"Apollo" Valves | INDUSTRIAL PRODUCTS

Actuation

section R

AD & AS SERIES

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: 29 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 to EN15714-3, where 1 cycle is 1 open stroke and 1 close stroke.

FINISH

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

LUBRICATION

- Castrol high temperature grease (or equivalent)

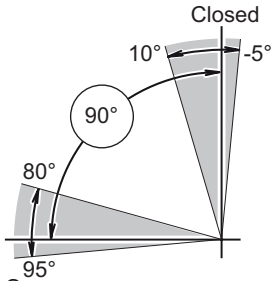
TEMPERATURE RANGE

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

ANGLE OF ROTATION

- Factory set at 90°
- Adjustable range:
  Size 0025 to 0600: -5° to +10° and +80° to 95°
  Size 0950 to 4000: -3° to +10° and +80° to 93°

Size 25 - 600



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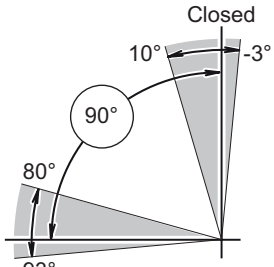


COMPLIANCE TO INTERNATIONAL STANDARDS

- Valve flange: ISO 5211
- Solenoid flange: VDE/VDI 3845 (NAMUR)
- Accessory flange: VDE/VDI 3845 (NAMUR)
- European Directives: ATEX, PED, & Machinery Directive
- SIL 3 rated according to IEC 61508-1-7:2010
- EAC Custom Union: Compliance to Russian TR010 & TR012

AD & AS SERIES

WEIGHTS & CYCLE TIME

ACTUATOR WEIGHTS

ACTUATOR MODEL	DOUBLE ACTING		SPRING RETURN SPRING SET N=6	
	LB.	KG	LB.	KG
0012	1.3	0.6	1.5	0.7
0025	3.1	1.4	3.5	1.6
0040	4.6	2.1	5.1	2.3
0065	6.2	2.8	7.3	3.3
0100	7.7	3.5	9.5	4.3
0150	10.8	4.9	14.6	6.6
0200	13.2	6.0	18.3	8.3
0350	22	10.2	32	14.5
0600	44	20	57	26
0950	58	26	89	41
1600	91	41	137	62
2500	141	64	221	100
4000	226	103	325	147

CYCLE TIME (SEC)

ACTUATOR MODEL	SPRING RETURN		DOUBLE ACTING	
	OPENING STROKE	CLOSING STROKE	OPENING STROKE	CLOSING STROKE
12	0.4	0.4	0.4	0.4
25	0.5	0.4	0.5	0.4
40	0.6	0.5	0.6	0.5
65	0.7	0.5	0.6	0.6
100	0.8	0.6	0.8	0.7
150	1	0.8	0.9	0.8
200	1.3	0.9	1	1
350	1.9	1.3	1.4	1.5
600	3.2	1.9	2.2	2.2
950	6.6	2.2	2.4	2
1600	10.6	3.5	3.6	3.3
2500	16.9	5.7	5.8	5.2
4000	29.1	9.2	9.2	9

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

AD & AS SERIES

AIR VOLUMES AND CONSUMPTION

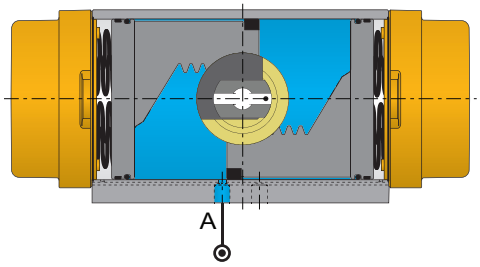
ACTUATOR AIR VOLUMES AND CONSUMPTION

ACTUATOR MODEL	ACTUATOR VOLUMES (CU.IN.)			CONSUMPTION PER STROKE (IN CU.IN., PRESSURE IN PSIG)					
				OUTWARD STROKE			INWARD STROKE		
				DOUBLE ACTING & SPRING RETURN			DOUBLE ACTING ONLY		
	CENTRAL CHAMBER[1]	END CAP CHAMBER[2]	DISPLACED VOLUME[3]	40 PSIG	80 PSIG	120 PSIG	40 PSIG	80 PSIG	120 PSIG
12	3.1	3.7	2.5	11	19	28	13	23	33
25	8.5	12.2	4.7	28	52	75	38	72	106
40	15.9	23	8.9	53	96	140	71	133	196
65	24	34	13.5	81	148	215	107	200	294
100	36	53	19.9	118	216	314	165	310	455
150	58	47	32	192	352	512	163	293	424
200	76	64	44	255	466	676	220	397	573
350	131	115	76	436	796	1157	392	709	1025
600	222	201	129	742	1354	1967	683	1237	1790
950	301	279	196	1025	1854	2682	966	1735	2505
1600	484	447	328	1662	2997	4331	1560	2792	4024
2500	769	728	508	2630	4751	6873	2515	4523	6530
4000	1324	1159	825	4477	8130	11782	4022	7219	10416

Notes:
[1] For double-acting and spring-return. Pistons at 90° outward position.
[2] Only for double-acting. Pistons at 0° inward position.
[3] Stroke is 90°.

