

ACTUATORS AND CONTROLS

Pneumatic Actuators – **New AD and AS** (Sizes 0025 to 0350)

APOLLO RACK & PINION

Designed and manufactured for the ultimate in durability and reliability, the new Apollo® Pneumatic Rack & Pinion Actuators provide outstanding service life.

Apollo Rack & Pinion actuators have replaceable insert drive adapters in all but the largest models, and many units have dual “F” series bolt patterns. The numerous actuator drive and bolt pattern combinations allow direct mounting of several valve styles.



FEATURES

1. **Cast Aluminum Body**
Yellow Chromate Powder Coat Finish
2. **Die Cast Aluminum End Caps**
Yellow Chromate Powder Coat Finish
3. **Die Cast Aluminum Pistons**
Hard Anodized
4. **Aluminum Alloy Pinion**
Hard-coat Anodized Finish
5. **Drive Inserts**
Extruded Aluminum
Hard-coat Anodized Finish
6. **Preloaded Concentric Springs**
Delta-Tone® Coated
7. **Bushings**
Polyoxymethylene (POM)
8. **O-Ring Seals**
Standard Temp. (-4°F to 180°F): Buna-N
High Temp. (-4°F to 250°F): Fluorocarbon
Low Temp. (-40°F to 180°F): Silicone
9. **Capscrews, Nuts & Other Hardware**
Stainless Steel or Delta-Tone® Coated

BENEFITS

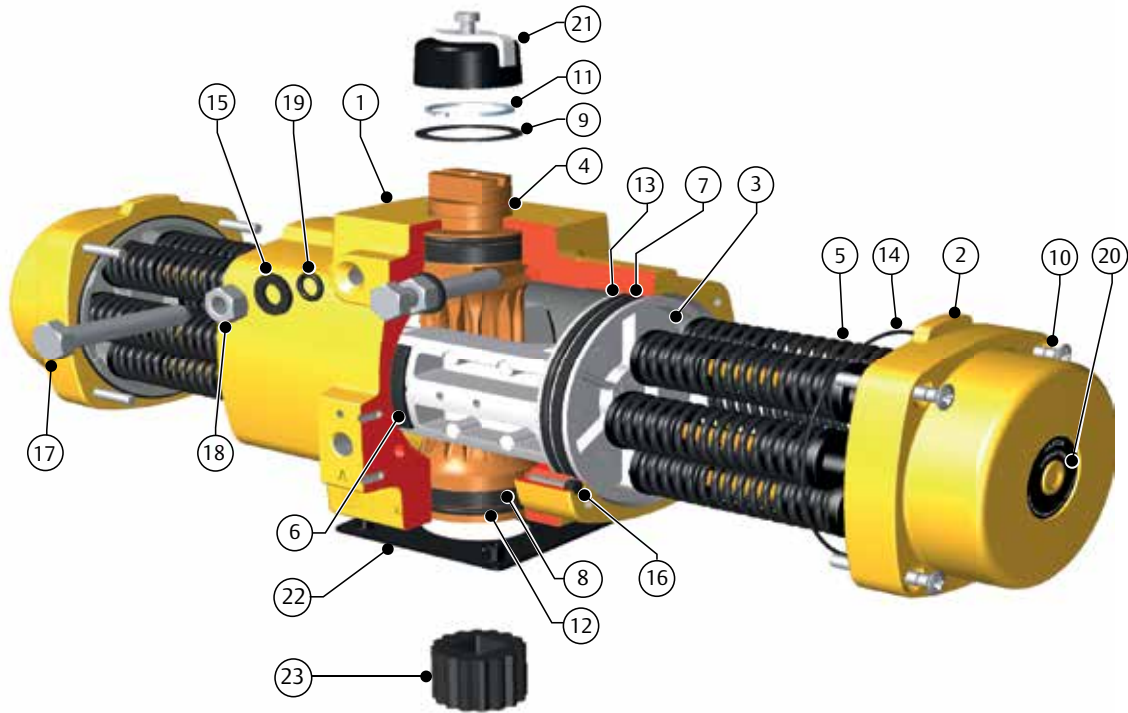
- Compact Rack & Pinion Design
- Quarter-Turn Operation
- Designed for use on a variety of Valve Types:
Ball Valves, Butterfly Valves, Plug Valves
- Applicable to Damper and Door Openers
- Both Double-Acting and Spring-Return Units
- Double-Acting Torque Outputs from 220 in-lbs to 3547 in-lbs with an 80 psi Air Supply
- Removable/Replaceable Drive Inserts*
- Pre-loaded Spring Assemblies
- ISO 5211 Valve Mounting
- NAMUR (VDI/VDE 3845) Accessory Mounts
- ATEC Classification II, 2 GD, Zones 1 or 2 (Gases) and 21 or 22 (Dust)
- Anti Blow-Out Pinion Design
- Maximum Pressure Rating: 116 psig (8 bar)
- Compatible Media: Clean, Dry Air, Filtered Non-corrosive Gas or Light Hydraulic Oil
- Pre-lubricated for the life of the Actuator
- Chromate Corrosion Protection on all Aluminum Components
- Each Unit is Serialized
- 5 Year Apollo Warranty**

Notes:

- * A wide selection of standard inserts is available for Square, DIN and Double-D drives.
See page 16.

ACTUATORS AND CONTROLS

0025 to 0350 Parts List – New AD and AS (Sizes 0025 to 0350)



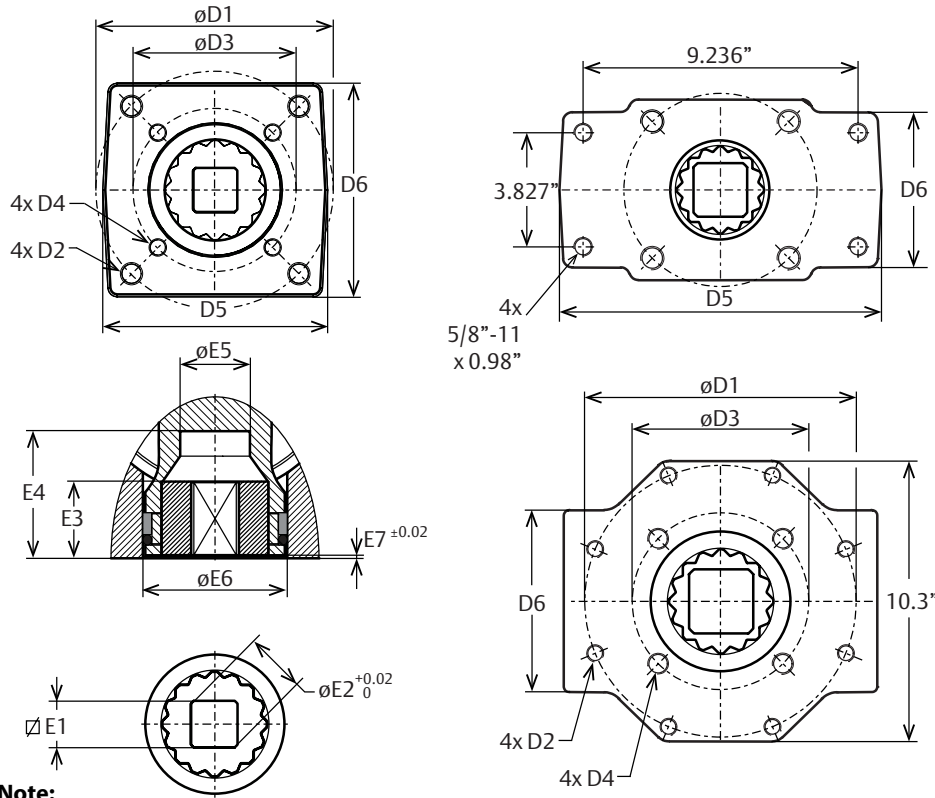
Part	Qty	Description	Material	Notes
1	1	Body	Cast Aluminium alloy	Chromated and polyurethane powder coated
2	2	End cap	Cast Aluminium alloy	Chromated and polyurethane powder coated
3	2	Piston	Cast Aluminium alloy	Chromated
4	1	Pinion	High grade aluminium	Hard anodized
5	Max. 12	Spring cartridge	Spring steel	Electrophoretic coated
6 *	2	Bearing strip piston rack	POM	
7 *	2	Bearing piston	PTFE 25% carbon-filled	
8 *	2	Bearing pinion	POM	
9 *	1	Thrust washer	POM, black UV-stabilized	
10	8	End cap screw	Stainless Steel	
11 *	1	Circlip	Spring steel	Deltatone® coated
12 *	2	O-ring seal pinion	Nitrile rubber	
13 *	2	O-ring seal piston	Nitrile rubber	
14 *	2	O-ring seal end cap	Nitrile rubber	
15 *	2	O-ring seal limit stop	Nitrile rubber	
16 *	2	B-port seal	Silicon rubber	
17	2	Limit stop screw	Stainless steel	
18	2	Limit stop nut	Stainless steel	
19	2	Limit stop washer	PA66	
20	2	Warning sticker	Polyester	
21	1	Indicator assembly	ABS + stainless steel screw	
22	1	Center plate (option)	Nylon PA6, Black	
23	1	Insert drive	Aluminium alloy	

* Included in repair kit

ACTUATORS AND CONTROLS

Dimensional Data – New AD and AS (Sizes 0025 to 0350)

ENVELOPE DIMENSIONS - SOLENOID INTERFACE - TOP MOUNTING INTERFACE



Note:

1. DA = Double-Acting, SR = Spring-Return
2. Solenoid interface and top mounting interface according to VDI/VDE3845 (NAMUR)
3. The solenoid drilling pattern is shifted 0.16" for size 0025 and 0.08" for size 0040 vs. the centerline of the actuator.

