 2)
- Castrol Spheerol EPL 2 (Formerly called BP Energrease LS-EP2)
- Total Ceran XM 220 (Formerly called Total Ceran WR2)

Optional temperature ranges:

- High temperature range: -10 °C to +120 °C / -14 °F to +248 °F see Data Sheet EFG.05.05.EN
- Low temperature range: -40 °C to +100 °C / -40 °F to +212 °F see Data Sheet EFG.05.06.EN

Construction, Parts and Materials F950-F2500



| 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 | Nylon 66 resin with Aramid Fibre & PTFE |
| 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 |

Notes:

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

Default temperature range:

-20 °C to +80 °C (-4 °F to 176 °F)

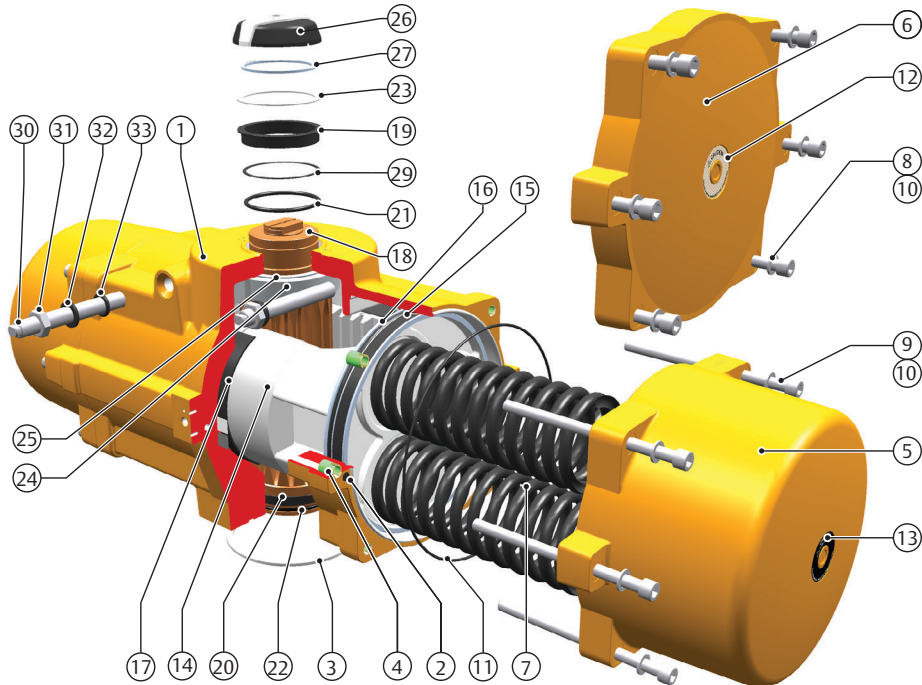
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- Rocol Sapphire Premier (Formerly called Sapphire HI-TEMP 2)
- Castrol Spheerol EPL 2 (Formerly called BP Energrease LS-EP2)
- Total Ceran XM 220 (Formerly called Total Ceran WR2)

Optional temperature ranges:

- High temperature range: -10°C to +120 °C / -14 °F to +248 °F see Data Sheet EFG.05.05.EN
- Low temperature range: -40 °C to +100 °C / -40 °F to +212 °F see Data Sheet EFG.05.06.EN

Construction, Parts and Materials F4000



| 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 | Nylon 66 resin with Aramid Fibre & PTFE |
| 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 |

Notes:

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

Default temperature range:

-20 °C to +80 °C (-4 °F to 176 °F)

Suitable greases:

- Castrol High Temperature (Formerly called Castrol LMX)
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Optional temperature ranges:

- High temperature range:
-10 °C to +120 °C / -14 °F to +248 °F
see Data Sheet EFG.05.05.EN
- Low temperature range:
-40 °C to +100 °C / -40 °F to +212 °F
see Data Sheet EFG.05.06.EN

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.

Anodize or chromate pre-treatment

The housing and end caps get a anodize or 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: | Sizes 25 to 600: Anodized and polyurethane powder coated Size 12 and 950 to 4000: Chromate and polyurethane powder coated |
| 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 |

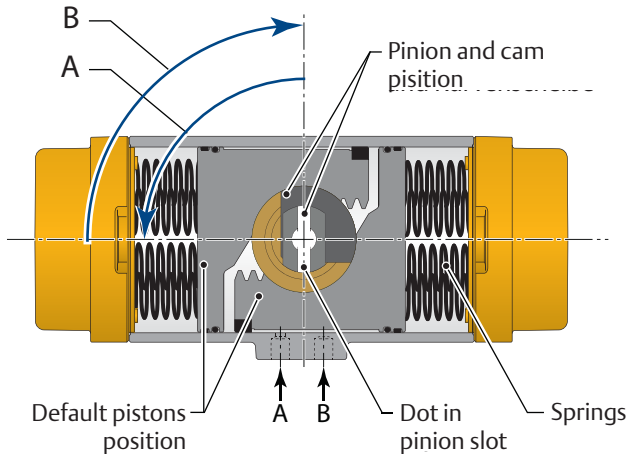
1. This Data Sheet contains general information as supplied by the paint supplier and describes typical properties for the coating.

Assembly Codes EL-O-Matic F-Series Actuators

Spring-Return actuators

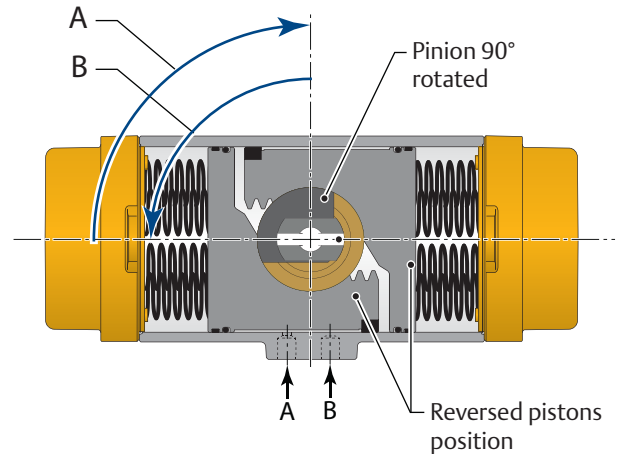
Assembly code: CW

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



Assembly code: CC

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

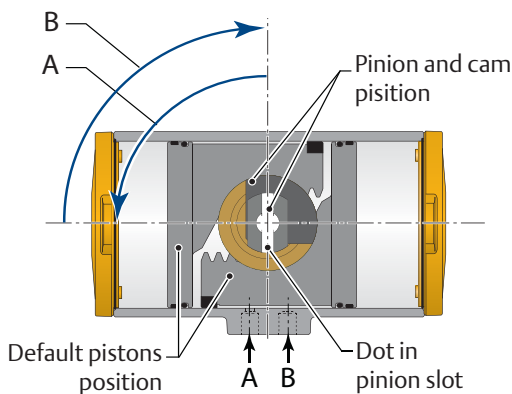


A = Central air chamber pressurized
B = Spring stroke

Double-Acting actuators

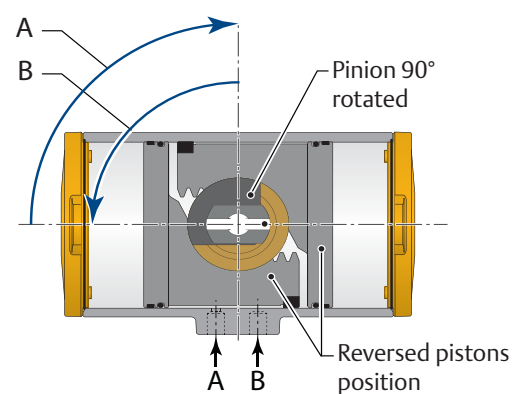
Assembly code: CW

= Standard, Clockwise-to-Close rotation



Assembly code: CC

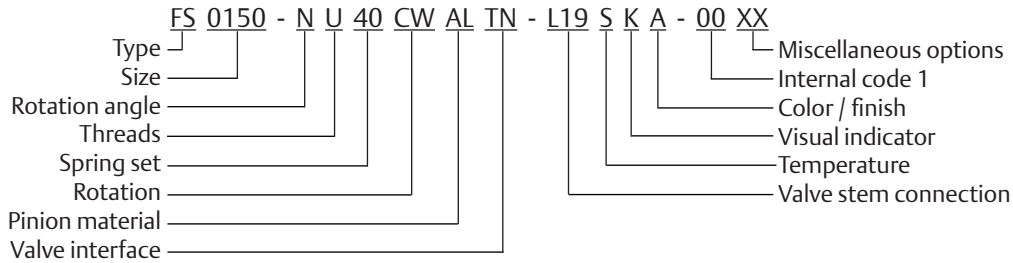
= Reverse, Counterclockwise-to-Open



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 ⁽⁷⁾ | | |
| SS | Stainless steel ASI 316 (+ A4-70 SS fasteners) | | |
| Valve Interface ⁽²⁾ | | | |
| 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 ⁽⁴⁾ |
| | | Parallel drive | Diagonal drive | Star drive |
| No insert | | 000 | | Not applicable |
| 0012 ⁽³⁾ | 9 mm / 0.354" | L09 | D09 | Q09 |
| 0025 | 11 mm / 0.433" | L11 | D11 | Q11 |
| 0040 & 0065 | 14 mm / 0.551" | L14 | D14 | Q14 |
| 0100 | 17 mm / 0.669" | | D17 | Q19 |
| | 19 mm / 0.748" | L19 | | |
| 0150 | 17 mm / 0.669" | | D17 | Q22 |
| | 19 mm / 0.748" | L19 | | |
| 0200 | 22 mm / 0.866" | L22 | D22 | Q22 |
| 0350 | 22 mm / 0.866" | | D22 | Q27 |
| | 27 mm / 1.063" | L27 | | |
| 600 | 27 mm / 1.063" | L27 | D27 | Q27 |
| 950 | 36 mm / 1.417" | L36 | D36 | Q36 |
| 1600 & 2500 | 46 mm / 1.811" | L46 | D46 | Q46 |
| 4000 ⁽³⁾ | 55 mm / 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 ⁽⁶⁾ | 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) | | | |
| Internal code 1 | | | | |
| 00 | Standard | | | |
| 10 | Stainless steel AISI316 (A4-70) end cap screws ⁽⁷⁾ | | | |
| 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) | | | |
| N1 | NAMUR solenoid adaptation plate for F12 | | | |

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 (DIN3337) 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.
7. Actuators with the default hard anodized pinions, come with stainless steel grade A2 (AISI304) end cap screws.
 - Optional, the actuator is available with stainless steel grade A4-70 (AISI316) end cap screws.
 - Select option 10 in the "Internal code 1" segment in case stainless steel grade A4 (AISI316) end cap screws are required.

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 |
| FS 40 | 60 | 21 | 13 | - | - | - | - | - | - | - | - | - | - | 11 | 2 | 13 | 4 | 18 | 9 | 23 | 14 |
| | 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 |
| FS 65 | 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 |
| | 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 |
| FS 100 | 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 |
| | 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 |
| FS 150 | 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 |
| | 10 | 24 | 15 | 79 | 69 | 96 | 86 | 112 | 102 | 128 | 118 | 145 | 135 | 161 | 151 | 177 | 167 | 210 | 200 | 243 | 233 |
| FS 200 | 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 350 | 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 |
| FS 600 | 60 | 196 | 124 | - | - | - | - | - | - | - | - | - | - | 102 | 18 | 124 | 41 | 169 | 85 | 213 | 130 |
| | 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 |
| FS 600 | 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 |
| | 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 |
| FS 600 | 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 |

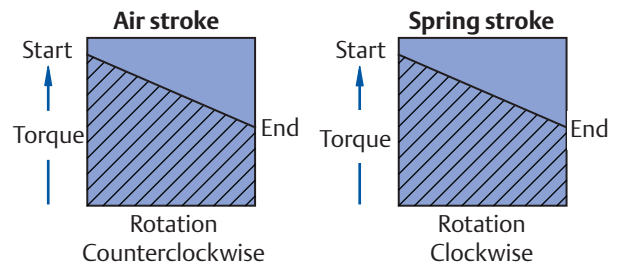
Actuator Torque - Spring-Return (Nm)

| 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 |

Notes:

- 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 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 | 316 |
| | 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 | 225 | 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 | 216 | 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 | 195 | 299 | 250 | 354 | 305 | 409 | 360 | 464 | 415 | 575 | 526 |
| | 30 | 174 | 110 | 91 | 18 | 146 | 73 | 201 | 128 | 257 | 183 | 312 | 239 | 367 | 294 | 422 | 349 | 533 | 459 |
| | 40 | 231 | 146 | - | - | - | - | 159 | 62 | 214 | 117 | 270 | 172 | 325 | 227 | 380 | 283 | 491 | 393 |
| | 50 | 289 | 183 | - | - | - | - | - | - | 172 | 50 | 228 | 106 | 283 | 161 | 338 | 216 | 449 | 327 |
| 60 | 347 | 220 | - | - | - | - | - | - | - | - | 186 | 39 | 241 | 94 | 296 | 150 | 407 | 260 | |
| FS 65 | 10 | 90 | 57 | 265 | 227 | 349 | 311 | 434 | 395 | 518 | 479 | 602 | 564 | 686 | 648 | 770 | 732 | 939 | 900 |
| | 20 | 181 | 114 | 200 | 123 | 284 | 207 | 368 | 291 | 452 | 376 | 537 | 460 | 621 | 544 | 705 | 628 | 873 | 796 |
| | 30 | 271 | 171 | 134 | 19 | 219 | 103 | 303 | 188 | 387 | 272 | 471 | 356 | 555 | 440 | 639 | 524 | 808 | 693 |
| | 40 | 361 | 228 | - | - | - | - | 237 | 84 | 322 | 168 | 406 | 252 | 490 | 336 | 574 | 420 | 742 | 589 |
| | 50 | 452 | 285 | - | - | - | - | - | - | 256 | 64 | 340 | 148 | 424 | 232 | 509 | 317 | 677 | 485 |
| 60 | 542 | 341 | - | - | - | - | - | - | - | - | 275 | 44 | 359 | 129 | 443 | 213 | 612 | 381 | |
| FS 100 | 10 | 131 | 83 | 394 | 339 | 518 | 463 | 643 | 588 | 767 | 712 | 892 | 836 | 1016 | 961 | 1141 | 1085 | 1390 | 1334 |
| | 20 | 262 | 166 | 299 | 188 | 423 | 313 | 548 | 437 | 672 | 562 | 797 | 686 | 921 | 811 | 1046 | 935 | 1295 | 1184 |
| | 30 | 392 | 248 | 203 | 38 | 328 | 162 | 452 | 287 | 577 | 411 | 701 | 536 | 826 | 660 | 950 | 785 | 1199 | 1034 |
| | 40 | 523 | 331 | - | - | - | - | 357 | 136 | 482 | 261 | 606 | 385 | 731 | 510 | 855 | 634 | 1104 | 883 |
| | 50 | 654 | 414 | - | - | - | - | - | - | 387 | 110 | 511 | 235 | 636 | 359 | 760 | 484 | 1009 | 733 |
| 60 | 785 | 497 | - | - | - | - | - | - | - | - | 416 | 85 | 540 | 209 | 665 | 334 | 914 | 583 | |
| FS 150 | 10 | 208 | 131 | 633 | 544 | 832 | 743 | 1031 | 942 | 1231 | 1142 | 1430 | 1341 | 1629 | 1540 | 1829 | 1740 | 2227 | 2138 |
| | 20 | 416 | 262 | 482 | 304 | 681 | 504 | 881 | 703 | 1080 | 902 | 1279 | 1102 | 1479 | 1301 | 1678 | 1500 | 2077 | 1899 |
| | 30 | 625 | 393 | 332 | 65 | 531 | 264 | 730 | 464 | 930 | 663 | 1129 | 862 | 1328 | 1062 | 1528 | 1261 | 1926 | 1660 |
| | 40 | 833 | 524 | - | - | - | - | 580 | 224 | 779 | 424 | 979 | 623 | 1178 | 823 | 1377 | 1022 | 1776 | 1421 |
| | 50 | 1041 | 654 | - | - | - | - | - | - | 629 | 185 | 828 | 384 | 1027 | 583 | 1227 | 783 | 1626 | 1181 |
| 60 | 1249 | 785 | - | - | - | - | - | - | - | - | 678 | 145 | 877 | 344 | 1076 | 543 | 1475 | 942 | |
| FS 200 | 10 | 289 | 182 | 862 | 739 | 1135 | 1012 | 1408 | 1285 | 1681 | 1558 | 1954 | 1831 | 2226 | 2104 | 2499 | 2376 | 3045 | 2922 |
| | 20 | 578 | 364 | 653 | 407 | 926 | 680 | 1198 | 953 | 1471 | 1226 | 1744 | 1499 | 2017 | 1771 | 2290 | 2044 | 2836 | 2590 |
| | 30 | 867 | 547 | 443 | 75 | 716 | 348 | 989 | 621 | 1262 | 894 | 1535 | 1166 | 1808 | 1439 | 2080 | 1712 | 2626 | 2258 |
| | 40 | 1156 | 729 | - | - | - | - | 780 | 289 | 1052 | 561 | 1325 | 834 | 1598 | 1107 | 1871 | 1380 | 2417 | 1926 |
| | 50 | 1445 | 911 | - | - | - | - | - | - | 843 | 229 | 1116 | 502 | 1389 | 775 | 1662 | 1048 | 2207 | 1593 |
| 60 | 1734 | 1093 | - | - | - | - | - | - | - | - | 906 | 170 | 1179 | 443 | 1452 | 716 | 1998 | 1261 | |
| FS 350 | 10 | 495 | 312 | 1503 | 1293 | 1978 | 1767 | 2452 | 2241 | 2926 | 2716 | 3400 | 3190 | 3874 | 3664 | 4348 | 4138 | 5296 | 5086 |
| | 20 | 990 | 624 | 1145 | 724 | 1619 | 1199 | 2093 | 1673 | 2567 | 2147 | 3041 | 2621 | 3515 | 3095 | 3990 | 3569 | 4938 | 4517 |
| | 30 | 1485 | 936 | 786 | 156 | 1261 | 630 | 1735 | 1104 | 2209 | 1578 | 2683 | 2052 | 3157 | 2526 | 3631 | 3000 | 4579 | 3948 |
| | 40 | 1979 | 1248 | - | - | - | - | 1376 | 535 | 1850 | 1009 | 2324 | 1483 | 2798 | 1957 | 3272 | 2431 | 4221 | 3380 |
| | 50 | 2474 | 1560 | - | - | - | - | - | - | 1492 | 440 | 1966 | 914 | 2440 | 1388 | 2914 | 1863 | 3862 | 2811 |
| 60 | 2969 | 1872 | - | - | - | - | - | - | - | - | 1607 | 346 | 2081 | 820 | 2555 | 1294 | 3504 | 2242 | |
| FS 600 | 10 | 848 | 534 | 2551 | 2190 | 3356 | 2996 | 4162 | 3801 | 4968 | 4607 | 5773 | 5413 | 6579 | 6218 | 7385 | 7024 | 8996 | 8635 |
| | 20 | 1695 | 1068 | 1937 | 1216 | 2743 | 2021 | 3548 | 2827 | 4354 | 3633 | 5160 | 4438 | 5965 | 5244 | 6771 | 6050 | 8382 | 7661 |
| | 30 | 2543 | 1601 | 1324 | 241 | 2129 | 1047 | 2935 | 1853 | 3741 | 2658 | 4546 | 3464 | 5352 | 4270 | 6158 | 5075 | 7769 | 6687 |
| | 40 | 3391 | 2135 | - | - | - | - | 2321 | 878 | 3127 | 1684 | 3933 | 2490 | 4738 | 3295 | 5544 | 4101 | 7155 | 5712 |
| | 50 | 4238 | 2669 | - | - | - | - | - | - | 2513 | 710 | 3319 | 1515 | 4125 | 2321 | 4930 | 3127 | 6542 | 4738 |
| 60 | 5086 | 3203 | - | - | - | - | - | - | - | - | 2706 | 541 | 3511 | 1346 | 4317 | 2152 | 5928 | 3763 | |

