



Instruction Manual

CVS Rack and Pinion Pneumatic Actuator

Introduction

These instructions apply specifically to the CVS Rack and Pinion pneumatic actuator. This manual provides sizing, maintenance, operation, installation, and parts ordering information. These actuators may be equipped with valve bodies, ball valves and accessories. Please refer to the appropriate instruction manuals.

The CVS Rack and Pinion Actuator has been designed, developed and tested utilizing the latest technology, and materials. This design is a rugged, reliable, high quality performer. The materials used allow for excellent corrosion protection. This design matches up to the latest global specifications; Full conformance to the latest specifications: ISO 5211, DIN 3337 and VDI/VDE 3845 NAMUR for product interchangeability and easy mounting of solenoids, limit switches and other accessories.

CONSTRUCTION/FEATURES

The CVS Rack and Pinion Pneumatic Actuator is constructed of a hard anodized, extruded aluminum body, with both internal and external corrosion protection.

This design utilizes a dual piston rack and pinion for compact construction, symmetrical mounting, high cycle life, and fast operation. Reverse rotation can be easily accomplished in the field by simply inverting the pistons.

Two independent external travel stop adjustments permit an easy and precise adjustment of $\pm 5^\circ$ in both the open and closed positions for accurate valve alignment.

A Universal and anti-blowout patented drive shaft, with easy conversion from parallel to diagonal square mounting positions.

A compact design with identical body and end caps for double acting and spring return models. This allows for easy field conversion, by adding or removing the modular spring cartridge.

These units come furnished with a multi-function position indicator with NAMUR slot. This slot aids as a visual indicator, allowing for easy installation, accommodates all accessories, and the most popular sensors.

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CONSTRUCTION/FEATURES

Multiple bearings with guides on racks, pinion shaft and pistons allow for precise operation, low friction, and high cycle life.

Modular coated preloaded spring cartridge design allows for simple torque range adjustment, greater safety and corrosion resistance.

Fully machined teeth on piston rack and pinion allows for minimum backlash and pinion engagement for maximum efficiency.

The Pinion is constructed from a high precision nickel alloy steel. It features a single piece blowout resistant design that is safe and has a high life cycle.

Quality bearings and seals were selected for low friction, high cycle life and a wide operating temperature range.

Internal and external stainless steel fasteners provide long term corrosion resistance.

QUALITY MANUFACTURING

The CVS Rack and Pinion actuator is manufactured under a quality system independently assessed and approved to ISO 9001: ISO 5211, DIN 3337 and VDI/VDE 3845 NAMUR.

Every actuator is factory tested and provided with a serial number for traceability.

Each actuator is packed in a special cardboard carton with a full description of the product for easy identification.

AVAILABLE ACCESSORIES

- Connector Brackets
- Couplings
- Solenoid valves
- Limit Switch boxes
- Proximity sensors
- Positioners

SPECIFICATIONS

Position indication:

The Actuator/Valve position is shown via a color-coded insert and NAMUR slot. The indicator is suitable for either direction of actuator rotation, and drive shaft size.

Actuator drive:

The NAMUR drive slot on the position indicator permits direct drive engagement of switch boxes and positioners.

Direct mounting of sensors:

The indicator can be supplied with metal inserts to allow for easy installation of many types of sensors.

Operating media:

Dry or lubricated air or inert/non-corrosive gases on condition that they are compatible with wetted internal actuator parts and lubricant. The operating media dew point must equal either -40°C (-40°F) or 10°C below the ambient temperature. The maximum particle size must not exceed 30 microns.

Supply pressure:

For Double Acting and Spring Return actuators the maximum supply pressure is 10 bar (145 psi). The minimum supply pressure is 2.5 bar (36 psi).

Operating Temperature:

Low temperature (LT) actuator with nitrile "O-rings" from -50°C(-58°F) to +80°C(+176°F)

High temperature (HT) actuator with FPM "O-rings" from -15°C(+5°F) to +150°C(+300°F).

CVS Controls stocks low temperature actuators as standard.

CAUTION: For high and low temperature service special grease is required. High and low temperature will vary the output torque of the actuator. Please contact a CVS sales representative for each application.

Stroke:

The stroke of the CVS rack and pinion actuator is as follows (see technical data):

Standard construction: 90° rotation with stroke adjustment at 0° and 90° ± 5°

SPECIFICATIONS, Continued

Lubrication:

The CVS Rack and Pinion Actuator comes factory lubricated for the life under normal operating conditions. The standard lubricant is suitable for use from -40°C (-40°F) $+80^{\circ}\text{C}$ ($+176^{\circ}\text{F}$). For high and low temperature service where special grease is required please contact a CVS sales representative.

Construction:

Durable twin piston rack and pinion actuator design is suitable for both indoor and outdoor applications.

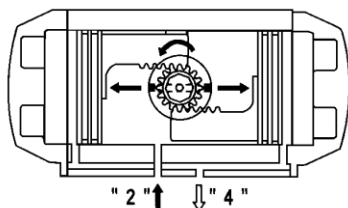
Protection and Corrosion resistance:

Actuators are supplied with corrosion protection for normal environments. For severe duties contact your CVS sales representative.

OPERATING FUNCTION AND DIRECTION OF ROTATION

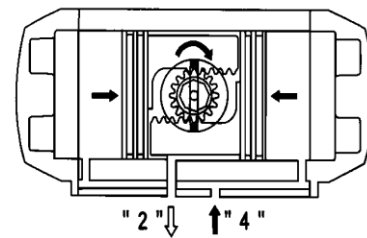
The standard rotation is clockwise to close; counter-clockwise rotation is achieved when port 2 is pressurized. For an actuator marked LF the rotation is counter-clockwise, clockwise rotation is obtained when port 2 is pressurized.

Double Acting (Standard Rotation)



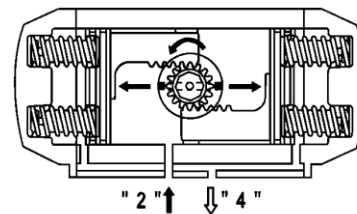
TOP View:

1. Air supplied to port 2 forces the pistons to separate, and move toward the end caps, with the exhaust air exiting at port 4, a counter-clockwise rotation is achieved.



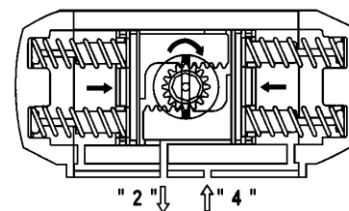
2. Air supplied to port 4 forces the pistons together with exhaust air exiting at port 2, a clockwise rotation is achieved.

Single Acting (standard rotation)



TOP View:

1. Air supplied to port 2 forces the pistons apart and toward the actuator end caps, compressing the springs, the exhaust air exits through port 4, a counter clockwise rotation is achieved.



2. A loss of air pressure (air or electric failure) at port 2 will allow the springs to force the pistons together exhausting air through port 2, a clockwise rotation is achieved.

In spring return applications the output torque is obtained in two different operations as shown in fig 2 and 3, each operation produces two different values in relation to the stroke position (0° or 90°). For spring return actuators the output torque is produced by multiplying the force (air or springs acting on the pistons) by the lever arm.

First condition (fig 2):

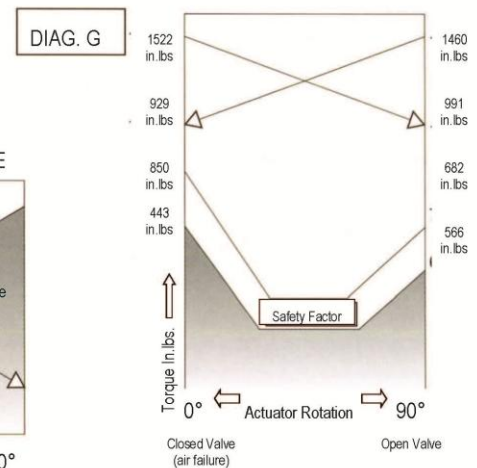
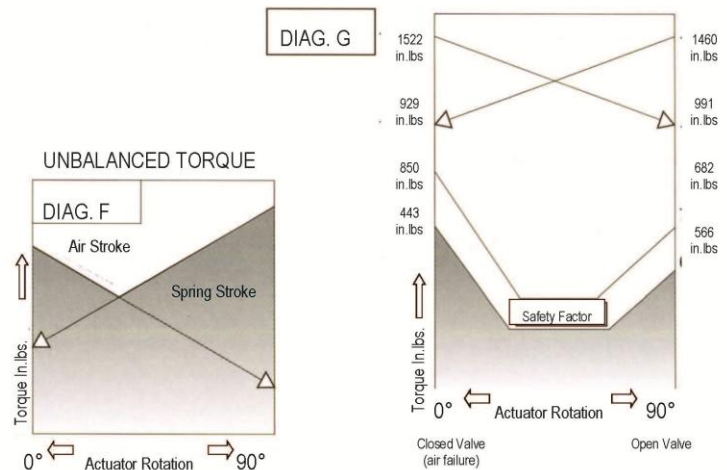
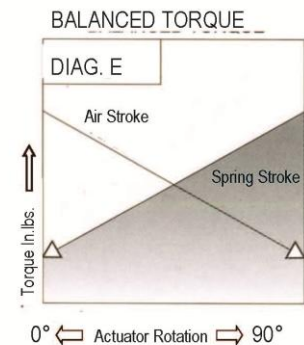
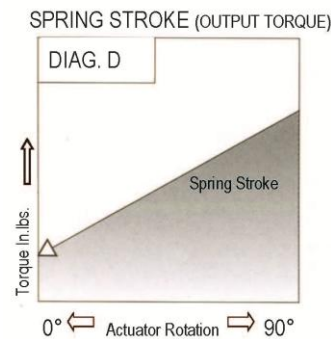
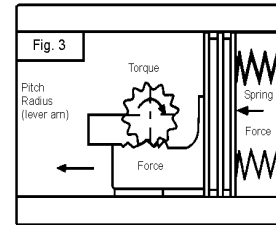
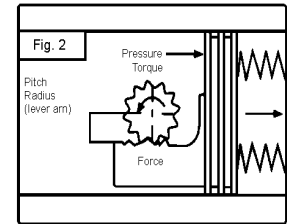
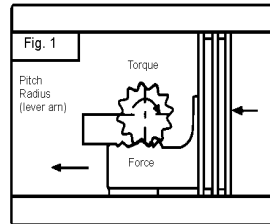
The output torque is generated by supply air pressure at port 2 after compressing the springs; this is called "Output Torque Air Stroke". In this case the air forces the pistons from the 0° to the 90° position and consequently the torque starts at a high value and during the stroke it continually decreases until 90° due to the natural force the springs generate (oppose) when they are compressed (see diagram C)

