

# CBA-Series Scotch-Yoke Pneumatic Actuators

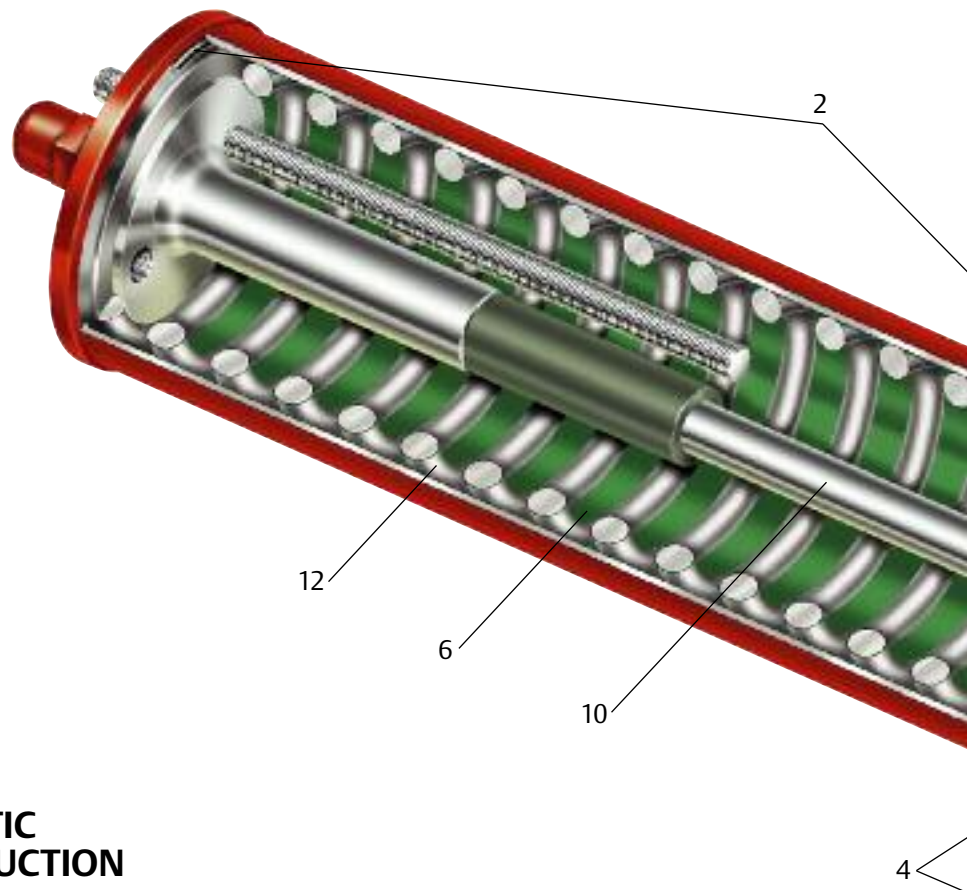
Compact, Lightweight and Economical



**BETTIS**

  
**EMERSON**<sup>™</sup>  
Process Management

- PED 97/23/EC Compliant
- Xylan™ Coated Cylinder
- Water Ingress Protected – IP66 and IP67M
- Low Maintenance
- Economical
- Jackscrew Option
- Five-Year Warranty
- Dual Mounting Interface
- Suitable for SIL 2 or SIL 3
- Bi-directional Travel Adjustment



## CBA-SERIES PNEUMATIC DESIGN AND CONSTRUCTION

### Mechanical Components

The Bettis CBA-Series pneumatic actuators are compact, lightweight and ideally suited for automating ball, butterfly and non-lubricated plug valves, or any quarter-turn (90 degree) rotating mechanism. These economical, low maintenance actuators provide a reliable means of automating your valve. Available with optional features and controls to meet your most demanding automation needs. The CBA-Series, available in double-acting and spring-return models, are independently certified to BS 5490: 1977 - IP66 and IP67M for water ingress protection.

### Operating Ranges

Double-acting CBA-Series actuators are available with guaranteed minimum torque outputs to 11,515 lb-in (1,301 Nm).

The CBA-Series spring-return models require pressure in only one direction of travel and are suitable for fail clockwise or counterclockwise applications without modification. These models produce guaranteed spring ending torques to 4,269 lb-in (482 Nm).

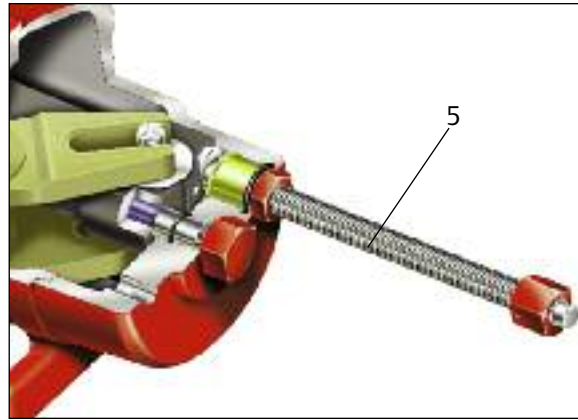
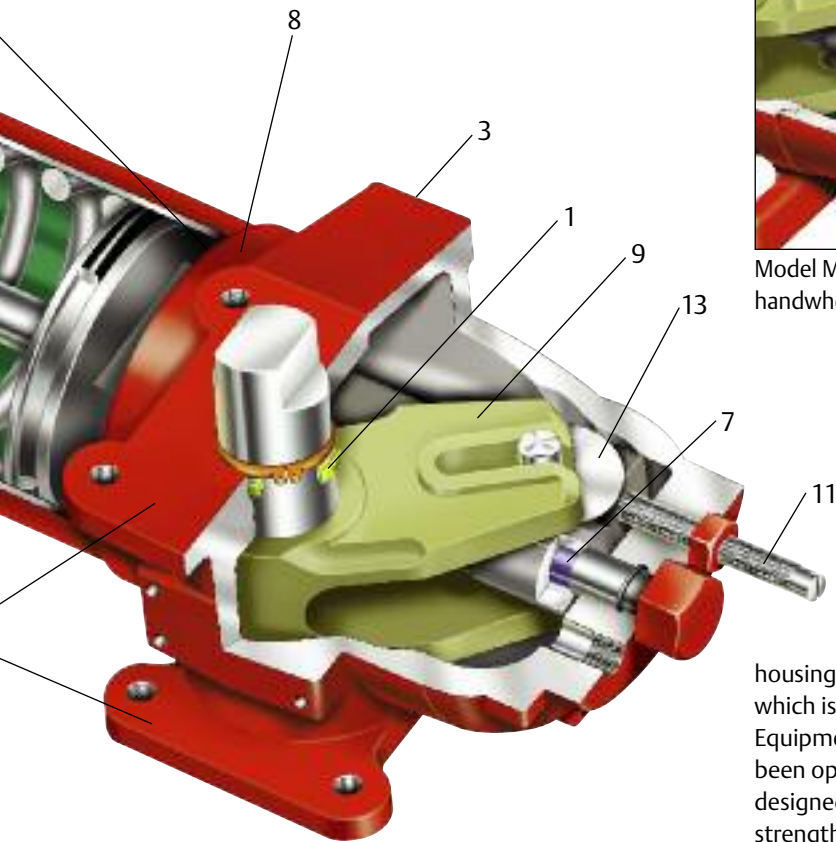
Standard construction CBA-Series actuators are designed for operating temperatures of -20°F to +200°F (-29°C to +93°C). High temperature trim allows continuous operation from 0°F to +350°F (-18°C to +177°C). Additionally, special non-PED low temperature trim allows operation to -40°F (-40°C). Consult factory when

temperature requirements exceed these limits. Operating pressures for the CBA-Series range from 40 to 150 PSIG (3 to 10 BAR).

### Design Features

**Water Ingress Protection** – The CBAs meet both IP66 and IP67M specifications for submergence and severe high pressure water deluge test, offering superior water ingress protection and corrosion resistance. The actuator has no gaskets and is totally o-ring sealed.

- 1) **New, Outer Lip-Type Torque Shaft Seals** restrict external contaminants, providing a high level of corrosion and water-resistance.
- 2) **New O-Ring Sealed Cylinders** essentially eliminate the possibility of any cylinder leakage throughout the full range of operating and climatic conditions.
- 3) **Standard Accessory Mounting Pad** – The new accessory mounting pad is standard and identical on all CBA and CBA-300 Series models, allowing the panel mounting of controls.
- 4) **Dual Valve Mounting Interface** allows the flexibility to change the actuator fail mode, without disassembly, by simply inverting the actuator. They may be installed in any position; parallel or at right angles to the flow line, in the vertical or the horizontal plane.



Model M3 Jackscrew shown (M3HW with optional handwheel not pictured).