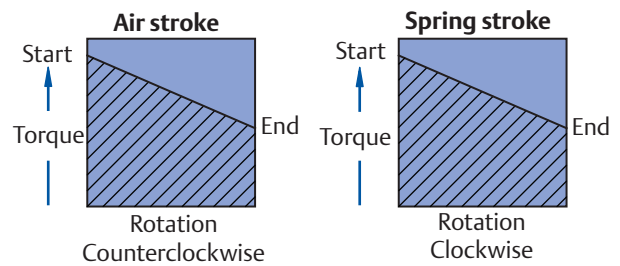
Actuator Torque - Spring-Return (lbf.in)

| 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 | 1070 | 685 | 3842 | 3360 | 5038 | 4556 | 6234 | 5752 | 7430 | 6948 | 8627 | 8144 | 9823 | 9340 | 11019 | 10536 | 13411 | 12929 |
| | 20 | 2141 | 1369 | 2986 | 2022 | 4182 | 3218 | 5379 | 4414 | 6575 | 5610 | 7771 | 6806 | 8967 | 8002 | 10163 | 9198 | 12555 | 11591 |
| | 30 | 3211 | 2054 | 2130 | 683 | 3327 | 1880 | 4523 | 3076 | 5719 | 4272 | 6915 | 5468 | 8111 | 6664 | 9307 | 7860 | 11699 | 10252 |
| | 40 | 4282 | 2738 | - | - | 2471 | 541 | 3667 | 1738 | 4863 | 2934 | 6059 | 4130 | 7255 | 5326 | 8451 | 6522 | 10844 | 8914 |
| | 50 | 5352 | 3423 | - | - | - | - | 2811 | 399 | 4007 | 1596 | 5203 | 2792 | 6400 | 3988 | 7596 | 5184 | 9988 | 7576 |
| | 60 | 6423 | 4108 | - | - | - | - | - | - | 3152 | 257 | 4348 | 1454 | 5544 | 2650 | 6740 | 3846 | 9132 | 6238 |
| FS 1600 | 10 | 1835 | 1141 | 6447 | 5579 | 8452 | 7583 | 10456 | 9588 | 12461 | 11592 | 14466 | 13597 | 16470 | 15602 | 18475 | 17606 | 22484 | 21615 |
| | 20 | 3671 | 2281 | 5022 | 3284 | 7026 | 5289 | 9031 | 7294 | 11035 | 9298 | 13040 | 11303 | 15044 | 13307 | 17049 | 15312 | 21058 | 19321 |
| | 30 | 5506 | 3422 | 3596 | 990 | 5600 | 2995 | 7605 | 4999 | 9610 | 7004 | 11614 | 9008 | 13619 | 11013 | 15623 | 13018 | 19632 | 17027 |
| | 40 | 7342 | 4562 | - | - | 4175 | 700 | 6179 | 2705 | 8184 | 4709 | 10188 | 6714 | 12193 | 8719 | 14198 | 10723 | 18207 | 14732 |
| | 50 | 9177 | 5703 | - | - | - | - | 4753 | 411 | 6758 | 2415 | 8763 | 4420 | 10767 | 6424 | 12772 | 8429 | 16781 | 12438 |
| | 60 | 11013 | 6844 | - | - | - | - | - | - | - | - | 7337 | 2125 | 9342 | 4130 | 11346 | 6135 | 15355 | 10144 |
| FS 2500 | 10 | 2607 | 1597 | 10204 | 8941 | 13310 | 12047 | 16416 | 15153 | 19523 | 18259 | 22629 | 21366 | 25735 | 24472 | 28841 | 27578 | 35054 | 33791 |
| | 20 | 5215 | 3194 | 8208 | 5681 | 11314 | 8788 | 14420 | 11894 | 17526 | 15000 | 20633 | 18106 | 23739 | 21213 | 26845 | 24319 | 33058 | 30532 |
| | 30 | 7822 | 4791 | 6211 | 2422 | 9318 | 5528 | 12424 | 8635 | 15530 | 11741 | 18636 | 14847 | 21743 | 17953 | 24849 | 21060 | 31062 | 27272 |
| | 40 | 10430 | 6388 | - | - | 7321 | 2269 | 10428 | 5375 | 13534 | 8482 | 16640 | 11588 | 19747 | 14694 | 22853 | 17800 | 29065 | 24013 |
| | 50 | 13037 | 7985 | - | - | - | - | 8432 | 2116 | 11538 | 5222 | 14644 | 8329 | 17750 | 11435 | 20857 | 14541 | 27069 | 20754 |
| | 60 | 15645 | 9582 | - | - | - | - | - | - | 9542 | 1963 | 12648 | 5069 | 15754 | 8176 | 18860 | 11282 | 25073 | 17494 |
| FS 4000 | 10 | 4183 | 2645 | 16495 | 14572 | 21537 | 19613 | 26578 | 24655 | 31620 | 29696 | 36661 | 34738 | 41703 | 39780 | 46744 | 44821 | 56828 | 54904 |
| | 20 | 8366 | 5289 | 13189 | 9343 | 18231 | 14384 | 23273 | 19426 | 28314 | 24467 | 33356 | 29509 | 38397 | 34550 | 43439 | 39592 | 53522 | 49675 |
| | 30 | 12550 | 7934 | 9884 | 4114 | 14925 | 9155 | 19967 | 14197 | 25008 | 19238 | 30050 | 24280 | 35092 | 29321 | 40133 | 34363 | 50216 | 44446 |
| | 40 | 16733 | 10578 | - | - | 11620 | 3926 | 16661 | 8968 | 21703 | 14009 | 26744 | 19051 | 31786 | 24092 | 36827 | 29134 | 46911 | 39217 |
| | 50 | 20916 | 13223 | - | - | - | - | 13355 | 3739 | 18397 | 8780 | 23439 | 13822 | 28480 | 18863 | 33522 | 23905 | 43605 | 33988 |
| | 60 | 25099 | 15867 | - | - | - | - | - | - | 15091 | 3551 | 20133 | 8593 | 25174 | 13634 | 30216 | 18676 | 40299 | 28759 |

Notes:

- 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 representative.

Figure 1. Spring-Return torque diagram



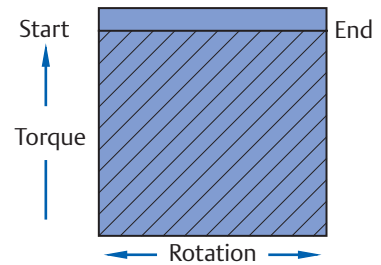
Actuator Torque - Double-Acting (Nm)

| 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 |

Notes:

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 representative.

Figure 1. Double-Acting torque diagram



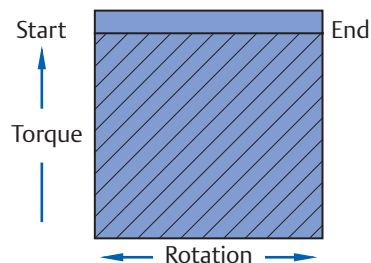
Actuator Torque - Double-Acting (lbf.in)

| 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 | 112 | 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 | 466 | 518 | 622 |
| FD 65 | 233 | 272 | 312 | 352 | 392 | 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 | 1304 | 1398 | 1492 | 1680 | 1868 | 2244 |
| FD 200 | 754 | 883 | 1011 | 1140 | 1269 | 1398 | 1527 | 1784 | 1913 | 2042 | 2299 | 2557 | 3072 |
| FD 350 | 1310 | 1534 | 1758 | 1981 | 2205 | 2429 | 2653 | 3100 | 3324 | 3547 | 3995 | 4442 | 5337 |
| FD 600 | 2226 | 2606 | 2987 | 3367 | 3747 | 4127 | 4508 | 5268 | 5648 | 6028 | 6789 | 7549 | 9070 |
| FD 950 | 3374 | 3950 | 4527 | 5103 | 5679 | 6255 | 6832 | 7984 | 8560 | 9137 | 10289 | 11442 | 13747 |
| FD 1600 | 5654 | 6620 | 7586 | 8552 | 9517 | 10483 | 11449 | 13380 | 14346 | 15312 | 17243 | 19175 | 23038 |
| FD 2500 | 8762 | 10259 | 11755 | 13252 | 14748 | 16245 | 17741 | 20734 | 22231 | 23727 | 26720 | 29713 | 35699 |
| FD 4000 | 14221 | 16650 | 19079 | 21508 | 23937 | 26365 | 28794 | 33652 | 36081 | 38510 | 43368 | 48225 | 57941 |

Notes:

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 representative.

Figure 2. Double-Acting torque diagram



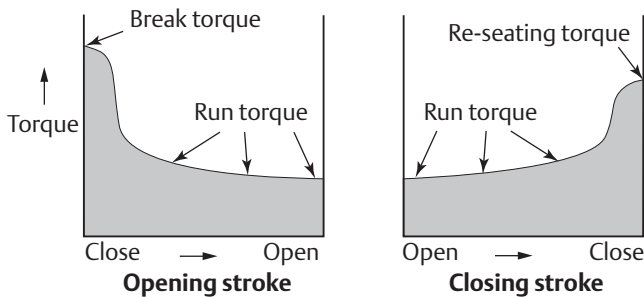
Sizing of Rack and Pinion Actuators

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

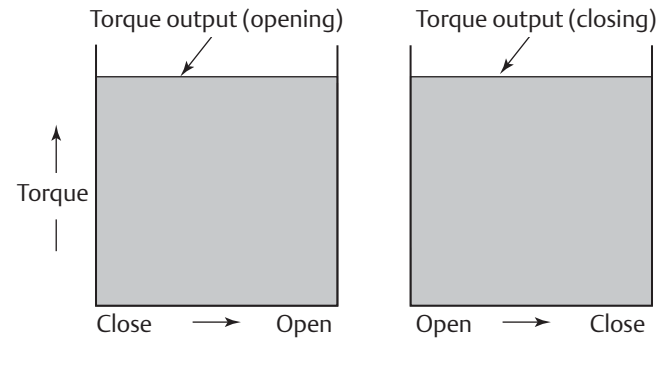
Emerson Process Management recommends that the valve manufacturer supply the maximum required and allowed torque values (Including any adjustments or suggested safety factors for valve service conditions or application).

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 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 105 Nm.

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

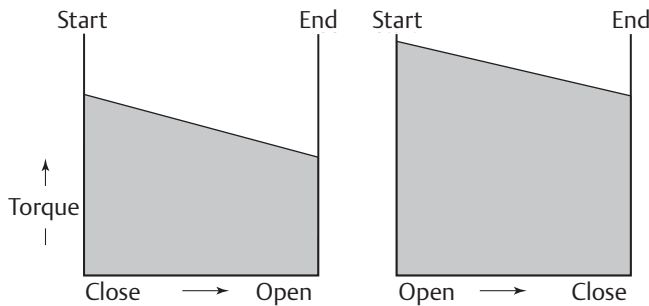


Table 1. For Fail-to Close actuators applies:

| 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.

Notes:

- 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:

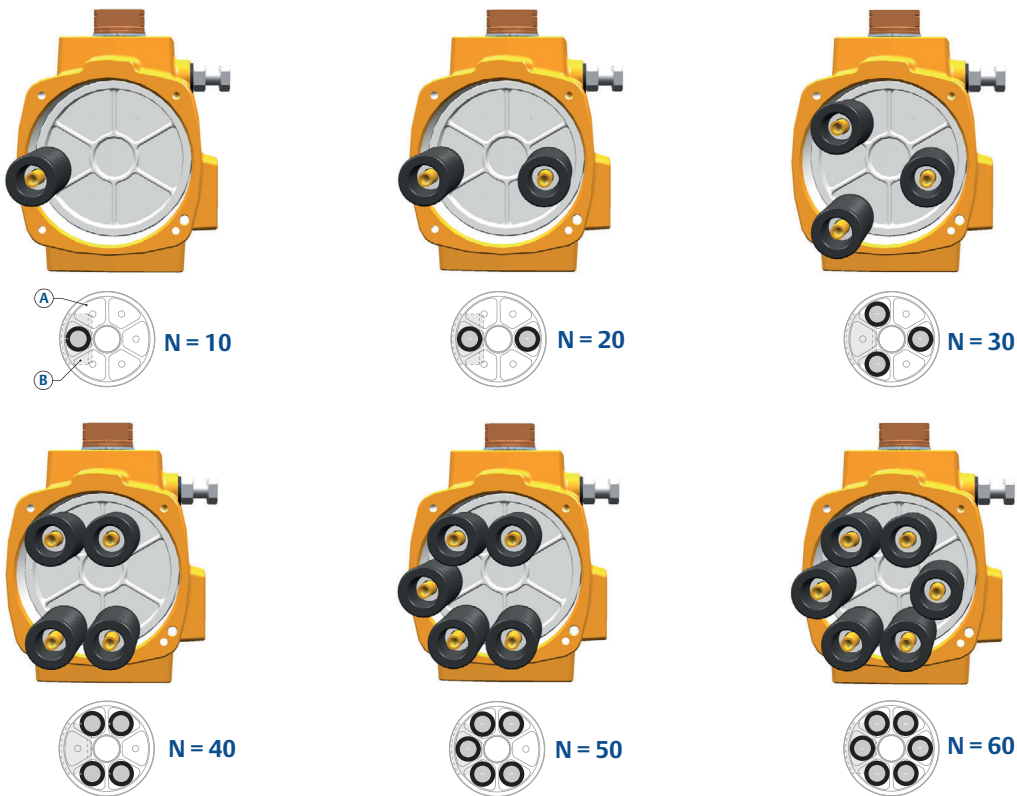
- Size F12 has only 1 spring on each side.
- Sizes F25 to F600 have 6 springs on each side (see Figure 1).
- Sizes F950 to F4000 have 3 springs on each side (see Figure 2).

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.

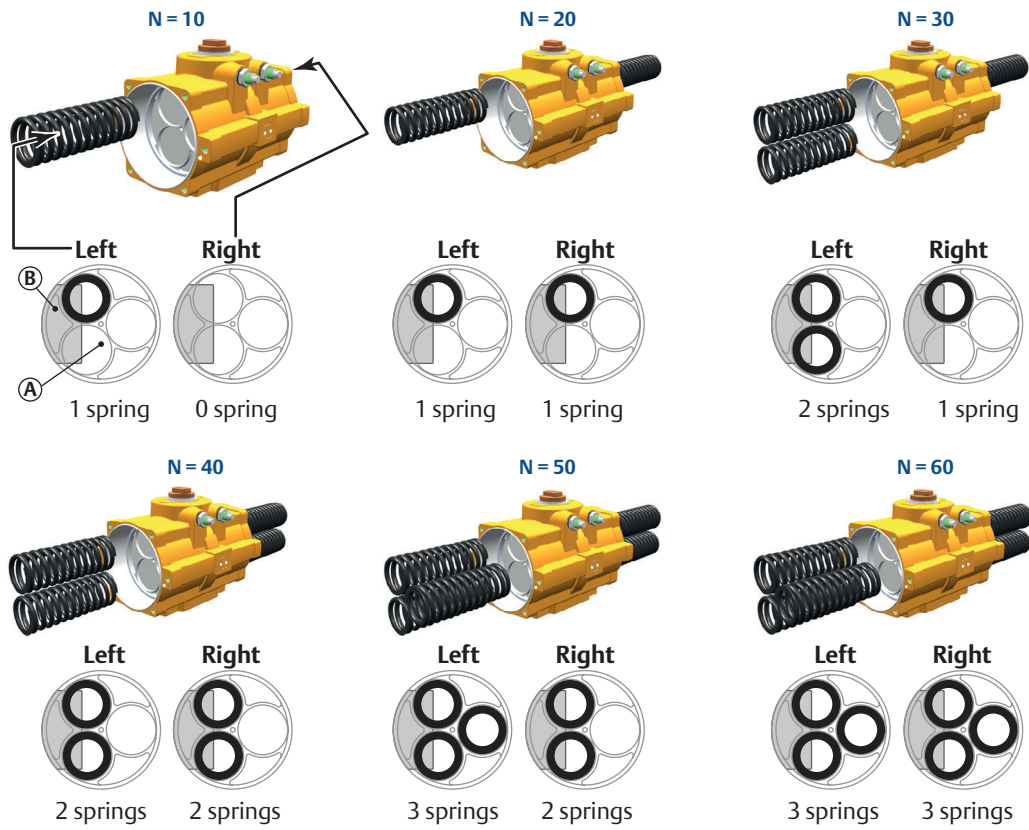
Figure 1. Spring placement sizes F25 to F600



A = Piston top view

B = Position of piston gear rack

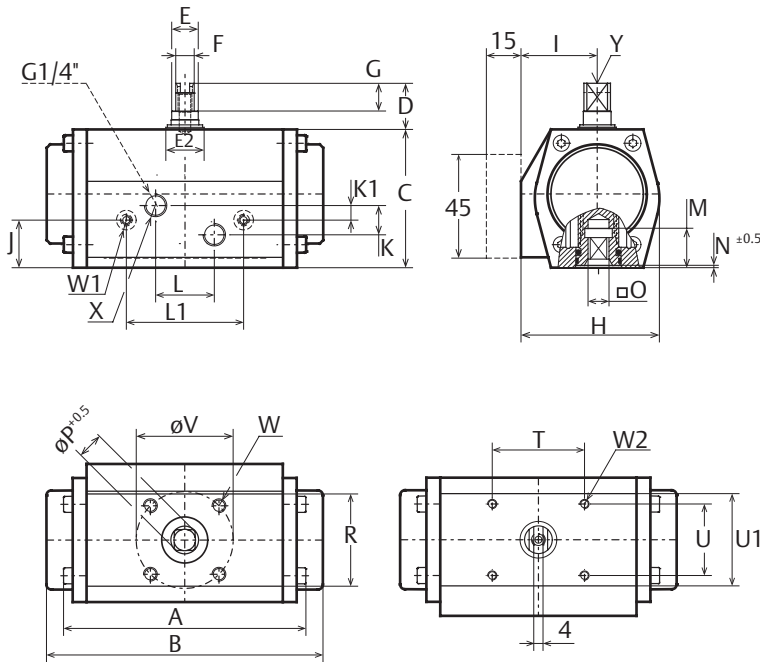
Figure 2. Spring placement sizes F950 to F4000