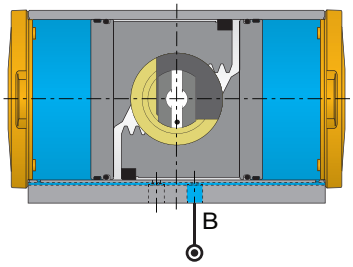
CENTRAL AIR CHAMBER VOLUME

DOUBLE-ACTING AND SPRING-RETURN



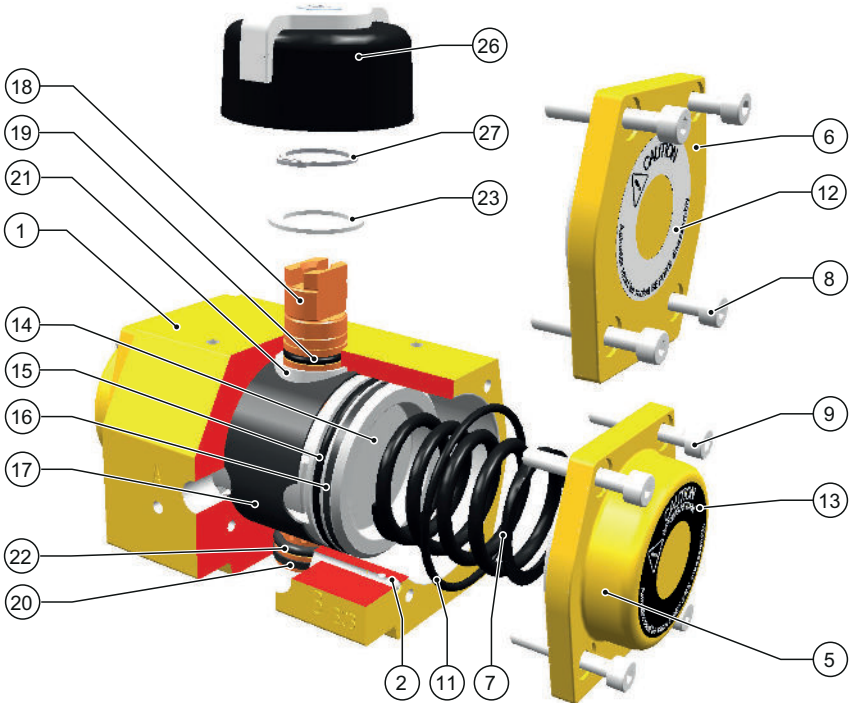
END CAP AIR CHAMBER VOLUME

DOUBLE-ACTING ONLY



AD & AS SERIES

PARTS LIST - SIZE 0012

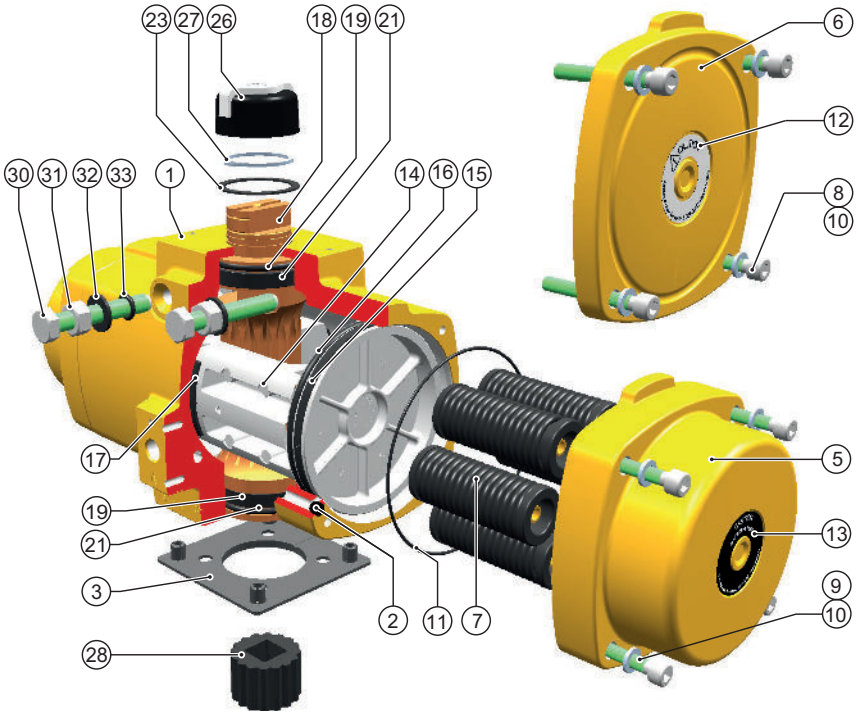


PART	QTY	NOTES	DESCRIPTION	MATERIAL
1	1	2	House	Extruded aluminum alloy
2	2	1	B-port ball	Steel
5	2	2	End cap SR	Cast Aluminum alloy
6	2	2	End cap DA	Cast Aluminum alloy
7	Max. 2	5	Springs	Spring steel
8	8		End cap screw DA	Stainless steel
9	8		End cap screw SR	Stainless steel
11	2	1	O-ring end cap	Nitrile rubber
12	2		Warning sticker DA	Polyester
13	2		Warning sticker SR	Polyester
14	2	3	Piston	Cast Aluminum 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 aluminum
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.*

AD & AS SERIES

PARTS LIST - SIZES 0025 TO 0600



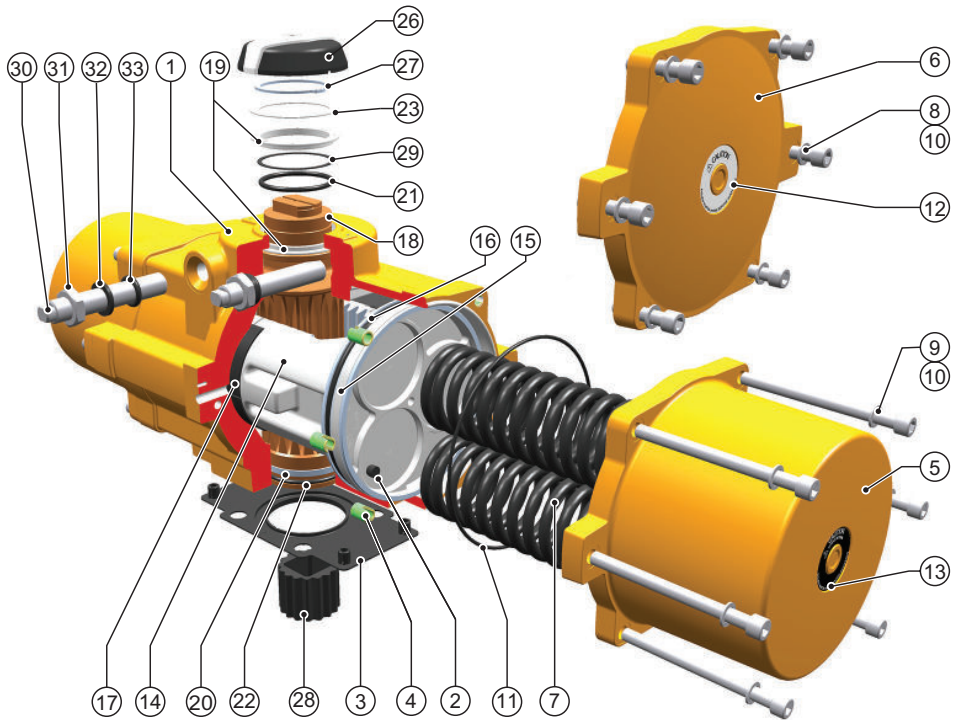
PART	QTY	NOTES	DESCRIPTION	MATERIAL
1	1	2	House	Cast Aluminum alloy
2	2	1	B-port seal	Nitrile rubber
3	1		Center plate (option)	Nylon PA6, Black
5	2	2, 8	End cap SR (DA)	Cast Aluminum alloy
6	2	2, 8	End cap DA	Cast Aluminum alloy
7	Max. 12	5	Spring cartridge	Spring steel
8	8		End cap screw DA	Stainless 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 Aluminum 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 aluminum
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	Aluminum
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 & spring-return models up to size 0100. Low end caps for double-acting models for sizes 0150 & larger.*

AD & AS SERIES

PARTS LIST - SIZES 0950 TO 2500



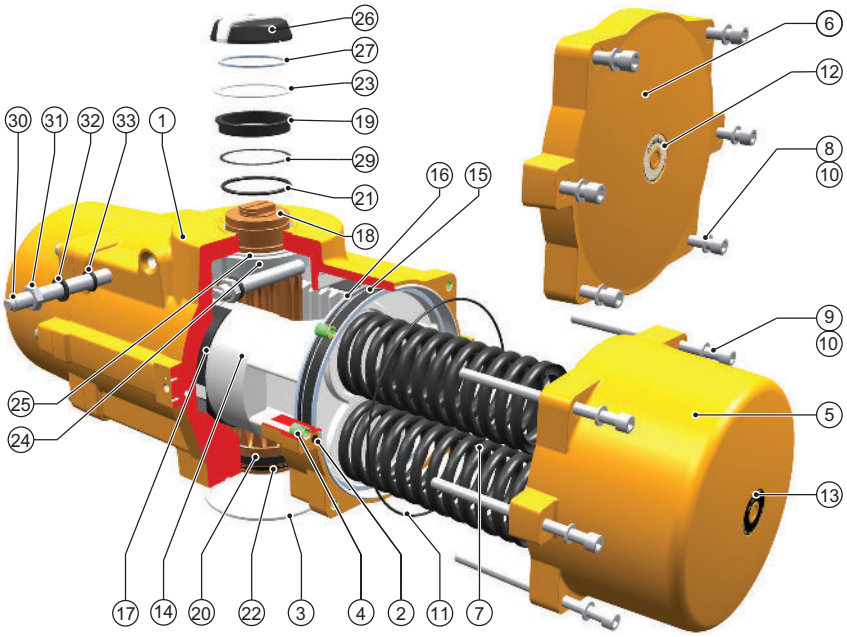
PART	QTY	NOTES	DESCRIPTION	MATERIAL
1	1	2	House	Cast Aluminum alloy
2	2	1	B-port seal	Nitrile rubber
3	1		Center plate (option)	Nylon PA6, Black
4	12-Aug	8	Thread insert	Steel
5	2	2	End cap SR	Cast Aluminum alloy
6	2	2	End cap DA	Cast Aluminum alloy
7	Max. 6	5	Springs	Spring steel
8	12-Aug	8	End cap screw DA	Stainless steel
9	12-Aug	8	End cap screw SR	Stainless steel
10	12-Aug	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 Aluminum alloy
15	2	1	Bearing piston	PTFE 25% carbon-filled
16	2	1	O-ring piston	Nitrile rubber
17	2	1	Bearing strip piston rack	POM
18	1	4	Pinion	High grade aluminum
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	Aluminum
29	1	1	Backup ring	POM
30	2		Limit stop screw	Stainless steel

Notes:

1. *Included in service kit.*
2. *Chromated and polyurethane powder coated.*
3. *Chromated.*
4. *Hard anodized.*
5. *Electrophoretic coated.*
6. *Deltatone® coated.*
7. *Anodized.*
8. *8x for size 0950*

AD & AS SERIES

PARTS LIST - SIZE 4000



PART	QTY	NOTES	DESCRIPTION	MATERIAL
1	1	2	House	Cast Aluminum alloy
2	2	1	B-port seal	Nitrile rubber
3	1		Center ring	Stainless Steel AISI 304
4	12		Thread insert	Steel
5	2	2	End cap SR	Cast Aluminum alloy
6	2	2	End cap DA	Cast Aluminum 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 Aluminum alloy
15	2	1	Bearing piston	PTFE 25% carbon-filled
16	2	1	O-ring piston	Nitrile rubber
17	2	1	Bearing strip piston rack	POM
18	1	4	Pinion	High grade aluminum
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.*
7. *Anodized.*
8. *8x for size 0950*

CORROSION PROTECTION SYSTEM

The corrosion protection system of a standard Apollo pneumatic actuator consists of the following treatments or materials:

ELECTROPHORETIC FINISH ON SPRINGS

- Springs are protected from corrosion using an electrophoretic finish.

CHROMATE PRE-TREATMENT

- The housing and end caps get a chromate pre-treatment prior to coating. The pre-treatment takes care of a perfect bonding of the coating layer to the aluminum 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 ALUMINUM PINION

- Actuators with high grade & hard anodized aluminum pinions have passed a 1,000 hours salt spray test.