**5) Jackscrew Option** – A blowout-proof economical jackscrew manual override is available as an option to the CBA models (see inset above). The jackscrew also acts as a stop adjustment screw.

This feature has several advantages:

- Produces full rated torque output in the event of air supply loss.
- During normal power operation, the manual override has no effect on actuator torque output or operating speed.
- Double-acting actuator models are available with one or two jackscrews.

**6) Xylan™ Cylinder Coating**, the standard internal coating on all CBA-Series actuators. This fluoropolymer coating is highly resistant to abrasion, thermal shock and provides excellent lubricity and low friction properties. Corrosive salts and other chemicals normally found in the atmosphere or instrument air supply system will not adversely affect its performance. Xylan™ bonds to the chemically prepared surface of the steel cylinder so effectively that, unlike other coatings, cracking and flaking are virtually eliminated.

**7) New Piston Heel and Yoke Pin Bearings**

– The CBA features PTFE/bronze bearings on the actuator’s piston heel and yoke pin. These bearings help to assure smooth and consistent torque output, while enhancing total cycle life.

**8) Ductile Iron Housing** – CBA actuator

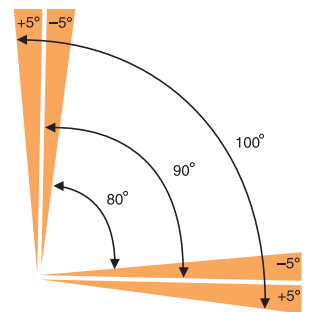
housings are made of pressure vessel quality ductile iron which is approved for use by ASME and the Pressure Equipment Directive (PED 97/23/EC). All housings have been optimized by finite element analysis and are designed for light weight while retaining maximum strength, ductility and corrosion resistance.

**9) The Scotch-Yoke Mechanism** transforms linear

movement of the piston into a 90 degree rotation, providing optimum torque curves, ideal for most quarter-turn valve applications.

**10) Center Bar**, made of improved high strength alloy steel, guides the piston throughout its full stroke, preventing metal to metal contact with the cylinder bore.

**11) Bi-directional Travel Stops** are an integral part of the actuator allowing 80° to 100° total travel adjustment. Extended travel stops are optional. This feature provides an unmatched travel range to assist in prolonging valve seat integrity.



**12) Springs** – High-strength, high-performance alloy carbon steel springs are protected by Tactyl 50, a pliable self-healing coating. Bettis takes an additional step and shot peens the springs, helping to extend the actuator’s spring cycle life.

**13) Yoke Arm Bearing Washer** – Acetal bearings positively prevent metal-to-metal contact, helping to assure smooth and consistent torque output.



# SIZING AND SELECTION

## General Definitions

To clarify and standardize terminology, Bettis offers the following definitions for terms commonly used. Please become familiar with and use the following standard definitions when referring to Bettis quarter-turn actuators.

**Quarter-turn:** A device which rotates a minimum of 90 degrees. All Bettis quarter-turn actuators will rotate more than 90 degrees.

**Position:** That degree of rotation describing an actuator's current location. The mid position of a quarter-turn actuator is generally at forty-five (45) degrees.

**CW:** Clockwise rotation.

**CCW:** Counterclockwise rotation.

**Stroke:** A continuous, ninety (90) degree rotation of a quarter-turn actuator. Bettis spring-return actuators have two (2) different strokes, a pressure stroke and a spring stroke. Bettis double-acting actuators have two (2) pressure strokes. Note that rack and pinon actuators have common torque values for both pressure strokes, while scotch yoke actuators have different torque values depending on which side of the piston is doing the work.

**Cycle:** The collective reference to two (2) strokes, one (1) for clockwise (CW) rotation and one (1) for counterclockwise (CCW) rotation. Bettis actuators must rotate through two (2) stroke to complete one (1) cycle.

**Safety Factor:** Represents a protective component (an adjustment to torque requirement) sometimes added to a valve's required torque value. Often used when the user/specifier is not certain of the valve's torque requirements, or because of other application concerns.

## Sizing Bettis Actuators

The following information is generally the minimum required for sizing Bettis quarter-turn pneumatic and hydraulic actuators for specific valve requirements.

**A)** An accurate maximum torque requirement must be obtained before actuator sizing begins. Normal maximum stem torque for a properly applied and maintained valve is usually defined as: The maximum starting torque required to rotate the valve element (ball, disc, plug, etc.) from a fully closed position (unsealing), against the maximum normal valve rated different pressures. Most valve manufacturers make adjustments in the form of torque amendments under various operating conditions. Application operating conditions such as temperature extremes, actual differential pressure, unusual loading, high flow rates, operating speeds, etc. are some of the most common causes for adjustments.

Bettis recommends that the valve manufacturer supply the maximum required torque value(s) (**including any adjustments or suggested safety factors**). Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (CCW or CW) these maximum requirements occur.

**B)** Bettis actuators include stops which will resist the maximum rated torque output of the actuator. The possibility exists, that should the valve become immobilized during rotation, the actuator could exceed the maximum allowable valve input torque rating. If this possibility is a concern, your application needs further review.

Once the maximum torque requirements, its position, and direction of rotation are identified, the appropriate Bettis actuator can be selected from torque output charts on pages 4-7.

## Actuator Selection Procedures

- A)** Determine the type of Bettis actuator required: double-acting or spring-return.
- B)** Determine the power supply media: pneumatic or hydraulic, and the minimum/maximum supply pressure(s) at the actuator.
- C)** Using this information, select the applicable torque rating table and see the appropriate following examples.

### Scotch-Yoke, Double-Acting Actuators (example assumes CW to close)

Note: The valve's torque requirements must be exceeded by the actuator's torque output at all corresponding positions and directions of rotation.

Bettis has included Start, Minimum, and End pressure torque outputs for your use.

**A)** Using your minimum operating pressure, select an operating pressure column from the Pressure Torque Rating Section of less than or equal pressure. Move down the column until both starting and minimum output torques are found which exceed the valve's maximum and minimum torque requirements. Determine the Bettis model number at the left, under the model number column.

**B)** Once a Bettis actuator model has been selected, use the performance data tables to ensure your maximum supply pressure does not exceed the maximum operating pressure (M.O.P.) for your Bettis actuator. If the actuator selected is not rated for your maximum supply pressure, either the maximum supply pressure must be reduced or an actuator rated for a higher M.O.P. must be selected.

### Scotch-Yoke, Spring-Return, Fail CLOCKWISE Actuators (example assumes CW to close)

Note: The valve's maximum torque requirements must be exceeded by the actuator's torque output at all corresponding positions and directions of rotation.

Bettis has included Start, Minimum, and End Spring Torque outputs, as well as Start, Minimum and End Pressure Torque Outputs for your use. The minimum torque outputs listed on the Spring-Return torque charts are the lowest value of torque output available at any position, during either stroke (pressure or spring).

**A)** Select from the Spring Torque column a Spring Ending torque output which exceeds that of the valve's maximum seating requirement.

**B)** Proceed to the right using your minimum operating pressure and select an operating pressure column from the Pressure Torque Rating Section of less than or equal pressure. The Pressure Start torque output must exceed the valve's torque requirement at this position (unseating). The Pressure End torque output must exceed the valve's torque requirement at this position (full flow) and direction of rotation (CCW).

**C)** Once a Bettis actuator model has been selected, use the performance data tables to ensure your maximum supply pressure does not exceed the maximum operating pressure (M.O.P.) for your Bettis actuator. If the actuator selected is not rated for your maximum supply pressure, either the maximum supply pressure must be reduced or an actuator rated for a higher M.O.P. must be selected.