Tolerance limits unless otherwise specified:
 X.X = $\pm 0.02''$
 X.XX = $\pm 0.01''$

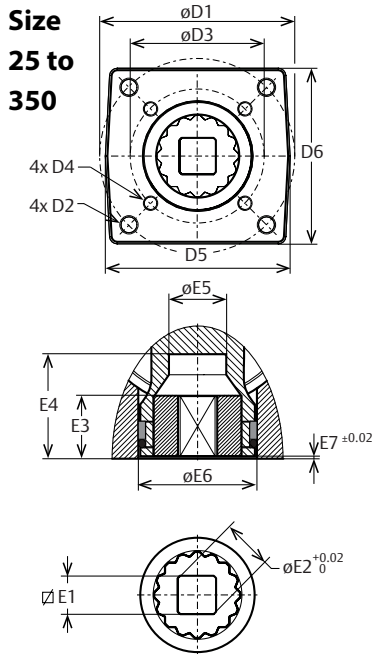
Dim in Inches	Actuator Size						
	0025	0040	0065	0100	0150	0200	0350
A1	6.54	7.55	8.53	9.72	11.97	14.23	15.15
A2	6.54	7.55	8.53	9.72	8.80	10.07	10.58
A3	3.59	4.39	4.86	5.14	6.19	6.42	7.92
A4	4.69	5.47	5.94	6.22	7.28	7.52	9.06
A5	3.23	3.74	4.09	4.53	5.00	5.28	6.50
A6	1.91	2.15	2.28	2.50	2.72	2.83	3.35
A7	1.16	1.34	1.48	1.50	1.93	1.92	1.65
A8	1.89	2.28	2.72	2.72	2.95	3.43	4.29
A9	0.71	0.98	1.06	1.10	1.81	1.81	1.81
B1	1.69	1.77	1.97	2.36	2.95	2.95	3.35
B2	3.70	3.70	3.70	3.82	3.70	3.70	3.94
B3	3.15	3.15	3.15	3.15	3.15	3.15	3.15
C1	0.63	0.87	0.87	0.87	1.34	1.42	1.42
C2	0.91	1.18	1.18	1.18	1.77	1.77	1.77
C3	0.39	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

ACTUATORS AND CONTROLS

Dimensional Data – New AD and AS (Sizes 0025 to 0350)

VALVE INTERFACE AND DRIVE DETAILS

Note: Tolerance limits unless otherwise specified:
 1. Flange and square drive according to DIN 3337
 X.X = ± 0.02"
 X.XX = ± 0.01"

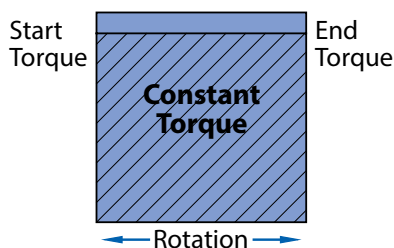


Dim in Inches	Actuator Size						
	0025	0040	0065	0100	0150	0200	0350
ISO 1	F05	F07	F07	F07	F10	F10	F10
D1	1.969	2.756	2.756	2.756	4.016	4.016	4.016
D2	1/4"-20 x0.39"	5/16"-18 x0.39"	5/16"-18 x0.39"	5/16"-18 x0.39"	3/8"-16 x0.63"	3/8"-16 x0.63"	3/8"-16 x0.63"
ISO 2	F03	F05	F05	F05	F07	F07	F07
D3	1.417	1.969	1.969	1.969	2.756	2.756	2.756
D4	10-24 x0.31"	1/4"-20 x0.39"	1/4"-20 x0.39"	1/4"-20 x0.39"	5/16"-18 x0.39"	5/16"-18 x0.39"	5/16"-18 x0.39"
D5	1.97	2.68	2.68	2.62	3.82	3.7	3.7
D6	1.89	2.56	2.56	2.48	3.62	3.54	3.7
E1 Max	0.436	0.554	0.554	0.751	0.751	0.87	1.067
E1 Min	0.433	0.551	0.551	0.748	0.748	0.866	1.063
E2	0.555	0.713	0.713	0.992	1.004	1.11	1.425
E3	0.591	0.591	0.591	0.709	1.083	1.083	1.083
E4	1.34	1.34	1.34	1.34	1.97	1.97	1.97
E5	0.56	0.71	0.83	0.93	1.12	1.26	1.26
E6	0.96	1.36	1.36	1.5	2.22	2.22	2.22
E7	0.02	0.04	0.04	0.04	0.05	0.05	0.05

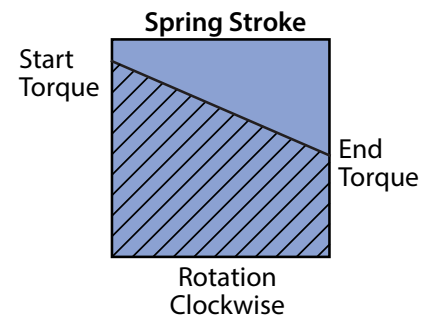
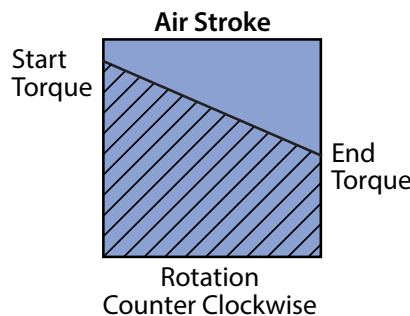
TORQUE OUTPUT OF DOUBLE ACTING RACK & PINION ACTUATORS (IN - LB)

Actuator Size	Supply Pressure (psi)										
	40	45	50	55	60	70	75	80	90	100	120
AD0025	109	123	137	151	165	193	207	220	248	276	332
AD0040	205	231	257	283	309	361	387	413	466	518	622
AD0065	312	352	392	431	471	550	590	630	709	789	948
AD0100	461	520	579	638	696	814	873	931	1049	1166	1401
AD0150	739	833	927	1021	1115	1304	1398	1492	1680	1868	2244
AD0200	1011	1140	1269	1398	1527	1784	1913	2042	2299	2557	3072
AD0350	1758	1981	2205	2429	2653	3100	3324	3547	3995	4442	5337

Double-Acting Torque Diagram



Spring-Return Torque Diagram



ACTUATORS AND CONTROLS

TORQUE OUTPUT OF SPRING RETURN RACK & PINION ACTUATORS (IN - LB)

Actuator Size	Spring Set	Spring Stroke		Air Stroke Supply Pressure (psi)															
				40		50		60		70		80		90		100		120	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
AS0025	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	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	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	2	262	166	299	188	423	313	548	437	672	562	797	686	921	811	1046	935	1295	1184
	3	392	248	203	38	328	162	452	287	577	411	701	536	826	660	950	785	1199	1034
	▶ 4	523	331	-	-	-	-	357	136	482	261	606	385	731	510	855	634	1104	883
	5	654	414	-	-	-	-	-	-	387	110	511	235	636	359	760	484	1009	733
	6	785	497	-	-	-	-	-	-	-	-	416	85	540	209	665	334	914	583
AS0150	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	2	578	364	653	407	926	680	1198	953	1471	1226	1744	1499	2017	1771	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
AS0350	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

▶STANDARD

ACTUATORS AND CONTROLS

Technical Data – New AD and AS (Sizes 0025 to 0350)

ACTUATOR WEIGHT

Actuator Size	Double-Acting	Spring-Return
	lbs	lbs
0025	3.1	3.5
0040	4.6	5.1
0065	6.2	7.3
0100	7.7	9.5
0150	10.8	14.6
0200	13.2	18.3
0350	22	32

OPERATING SPEED RESULTS (See test conditions below)

Actuator Size	Cycle Time in Seconds			
	Spring-Return		Double-Acting	
	A-port pressurized	Spring Stroke	A-port pressurized	B-port pressurized
0025	0.5	0.4	0.5	0.4
0040	0.6	0.5	0.6	0.5
0065	0.7	0.5	0.6	0.6
0100	0.8	0.6	0.8	0.7
0150	1.0	0.8	0.9	0.8
0200	1.3	0.9	1.0	1.0
0350	1.9	1.3	1.4	1.5

DISPLACEMENT

Actuator Size	Actuator Volume			Consumption per stroke (cubic inch, pressure in psig)					
	Maximum Volume (cubic inch)			Outward Stroke (Double-Acting & Spring Return)			Inward Stroke (Double-Acting Only)		
	Central ¹ chamber	End cap ² chamber	Displaced ³ volume	40 psig	80 psig	120 psig	40 psig	80 psig	120 psig
0025	6.4	11.8	4.7	23	80	120	40	80	120
0040	10.0	22	8.9	36	64	92	70	131	192
0065	22	34	13.5	74	134	194	107	200	293
0100	22	50	19.9	80	140	200	158	295	433
0150	48	43	32	163	295	427	151	270	389
0200	50	59	44	182	320	458	207	369	532
0350	118	103	76	402	729	1055	359	642	925

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°

OPERATING SPEED TEST

Solenoid with flow capacity:	0.6 m ³ /hr
Pipe diameter:	6 mm
Medium:	clean air
Supply pressure:	80 psi
Load:	with average load
Stroke:	90°
Temperature:	Room temperature

SELECTING/SIZING APOLLO RACK & PINION ACTUATORS

Establish the valve operating torque beginning with the torque constants for the appropriate pressure and valve as found on pages 49-51. Use the torque adjustment factors found on page 52 to arrive at an in-service torque. Multiple adjustment factors may be required. Do not forget to include adjustments for graphite stem packing.

FOR DOUBLE ACTING ACTUATORS

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

FOR SPRING RETURN ACTUATORS

Considering the available air supply, select an actuator where both the Spring-Ending torque figure and the Air-Ending torque figure exceeds the in-service torque by at least 10%.

How to Order Apollo Pneumatic Rack & Pinion Actuators – New AD and AS

APOLLO RACK & PINION NUMBERING SYSTEM

A	S	0350	N	04	A	C	A
PREFIX	ACTION	SIZE	SEAL OPTION	SPRING SET	INSERTS	FAIL POSITION	REVISION
A	D = DOUBLE ACTING S = SPRING RETURN K = KIT	0025 0040 0065 0100 0150 0200 0350	N = NITRILE H = FLOUROCARBON L = SILICONE	00 (DA) 02 03 04 05 06 08	A = STANDARD SQUARE B = WITHOUT INSERT	C = FAIL CLOSED (FC) F = FAIL OPEN (FO) D = NO SPRING	A

ACTUATORS AND CONTROLS

Pneumatic Actuators – AD and AS (Sizes 0600 to 4000)

APOLLO RACK & PINION

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2. **Die Cast Aluminum End Caps**
Yellow Chromate Powder Coat Finish
3. **Die Cast Aluminum Pistons**
Hard Anodized
4. **Aluminum Alloy Pinion**
7075-T6
Hard-coat Anodized Finish
5. **Drive Inserts**
Extruded Aluminum
Hard-coat Anodized Finish
6. **Preloaded Concentric Springs**
Deltatone® Coated
7. **Piston Guides**
Molybdenum Disulfide filled Polyamide
8. **Bushings**
Polyoxymethylene (POM)
9. **O-Ring Seals**
Standard Temp. (-4°F to 180°F): Buna-N
High Temp. (-4°F to 250°F): Fluorocarbon
Low Temp. (-40°F to 180°F): Silicone
10. **Capscrews, Nuts & Other Hardware**
304 Stainless Steel

BENEFITS

- Compact Rack & Pinion Design
- Quarter-Turn Operation
- Designed for use on a variety of Valve Types:
Ball Valves, Butterfly Valves, Plug Valves
- Applicable to Damper and Door Openers
- Both Single Stop and Double Stop Versions**
- Both Double-Acting and Spring-Return Units
- Double-Acting Torque Outputs from 6028 in-lbs to 40293 in-lbs with an 80 psi Air Supply
- Removable/Replaceable Drive Inserts*



- Pre-loaded Spring Assemblies
- ISO 5211 Valve Mounting
- NAMUR (VDI/VDE) Accessory Mounts
- ATEC Classification II, 2 GD, Zones 1 or 2 (Gases) and 21 or 22 (Dust)
- Anti Blow-Out Pinion Design
- Maximum Pressure Rating: 116 psig (8 bar)
- Compatible Media: Clean, Dry Air, Filtered Non-corrosive Gas or Light Hydraulic Oil
- Pre-lubricated for the life of the Actuator
- Chromate Corrosion Protection on all Aluminum Components
- Each Unit is Serialized
- 5 Year Apollo Warranty**