Second condition (fig 3):

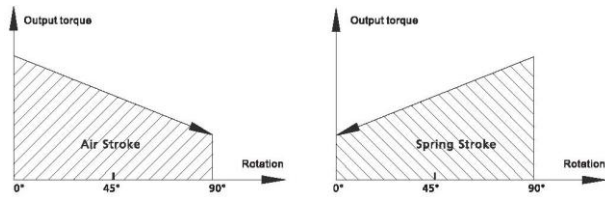
The output torque is generated by the force the springs release onto the pistons when air fails; this is called "Output Torque Spring Stroke". In this case the torque, starting from the 90° position, continually decreases until 0° because the spring extends (see diagram D).

The CVS spring return actuator is designed to produce a balanced torque in the two conditions explained above when the number of springs per side is equal to the air pressure supply (4 bar-4 springs each side) as shown in diagram E. For specific applications it is possible to achieve (where desired) the unbalanced torque as shown in diagram F, by changing the relation between the number of springs per side and air pressure supply in bar (for example, 6 springs and 5.5 bar or vice versa).

In spring return applications two conditions can be achieved: air failure to close or failure to open. The suggested safety factor for spring return actuators in normal working conditions is 30%.



Output Torque – CVS C Series, Spring Return Actuator



Output Torque of CVS C Series Pneumatic Actuator with Spring Return (in/lbf)

Model	Air Pressure (psi)																						Spring Output	
	Spring Qty.	36		43		50		58		65		72		80		87		94		100				
		0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	90°	0°	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	
C52SR	5	50	33	67	50	86	69															55	38	
	6	43	22	61	40	79	58	96	75	115	94											65	44	
	7	35	11	53	29	71	47	86	64	107	83	124	92	141	117							76	52	
	8			46	17	64	36	81	53	100	71	117	80	134	106	152	124	171	142			87	59	
	9			38	7	56	25	73	42	92	61	109	70	126	95	144	113	163	132	179	148	98	67	
	10							65	32	84	49	101	59	118	84	137	102	155	120	172	138	109	75	
	11							58	20	77	39	94	47	111	73	129	92	148	110	164	126	120	82	
	12									69	28	86	37	103	62	122	80	140	99	157	108	131	90	
C63SR	5	101	68	132	101	166	134	197	132													92	60	
	6	89	50	120	82	154	116	185	147	217	179	250	211									110	72	
	7	76	32	110	63	141	97	172	128	205	161	237	193	270	225							129	85	
	8			96	45	130	78	161	109	193	142	225	175	258	207	290	239	324	272	355	303	147	96	
	9							148	92	181	124	213	156	246	188	278	220	311	254	342	285	166	109	
	10							12	72	169	105	201	138	233	170	265	201	299	235	330	266	185	121	
	11									157	87	190	119	222	152	254	183	287	217	318	247	202	132	
	12									145	69	177	101	209	133	241	164	275	199	306	229	221	145	
C75SR	5	128	93	171	137	217	182	261	227													128	93	
	6	109	67	153	111	198	156	242	201	286	245	332	290	376	334							154	112	
	7	92	42	134	86	179	131	224	176	268	219	313	264	357	309							179	131	
	8			116	60	161	105	204	149	249	193	294	239	339	283	382	327	425	371	471	416	205	149	
	9					142	79	185	124	231	168	276	213	320	257	363	301	409	346	453	391	231	168	
	10							168	98	212	142	255	187	301	232	345	276	390	320	434	364	256	186	
	11									193	116	239	162	283	206	327	250	371	294	416	340	282	205	
	12									175	92	220	136	264	181	309	224	353	270	397	313	307	224	
C83SR	5	206	142	275	212	345	281	414	351													203	140	
	6	178	101	247	170	317	240	386	310	455	379	525	448	594	518							244	168	
	7	150	61	219	131	289	200	358	270	428	339	497	409	567	478							285	195	
	8			192	89	261	159	331	228	400	298	470	367	539	437	609	506	677	575	748	645	325	224	
	9					232	118	302	188	371	257	441	327	510	396	580	465	648	534	718	604	366	252	
	10							274	147	344	216	413	286	483	355	552	424	621	494	691	563	407	279	
	11									316	176	386	245	455	315	524	384	593	453	663	523	447	308	
	12											357	205	426	274	496	344	564	412	629	482	488	336	

Output Torque – CVS C Series, Spring Return Actuator, Continued

Output Torque of CVS C Series Pneumatic Actuator with Spring Return (in/lbf)																								
Model	Air Pressure (psi)																						Spring Output	
	Spring Qty.	36		43		50		58		65		72		80		87		94		100				
		0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	
	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End		
C92SR	5	293	194	391	294	493	394	591	494												304	206		
	6	251	134	350	233	451	334	550	433	651	534	750	633	850	733						364	247		
	7	210	72	309	171	409	273	509	372	609	473	709	572	809	672						425	289		
	8			277	111	369	212	468	311	569	412	668	512	768	611	868	712	968	811	1068	911	486	330	
	9					327	151	426	251	527	351	627	451	726	550	827	651	926	750	1026	850	547	371	
	10							386	190	486	291	586	390	685	490	786	590	885	690	985	789	608	413	
	11											544	329	643	429	744	530	843	629	943	729	669	455	
	12											502	269	602	368	702	469	802	568	902	668	730	495	
C105SR	5	451	295	597	441	744	588	890	734												435	279		
	6	395	208	540	354	687	501	833	648	980	794	1126	940	1272	1086						523	336		
	7	340	121	486	268	632	414	778	561	925	707	1071	853	1217	999						609	392		
	8			429	180	576	327	722	473	869	620	1015	765	1161	912	1307	1058	1158	795	1600	1351	696	447	
	9							666	386	813	532	959	679	1105	825	1252	971	1070	654	1544	1264	784	503	
	10							609	295	756	446	902	588	1048	738	1195	881	972	512	1488	1173	871	560	
	11											847	504	993	650	1139	797	884	370	1432	1089	958	616	
	12											791	420	937	563	1084	713	795	238	1376	1005	1045	671	
C125SR	5	646	415	867	637	1094	855	1310	1079												699	460		
	6	557	274	779	495	996	722	1221	947	1440	1165	1663	1389	1884	1610						832	557		
	7	460	132	681	354	908	580	1124	796	1351	1024	1575	1248	1795	1468						973	646		
	8			593	221	810	447	1035	663	1254	891	1478	1106	1698	1335	1920	1557	3706	3096	2372	2000	1106	743	
	9							947	522	1165	749	1389	964	1610	1194	1832	1407	3547	2865	2274	1858	1248	832	
	10							849	389	1068	608	1292	832	1512	1052	1734	1274	3397	2635	2186	1717	1389	929	
	11											1203	690	1424	910	1646	1133	3246	2405	2088	1575	1531	1017	
	12											1106	557	1335	778	1557	1000	3096	2175	2000	1442	1664	1106	
C140SR	5	1133	752	1513	1124	1888	1507	2265	1185												1141	761		
	6	982	522	1363	902	1737	1277	2115	1655	2494	2034	2876	2416	3251	2790						1372	911		
	7	832	292	1212	672	1587	1047	1965	1433	2343	1803	2726	2186	3100	2560						1602	1062		
	8			1062	442	1436	825	1814	1203	2193	1582	2575	1956	2950	2339	3327	2717	3706	3096	4089	3469	1823	1212	
	9							1655	973	2034	1352	2416	1734	2790	2109	3168	2487	3547	2866	3929	3248	2053	1372	
	10							1504	743	1883	1122	2265	1495	2640	1879	3018	2257	3397	2635	3779	3009	2283	1522	
	11											2106	1265	2489	1649	2867	2026	3246	2405	3620	2779	2513	1672	
	12											1956	1044	2339	1418	2717	1796	3096	2175	3469	2558	2743	1823	