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

Data sheet F12

Metric - ISO5211



| 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 | | |

| Dim. in mm | | Size 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|-----|---------|----|----|----|----|----|----|----|----|------|-----|------|------|------|--------|--------|------|------|----|----|----|----|----|------|------|------|-------|-------|
| A | F | 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 | |
| 103 | 118 | 60 | 20 | 16 | 23 | 10 | 12 | 60 | 33 | 21 | 12.7 | 6.4 | 25.4 | 50.8 | 16.5 | 1 | 9.14 | 9.05 | 12.1 | 40 | 40 | 40 | 31 | 42 | M6x8 | M4x5 | M4x5 | G1/8" | M6x12 |

1. According 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 ~ 80 psig;
Load: with average load; Stroke: 90°;
Temperature: Room temperature
3. SR = Spring-Return, DA = Double-Acting
MOP = Maximum Operating Pressure

| Torque Output | | | | | | | | | | | | | | | | | | | | |
|----------------------|----------------------|-----|------------------------|---|----------|---|----------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|------|----------|------|
| Spring-Return | | | | | | | | | | | | | | | | | | | | |
| Spring set | Spring Stroke Torque | | Air Stroke Torque (Nm) | | | | | | | | | | | | | | | | | |
| | 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 | |
| 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 |
| Double-Acting | | | 7.3 | | 8.5 | | 9.7 | | 11.0 | | 12.2 | | 13.4 | | 14.6 | | 17.1 | | 19.6 | |

Notes:

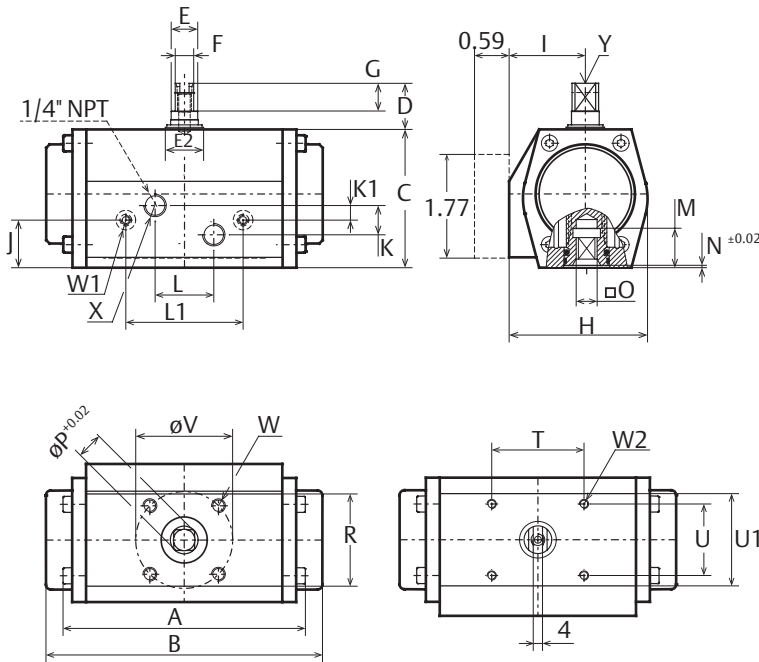
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO5211
- For further information regarding options, materials, certifications and additional execution please contact your Regional Sales Office.

European Directives:

- PED: Suitable for use with group 2 gases according to Pressure Equipment Directive (PED) 2014/68/EU
- ATEX: 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

Imperial - ISO5211



| Dim. in inches | | Size 12 | | | | | | | | | | |
|----------------|------|---------|------|-------|-------------|-------------|-------------|----------|----------|---|---|---|
| A | FD | B | F | S | C | D | E | E2 | F | G | H | I |
| 4.06 | 4.65 | 2.36 | 0.79 | 0.63 | 0.91 | 0.39 | 0.47 | 2.36 | 1.30 | | | |
| J | K | K1 | L | L1 | M | N | O max. | O min. | P | | | |
| 0.83 | 0.50 | 0.25 | 1.00 | 2.00 | 0.65 | 0.039 | 0.360 | 0.356 | 0.476 | | | |
| R | R1 | T | U | V | W | W1 | W2 | X | Y | | | |
| 1.57 | 1.57 | 1.57 | 1.22 | 1.654 | 10-24 x.24" | 10-24 x.20" | 10-24 x.20" | 1/8" NPT | M6 x.47" | | | |

| 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 ⁽²⁾ | Open | 0.4 | Sec. |
| | Close | 0.4 | Sec. |
| Cycle speed SR ⁽²⁾ | Open | 0.4 | Sec. |
| | Close | 0.4 | Sec. |
| Temperature range | -4 °F to +176 °C | | |
| Lubrication | Lubricated for life ⁽¹⁾ | | |
| Stroke | 90° | | |
| Finish | Polyurethane powder coat | | |

1. According 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 ~ 80 psig;
Load: with average load; Stroke: 90°;
Temperature: Room temperature
3. SR = Spring-Return, DA = Double-Acting
MOP = Maximum Operating Pressure

| 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 | Start | End |
| 20 | 64 | 41 | - | - | 31 | 5 | 47 | 21 | 63 | 37 | 79 | 53 | 95 | 69 | 111 | 84 | 142 | 116 |
| Double-Acting | | | 59 | | 74 | | 89 | | 104 | | 119 | | 134 | | 149 | | 179 | |

Notes:

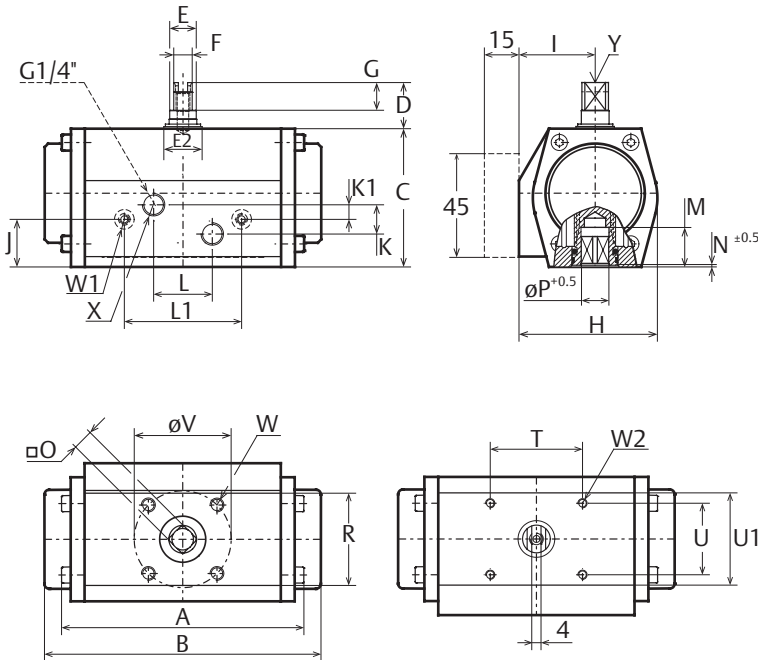
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO5211
- For further information regarding options, materials, certifications and additional execution please contact your Regional Sales Office.

European Directives:

- PED: Suitable for use with group 2 gases according to Pressure Equipment Directive (PED) 2014/68/EU
- ATEX: 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 | C | D | E | E2 | F | G | H | I | J | K | K1 | L | L1 | M | N | O max. | O min. | P |
| 103 | 118 | 60 | 20 | 16 | 23 | 10 | 12 | 60 | 33 | 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 | M4x5 | M4x5 | 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 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 ~ 80 psig;
Load: with average load; Stroke: 90°;
Temperature: Room temperature
3. SR = Spring-Return, DA = Double-Acting
MOP = Maximum Operating Pressure

| 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 | 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 |
| Double-Acting | | | 7.3 | | 8.5 | | 9.7 | | 11.0 | | 12.2 | | 13.4 | | 14.6 | | 17.1 | | 19.6 | |

Notes:

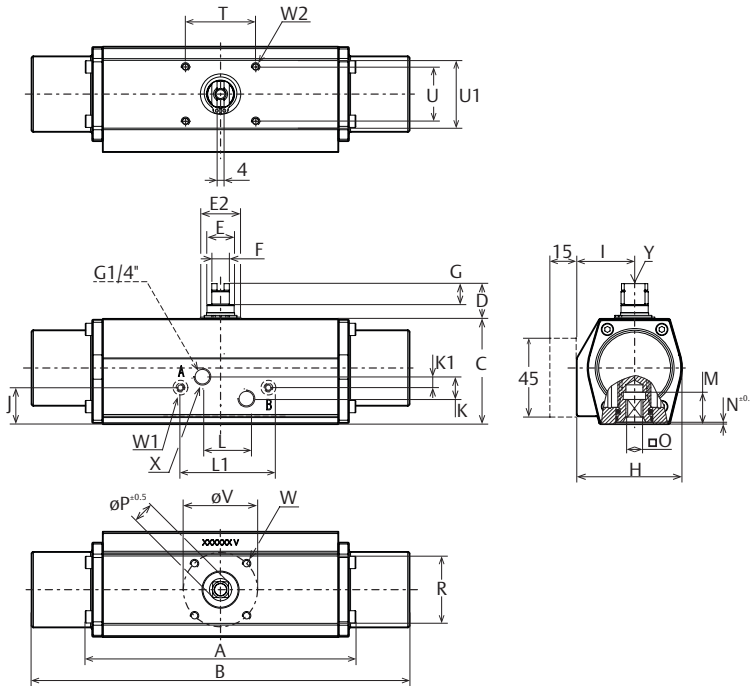
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO5211
- For further information regarding options, materials, certifications and additional execution please contact your Regional Sales Office.

European Directives:

- PED: Suitable for use with group 2 gases according to Pressure Equipment Directive (PED) 2014/68/EU
- ATEX: 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 180° Rotation

Metric - ISO5211



| Dim. in mm | | Size 12 | | | | | | | | | |
|------------|--------|---------|------|------|------|------|--------|--------|-------|--|--|
| A (FD) | B (FS) | C | D | E | E2 | F | G | H | I | | |
| 155 | 216 | 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 | M4x5 | M4x5 | G1/8" | M6x12 | | |

| Principle | | |
|----------------------------------|--|----------------|
| Pneumatic rack & pinion actuator | | |
| General Data | | |
| Bore | | 46 mm |
| Stroke | | 25.2 mm |
| Weight | SR ⁽³⁾ | 0.99 kg |
| | DA ⁽³⁾ | 0.84 kg |
| Volume | Port A | 0.13 L |
| | Port B | 0.11 L |
| Air connection | | 2x 1/8" BSP |
| Pressure range | MOP ⁽³⁾ | 8.3 barg |
| | SR ⁽³⁾ | 3-8.3 barg |
| | DA ⁽³⁾ | 0.2 - 8.3 barg |
| Pressure media | Clean, dry or lubricated air or inert gas. | |
| Cycle speed DA ⁽²⁾ | Open | 0.5 Sec. |
| | Close | 0.4 Sec. |
| Cycle speed SR ⁽²⁾ | Open | 0.5 Sec. |
| | Close | 0.4 Sec. |
| Temperature range | -20 °C to +80 °C | |
| Lubrication | Lubricated for life ⁽¹⁾ | |
| Rotation angle | 180° | |
| Finish | Polyurethan powder coat | |

1. According 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 ~ 80 psig;
Load: with average load; Stroke: 90°;
Temperature: Room temperature
3. SR = Spring-Return, DA = Double-Acting
MOP = Maximum Operating Pressure

| Torque Output F12 180° | | | | | | | | | | | | | | | | | | | | |
|------------------------|----------------------|-----|------------------------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|------|
| 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 | | |
| 20 | 7.1 | 4.5 | - | - | - | - | 5.2 | 2.1 | 6.5 | 3.4 | 7.8 | 4.7 | 9.1 | 6.0 | 10.4 | 7.3 | 13.0 | 9.9 | 15.6 | 12.5 |
| Double-Acting | | | 7.3 | | 8.5 | | 9.7 | | 10.9 | | 12.2 | | 13.4 | | 14.6 | | 17.1 | | 19.6 | |

Notes:

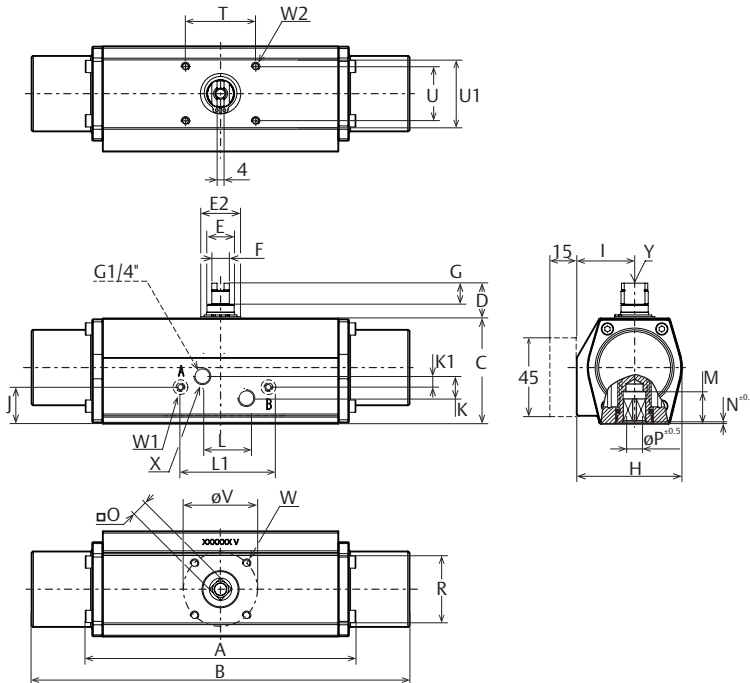
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO5211
- For further information regarding options, materials, certifications and additional execution please contact your Regional Sales Office.

European Directives:

- PED: Suitable for use with group 2 gases according to Pressure Equipment Directive (PED) 2014/68/EU
- ATEX: 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 180° Rotation

Metric - DIN3337



| Dim. in mm | | Size 12 | | | | | | | | | | | | | | | | | |
|------------|--------|---------|----|----|------|------|------|-------|-------|----|------|-----|------|------|------|---|--------|--------|------|
| A (FD) | B (FS) | C | D | E | E2 | F | G | H | I | J | K | K1 | L | L1 | M | N | O max. | O min. | P |
| 155 | 216 | 60 | 20 | 16 | 23 | 10 | 12 | 60 | 33 | 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 | M4x5 | M4x5 | G1/8" | M6x12 | | | | | | | | | | |

| Principle | | |
|----------------------------------|--|----------------|
| Pneumatic rack & pinion actuator | | |
| General Data | | |
| Bore | | 46 mm |
| Stroke | | 25.2 mm |
| Weight | SR ⁽³⁾ | 0.99 kg |
| | DA ⁽³⁾ | 0.84 kg |
| Volume | Port A | 0.13 L |
| | Port B | 0.11 L |
| Air connection | | 2x 1/8" BSP |
| Pressure range | MOP ⁽³⁾ | 8.3 barg |
| | SR ⁽³⁾ | 3-8.3 barg |
| | DA ⁽³⁾ | 0.2 - 8.3 barg |
| Pressure media | Clean, dry or lubricated air or inert gas. | |
| Cycle speed DA ⁽²⁾ | Open | 0.5 Sec. |
| | Close | 0.4 Sec. |
| Cycle speed SR ⁽²⁾ | Open | 0.5 Sec. |
| | Close | 0.4 Sec. |
| Temperature range | -20 °C to +80 °C | |
| Lubrication | Lubricated for life ⁽¹⁾ | |
| Rotation angle | 180° | |
| Finish | Polyurethan powder coat | |

1. According 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 ~ 80 psig;
Load: with average load; Stroke: 90°;
Temperature: Room temperature
3. SR = Spring-Return, DA = Double-Acting
MOP = Maximum Operating Pressure

| Torque Output F12 180° | | | | | | | | | | | | | | | | | | | | |
|------------------------|----------------------|-----|------------------------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|-----|----------|------|
| 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 | Start | End |
| 20 | 7.1 | 4.5 | - | - | - | - | 5.2 | 2.1 | 6.5 | 3.4 | 7.8 | 4.7 | 9.1 | 6.0 | 10.4 | 7.3 | 13.0 | 9.9 | 15.6 | 12.5 |
| Double-Acting | | | 7.3 | | 8.5 | | 9.7 | | 10.9 | | 12.2 | | 13.4 | | 14.6 | | 17.1 | | 19.6 | |

Notes:

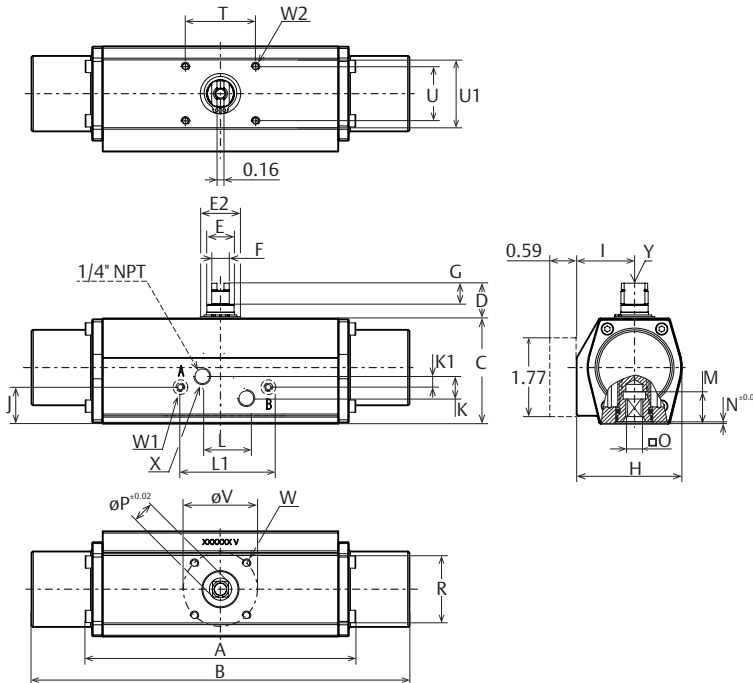
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO5211
- For further information regarding options, materials, certifications and additional execution please contact your Regional Sales Office.