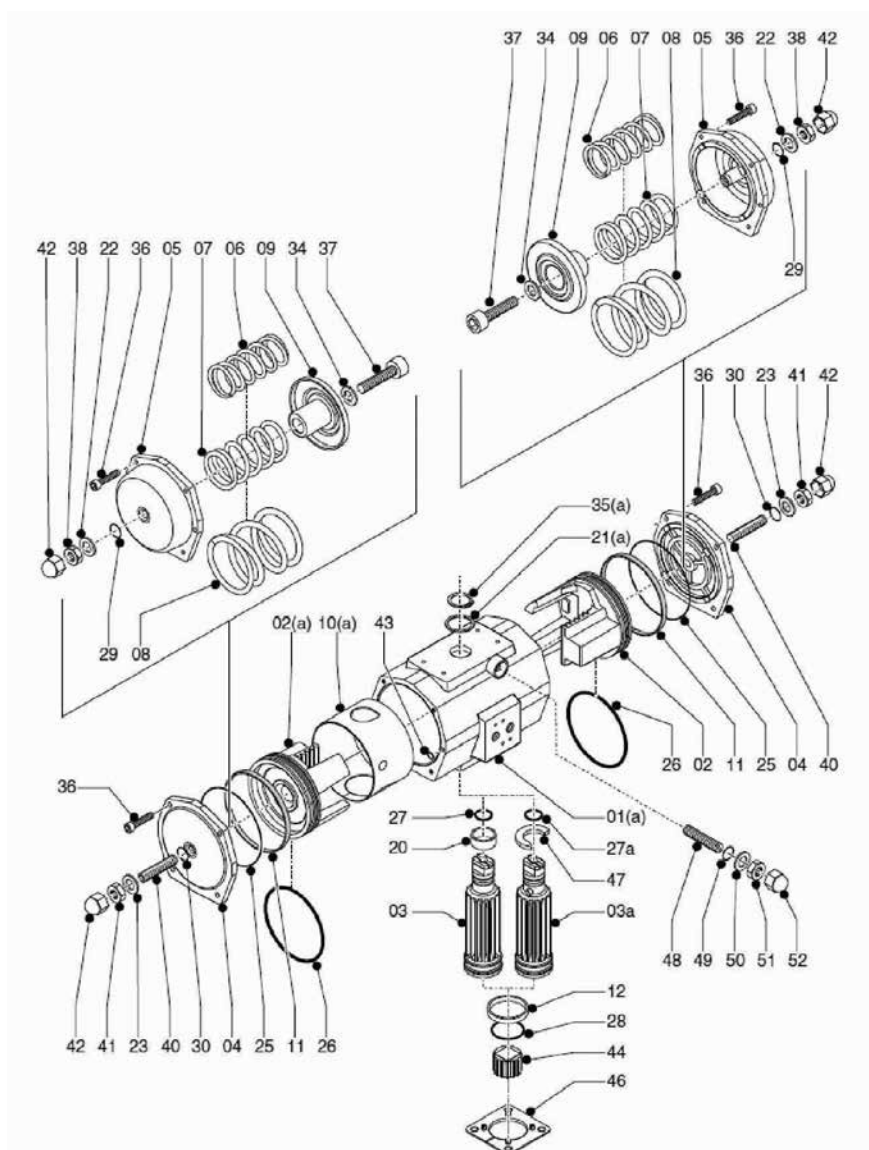
Notes:

* A wide selection of standard inserts is available for Square, DIN and Double-D drives.

** Single Stop units are used where the open position of the valve requires precise adjustment. These are standard on all actuators with the exception of the two larger sizes where single stops are optional. Actuators with dual adjustable stops are also available for those applications on butterfly valves, for example, to allow precise adjustment of both the open and closed positions. Refer to page 16.

ACTUATORS AND CONTROLS

0600 to 1600 Parts List – AD and AS



Part	Qty	
01	Body	1
02	Piston	2
03	Pinion	1
04	AD End Cap (Double Acting)	2
05	AS End Cap (Spring Return)	2
06	Inner Spring	0 to 2
07	Middle Spring	0 to 2
08	Outer Spring	0 to 2
09	Spring Holder	2
10*	Guide Band	1
11*	Piston Guide	2
12	Lower Bearing	1
20*	Upper Bearing	1

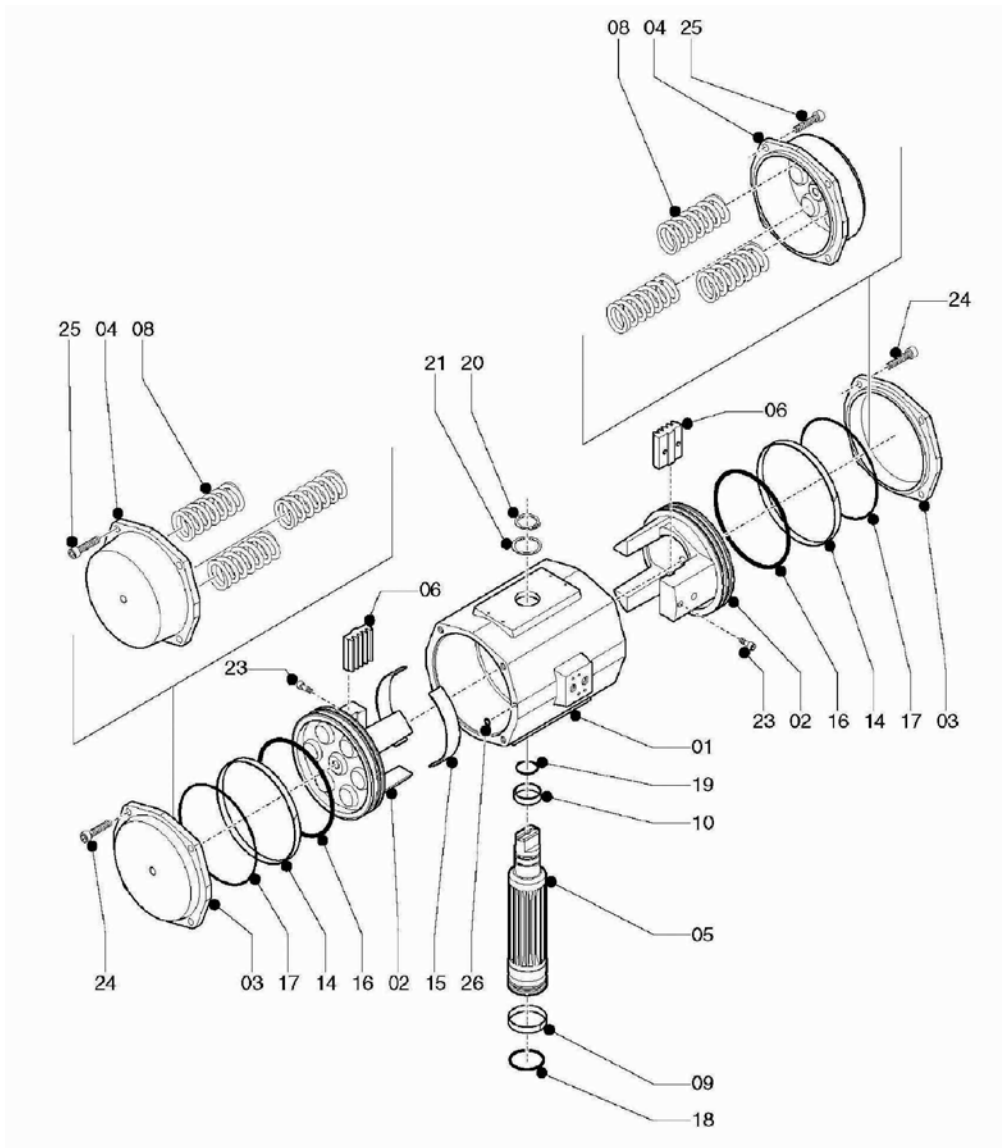
Part	Qty	
21*	Thrust Washer	1
22*	Stop Screw Washer	2
23*	Stop Screw Washer	2
25*	End Cap O-ring	2
26*	Piston O-ring	2
27*	Upper Pinion O-ring	1
28*	Lower Pinion O-ring	1
29*	Stop Screw O-ring	2
30*	Stop Screw O-ring	2
34	Stop Screw Washer	2
35	Spring Clip	1
36	End Cap Bolt	8
37	Limit Stop Bolt	2

Part	Qty	
38	Stop Adjustment Nut	2
40	Limit Stop Bolt	2
42	Nut Cover	2
43	Port O-ring	2
44	Insert/Adapter	1
47	Stroke Cam	1
48	Dual Stop Bolt	1
49*	Dual Stop O-ring	1
50*	Dual Stop Washer	1
51	Dual Stop Lock Nut	1
52	Dual Stop Nut Cover	1

* Included in Repair Kit

ACTUATORS AND CONTROLS

2500 to 4000 Parts List – AD and AS



Part	Qty	
01	Body	1
02	Piston	2
03	AD End Cap (Double Acting)	2
04	AS End Cap (Spring Return)	2
05	Pinion	1
06	Gear Rack	2
08	Coil Spring	0 to 14
09*	Lower Bearing	1

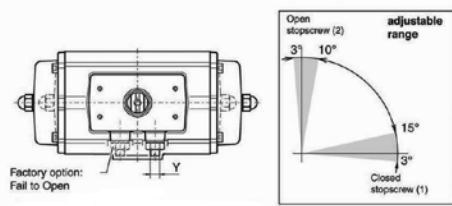
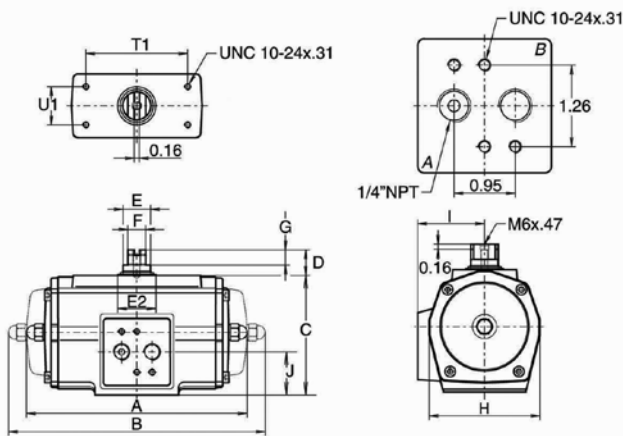
Part	Qty	
10*	Upper Bearing	1
14*	Piston Guide	2
15*	Heel Guide	2
16*	Piston O-ring	2
17*	End Cap O-ring	2
18*	Lower Pinion O-ring	1
19*	Upper Pinion O-ring	1
20*	Spring Clip	1

Part	Qty	
21*	Thrust Washer	1
23	Rack Capscrew	2 or 4
24	DA End Cap Bolt	8 or 20
25	SR End Cap Bolt	8 or 20
26	Port O-ring	2

