

Bettis Q-Series

Integrated Concept for Valve Automation



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Bettis Q-Series “Fully Integrated” Actuator and Control Modules

General Overview

Description

The Bettis Q-Series package consists of an actuator with a module for control and position feed back and forms an integrated concept for “On/Off” valve automation.

1. Basic Actuators

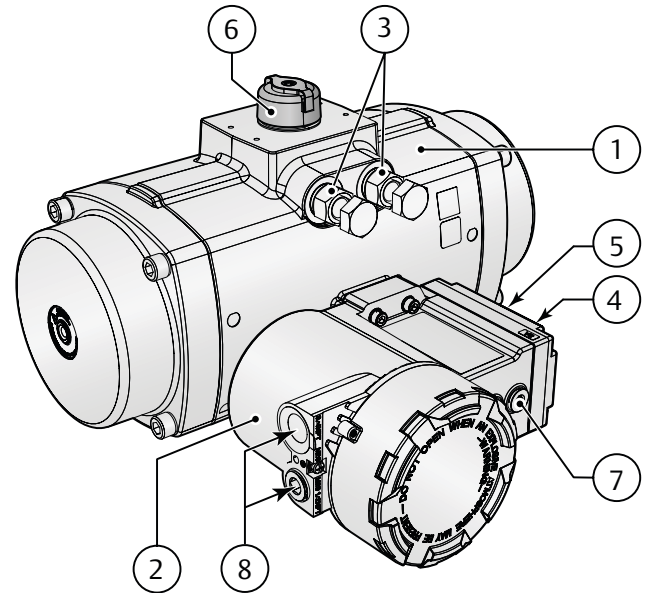
The basic actuator supplies the torque, required to open and close valves and is available in various sizes, rated 413 to 15312 lbf.in at 80 psig (47 to 1725 Nm at 5.5 barg). Double-Acting and Spring-Return executions are available. The Spring-Return execution can be equipped with multiple spring sets to cover a pressure range from 30 to 120 psig (2 to 8 barg).

2. Control Modules

The Control Modules contain, next to the components for feedback switches, also all the pneumatic control components.

Its compact and robust construction incorporates basic control and feedback functionality and is suitable for indoor and outdoor use.

1. The enclosure of the control modules are rated IP66 / NEMA 4X according IEC 60529 and are suitable for indoor and outdoor use.
2. The QC41, QC42 and QC43 Explosion proof control modules are suitable for use in potentially explosive atmospheres and are available with FM, CSA, ATEX or IECEx approvals.
3. The QC40 with AS-Interface bus communication is available with Non-Sparking Ex nA or Non Incendive approvals and is suitable for use in potentially explosive atmospheres. For this QC40 ASI module FM, ATEX or IECEx approvals are available.
4. The QC54 with Foundation Fieldbus bus communication is available with Non-Sparking Ex nA or Non Incendive or Intrinsically Safe approvals and is suitable for use in potentially explosive atmospheres. For this QC54 ASI module FM, ATEX or IECEx approvals are available.
5. Both the weatherproof and certified control modules are available with the Fail-In-Last-Position control function for Double-Acting actuators and the nonintrusive switch point adjustment.



Bettis Q-Series valve actuator with Control Module

1. Basic Actuator
2. Control Module
3. Limit stop screws for “Open” and “Closed” position
4. G1/4” air connections
5. Optional: Built-in speed control
6. Visual position indication
7. Optional: Manual Control
8. Electrical entries

Actuator Specifications:

Torque Range

- Double-Acting: 413 to 15312 lbf.in at 80 psig (47 to 1725 Nm at 5.5 barg)
- Spring-Return: 220 to 6844 lbf.in (25 to 773 Nm) spring end torque at maximum spring set.

Pressure Range

- Double-Acting:
 - 2.9 to 120 psig (0.2 to 8.3 barg)
- Spring-Return:
 - 87 to 120 psig (6 to 8.3 barg), with maximum spring set
 - 43.5 to 120 psig (3 to 8.3 barg), reduced spring quantity

Pressure Media

- Air, dry or lubricated and inert gases
- Dew point at least 10K below ambient temperature
- For sub-zero applications, take appropriate measures
- Mentioned pressure levels are “gauge pressures”. Gauge pressure is equal to absolute pressure minus atmospheric pressure.

Cycle life

- Normal working life is 500,000 cycles according EN15714-3, where 1 cycle is 1 open stroke and 1 close stroke.

Finish

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

Lubrication

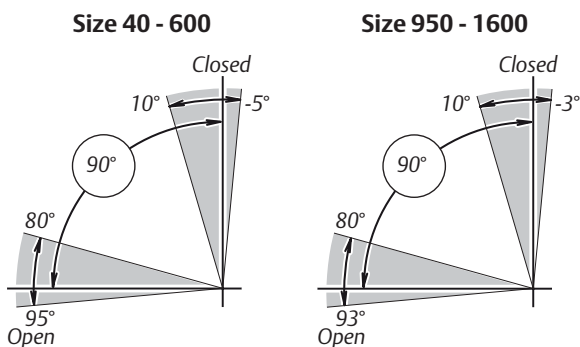
- Castrol High Temperature grease (or equivalent)

Temperature Range

- Standard: -4°F to 176°F (-20°C to +80°C)

Angle of Rotation

- Factory set at 90°
- Adjustable range:
 - Size 40 to 600: -5° to +10° and +80° to 95°
 - Size 950 to 1600: -3° to +10° and +80° to 93°



Compliance to International Standards

- Valve flange: ISO 5211/DIN3337
- Solenoid flange: VDE/VDI 3845 (NAMUR)
- Accessory flange: VDE/VDI 3845 (NAMUR)
- European Directives: ATEX, PED and Machinery Directive
- This product is only intended for use in large-scale fixed installations excluded from the scope of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2).
- EAC Customs union: Compliance to Russian TR010 and TR012

Control Module Specifications

The following versions of Control modules are available. Please check the indicated Data Sheet for more detailed information.

- QC41 24VDC 1.604.10
- QC42 115VAC 1.604.10
- QC43 230VAC 1.604.10
- QC40 AS-Interface 1.604.11
- QC54 Foundation Fieldbus 1.604.12

Options

Speed control, Manual control, IECEx, ATEX, FM INMETRO or CSA approvals, glands, quick connectors, exhaust port filters and silencers.

Functions

- Double or Single-Acting (Spring-Return)
- Fail-in-Last position

Actuator range

- Suitable for Q40 to Q1600 (see Note below).