European Directives:

- PED: Suitable for use with group 2 gases according to Pressure Equipment Directive (PED) 2014/68/EU
- ATEX: 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 180° Rotation

Imperial - ISO5211



| Dim. in inches | | Size 12 | | | | | | | | |
|----------------|--------|---------|------|-------|------------------------|------------------------|------------------------|--------|-------------|--|
| A (FD) | B (FS) | C | D | E | E2 | F | G | H | I | |
| 6.10 | 8.50 | 2.36 | 0.79 | 0.63 | 0.91 | 0.39 | 0.47 | 2.36 | 1.30 | |
| J | K | K1 | L | L1 | M | N | O max. | O min. | P | |
| 0.83 | 0.50 | 0.25 | 1.00 | 2.00 | 0.65 | 0.039 | 0.358 | 0.354 | 0.476 | |
| R | R1 | T | U | V | W | W1 | W2 | X | Y | |
| 1.57 | 1.57 | 1.57 | 1.22 | 1.654 | 10-24 UNC x0.24" | 10-24 UNC x0.20" | 10-24 UNC x0.20" | G1/8" | M6 x.047 | |

| Principle | | |
|----------------------------------|--|-------------|
| Pneumatic rack & pinion actuator | | |
| General Data | | |
| Bore | | 1.811 inch |
| Stroke | | 0.992 inch |
| Weight | SR ⁽³⁾ | 2.2 lb |
| | DA ⁽³⁾ | 1.9 lb |
| Volume | Port A | 8.2 cu.in. |
| | Port B | 6.5 cu.in. |
| Air connection | | 2x 1/8" NPT |
| Pressure range | MOP ⁽³⁾ | 120 psig |
| | SR ⁽³⁾ | 43-120 psig |
| | DA ⁽³⁾ | 3-120 psig |
| Pressure media | Clean, dry or lubricated air or inert gas. | |
| Cycle speed DA ⁽²⁾ | Open | 0.5 Sec. |
| | Close | 0.4 Sec. |
| Cycle speed SR ⁽²⁾ | Open | 0.5 Sec. |
| | Close | 0.4 Sec. |
| Temperature range | -4 °F to +176 °F | |
| Lubrication | Lubricated for life ⁽¹⁾ | |
| Stroke | 180° | |
| Finish | Polyurethan powder coat | |

1. According 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 ~ 80 psig;
Load: with average load; Stroke: 90°;
Temperature: Room temperature
3. SR = Spring-Return, DA = Double-Acting
MOP = Maximum Operating Pressure

| Torque Output F12 180° | | | | | | | | | | | | | | | | | | |
|------------------------|----------------------|-----|----------------------------|-----|---------|-----|---------|-----|---------|-----|---------|-----|---------|-----|----------|-----|----------|-----|
| 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 | Start | End |
| 20 | 63 | 40 | - | - | - | - | 49 | 22 | 65 | 38 | 81 | 53 | 96 | 69 | 112 | 85 | 144 | 117 |
| Double-Acting | | | 59 | | 74 | | 89 | | 104 | | 119 | | 134 | | 149 | | 179 | |

Notes:

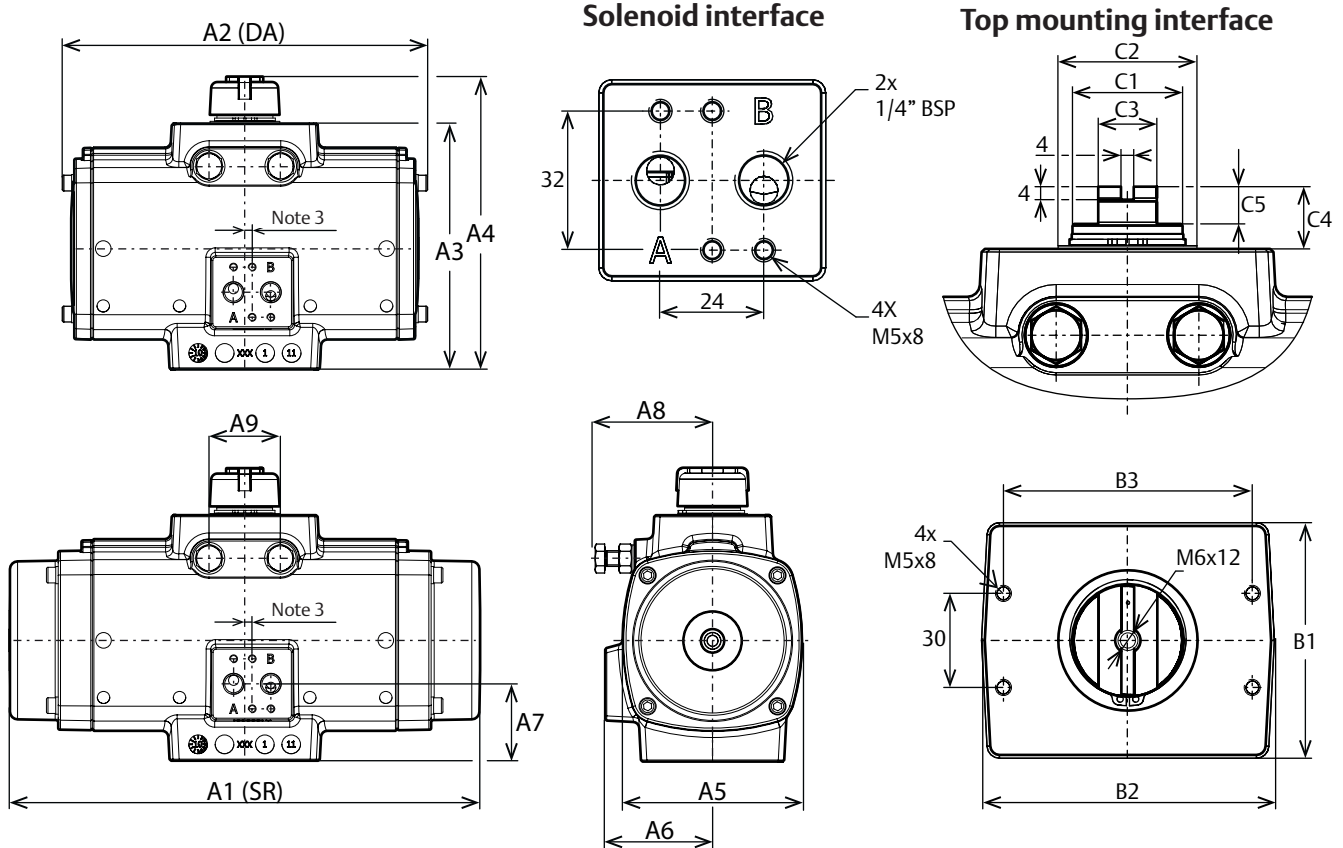
- Volume is the actual free air volume at 1 atm
- Flange and square drive to ISO5211
- For further information regarding options, materials, certifications and additional execution please contact your Regional Sales Office.

European Directives:

- PED: Suitable for use with group 2 gases according to Pressure Equipment Directive (PED) 2014/68/EU
- ATEX: 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

Dimensions - Metric (ISO5211)

Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 25 - 600



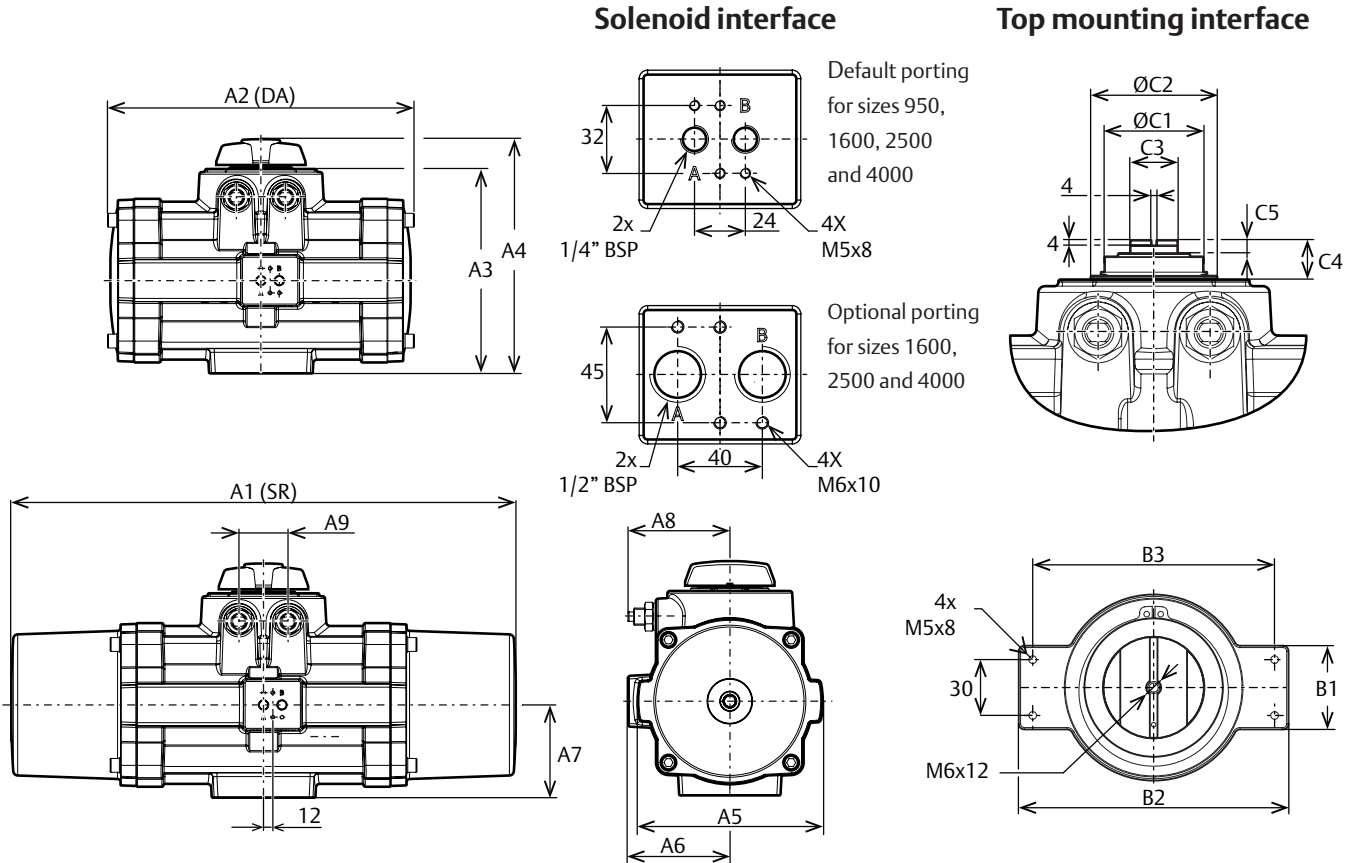
Notes:

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 | 0600 |
| A1 | 166 | 192 | 217 | 247 | 304 | 362 | 385 | 476 |
| A2 | 166 | 192 | 217 | 247 | 235 | 265 | 284 | 356 |
| A3 | 91 | 112 | 124 | 131 | 157 | 163 | 201 | 248 |
| A4 | 119 | 139 | 151 | 158 | 185 | 191 | 230 | 292 |
| A5 | 68 | 82 | 92 | 103 | 116 | 124 | 161 | 195 |
| A6 | 49 | 55 | 58 | 64 | 69 | 72 | 85 | 102 |
| A7 | 30 | 34 | 38 | 38 | 49 | 49 | 42 | 67 |
| A8 | 48 | 58 | 69 | 69 | 75 | 87 | 109 | 132 |
| A9 | 18 | 25 | 27 | 28 | 46 | 46 | 46 | 60 |
| B1 | 43 | 45 | 50 | 60 | 75 | 75 | 85 | 98 |
| B2 | 94 | 94 | 94 | 97 | 94 | 94 | 100 | 148 |
| B3 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 130 |
| C1 | 16 | 22 | 22 | 22 | 34 | 36 | 36 | 55 |
| C2 | 23 | 30 | 30 | 35 | 45 | 45 | 45 | 65 |
| C3 | 14 | 14 | 14 | 14 | 19 | 19 | 19 | 36 |
| C4 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 30 |
| C5 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 10 |

Dimensions - Metric (ISO5211)

Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 950 - 4000



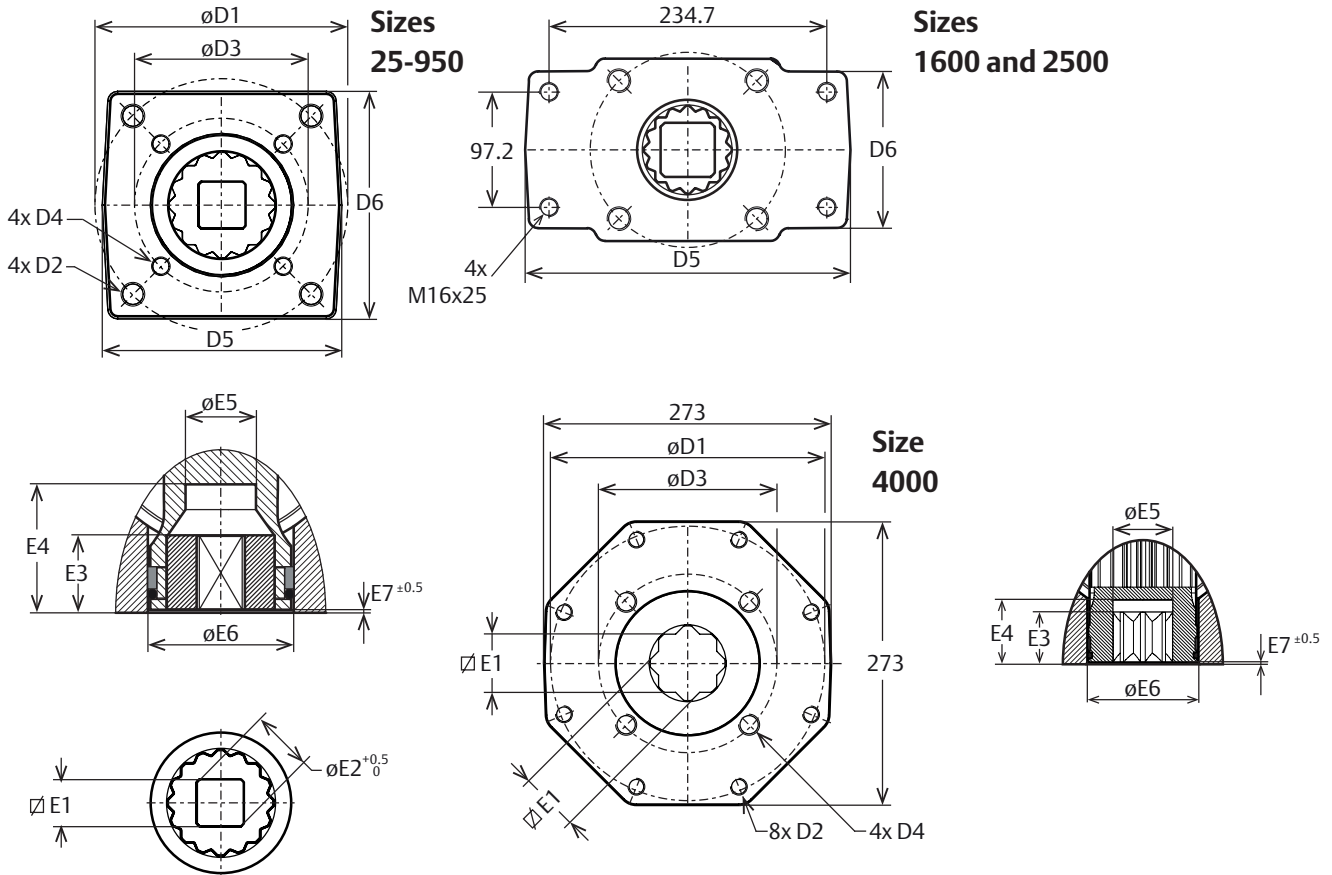
Notes:

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 | | | |
|------------|---------------|------------------------|------------------------|------------------------|
| | 0950 | 1600 | 2500 | 4000 |
| A1 | 658 | 732 | 877 | 959 |
| A2 | 400 | 462 | 550 | 649 |
| A3 | 268 | 302 | 354 | 389 |
| A4 | 305 | 339 | 392 | 427 |
| A5 | 239 | 306 | 350 | 400 |
| A6 | 131 | 149 | 170 | 196 |
| A7 | 121 | 137 (140) ⁴ | 157 (160) ⁴ | 184 (186) ⁴ |
| A8 | 131 | 156 | 181 | 175 |
| A9 | 64 | 85 | 102 | 184 |
| B1 | 45 | 45 | 45 | 45 |
| B2 | 145 | 145 | 145 | 145 |
| B3 | 130 | 130 | 130 | 130 |
| C1 | 65 | 75 | 95 | 96 |
| C2 | 83 | 96 | 115 | 115 |
| C3 | 36 | 36 | 36 | 36 |
| C4 | 30 | 30 | 30 | 30 |
| C5 | 10 | 10 | 10 | 10 |

Dimensions - Metric (ISO5211)

Valve Flange and Drive Details Sizes 25 - 4000



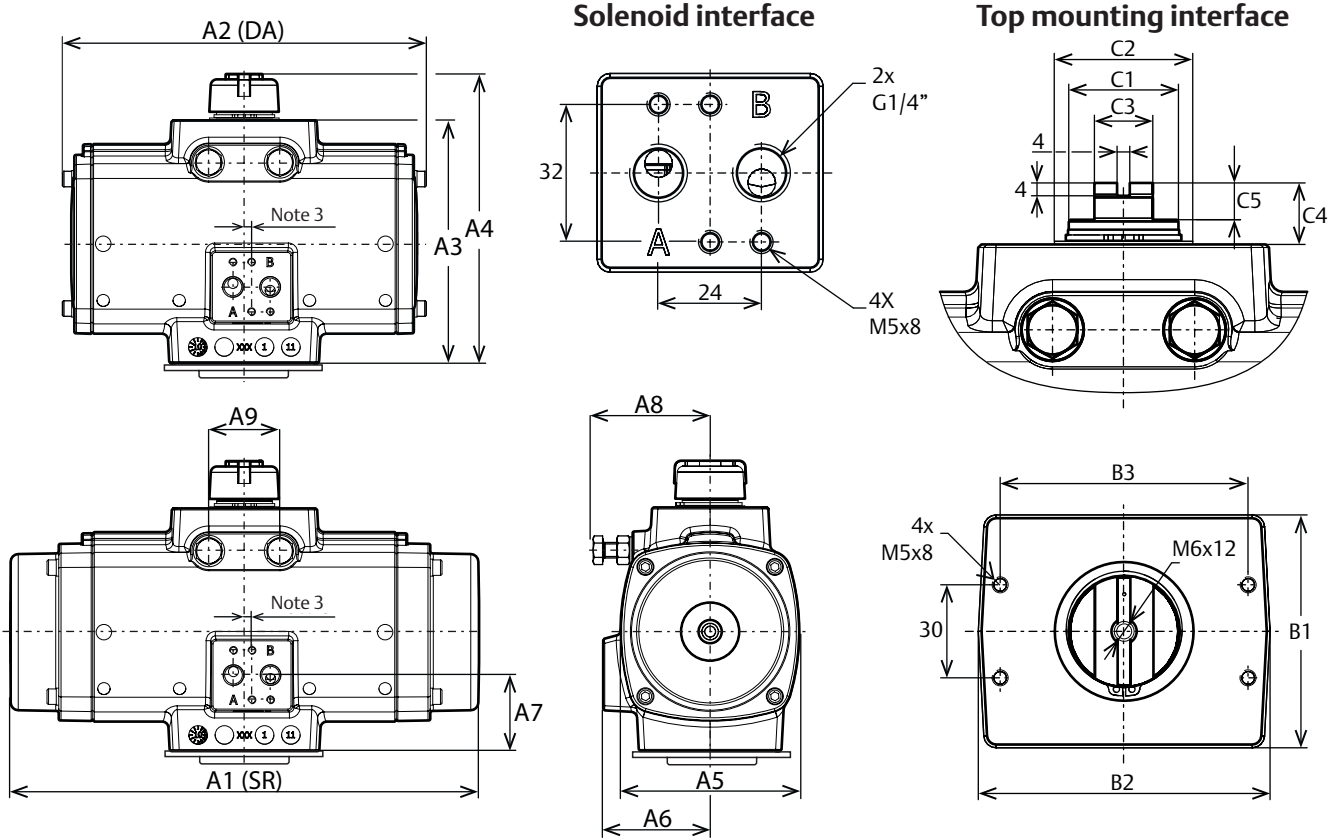
Notes:

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 | M20x30 | M20x30 | 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 | -/- | -/- | M20x30 |
| 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 | 48.2 | 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 - 600



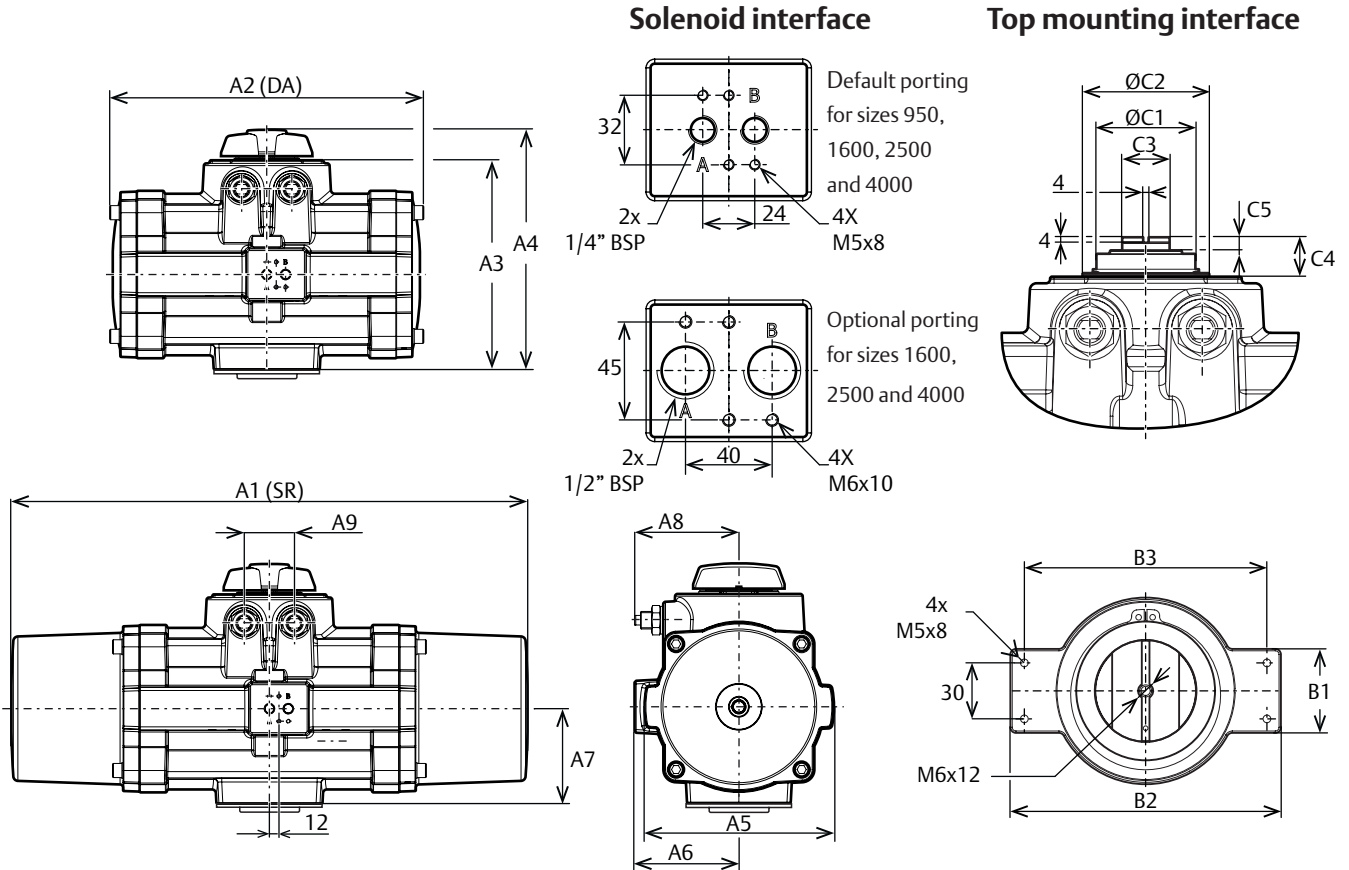
Notes:

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 | 0600 |
| A1 | 166 | 192 | 217 | 247 | 304 | 362 | 385 | 476 |
| A2 | 166 | 192 | 217 | 247 | 235 | 265 | 284 | 356 |
| A3 | 91 | 112 | 124 | 131 | 157 | 163 | 201 | 248 |
| A4 | 119 | 139 | 151 | 158 | 185 | 191 | 230 | 292 |
| A5 | 68 | 82 | 92 | 103 | 116 | 124 | 161 | 195 |
| A6 | 49 | 55 | 58 | 64 | 69 | 72 | 85 | 102 |
| A7 | 30 | 34 | 38 | 38 | 49 | 49 | 42 | 67 |
| A8 | 48 | 58 | 69 | 69 | 75 | 87 | 109 | 132 |
| A9 | 18 | 25 | 27 | 28 | 46 | 46 | 46 | 60 |
| B1 | 43 | 45 | 50 | 60 | 75 | 75 | 85 | 98 |
| B2 | 94 | 94 | 94 | 97 | 94 | 94 | 100 | 148 |
| B3 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 130 |
| C1 | 16 | 22 | 22 | 22 | 34 | 36 | 36 | 55 |
| C2 | 23 | 30 | 30 | 35 | 45 | 45 | 45 | 65 |
| C3 | 14 | 14 | 14 | 14 | 19 | 19 | 19 | 36 |
| C4 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 30 |
| C5 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 10 |

Dimensions - Metric (DIN3337)

Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 950 - 4000



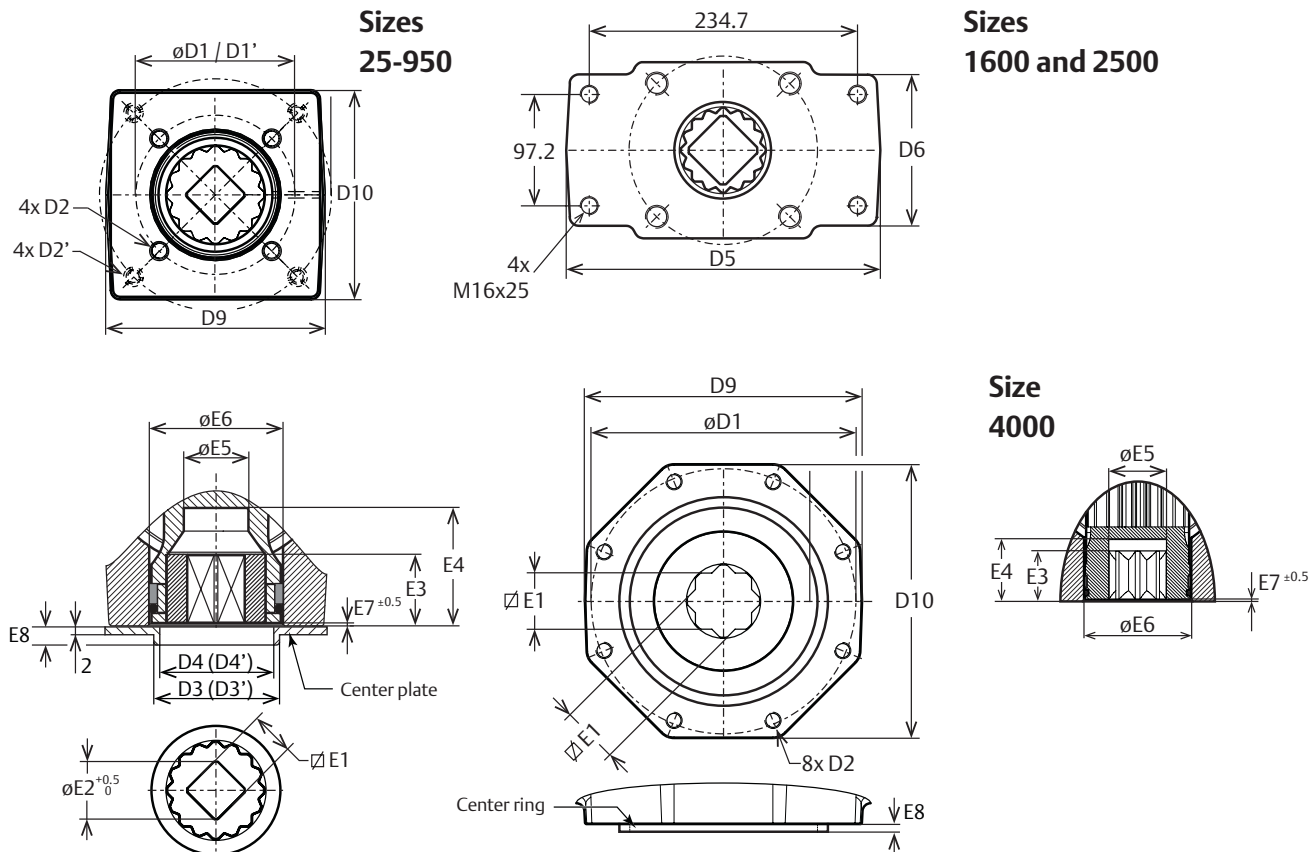
Notes:

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 | | | |
|---------------|---------------|------------------------|------------------------|------------------------|
| | 0950 | 1600 | 2500 | 4000 |
| A1 | 658 | 732 | 877 | 959 |
| A2 | 400 | 462 | 550 | 649 |
| A3 | 268 | 302 | 354 | 389 |
| A4 | 305 | 339 | 392 | 427 |
| A5 | 239 | 306 | 350 | 400 |
| A6 | 131 | 149 | 170 | 196 |
| A7 | 121 | 137 (140) ⁴ | 157 (160) ⁴ | 184 (186) ⁴ |
| A8 | 131 | 156 | 181 | 175 |
| A9 | 64 | 85 | 102 | 184 |
| B1 | 45 | 45 | 45 | 45 |
| B2 | 145 | 145 | 145 | 145 |
| B3 | 130 | 130 | 130 | 130 |
| C1 | 65 | 75 | 95 | 96 |
| C2 | 83 | 96 | 115 | 115 |
| C3 | 36 | 36 | 36 | 36 |
| C4 | 30 | 30 | 30 | 30 |
| C5 | 10 | 10 | 10 | 10 |

Dimensions - Metric (DIN3337)

Valve Flange and Drive Details Sizes 25 - 4000



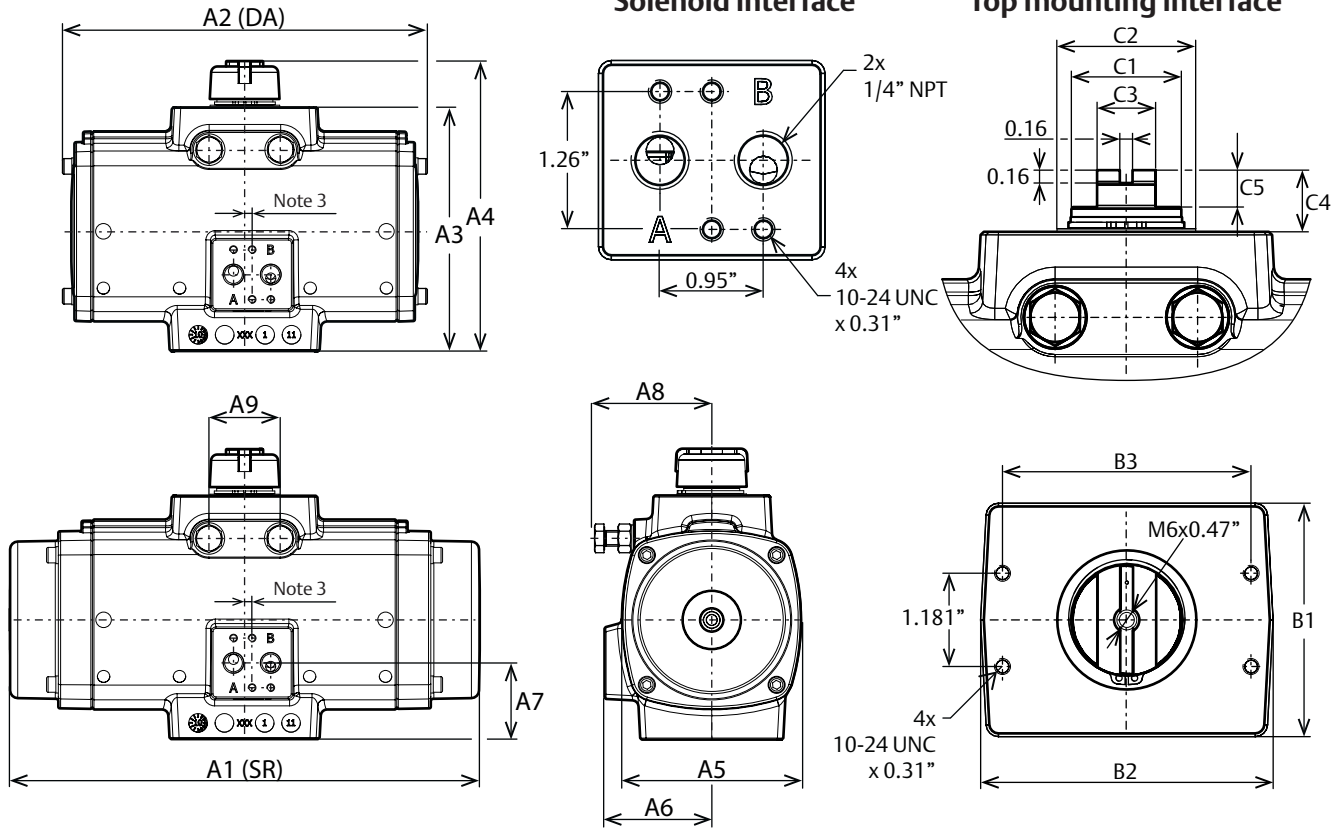
Notes:

1. Flange and square drive according to ISO5211.
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 |
| DIN 1 | F05 | F05 | F05 | F07 | F07 | F10 | F10 | F12 | F14 | F16 | F16 | F25 |
| D1 | 50 | 50 | 50 | 70 | 70 | 102 | 102 | 125 | 140 | 165 | 165 | 254 |
| D2 | M6x10 | M6x10 | M6x10 | M8x13 | M8x13 | M10x15 | M10x15 | M12x18 | M16x25 | M20x30 | M20x30 | M16x25 |
| D3 | 35 | 35 | 35 | 55 | 55 | 70 | 70 | 85 | 100 | 130 | 130 | 200 |
| D4 | 29 | 32 | 32 | 40 | 50 | 54 | 54 | 68 | 75 | 95 | 95 | 120 |
| DIN 2 | F03 | F07 | F07 | F05 | F10 | F07 | F07 | F10 | F10 | F25* | F25* | -/- |
| D1' | 36 | 70 | 70 | 50 | 102 | 70 | 70 | 102 | 102 | -/- | -/- | -/- |
| D2' | M5x8 | M8x13 | M8x13 | M6x10 | M10x15 | M8x13 | M8x13 | M10x15 | M10x15 | -/- | -/- | -/- |
| D3' | - | 55 | 55 | 35 | 70 | 55 | 55 | -/- | -/- | -/- | -/- | -/- |
| D4' | - | 40 | 40 | 32 | 54 | 50 | 50 | -/- | -/- | -/- | -/- | -/- |
| D9 | 50 | 68 | 68 | 66 | 97 | 94 | 94 | 118 | 135 | 280 | 280 | 273 |
| D10 | 48 | 65 | 65 | 63 | 92 | 90 | 94 | 113 | 130 | 132 | 132 | 269 |
| E1 Max | 11.08 | 14.08 | 14.08 | 17.08 | 17.08 | 22.10 | 22.10 | 27.11 | 36.16 | 46.16 | 46.16 | 55.24 |
| E1 Min | 11.00 | 14.00 | 14.00 | 17.00 | 17.00 | 22.00 | 22.00 | 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 | 48.2 | 60.2 | 60.2 | 72.2 |
| E3 | 15.0 | 15.0 | 15.0 | 18.0 | 27.5 | 27.5 | 27.5 | 27.5 | 48.5 | 59.5 | 59.5 | 61.5 |
| E4 | 34.0 | 34.0 | 34.0 | 34.0 | 50.0 | 50.0 | 50.0 | 50.0 | 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 | 38.0 | 56.5 | 56.5 | 56.5 | 67.5 | 86 | 104 | 125 | 133 |
| E7 | 0.5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1 | 1 | 1 | 1 |
| E8 | 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 - 600