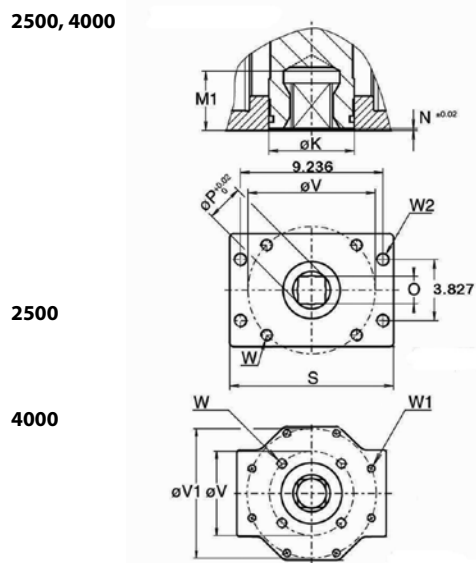
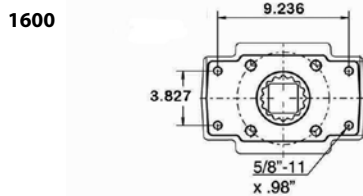
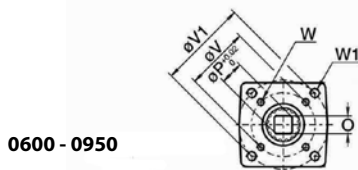
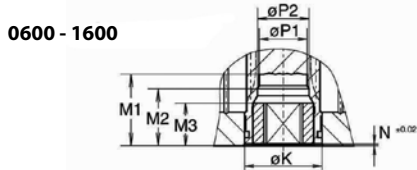
* Included in Repair Kit

ACTUATORS AND CONTROLS

Dimensional Data – AD and AS (Sizes 0600 to 4000)



For Models with Dual Adjustable Limit Stops



RACK & PINION ACTUATOR ENVELOPE DIMENSIONS – INCHES

Model	Overall Length A (DA)	Overall Length B (SR)	Body Height C	Body Width H	Solenoid Pad Offset I	Port Location J	Adjustable Closed Stop J1*	Adjustable Closed Stop L*	Stop Size Y*	Stop Protrusion X max.*
0600	15.24	18.78	8.66	8.15	4.45	3.33	3.50	1.63	5/8"-11	4.51
0950	16.69	20.35	10.20	9.09	4.96	4.15	4.03	1.63	5/8"-11	4.51
1600	20.31	25.08	11.69	10.43	5.59	4.74	4.50	1.87	3/4"-10	4.88
2500	14.88	22.40	14.02	13.78	7.28	7.01	N/A	N/A	N/A	N/A
4000	19.76	32.83	14.96	14.96	7.87	7.48	N/A	N/A	N/A	N/A

*Applies to double stop versions only

ACTUATORS AND CONTROLS

Dimensional Data – AD and AS (Sizes 0600 to 4000)

RACK & PINION ACTUATOR DRIVE DETAILS – INCHES

Model	Bottom Pinion Diameter K	Valve Stem Clearance M1	Insert or Adapter Height M3	Pinion Recess N	Standard Square Output O max	Standard Square Output O min	Across Corners Diameter P1
0600	2.68	2.05	1.16	0.06	1.068	1.063	1.425
0950	2.95	2.52	1.95	0.06	1.424	1.417	1.898
1600	3.74	3.23	2.30	0.06	1.817	1.811	2.370
2500	3.35	2.60	N/A	0.12	1.817	1.811	2.370
4000	4.72	3.03	N/A	0.06	2.173	2.165	2.843

RACK & PINION ACTUATOR MOUNTING DIMENSIONS – INCHES

Model	Primary ISO "F" Pattern	Primary Bolt Circle V	Primary Fastener W	Secondary ISO "F" Pattern	Secondary Bolt Circle V1	Secondary Fastener W1
0600	F10	4.016	3/8"-16 x .63"	F12	4.921	1/2"-13 x .79"
0950	F10	4.016	3/8"-16 x .63"	F14	5.512	5/8"-11 x .98"
1600	F16	6.496	3/4"-10 x 1.14"	N/A	N/A	N/A
2500	F16	6.496	3/4"-10 x 1.14"	N/A	N/A	N/A
4000	F16	6.496	3/4"-10 x 1.14"	F25	10.000	5/8"-11 x .98"

RACK & PINION ACTUATOR MOUNTING DETAILS – INCHES

Model	Namur Shaft Extension D	Namur Shaft Diameter E	Thrust Bearing Diameter E2	Namur Shaft Flats F	Namur Flat Length G	Namur Bolt Pattern T1	Namur Bolt Pattern U1
0600	1.18	2.17	2.56	1.42	0.39	5.118	1.181
0950	1.18	2.17	2.56	1.42	0.39	5.118	1.181
1600	1.18	2.52	2.95	1.42	0.39	5.118	1.181
2500	1.18	2.17	2.56	1.42	0.39	5.118	1.181
4000	1.18	2.52	3.15	1.42	0.39	5.118	1.181

ACTUATORS AND CONTROLS

Rack & Pinion Actuator

TORQUE OUTPUT OF DOUBLE ACTING RACK & PINION ACTUATORS (IN - LB)

Actuator Size	Supply Pressure (psi)										
	40	45	50	55	60	70	75	80	90	100	120
AD0600	2986	3366	3747	4127	4507	5267	5647	6028	6788	7548	9069
AD0950	4458	5025	5593	6160	6728	7862	8430	8997	10132	11267	13537
AD1600	7369	8307	9245	10183	11121	12998	13936	14874	16750	18626	22379
AD2500	11825	13270	14768	16267	17847	20858	22363	23869	26880	29891	35912
AD4000	19962	22495	25035	27576	30127	35210	37751	40293	45375	50458	60623

TORQUE OUTPUT OF SPRING RETURN RACK & PINION ACTUATORS (IN - LB)

Actuator Size	Spring Set	Spring Stroke		Air Stroke Supply Pressure (psi)									
				40		60		80		100		120	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
AS0600	2	1723	1082	1920	1183	3531	2794	5142	4405	6753	6016	8364	7628
	3	2585	1624	1298	193	2909	1804	4520	3415	6131	5026	7742	6637
	4	3446	2165	-	-	2287	814	3898	2425	5509	4036	7120	5647
	5	4308	2706	-	-	-	-	3276	1434	4887	3046	6498	4657
	6	5169	3247	-	-	-	-	2654	444	4265	2055	5876	3666
AS0950	2	2563	1587	2898	1777	5303	4182	7708	6587	10113	8992	12518	11397
	3	3844	2381	1986	304	4391	2709	6796	5114	9201	7519	11606	9924
	4	5125	3175	-	-	3479	1236	5884	3641	8288	6046	10693	8451
	5	6407	3968	-	-	-	-	4971	2168	7376	4573	9781	6978
	6	7688	4762	-	-	-	-	4059	695	6464	3100	8869	5505
AS1600	2	4193	2646	4765	2988	8741	6964	12716	10939	16692	14915	20668	18890
	3	6289	3970	3244	578	7220	4554	11196	8530	15171	12505	19147	16481
	4	8385	5293	-	-	5699	2145	9675	6120	13650	10096	17626	14071
	5	10481	6616	-	-	-	-	8154	3711	12129	7686	16105	11662
	6	12578	7939	-	-	-	-	6633	1301	10608	5277	14584	9252
AS2500	6	7013	4401	6881	4278	12875	10273	18869	16267	24863	22261	30858	28255
	8	9351	5868	5251	1781	11245	7775	17239	13769	23233	19764	29228	25758
	10	11689	7335	-	-	9615	5278	15609	11272	21603	17266	27597	23260
	12	14026	8803	-	-	7985	2780	13979	8774	19973	14768	25967	20763
	14	16364	10270	-	-	-	-	12349	6277	18343	12271	24337	18265
AS4000	6	11835	7429	11701	7310	21862	17472	32024	27633	42185	37795	52347	47956
	8	15780	9905	8949	3096	19111	13257	29272	23419	39434	33580	49595	43742
	10	19725	12381	-	-	16359	9042	26521	19204	36682	29365	46844	39527
	12	23670	14857	-	-	13608	4828	23770	14989	33931	25150	44093	35312
	14	27615	17333	-	-	-	-	21018	10774	31180	20936	41341	31097

▶STANDARD

ACTUATORS AND CONTROLS

Technical Data – AD and AS (Sizes 0600 to 4000)

Double Acting	AD0600	AD0950	AD1600	AD2500	AD4000
Weight (lbs)	43	58	95	125	191

Spring Return	AS0600	AS0950	AS1600	AS2500	AS4000
Weight (lbs)	61	85	145	194	291

Displacement (cu in.)		AD0600	AD0950	AD1600	AD2500	AD4000
		AS0600	AS0950	AS1600	AS2500	AS4000
Port A	CCW	177	287	445	488	824
Port B	CW	189	299	488	568	1068

Air consumption (scf per 90°) = (Displacement/1728)*(Supply Pressure + 14.7)/14.7

Operating Time	AD0600 AS0600	AD0950 AS0950	AD1600 AS1600	AD2500 AS2500	AD4000 AS4000
Seconds	4.5	5.4	6.9	7	12

SELECTING/SIZING APOLLO RACK & PINION ACTUATORS

Establish the valve operating torque beginning with the torque constants for the appropriate pressure and valve as found on pages 49-51. Use the torque adjustment factors found on page 52 to arrive at an in-service torque. Multiple adjustment factors may be required. Do not forget to include adjustments for graphite stem packing.

FOR DOUBLE ACTING ACTUATORS

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

FOR SPRING RETURN ACTUATORS

Considering the available air supply, select an actuator where both the Spring-Ending torque figure and the Air-Ending torque figure exceeds the in-service torque by at least 10%.

Note: Single-Stop actuators are appropriate for use on ball valves. Dual-Stop actuators are required for most butterfly valve applications but may also be used on ball valves.

How to Order Apollo Pneumatic Rack & Pinion Actuators – AD and AS (Sizes 0600 to 4000)

APOLLO RACK & PINION NUMBERING SYSTEM

A	S	1600	N	04	1	A	F
PREFIX	ACTION	SIZE	SEAL OPTION	SPRING SET	LIMIT STOP	INSERTS	"AS" MODEL ONLY
A	D = DOUBLE ACTING S = SPRING RETURN K = KIT	0600 0950 1600 2500* 4000*	N = NITRILE (Normal temp range, -4° to 175°F) H = FLOUROCARBON (High temp range, -4° to 250°F) L = SILICONE (Low temp range, -40° to 175°F)	00 (DA) 01 02 03 04 05 06 07 08 10 12 14	0 = None** (Std. on sizes 0012, 2500, & 4000) 1 = Single Adjustable Limit Stop (For sizes 0025 thru 1600 only) 2 = Dual Adjustable Limit Stops (For sizes 0025 thru 1600 only)	A = STANDARD SQUARE B = WITHOUT	Add Suffix "F" if spring-to-open (i.e. fail open), otherwise, leave blank

* No insert adapter options

** Optional double stroke adjustment plate is available for 2500 & 4000 (see price list)

ACTUATORS AND CONTROLS

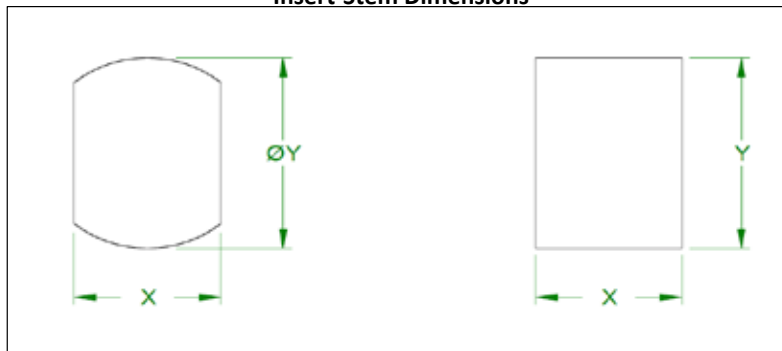
Acuator Inserts – AD and AS (Sizes 0025 to 1600)