*Contact your local Authorized Bettis distributor or a Bettis manufacturing facility if you require assistance.*

# Performance Data – CBA-Series (Pneumatic) – Imperial & metric

## Double-Acting Actuators CBA-Series

Actuator Model	Volumes				Maximum Operating Pressure (MOP)*		Maximum Allowable Working Pressure (MAWP)**		Approximate Weight of Actuator (MAWP)**	
	Outboard		Inboard (Housing)		PSIG	Bar	PSIG	Bar	Lbs.	KG
	Cu. Inches	Cubic CM	Cu. Inches	Cubic CM						
CBA 315	24	393.3	54	885.0	120	8.3	200	13.8	20	9.1
CBA 420	53	868.5	115	1884.5	120	8.3	200	13.8	22	10.0
CBA 520	83	1360.1	148	2425.3	70	4.8	160	11.0	28	12.7
CBA 525	105	1720.6	207	3392.1	120	8.3	200	13.8	44	20.0
CBA 725	208	3408.5	327	5358.6	80	5.5	160	11.0	68	31.0

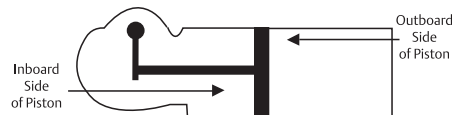
## Spring-Return Actuators CBA-Series

Actuator Model	Volume		Maximum Operating Pressure (MOP)*		Maximum Allowable Working Pressure (MAWP)**		Approximate Weight of Actuator	
	Cu. Inches	Cubic CM	PSIG	Bar	PSIG	Bar	Lbs.	KG
◆ CBA 315- SR40	54	885	155	10.7	200	13.8	22	10.0
SR60	54	885	152	10.5	200	13.8	23	10.4
SR80	54	885	150	10.3	200	13.8	26	11.8
SR100	54	885	164	11.3	200	13.8	25	11.4
◆ CBA 415- SR40	75	1229	100	6.9	160	11.0	27	12.7
SR60	75	1229	112	7.7	160	11.0	29	14.1
SR80	75	1229	117	8.1	160	11.0	30	14.1
SR100	75	1229	114	7.9	160	11.0	31	14.1
◆ CBA 420- SR40	115	1884.5	157	10.8	200	13.8	37	16.8
SR60	115	1884.5	156	10.8	200	13.8	39	17.7
SR80	115	1884.5	161	11.0	200	13.8	40	18.1
SR100	115	1884.5	166	11.4	200	13.8	41	18.6
◆ CBA 520- SR40	148	2425.3	110	7.6	160	11.0	45	20.4
SR60	148	2425.3	116	8.0	160	11.0	48	21.8
SR80	148	2425.3	120	8.3	160	11.0	49	22.2
SR100	148	2425.3	132	9.1	160	11.0	53	24.0
◆ CBA 525- SR40	207	3392	146	10.1	200	13.8	62	28.1
SR60	207	3392	151	10.4	200	13.8	65	29.5
SR80	207	3392	159	11.0	200	13.8	65	29.5
SR100	207	3392	163	11.2	200	13.8	67	30.4
◆ CBA 725- SR40	327	5358.6	102	7.0	160	11.0	97	44.0
SR60	327	5358.6	115	8.0	160	11.0	98	44.5
SR80	327	5358.6	124	8.6	160	11.0	104	47.2
SR100	327	5358.6	124	8.6	160	11.0	107	48.5

### Notes:

- ◆ CBA-SRXXM mechanical handwheel overrides are available on these models. The override adds approximately 2 lbs. (.8 kg) to the weight of the standard CBA model.
- ▲ Maximum volume including cavity required for calculating consumption per stroke.
- \* **Maximum Operating Pressure (MOP)** is the pressure required to produce the maximum rated torque of the actuator.
- \*\* **Maximum Allowable Working Pressure (MAWP)** is the maximum static pressure that may be applied to a fully stroked actuator against the travel stops.

Standard installation produces clockwise rotation when the outboard side of piston is pressurized.  
Standard installation produces counterclockwise rotation when the inboard side of piston is pressurized.



**Note:** Actuator may be installed opposite of that shown above.

# Torque Ratings – CBA-Series (Pneumatic) – Imperial

All Published Torques are Typical Minimum Values.

## Double-Acting Actuators

### CBA-Series

Actuator Model	See Bettis' Definitions	Operating Pressure (PSIG)							
		40	50	60	70	80	90	100	120
		Pressure Torque Output Start/Min./End (lb-in)							
CBA 315	Start/End	678	848	1017	1187	1356	1526	1695	2034
	Minimum	404	505	606	707	808	910	1011	1213
CBA 420	Start/End	1536	1921	2305	2689	3073	3457	3841	4609
	Minimum	871	1089	1307	1525	1743	1961	2179	2614
CBA 520	Start/End	2133	2666	3200	3733				
	Minimum	1302	1628	1954	2279				
CBA 525	Start/End	2944	3680	4416	5152	5888	6624	7361	8833
	Minimum	1720	2150	2580	3009	3439	3869	4299	5159
CBA 725	Start/End	5757	7197	8636	10075	11515			
	Minimum	3434	4292	5151	6009	6868			

### Notes:

**Start:** (starting) That torque output position at which an actuator produces its greatest torque output. The starting torque outputs listed in Bettis scotch-yoke torque output charts are the lesser of the two (2) pressure strokes, when there is a difference (different areas).

**Minimum:** (min.) That torque output, at an intermediate position, at which an actuator produces its lowest torque output. The minimum torque outputs shown on Bettis pressure torque output charts are the lowest torque values produced during the pressure stroke(s). For double-acting actuators, this is also the mid position.

**End:** (ending) That torque output position at which an actuator has reached the limit of a pressure stroke. For double-acting actuators the end torque output is equal to the start torque output.

## Spring-Return Actuators

### CBA-Series

Actuator Model	Spring Torque Start/Min./End (lb-in)	Operating Pressure (PSIG)									
		40	50	60	70	80	90	100	120	150	
		Pressure Torque Output Start/Min./End (lb-in)									
CBA315 SR40	Start	350	375	531	688	844	1000	1157	1313	1626	2095
	Min.	151	158	247	336	424	512	600	688	864	1128
	End	202	216	377	538	698	859	1020	1181	1502	1985
CBA315 SR60	Start	598		438	608	778	948	1117	1287	1627	2136
	Min.	238		153	249	343	436	530	623	808	1085
	End	305		172	342	512	681	851	1021	1360	1870
CBA315 SR80	Start	757				698	884	1069	1254	1625	2181
	Min.	306				237	328	418	509	689	958
	End	402				312	498	683	869	1239	1795
CBA315 SR100	Start	1069						876	1053	1406	1935
	Min.	405						331	428	621	906
	End	494						421	600	957	1493
CBA415 SR40	Start	682	692	981	1271	1560	1850	2139	2429		
	Min.	284	285	451	614	778	941	1105	1268		
	End	365	387	701	1014	1328	1641	1955	2269		
CBA415 SR60	Start	1076		701	979	1256	1533	1811	2088		
	Min.	431		264	435	603	770	934	1099		
	End	577		294	600	905	1211	1516	1822		
CBA415 SR80	Start	1345				1077	1362	1648	1933		
	Min.	576				428	602	772	942		
	End	711				510	811	1113	1414		
CBA415 SR100	Start	1659						1701	2007		
	Min.	673						542	719		
	End	756						564	861		

# Torque Ratings – CBA-Series (Pneumatic) – Imperial

All Published Torques are Typical Minimum Values.

## Spring-Return Actuators

### CBA-Series (continued)

Actuator Model	Spring Torque Start/Min./End (lb-in)		Operating Pressure (PSIG)								
			40	50	60	70	80	90	100	120	150
			Pressure Torque Output Start/Min./End (lb-in)								
CBA420 SR40	Start	591	844	1173	1501	1829	2157	2485	2813	3470	4454
	Min.	301	317	500	680	859	1037	1215	1393	1748	2282
	End	479	391	709	1028	1346	1665	1983	2302	2939	3894
CBA420 SR60	Start	1320			1333	1685	2037	2390	2742	3446	4503
	Min.	481			480	670	860	1048	1235	1607	2166
	End	691			562	871	1179	1488	1797	2415	3341
CBA420 SR80	Start	1661				1468	1825	2182	2539	3253	4325
	Min.	655				481	690	891	1088	1480	2068
	End	901				502	844	1187	1529	2215	3243
CBA420 SR100	Start	2230						1958	2320	3044	4130
	Min.	836						643	857	1264	1859
	End	1119						674	1021	1716	2758
CBA520 SR40	Start	1004	1311	1805	2300	2794	3289	3783	4278		
	Min.	445	503	782	1056	1326	1596	1867	2137		
	End	562	677	1255	1834	2412	2990	3568	4146		
CBA520 SR60	Start	1719		1385	1895	2405	2914	3424	3934		
	Min.	747		484	794	1095	1390	1685	1980		
	End	966		509	1087	1665	2243	2821	3399		
CBA520 SR80	Start	2575				2133	2658	3183	3708	4757	
	Min.	1019				790	1111	1424	1734	2347	
	End	1243				893	1494	2095	2696	3898	
CBA520 SR100	Start	3880						2535	3067	4132	
	Min.	1361						855	1171	1773	
	End	1715						913	1491	2647	
CBA525 SR40	Start	1652	1619	2310	3001	3692	4383	5074	5765	7147	
	Min.	608	638	993	1345	1698	2050	2402	2752	3452	
	End	949	946	1637	2328	3019	3710	4401	5092	6474	
CBA525 SR60	Start	2527		1849	2549	3250	3950	4651	5351	6752	8854
	Min.	983		632	1035	1425	1814	2198	2582	3348	4499
	End	1372		694	1404	2114	2824	3534	4244	5665	7795
CBA525 SR80	Start	3038				2732	3432	4133	4833	6234	8336
	Min.	1293				966	1363	1750	2138	2900	4042
	End	1680				1130	1859	2589	3318	4777	6965
CBA525 SR100	Start	4620						3673	4392	5832	7991
	Min.	1676						1369	1777	2581	3770
	End	2234						1696	2454	3970	6245
CBA725 SR40	Start	3148	3354	4780	6206	7632	9058	10484	11910		
	Min.	1283	1306	2048	2788	3520	4252	4984	5716		
	End	1641	1948	3488	5028	6568	8108	9648	11189		
CBA725 SR60	Start	5249		3467	4817	6167	7517	8867	10217		
	Min.	2106		1234	2080	2897	3709	4511	5313		
	End	2762		1284	2824	4364	5904	7444	8984		
CBA725 SR80	Start	7370				5064	6395	7726	9057	11719	
	Min.	2830				2018	2872	3706	4541	6189	
	End	3330				2326	3885	5444	7003	10122	
CBA725 SR100	Start	9482						7374	8781	11595	
	Min.	3260						2478	3279	4828	
	End	4269						2748	4250	7254	

**Notes:** Spring-return, quarter-turn actuators use pressure and springs(s) to produce torque.

**Start:** (starting) That torque output position at which a spring-return actuator produces its greatest torque output during a spring stroke. The starting torque output listed in Bettis spring-return torque output charts is that torque output position, where the spring is fully compressed, and capable of transferring its maximum force.