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
- Materials:
  Housing: Chromated aluminum alloy
  Endcaps: Chromated aluminum alloy
  Pistons: Chromated aluminum alloy
  Pinion: High grade aluminum alloy, hard anodized
- Springs: Electrophoretic finish
- Fasteners: Stainless steel or alloy steel with Deltatone® treatment
- Type Sticker: Nylon

POLYURETHANE POWDER COATING - TEST RESULTS

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 humidity	ASTM D543 3% H2S04, 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 retentionion

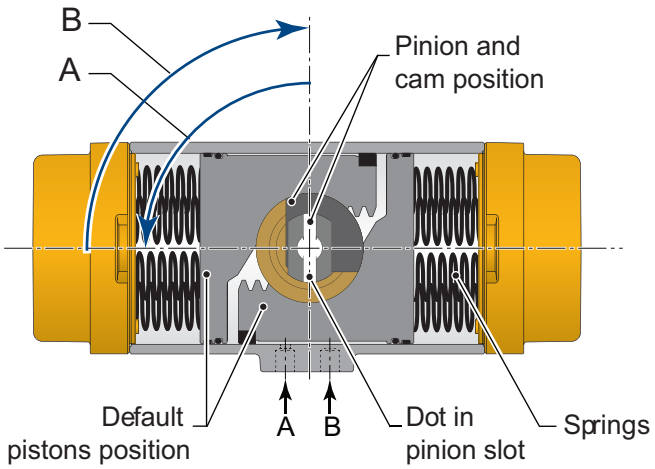
Note: Contains general information as supplied by the paint supplier and describes typical properties of the coating.

ASSEMBLY CODES

SPRING RETURN (AS) ACTUATORS

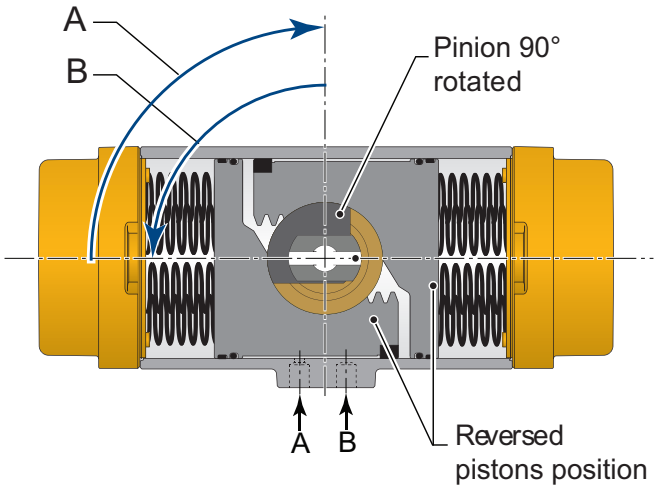
ASSEMBLY CODE: -ACA

- Standard orientation, clockwise-to-close, fail-close



ASSEMBLY CODE: -AFA

- Reverse, Counterclockwise-to-close, fail-open



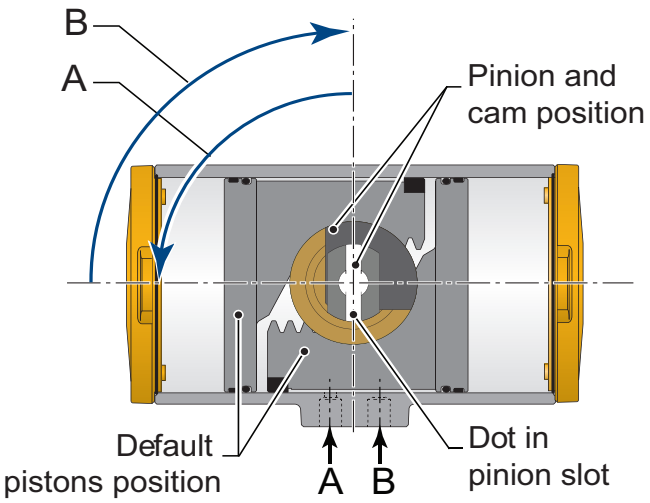
All views are from above. Pistons are shown in inward positions.
A = Central air chamber pressurized
B = Spring Stroke

ASSEMBLY CODES

DOUBLE-ACTING (AD) ACTUATORS

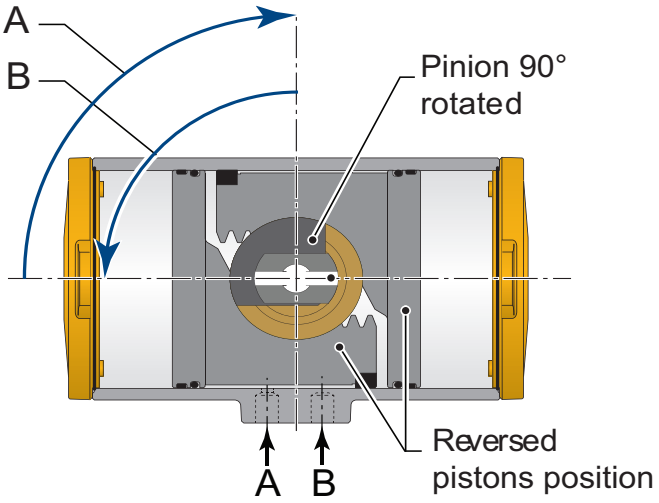
ASSEMBLY CODE: -ACA

- Standard orientation, clockwise-to-close



ASSEMBLY CODE: -AFA

- Reverse, counterclockwise-to-open



All views are from above. Pistons are shown in inward positions.
A = Central air chamber pressurized
B = Spring Stroke

ACTUATOR TORQUE

SPRING RETURN (LBF.IN.)

ACTUATOR SIZE	SPRING SET #	SPRING STROKE TORQUE (LBF.IN.)		AIR STROKE TORQUE SUPPLY PRESSURE (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
AS0012	2	64	41	-	-	31	5	47	21	63	37	79	53	95	69	111	84	142	116
AS0025	1	31	20	93	80	123	109	152	139	181	168	211	198	240	227	270	257	329	316
	2	63	39	70	44	100	73	129	103	159	132	188	162	218	191	247	221	306	280
	3	94	59	48	8	77	37	107	67	136	96	166	126	195	155	225	185	283	244
	4	125	79	-	-	-	-	84	31	113	60	143	90	172	119	202	149	261	208
	5	156	99	-	-	-	-	-	-	91	24	120	54	150	83	179	113	238	172
	6	188	118	-	-	-	-	-	-	-	-	98	18	127	47	157	77	216	136
AS0040	1	58	37	175	150	230	206	285	261	341	316	396	371	451	427	506	482	617	592
	2	116	73	133	84	188	139	243	195	299	250	354	305	409	360	464	415	575	526
	3	174	110	91	18	146	73	201	128	257	183	312	239	367	294	422	349	533	459
	4	231	146	-	-	-	-	159	62	214	117	270	172	325	227	380	283	491	393
	5	289	183	-	-	-	-	-	-	172	50	228	106	283	161	338	216	449	327
	6	347	220	-	-	-	-	-	-	-	-	186	39	241	94	296	150	407	260
AS0065	1	90	57	265	227	349	311	434	395	518	479	602	564	686	648	770	732	939	900
	2	181	114	200	123	284	207	368	291	452	376	537	460	621	544	705	628	873	796
	3	271	171	134	19	219	103	303	188	387	272	471	356	555	440	639	524	808	693
	4	361	228	-	-	-	-	237	84	322	168	406	252	490	336	574	420	742	589
	5	452	285	-	-	-	-	-	-	256	64	340	148	424	232	509	317	677	485
	6	542	341	-	-	-	-	-	-	-	-	275	44	359	129	443	213	612	381
AS0100	1	131	83	394	339	518	463	643	588	767	712	892	836	1016	961	1141	1085	1390	1334
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	3	392	248	203	38	328	162	452	287	577	411	701	536	826	660	950	785	1199	1034
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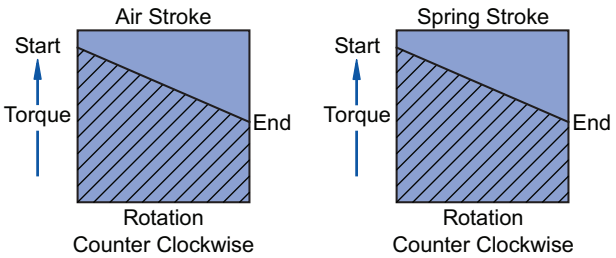
	6	785	497	-	-	-	-	-	-	-	-	416	85	540	209	665	334	914	583
AS0150	1	208	131	633	544	832	743	1031	942	1231	1142	1430	1341	1629	1540	1829	1740	2227	2138
	2	416	262	482	304	681	504	881	703	1080	902	1279	1102	1479	1301	1678	1500	2077	1899
	3	625	393	332	65	531	264	730	464	930	663	1129	862	1328	1062	1528	1261	1926	1660
	4	833	524	-	-	-	-	580	224	779	424	979	623	1178	823	1377	1022	1776	1421
	5	1041	654	-	-	-	-	-	-	629	185	828	384	1027	583	1227	783	1626	1181
	6	1249	785	-	-	-	-	-	-	-	-	678	145	877	344	1076	543	1475	942
AS0200	1	289	182	862	739	1135	1012	1408	1285	1681	1558	1954	1831	2226	2104	2499	2376	3045	2922
	2	578	364	653	407	926	680	1198	953	1471	1226	1744	1499	2017	1774	2290	2044	2836	2590
	3	867	547	443	75	716	348	989	621	1262	894	1535	1166	1808	1439	2080	1712	2626	2258
	4	1156	729	-	-	-	-	780	289	1052	561	1325	834	1598	1107	1871	1380	2417	1926
	5	1445	911	-	-	-	-	-	-	843	229	1116	502	1389	775	1662	1048	2207	1593
	6	1734	1093	-	-	-	-	-	-	-	-	906	170	1179	443	1452	716	1998	1261