Actuator	Item Number	Description	Fits Stems of the Following Dimensions			
			Imperial (in)		Metric (mm)	
			X-Dimension	Y-Dimension	X-Dimension	Y-Dimension
AD/AS 0025	CX04573	ADAPTER, 11MM SQ	0.433	0.433	11	11
	CX04549	ADAPTER, 0.500DIA X 0.397FLAT,	0.394	Ø0.500	10	Ø13
	CX04684	ADAPTER,BLANK				
AD/AS 0040/0065	CX04620	ADAPTER, 77D104 TO AD/AS 0040,0065; 7MM SQ.	0.28	0.28	7	7
	CX04550	ADAPTER, 0.555DIA X 0.397FLAT,	0.394	Ø0.55	10	Ø14
	CX04570	ADAPTER, 11MM SQ,ALUM,77D105 TO	0.433	0.433	11	11
	CX04551	ADAPTER, 0.625DIA X 0.476FLAT,	0.476	Ø0.627	12	Ø16
	CX04580	ADAPTER, 14MM SQ,	0.551	0.55	14	14
	CX04552	ADAPTER, 0.751DIA X 0.555FLAT,	0.551	Ø0.748	14	Ø19
	CX04675	ADAPTER,BLANK				
AD/AS 0100	CX04553	ADAPTER, 0.397DIA X 0.524FLAT,	0.394	0.524	10	Ø13
	CX04554	ADAPTER, 0.625DIA X 0.475FLAT,	0.476	Ø0.627	12	Ø16
	CX04623	ADAPTER, 14MM SQ	0.551	0.55	14	14
	CX04555	ADAPTER, 0.750DIA X 0.555FLAT,	0.551	Ø0.748	14	Ø19
	CX04584	ADAPTER, 17MM SQ	0.669	0.669	17	17
	CX04569	ADAPTER, 19MM (0.748 SQ.)	0.748	0.748	19	19
	CX04685	ADAPTER,BLANK				
AD/AS 0150/0200/0350/0600	CX04556	ADAPTER, 0.628DIA X 0.376FLAT,	0.375	Ø.628	9.5	Ø16
	CX04720	ADAPTER, 11MM SQ	0.433	0.433	11	11
	CX04558	ADAPTER, 0.475DIA X 0.650RECT,	0.475	0.65	12	17
	CX04572	ADAPTER, 77D107-108 TO	0.551	0.551	14	14
	CX04566	ADAPTER, 0.750DIA X 0.555FLAT,	0.551	Ø0.748	14	Ø19
	CX04560	ADAPTER, 0.673 X 0.886RECT,	0.669	0.875	17	22
	CX04571	ADAPTER, 19MM	0.748	0.748	19	19
	CX04581	ADAPTER, 22MM	0.87	0.87	22	22
	CX04559	ADAPTER, 0.869DIA X 1.18RECT,	0.87	1.18	22	30
	CX04557	ADAPTER, 1.250DIA X 0.949FLAT,	0.95	Ø1.25	24	Ø32
	CX04582	ADAPTER, 27MM	1.063	1.063	27	27
	CX04686	ADAPTER,BLANK				
	CX04567	ADAPTER, 0.673 X 0.886RECT,	0.669	0.886	17	22.5
AD/AS 0950	CX04562	ADAPTER, 1.125DIA X 0.870FLAT,	0.87	Ø1.127	22	Ø29
	CX04561	ADAPTER, 1.250DIA X 0.949FLAT,	0.95	Ø1.25	24	Ø32
	CX04622	ADAPTER, 36MM SQ	1.417	1.417	36	36
	CX04563	ADAPTER,BLANK				
	CX04568	ADAPTER, 1.250DIA X 0.870FLAT,	0.87	Ø1.127	22	Ø29
AD/AS 1600	CX04564	ADAPTER, 1.248DIA X 0.950FLAT,	0.95	Ø1.25	24	Ø32
	CX04565	ADAPTER,BLANK				
AD/AS 0150/0200/0350/0600 (Fits HPBFVs)	CX04680	CLASS 150/300 2"HPBFV (.356 x .490)	0.354	0.49	9	12.5
	CX04714	CLASS 150/300 2-1/2" & 3" HPBFV (.434 x .580)	0.433	0.55	11	14
	CX04681	CLASS 150/300 4"HPBFV (.553 x .725)	0.551	0.725	14	18
	CX04682	CLASS 150/300 5"&6" HPBFV (.671 x .890)	0.669	0.886	17	22.5
	CX04683	CLASS 150 8" HPBFV (.750 x .1.01)	0.748	1.01	19	25.5

Notes:

1. Inserts for optional stem sizes or when the actuator is ordered without a factory installed insert.
2. Contact factory for additional configurations and pricing.

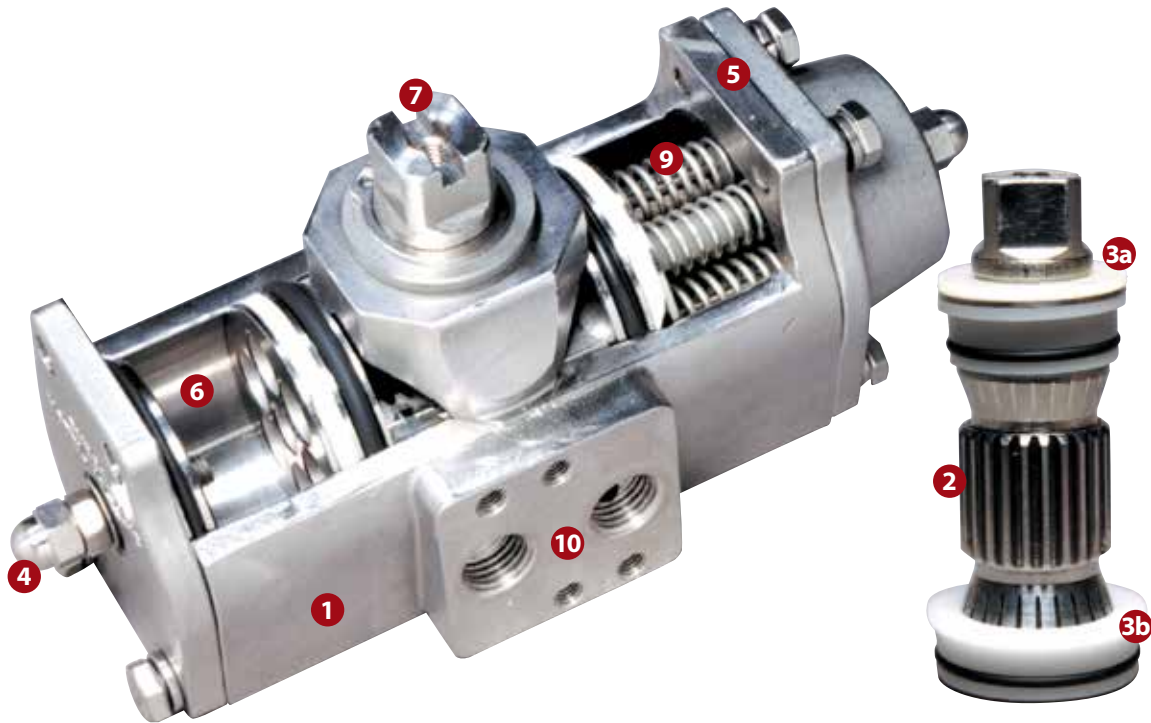
Insert-Stem Dimensions



ACTUATORS AND CONTROLS

"Acutorque" Stainless Steel Actuator

DESIGN AND CONSTRUCTION



1. INVESTMENT CAST BODY

Assures manufacturing of other special alloys, such as Monel

2. UNIQUE DRIVE PINION

One piece stainless steel alloy shaft, precision machined gear and teeth for precise control

3. BEARINGS

Replaceable top and bottom TFE Pinion Bearings to ensure low friction, stability above 400°F, and chemical resistance

4. TRAVEL STOPS

Provides +/-4° travel adjustment in outboard direction

5. ACCESSORY MOUNTING

Manufactured to NAMUR to provide international standardized mounting

6. STAINLESS STEEL PISTONS

Precision cast pistons are guided through full face engagement with the pinion and piston guide

7. NAMUR SLOTTED SHAFT

Standard to provide a self-centering positive drive for positioners, a variety of switches

8. ACTUATOR MOUNTING

Manufactured in accordance with ISO 5211 to ensure mounting the actuator directly on valves

9. PRE-LOADED CARTRIDGES

Converts a standard double acting actuator to a spring return unit by simply removing the end caps and adding the spring cartridges

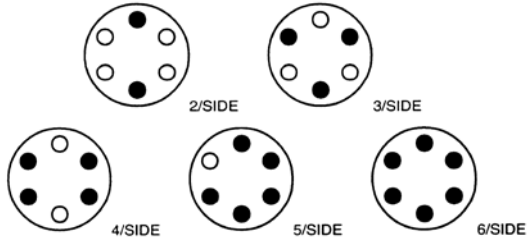
10. NAMUR SOLENOID MOUNTING

International standard for direct mounting of solenoid valves

ACTUATORS AND CONTROLS

Operation – “Acutorque” Stainless Steel Actuator

The Apollo® Acutorque actuator is manufactured with an integral and internal air manifold. The solenoid mounting pad is manufactured to Namur dimensional standards as to allow for the direct mounting of various manufacturers' solenoid valves and other flow control devices. For applications not requiring a direct mount solenoid valve, ports are tapped to NPT standards (American National Standard taper threads).

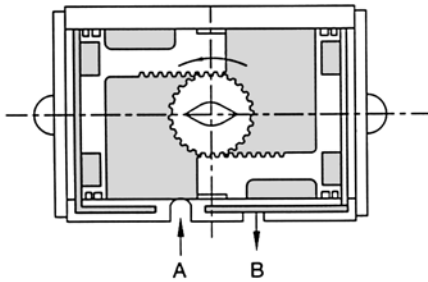


REVERSE ROTATION

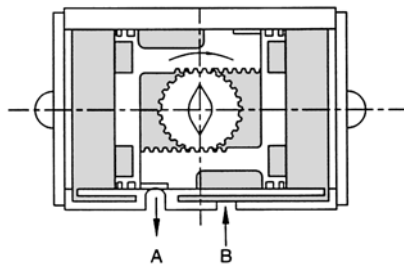
When required, a clockwise rotation of the drive pinion, by means of air to PORT A can be achieved by reversing the pistons inside the actuator body (rotate 180 degrees).

SPRING CONFIGURATION

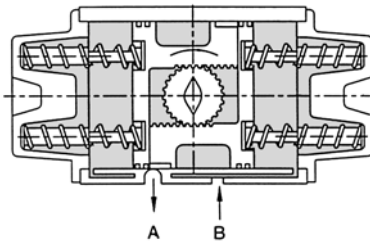
Each Acutorque actuator comes with a complete spring pack (6 springs per side with nylon retainers) unless otherwise specified. When less than the full spring pack is desired for various torque outputs (see torque chart); springs can be removed from the actuator end caps. It is very important that springs can be arranged in a symmetrical manner (positioned as shown) so that unwarranted side-load does not occur between the pistons and actuator body. *CAUTION: Refer to operation and maintenance instructions before disassembly and removal of springs.*



Air to PORT A: Pressure applied enters center of chamber forcing the pistons outward and rotating the drive pinion in a counter-clockwise direction and forcing exhaust air out of PORT B.