Ingress protection rating

- IP66 / NEMA4X

Pneumatic connections

- G1/4" or 1/4" NPT

“Breather” function

- Standard for Single-Acting actuators

Actuator Weight

Actuator Model	Double-Acting		Spring-Return Springset N=6	
	lbs	Kg	lbs	Kg
Q 40	4.6	2.1	5.1	2.3
Q 65	6.2	2.8	7.3	3.3
Q 100	7.7	3.5	9.5	4.3
Q 150	10.8	4.9	14.6	6.6
Q 200	13.2	6.0	18.3	8.3
Q 350	22	10.2	32	14.5
Q 600	44	20	57	26
Q 950	58	26	89	41
Q 1600	91	41	137	62

Cycle time in seconds (Control Module)

Actuator Model	Spring-Return		Double-Acting	
	Opening Stroke	Closing Stroke	Opening Stroke	Closing Stroke
Q 40	0.41	0.41	0.55	0.41
Q 65	0.55	0.55	0.67	0.55
Q 100	0.57	0.57	0.85	0.57
Q 150	0.85	0.85	0.78	0.85
Q 200	0.85	0.85	0.98	0.85
Q 350	1.59	1.6	1.46	1.6
Q 600	2.75	2.75	2.55	2.75
Q 950	3.66	3.66	3.66	3.42
Q 1600	5.71	5.71	5.71	5.29

Test conditions:

1. Control Module with flow capacity: 0.28 m³/hr
2. Pipe diameter: 6 mm
3. Medium: clean air
4. Supply pressure: 5.5 bar/80 psi
5. Load: with average load
6. Stroke: 90°
7. Temperature: Room temperature

Actuator air volumes and consumption

Actuator model	Actuator volumes:		
	Maximum volume (in liters)		
	Central ¹ chamber	End cap ² chamber	Displace ³ volume
Q 40	0.26	0.37	0.15
Q 65	0.40	0.56	0.22
Q 100	0.6	0.9	0.3
Q 150	1.0	0.8	0.5
Q 200	1.3	1.0	0.7
Q 350	2.1	1.9	1.2
Q 600	3.6	3.3	2.1
Q 950	4.9	4.6	3.2
Q 1600	7.9	7.3	5.4

Consumption per stroke (in liters, pressure in barg)					
Outward Stroke			Inward Stroke		
Double-Acting and Spring-Return			Double-Acting only		
2.0 barg	4.0 barg	8.0 barg	2.0 barg	4.0 barg	8.0 barg
0.67	1.2	2.2	0.89	1.6	3.1
1.02	1.8	3.4	1.3	2.4	4.7
1.5	2.7	5.0	2.0	3.8	7.2
2.4	4.3	8.1	2.1	3.6	6.7
3.2	5.7	11	2.8	4.9	9.1
5.5	9.8	18	5.0	8.8	16
9.4	17	31	8.7	15	28
13	23	43	12	22	40
21	37	69	20	35	64

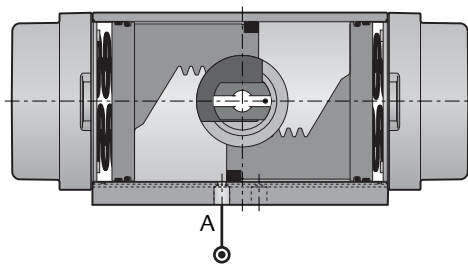
Actuator model	Actuator volumes:		
	Maximum volume (Cu.in.)		
	Central ¹ chamber	End cap ² chamber	Displace ³ volume
Q 40	15.9	23	8.9
Q 65	24	34	13.5
Q 100	36	53	19.9
Q 150	58	47	32
Q 200	76	64	44
Q 350	131	115	76
Q 600	222	201	129
Q 950	301	279	196
Q 1600	484	447	328

Consumption per stroke (in Cu.in., pressure in psig)					
Outward Stroke			Inward Stroke		
Double-Acting and Spring-Return			Double-Acting only		
40 psig	80 psig	120 psig	40 psig	80 psig	120 psig
53	96	140	71	133	196
81	148	215	107	200	294
118	216	314	165	310	455
192	352	512	163	293	424
255	466	676	220	397	573
436	796	1157	392	709	1025
742	1354	1967	683	1237	1790
1025	1854	2682	966	1735	2505
1662	2997	4331	1560	2792	4024

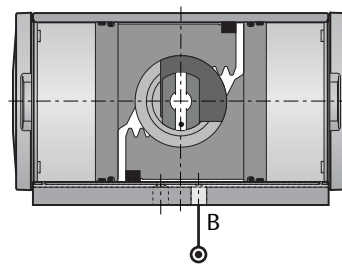
Notes:

1. For Double-Acting and Spring-Return. Pistons at 90° outward position
2. Only For Double-Acting. Pistons at 0° inward position
3. Stroke is 90°

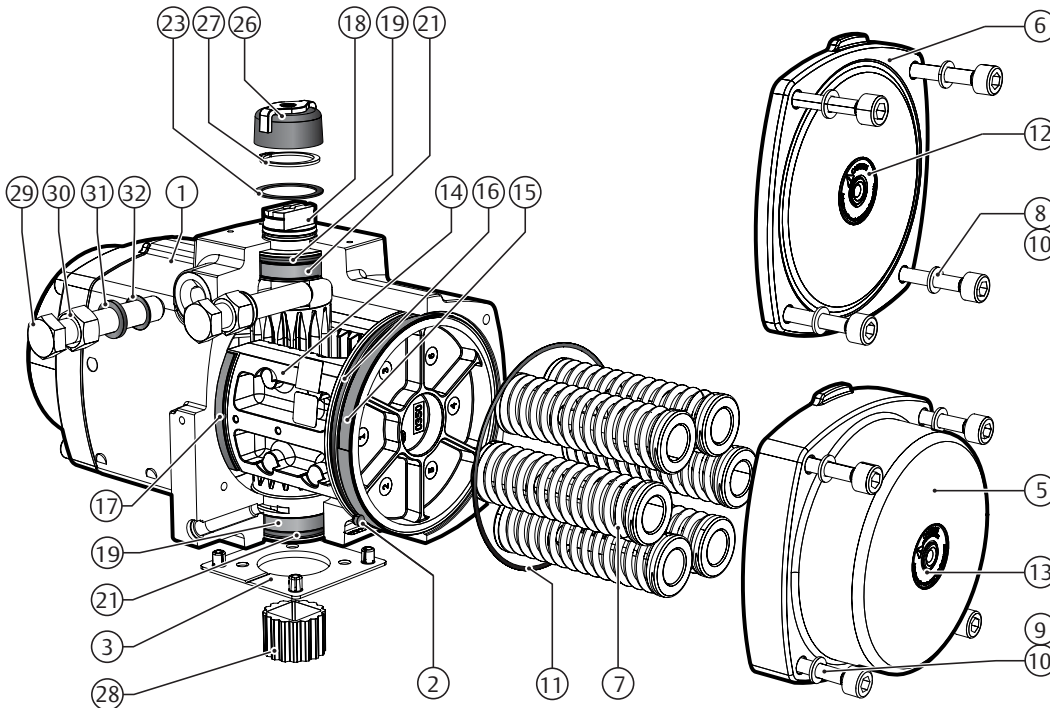
Central air chamber volume
Double-Acting and Spring-Return