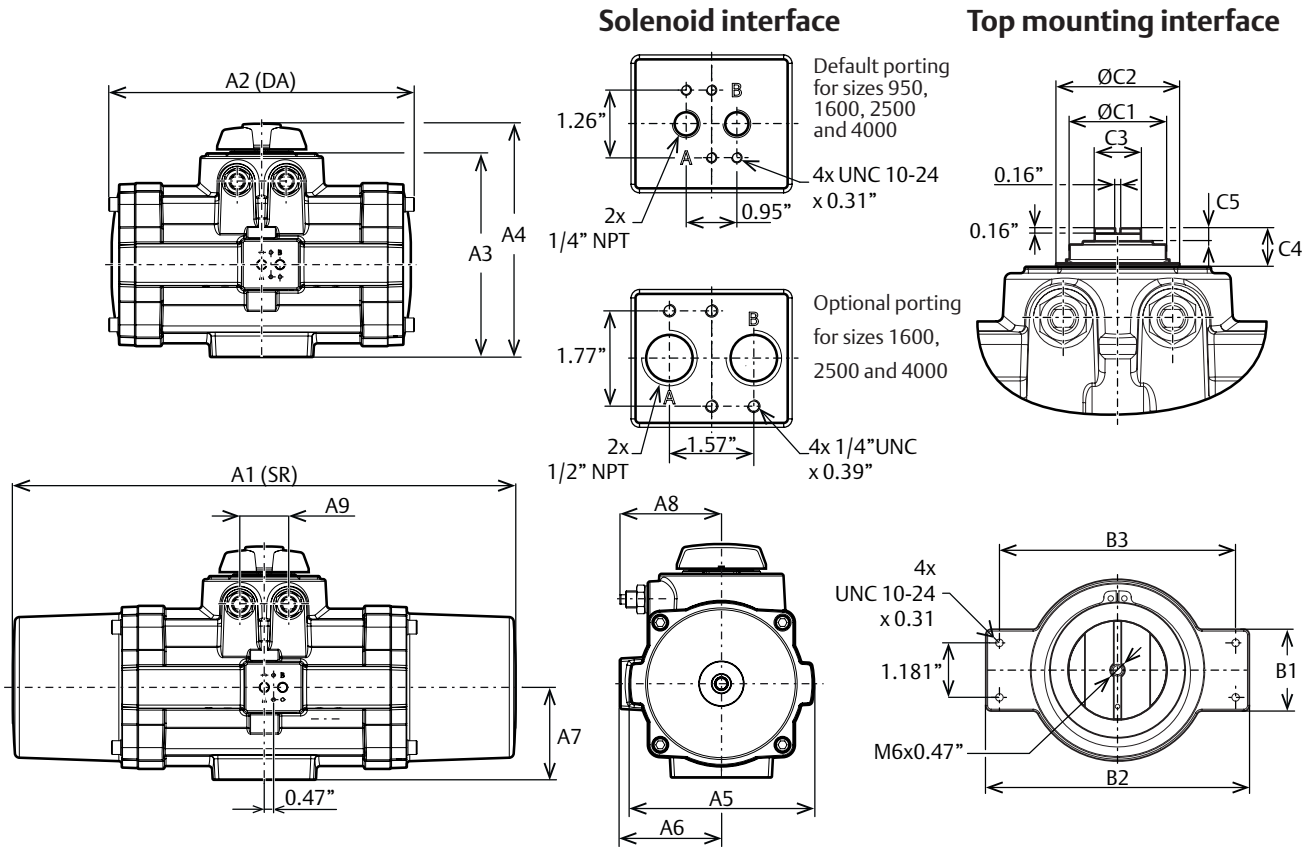
Notes:

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 | 0600 |
| A1 | 6.54 | 7.55 | 8.53 | 9.72 | 11.97 | 14.23 | 15.15 | 18.73 |
| A2 | 6.54 | 7.55 | 8.53 | 9.72 | 9.25 | 10.43 | 11.18 | 14.02 |
| A3 | 3.59 | 4.39 | 4.86 | 5.14 | 6.19 | 6.42 | 7.92 | 9.77 |
| A4 | 4.69 | 5.47 | 5.94 | 6.22 | 7.28 | 7.52 | 9.06 | 11.50 |
| A5 | 2.68 | 3.23 | 3.62 | 4.06 | 4.57 | 4.88 | 6.34 | 7.68 |
| A6 | 1.91 | 2.15 | 2.28 | 2.50 | 2.72 | 2.83 | 3.35 | 4.02 |
| A7 | 1.16 | 1.34 | 1.48 | 1.50 | 1.93 | 1.92 | 1.65 | 2.64 |
| A8 | 1.89 | 2.28 | 2.72 | 2.72 | 2.95 | 3.43 | 4.29 | 5.20 |
| A9 | 0.71 | 0.98 | 1.06 | 1.10 | 1.81 | 1.81 | 1.81 | 2.36 |
| B1 | 1.69 | 1.77 | 1.97 | 2.36 | 2.95 | 2.95 | 3.35 | 3.86 |
| B2 | 3.70 | 3.70 | 3.70 | 3.82 | 3.70 | 3.70 | 3.94 | 5.83 |
| B3 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 3.15 | 5.12 |
| C1 | 0.63 | 0.87 | 0.87 | 0.87 | 1.34 | 1.42 | 1.42 | 2.17 |
| C2 | 0.91 | 1.18 | 1.18 | 1.38 | 1.77 | 1.77 | 1.77 | 2.56 |
| C3 | 0.55 | 0.55 | 0.55 | 0.55 | 0.75 | 0.75 | 0.75 | 1.42 |
| C4 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 1.18 |
| C5 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.39 |

Dimensions - Imperial (ISO5211)

Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 950 - 4000



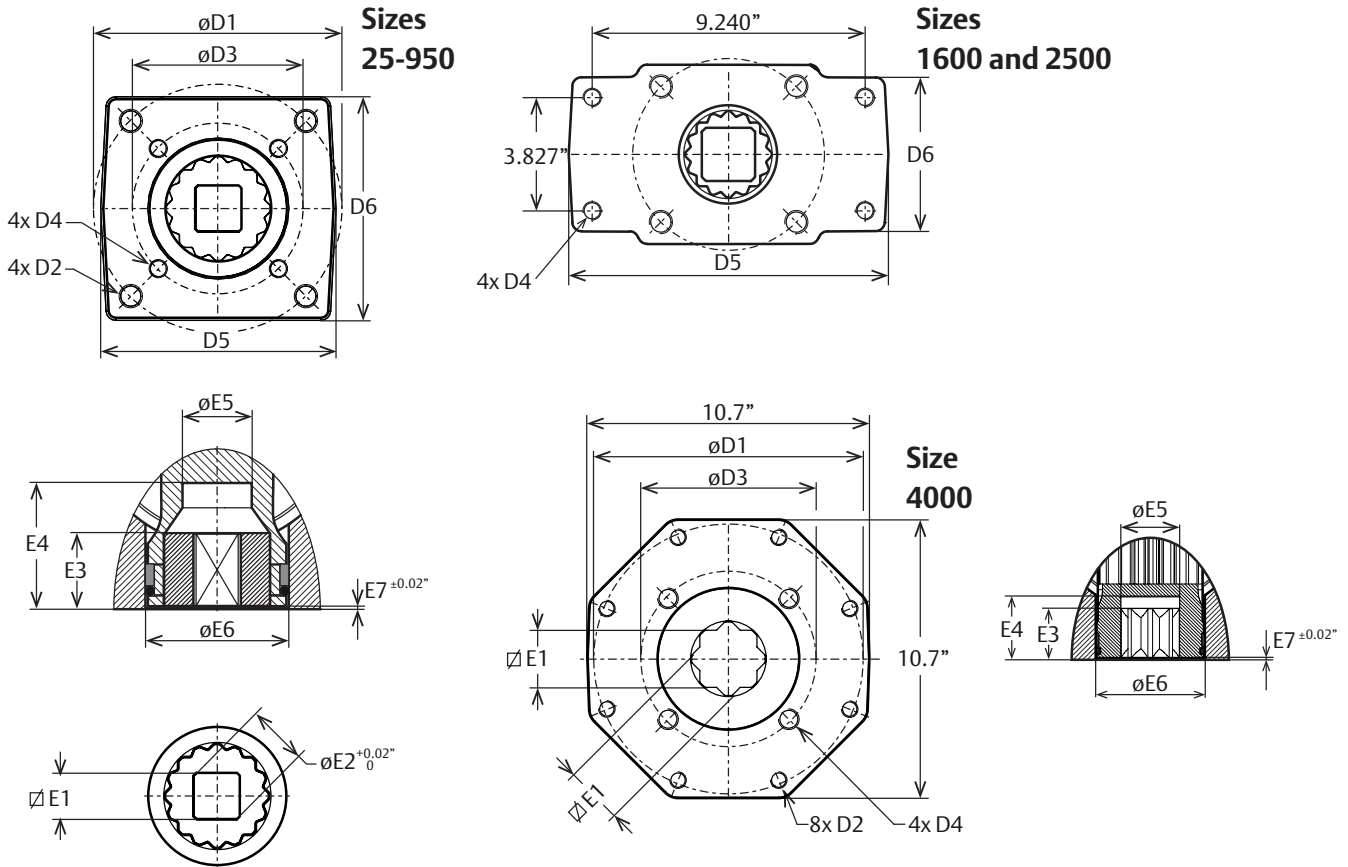
Notes:

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 | | | |
|----------------|---------------|--------------------------|--------------------------|--------------------------|
| | 0950 | 1600 | 2500 | 4000 |
| A1 | 25.91 | 28.82 | 34.53 | 37.76 |
| A2 | 15.75 | 18.19 | 21.65 | 25.55 |
| A3 | 10.55 | 11.89 | 13.94 | 15.31 |
| A4 | 12.01 | 13.35 | 15.43 | 16.81 |
| A5 | 9.41 | 12.05 | 13.78 | 15.75 |
| A6 | 5.16 | 5.87 | 6.69 | 7.72 |
| A7 | 4.76 | 5.39 (5.51) ⁴ | 6.18 (6.29) ⁴ | 7.24 (7.32) ⁴ |
| A8 | 5.16 | 6.14 | 7.13 | 6.89 |
| A9 | 2.52 | 3.35 | 4.02 | 7.24 |
| B1 | 1.77 | 1.77 | 1.77 | 1.77 |
| B2 | 5.71 | 5.71 | 5.71 | 5.71 |
| B3 | 5.12 | 5.12 | 5.12 | 5.12 |
| C1 | 2.56 | 2.95 | 3.74 | 3.78 |
| C2 | 3.27 | 3.78 | 4.53 | 4.53 |
| C3 | 1.42 | 1.42 | 1.42 | 1.42 |
| C4 | 1.18 | 1.18 | 1.18 | 1.18 |
| C5 | 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 ISO5211.
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 |
| ISO 1 | F05 | F07 | F07 | F07 | F10 | F10 | F10 | F12 | F14 | F16 | F16 | F25 |
| D1 | 1.969 | 2.756 | 2.756 | 2.756 | 4.016 | 4.016 | 4.016 | 4.921 | 5.512 | 6.496 | 6.496 | 10.000 |
| D2 | 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 |
| ISO 2 | F03 | F05 | F05 | F05 | F07 | F07 | F07 | F10 | F10 | F25* | F25* | F16 |
| D3 | 1.417 | 1.969 | 1.969 | 1.969 | 2.756 | 2.756 | 2.756 | 4.016 | 4.016 | -/- | -/- | 6.496 |
| D4 | 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 |
| D5 | 1.97 | 2.68 | 2.68 | 2.62 | 3.82 | 3.7 | 3.7 | 4.65 | 5.31 | 11.02 | 11.02 | 10.75 |
| D6 | 1.89 | 2.56 | 2.56 | 2.48 | 3.62 | 3.54 | 3.7 | 4.45 | 5.12 | 5.2 | 5.2 | 10.59 |
| E1 Max. | 0.436 | 0.554 | 0.554 | 0.751 | 0.751 | 0.87 | 1.067 | 1.067 | 1.424 | 1.817 | 1.817 | 2.175 |
| E1 Min. | 0.433 | 0.551 | 0.551 | 0.748 | 0.748 | 0.866 | 1.063 | 1.063 | 1.417 | 1.811 | 1.811 | 2.165 |
| E2 | 0.555 | 0.713 | 0.713 | 0.992 | 1.004 | 1.11 | 1.425 | 1.425 | 1.898 | 2.37 | 2.37 | 2.843 |
| E3 | 0.591 | 0.591 | 0.591 | 0.709 | 1.083 | 1.083 | 1.083 | 1.083 | 1.909 | 2.343 | 2.343 | 2.421 |
| E4 | 1.34 | 1.34 | 1.34 | 1.34 | 1.97 | 1.97 | 1.97 | 1.97 | 2.58 | 3.21 | 3.21 | 3.02 |
| E5 | 0.56 | 0.71 | 0.83 | 0.93 | 1.12 | 1.26 | 1.26 | 1.44 | 1.89 | 2.36 | 2.36 | 2.87 |
| E6 | 0.96 | 1.36 | 1.36 | 1.5 | 2.22 | 2.22 | 2.22 | 2.66 | 3.39 | 4.09 | 4.92 | 5.24 |
| E7 | 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-Series 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 grand packing, the use of inserts often simplifies the design of the mounting kit.

- Material: Aluminium alloy
- Finish: Anodized

Notes:

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.

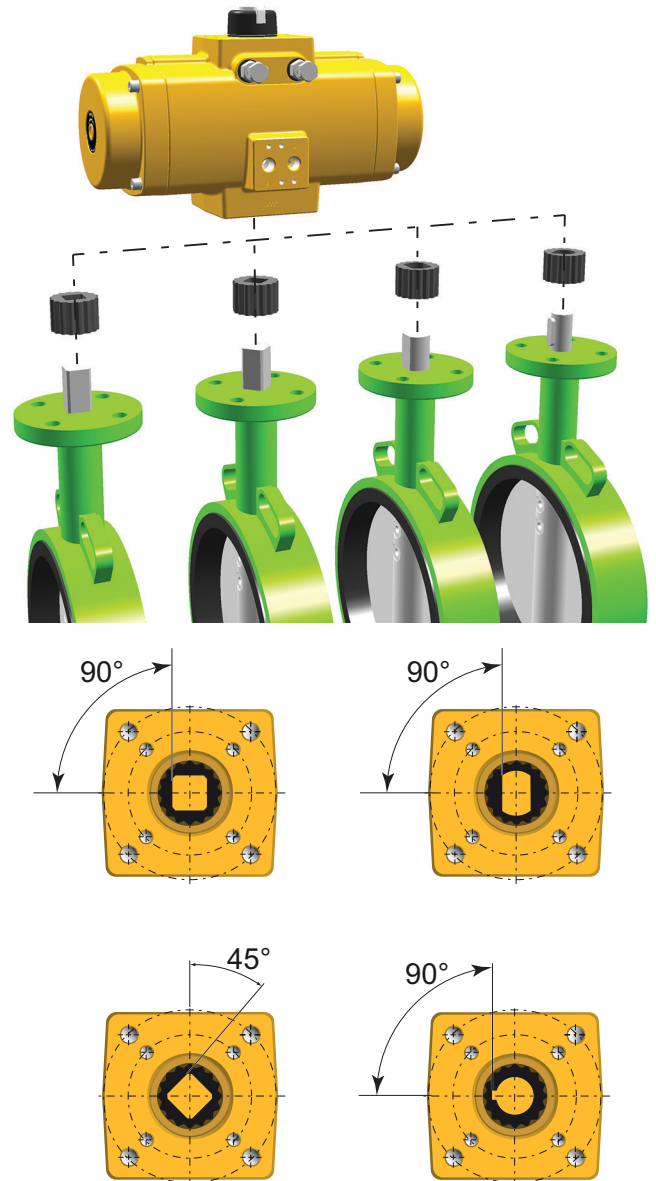


Table 1. Metric drive square overview

| Dim. in mm | Inserts with inner-square-dimensions per actuator type | | | | | | | | | | | |
|--|--|--------|---------------|--------|--------|--------|--------|--------|--------|--------|--------|------------|
| | 0012 | 0025 | 0040/ 0065 | 0100 | 0150 | 0200 | 0350 | 0600 | 0950 | 1600 | 2500 | 4000 |
| Standard square drive dimensions | | | | | | | | | | | | |
| 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 |
| Optional square insert dimensions (Notes 1) | | | | | | | | | | | | |
| 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 | | | | | |
| Maximum adaptor/valve stem dimensions | | | | | | | | | | | | |
| 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.

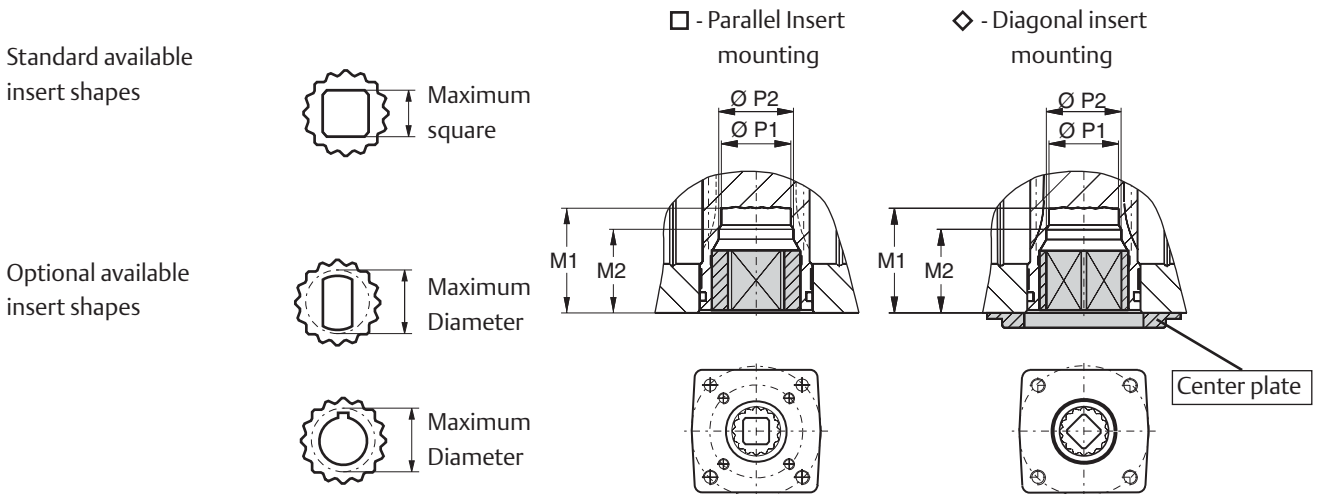
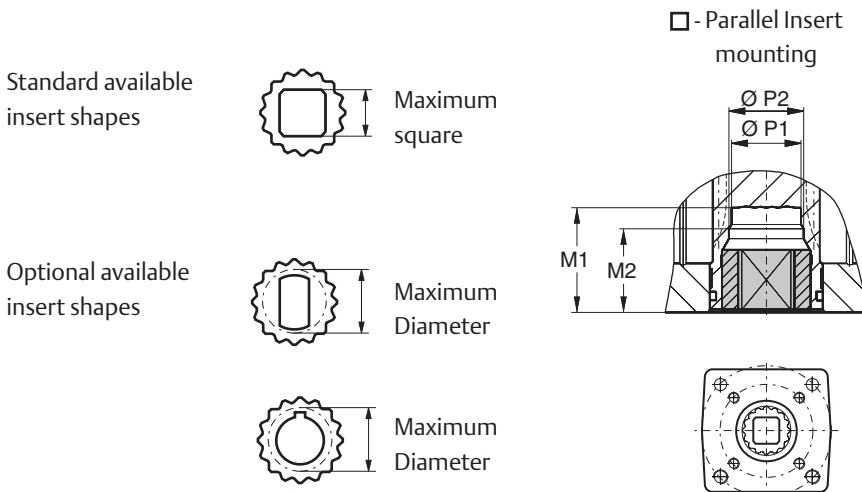


Table 2. Imperial drive square overview

| Dim. in inches | Inserts with inner-square-dimensions per actuator type | | | | | | | | | | | |
|--|--|--------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|------------|
| | 12 | 25 | 0040/0065 | 100 | 150 | 200 | 350 | 600 | 950 | 1600 | 2500 | 4000 |
| Standard square drive dimensions | | | | | | | | | | | | |
| 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 |
| Optional square insert dimensions (Notes 1) | | | | | | | | | | | | |
| 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 | | | | | |
| Maximum adaptor/valve stem dimensions | | | | | | | | | | | | |
| 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.