Output Torque – CVS C Series, Spring Return Actuator, Continued

Output Torque of CVS C Series Pneumatic Actuator with Spring Return (in/lbf)																							
Model	Air Pressure (psi)																				Spring Output		
	Spring Qty.	36		43		50		58		65		72		80		87		94		100			
		0° Start	90° End	0° Start	90° End	0° Start	90° End	0° Start	90° End	0° Start	90° End	0° Start	90° End	0° Start	90° End	0° Start	90° End	0° Start	90° End	0° Start	90° End	0° Start	90° End
C160SR	5	1708	1097	2292	1690	2881	2279	3469	2867													1841	1239
	6	1460	734	2053	1318	2633	1907	3230	2496	3810	3084	4407	3673	5545	5102							2212	1487
	7	1212	363	1796	947	2385	1535	2973	2124	3562	2712	4151	3301	5412	4872							2584	1734
	8			1557	584	2146	1172	2735	1761	3323	2349	3912	2097	5261	4651	5089	4115	5677	4704	6266	5292	2947	1973
	9							2478	1389	3075	1978	3655	2566	5102	4421	4832	3743	5430	4332	6009	4921	3319	2221
	10							2239	1017	2827	1606	3416	2195	4952	4190	4593	3372	5182	3960	5770	4549	3690	2469
	11											3168	1832	4801	3960	4345	3009	4934	3597	5522	4186	4053	2717
	12											2920	1460	4651	3730	4098	2637	4686	3226	5275	3814	4425	2965
C190SR	5	2938	1964	3876	2912	4822	3857	5761	4797													2734	1770
	6	2584	1425	3522	2363	4467	3308	5407	4248	6705	5545	7293	6133	8234	7075							3283	2124
	7	2230	876	3168	1814	5724	2759	5053	3699	6350	4996	6939	5584	7880	6256							3832	2478
	8			2814	1265	3759	2211	4699	3150	5996	4447	6585	5036	7526	5978	8470	6921	9410	7861	10346	8806	4381	2832
	9							4345	2611	5642	3898	6231	4487	7172	5429	8116	6372	9056	7312	10001	8257	4929	3186
	10							3991	2062	5288	3358	5877	3947	6818	4889	7762	5823	8702	6772	9647	7709	5469	3540
	11											5522	3398	6464	4340	7408	5284	8348	6223	9293	7160	6018	3894
	12											5168	2850	6110	3791	7054	4735	7994	5675	8939	6620	6567	4248
C210SR	5	3451	2522	4629	3699	5806	4876	6983	6054													3363	2434
	6	2965	1849	4142	3027	5319	4204	6496	5381	7673	6558	8850	7735	10028	8912							4036	2920
	7	2478	1177	3655	2354	4832	3531	6009	4708	7186	5885	8364	7063	9541	8240							4708	3407
	8			3168	1681	4345	2858	5522	4036	6700	5213	7877	6390	9054	7567	10231	8744	11408	9921	12585	11098	5381	3894
	9							5036	3363	6213	4540	7390	5717	8567	6894	9744	8072	10921	9249	12099	10426	6054	4381
	10							4549	2690	5726	3867	6903	5045	8080	6222	9258	7399	10435	8576	11612	9753	6726	4868
	11											6416	4372	7594	5549	8771	6726	9948	7903	11125	9081	7399	5354
	12											5930	3699	7107	4876	8284	6054	9461	7231	10638	8408	8072	5841
C240SR	5	4885	3620	6585	5310	8290	7016	9992	8718													4903	3628
	6	4159	2628	5859	4328	7564	6033	9266	7735	10969	9438	12674	11143	14374	12843							5885	4354
	7	3434	1655	5133	3354	6830	5060	8532	6762	10235	8464	11939	10169	13640	11869							6859	5089
	8			4407	2372	6113	4077	7815	5779	9518	7482	11214	9178	12923	10887	14621	12585	16329	14294	18029	15993	7841	5806
	9							7080	4797	8783	6491	10488	8195	12188	9896	13886	11603	15595	13302	17294	15011	8833	6540
	10							6354	3814	8057	5517	9762	7222	11462	8922	13170	10629	14869	12329	16568	14037	9806	7266
	11											9036	6239	10736	7940	12444	9647	14143	11346	15851	13046	10789	7992
	12											8310	5257	10011	6957	11709	8665	13417	10364	15117	12063	11771	8718
C270SR	5	7992	5974	10576	8567	13160	11151	15745	13736													6965	4956
	6	6992	4593	9585	7178	12169	9770	14757	12355	17344	14946	19932	17533	22520	20122							8346	5947
	7	6009	3195	8603	5788	11186	8372	13771	10957	16362	14610	18949	16135	21538	18723							9744	6930
	8			7611	4398	10195	6982	12780	9567	15371	12158	17958	14745	20547	17334	23135	19932	25723	22511	28313	25100	11134	7921
	9					9204	5584	11789	8169	14379	10759	16967	13355	19555	15935	22144	18533	24732	21112	27322	23702	12535	8912
	10					8212	4203	10798	6788	13388	9379	15975	11966	18564	14555	21153	17144	23741	19731	26322	22312	13913	9904
	11											14984	10567	17573	13156	20162	15745	22750	18333	25330	20923	15311	10895
	12											14002	9178	16590	11767	19179	14364	21767	16944	24348	19533	16701	11877

Output Torque – CVS C Series, Spring Return Actuator, Continued

Output Torque of CVS C Series Pneumatic Actuator with Spring Return (in/lbf)																							
Model	Air Pressure (psi)																					Spring Output	
	Spring Qty.	36		43		50		58		65		72		80		87		94		100			
		0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	90°	0°
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
C300SR	4	11718	9374																			7512	5168
	5	9709	6894																			9390	6461
	6	8275	4372	11647	7744																	11267	7753
	7	6832	2283	10204	5655			16958	12408													13143	9045
	8			8771	3566			15524	10319			22277	17073									15019	10337
	9							14090	8231			20843	14984			27596	21737					16896	11629
	10							12656	6151			19409	12904			26162	19657			32915	26410	18781	12922
	11											17967	10815			24720	17568			31473	24321	20657	14214
	12											16533	8726			23286	15479			30039	22233	22534	15506

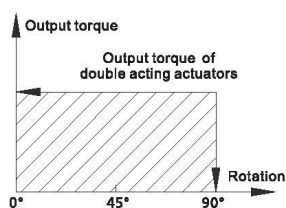
Output Torque – CVS B Series, Spring Return Actuator

Output Torque of CVS B Series Pneumatic Actuator with Spring Return (in/lbf)																								
Model	Air Pressure (psi)																					Spring Output		
	Spring Qty.	36		43		50		58		65		72		80		87		94		100				
		0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	90°	0°	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	
B300SR	5	9709	6452																			9390	6461	
	6	8275	4372	11647	7744	15882	12369															11267	7753	
	7	6832	2283	10205	5655	14590	10492	16958	12408	21348	17250											13143	9045	
	8			8771	3566	13299	8616	15524	10320	20055	15373	22277	17073	26809	22127							15019	10337	
	9					12006	6739	14090	8231	18763	13497	20843	14984	25516	20250	28216	21737					16896	11630	
	10					10713	4854	12656	6151	17471	11612	19409	12904	24224	18365	26162	19657	30973	25379	32916	26410	18781	12922	
	11										16179	9735	17967	10815	25587	16489	24720	17568	29681	23237	31473	24321	20657	14214
	12										14887	7859	16533	8726	21640	14612	23286	15480	28388	21361	30039	22233	22534	15506
B350SR	5	13568	8532																			15064	10382	
	6	11435	5186	16489	10240	22929	17309															18082	12461	
	7	9125	1841	14179	6894	20858	14300	24295	17011	30968	24410											21091	14533	
	8			11868	3549	18778	11282	21985	13665	28888	21392	32092	23773	38996	31499							24109	16612	
	9					16698	8272	19684	10311	26809	18383	29791	20418	36916	28490	39899	30526					27118	18692	
	10					14627	5254	17374	6965	24737	15365	27481	17073	34845	25472	37589	27180	44954	35581	47705	37297	30136	20763	
	11										22658	12355	25171	13727	32765	22463	35279	23835	42874	32572	45395	33951	33146	22843
	12										20578	9337	22870	10373	30287	19445	32987	20480	40795	29554	43094	30597	36164	24923
B400SR	7	17949	7691																			25490	16258	
	8	15365	3637	22569	10842	31836	21286															29136	18586	
	9			19993	6797	29517	17648	34402	21206	43926	32057											32774	20905	
	10			17409	2752	27198	14002	31818	17161	41607	28411	46227	31570	56016	42820							36420	23224	
	11							29234	13116	39279	24773	43643	27525	53688	39182	58052	41934					40058	25552	
	12							26658	9072	36960	20728	41067	23481	51369	35535	55476	37890	65778	49944	70673	52290	43705	27871	
	13											38483	19427	49042	31898	52892	33836	63451	47103	67292	48263	47342	30198	
	14											35907	15382	46723	28251	50316	29791	61132	42660	64716	44191	50989	32517	
	15											33323	11337	44395	24614	47732	25746	58804	39023	62132	40147	54626	34845	
	16															45147	21702	56485	35376	59547	36102	58273	37164	
B500SR	4	45280	17321																			77364	48519	
	5			51900	15851	70664	33730															96703	60645	
	6							77293	34031	96057	52794											116042	72779	
	7							65159	14683	83922	33447	102677	52201	121441	70965							135390	84914	
	8											90543	32862	109306	51626	128061	70381	146825	89144	165579	107899	154728	97048	

Output Torque – CVS B Series, Spring Return Actuator, Continued

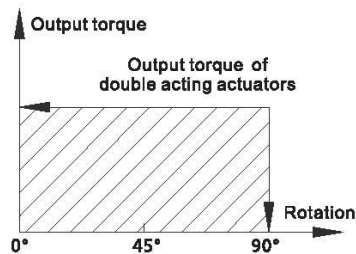
Output Torque of CVS B Series Pneumatic Actuator with Spring Return (in/lbf)																							
Model	Air Pressure (psi)																				Spring Output		
	Spring Qty.	36		43		50		58		65		72		80		87		94		100			
		0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	0°	90°	90°	0°
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
B600SR	4	92906	35102																				76718
	5			107138	34872	70664	33730														163110	95898	
	6							157384	70664	96057	52794										195734	115069	
	7							135584	34411	83922	33447	207612	106439	121441	70965						228358	134248	
	8												185821	70195	109306	51626	257857	142231	146825	89144	329894	214267	260982
B700SR	6			249635	110076	317759	178201																
	7							359367	196548	427482	264664	495615	332797	563722	400903								
	8											469098	283020			605338	419260	673471	487393	741586	555508		