**Minimum:** (min.) That torque output, at an intermediate position, at which an actuator produces its lowest torque output. The minimum torque outputs listed on the Bettis spring torque output charts are the lowest value of torque output produced at any position, during either stroke (pressure or spring).

**End:** (ending) That torque output position, at which an actuator has reached the limit of the spring stroke. The spring ending torque output values listed on Bettis spring-return torque output charts is the torque output value where the spring is fully extended and is transferring its lowest force value.

# Torque Ratings – CBA-Series (Pneumatic) – metric

All Published Torques are Typical Minimum Values.

## Double-Acting Actuators

### CBA-Series

Actuator Model	See Bettis' Definitions	Operating Pressure (Bar)							
		3	3.5	4	5	5.5	6	7	8
		Pressure Torque Output Start/Min./End (Nm)							
CBA315	Start/End	83	97	111	139	153	167	194	222
	Minimum	50	58	66	83	91	99	116	133
CBA420	Start/End	189	220	252	315	346	378	441	504
	Minimum	107	125	143	179	196	214	250	286
CBA520	Start/End	262	306	350	437				
	Minimum	160	187	213	267				
CBA525	Start/End	362	422	482	603	663	724	844	965
	Minimum	211	247	282	352	387	423	493	564
CBA725	Start/End	708	826	944	1179	1297			
	Minimum	422	492	563	703	774			

### Notes:

**Start:** (starting) That torque output position at which an actuator produces its greatest torque output. The starting torque outputs listed in Bettis scotch-yoke torque output charts are the lesser of the two (2) pressure strokes, when there is a difference (different areas).

**Minimum:** (min.) That torque output, at an intermediate position, at which an actuator produces its lowest torque output. The minimum torque outputs shown on Bettis pressure torque output charts are the lowest torque values produced during the pressure stroke(s). For double-acting actuators, this is also the mid position.

**End:** (ending) That torque output position at which an actuator has reached the limit of a pressure stroke. For double-acting actuators the end torque output is equal to the start torque output.

## Spring-Return Actuators

### CBA-Series

Actuator Model	Spring Torque Start/Min/End (Nm)	Operating Pressure (Bar)											
		3	3.5	4	5	5.5	6	7	8	9	10	11	
		Pressure Torque Output Start/Min./End (Nm)											
CBA315-SR40	Start	39	49	61	74	100	113	125	151	177	202	228	
	Min.	17	21	29	36	51	58	65	79	94	108	123	
	End	23	31	44	57	84	97	110	136	162	189	215	
CBA315-SR60	Start	68		51	65	93	107	121	148	176	204	232	
	Min.	27		18	26	41	49	57	72	87	102	117	
	End	34		21	35	63	76	90	118	146	174	202	
CBA315-SR80	Start	86				84	99	115	145	175	206	236	
	Min.	35				29	37	44	59	74	89	103	
	End	45				41	56	71	101	132	162	192	
CBA315-SR100	Start	121						93	122	151	180	209	238
	Min.	46						34	50	66	81	97	113
	End	56						42	71	100	129	159	188
CBA415-SR40	Start	77	90	113	137	185	208	232	279				
	Min.	32	39	52	66	93	106	119	146				
	End	41	56	82	108	159	185	210	262				
CBA415-SR60	Start	122		82	104	150	173	195	241				
	Min.	49		31	45	73	87	100	127				
	End	65		36	61	111	136	161	211				
CBA415-SR80	Start	152				130	153	176	223	270			
	Min.	65				53	68	82	109	137			
	End	80				66	91	116	165	214			
CBA415-SR100	Start	187						182	232				
	Min.	76						54	84				
	End	85						54	102				



# Torque Ratings – CBA-Series (Pneumatic) – metric

All Published Torques are Typical Minimum Values.

## Spring-Return Actuators

### CBA-Series (continued)

Actuator Model	Spring Torque Start/Min/End (Nm)	Operating Pressure (Bar)											
		3	3.5	4	5	5.5	6	7	8	9	10	11	
		Pressure Torque Output Start/Min./End (Nm)											
CBA420-SR40	Start	67	108	135	162	216	243	270	324	377	431	485	
	Min.	34	43	58	73	102	117	131	160	190	219	248	
	End	54	57	83	109	161	187	213	266	318	370	422	
CBA420-SR60	Start	149			143	200	229	258	316	374	431	489	
	Min.	54			50	81	97	112	143	173	204	234	
	End	78			56	107	132	158	208	259	310	360	
CBA420-SR80	Start	188				176	205	235	293	352	410	469	527
	Min.	74				61	77	94	126	158	191	223	255
	End	102				66	94	123	179	235	291	347	403
CBA420-SR100	Start	252						209	268	328	387	446	506
	Min.	94						64	100	134	166	199	232
	End	126						64	121	178	235	292	349
CBA520-SR40	Start	113	168	208	249	330	370	411	492				
	Min.	50	68	91	113	158	180	202	246				
	End	64	99	147	194	289	336	384	478				
CBA520-SR60	Start	194		161	203	286	328	370	453	537			
	Min.	84		58	83	132	156	180	229	277			
	End	109		62	110	205	252	299	394	489			
CBA520-SR80	Start	291				256	299	342	428	514			
	Min.	115				98	125	150	201	251			
	End	140				118	167	216	315	413			
CBA520-SR100	Start	438						268	356	443	530		
	Min.	154						84	138	187	236		
	End	194						84	178	273	368		
CBA525-SR40	Start	187	210	267	324	437	493	550	663	776	890	1003	
	Min.	69	86	115	144	202	231	260	317	374	432	489	
	End	107	134	191	248	361	417	474	587	700	814	927	
CBA525-SR60	Start	286		215	272	387	445	502	617	732	846	961	
	Min.	111		75	108	172	204	235	298	361	424	487	
	End	155		85	143	259	317	375	492	608	725	841	
CBA525-SR80	Start	343				329	386	443	558	673	788	903	1017
	Min.	146				121	153	185	248	311	373	435	498
	End	190				148	208	268	387	507	627	746	866
CBA525-SR100	Start	522						391	509	627	745	862	980
	Min.	189						141	208	274	339	404	469
	End	252						166	290	415	539	663	787
CBA725-SR40	Start	356	436	552	669	903	1020	1137	1370				
	Min.	145	175	236	297	419	479	539	658				
	End	185	281	407	534	786	912	1038	1291				
CBA725-SR60	Start	593		403	514	735	846	956	1178	1399			
	Min.	238		147	217	351	417	483	614	745			
	End	312		158	284	537	663	789	1042	1294			
CBA725-SR80	Start	833				610	719	828	1046	1264			
	Min.	320				253	322	391	527	662			
	End	376				307	435	563	818	1074			
CBA725-SR100	Start	1071						786	1016	1247			
	Min.	368						251	384	511			
	End	482						260	506	752			

**Notes:** Spring-return, quarter-turn actuators use pressure and springs(s) to produce torque.

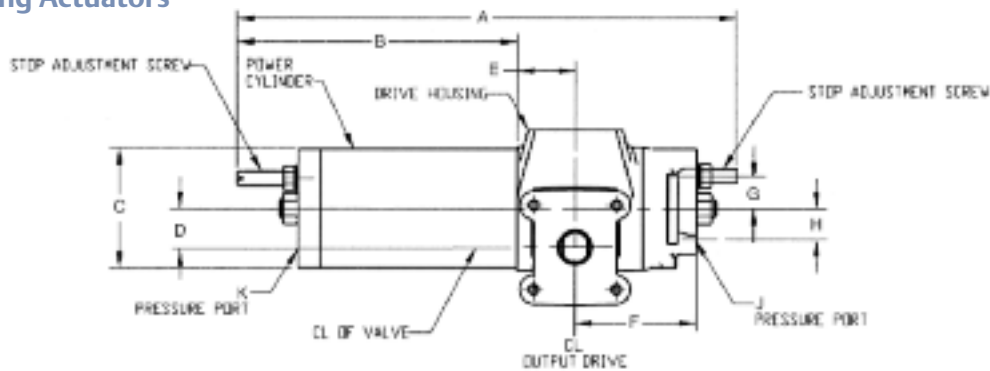
**Start:** (starting) That torque output position at which a spring-return actuator produces its greatest torque output during a spring stroke. The starting torque output listed in Bettis spring-return torque output charts is that torque output position, where the spring is fully compressed, and capable of transferring its maximum force.