= Standard Spring Set

SPRING RETURN TORQUE DIAGRAM



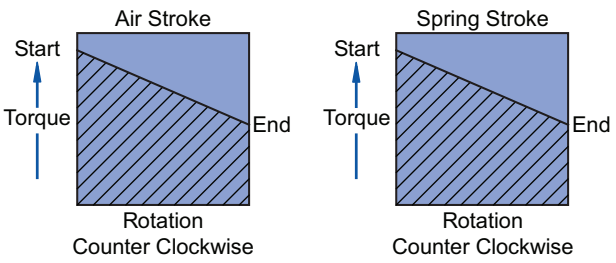
ACTUATOR TORQUE

SPRING RETURN (LBF.IN.)

ACTUATOR SIZE	SPRING SET #	SPRING STROKE TORQUE (LBF.IN.)		AIR STROKE TORQUE SUPPLY PRESSURE (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
AS0350	1	495	312	1503	1293	1978	1767	2452	2241	2926	2716	3400	3190	3874	3664	4348	4138	5296	5086
	2	990	624	1145	724	1619	1199	2093	1673	2567	2147	3041	2621	3515	3095	3990	3569	4938	4517
	3	1485	936	786	156	1261	630	1735	1104	2209	1578	2683	2052	3157	2526	3631	3000	4579	3948
	4	1979	1248	-	-	-	-	1376	535	1850	1009	2324	1483	2798	1957	3272	2431	4221	3380
	5	2474	1560	-	-	-	-	-	-	1492	440	1966	914	2440	1388	2914	1863	3862	2811
	6	2969	1872	-	-	-	-	-	-	-	-	1607	346	2081	820	2555	1294	3504	2242
AS0600	1	848	534	2551	2190	3356	2996	4162	3801	4968	4607	5773	5413	6579	6218	7385	7024	8996	8635
	2	1695	1068	1937	1216	2743	2021	3548	2827	4354	3633	5160	4438	5965	5244	6771	6050	8382	7661
	3	2543	1601	1324	241	2129	1047	2935	1853	3741	2658	4546	3464	5352	4270	6158	5075	7769	6687
	4	3391	2135	-	-	-	-	2321	878	3127	1684	3933	2490	4738	3295	5544	4101	7155	5712
	5	4238	2669	-	-	-	-	-	-	2513	710	3319	1515	4125	2321	4930	3127	6542	4738
	6	5086	3203	-	-	-	-	-	-	-	-	2706	541	3511	1346	4317	2152	5928	3763
AS0950	1	1070	685	3842	3360	5038	4556	6234	5752	7430	6948	8627	8144	9823	9340	11019	10536	13411	12929
	2	2141	1369	2986	2022	4182	3218	5379	4414	6575	5610	7771	6806	8967	8002	10163	9198	12555	11591
	3	3211	2054	2130	683	3327	1880	4523	3076	5719	4272	6915	5468	8111	6664	9307	7860	11699	10252
	4	4282	2738	-	-	2471	541	3667	1738	4863	2934	6059	4130	7255	5326	8451	6522	10844	8914
	5	5352	3423	-	-	-	-	2811	399	4007	1596	5203	2792	6400	3988	7696	5184	9988	7576
	6	6423	4108	-	-	-	-	-	-	3152	257	4318	1454	5544	2650	6740	3846	9132	6238
AS1600	1	1835	1141	6447	5579	8452	7583	10456	9588	12461	11592	14466	13597	16470	15602	18475	17606	22484	21615
	2	3671	2281	5022	3284	7026	5289	9031	7294	11035	9298	13040	11303	15044	13307	17049	15312	21058	19321
	3	5506	3422	3596	990	5600	2995	7605	4999	9610	7004	11614	9008	13619	11013	15623	13018	19632	17027
	4	7342	4562	-	-	4175	700	6179	2705	8184	4709	10188	6714	12193	8719	14198	10723	18207	14732
	5	9177	5703	-	-	-	-	4753	411	6758	2415	8763	4420	10767	6424	12772	8429	16781	12438
	6	11013	6844	-	-	-	-	-	-	-	-	7337	2125	9342	4130	11346	6135	15355	10144
AS2500	1	2607	1597	10204	8941	13310	12047	16416	15153	19523	18259	22629	21366	25735	24472	28841	27578	35054	33791
	2	5215	3194	8208	5681	11314	8788	14420	11894	17526	15000	20633	18106	23739	21213	26845	24319	33058	30532
	3	7822	4791	6211	2422	9318	5528	12424	8635	15530	11741	18636	14847	21743	17953	24849	21060	31062	27272
	4	10430	6388	-	-	7321	2269	10428	5375	13534	8482	16640	11588	19747	14694	22853	17800	29065	24013
	5	13037	7985	-	-	-	-	8432	2116	11538	5222	14644	8329	17750	11435	20857	14541	27069	20754
	6	15645	9582	-	-	-	-	-	-	9542	1963	12648	5069	15754	8176	18860	11282	25073	17494
AS4000	1	4183	2645	16495	14572	21537	19613	26578	24655	31620	29696	36661	34738	41703	39780	46744	44821	56828	54904
	2	8366	5289	13189	9343	18231	14384	23273	19426	28314	24467	33356	29509	38397	34550	43439	39592	53522	49675
	3	12550	7934	9884	4114	14925	9155	19967	14197	25008	19238	30050	24280	35092	29321	40133	34363	50216	44446
	4	16733	10578	-	-	11620	3926	16661	8968	21703	14009	26744	19051	31786	24092	36827	29134	46911	39217
	5	20916	13223	-	-	-	-	13355	3739	18397	8780	23439	13822	28480	18863	33522	23905	43605	33988
	6	25099	15867	-	-	-	-	-	-	15091	3551	20133	8593	25174	13634	30216	18676	40299	28759

= Standard Spring Set

SPRING RETURN TORQUE DIAGRAM



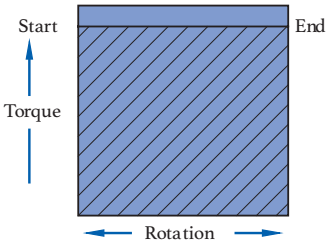
ACTUATOR TORQUE

DOUBLE ACTING (LBF.IN.)

ACTUATOR SIZE	TORQUE (LBF.IN.) @ SUPPLY PRESSURE (PSIG)												
	30	35	40	45	50	55	60	70	75	80	90	100	120
AD0012	44	51	59	66	74	81	89	104	112	119	134	149	179
AD0025	81	95	109	123	137	151	165	193	207	220	248	276	332
AD0040	153	179	205	231	257	283	309	361	387	413	466	518	622
AD0065	233	272	312	352	392	431	471	550	590	630	709	789	948
AD0100	344	403	461	520	579	638	696	814	873	931	1049	1166	1401
AD0150	551	645	739	833	927	1021	1115	1304	1398	1492	1680	1868	2244
AD0200	754	883	1011	1140	1269	1398	1527	1784	1913	2042	2299	2557	3072
AD0300	1310	1534	1758	1981	2205	2429	2653	3100	3324	3547	3995	4442	5337
AD0600	2226	2606	2987	3367	3747	4127	4508	5268	5648	6028	6789	7549	9070
AD0950	3374	3950	4527	5103	5679	6255	6832	7984	8560	9137	10289	11442	13747
AD1600	5654	6620	7586	8552	9517	10483	11449	13380	14346	15312	17243	19175	23038
AD2500	8762	10259	11755	13252	14748	16245	17741	20734	22231	23727	26720	29713	35699
AD4000	14221	16650	19079	21508	23937	26365	28794	33652	36081	38510	43368	48225	57941