Insert Removal Tool

Description

The standard EL-O-Matic F-Series actuators are equipped with Square-Drive inserts according to ISO5211. When assembled at the factory, the inserts are press-fitted on an edge in the pinion bottom. In order to be able to replace these standard inserts, these insert removal tools will help you to easily remove the standard insert from the pinion bottom.

Availability

The insert removal tools are available in two versions and can be used up to actuator size 600. For larger actuator sizes, up to size 2500, it is recommended to use a generic pulley puller.

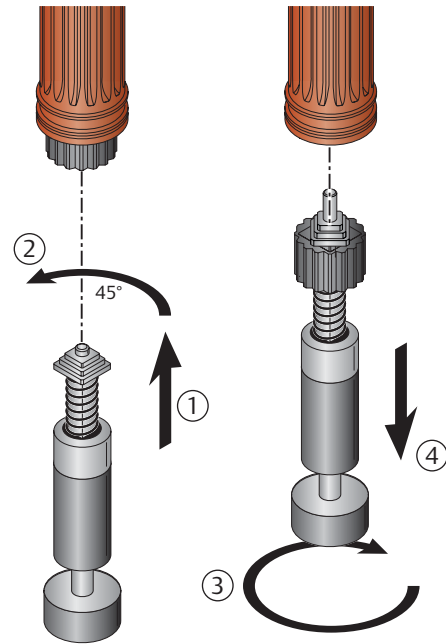
Intended use:

These insert removal tools are intended to be used just before the installation of the actuator onto a valve and where the default insert needs to be replaced by an insert with a different size or shape.

Operation:

The insert removal tools are equipped with 3 square bits that fit exactly in the insert square of the actuator. Make sure the square bits are as high as possible on the threaded rod. Then you can insert (1) and rotated 45° (2) the tool and one of the square bits will hook under the insert.

The knob (3) on the tool can now be rotated until the insert get loose (4) and it can be removed from the pinion's bottom.



Specifications:

| Tool part nr. | Squares | Actuator sizes |
|---------------|---------------|-------------------------|
| VA590.00.001 | 11, 14 and 17 | 25, 40, 65, 100, 150 |
| VA590.00.002 | 19, 22 and 27 | 100, 150, 200, 350, 600 |

Materials:

Body, Knob and bits: Carbon steel, Zinc Plated

Center Plate / Center Ring

Key features

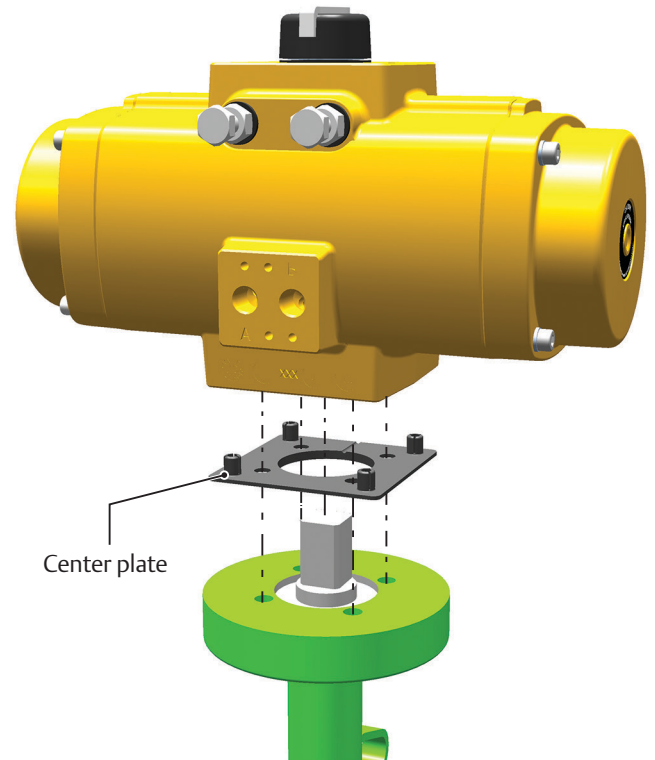
- Durable design allows good alignment of actuator and valve.
- Prevents wear on valve spindle or mounting kit due to misalignment.
- Center plates can easily be added to standard actuator.
- Most actuators are available with two center plates for flexible valve mounting.
- Equipped with slot to release 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 ⁽¹⁾ | | | | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|------|------|---------------------|
| | 0025 | 0040 | 0065 | 0100 | 0150 | 0200 | 0350 | 0600 | 0950 | 1600 | 2500 | 4000 ⁽²⁾ |
| Default ⁽¹⁾ | 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 20 mm (0.787").

Ø 20 mm (0.787")

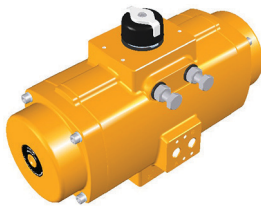


Punched out center piece

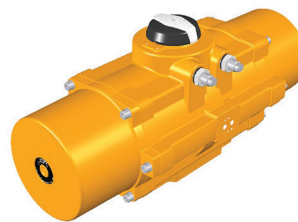


Indicator mounting "in-line"

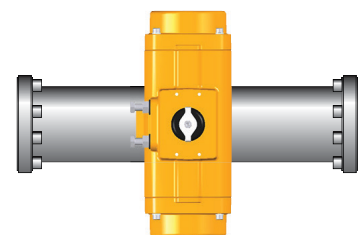
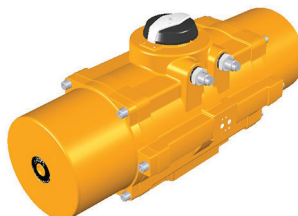
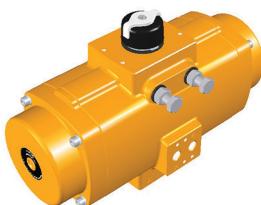
Size 12 - 350



Size 600 - 4000



Indicator mounting "Across-Line"

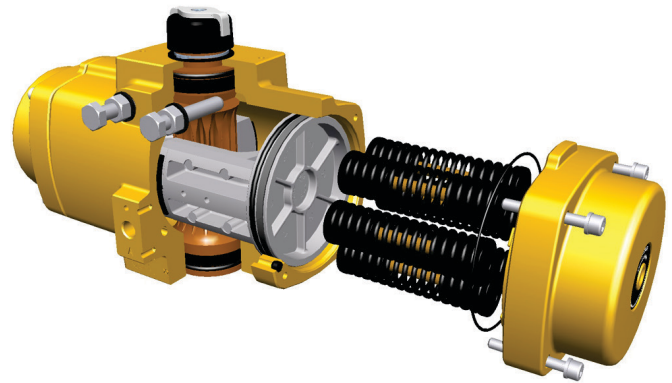


High Temperature Execution

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 noncorrosive 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.

| Description | Material | Dedicated High Temperature materials | |
|--|--|--|---|
| 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 and PTFE | X | |
| Bearing piston | PTFE 25% carbon filled | X | |
| Bearing pinion | Nylon 66 resin containing Aramid Fibre and PTFE | X | |
| Thrust washer | POM, black UV stabilized | | |
| End cap screw | Stainless Steel | | |
| Circlip | Spring Steel | | |
| O-ring seal pinion | Viton FPM | X | |
| O-ring seal piston | Viton FPM | X | |
| O-ring seal end cap | Viton FPM | X | |
| O-ring seal limit stop | Viton FPM | X | |
| 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 | | |
| Approved greases for High temperature operation: | <ul style="list-style-type: none"> Castrol High Temperature Rocol Sapphire Premier New: Castrol Spheerol EPL 2 New: Total Ceran XM 220 | Formerly called Castrol LMX Formerly called Sapphire HI-TEMP 2 Formerly called BP Energrease LS-EP2 Formerly called Total Ceran WR2 | X |

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.

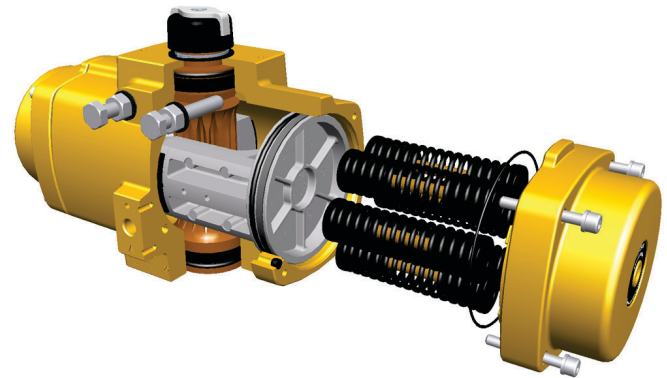
This version is a standard aluminum actuator, but incorporating grease and O-ring seal materials, suitable for low temperature operation down to -40 °F (-40 °C).

Notes:

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 noncorrosive 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.

| Description | Material | Dedicated Low Temperature materials: |
|---|---|--------------------------------------|
| 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 | X |
| O-ring seal piston | Silicone MVQ70 | X |
| O-ring seal end cap | Silicone MVQ70 | X |
| O-ring seal limit stop | Silicone MVQ70 | X |
| B-port seal | Silicon rubber | X |
| 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 | |
| Approved greases for Low temperature operation: | Castrol Optitemp LG2 or SKF – LGLT 2 or FUCHS – Renolit Unitemp 2 | X |

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.

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 pinion material

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.

A4-70 Grade Stainless Steel fastener material

A4 Grade fasteners are made of AISI 316 Stainless Steel and comes with the same excellent corrosion resistance as the pinion material.

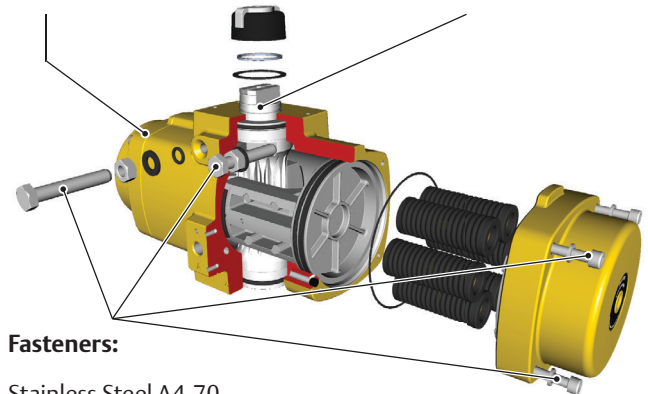
As such actuators with AISI 316 Stainless Steel pinions and fasteners can be used in very corrosive environments like near sea shore plants or protected areas on off-shore platforms.

Coating:

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

Pinion:

Stainless Steel
AISI 316



Fasteners:

Stainless Steel A4-70

Technical data:

| | |
|-----------------------|---|
| Coating: | Polyurethane powder coating for exterior use (= default coating). |
| Color: | Yellow (RAL 1007) |
| Corrosion resistance: | 1000 hr, 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 |

Availability:

- When ordering the optional AISI 316 Stainless Steel pinion, the actuator will also be equipped with the Stainless Steel A4-70 grade fasteners.
- The optional A4-70 grade Stainless Steel fasteners can also be ordered as an individual upgrade feature on default actuators.
- For actuator model string definition of these options see Data Sheet EFG.02.01.EN

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.

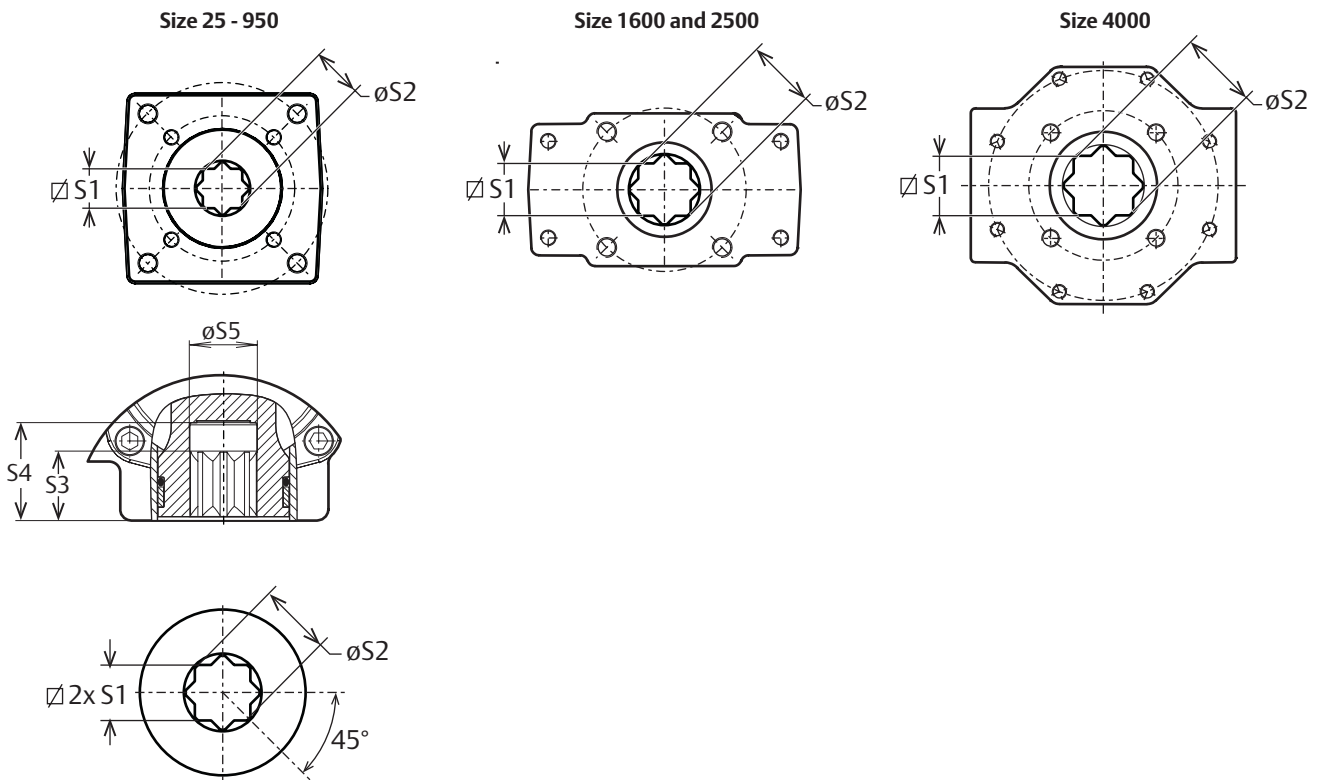
All the other actuator dimensions are the same. Please refer to:

- 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 |
| S1 Max. | 11.08 | 14.08 | 14.08 | 19.13 | 22.11 | 22.11 | 27.11 | 27.11 | 36.16 | 46.16 | 46.16 | 55.19 |
| S1 Min. | 11.00 | 14.00 | 14.00 | 19.00 | 22.00 | 22.00 | 27.00 | 27.00 | 36.00 | 46.00 | 46.00 | 55.00 |
| S2 ^{+0.5} | 14.4 | 18.5 | 18.5 | 22.5 | 22.5 | 28.5 | 36.5 | 36.5 | 48.2 | 60.2 | 60.2 | 72.2 |
| S3 | 17 | 17 | 17 | 20 | 28 | 28 | 30 | 31 | 40.5 | 53.5 | 53.5 | 61.5 |
| S4 | 27 | 27 | 27 | 27 | 40 | 40 | 38 | 38 | 50.5 | 65.5 | 65.5 | 76.5 |
| S5 | 15 | 19 | 19 | 23 | 23 | 29 | 37 | 37 | 48.8 | 60.8 | 60.8 | 72.8 |

| Dim. in | Drive square dimensions Stainless Steel pinions | | | | | | | | | | | |
|---------------------|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| inches | 25 | 40 | 65 | 100 | 150 | 200 | 350 | 600 | 950 | 1600 | 2500 | 4000 |
| S1 Max. | 0.436 | 0.554 | 0.554 | 0.753 | 0.870 | 0.870 | 1.067 | 1.067 | 1.424 | 1.817 | 1.817 | 2.173 |
| S1 Min. | 0.433 | 0.551 | 0.551 | 0.748 | 0.866 | 0.866 | 1.063 | 1.063 | 1.417 | 1.811 | 1.811 | 2.165 |
| S2 ^{+0.02} | 0.57 | 0.73 | 0.73 | 0.89 | 0.89 | 1.12 | 1.44 | 1.44 | 1.90 | 2.37 | 2.37 | 2.84 |
| S3 | 0.67 | 0.67 | 0.67 | 0.79 | 1.1 | 1.1 | 1.18 | 1.22 | 1.59 | 2.11 | 2.11 | 2.42 |
| S4 | 1.06 | 1.06 | 1.06 | 1.06 | 1.57 | 1.57 | 1.50 | 1.50 | 1.99 | 2.58 | 2.58 | 3.01 |
| S5 | 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 an 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.

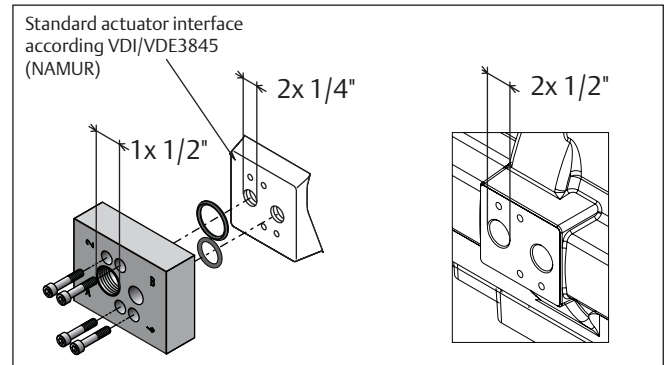
The customer side of the plate is equipped with one larger 1/2" NPT or BSP air connection (A-port) for piped solenoid control.

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 | 0.4 | Not available |
| 25 | 0.4 | Not available |
| 40 | 0.5 | Not available |
| 65 | 0.6 | Not available |
| 100 | 0.7 | Not available |
| 150 | 0.8 | Not available |
| 200 | 1.0 | Not available |
| 350 | 1.5 | Not available |
| 600 | 2.2 | Not available |
| 950 | 2.5 | 0.8 |
| 1600 | 3.3 | 1.2 |
| 2500 | 5.4 | 1.7 |
| 4000 | 10.7 | 3.2 |

| Test conditions: | | |
|-----------------------------|-------------------------|-------------------------|
| Solenoid with flow capacity | | |
| - Up to size 600 | 0.6 m ³ /hr | Not available |
| - 950 and larger | 1.45 m ³ /hr | 2.49 m ³ /hr |
| Pipe diameter | | |
| - Up to size 600 | 6 mm | Not available |
| - 950 and larger | 10 mm | 12 mm |
| Medium: | Clean air | |
| Supply pressure: | 5.5 bar/80 psi | |
| Load: | With average load | |
| Stroke: | 90° | |
| Temperature: | Room temperature | |

Notes:

Faster stroking speeds are available but may require special design. If faster stroking speeds are required contact the Engineering Department.