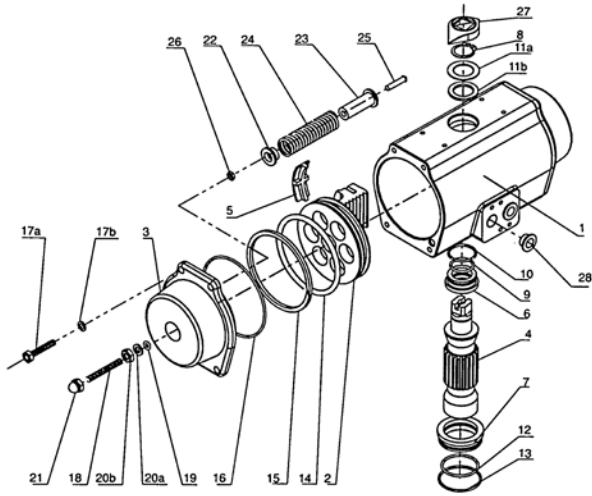
Air to PORT B: Air pressure enters the outer chambers forcing the pistons inward and rotating the drive pinion in a clockwise direction while forcing exhaust air out of PORT A.



Loss of air pressure in the center chamber allows energy in the compressed springs to force the pistons inward, resulting in a clockwise rotation of the drive pinion while exhaust air leaves via PORT A.

ACTUATORS AND CONTROLS

Features – “Acutorque” Stainless Steel Actuator



CORROSION RESISTANCE

All metal components are cast or machined from Stainless Steel or Monel, which offers excellent resistance to most corrosive chemicals as well as industrial atmospheres.

NO LUBRICATION

All actuators are factory lubricated for the optimum life of the actuator under normal conditions. Teflon® piston bearings are used because of their self-lubricating properties.

SIMPLE MAINTENANCE

Each actuator is designed for ease of maintenance. Should you wish to change a spring rating or completely rebuild a unit, total disassembly and reassembly is easily performed in just minutes with standard shop tools.

ISO/NAMUR MOUNTING

By using ISO/Namur standards, our actuators lend themselves to a host of various manufacturers' direct mount accessories. Solenoid valves, limit switches, positioners, etc. bolt directly to the actuator and in turn reduces the cost of assembly and installation of automated packages. Flexibility for future system modifications is greatly enhanced.

QUALITY

Each part of the actuator must pass a stringent quality test before it can be incorporated into an assembly. All materials used in construction must be certified and tested to prove their proper composition. Every cast part must pass an X-ray test before proceeding to the machining process. After machining, every part is dimensionally evaluated to assure it meets acceptable tolerance.

SAFETY

All actuator bodies and end caps are investment cast stainless steel, rugged and built to last. It may be argued that the mechanical properties of stainless steel permit the ability to use this wall tubing in the construction of an actuator. However, that is not the case with our actuator. Thick wall castings mean protection for actuator internal porting and components as well as maintenance and operating personnel. Our unique drive pinion design ensures blowout proof protection. Spring retainers are incorporated to allow safe removal of end caps during spring torque rating change or rebuild process.

GRADE OF STAINLESS STEEL

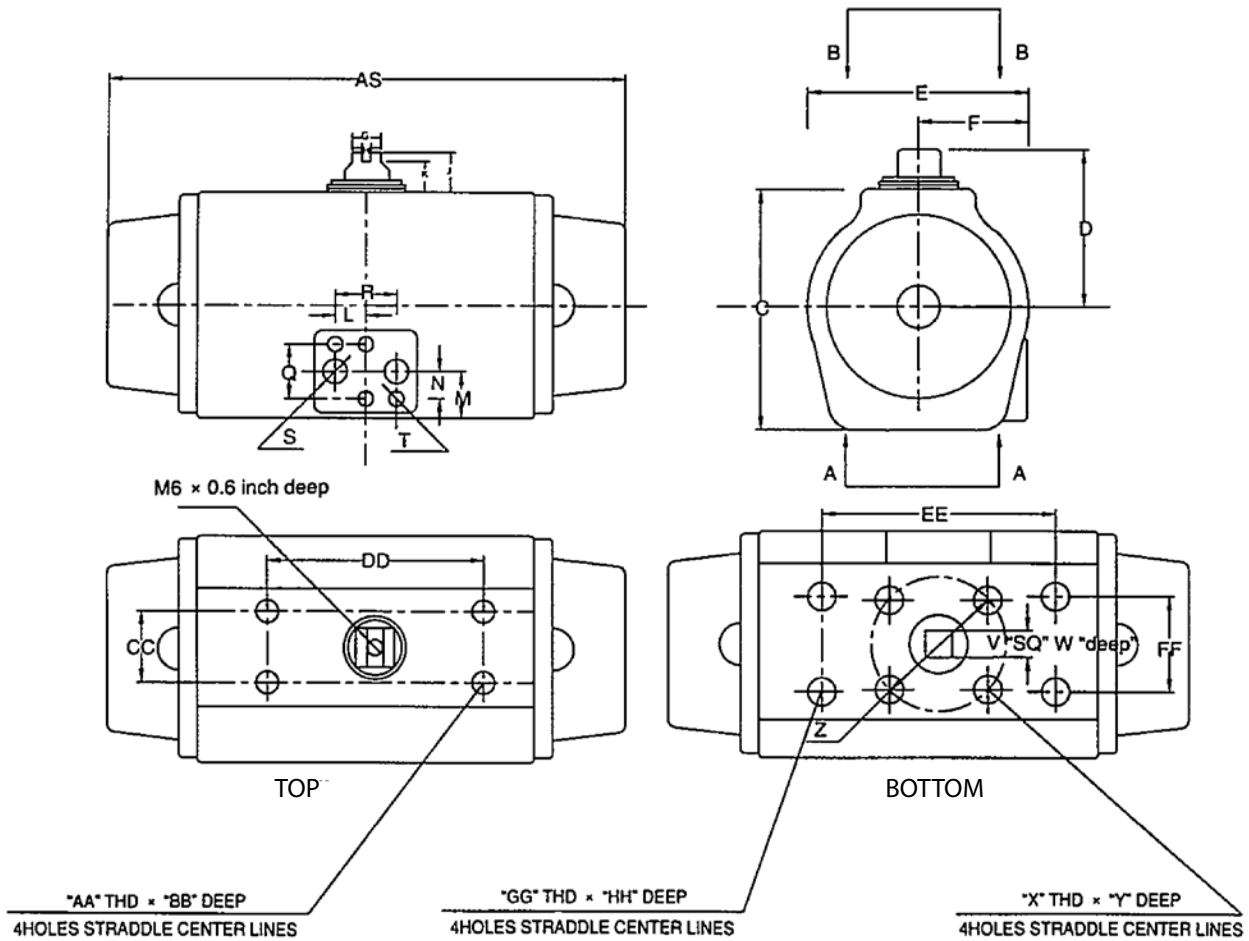
Body & End Caps	304
Shaft	17-4 ph
Piston	303
Bolts	18-8

Part	Qty	Material
1 Body	1	304 Stainless Steel
2 Piston	2	303 Stainless Steel
3 End Caps-Double Acting	2	Stainless Steel
4 Drive Pinion	1	17-4 Stainless Steel
5 Guide Bearing Plate	2	Nylon 6
6 Pinion Bearing Top	1	Teflon
7 Pinion Bearing Bottom	1	Teflon
8 Snap Ring	1	Stainless Steel
9 O-Ring-Inner Top	1	Viton
10 O-Ring-Outer Top	1	Viton
11a Washer	1	Stainless Steel
11b Bearing	1	Nylon 6
12 O-Ring-Inner Bottom	1	Viton
13 O-Ringer-Outer Bottom	1	Viton
14 O-Ring-Piston	2	Viton
15 Bearing-Piston	2	Nylon 6

Part	Qty	Material
16 O-Ring-End Cap	2	Nitrile
17a Bolts-End Cap	8	Stainless Steel
17b Spring Bearing	8	Stainless Steel
18 Adjusting Travel Stop	2	Stainless Steel
19 O-Ring-Travel Stop	2	Nitrile
20a Washer	2	Stainless Steel
20b Nut-Travel Stop	2	Stainless Steel
21 End Nut-Travel	2	Stainless Steel
22 Spring Retainer (S)	*	Nylon 6
23 Spring Retainer (L)	*	Nylon 6
24 Spring	*	Plated CS
25 Spring Screw	*	Stainless Steel
26 Spring Nut	*	Stainless Steel
27 Positioner Indicator	1	Nylon
28 Plug	2	Nylon 6

ACTUATORS AND CONTROLS

Dimensional Data – "Acutorque" Stainless Steel Actuator



MOUNTING DIMENSIONS

Model		R	S	T	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH
3SD04500	mm	24	1/4"NPT	M5	11	15	M5	8	42	M5	6	30	80	88.9	31.75	M5	8
3SS04560	in	0.95	1/4"NPT	M5	0.4	0.59	M5	0.31	1.65	M5	0.24	1.18	3.15	3.5	1.25	M5	0.31
3SD06000	mm	24	1/4"NPT	M5	14	15	M6	8	50	M5	6	30	80	88.9	31.75	M6	8
3SS06060	in	0.95	1/4"NPT	M5	0.55	0.59	M6	0.31	1.97	M5	0.24	1.18	3.15	3.5	1.25	M6	0.31
3SD08500	mm	24	1/4"NPT	M5	19	17	M8	12	70	M5	6	30	80	114	38	M8	12
3SS08560	in	0.95	1/4"NPT	M5	0.75	0.68	M8	0.47	2.75	M5	0.24	1.18	3.15	4.5	1.5	M8	0.47
3SD10500	mm	24	1/4"NPT	M5	19	20	M8	12	70	M5	6	30	80	114	38	M8	12
3SS10560	in	0.95	1/4"NPT	M5	0.75	0.79	M8	0.47	2.75	M5	0.24	1.18	3.15	4.5	1.5	M8	0.47
3SD12500	mm	24	1/4"NPT	M5	22	30	M8	18	102	M5	8	30	130	NA	50.8	NA	NA
3SS12560	in	0.95	1/4"NPT	M5	0.87	1.2	M8	0.71	4.02	M5	0.31	1.18	5.12	NA	2	NA	NA
3SD14000	mm	24	1/4"NPT	M5	22	27	M10	18	102	M5	8	30	130	NA	50.8	NA	NA
3SS14060	in	0.95	1/4"NPT	M5	0.87	1.06	M10	0.71	4.02	M5	0.31	1.18	5.12	NA	2	NA	NA
3SD17000	mm	24	1/4"NPT	M5	32	36	M12	24	125	M5	8	30	130	NA	76	NA	NA
3SS17060	in	0.95	1/4"NPT	M5	1.26	1.42	M12	0.95	4.92	M5	0.31	1.18	5.12	NA	3	NA	NA
3SD21000	mm	24	1/4"NPT	M5	36	43	M20	28	140	M5	8	30	130	NA	76	NA	NA
3SS21060	in	0.95	1/4"NPT	M5	1.42	1.69	M20	1.1	5.51	M5	0.31	1.18	5.12	NA	3	NA	NA