End cap air chamber volume
Double-Acting only



Construction, Parts and Materials Q40 - Q600

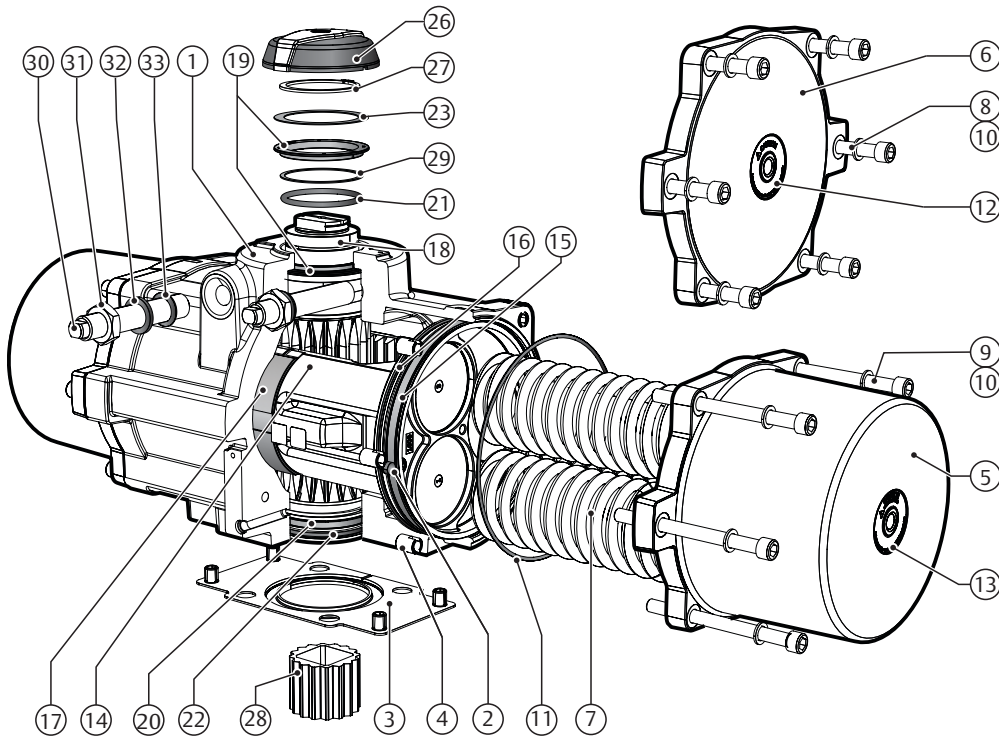


Notes:

- 1. Included in Service Kit.
- 2. Anodized and polyurethane powder coated.
- 3. Chromated
- 4. Hard anodized
- 5. Electrophoretic coated
- 6. Deltatone® coated
- 7. Anodized
- 8. High end caps for Double-Acting and Spring-Return models up to size F100. Low end caps for Double-Acting models for sizes Q150 and larger.

Pos.	Qty.	Notes	Description	Material
1	1	2	House	Cast Aluminium alloy
2	2	1	B-port seal	Nitrile rubber
3	1		Center plate (option)	Nylon PA6, Black
5	2	2, 8	End cap SR (DA)	Cast Aluminium alloy
6	2	2, 8	End cap DA	Cast Aluminium alloy
7	Max. 12	5	Spring cartridge	Spring steel
8	8		End cap screw DA	Stainless Steel
9	8		End cap screw SR	Stainless Steel
10	8		End cap screw washer	Stainless Steel
11	2	1	O-ring end cap	Nitrile rubber
12	2		Warning sticker DA	Polyester
13	2		Warning sticker SR	Polyester
14	2	3	Piston	Cast Aluminium alloy
15	2	1	Bearing piston	PTFE 25% carbon-filled
16	2	1	O-ring piston	Nitrile rubber
17	2	1	Bearing strip piston rack	POM
18	2	4	Pinion	High grade aluminium
19	2	1	Bearing pinion	POM
21	2	1	O-ring pinion	Nitrile rubber
23	1	1	Thrust bearing pinion	POM, black UV stabilized
26	1		Indicator assembly	ABS + stainless steel screw
27	1	1, 6	Circlip	Spring steel
28	1	7	Drive insert	Aluminium
30	2		Limit stop screw	Stainless steel
31	2		Limit stop nut	Stainless steel
32	2	1	Limit stop washer	PA66
33	2	1	O-ring limit stop	Nitrile rubber

Construction, Parts and Materials Q950 - Q1600



Notes:

1. Included in Service Kit.
2. Anodized and polyurethane powder coated.
3. Chromated
4. Hard anodized
5. Electrophoretic coated
6. Deltatone® coated
7. Anodized
8. 8x for Size 950
12x for Size 1600

Pos.	Qty.	Notes	Description	Material
1	1	2	House	Cast Aluminium alloy
2	2	1	B-port seal	Nitrile rubber
3	1		Center plate (option)	Nylon PA6, Black
4	8/12	8	Thread insert	Steel
5	2	2	End cap SR	Cast Aluminium alloy
6	2	2	End cap DA	Cast Aluminium alloy
7	Max. 6	5	Springs	Spring steel
8	8/12	8	End cap screw DA	Stainless Steel
9	8/12	8	End cap screw SR	Stainless Steel
10	8/12	8	End cap screw washer	Stainless Steel
11	2	1	O-ring end cap	Nitrile rubber
12	2		Warning sticker DA	Polyester
13	2		Warning sticker SR	Polyester
14	2	3	Piston	Cast Aluminium alloy
15	2	1	Bearing piston	PTFE 25% carbon-filled
16	2	1	O-ring piston	Nitrile rubber
17	2	1	Bearing strip piston rack	POM
18	1	4	Pinion	High grade aluminium
19	2	1	Bearing pinion top	POM
20	1	1	Bearing pinion bottom	POM
21	1	1	O-ring pinion top	Nitrile rubber
22	1	1	O-ring pinion bottom	Nitrile rubber
23	1	1	Thrust bearing pinion	POM, black UV stabilized
26	1		Indicator assembly	ABS + stainless steel screw
27	1	1, 6	Circlip	Spring steel
28	1	7	Drive insert	Aluminium
29	1	1	Backup ring	POM
30	2		Limit stop screw	Stainless steel
31	2		Limit stop nut	Stainless steel
32	2	1	Limit stop washer	PA66
33	2	1	O-ring limit stop	Nitrile rubber

Assembly Codes Bettis Q-Series Actuators

Spring-Return Actuators

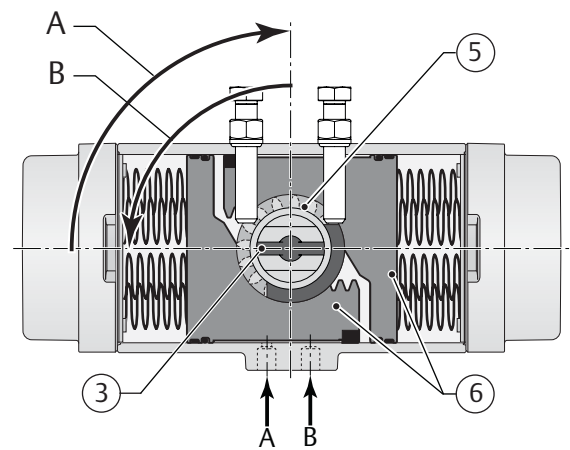
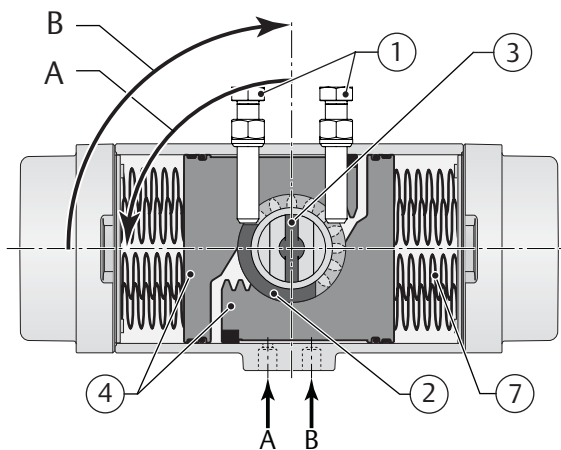
Assembly code: CW