Output Torque – CVS B Series, Double Acting Actuator



Output Torque of CVS B Series Double Acting Pneumatic Actuator (in/lbf)													
Model	Air Pressure (psi)												
	29	36	43	50	58	65	72	80	87	94	100	108	116
B300DA	13506	16887	20259	23636	27012	30393	33765	37146	40518	43895	47271	50648	54025
B350DA	20224	25277	30331	35391	40448	45501	50555	55609	60663	65718	70779	75835	80887
B400DA	28818	36013	43218	50421	57267	64831	72036	79240	86445	93649	100845	108049	115254
B500DA	75036	93800	112555	131314	150073	168837	187591	206355	225110	243869	262628	281387	300146
B600DA	144072	180086	261108	252127	288145	324158	360172	396195	432208	468226	504245	540262	576281
B700DA	272488	340603	408736	476859	544985	613100	681233	749340	817473	885604	951951	1021845	1089970

Output Torque – CVS C Series, Double Acting Actuator



Output Torque of CVS C Series Double Acting Pneumatic Actuator (in/lbf)													
Model	Air Pressure (psi)												
	29	36	43	50	58	65	72	80	87	94	100	108	116
C52DA	70	88	106	124	141	159	177	193	211	230	247	232	282
C63DA	129	161	193	226	258	290	323	355	387	420	452	485	517
C75DA	178	222	266	310	355	399	444	488	532	577	621	665	710
C83DA	278	347	416	485	555	624	694	763	832	901	971	1040	1110
C92DA	399	499	599	699	799	899	999	1098	1198	1298	1398	1497	1598
C105DA	585	732	878	1024	1170	1317	1463	1609	1756	1902	2048	2195	2341
C125DA	887	1110	1332	1554	1775	2882	2219	2442	2664	2885	3107	3329	3551
C140DA	1513	1892	2270	2649	3027	3405	3783	4162	4540	4919	5297	5676	6054
C160DA	2354	2942	3531	4120	4708	5297	5885	6474	7063	7651	8240	8828	9417
C190DA	3766	4708	5650	6592	7533	8475	9417	10359	11300	12242	13184	14125	15067
C210DA	4708	5885	7063	8240	9417	10594	11771	12948	14125	15303	16480	17657	18834
C240DA	6810	8513	10216	11919	13621	15324	17027	18729	20432	22135	23837	25540	27242
C270DA	10351	12940	15528	18116	20704	23292	25880	28468	31056	33645	26232	38821	41409
C300DA	22132	27673	38739		44265	49806	55332	60872	66398		77464		88531

Operating Conditions

Operating Media

- Dry or lubricated air, non-corrosive gas

Air Supply Pressure

- Minimum supply pressure is 29psi
- Maximum Supply pressure is 116psi

Operating Temperatures

- Low temp -50°C to 80°C
- High Temp -15°C to 150°C

Travel Adjustment

- $\pm 5^\circ$ for the rotation at 0° and 90°

Suitable for indoor or outdoor use.

Air Consumption

Air consumption depends on air supply pressure. Air volume and Action Cycle times are calculated as follows:

Air Consumption(L/Min)=Air Volume (Air Volume Opening + Air Volume Closing) X $\left(\frac{\text{Air Supply (Kpa)} + 101.3}{101.3}\right)$ X Action Cycle Times (per/min)

CVS C Series Air Consumption

Air Volume Opening and Closing – Unit: Liter

Model	Air Volume Opening	Air Volume Closing	Model	Air Volume Opening	Air Volume Closing
C52	0.12	0.16	C140	2.5	2.2
C63	0.21	0.23	C160	3.7	3.2
C75	0.3	0.34	C190	5.9	5.4
C83	0.43	0.47	C210	7.5	7.5
C92	0.64	0.73	C240	11	9
C105	0.95	0.88	C270	17	14
C125	1.6	1.4	C300	23.8	29.7

CVS B Series Air Consumption

Air Volume Opening and Closing – Unit: Liter

Model	Air Volume Opening	Air Volume Closing
B300	23.8	29.7
B350	35.1	46.3
B400	52.6	36
B500	132.6	110
B600	252.5	210
B700	557	572

Operating Times

CVS C Series Operating Times – Unit: Seconds, Pressure 72psi

Double Acting			Spring Return														
Size	0°-90°	90°-0°	Size	Spring Quantity													
				3+3		3+4		4+4		4+5		5+5		5+6		6+6	
				0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°
C52DA	0.6	0.53	C52SR	2.46	0.48	2.48	0.46	2.5	0.44	2.52	0.42	2.54	0.4	2.56	0.38	2.58	0.36
C63DA	0.66	0.58	C63SR	2.54	0.56	2.56	0.54	2.58	0.52	2.6	0.5	2.62	0.48	2.64	0.46	2.66	0.44
C75DA	0.72	0.64	C75SR	2.62	0.64	2.64	0.62	2.66	0.6	2.68	0.58	2.7	0.56	2.72	0.54	2.74	0.52
C83DA	0.83	0.73	C83SR	2.71	0.73	2.73	0.71	2.75	0.69	2.77	0.67	2.79	0.65	2.81	0.63	2.83	0.61
C92DA	1	0.86	C92SR	2.89	0.86	2.91	0.84	2.93	0.82	2.95	0.8	2.97	0.78	2.99	0.76	3.01	0.74
C105DA	1.35	1.3	C105SR	3.14	0.91	3.16	0.89	3.18	0.87	3.2	0.85	3.22	0.83	3.24	0.81	3.26	0.79
C125DA	2.4	1.79	C125SR	4.24	1.2	4.26	1.18	4.28	1.16	4.3	1.14	4.32	1.12	4.34	1.1	4.36	1.08
C140DA	2.5	2.1	C140SR	4.4	1.35	4.4	1.33	4.62	1.31	4.64	1.29	4.66	1.27	4.68	1.25	4.68	1.22
C160DA	3.93	2.6	C160SR	4.74	1.77	4.76	1.75	4.78	1.73	4.8	1.71	4.82	1.69	4.82	1.67	4.84	1.65
C190DA	4.55	3.45	C190SR	5.75	3.7	5.77	3.5	5.75	3.48	5.77	3.46	5.79	3.44	5.8	3.42	5.83	3.4
C210DA	5.5	4.35	C210SR	8.25	4.8	8.4	4.6	8.42	4.58	8.44	4.56	8.46	4.54	8.48	4.52	8.5	4.5
C240DA	8.4	8.33	C240SR	16.2	5.14	16.4	5.12	16.42	5.1	16.44	4.9	16.6	4.98	16.8	4.86	17	4.84
C270DA	10.9	8.53	C270SR	17.6	6.28	17.8	6.26	17.6	6.24	17.8	6.2	18	6.18	18.2	6.16	18.4	6.14
C300DA	15	14.9	C300SR	24	13.2	24.5	13	24.4	12.8	24.3	12.6	24.5	12.58	24.7	12.56	24.9	12.54

CVS B Series Operating Times – Unit: Seconds, Pressure 72psi

Double Acting			Spring Return														
Size	0°-90°	90°-0°	Size	Spring Quantity													
				3+3		3+4		4+4		4+5		5+5		5+6		6+6	
				0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°	0°-90°	90°-0°
B300DA	15	14.9	B300SR	24	13.2	24.5	13	24.4	12.8	24.3	12.6	24.5	12.58	24.7	12.56	24.9	12.54
B350DA	23.7	18.6	B350SR	31	17.3	31.5	17	31.3	16.8	31	16.6	31.2	16.58	31.4	16.56	31.6	16.54
B400DA	31	29	B400SR	45	27	51	27	51.3	26.8	51.5	26.8	51.7	26.6	51.9	26.4	52.1	26.2
B500DA			B500SR													85.9	35.86
B600DA			B600SR														
B700DA	65	62	B700SR	70	25	73	24	78	23								

Weights

CVS C Series Weights – Unit: lbs

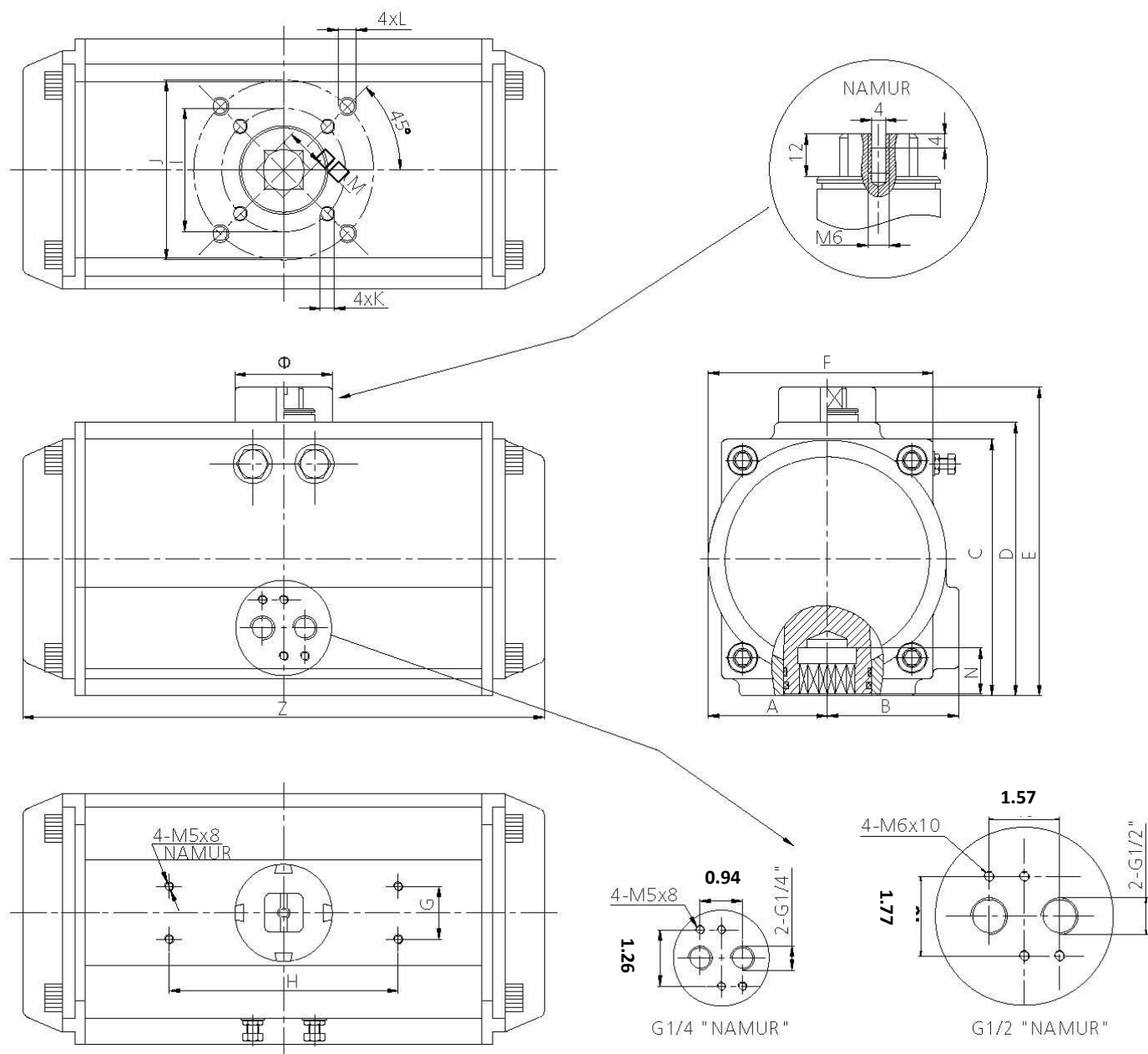
Model	C52	C63	C75	C83	C92	C105	C125	C140	C160	C190	C210	C240	C270	C300
DA	3.04	4.47	5.95	6.9	10.14	14.93	19.62	29.21	44.40	69	103.17	148.32	213.63	282
SR	3.19	4.5	6.39	7.93	11.51	15.10	22.29	34.28	52.91	77.71	120.81	176.81	160.14	344