**Minimum:** (min.) That torque output, at an intermediate position, at which an actuator produces its lowest torque output. The minimum torque outputs listed on the Bettis spring torque output charts are the lowest value of torque output produced at any position, during either stroke (pressure or spring).

**End:** (ending) That torque output position, at which an actuator has reached the limit of the spring stroke. The spring ending torque output values listed on Bettis spring-return torque output charts is the torque output value where the spring is fully extended and is transferring its lowest force value.

# Dimensions – CBA-Series (Pneumatic) – Imperial

## Double-Acting Actuators CBAXXX

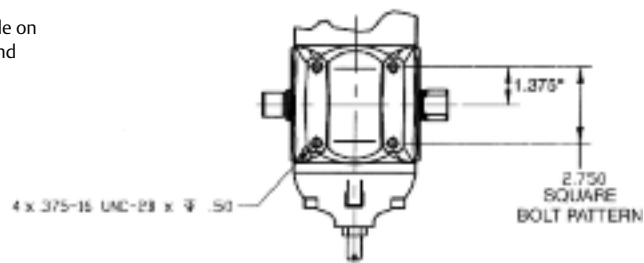


Actuator Model	A	B	C	D	E	F	G	H	J/K	L	M	N
CBA315	14.16	7.38	3.25	1.09	1.88	3.46	0.94	.94	1/4" NPT	.313-18 UNC	.38	2.250
CBA420	16.43	8.57	4.25	1.38	2.13	4.37	1.10	1.10	3/8" NPT	.375-16 UNC	.50	3.000
CBA520	16.46	8.63	5.38	1.38	2.07	4.37	1.10	1.10	3/8" NPT	.375-16 UNC	.50	3.000
CBA525	19.22	9.88	5.38	1.69	2.56	5.00	1.25	1.25	3/8" NPT	.500-13 UNC	.50	3.500
CBA725	19.44	10.24	7.50	1.69	2.53	5.00	1.25	1.25	3/8" NPT	.500-13 UNC	.50	3.500

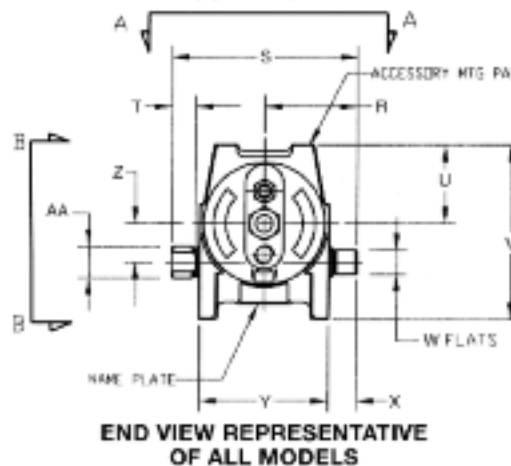
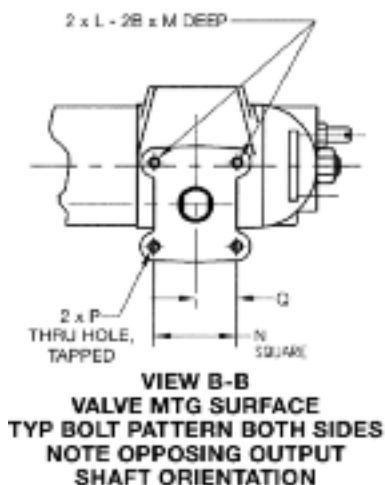
Actuator Model	P	Q	R	S	T	U	V	W	X	Y	Z	AA
CBA315	.313-18 UNC	1.125	2.91	5.81	.75	2.22	5.18	.614 .620	1.03	3.75	1.09	0.873 0.875
CBA420	.375-16 UNC	1.500	3.35	6.69	.75	2.81	6.25	.864 .870	1.03	4.63	1.38	1.123 1.125
CBA520	.375-16 UNC	1.500	3.35	6.69	.75	2.81	6.25	.864 .870	1.03	4.63	1.38	1.121 1.125
CBA525	.500-13 UNC	1.750	4.38	8.75	1.12	3.50	7.58	1.115 1.121	1.50	5.75	1.69	1.498 1.500
CBA725	.500-13 UNC	1.750	4.38	8.75	1.12	3.50	7.58	1.115 1.121	1.50	5.75	1.69	1.498 1.500

Note: Not Certified dimensional drawings. Such drawings available on request. Contact factory with correct model designation and serial number.

All dimensions are expressed in inches.

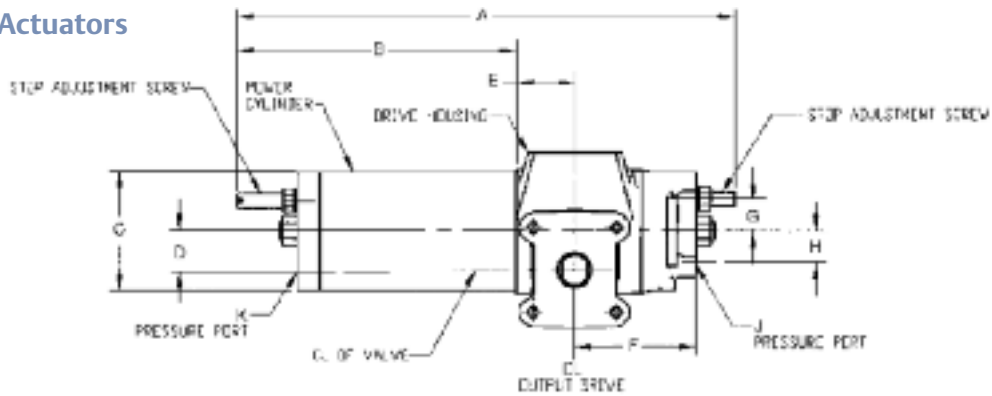


ACTUATORS SHOWN ROTATED TO FULL CLOCKWISE POSITION



# Dimensions – CBA-Series (Pneumatic) – metric

## Double-Acting Actuators CBAXXX

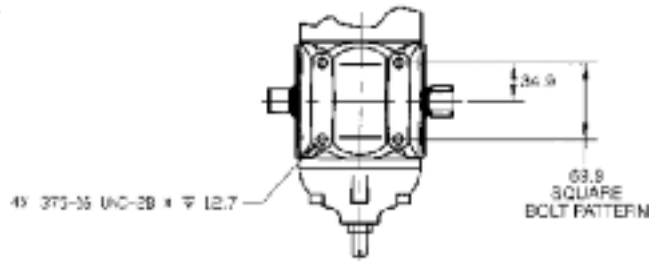


Actuator Model	A	B	C	D	E	F	G	H	J/K	L	M	N
CBA315	359.8	187.5	82.6	27.8	47.8	87.8	23.8	23.9	1/4" NPT	.313-18 UNC	9.7	57.2
CBA420	417.3	217.6	108.0	34.9	54.1	111.0	27.9	27.9	3/8" NPT	.375-16 UNC	12.7	76.2
CBA520	418.1	219.2	136.7	34.9	53.5	111.0	27.9	27.9	3/8" NPT	.375-16 UNC	12.7	76.2
CBA525	488.1	250.9	136.7	42.9	65.0	127.0	31.8	28.4	3/8" NPT	.500-13 UNC	12.7	88.9
CBA725	492.7	260.1	190.5	42.9	64.2	127.0	31.8	28.4	3/8" NPT	.500-13 UNC	12.7	88.9

Actuator Model	P	Q	R	S	T	U	V	W	X	Y	Z	AA
CBA315	.313-18 UNC	28.6	73.8	147.6	19.1	56.4	131.5	15.6 15.73	26.2	95.3	27.8	22.15 22.25
CBA420	.375-16 UNC	38.1	85.1	169.9	19.1	71.3	158.9	22.09 21.09	26.2	117.5	35.1	28.5 28.6
CBA520	.375-16 UNC	38.1	85.1	169.9	19.1	71.3	158.9	22.09 21.09	26.2	117.5	35.1	28.5 28.6
CBA525	.500-13 UNC	44.5	111.1	222.3	28.4	88.9	192.6	28.33 24.47	38.1	146.1	42.9	38.02 38.12
CBA725	.500-13 UNC	44.5	111.1	222.3	28.4	88.9	192.6	28.32 28.48	38.1	146.1	42.9	38.02 38.12

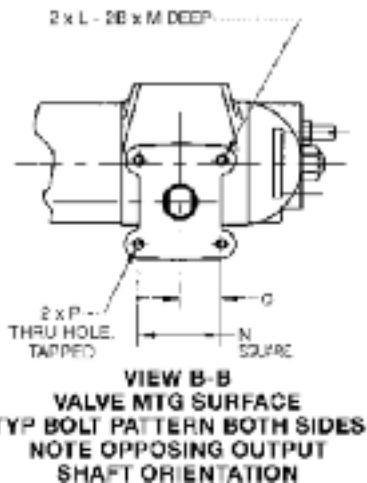
Note: Not Certified dimensional drawings. Such drawings available on request. Contact factory with correct model designation and serial number.