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

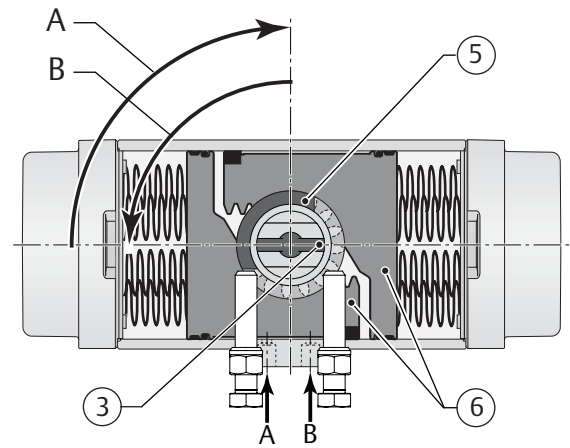
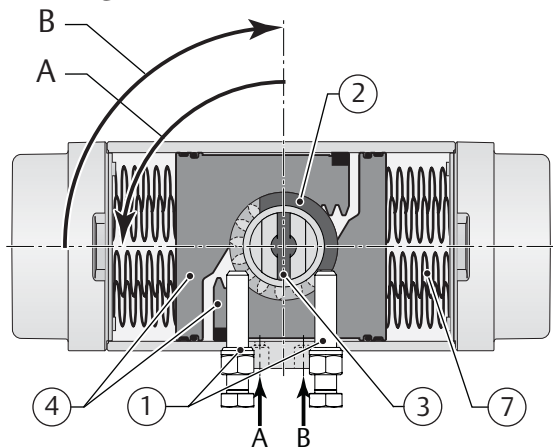
Assembly code: CC

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

Sizes Q40 and Q65



Sizes Q100 to Q1600



Rotation A = Central air chamber pressurized

Rotation B = Spring stroke

1. Limit stops location
2. Position of cam
3. Position of slot and dot in pinion
4. Default pistons position
5. Pinion 90° Rotated
6. Reversed piston position
7. Springs

All views are from above. Pistons are shown in inward position.

Double-Acting Actuators

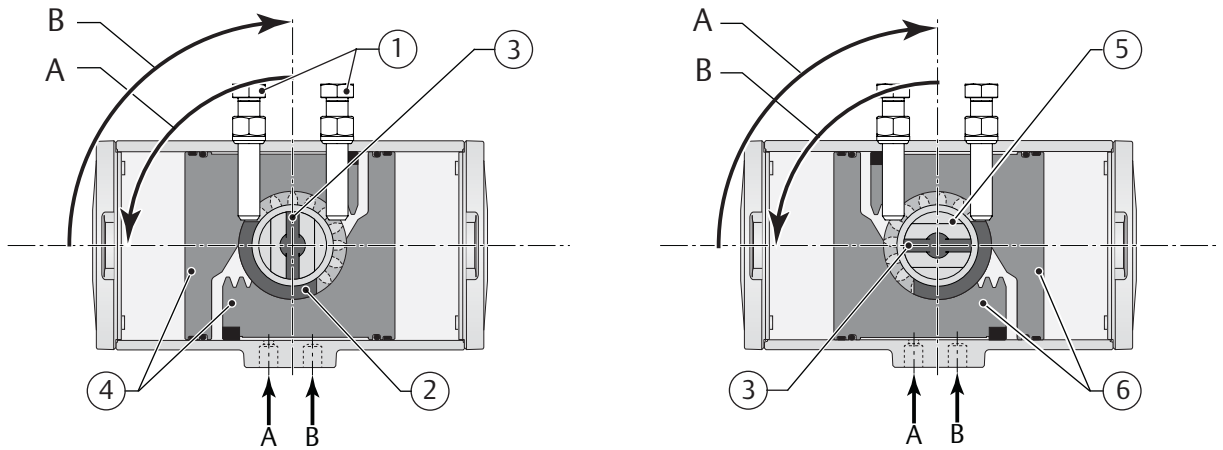
Assembly code: CW

= Standard, Clockwise-to-Close rotation

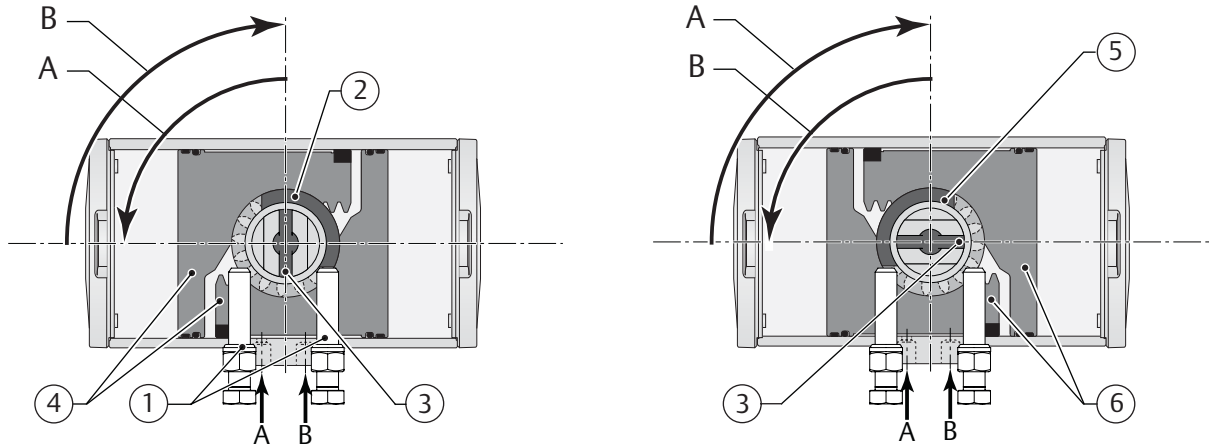
Assembly code: CC

= Reverse, Counterclockwise-to-Open

Sizes Q40 and Q65



Sizes Q100 to Q1600

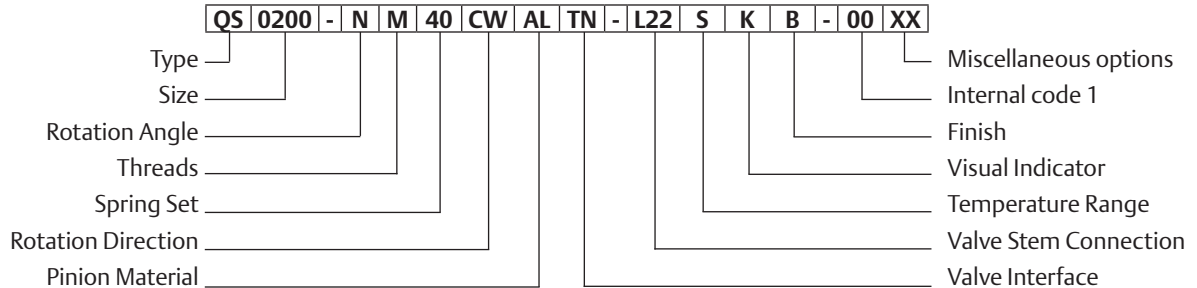


Rotation A = Central air chamber pressurized
 Rotation B = End cap air chambers pressurized