= Standard Spring Set

DOUBLE ACTING TORQUE DIAGRAM



PART NUMBER MATRIX

PART NUMBER MATRIX

A	S	0100	N	04	A	C	A
PREFIX	ACTION	SIZE	SEAL OPTION	SPRING SET	INSERTS	FAIL POSITION	REVISION
A	D - DOUBLE ACTING	0012	N - NITRILE NORMAL TEMP RANGE: -4°F - 175°F	00 (DA)	A - STANDARD SQUARE	C - FAIL CLOSED (FC)	A
	S - SPRING RETURN	0025		02	B - WITHOUT INSERT	F - FAIL OPEN (FO)	
	K - KIT	0040		03		D - NO SPRING (DOUBLE ACTING FAIL LAST POSITION)	
		0065	H - FLUOROCARBON HIGH TEMP RANGE: -4°F - 250°F	04			
		0100		05			
		0150		06			
		0200	L - SILICONE LOW TEMP RANGE: -40°F - 175°F				
		0350					
		0600					
		0950					
		1600		EXAMPLE: AS0100N04ACA = Spring Return, 0100 Size, Nitrile Seals, 04 Spring Set, Standard Square Drive, Fail Closed			
		2500					
		4000					

SIZING OF RACK & PINION ACTUATOR

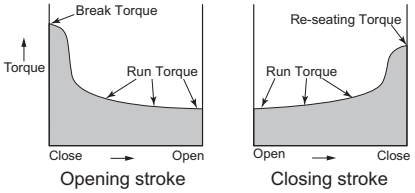
Sizing is the selection procedure to select the right size of actuator on a valve with a given torque characteristic. The following information gives brief examples on how to size actuators and which data is needed.

TORQUE CHARACTERISTICS OF VALVES

Apollo actuators are commonly used to operate butterfly, ball, and plug valves. The instructions below are intended for these types of valve applications, but can also be used for other quarter-turn applications.

GENERIC

TORQUE CHARACTERISTICS



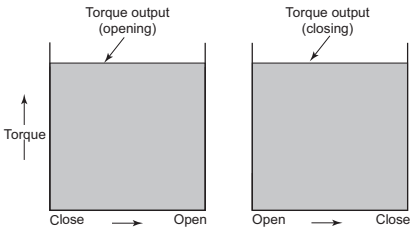
VALVE TORQUE VALUES AND SAFETY FACTORS

Establish the valve operating torque beginning with the torque constants for the appropriate pressure and valve. Use the torque adjustment factors to arrive at an in-service torque. Multiple adjustment factors may be required. Do not forget to include adjustments for graphite stem packing.

DOUBLE ACTING

TORQUE CHARACTERISTICS

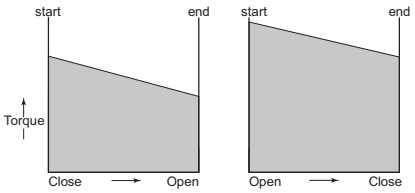
Based on the available air supply, select an actuator with torque outputs that exceed the in-service torque by at least 10%.



SPRING RETURN

TORQUE CHARACTERISTICS

Based on the available air supply, select an actuator where both the spring-ending torque and air-ending torque amount exceeds the in-service torque by at least 10%.



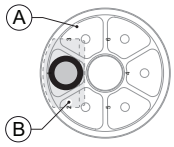
aalberts integrated piping systems

SPRING (CARTRIDGE) PLACEMENT

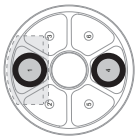
SIZES 0025 THRU 0600

Apollo spring return actuators are supplied with springs on each end of the actuator. Throughout the size range, there are different spring designs:

- Size 0012 has only 1 spring per side
- Sizes 0025 thru 0600 have a maximum of 6 springs per side
- Sizes 0950 thru 4000 have a maximum of 3 springs per side



N = 10

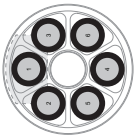


N = 20

N = 30

N = 40

N = 50



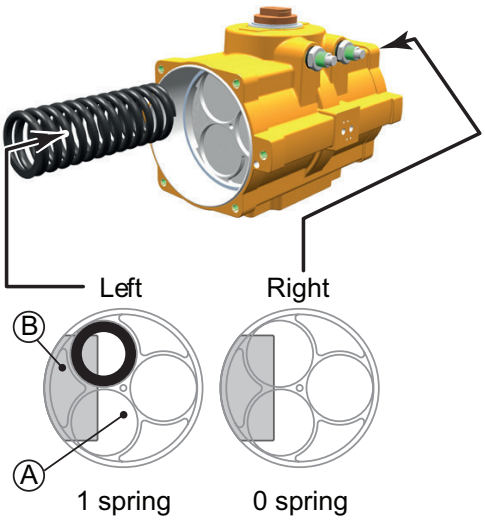
N = 60

A = Piston Top View
B = Position of Piston Gear Rack

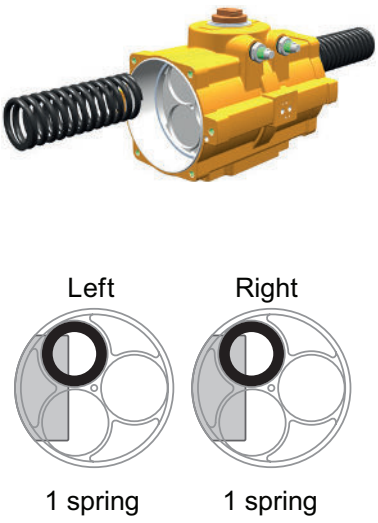
SPRING (CARTRIDGE) PLACEMENT

SIZES 0950 THRU 4000

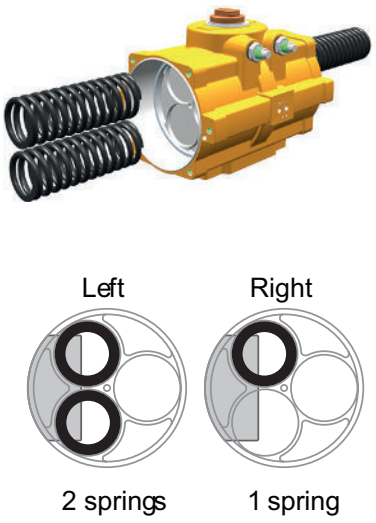
N = 10



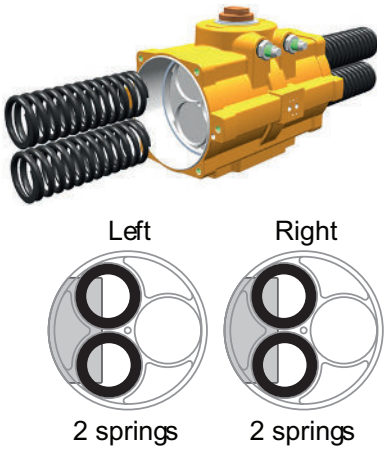
N = 20



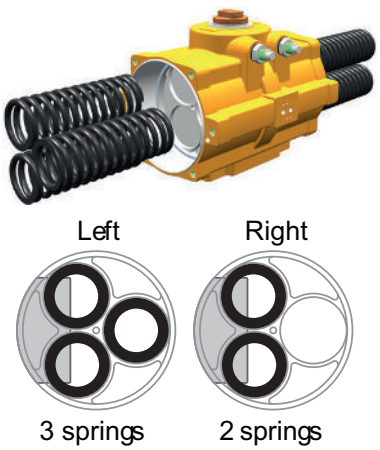
N = 30



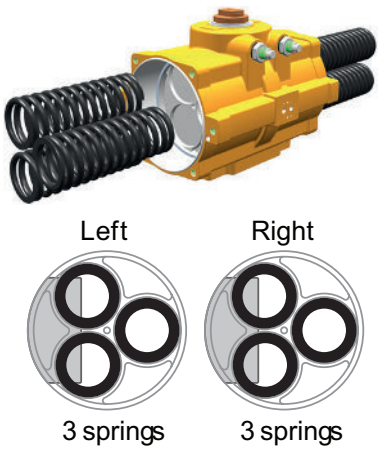
N = 40



N = 50



N = 60



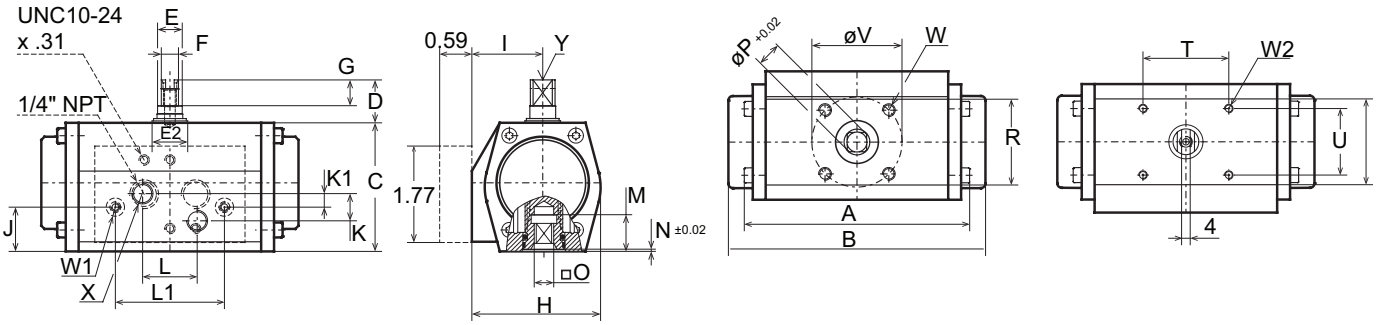
A = Piston Top View
B = Position of Piston Gear Rack