ACTUATORS AND CONTROLS

Envelope Dimensions – “Acutorque” Stainless Steel Actuator

DIMENSIONS

Model		AS	C	D	E	F	G	H	J	K	L	N	M	Q
3SD04500	mm	168	65	52.5	62.5	35	16	4	20	10	12	16	23	32
3SS04560	in	6.61	2.56	2.07	2.46	1.38	0.63	0.16	0.79	0.39	0.47	0.63	0.91	1.26
3SD06000	mm	180	81	60.5	74	39	16	4	20	10	12	16	23	32
3SS06060	in	7.09	3.19	2.38	2.91	1.54	0.63	0.16	0.79	0.39	0.47	0.63	0.91	1.26
3SD08500	mm	222	108	74	100.5	52	16	4	20	10	12	16	24	32
3SS08560	in	8.74	4.25	2.91	3.96	2.05	0.63	0.16	0.79	0.39	0.47	0.63	0.95	1.26
3SD10500	mm	290	133	86.5	117	58.5	16	4	20	10	12	16	30	32
3SS10560	in	11.42	5.24	3.41	4.61	2.3	0.63	0.16	0.79	0.39	0.47	0.63	1.18	1.26
3SD12500	mm	390	155	110.2	136	68	20	4	30.5	10.5	12	16	40	32
3SS12560	in	15.5	5.02	3.59	5.65	2.91	0.79	0.16	1.2	0.41	0.47	0.63	1.57	1.26
3SD14000	mm	420	176	116.5	156	79	20	4	30.5	10.5	12	16	40	32
3SS14060	in	16.54	6.93	4.59	6.14	3.11	0.79	0.16	1.2	0.41	0.47	0.63	1.57	1.26
3SD17000	mm	538	210	131.5	193	98	20	4	30.5	10.5	12	16	50	32
3SS17060	in	21.18	8.27	5.18	7.6	3.86	0.79	0.16	1.2	0.41	0.47	0.63	1.97	1.26
3SD21000	mm	698	258	156	236	120	32	4	30.5	10.5	12	16	68	32
3SS21060	in	27.48	10.16	6.14	9.29	4.72	1.26	0.16	1.2	0.41	0.47	0.63	2.68	1.26

Technical Data – “Acutorque” Stainless Steel Actuator

Acuator Model	Volume (in ³ per 90° cycle)	Air Consumption (scf per 90° rotation)*	
		CW	CCW
3SS045X0	45	8.5	6.5
3SS060X0	60	17.5	14.8
3SS085X0	85	36.5	24.5
3SS105X0	105	72	49.3
3SS125X0	125	196	147
3SS140X0	140	358	278
3SS170X0	170	542	382
3SS210X0	210	753	470

Acuator Model	Weight (lbs)
3SS045X0	9
3SS060X0	16
3SS085X0	23
3SS105X0	37
3SS125X0	52
3SS140X0	75
3SS170X0	188
3SS210X0	258

Notes: *Temperature and atmospheric conditions could change values above.

Double Acting Torque – “Acutorque” Stainless Steel Actuator

Actuator Model	Torque (Inch/Lbs) vs. Air Supply Pressure (PSI)					
	40	60	80	100	120	150
3SD04500	74	116	152	199	239	289
3SD06000	151	234	328	413	499	600
3SD08500	365	548	732	915	1097	1315
3SD10500	701	1068	1436	1829	2184	2632

Actuator Model	Torque (Inch/Lbs) vs. Air Supply Pressure (PSI)					
	40	60	80	100	120	150
3SD12500	1355	2069	2759	3449	4115	5168
3SD14000	2018	3032	4039	5046	6056	6615
3SD17000	2868	4050	5324	6640	7987	10042
3SD21000	5328	8462	11188	13884	16709	20929

ACTUATORS AND CONTROLS

Spring Return Torque – “Acutorque” Stainless Steel Actuator

Actuator Model	Spring Set#*	Spring Stroke		Torque (Inch/Lbs) vs. Air Supply Pressure (PSI)											
				40		60		80		100		120		150	
		0	90	0	90	0	90	0	90	0	90	0	90	0	90
3SS045X0	2	34	21	56	43	98	84	136	121	178	162	220	203	256	230
	3	49	29	45	24	88	65	126	93	165	142	204	179	238	204
	4	71	43			72	42	115	90	154	126	196	163	218	175
	5	88	52					109	76	147	109	182	184	209	156
	6	107	64					97	58	135	91	172	103	190	129
3SS060X0	2	61	37	101	79	167	140	237	214	304	278	369	345	435	399
	3	93	55	84	48	147	107	219	185	284	248	352	315	405	350
	4	124	75			129	77	203	157	268	219	331	276	380	315
	5	156	93			110	45	187	131	250	189	315	250	359	272
	6	186	112					171	102	233	158	296	218	335	228
3SS085X0	2	172	93	275	206	450	369	645	572	821	744	999	919	1175	1065
	3	257	139	236	126	403	281	602	493	773	661	949	884	1105	945
	4	343	185			354	192	558	414	729	574	901	743	1042	825
	5	428	232					516	303	683	490	853	651	975	705
	6	515	288					473	258	636	405	800	564	915	580
3SS105X0	2	325	182	527	394	852	703								
	3	483	256	443	246	759	537	1137	939						
	4	643	358			665	369	1051	790	1374	1099	1703	1413	1975	1570
	5	805	447			556	119	974	641	1291	934	1615	1241	1852	1340
	6	964	537					888	493	1195	777	1519	1077	1705	1100
3SS125X0	2	628	343	1025	730	1724	1435								
	3	945	510	860	425	1545	1118	2310	1864						
	4	1259	687			1370	806	2068	1480	2720	2158	3333	2450	4166	3062
	5	1579	865			1199	483	1875	1160	2545	1835	3157	2185	3947	2728
	6	1895	1040					1690	850	2371	1528	2915	1846	3628	2310
3SS140X0	2	905	520	1478	1092	2469	2088								
	3	1355	780	1215	642	2210	1639	3195	2620						
	4	1808	1035			1956	1197	2935	2180	3960	3175	5000	4000	6250	5010
	5	2257	1301			1692	739	2680	1750	3700	2748	4608	3425	5760	4290
	6	2708	1562					2441	1279	3444	2290	4280	2852	5362	3568
3SS170X0	2	1227	738	1985	1494	3411	2923								
	3	1830	1092	1824	1087	3045	2347	3945	3626						
	4	2417	1446			2695	1713	4012	3035	4307	4291	6305	5221	7890	6526
	5	3044	1811			2329	1104	3647	2417	4934	3700	6000	4608	7495	5760
	6	3653	2166					3295	1817	4579	3093	5719	3750	7149	4680
3SS210X0	2	2425	1388	4080	2988	7149	6112								
	3	3640	2080	3388	1831	6456	4899	9205	7626						
	4	4857	2769			5750	3675	8510	6438	11150	9082	9231	12900	16100	12835
	5	6060	3465			5070	2475	7772	5224	10400	5160	7835	12000	15000	11030
	6	7270	4165					7125	4010	9700	4238	6616	10909	13650	9150

* X in Actuator Model is Spring Set

ACTUATORS AND CONTROLS

Scotch-Yoke Actuator

G SERIES



NAMUR

The shaft driven accessory interface conforms to the NAMUR standard and is identical on all G-Series actuators, allowing for standardization of accessory mounting hardware and installation practices

- Pneumatic and hydraulic scotch-yoke actuators
- Automates ball, butterfly, plug valves and any other 90° rotating mechanisms
- Salt Spray Testing per ASTM B117 criteria. Construction features prevent water ingress, allowing G-Series actuators to meet IP 66 and IP 67M specifications and severe high pressure water deluge test

OPERATING RANGES

G-Series double acting actuators produce guaranteed minimum torque outputs from 10,000 lb-in. up to 6,000,000 lb-in. The spring return units produce spring torques from 2,500 lb-in. to 3,000,000 lb-in.

- Standard operating pressures:
Pneumatic — to 200 psig (14 BAR)
- Standard operating temperature is -20°F to +200°F (-29°C to +93°C)
Optional trims available:
0°F to +350°F (-18°C to +177°C)
-50°F to +180°F (-46°C to +82°C)
- Mechanical and hydraulic manual overrides are available
- MSS and ISO Valve Mounting
The G-Series valve interface meets the dimensional requirements of MSS SP-101 or ISO 5211 defined for each torque range

DOUBLE ACTING G1 PNEUMATIC ACTUATOR TORQUE CHART

Apollo Model No.	Reference Number	Stroke Position	Operating Pressure (psig)											
			40	50	60	70	80	90	100	110	120	150	175	200
			Output Torque (In-Lbs)											
3TG100800	G01008	Start/End	12465	14543	16620	18698	20775	22853	24930	31163	36356	41550		
		Minimum			6579	7675	8772	9868	10965	12061	13158	16447	19188	21929
3TG100900	G01009	Start/End	10593	13241	15890	18538	21186	23835	26483	29131	31779	39724		
		Minimum	5591	6989	8386	9784	11182	12579	13977	15375	16772	20966		
3TG101000	G01010	Start/End	14046	17557	21069	24580	28092	31603	35115	38626				
		Minimum	7413	9266	11120	1973	14826	16680	18533	20386				
3TG101200	G01012	Start/End	20133	25166	30199	35232								
		Minimum	10626	13282	15938	18595								
3TG101400	G01014	Start/End	24482	30603	36723									
		Minimum	12921	16152	19382									

ACTUATORS AND CONTROLS

Torque Ratings G Series – Scotch-Yoke Actuator

All published torques are guaranteed minimum values.