- 1. Limit stops location
- 2. Position of cam
- 3. Position of slot and dot in pinion
- 4. Default pistons position
- 5. Pinion 90° Rotated
- 6. Reversed piston position

All views are from above. Pistons are shown in inward position.

Configuration String Bettis Q-Series Actuators



Type			
QD	Double-Acting		
QS	Spring-Return		
Size			
0040	Size 0040	0350	Size 0350
0065	Size 0065	0600	Size 0600
0100	Size 0100	0950	Size 0950
0150	Size 0150	1600	Size 1600
0200	Size 0200		
Rotation angle			
N	90° rotation angle		
Threads			
M	Metric ISO 5211		
U	UNC/NPT/Imperial		
Spring Set			
00	Double-Acting (no springs)		
10	Spring Set 10	40	Spring Set 40
20	Spring Set 20	50	Spring Set 50
30	Spring Set 30	60	Spring Set 60
Rotation direction			
CW	Spring to Close/Clock Wise		
CC	Spring to Open/Counter Clock Wise		
Pinion Material			
AL	High Grade Aluminium, Hard anodized		
Valve Interface, Note 2			
TN	Standard ISO 5211 interface		
SY	Small interface with center plate (DIN3337)		
LY	Large interface with center plate (DIN3337)		

Valve Stem Connection, Note 3			
Actuator size	Square dimensions	Parallel drive (■)	Diagonal drive (◆)
No insert		000	
0040 & 0065	14 mm / 0.551"	L14	D14
0100	17 mm / 0.669"		D17
	19 mm / 0.748"	L19	
0150	17 mm / 0.669"		D17
	19 mm / 0.748"	L19	
0200	22 mm / 0.866"	L22	D22
0350	22 mm / 0.866"		D22
	27 mm / 1.063"	L27	
0600	27 mm / 1.063"	L27	D27
0950	36 mm / 1.417"	L36	D36
1600	46 mm / 1.811"	L46	D46
Temperature Range			
S	Standard: -20°C to +80°C (-4°F to +176°F)		
Visual Indication Code			
K	Standard (Knob)		
N	No Visual Indication		
Finish			
B	Standard coating (Bettis Orange)		
Internal code 1			
00	Standard		
Miscellaneous options			
XX	Standard: Suitable for Control module mounting		
FS	Full stroke adjustment (only sizes 40 to 600)		

Notes:

- The options, listed here, are all options available. Not all options apply to all configurations.
- Valve Interface:
Option "SY"; Small Interface with Center Plate (DIN3337) is not available for sizes 0950.
Option "LY"; Large Interface with Center Plate (DIN3337) is not available for sizes 1600.
- Contact your local Bettis Q-Series representative for additional insert options.
- PED Group 1 Label only available up to size 950.

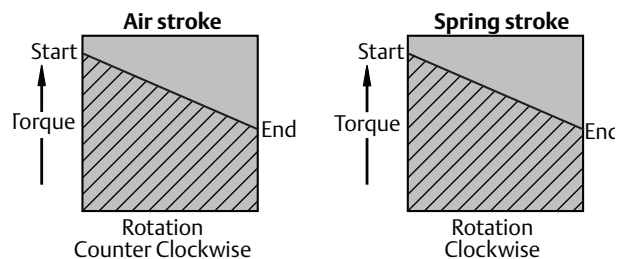
Actuator Torque - Spring-Return (Nm)

Actuator Size	Spring set nr.	Spring Stroke Torque (Nm)		Air Stroke Torque (Nm)																	
				SUPPLY PRESSURE																	
		Start	End	3.0 barg		3.5 barg		4.0 barg		4.5 barg		5.0 barg		5.5 barg		6.0 barg		7.0 barg		8.0 barg	
QS 40	10	7	4	22	19	26	24	31	28	36	33	40	37	45	42	49	46	58	55	67	64
	20	13	8	17	12	22	16	26	21	31	25	35	30	40	34	44	39	53	48	62	57
	30	20	12	12	4	17	9	21	13	26	18	31	22	35	27	40	31	49	40	58	49
	40	26	17	-	-	12	1	17	6	21	10	26	15	30	19	35	24	44	33	53	42
	50	33	21	-	-	-	-	-	-	17	3	21	7	26	12	30	16	39	25	48	34
	60	39	25	-	-	-	-	-	-	-	-	-	-	21	4	25	9	34	18	43	27
QS 65	10	10	6	33	29	40	36	47	43	54	50	61	57	68	63	75	70	88	84	102	98
	20	20	13	26	17	33	24	40	31	47	38	53	45	60	52	67	59	81	72	95	86
	30	31	19	19	5	25	12	32	19	39	26	46	33	53	40	60	47	74	61	87	74
	40	41	26	-	-	-	-	25	8	32	14	39	21	46	28	52	35	66	49	80	63
	50	51	32	-	-	-	-	-	-	24	3	31	10	38	17	45	23	59	37	73	51
	60	61	39	-	-	-	-	-	-	-	-	-	-	31	5	38	12	52	25	65	39
QS 100	10	15	9	49	43	60	53	70	64	80	74	90	84	100	94	111	104	131	125	151	145
	20	30	19	39	26	49	36	59	47	69	57	79	67	90	77	100	87	120	108	141	128
	30	44	28	28	9	38	19	48	30	59	40	69	50	79	60	89	70	109	91	130	111
	40	59	37	-	-	27	2	38	13	48	23	58	33	68	43	78	53	99	74	119	94
	50	74	47	-	-	-	-	-	-	37	6	47	16	57	26	68	36	88	57	108	77
	60	89	56	-	-	-	-	-	-	-	-	-	-	47	9	57	19	77	40	98	60
QS 150	10	24	15	79	69	96	86	112	102	128	118	145	135	161	151	177	167	210	200	243	233
	20	47	30	62	42	79	59	95	75	111	91	128	108	144	124	160	140	193	173	226	206
	30	71	44	45	15	62	32	78	48	94	64	111	81	127	97	143	113	176	146	209	179
	40	94	59	-	-	45	5	61	21	77	37	94	54	110	70	126	86	159	119	192	152
	50	118	74	-	-	-	-	-	-	60	10	77	26	93	43	109	59	142	92	175	124
	60	141	89	-	-	-	-	-	-	-	-	-	-	76	16	92	32	125	65	158	97
QS 200	10	33	21	108	94	131	117	153	139	175	161	198	184	220	206	242	228	287	273	332	318
	20	65	41	85	57	107	79	129	102	152	124	174	146	196	169	219	191	263	236	308	280
	30	98	62	61	19	83	42	106	64	128	86	150	109	173	131	195	153	240	198	284	243
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	50	163	103	-	-	-	-	-	-	81	11	103	34	125	56	148	78	192	123	237	168
	60	196	124	-	-	-	-	-	-	-	-	-	-	102	18	124	41	169	85	213	130
QS 350	10	56	35	189	165	227	204	266	243	305	281	344	320	383	359	422	398	499	476	577	553
	20	112	70	148	101	187	139	226	178	265	217	303	256	342	295	381	334	459	411	537	489
	30	168	106	108	36	146	75	185	114	224	153	263	192	302	231	341	269	418	347	496	425
	40	224	141	-	-	106	11	145	50	184	89	222	127	261	166	300	205	378	283	455	360
	50	280	176	-	-	-	-	-	-	143	24	182	63	221	102	260	141	337	218	415	296
	60	335	211	-	-	-	-	-	-	-	-	-	-	180	38	219	77	297	154	374	232
QS 600	10	96	60	320	279	386	345	452	411	518	477	584	543	650	609	716	675	848	807	980	939
	20	192	121	251	169	317	235	383	301	449	367	515	433	581	499	647	565	779	697	911	829
	30	287	181	181	59	247	125	313	191	379	257	445	323	511	389	577	455	709	587	841	719
	40	383	241	-	-	178	15	244	81	310	147	376	213	442	279	508	345	640	477	772	609
	50	479	302	-	-	-	-	-	-	241	37	307	103	373	169	439	235	571	367	703	499
	60	575	362	-	-	-	-	-	-	-	-	-	-	303	59	369	125	501	257	633	389