DATA SHEET

0012 (ISO 5211)

DIMENSIONS

SOLENOID, TOP MOUNTING INTERFACES, VALVE INTERFACE, AND DRIVE DETAILS



DIMENSIONS

DIMENSIONS (IN.)									
A (AD)	**A (AS)**	**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	1.3
J	**K**	**K1**	**L**	**L1**	**M**	**N**	**O MAX.**	**O MIN.**	**P**
0.83	0.5	0.25	1	2	0.65	0.039	0.36	0.356	0.476
R	**R1**	**T**	**U**	**V**	**W**	**W1**	**W2**	**X**	**Y**
1.57	1.57	1.57	1.22	1.654	M6 x 0.48"	10-24 x 0.24"	10-24 x 0.24"	10-24 x 0.24"	M6 x 0.48"

GENERAL DATA

0012

BORE		1.811	inch
STROKE		0.496	inch
WEIGHT	Spring return	1.3	lb.
	Double-acting	1.5	lb.
VOLUME	Port A	3.1	cu.in.
	Port B	3.7	cu.in.
AIR CONNECTION		2 x ¼"	NPT
PRESSURE RANGE	Max. Operating	120	psig
	Spring return	43-120	psig
	Double-acting	3-120	psig
PRESSURE MEDIA	Clean, dry, or lubricated air or inert gas		
CYCLE SPEED SPRING RETURN	Open	0.4	sec.
	Close	0.4	sec.
CYCLE SPEED DOUBLE-ACTING	Open	0.4	sec.
	Close	0.4	sec.
STANDARD TEMPERATURE RANGE		-4 to 176	°F
LUBRICATION	Lubricated for life[1]		
STROKE	90°		
FINISH	Polyurethane powder coat		

[1] *According to EN 15714-3.*

Test Conditions:

1. *Solenoid with flow capacity of 0.6 m³/hr.*
2. *Pipe diameter: 6 mm*
3. *Medium: clean air*
4. *Supply pressure: 5.5 barg (80 psig)*
5. *Temperature: Room temperature*

Notes:

- Volume is the actuator free air volume at 1 atm
- Flange and square drive to ISO 5211

European Directives:

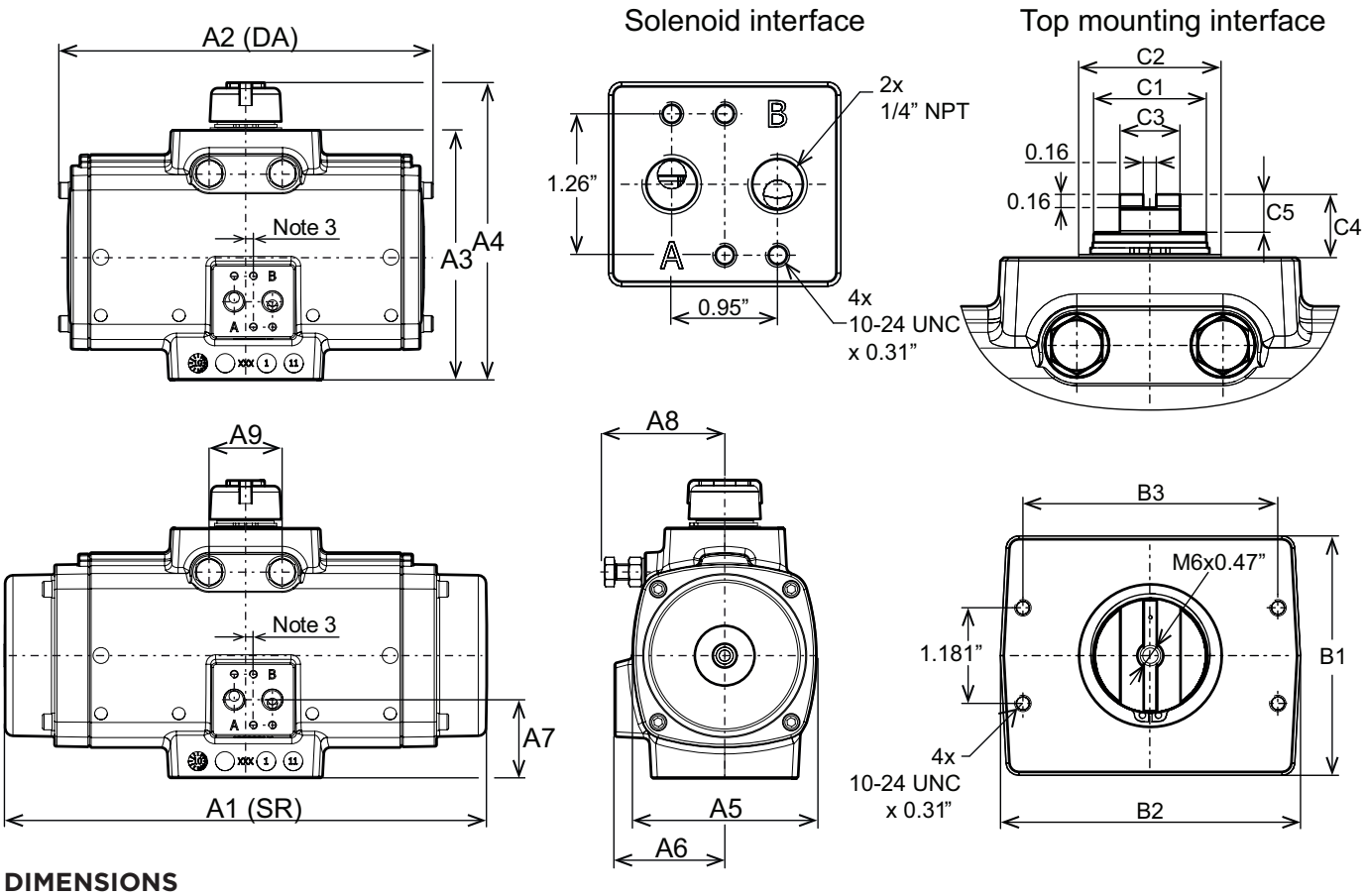
- PED: Suitable for use with group 2 gases according to Pressure Equipment Directive (PED) 2014/68/EU
- ATEX: Suitable for use in hazardous areas classified II 2 GD, zones 1 or 2 (gases) and 21 and 22 (dust) according to ATEX Directive 2014/34/EU

DATA SHEET

SIZE 0025 – 0350 (ISO 5211)