CVS B Series Weights – Unit: lbs

Model	B300	B350	B400	B500	B600	B700
DA	242.50	411.16	637.13	2161.41	4354.12	8818.48
SR	286.60	516.76	794.54	2447.13	4695.84	10141.25

Dimensions CVS C52-CVS C270

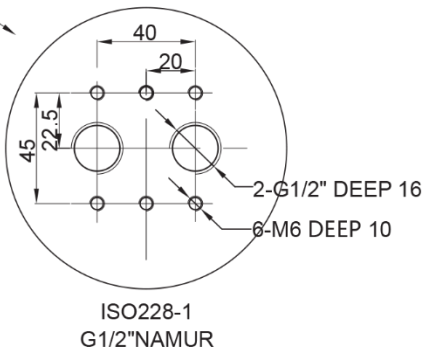
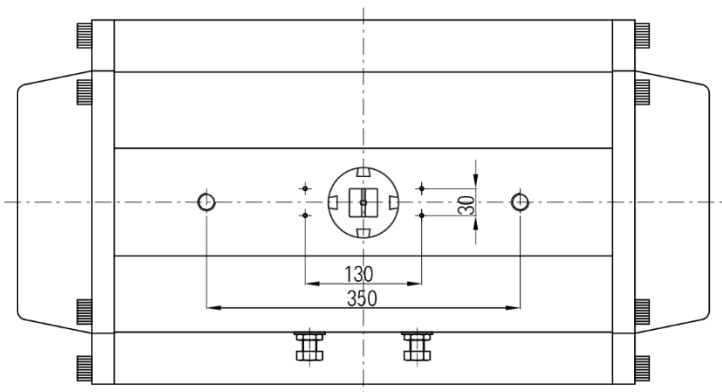
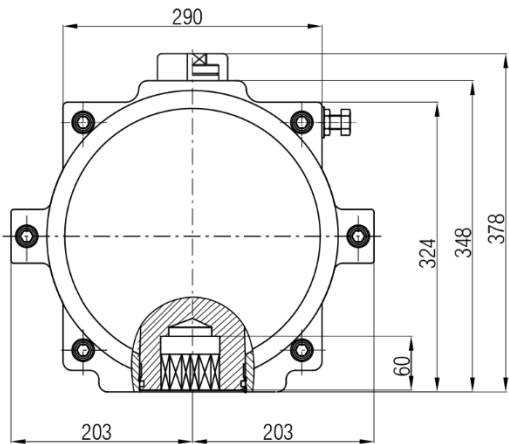
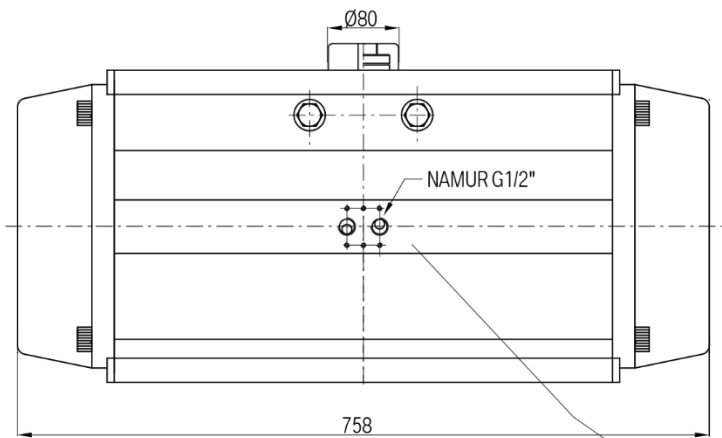
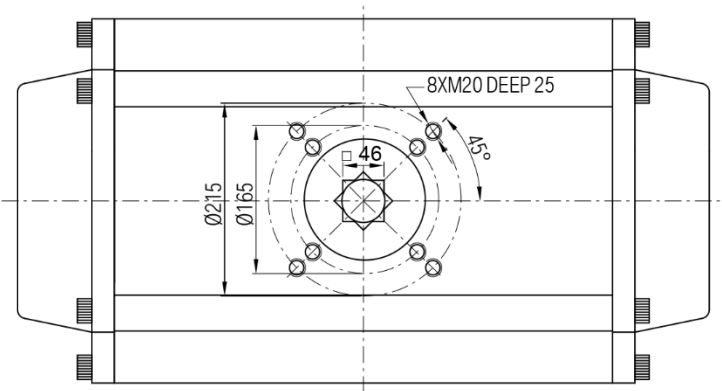
CVS C Series – Unit: inches



Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Z	F	Air Connection
C52	1.81	1.63	2.58	2.83	3.62	2.56	1.18	3.15	Φ1.41	Φ1.97	M5X8	M6X10	0.43	0.55	5.79	Φ1.57	1/4" NPT
C63	1.42	1.85	3.19	3.44	4.23	2.83	1.18	3.15	Φ1.97	Φ2.76	M6X10	M8X13	0.55	0.71	6.61	Φ1.57	1/4" NPT
C75	1.65	2.09	3.70	3.92	4.70	3.19	1.18	3.15	Φ1.97	Φ2.76	M6X10	M8X13	0.55	0.71	7.24	Φ1.57	1/4" NPT
C83	1.81	2.24	3.88	4.28	5.07	3.62	1.18	3.15	Φ1.97	Φ2.76	M6X10	M8X13	0.67	0.83	8.03	Φ1.57	1/4" NPT
C92	1.97	2.30	4.37	4.60	5.37	3.86	1.18	3.15	Φ1.97	Φ2.76	M6X10	M8X13	0.67	0.83	10.31	Φ1.57	1/4" NPT
C105	2.26	2.52	4.82	5.23	6.02	4.31	1.18	3.15	Φ2.76	Φ4.02	M8X13	M10X16	0.87	1.02	10.55	Φ1.57	1/4" NPT
C125	2.66	2.93	5.73	6.10	6.89	5.02	1.18	3.15	Φ2.76	Φ4.02	M8X13	M10X16	0.87	1.02	11.85	Φ	1/4" NPT
C140	2.95	3.03	6.34	6.77	7.56	5.41	1.18	3.15	Φ4.02	Φ4.92	M10X16	M12X20	1.06	1.22	15.35	Φ	1/4" NPT
C160	3.43	3.42	7.24	7.75	8.54	6.22	1.18	3.15	Φ4.02	Φ4.92	M10X16	M12X20	1.06	1.22	18.03	Φ	1/4" NPT
C190	4.06	4.06	8.50	9.05	10.24	7.44	1.18	5.12		Φ5.51		M16X25	1.42	1.57	20.67	Φ	1/4" NPT
C210	4.45	4.45	9.27	10.03	11.22	8.27	1.18	5.12		Φ5.51		M16X25	1.42	1.57	20.94	Φ	1/4" NPT
C240	5.12	5.12	10.41	11.38	12.56	9.64	1.18	5.12		Φ6.50		M20X25	1.81	1.97	23.70	Φ	1/4" NPT
C270	5.79	5.79	11.77	12.83	14.01	10.74	1.18	5.12		Φ6.50		M20X25	1.81	1.97	28.43	Φ	1/2" NPT