Notes:

- Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
- Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
- If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson representative.

Spring-Return Torque Diagram



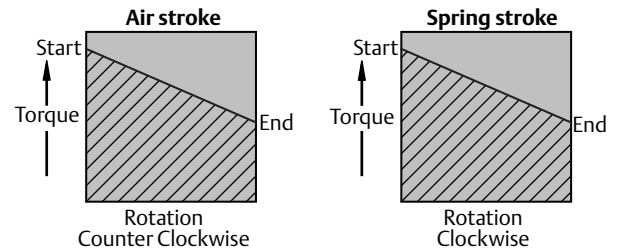
Actuator Torque - Spring-Return (Nm)

Actuator Size	Spring set nr.	Spring Stroke Torque (Nm)		Air Stroke Torque (Nm)																	
				SUPPLY PRESSURE																	
		Start	End	3.0 barg		3.5 barg		4.0 barg		4.5 barg		5.0 barg		5.5 barg		6.0 barg		7.0 barg		8.0 barg	
QS 950	10	121	77	481	427	579	525	677	623	775	721	873	819	971	917	1069	1015	1265	1211	1461	1407
	20	242	155	385	276	483	374	581	472	679	570	777	668	875	766	973	864	1169	1060	1365	1256
	30	363	232	288	125	386	223	484	321	582	418	680	516	778	614	876	712	1072	908	1268	1104
	40	484	309	-	-	289	71	387	169	485	267	583	365	681	463	779	561	975	757	1171	953
	50	605	387	-	-	-	-	-	-	389	116	487	214	585	312	683	410	879	606	1075	802
	60	726	464	-	-	-	-	-	-	-	-	390	63	488	161	586	259	782	455	978	651
QS 1600	10	207	129	808	710	972	874	1136	1038	1300	1202	1465	1367	1629	1531	1793	1695	2122	2023	2450	2352
	20	415	258	647	450	811	615	975	779	1139	943	1304	1107	1468	1271	1632	1436	1960	1764	2289	2093
	30	622	387	486	191	650	355	814	520	978	684	1142	848	1307	1012	1471	1176	1799	1505	2128	1833
	40	830	516	-	-	489	96	653	260	817	425	981	589	1146	753	1310	917	1638	1246	1967	1574
	50	1037	644	-	-	-	-	-	-	656	165	820	330	984	494	1149	658	1477	986	1806	1315
	60	1244	773	-	-	-	-	-	-	-	-	659	70	823	234	988	399	1316	727	1644	1056

Notes:

1. Emerson recommends that the valve manufacturer supply the maximum required torque values (including any adjustments or suggested safety factors for valve service conditions or application).
2. Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
3. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson representative.

Spring-Return Torque Diagram



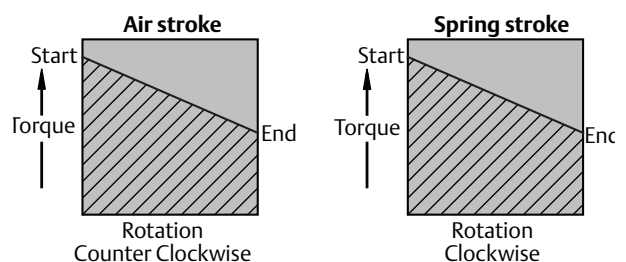
Actuator Torque - Spring-Return (lbf.in)