All dimensions are expressed in millimeters.

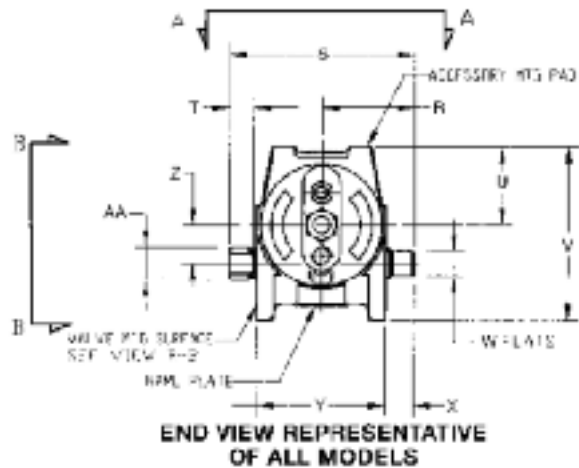


VIEW A-A  
ACCY MTG PAD

ACTUATORS SHOWN ROTATED TO FULL CLOCKWISE POSITION



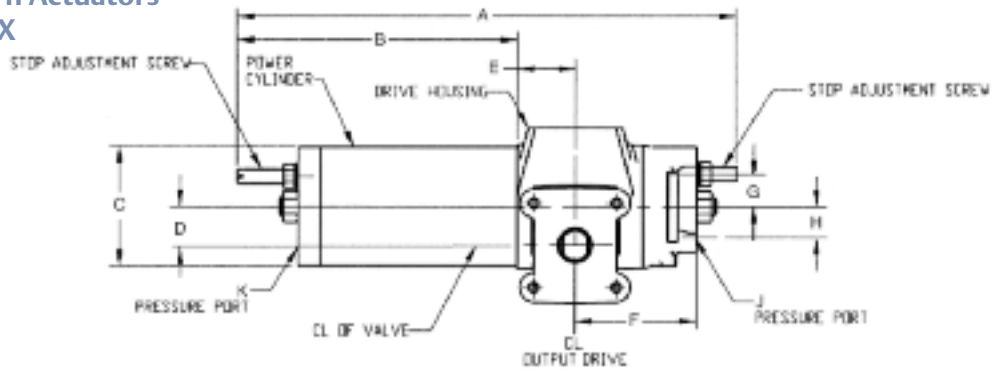
VIEW B-B  
VALVE MTG SURFACE  
TYP BOLT PATTERN BOTH SIDES  
NOTE OPPOSING OUTPUT SHAFT ORIENTATION



END VIEW REPRESENTATIVE OF ALL MODELS

# Dimensions – CBA-Series (Pneumatic) – Imperial

## Spring Return Actuators CBA XXX-SRX

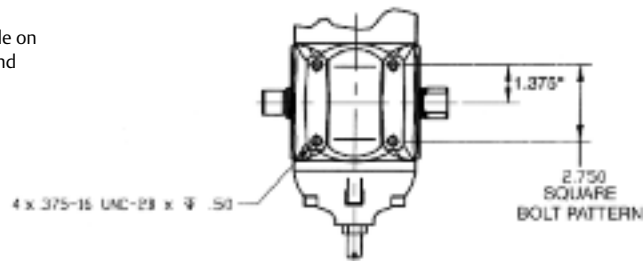


Actuator Model	A	B	C	D	E	F	G	H	J/K	L
CBA315-SRX	20.13	13.66	3.25	1.09	1.88	3.46	0.94	.94	1/4" NPT	.313-18 UNC
CBA415-SRX	20.20	13.71	4.25	1.09	1.88	3.46	0.94	.94	1/4" NPT	.313-18 UNC
CBA420-SRX	24.54	17.07	4.25	1.38	2.13	4.37	1.10	1.10	3/8" NPT	.375-16 UNC
CBA520-SRX	24.88	17.44	5.38	1.38	2.07	4.37	1.10	1.10	3/8" NPT	.375-16 UNC
CBA525-SRX	28.21	18.01	5.38	1.69	2.56	5.00	1.25	1.25	3/8" NPT	.500-13 UNC
CBA725-SRX	28.09	18.37	7.50	1.69	2.53	5.00	1.25	1.25	3/8" NPT	.500-13 UNC

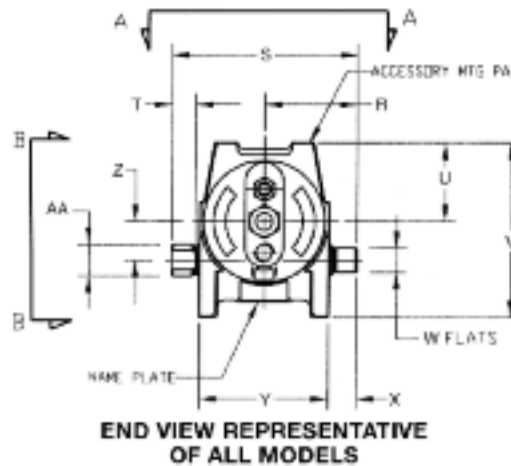
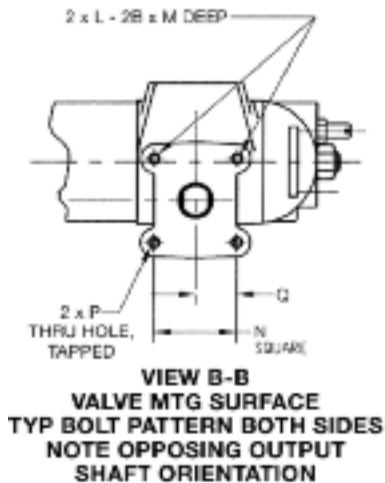
Actuator Model	M	N	P	Q	R	S	T	U	V	W	X	Y	Z	AA
CBA315-SRX	.38	2.250	.313-18 UNC	1.125	2.91	5.81	.75	2.22	5.18	.614 .620	1.03	3.75	1.09	0.873 0.875
CBA415-SRX	.38	2.250	.313-18 UNC	1.125	2.91	5.81	.75	2.22	5.18	.614 .620	1.03	3.75	1.09	0.871 0.875
CBA420-SRX	.50	3.000	.375-16 UNC	1.500	3.35	6.69	.75	2.81	6.25	.864 .870	1.03	4.63	1.38	1.123 1.125
CBA520-SRX	.50	3.000	.375-16 UNC	1.500	3.35	6.69	.75	2.81	6.25	.864 .870	1.03	4.63	1.38	1.121 1.125
CBA525-SRX	.50	3.500	.500-13 UNC	1.750	3.50	8.75	1.12	3.50	7.58	1.115 1.121	1.50	5.75	1.69	1.498 1.500
CBA725-SRX	.50	3.500	.500-13 UNC	1.750	3.50	8.75	1.12	3.50	7.58	1.115 1.121	1.50	5.75	1.69	1.498 1.500

Note: Not Certified dimensional drawings. Such drawings available on request. Contact factory with correct model designation and serial number.

All dimensions are expressed in inches.