ENVELOPE DIMENSIONS

SOLENOID AND TOP MOUNTING INTERFACE, SIZES 0025 – 0350



DIMENSIONS

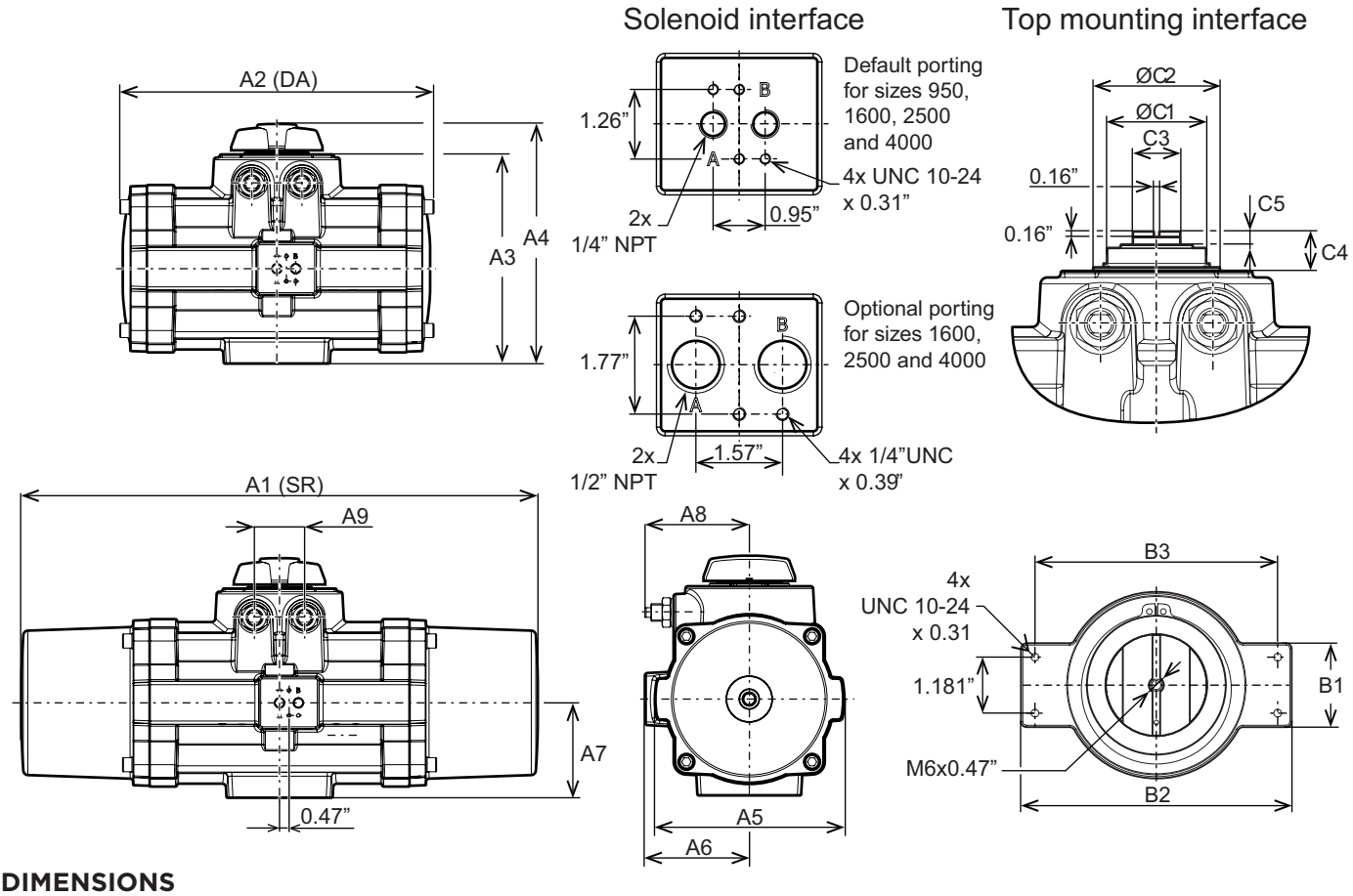
DIMENSIONS (IN.)	ACTUATOR SIZE						
	25	40	65	100	150	200	350
A1	6.54	7.55	8.53	9.72	11.97	14.23	15.15
A2	6.54	7.55	8.53	9.72	9.25	10.43	11.18
A3	3.59	4.39	4.86	5.14	6.19	6.42	7.92
A4	4.69	5.47	5.94	6.22	7.28	7.52	9.06
A5	2.68	3.23	3.62	4.06	4.57	4.88	6.34
A6	1.91	2.15	2.28	2.5	2.72	2.83	3.35
A7	1.16	1.34	1.48	1.5	1.93	1.92	1.65
A8	1.89	2.28	2.72	2.72	2.95	3.43	4.29
A9	0.71	0.98	1.06	1.1	1.81	1.81	1.81
B1	1.69	1.77	1.97	2.36	2.95	2.95	3.35
B2	3.7	3.7	3.7	3.82	3.7	3.7	3.94
B3	3.15	3.15	3.15	3.15	3.15	3.15	3.15
C1	0.63	0.87	0.87	0.87	1.34	1.42	1.42
C2	0.91	1.18	1.18	1.38	1.77	1.77	1.77
C3	0.55	0.55	0.55	0.55	0.75	0.75	0.75
C4	0.79	0.79	0.79	0.79	0.79	0.79	0.79
C5	0.47	0.47	0.47	0.47	0.47	0.47	0.47

Notes:

1. *DA= Double acting, SR= Spring return*
2. *Solenoid interface and top mounting interface according to VDI/VDE 3845 (NAMUR).*
3. *The solenoid drilling pattern is shifted 0.16" for sizes 0025 and 0.08" for the size 0040 vs. the centerline of the actuator.*
4. *Imperial threads are UNC for fastener thread holes and NPT for air connection ports.*

ENVELOPE DIMENSIONS

ENVELOPE DIMENSIONS: SOLENOID AND TOP MOUNTING INTERFACE, SIZES 0600 – 4000



DIMENSIONS

DIMENSIONS (IN.)	ACTUATOR SIZE				
	600	950	1600	2500	4000
A1	18.73	25.91	28.82	34.53	37.76
A2	14.02	15.75	18.19	21.65	25.55
A3	9.77	10.55	11.89	13.94	15.31
A4	11.5	12.01	13.35	15.43	16.81
A5	7.68	9.41	12.05	13.78	15.75
A6	4.02	5.16	5.87	6.69	7.72
A7	2.64	4.76	5.39	6.18	7.24
A8	5.2	5.16	6.14	7.13	6.89
A9	2.36	2.52	3.35	4.02	7.24
B1	3.86	1.77	1.77	1.77	1.77
B2	5.83	5.71	5.71	5.71	5.71
B3	5.12	5.12	5.12	5.12	5.12
C1	2.17	2.56	2.95	3.74	3.78
C2	2.56	3.27	3.78	4.65	4.53
C3	1.42	1.42	1.42	1.42	1.42
C4	1.18	1.18	1.18	1.18	1.18
C5	0.39	0.39	0.39	0.39	0.39

Notes:

1. *DA=Double-Acting, SR=Spring return*
2. *Solenoid interface and top mounting interface according to VDI/VDE 3845 (NAMUR).*
3. *The solenoid drilling pattern is shifted 0.95" for sizes 0950 4000 versus the centerline of the actuator.*
4. *Imperial threads are UNC for fastener thread holes and NPT for air connection ports.*

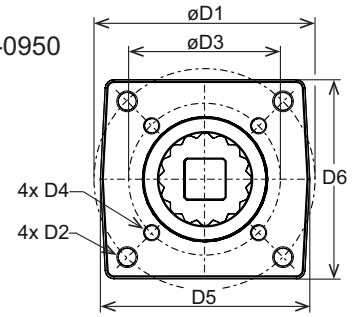
DATA SHEET

SIZE 0600 – 4000 (ISO 5211)

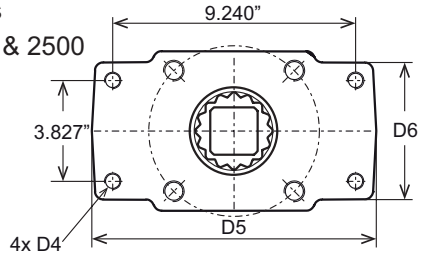
VALVE FLANGE AND DRIVE DETAILS

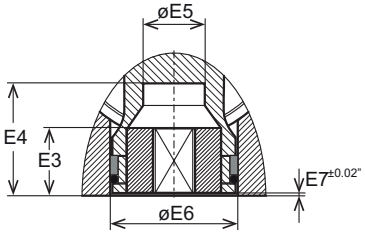
DIMENSIONS: SIZES 0025 – 4000

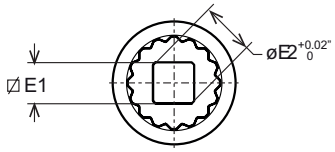
Sizes 0025-0950



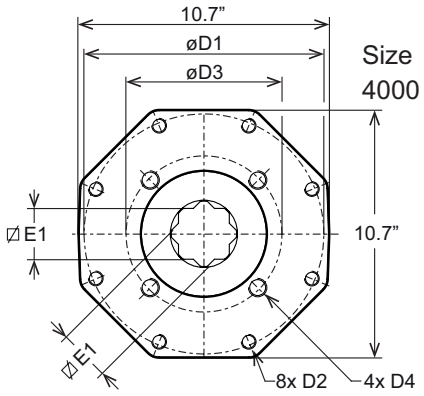
Sizes 1600 & 2500

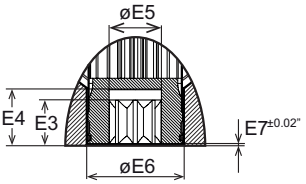






Size 4000





DIMENSIONS

DIMENSIONS (IN.)	ACTUATOR SIZE											
	0025	0040	0065	0100	0150	0200	0350	0600	0950	1600	2500	4000
ISO 1	F05	F07	F07	F7	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
D2	1/4"-20 x 0.35	5/16"-18 x 0.47	5/16"-18 x 0.47	5/16"-18 x 0.47	3/8"-16 x 0.59	3/8"-16 x 0.59	3/8"-16 x 0.59	1/2"-13 x 0.71	5/8"-11 x 0.94	3/4"-10 x 1.18	3/4"-10 x 1.18	5/8"-11 x 0.94
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 x 0.31	1/4"-20 x 0.35	1/4"-20 x 0.35	1/4"-20 x 0.35	5/16"-18 x 0.47	5/16"-18 x 0.47	5/16"-18 x 0.47	3/8"-16 x 0.59	3/8"-16 x 0.59	5/8"-11 x 0.94	5/8"-11 x 0.94	3/4"-1 x 1.18
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	2.176
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	2.291	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

Notes:

1. *Flange and square drive according to ISO 5211.*
2. *F25* =F or 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.*

DRIVE INSERTS

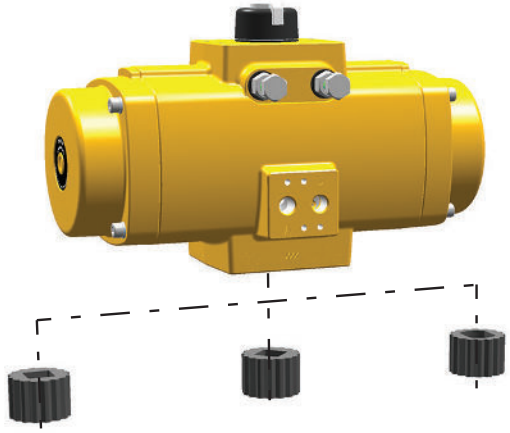
KEY FEATURES

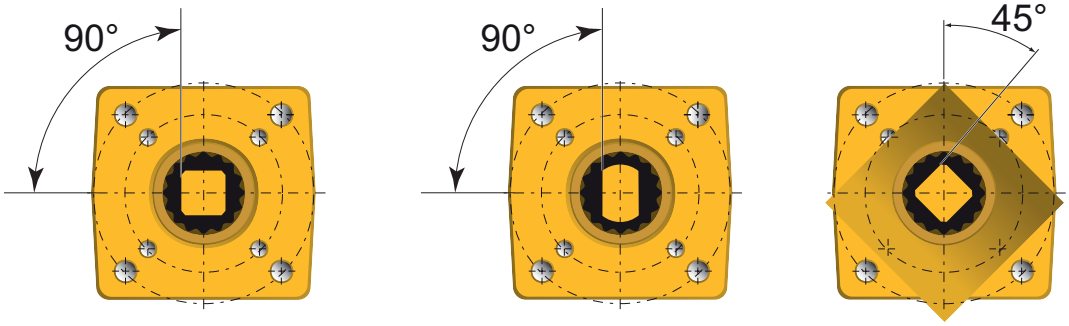
- Drive inserts allow actuators to be directly mounted to valves.
  Eliminates the need for a bracket and coupling type mounting kit.
  The use of drive inserts significantly cuts the cost of the valve/actuator assembly.
- Standard actuators are fitted with square drive inserts.
- Special inserts may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

DESCRIPTION

- Standard actuators are fitted with square drives inserts in accordance with ISO 5211. The ISO 5211 standard covers parallel and diagonal oriented inner squares (as per the old DIN 3337 standard).
- Additionally, a wide variety of other inserts are also available. Special inserts may have oversized/undersized squares or double-D configurations.
- Drive inserts can be supplied on factory supplied actuators or as loose items and are easily replaceable.
- Material: aluminum alloy

Notes:
Actuator size 0012 does not have inserts. This square drive is machined directly in the bottom of the pinion.
Actuator size 4000 does not have inserts. This actuator size ha *ɔm of the pinion.*





HIGH-TEMPERATURE SERVICE

DESCRIPTION

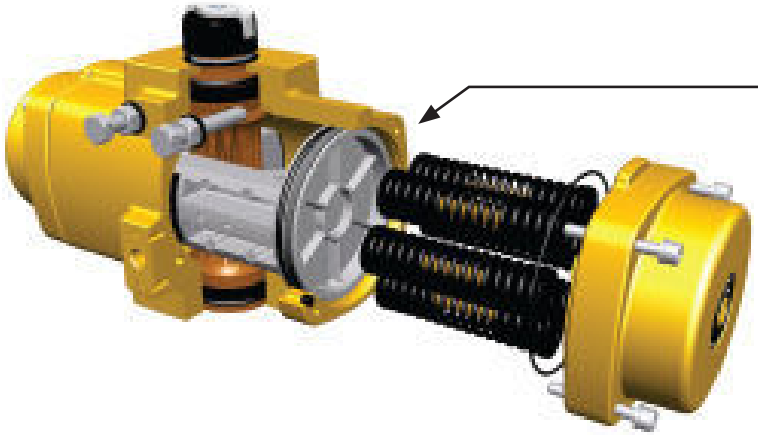
This version uses the standard aluminum actuator, but incorporates high-temperature grease, O-rings, and bearing materials; all suitable for high temperature operation up to 250°F (120°C).

SPECIFICATION

- Max. Pressure: 120 psig (8.3 barg)
- Torque Output: Standard
- Media: Air or non-corrosive gas
- Temperature: 14°F to 250°F (-10°C to 120°C)
- Finish: Polyurethane powder coating

SPARE PARTS/KITS

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



HIGH-TEMPERATURE COMPONENTS:
- Castrol High Performance Grease
- Viton (FPM) o-ring seals
- PTFE 24% carbon filled piston bearings
- Nylon 66 resin containing Aramid Fibre & PTFE for bearing strip piston rack and pinion bearings

STANDARD PARTS LIST

DESCRIPTION	MATERIAL
Housing	Cast Aluminum Alloy
End Cap	Cast Aluminum Alloy
Piston	Cast Aluminum Alloy
Pinion	High Grade Aluminum
Spring Cartridge	Spring Steel
Bearing Strip Piston Rack	Nylon-66 Resin containing Aramid Fiber & PTFE
Bearing Piston	PTFE 25% Carbon Filled
Bearing Pinion	Nylon-66 Resin containing Aramid Fiber & PTFE
Thrust Washer	POM, Black UV Stabilized
End Cap Screw	Stainless Steel
Circlip	Spring Steel
O-ring Seal Pinion	Viton FPM
O-ring Seal Piston	Viton FPM
O-ring Seal End cap	Viton FPM
O-ring Seal Limit Stop	Viton FPM
B-Port Seal	Silicon Rubber
Limit Stop Screw	Stainless Steel
Limit Stop Nut	Stainless Steel
Limit Stop Washer	PA66
Warning Sticker	Polyester
Indicator Assembly	ABS + Stainless Steel Screw
Insert Drive	Aluminum Alloy
Grease	Castrol High Temperature Grease (or Equiv.)

LOW-TEMPERATURE SERVICE

DESCRIPTION

This version uses the standard aluminum actuator, but incorporates low temperature grease and O-ring seal materials; all suitable for low temperature operation down to -40°F (-40°C).

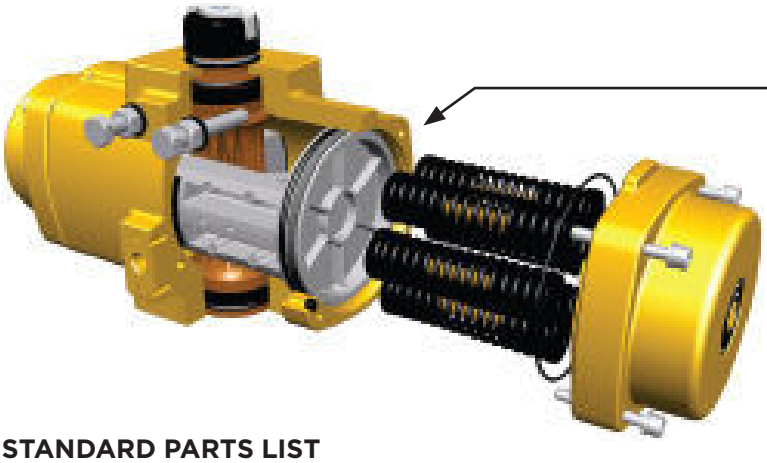
SPECIFICATION

- Max. Pressure: 120 psig (8.3 barg)
- Torque Output: Standard
- Media: Air or non-corrosive gas
- Temperature: -40°F to 176°F (-40°C to 80°C)
- Finish: Polyurethane Powder Coating
- Cycle Life: Replace seals after 250,000 cycles

SPARE PARTS/KITS

Dedicated low temperature spare parts kits are available for maintenance or to convert a standard actuator into a version suitable for low temperature service.

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



LOW-TEMPERATURE COMPONENTS:
- Castrol Tribol GR TT 1 PD grease
- Silicone (MVQ70 rubber) o-ring seals

STANDARD PARTS LIST

DESCRIPTION	MATERIAL
Housing	Cast Aluminum Alloy
End Cap	Cast Aluminum Alloy
Piston	Cast Aluminum Alloy
Pinion	High Grade Aluminum
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	Silicon MVQ70
O-ring Seal Piston	Silicon MVQ70
O-ring Seal End cap	Silicon MVQ70
O-ring Seal Limit Stop	Silicon MVQ70
B-Port Seal	Silicon Rubber
Limit Stop Screw	Stainless steel
Limit Stop Nut	Stainless steel
Limit Stop Washer	PA66
Warning Sticker	Polyester
Indicator Assembly	ABS + Stainless steel screw
Insert Drive	Aluminum Alloy
Grease	Castrol Tribol GR TT 1 PD grease (or Equiv.)