G SERIES PNEUMATIC DOUBLE-ACTING ACTUATOR TORQUE CHART

Apollo Model No.	Reference Number	Stroke Position	Operating Pressure (psig)											
			40	50	60	70	80	90	100	110	120	150	175	200
			Output Torque (In-Lbs)											
3TG200900	G2009	Start/End				22441	25647	28852	32058	35264	38470	48087	56102	
		Minimum			11844	13536	15228	16920	18612	20304	25379	29609		
3TG201000	G2010	Start/End		21254	25504	29755	34006	38257	42507	46758	51009			
		Minimum		11217	13461	15704	17948	20191	22434	24678	26921			
3TG201200	G2012	Start/End	24371	30464	36556	42649	48742	54835	60927					
		Minimum	12862	16078	19294	22509	25725	28941	32156					
3TG201400	G2014	Start/End	29636	37046	44455	51864	59273							
		Minimum	15641	19552	23462	27373	31283							
3TG201600	G2016	Start/End	39118	48897	58677									
		Minimum	20646	25807	30968									
3TG301000	G3010	Start/End				35888	41015	46142	51269	56396	61523	76903	89721	102538
		Minimum				18941	21647	24353	27059	29764	32470	40588	47352	54117
3TG301200	G3012	Start/End		36847	44216	51585	58955	66324	73693	81063	88432			
		Minimum		19447	23336	27226	31115	35004	38894	42783	46672			
3TG301400	G3014	Start/End	35887	44859	53831	62803	71775	80747	89719	98690				
		Minimum	18941	23676	28411	33146	37881	42616	47351	52087				
3TG301600	G3016	Start/End	47430	59288	71145	83003	94860							
		Minimum	25033	31291	37549	43807	50065							
3TG302000	G3020	Start/End	75266	94082										
		Minimum	39724	49654										

SPRING RETURN G1 PNEUMATIC ACTUATOR TORQUE CHART

Apollo Model No.	Reference Number	Spring Torque (In-Lbs) Start/Min/End	Operating Pressure (psig)											
			40	50	60	70	80	90	100	110	120	150	175	200
			Output Torque Start/Min/End (In-Lbs)											
3TG100804	G01008-SR4	11614					5551	7628	9706	11783	13861	20093	25287	30481
		5708					2439	3543	4648	5752	6849	10138	12880	15621
		10015					3783	5861	7938	10016	12093	18326	23520	28713
3TG100904	G01009-SR4	11614			4820	7469	10117	12765	15414	18062	20710	28655		
		5708			2051	3459	4866	6271	7669	9066	10464	14657		
		10015			3053	5701	8350	10998	13646	16295	18943	26888		
3TG101004	G1010-SR4	11614		6488	10000	13511	17023	20534	24046	27557				
		5708		2938	4804	6664	8518	10371	12224	14078				
		10015		4721	4232	11744	15255	18767	22278	25790				
3TG101204	G01012-SR4	11614	9063	14096	19130	24163								
		5708	4306	6973	9630	12286								
		10015	7296	12329	17362	22395								
3TG101404	G01014-SR4	11614	13413	19534	25654									
		5708	6613	9843	13073									
		10015	11646	17766	23887									
3TG100803	G01008-SR3	13598						6048	8126	10203	12281	18513	23707	28901
		6605						2523	3631	4735	5839	9143	11884	14625
		11445						3669	5746	7824	9901	16434	21327	26521
3TG100903	G01009-SR3	13598				5889	8537	11185	13834	16482	19130	27075		
		6605				2437	3850	5257	6665	8071	9469	13662		
		11445				3509	6157	8806	11454	14102	16751	24695		
3TG101003	G01010-SR3	13598		4908	8420	11931	15443	18954	22466	25977				
		6605		1904	3787	5653	7520	9376	11229	13082				
		11445		2529	6040	9552	13063	16574	20086	23597				
3TG101203	G01012-SR3	13598	7483	12516	17550	22583								
		6605	3289	5964	8634	11291								
		11445	5104	10137	15170	20203								
3TG101403	G01014-SR3	13598	11833	17954	24074									
		6605	5601	8848	12078									
		11445	9453	15574	21695									

ACTUATORS AND CONTROLS

Torque Ratings G Series – Scotch-Yoke Actuator

SPRING RETURN G1 PNEUMATIC ACTUATOR TORQUE CHART (CONT.)

Apollo Model No.	Reference Number	Spring Torque (In-Lbs) Start/Min/End	Operating Pressure (psig)												
			40	50	60	70	80	90	100	110	120	150	175	200	
			Output Torque Start/Min/End (In-Lbs)												
3TG100802	G01008-SR2	15526									8443	10521	16753	21947	27141
		7352									3692	4796	8109	10857	13598
		13037									5692	7770	14002	19196	24390
3TG100902	G01009-SR2	15526					6777	9425	12074	14722	17370	25315			
		7352					2800	4214	5622	7029	8437	12635			
		13037					4026	6674	3923	11971	14619	22564			
3TG101002	G01010-SR2	15526			6660	10171	13683	17194	20706	24217					
		7352			2736	4611	6477	8348	10202	12055					
		13037			3909	7420	10932	14443	17955	21466					
3TG101202	G01012-SR2	15526	5723	10756	15789	20823									
		7352	2228	4922	7597	10264									
		13037	2972	8005	13039	18072									
3TG101402	G01014-SR2	15526	10073	16194	22314										
		7352	4559	7811	11051										
		13037	7322	13443	19563										
3TG100801	G01008-SR1	18470									8599	14831	20025	25219	
		8749									3364	6703	9463	12223	
		14776									4516	10748	15942	21136	
3TG100901	G01009-SR1	18470						7503	1152	12800	15448	23393			
		8749						2764	4207	5623	7030	11253			
		14776						3420	6069	8717	11365	19310			
3TG101001	G01010-SR1	18470			8249	11761	15272	18784	22295						
		8749			3174	5071	6937	8803	10669						
		14776			4166	7678	11189	14701	18212						
3TG101201	G01012-SR1	18470		8834	13868	18901									
		8749		3492	6190	8865									
		14776		4752	9785	14818									
3TG101401	G01014-SR1	18470	8151	14272	20392										
		8749	3121	6405	9658										
		14776	4068	10189	16309										

ACTUATORS AND CONTROLS

Torque Ratings G Series – Scotch-Yoke Actuator

SPRING-RETURN ACTUATOR

All published torques are guaranteed minimum values.

Apollo Model No.	Reference Number	Spring Torque (In-Lbs) Start/Min/End	Operating Pressure (psig)								
			40	50	60	70	80	90	100	110	120
			Output Torque Start/Min/End (In-Lbs)								
3TG200902	G2009-SR2	26818									14072
		12882									5964
		22074									8829
3TG201002	G2010-SR2	26818						13859	18810	22361	26611
		12882						5848	8110	10369	12628
		22074						8616	12866	17117	21368
3TG201202	G2012-SR2	26818			12159	18252	24344	30437	36530		
		12882			4926	8185	11423	14661	17896		
		22074			6915	13008	19101	25194	31286		
3TG201402	G2014-SR2	26818		12648	20057	27466	34875				
		12882		5191	9145	13082	17020				
		22071		7404	14814	22223	29632				
3TG201602	G2016-SR2	26818	14720	24500	34279						
		12882	6308	11506	16703						
		22074	9477	19256	29036						
3TG200901	G2009-SR1	30997									
		14742									
		25004									
3TG201001	G2010-SR1	30997							14871	19122	23373
		14742							5957	8249	10508
		25004							8248	12498	16749
3TG201201	G2012-SR1	30997					21106	27199	33291		
		14742					9303	12541	15779		
		25004					14482	20575	26668		
3TG201401	G2014-SR1	30997			16819	24228	31637				
		14742			7014	10962	14900				
		25004			10195	17604	25013				
3TG201601	G2016-SR1	30997		21261	31041						
		14742		9386	14583						
		25004		14638	24417						
3TG200904	G2009-SR4	20678						10155	13361	16567	19772
		9903						4185	5900	7603	9307
		16917						5998	9204	12410	15616
3TG201004	G2010-SR4	20678				11058	15308	19559	23810	28061	32311
		9903				4675	6935	9194	11453	13712	15956
		16917				6901	11152	15402	19653	23904	28155
3TG201204	G2012-SR4	20678		11766	17859	23952	30044	36137	42230		
		9903		5052	8290	11528	14760	17975	21191		
		16917		7609	13702	19795	25888	31980	38073		
3TG201404	G2014-SR4	20678	10939	18348	25757	33166	40575				
		9903	4610	8550	12488	16407	20318				
		16917	6782	14191	21600	29009	36419				
3TG201604	G2016-SR4	20678	20420	30200	39979						
		9903	9652	14842	20003						
		16917	16264	26043	35823						
3TG200903	G2009-SR3	24139								13833	17039
		11457								5833	7539
		19390								8584	11790
3TG201003	G2010-SR3	24139					12575	16826	21077	25327	29578
		11457					5150	7426	9685	11944	14203
		19390					7326	11577	15828	20078	24329
3TG201203	G2012-SR3	24139			15126	21219	27311	33404	39497		
		11457			6522	9760	12998	16236	19460		
		19390			9877	15970	22062	28155	34248		
3TG201403	G2014-SR3	24139		15615	23024	30433	37842				
		11457		6782	10720	14657	18587				
		19390		10366	17775	25184	32593				

ACTUATORS AND CONTROLS

Torque Ratings G Series – Scotch-Yoke Actuator

SPRING-RETURN ACTUATOR (CONT.)

Apollo Model No.	Reference Number	Spring Torque (In-Lbs) Start/Min/End	Operating Pressure (psig)								
			40	50	60	70	80	90	100	110	120
			Output Torque Start/Min/End (In-Lbs)								
3TG201603	G2016-SR3	24139	17687	27467	37246						
		11457	7883	13081	18273						
		19390	12438	22218	31997						
3TG301002	G3010-SR2	49017									20655
		22571									6848
		36975									7346
3TG301202	G3012-SR2	49017						25456	32826	40195	47564
		22571						9568	13568	17516	21433
		36975						12147	19516	26886	34255
3TG301402	G3014-SR2	49017			21936	30907	39879	48851	57823		
		22571			7591	12527	17349	22117	26885		
		36975			8626	17598	26570	35542	44514		
3TG301602	G3016-SR2	49017		30278	42135	53993					
		22571		12185	18548	24849					
		36975		16968	28826	40683					
3TG302002	G3020-SR2	49017	34398	53215							
		22571	14422	24436							
		36975	21089	39905							
3TG301001	G3010-SR1	54045									
		25307									
		42224									
3TG301201	G3012-SR1	54045						27024	34394	41763	
		25307						10497	14497	18420	
		42224						13960	21329	28698	
3TG301401	G3014-SR1	54045				25106	34078	43050	52022		
		25307				9456	14326	19104	23873		
		42224				12041	21013	29985	38957		
3TG301601	G3016-SR1	54045		24476	36334	48191					
		25307		9107	15535	21837					
		42224		11412	23269	35127					
3TG302001	G3020-SR1	54045	28597	47413							
		25307	11351	21423							
		42224	15532	34349							
3TG301004	G3010-SR4	36568						19695	24822	29949	
		17123						7867	10637	13361	
		28566						10851	15978	21105	
3TG301204	G3012-SR4	36568			20012	27381	34751	42120	49489	56858	
		17123			8038	11996	15913	19830	23746	27663	
		28566			11168	18537	25906	33276	40676	48014	
3TG301404	G3014-SR4	36568		22258	31239	40201	49173	58145	67117		
		17123		9257	14042	18810	23578	28347	33089		
		28566		13414	22385	31357	40329	49301	58273		
3TG301604	G3016-SR4	36568	15857	27714	39572	51429	63287				
		17123	5764	12174	18475	24777	31068				
		28566	7013	18870	30728	42585	54443				
3TG301003	G3010-SR3	42128								20609	25735
		19573								7746	10528
		32379								9833	14960
3TG301203	G3012-SR3	42128				23167	30537	37906	45275	52645	
		19573				9135	13115	17032	20949	24865	
		32379				12392	19761	27130	34500	41869	
3TG301403	G3014-SR3	42128		18044	27016	35988	44960	53931	62903		
		19573		6305	11223	16012	20781	25549	30317		
		32379		7268	15240	25212	34184	43156	52127		
3TG301603	G3016-SR3	42128		23501	35358	47216	59073				
		19573		9315	15678	21980	28282				
		32379		12725	24582	36440	48297				
3TG302003	G3020-SR3	42128	39479	58295							
		19573	17868	27868							
		32379	28703	47519							