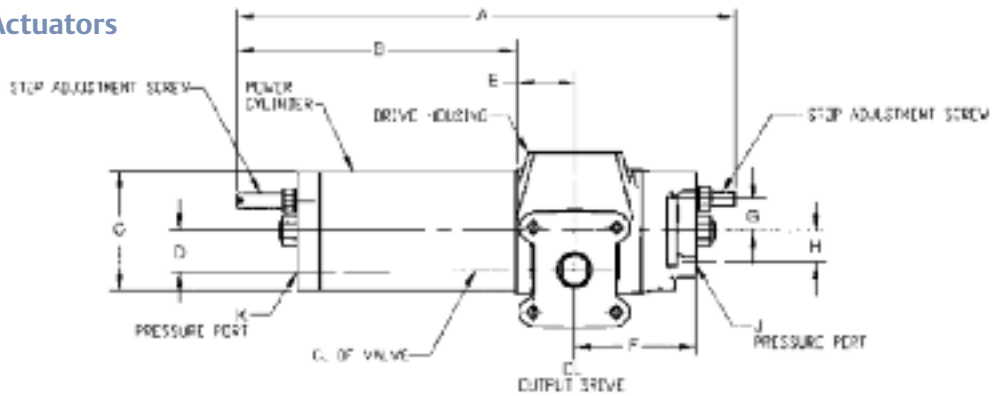


ACTUATORS SHOWN ROTATED TO FULL CLOCKWISE POSITION



# Dimensions – CBA-Series (Pneumatic) – metric

## Spring Return Actuators CBA XXX-SRX

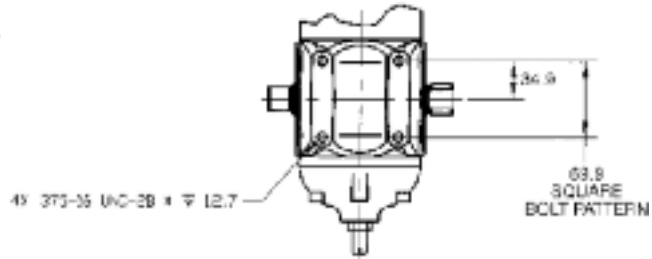


Actuator Model	A	B	C	D	E	F	G	H	J/K	L
CBA315-SRX	511.2	347.0	82.6	27.8	47.8	87.8	23.8	23.9	1/4" NPT	.313-18 ULC
CBA415-SRX	513.3	348.2	108.0	27.8	47.8	87.8	23.9	23.9	1/4" NPT	.313-18 ULC
CBA420-SRX	623.3	433.5	108.0	34.9	54.1	111.0	27.9	27.9	3/8" NPT	.375-16 UNC
CBA520-SRX	631.9	442.9	136.7	34.9	52.2	111.0	27.9	27.9	3/8" NPT	.375-16 UNC
CBA525-SRX	716.6	457.4	136.7	42.9	65.0	127.0	31.8	28.4	3/8" NPT	.500-13 UNC
CBA725-SRX	713.6	466.7	190.5	42.9	64.2	127.0	31.8	28.4	3/8" NPT	.500-13 UNC

Actuator Model	M	N	P	Q	R	S	T	U	V	W	X	Y	Z	AA
CBA315-SRX	9.7	57.2	.313-18 UNC	28.6	73.8	147.6	19.1	56.4	131.5	15.6 15.73	26.2	95.3	27.8	22.15 22.25
CBA415-SRX	9.7	57.2	.313-18 UNC	28.6	73.8	147.6	19.1	56.4	131.5	15.59 15.75	26.2	95.3	27.8	22.12 22.22
CBA420-SRX	12.7	76.2	.375-16 UNC	38.1	85.1	169.9	19.1	71.3	158.9	22.09 21.09	26.2	117.5	35.1	28.5 28.6
CBA520-SRX	12.7	76.2	.375-16 UNC	38.1	85.1	169.9	19.1	71.3	158.9	22.09 21.09	26.2	117.5	35.1	28.5 28.6
CBA525-SRX	12.7	88.9	.500-13 UNC	44.5	111.1	222.3	28.4	88.9	192.6	28.33 24.47	38.1	146.1	42.9	38.02 38.12
CBA725-SRX	12.7	88.9	.500-13 UNC	44.5	111.1	222.3	28.4	88.9	192.6	28.32 28.48	38.1	146.1	42.9	38.02 38.12

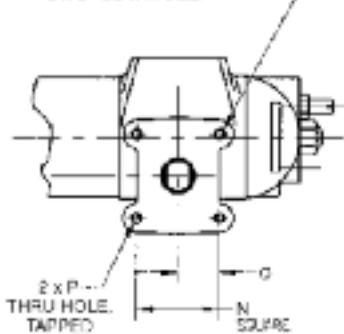
Note: Not Certified dimensional drawings. Such drawings available on request. Contact factory with correct model designation and serial number.

All dimensions are expressed in millimeters.

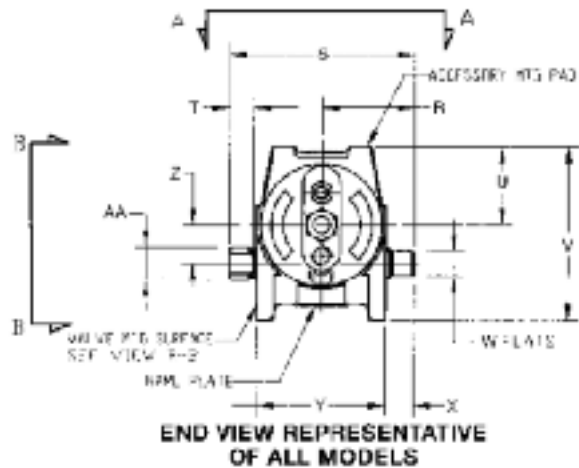


ACTUATORS SHOWN ROTATED TO FULL CLOCKWISE POSITION

2 x L - 2B x M DEEP



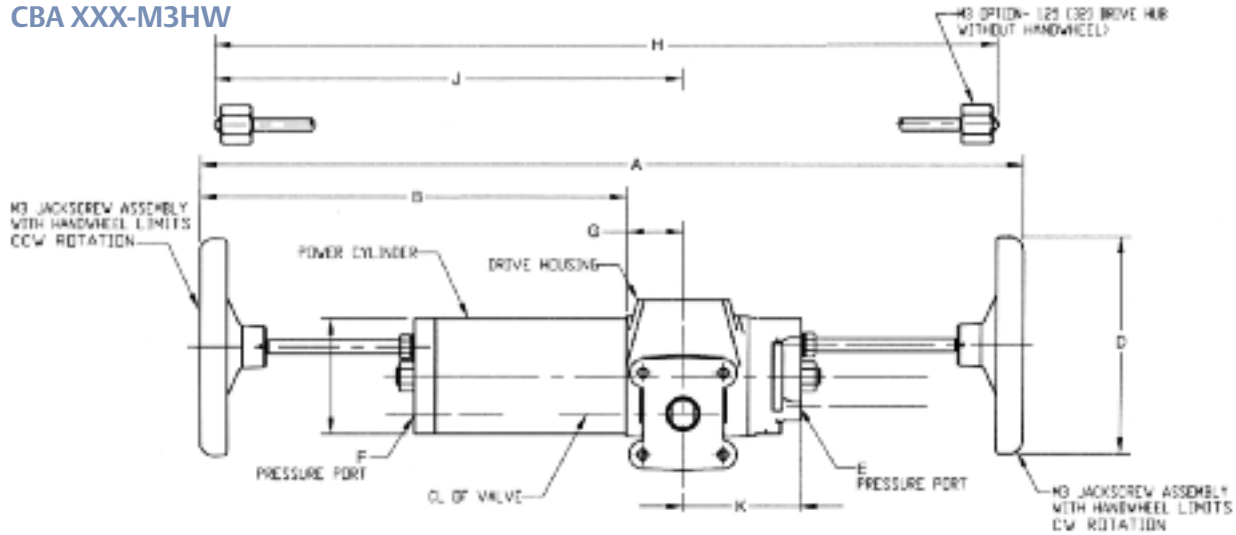
**VIEW B-B**  
VALVE MTG SURFACE  
TYP BOLT PATTERN BOTH SIDES  
NOTE OPPOSING OUTPUT SHAFT ORIENTATION