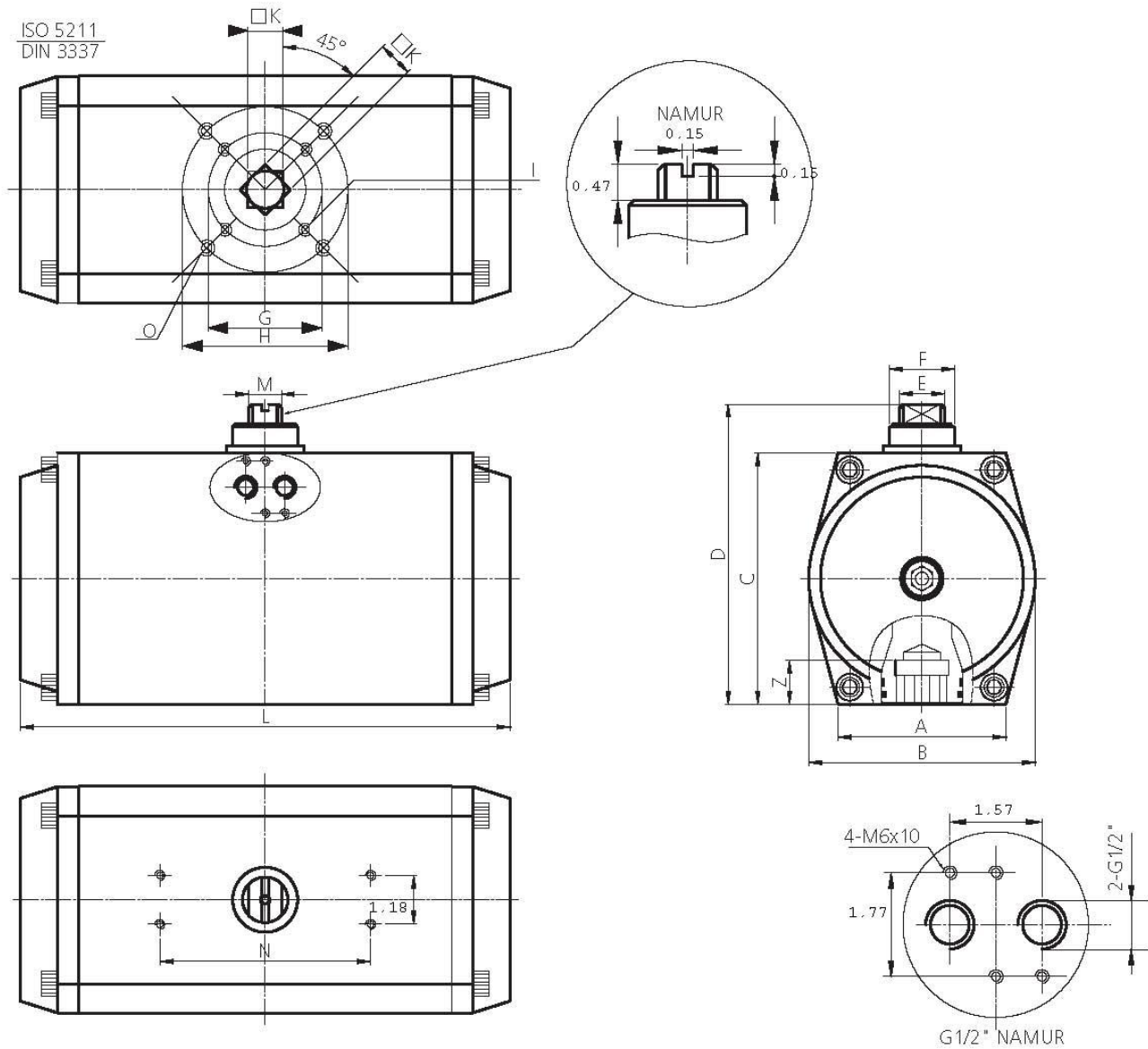
Dimensions CVS C300

CVS C Series – Unit: mm



Dimensions CVS B300 and CVS B350

CVS B Series – Unit: inches



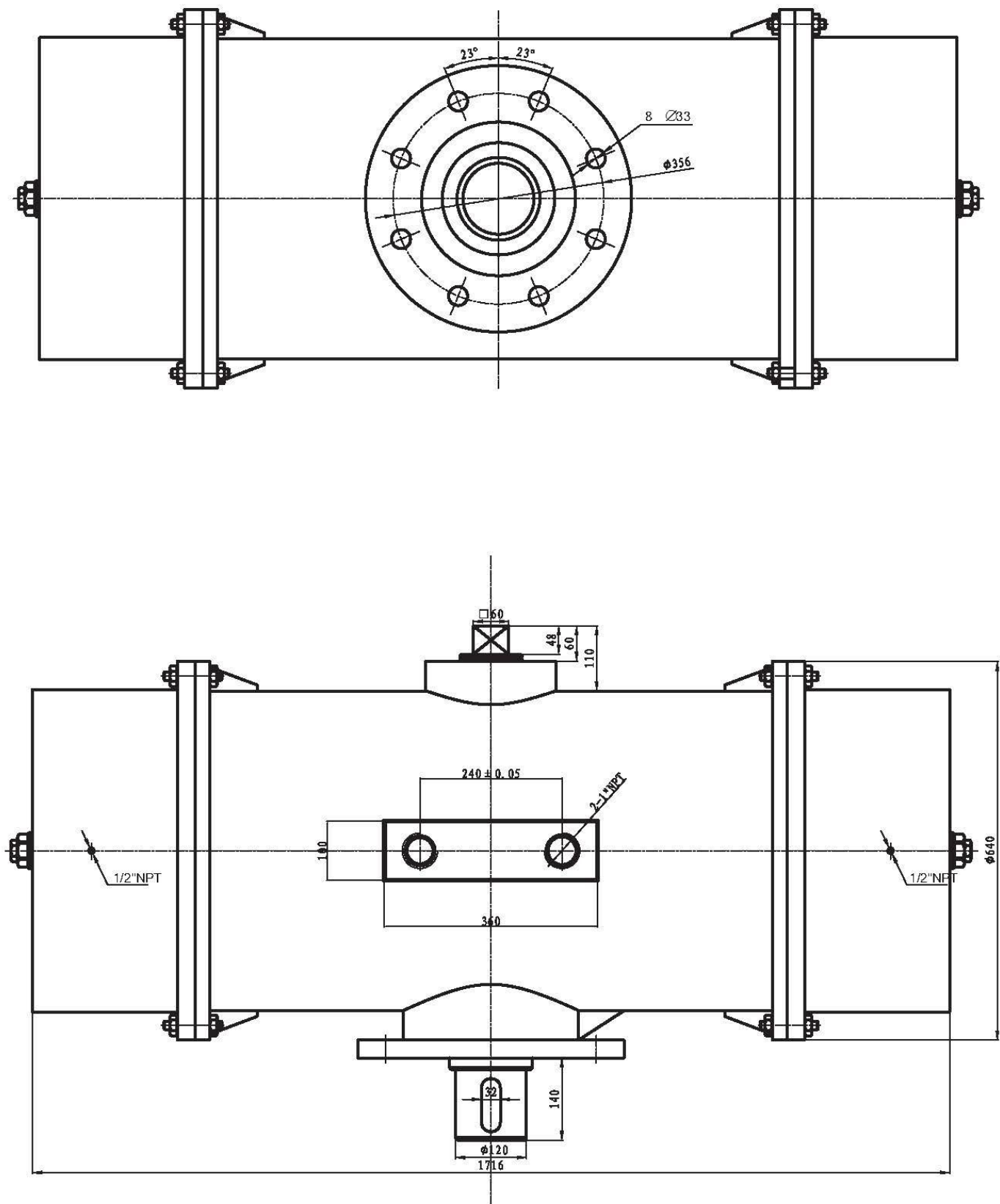
Model	A	B	C	D	E	F	G	H	I	K	L	M	N	O	Z	Air Connection
B300	7.72	12.75	13.70	14.88	1.77	2.36	Φ6.50	Φ8.50	M20X25	1.81	29.21	1.26	5.12	M20X25	2.36	NAMUR G1/2"
B350	8.66	14.96	15.82	17.01	1.77	2.36	Φ6.50	Φ8.50	M20X25	1.81	33.86	1.26	5.12	M20X25	2.36	NAMUR G1/2"