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 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 2. 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"UNC x 0.39" |

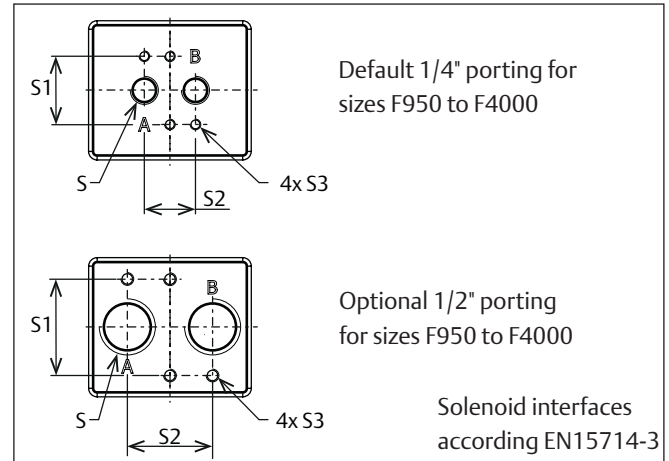
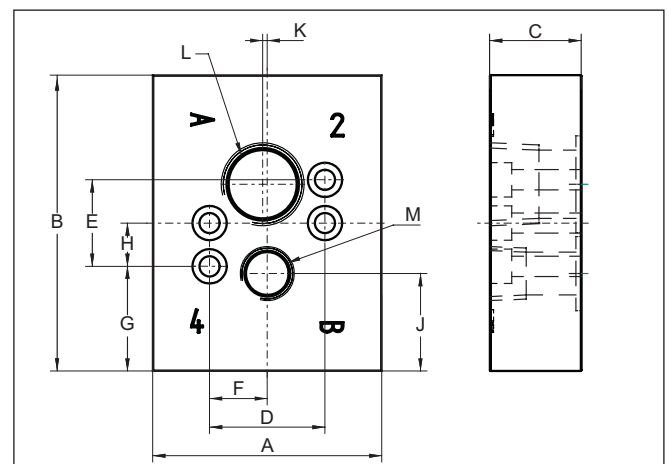


Table 4. High Flow Plate Dimensions

| Dimension in | mm | Inch |
|--------------|----------|----------|
| A | 63.5 | 2.50 |
| B | 82 | 3.23 |
| C | 25.4 | 1.00 |
| D | 32 | 1.26 |
| E | 25 | 0.98 |
| 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 |



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 CO₂
- Contains < 1 volume % of H₂S

If the natural gas contains more than 2 volume % of CO₂ and more than 1 volume % of H₂S 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.

Notes:

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.

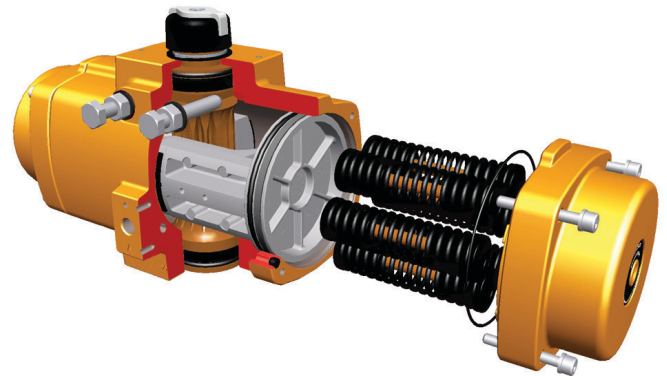
EL-O-Matic F-Series

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.



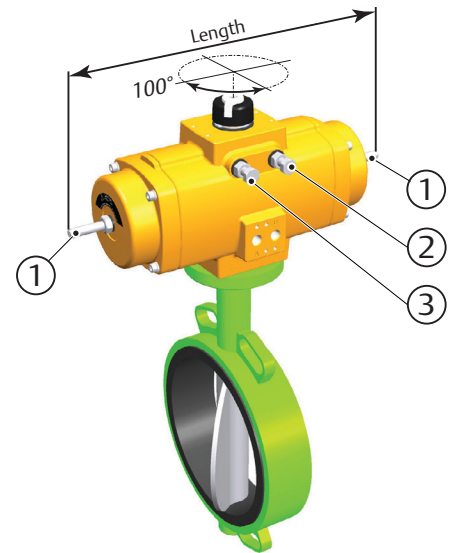
General specifications:

| | | | |
|------------------|--|---------|--------------|
| 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: | Sizes 25 to 600: Anodized and polyurethane powder coated | | |
| | Size 12 and 950 to 4000: Chromate and polyurethane powder coated | | |
| Pistons: | Chromated aluminium alloy | | |
| Pinion: | High grade aluminium alloy, hard anodized | | |
| Fasteners: | Stainless Steel or Alloy Steel with Deltatone® treatment | | |
| Type Sticker: | Polyester | | |

Full Stroke Adjustment Option

Key features

- Allows the reduction of the flow of over dimensioned valves.
- Outward stroke of the actuator can be limited over the full 100° of rotation.
- Easy setting to the required angle.
- Stainless Steel full stroke adjustment screws.
- Available as complete actuator or upgrade kit for standard actuators.



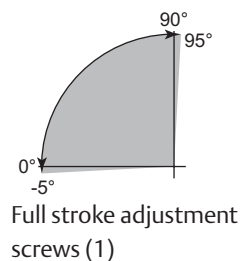
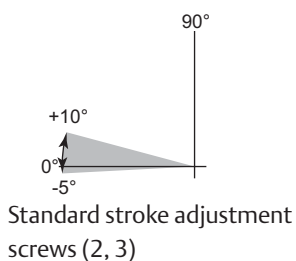
Description

EL-O-Matic F-Series actuators, with the Full Stroke Adjustment option, can be used where the maximum opening (or closing) position of the valve needs to be reduced, for instance to adjust the maximum flow capacity of a remote operated valve to 50%.

Operation

Full Stroke Adjustment screws (1) are fitted to both end caps and the screw length is such that adjustment is possible through the full outward stroke/rotation of the actuator.

Turning in the Full Stroke Adjustment screws will reduce the stroke.



Notes:

- Only the outward stroke can be adjusted with the Full Stroke Adjustment screws.
 - In case of assembly code CW, limit stop (3) is redundant.
 - In case of assembly code CC, limit stop (2) is redundant.
- For the inward stroke the standard limit stops can be used:
 - Limit stop (2) for assembly code CW
 - Limit stop (3) for assembly code CC
- The Full Stroke Adjustment option is available as a factory mounted option or as a kit option to convert standard actuators into a version with the Full Stroke Adjustment feature.
- The Full Stroke Adjustment option comes always with Spring-Return (high) end caps.

General specifications:

- Available on actuators sizes 25 to 600
- Factory set rotation angle: 90°±0.5°
- Adjustable range:
 - Full Stroke Adjustment screws (1): -5° to +95°
 - Standard Stroke Adjustment screws (2/3): -5° to 10°

Dimensions

The dimensions of the actuator remain the same except the length of the actuator due to the longer Full Stroke Adjustment screw (see Table below).

Table 1. Length dimension of Full Stroke Adjustment units at 90° rotation.

| Spring-Return and Double-Acting | | |
|--|-----------|-------------|
| | mm | Inch |
| Size 25 | 220 | 8.6 |
| Size 40 | 394 | 15.5 |
| Size 65 | 312 | 12.3 |
| Size 100 | 327 | 12.9 |
| Size 150 | 399 | 15.7 |
| Size 200 | 490 | 19.3 |
| Size 350 | 499 | 19.7 |
| Size 600 | 626 | 24.6 |

For all other actuator dimensions see Data Sheets:

- Metric ISO units: EFM.04.01.EN
- Imperial ISO units: EFI.04.01.EN
- Metric DIN units: EFD.04.01.EN

Sizing

Applying the stroke adjustment option will change the torque output level of Spring-Return actuators depending on the amount of stroke adjustment.

For sizing though, you can assume that the actuator does not have Full Stroke Adjustment. Sizing this way will assure that you can set the stop position anywhere between fully open and fully closed.

Please see Torque Data Sheets (1.602.02 Nm or 1.602.03 lbf.in) for the torque values of a Spring-Return actuator.

Block Dimensions F10 Positioner on Actuator

Dimensions on EL-O-Matic F-Series

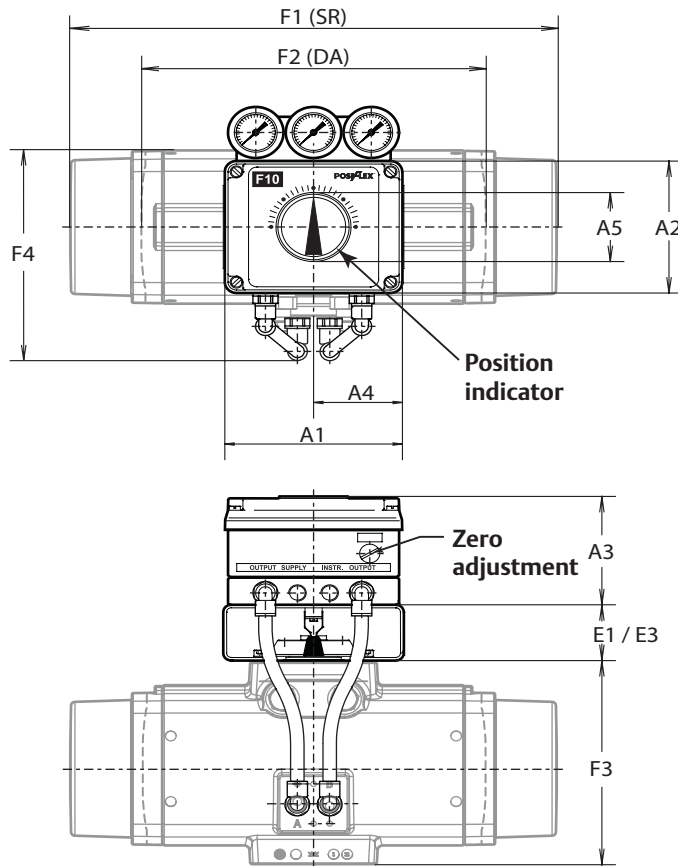


Table 1. General Dimensions

| Dim. | A1 | A2 | A3 | A4 | A5 | E1 | E3 |
|------|------|------|------|------|------|------|------|
| mm | 132 | 106 | 88 | 66 | 53 | 45 | 55 |
| Inch | 5.20 | 4.17 | 3.46 | 2.60 | 2.09 | 1.77 | 2.17 |

Notes:

1. For more detailed information of Posiflex positioners and options. Please consult Data Sheet PF.00.00.EN.
2. Dimension F4 is a guide dimension. Actual F4 dimension might differ depending on actual used pipe fitting.
3. A dedicated bracket is available for actuator size F12.

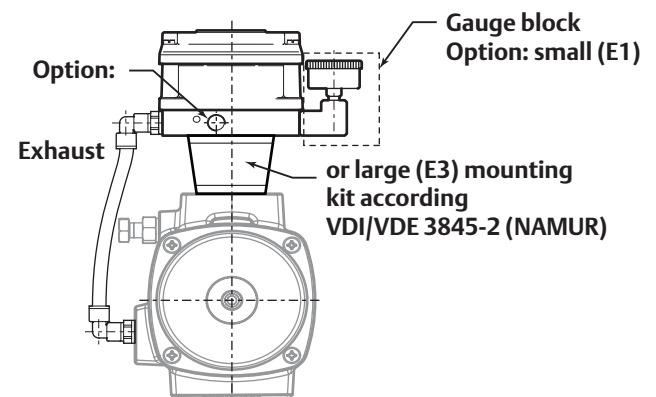


Table 2. Assembly Dimensions of Actuator and Positioner

| Dim. in mm | Actuator size | | | | | | | | | | | | |
|------------|---------------|------|------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 0012 | 0025 | 0040 | 0065 | 0100 | 0150 | 0200 | 0350 | 0600 | 0950 | 1600 | 2500 | 4000 |
| F1 | 118 | 166 | 192 | 217 | 247 | 304 | 362 | 385 | 476 | 658 | 732 | 877 | 959 |
| F2 | 103 | 166 | 192 | 217 | 247 | 235 | 265 | 284 | 356 | 400 | 462 | 550 | 649 |
| F3 | 60 | 91 | 112 | 124 | 131 | 157 | 163 | 201 | 248 | 268 | 302 | 354 | 389 |
| F4 | 115 | 124 | 132 | 143.5 | 155 | 162 | 193.5 | 227.5 | 278.5 | 330 | 373 | 424 | 427 |
| Inch | 0012 | 0025 | 0040 | 0065 | 0100 | 0150 | 0200 | 0350 | 0600 | 0950 | 1600 | 2500 | 4000 |
| F1 | 4.65 | 6.54 | 7.56 | 8.54 | 9.72 | 11.97 | 14.25 | 15.16 | 18.74 | 25.91 | 28.82 | 34.53 | 37.76 |
| F2 | 4.06 | 6.54 | 7.56 | 8.54 | 9.72 | 9.25 | 10.43 | 11.18 | 14.02 | 15.75 | 18.19 | 21.65 | 25.55 |
| F3 | 2.36 | 3.58 | 4.41 | 4.88 | 5.16 | 6.18 | 6.42 | 7.91 | 9.76 | 10.55 | 11.89 | 13.94 | 15.31 |
| F4 | 4.53 | 4.88 | 5.2 | 5.65 | 6.1 | 6.38 | 7.62 | 8.96 | 10.96 | 12.99 | 14.69 | 16.69 | 16.81 |

Block Dimensions F20 Positioner on Actuator

Dimensions on EL-O-Matic F-Series

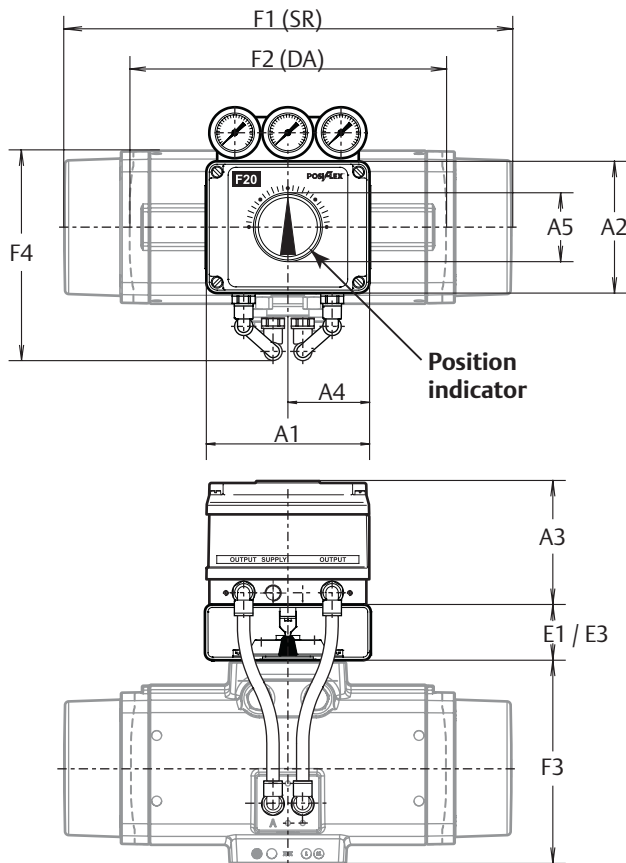


Table 1. General dimensions

| Dim. | A1 | A2 | A3 | A4 | A5 | E1 | E3 |
|------|------|------|------|------|------|------|------|
| mm | 132 | 106 | 102 | 66 | 53 | 45 | 55 |
| Inch | 5.20 | 4.17 | 4.02 | 2.60 | 2.09 | 1.77 | 2.17 |

Notes:

1. For more detailed information of Posiflex positioners and options please consult Data Sheet PF.00.00.EN.
2. Dimension F4 is a guide dimension. Actual F4 dimension might differ depending on actual used pipe fitting.
3. A dedicated bracket is available for actuator size F12

Electric entry:

Metric: M20x1.5
Imperial: 1/2" NPT

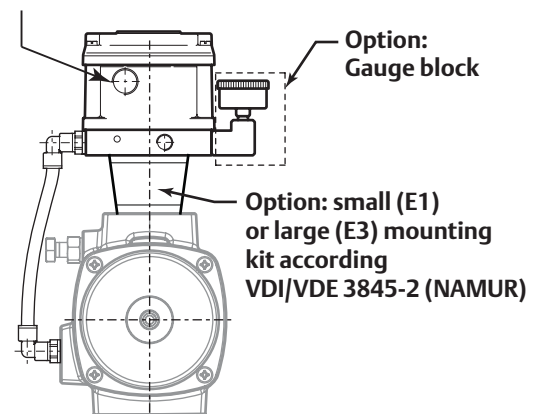


Table 2. Assembly Dimensions of Actuator and Positioner

| Dim. in mm | Actuator size | | | | | | | | | | | | |
|------------|---------------|------|------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 0012 | 0025 | 0040 | 0065 | 0100 | 0150 | 0200 | 0350 | 0600 | 0950 | 1600 | 2500 | 4000 |
| F1 | 118 | 166 | 192 | 217 | 247 | 304 | 362 | 385 | 476 | 658 | 732 | 877 | 959 |
| F2 | 103 | 166 | 192 | 217 | 247 | 235 | 265 | 284 | 356 | 400 | 462 | 550 | 649 |
| F3 | 60 | 91 | 112 | 124 | 131 | 157 | 163 | 201 | 248 | 268 | 302 | 354 | 389 |
| F4 | 115 | 124 | 132 | 143.5 | 155 | 162 | 193.5 | 227.5 | 278.5 | 330 | 373 | 424 | 427 |
| Inch | 0012 | 0025 | 0040 | 0065 | 0100 | 0150 | 0200 | 0350 | 0600 | 0950 | 1600 | 2500 | 4000 |
| F1 | 4.65 | 6.54 | 7.56 | 8.54 | 9.72 | 11.97 | 14.25 | 15.16 | 18.74 | 25.91 | 28.82 | 34.53 | 37.76 |
| F2 | 4.06 | 6.54 | 7.56 | 8.54 | 9.72 | 9.25 | 10.43 | 11.18 | 14.02 | 15.75 | 18.19 | 21.65 | 25.55 |
| F3 | 2.36 | 3.58 | 4.41 | 4.88 | 5.16 | 6.18 | 6.42 | 7.91 | 9.76 | 10.55 | 11.89 | 13.94 | 15.31 |
| F4 | 4.53 | 4.88 | 5.2 | 5.65 | 6.1 | 6.38 | 7.62 | 8.96 | 10.96 | 12.99 | 14.69 | 16.69 | 16.81 |

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