**END VIEW REPRESENTATIVE OF ALL MODELS**

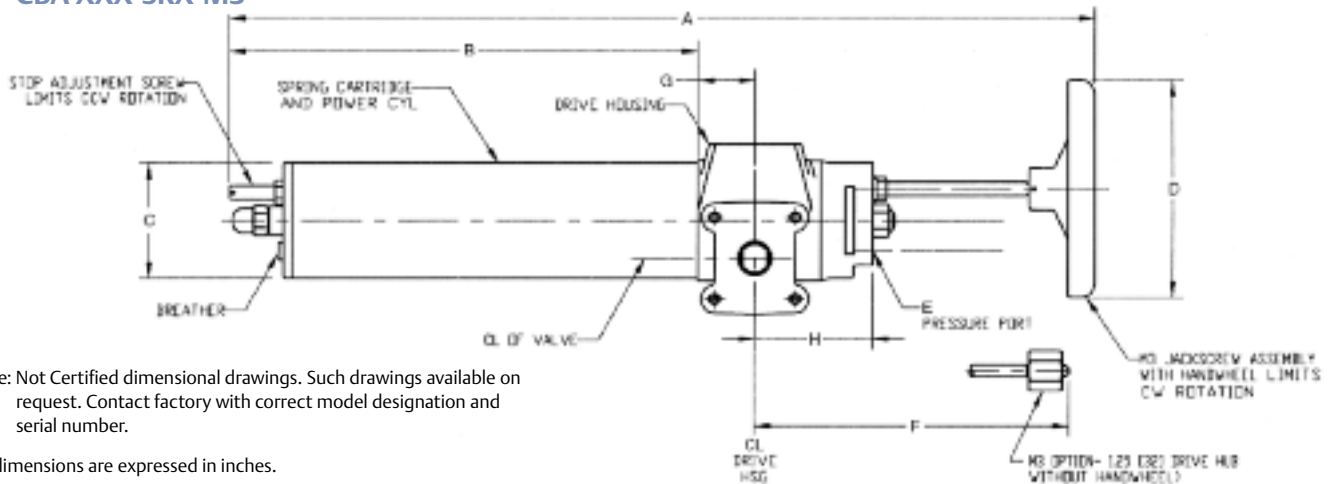


## Double-Acting Actuators CBA XXX-M3HW



Actuator Model		A	B	C	D	E	F	G	H	J	K
CBA315-M3HW	in mm	25.23 640.8	13.01 365.0	3.25 82.6	6.00 152.4	1/4" NPT	1/4" NPT	1.88 47.6	24.21 614.9	14.37 365.0	3.47 88.2
CBA420-M3HW	in mm	30.58 776.8	15.82 401.8	4.25 108.0	8.00 203.2	3/8" NPT	3/8" NPT	2.13 54.0	29.12 739.6	17.37 441.1	4.38 111.1
CBA520-M3HW	in mm	30.58 776.8	15.85 402.5	5.25 133.4	8.00 203.2	3/8" NPT	3/8" NPT	2.09 53.2	29.06 738.0	17.37 441.1	4.38 111.1
CBA525-M3HW	in mm	36.52 927.5	18.92 480.5	5.25 133.4	10.00 254.0	3/8" NPT	3/8" NPT	2.56 65.0	34.17 867.9	20.31 515.8	5.00 127.0
CBA725-M3HW	in mm	36.65 930.8	19.08 484.6	7.50 190.5	10.00 254.0	3/8" NPT	3/8" NPT	2.53 64.2	34.17 867.9	20.31 515.8	5.00 127.0

## Spring Return Actuators CBA XXX-SRX-M3



Note: Not Certified dimensional drawings. Such drawings available on request. Contact factory with correct model designation and serial number.

All dimensions are expressed in inches.

Actuator Model		A	B	C	D	E	F	G	H
CBA315-SR-M3HW	in mm	26.66 677.1	14.43 366.5	3.25 82.6	6.00 152.4	1/4" NPT	9.84 249.9	1.88 47.6	3.47 88.2
CBA415-SR-M3HW	in mm	26.74 679.1	14.51 368.6	4.25 108.0	6.00 152.4	1/4" NPT	9.84 249.9	1.88 47.6	3.47 88.2
CBA420-SR-M3HW	in mm	32.13 816.2	17.37 441.3	4.25 108.0	8.00 203.2	3/8" NPT	11.69 297.0	2.13 54.0	4.38 111.1
CBA520-SR-M3HW	in mm	32.16 816.8	17.43 442.7	5.38 136.7	8.00 203.2	3/8" NPT	11.69 297.0	2.09 53.2	4.38 111.1
CBA525-SR-M3HW	in mm	36.93 937.9	19.33 491.0	5.38 136.7	10.00 254.0	3/8" NPT	13.86 351.9	2.56 65.0	5.00 127.0
CBA725-SR-M3HW	in mm	36.98 939.2	19.41 493.1	7.50 190.5	10.00 254.0	3/8" NPT	13.86 352.1	2.53 64.2	5.00 127.0

## Options

### **SIL-PAC™**

The unique SIL-PAC solution provides a complete hardware and Bettis-supplied documentation package, embracing IEC, ISA and OSHA standards, for use in a SIL application. The CBA-Series actuators have a Failure Modes and Effects Diagnostics Analysis (FMEDA) report performed by Exida.com™ for SIL suitability. They can be combined with other components such as solenoid valves, switches and regulators. When Fisher's TÜV-certified FIELDVUE® DVC controller is added, SIL-PAC is capable of partial stroke testing PLUS providing continuous monitoring of supply pressure, valve position and pressure values to the actuator to verify its proper working condition. The SIL-PAC package can then be mounted on the appropriate quarter-turn valve as a final control solution suitable for SIL1, 2 or 3 applications.

### **Bettis Automated Packages**

Bettis offers complete packages as a solution for final valve control. Bettis has the capability to combine the CBA actuator, necessary controls and selected valve into a single system – perfect for large international projects.

With this capability, Bettis can integrate its products with the complete offering of control options, including world-class PlantWeb® digital plant architecture and the entire range of Emerson automation solutions.

### **BettiSystems™**

Bettis has pre-engineered and documented a series of commonly required control systems. These approved systems utilize standard components, reduce lead times, and simplify purchasing, installation and start-up. Please consult the factory for additional information.

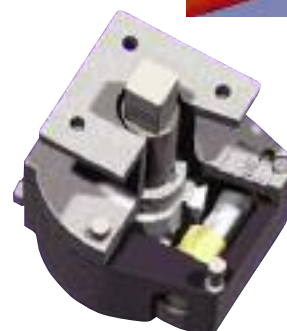
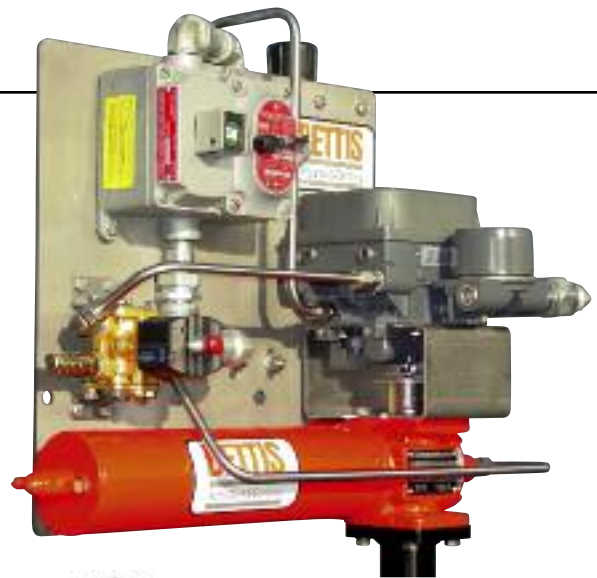
### **M3/M3HW**

This blowout-proof Jackscrew manual override is a mechanical advantage device threaded through a special adapter or the end cap of the CBA-Series cylinder to exert linear thrust on the actuator's piston rod. The Jackscrew override is available for all CBA models, with (HW) or without handwheel. It provides fully-rated torque output if air supply is lost.

### **BettiStop™ Partial Stroke Test Device**

This external-mount device is sandwiched between the CBA-Series actuator and the valve. It is ideal for periodic testing of Emergency Shutdown valves (ESD) while remaining in service and is used for other safety process flow applications. It is particularly useful where compliance with ANSI/ISA S84.01, OSHA CFR 1910.119 and IEC 61508/61511 are applicable.

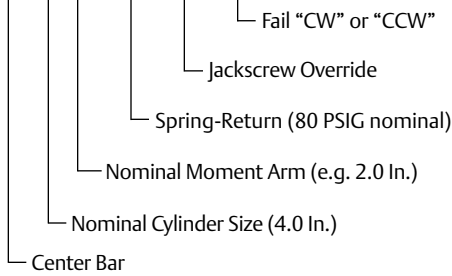
The BettiStop can test a valve automation package by mechanically limiting valve stem rotation, clockwise or counter-clockwise, to 20 degrees as standard or 15 degrees optionally. When disengaged, the BettiStop does not interfere with the actuated valve. Consult factory for additional information.



## ORDERING / MODEL DESIGNATION

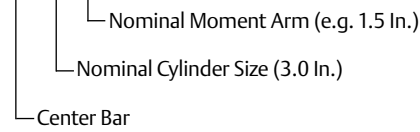
### Spring-Return Example

“CBA 4 20 SR80-M3-CW”



### Double-Acting Example

“CBA 3 15”



## OPTIONAL FEATURES

### Fail-Safe Operation

Each Bettis CBA actuator is capable of fail-safe operation using either stored compressed gas (air) or a mechanical spring.

### Trims

Trim options for CBA-Series actuators include seals for high and low temperature applications and no copper or yellow metals. The N-Series actuator is designed to resist affects of environmental conditions and seismic loading design criteria imposed by the Nuclear Power Industry. Consult Bettis for more information on these and other specific trims.

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