CVS B Series Size 400 – Unit: mm



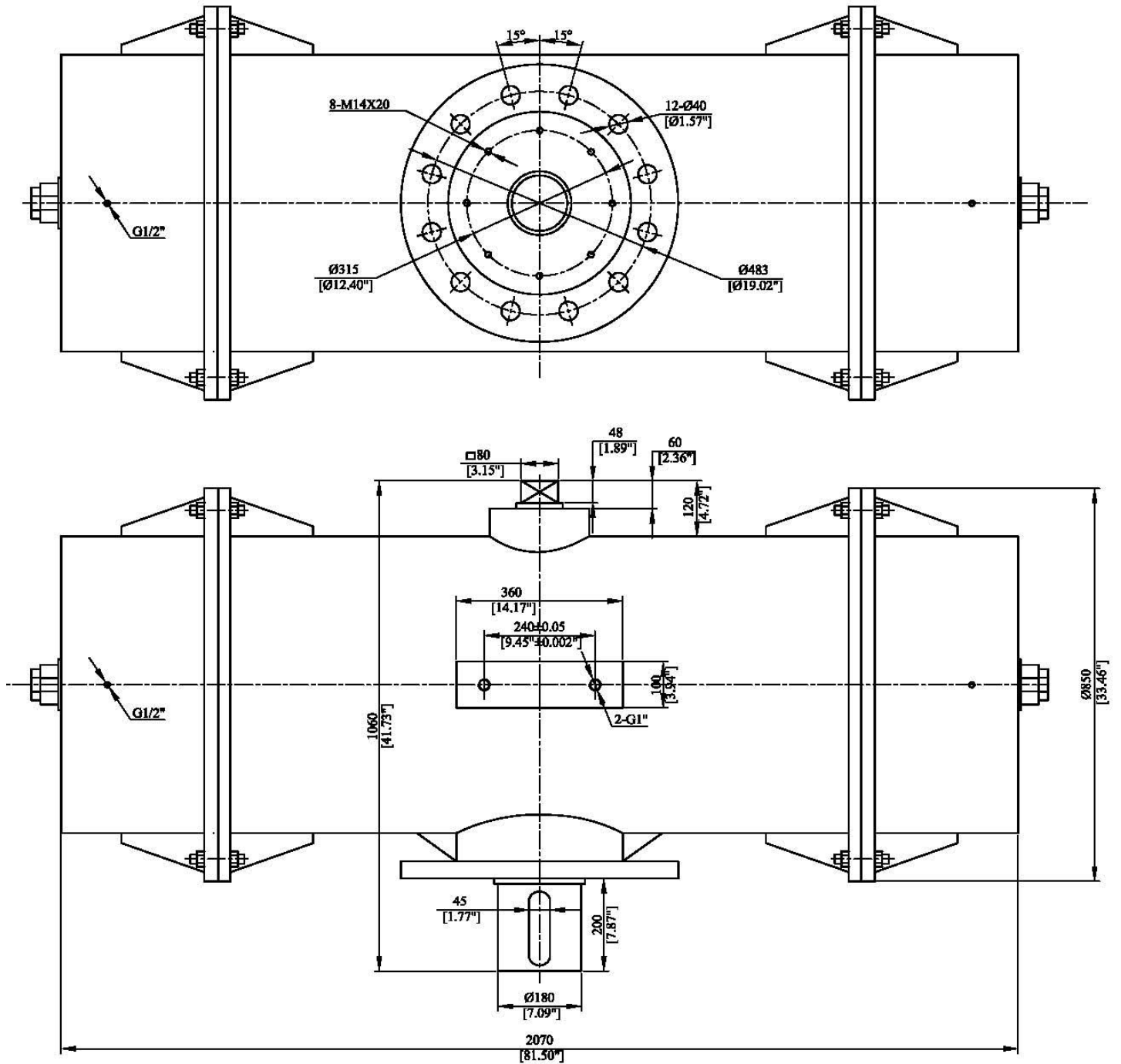
Dimensions

CVS B Series Size 500 – Unit: inch (mm)



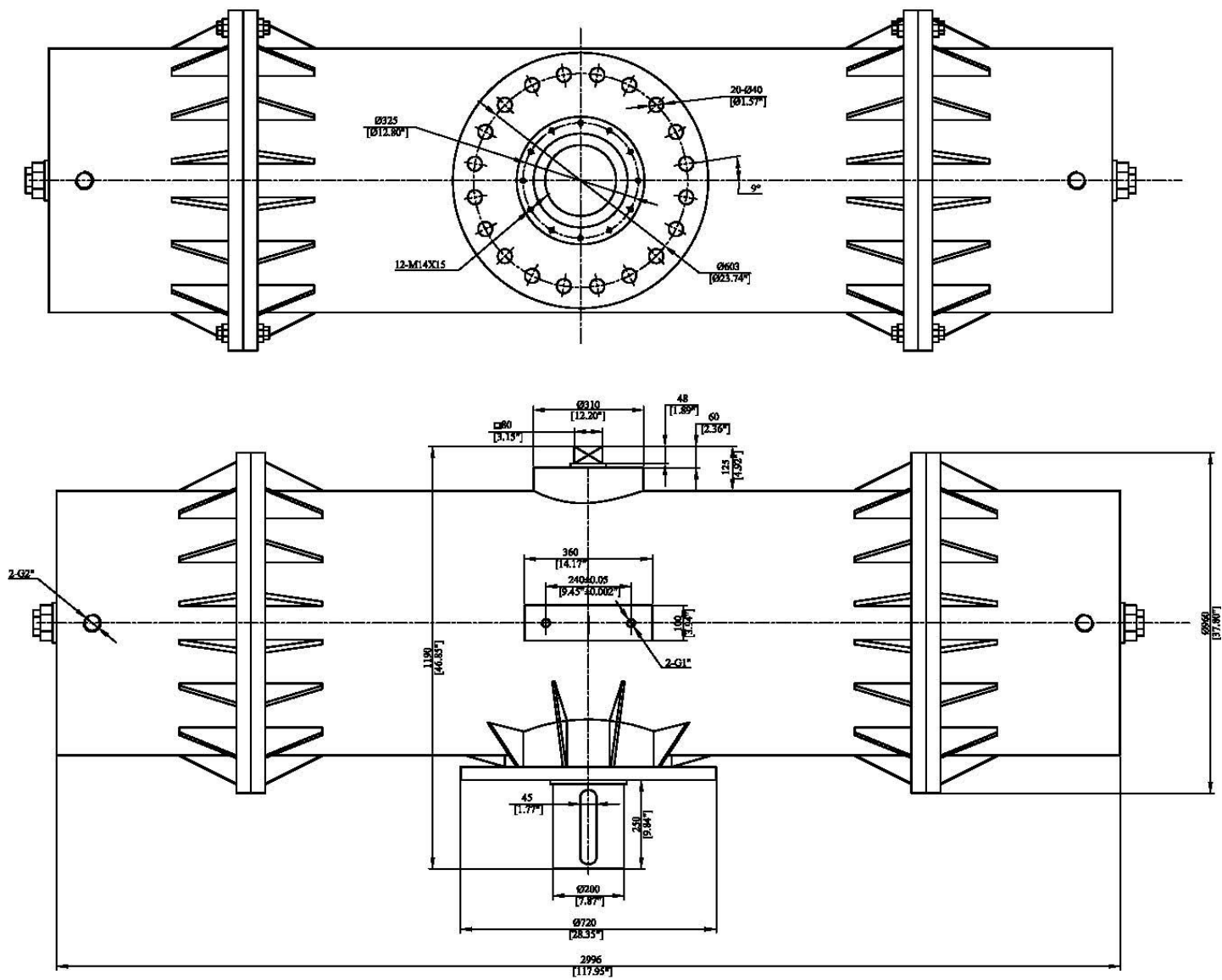
Dimensions

CVS B Series Size 600 – Unit: inch (mm)



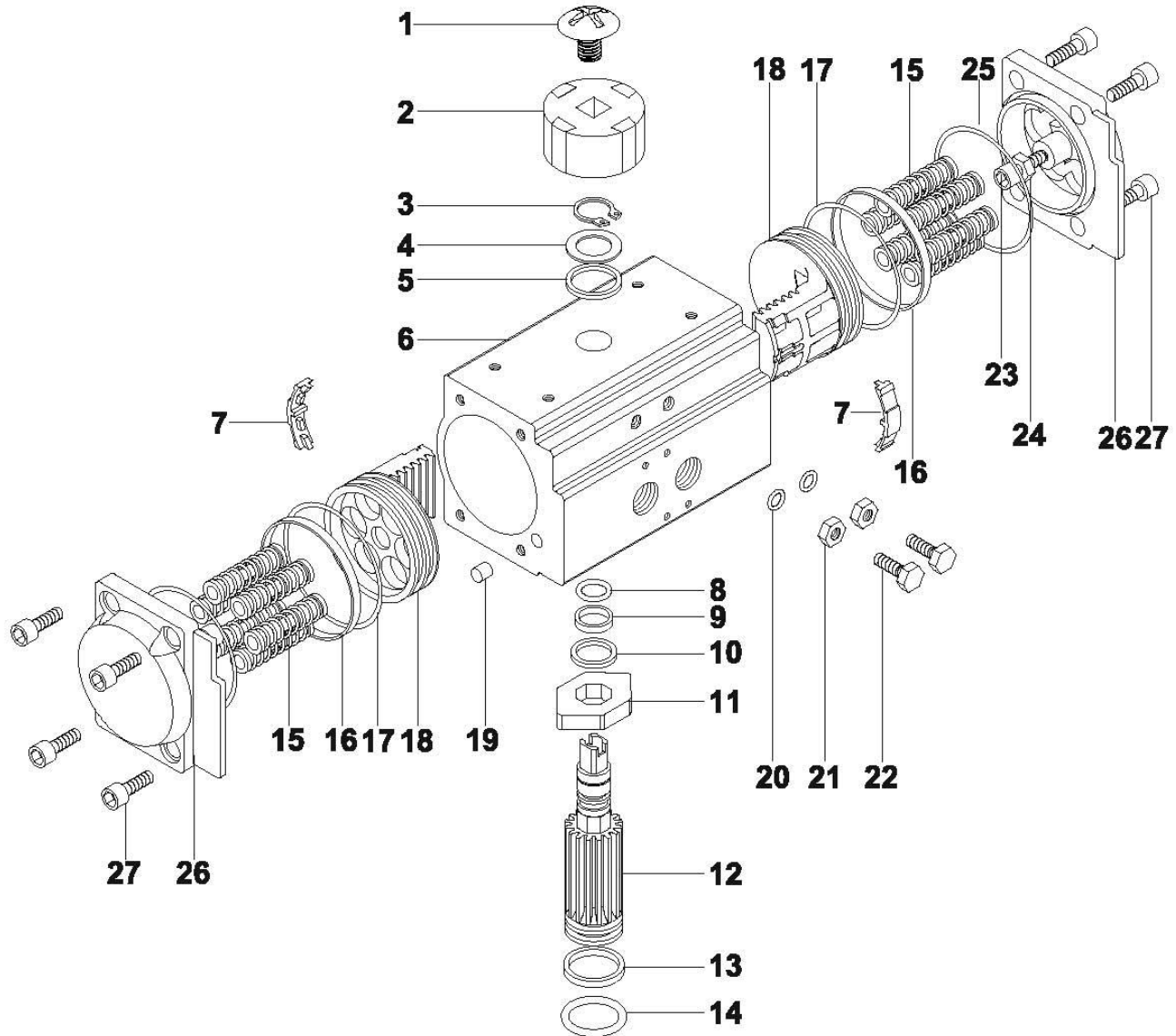
Dimensions

CVS B Series Size 700 – Unit: inch (mm)