Actuator Size	Spring set nr.	Spring Stroke Torque (lbf.in)		Air Stroke Torque (lbf.in)																
				SUPPLY PRESSURE																
		Start	End	40 psig		50 psig		60 psig		70 psig		80 psig		90 psig		100 psig		120 psig		
QS 40	10	58	37	175	150	230	206	285	261	341	316	396	371	451	427	506	482	617	592	
	20	116	73	133	84	188	139	243	195	299	250	354	305	409	360	464	415	575	526	
	30	174	110	91	18	146	73	201	128	257	183	312	239	367	294	422	349	533	459	
	40	231	146	-	-	-	-	-	159	62	214	117	270	172	325	227	380	283	491	393
	50	289	183	-	-	-	-	-	-	-	172	50	228	106	283	161	338	216	449	327
	60	347	220	-	-	-	-	-	-	-	-	-	186	39	241	94	296	150	407	260
QS 65	10	90	57	265	227	349	311	434	395	518	479	602	564	686	648	770	732	939	900	
	20	181	114	200	123	284	207	368	291	452	376	537	460	621	544	705	628	873	796	
	30	271	171	134	19	219	103	303	188	387	272	471	356	555	440	639	524	808	693	
	40	361	228	-	-	-	-	237	84	322	168	406	252	490	336	574	420	742	589	
	50	452	285	-	-	-	-	-	-	256	64	340	148	424	232	509	317	677	485	
	60	542	341	-	-	-	-	-	-	-	-	275	44	359	129	443	213	612	381	
QS 100	10	131	83	394	339	518	463	643	588	767	712	892	836	1016	961	1141	1085	1390	1334	
	20	262	166	299	188	423	313	548	437	672	562	797	686	921	811	1046	935	1295	1184	
	30	392	248	203	38	328	162	452	287	577	411	701	536	826	660	950	785	1199	1034	
	40	523	331	-	-	-	-	357	136	482	261	606	385	731	510	855	634	1104	883	
	50	654	414	-	-	-	-	-	-	387	110	511	235	636	359	760	484	1009	733	
	60	785	497	-	-	-	-	-	-	-	-	416	85	540	209	665	334	914	583	
QS 150	10	208	131	633	544	832	743	1031	942	1231	1142	1430	1341	1629	1540	1829	1740	2227	2138	
	20	416	262	482	304	681	504	881	703	1080	902	1279	1102	1479	1301	1678	1500	2077	1899	
	30	625	393	332	65	531	264	730	464	930	663	1129	862	1328	1062	1528	1261	1926	1660	
	40	833	524	-	-	-	-	580	224	779	424	979	623	1178	823	1377	1022	1776	1421	
	50	1041	654	-	-	-	-	-	-	629	185	828	384	1027	583	1227	783	1626	1181	
	60	1249	785	-	-	-	-	-	-	-	-	678	145	877	344	1076	543	1475	942	
QS 200	10	289	182	862	739	1135	1012	1408	1285	1681	1558	1954	1831	2226	2104	2499	2376	3045	2922	
	20	578	364	653	407	926	680	1198	953	1471	1226	1744	1499	2017	1771	2290	2044	2836	2590	
	30	867	547	443	75	716	348	989	621	1262	894	1535	1166	1808	1439	2080	1712	2626	2258	
	40	1156	729	-	-	-	-	780	289	1052	561	1325	834	1598	1107	1871	1380	2417	1926	
	50	1445	911	-	-	-	-	-	-	843	229	1116	502	1389	775	1662	1048	2207	1593	
	60	1734	1093	-	-	-	-	-	-	-	-	906	170	1179	443	1452	716	1998	1261	
QS 350	10	495	312	1503	1293	1978	1767	2452	2241	2926	2716	3400	3190	3874	3664	4348	4138	5296	5086	
	20	990	624	1145	724	1619	1199	2093	1673	2567	2147	3041	2621	3515	3095	3990	3569	4938	4517	
	30	1485	936	786	156	1261	630	1735	1104	2209	1578	2683	2052	3157	2526	3631	3000	4579	3948	
	40	1979	1248	-	-	-	-	1376	535	1850	1009	2324	1483	2798	1957	3272	2431	4221	3380	
	50	2474	1560	-	-	-	-	-	-	1492	440	1966	914	2440	1388	2914	1863	3862	2811	
	60	2969	1872	-	-	-	-	-	-	-	-	1607	346	2081	820	2555	1294	3504	2242	
QS 600	10	848	534	2551	2190	3356	2996	4162	3801	4968	4607	5773	5413	6579	6218	7385	7024	8996	8635	
	20	1695	1068	1937	1216	2743	2021	3548	2827	4354	3633	5160	4438	5965	5244	6771	6050	8382	7661	
	30	2543	1601	1324	241	2129	1047	2935	1853	3741	2658	4546	3464	5352	4270	6158	5075	7769	6687	
	40	3391	2135	-	-	-	-	2321	878	3127	1684	3933	2490	4738	3295	5544	4101	7155	5712	
	50	4238	2669	-	-	-	-	-	-	2513	710	3319	1515	4125	2321	4930	3127	6542	4738	
	60	5086	3203	-	-	-	-	-	-	-	-	2706	541	3511	1346	4317	2152	5928	3763	

Notes:

- Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
- Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
- If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson representative.

Spring-Return Torque Diagram



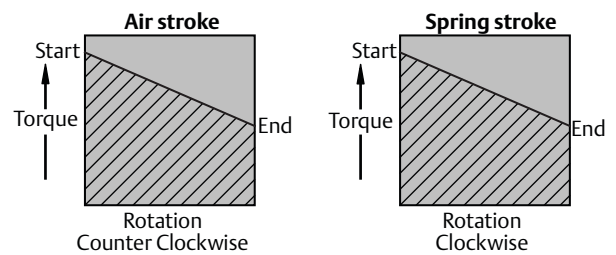
Actuator Torque - Spring-Return (lbf.in)

Actuator Size	Spring set nr.	Spring Stroke Torque (lbf.in)		Air Stroke Torque (lbf.in)															
				SUPPLY PRESSURE															
		Start	End	40 psig		50 psig		60 psig		70 psig		80 psig		90 psig		100 psig		120 psig	
QS 950	10	1070	685	3842	3360	5038	4556	6234	5752	7430	6948	8627	8144	9823	9340	11019	10536	13411	12929
	20	2141	1369	2986	2022	4182	3218	5379	4414	6575	5610	7771	6806	8967	8002	10163	9198	12555	11591
	30	3211	2054	2130	683	3327	1880	4523	3076	5719	4272	6915	5468	8111	6664	9307	7860	11699	10252
	40	4282	2738	-	-	2471	541	3667	1738	4863	2934	6059	4130	7255	5326	8451	6522	10844	8914
	50	5352	3423	-	-	-	-	2811	399	4007	1596	5203	2792	6400	3988	7596	5184	9988	7576
	60	6423	4108	-	-	-	-	-	-	3152	257	4348	1454	5544	2650	6740	3846	9132	6238
QS 1600	10	1835	1141	6447	5579	8452	7583	10456	9588	12461	11592	14466	13597	16470	15602	18475	17606	22484	21615
	20	3671	2281	5022	3284	7026	5289	9031	7294	11035	9298	13040	11303	15044	13307	17049	15312	21058	19321
	30	5506	3422	3596	990	5600	2995	7605	4999	9610	7004	11614	9008	13619	11013	15623	13018	19632	17027
	40	7342	4562	-	-	4175	700	6179	2705	8184	4709	10188	6714	12193	8719	14198	10723	18207	14732
	50	9177	5703	-	-	-	-	4753	411	6758	2415	8763	4420	10767	6424	12772	8429	16781	12438
	60	11013	6844	-	-	-	-	-	-	-	-	7337	2125	9342	4130	11346	6135	15355	10144

Notes:

- Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
- Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
- If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson representative.

Spring-Return Torque Diagram



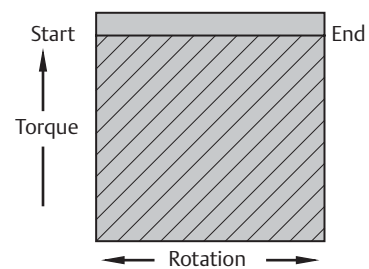
Actuator Torque - Double-Acting (Nm)

Actuator Size	Torque in Nm										
	Supply Pressure (barg)										
	2	3	3.5	4	4.5	5	5.5	6	6.5	7	8
QD 40	17	25	29	34	38	42	47	51	55	59	68
QD 65	25	38	45	51	58	64	71	77	84	90	103
QD 100	38	57	66	76	86	95	105	115	124	134	153
QD 150	60	91	106	122	137	153	168	183	199	214	245
QD 200	82	124	146	167	188	209	230	251	272	293	335
QD 350	143	216	253	290	326	363	400	436	473	510	583
QD 600	243	368	430	492	554	617	679	741	804	866	991
QD 950	368	557	651	746	840	935	1029	1124	1218	1312	1501
QD 1600	617	934	1092	1250	1408	1566	1725	1883	2041	2199	2516

Notes:

1. Emerson recommends that the valve manufacturer supply the maximum required torque values (including any adjustments or suggested safety factors for valve service conditions or application).
2. Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
3. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson representative.