Assembly

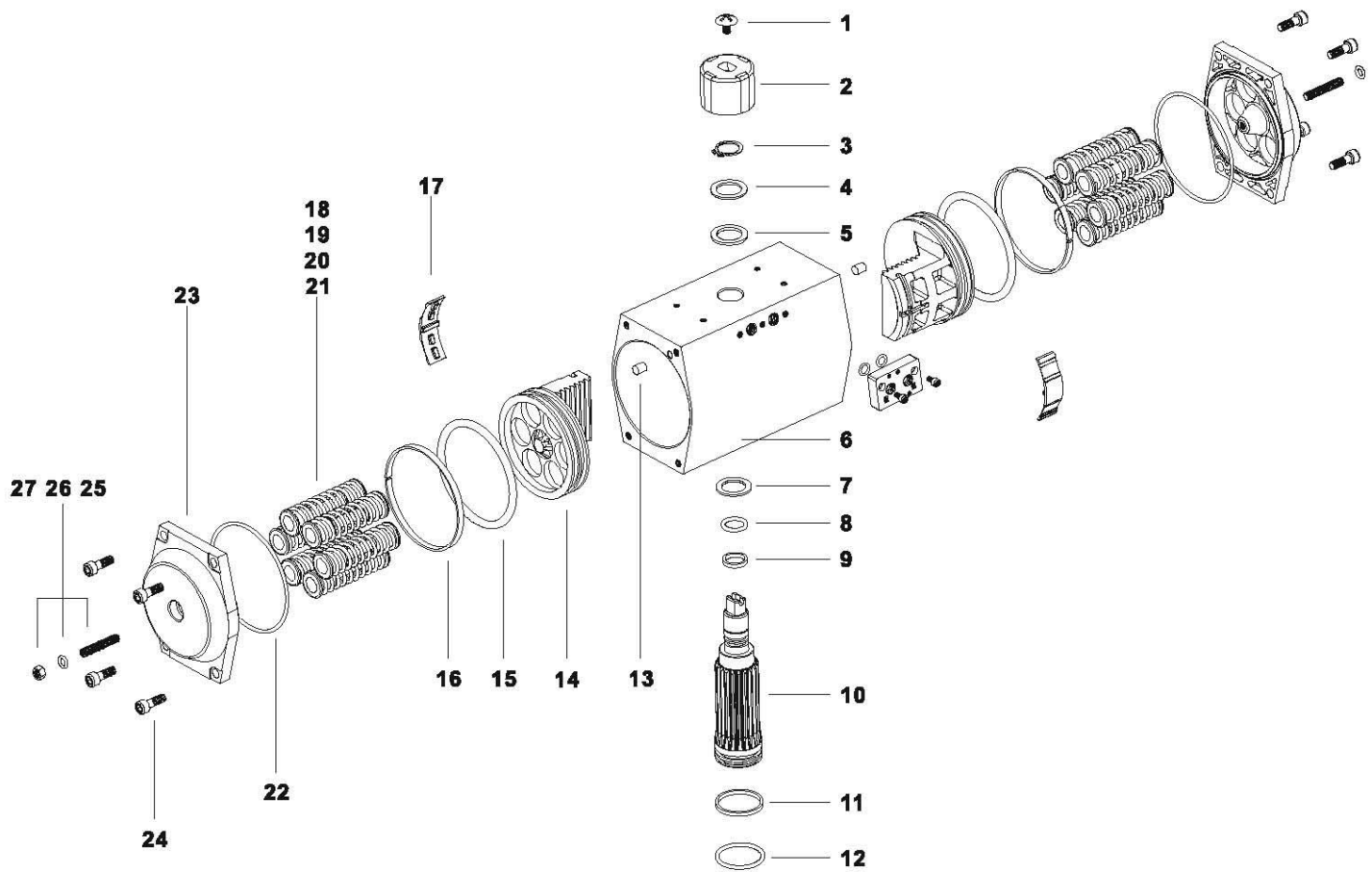
CVS C Series Assembly



Item	Description	Qty	Material	Item	Description	Qty	Material
1	Indicator Screw	1	Plastic, ABS	15	Spring	0-12	Steel
2	Indicator	1	Plastic, ABS	16	Bearing (piston)	2	Polyoxymethylene
3	Circlip	1	SS, 304	17	O-Ring (piston)	2	NBR
4	Thrust Washer	1	SS, 304	18	Piston	2	Die Cast Alum. ADC12
5	Outside Washer	1	Polyoxymethylene	19	Plug	2	NBR
6	Body	1	Ext. Alum. Alloy, 6005-T5	20	O-Ring (adj. screw)	2	NBR
7	Guide (piston)	2	Polyoxymethylene	21	Nut (adj. screw)	2	SS, 304
8	O-Ring (pinion top)	1	NBR	22	Adjustment Screw	2	SS, 304
9	Bearing (pinion top)	1	Polyoxymethylene	23	Stop Screw	2	SS, 304
10	Inside Washer	1	Polyoxymethylene	24	Nut (stop screw)	2	SS, 304
11	Cam	1	#45	25	O-ring (end cap)	2	NBR
12	Piston	1	#45	26	End Cap	2	Die Cast Alum. ADC12
13	Bearing (pinion bottom)	1	Polyoxymethylene	27	End Cap Screw	8	SS, 304
14	O-Ring (pinion bottom)	1	NBR				

Assembly

CVS B Series



Item	Description	Qty	Material	Item	Description	Qty	Material
1	Indicator Screw	1	SS, 304	15	O-Ring (piston)	2	NBR
2	Indicator	1	Plastic, ABS	16	Bearing (piston)	2	Polyoxymethylene
3	Circlip	1	SS, 304	17	Guide (piston)	2	Nylon 6
4	Thrust Washer	1	SS, 304	18	Spring		Steel
5	Outside Washer	1	Polyoxymethylene	19	Spring Retainer, Left		Nylon 6-6
6	Body	1	Ext. Alum. Alloy, 6005-T5	20	Spring Retainer, Right		Nylon 6-6
7	Inside Washer	1	Polyoxymethylene	21	Retainer Connector		Brass
8	O-Ring (pinion top)	1	NBR	22	O-ring (end cap)	2	NBR
9	Bearing (pinion top)	1	Polyoxymethylene	23	End Cap	2	Die Cast Alum. ADC12
10	Pinion	1	#45	24	End Cap Screw	8	SS, 304
11	Bearing (pinion bottom)	1	Polyoxymethylene	25	Adjustment Screw	2	SS, 304
12	O-Ring (pinion bottom)	1	NBR	26	O-Ring (adj. screw)	2	NBR
13	Plug	2	NBR	27	Nut (adj. screw)	2	SS, 304
14	Piston	2	Die Cast Alum. (101A)				

Maintenance

CVS Controls Ltd. recommends that periodic checks and inspections are performed to ensure proper operation of the Rack and Pinion actuator.

Fasteners should be checked to make sure they remain tight. The actuator has been lubricated from factory, therefore no additional lubrication should be necessary. Under extreme conditions, should the actuator require additional lubrication, CVS Controls recommends EP-1 grease. These conditions may also require periodic inspection of the internal seals. Replace when necessary.

Over time, spring return actuators may show signs of fatigue, requiring the springs to be replaced. Always replace the springs as a full set.

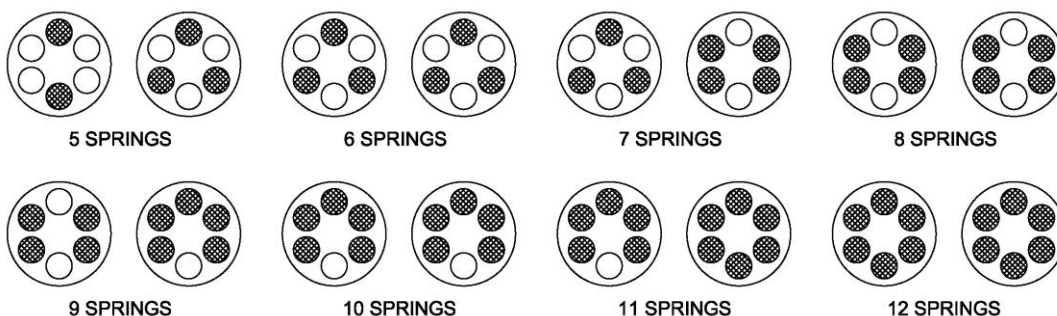
Always adhere to proper safety procedures and lockouts when performing any maintenance.

Under normal working conditions the CVS Controls Rack and Pinion Actuator will be maintenance free. It has been lubricated and inspected to meet or exceed all applicable standards. Should it become necessary to replace seals, it is recommended to be returned to CVS Controls for maintenance and inspection. Seal kits are available upon request. Please contact a CVS Controls representative for more information.



Mounting Operation

Remove any manual operating device from the valve, leaving the valve stem clear. Mount the actuator onto the valve ensuring the fit to the stem. Check that rotation direction is correct for the application. CVS Controls recommends the use of an air filter to provide clean air supply. A spacer may be required between the actuator and valve for high temperature applications.



Spring Configuration –
Spring Return Actuators

Sizing Information

Double Acting Actuators

CVS Controls recommends a safety factor of 20%-30% be added under normal working operation.

Example:

80 psig air supply

Required valve torque – 1000 in/lbs

Safety factor of 30% - 1300 in/lbs

Using the above recommendations a CVS C105DA would be acceptable according to output torques referred to in this manual.

CVS C105DA – Output torque, 1609 in/lbs

Single Acting Actuators

CVS Controls recommends a safety factor of 30%-50% be added under normal working conditions.

Example:

80 psig air supply

Required valve torque – 100 in/lbs

Safety factor of 30% - 130 in/lbs

Using the above recommendations, a CVS C63SR would be acceptable according to the output torques referred to in this manual.

CVS C63SR:

Spring output 0° – 202 in/lbs, 90° – 132 in/lbs

Air Stroke 0° – 222 in/lbs, 90° – 152 in/lbs



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