Double-Acting Torque Diagram



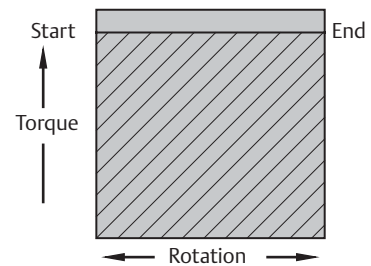
Actuator Torque - Double-Acting (lbf.in)

Actuator Size	Torque in lbf.in												
	Supply pressure (psig)												
	30	35	40	45	50	55	60	70	75	80	90	100	120
QD 40	153	179	205	231	257	283	309	361	387	413	466	518	622
QD 65	233	272	312	352	392	431	471	550	590	630	709	789	948
QD 100	344	403	461	520	579	638	696	814	873	931	1049	1166	1401
QD 150	551	645	739	833	927	1021	1115	1304	1398	1492	1680	1868	2244
QD 200	754	883	1011	1140	1269	1398	1527	1784	1913	2042	2299	2557	3072
QD 350	1310	1534	1758	1981	2205	2429	2653	3100	3324	3547	3995	4442	5337
QD 600	2226	2606	2987	3367	3747	4127	4508	5268	5648	6028	6789	7549	9070
QD 950	3374	3950	4527	5103	5679	6255	6832	7984	8560	9137	10289	11442	13747
QD 1600	5654	6620	7586	8552	9517	10483	11449	13380	14346	15312	17243	19175	23038

Notes:

1. Emerson recommends that the valve manufacturer supply the maximum required torque values (Including any adjustments or suggested safety factors for valve service conditions or application).
2. Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.
3. If in doubt, or you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson representative.

Figure 1. Double-Acting Torque Diagram



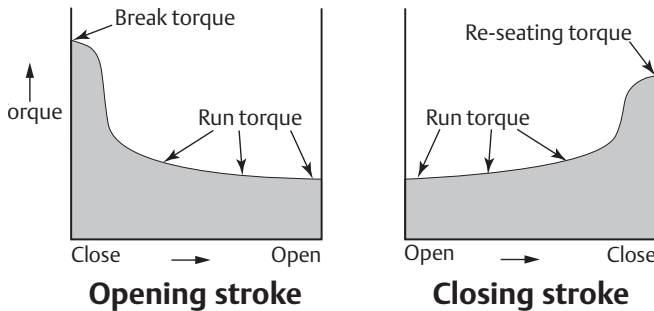
Sizing of Rack & Pinion actuators

Sizing is the selection procedure to select the right size of actuator on a valve with a given torque characteristic. This Data Sheet gives brief samples on how to size actuators and which data is needed.

Torque Characteristics of Valves

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

Generic torque characteristic of a valve



Valve Torque Values and Safety Factors

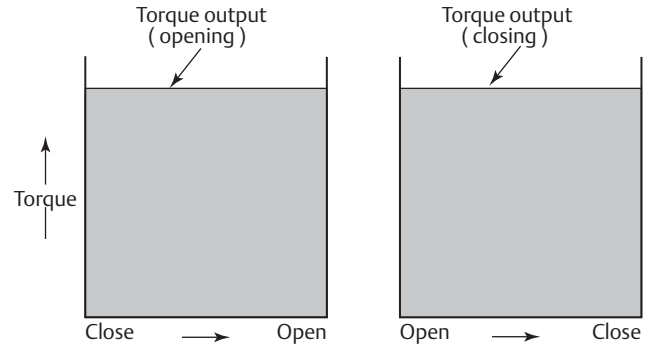
Emerson recommends that the valve manufacturer supplies the maximum required and allowed torque values (Including any adjustments or suggested safety factors for valve service conditions or application).

Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counterclockwise or Clockwise) these maximum requirements occur.

If in doubt or if you require any assistance with sizing actuators, do not hesitate to contact your nearest Emerson representative.

Sizing Double-Acting Actuators

Figure 2. Double-Acting torque characteristic



Sample Calculation of Double-Acting Sizing

- Publish valve break torque: 40 Nm 354 lbf.in
- Publish maximum stem torque: 105 Nm 929 lbf.in
- Recommended safety factor: 1.2 (20%)
- Minimum supply pressure: 5.5 bar 80 psi
- Maximum supply pressure: 6.5 bar 94 psi

Calculation:

1. Because the recommended safety factor is 1.2, the sizing torque will be $40 \times 1.2 = 48 \text{ Nm}$ ($354 \times 1.2 = 425 \text{ lbf.in}$).
2. Lookup in the Double-Acting Torque Table, in the 5.5 bar column (or 80 psi column), from top down, the first actuator size that generates more than 48 Nm (or 425 lbf.in).
3. Size QD65 is the first actuator that supplies more than
 - a. 48 Nm (71 Nm) at 5.5 bar.
 - b. 425 lbf.in (630 lbf.in) at 80 psi.
4. The maximum torque output of a QD65 is 84 Nm (743 lbf.in). This is lower than the maximum stem torque of 105 Nm.

Conclusion

Because QD65 supplies more torque than the sizing torque (see point 3) and less than the maximum stem torque (see point 4), size QD65 is suitable to operate this valve.

Sizing Spring-Return Actuators

Figure 3. Spring-to-Close Configuration

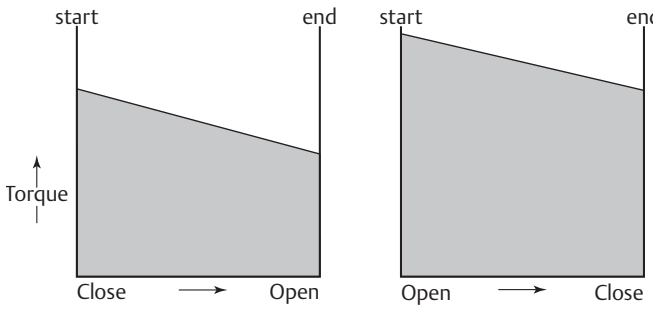


Table 1. For Fail-to Close actuators applies:

Actuator stroke:	Valve Stroke:
Air-Start torque	> Break torque and
Air-End torque	> Run open torque and
Spring-Start torque	> Run open torque and
Spring-End torque	> Re-seat torque

For Fail-to Open actuators applies:

Actuator stroke:	Valve Stroke:
Spring-Start torque	> Break torque and
Spring-End torque	> Run torque and
Air-Start torque	> Run torque and
Air-End torque	> Re-seat torque

Sample calculation Spring-Return sizing for a Spring-to-Close application

- Published valve torques
 - Break torque: 150 Nm 1328 lbf.in
 - Run torque opening: 45 Nm 398 lbf.in
 - Run torque closing: 45 Nm 398 lbf.in
 - Re-seating torque; 90 Nm 797 lbf.in
- Publish maximum stem torque: 375 Nm 3496 lbf.in
- Recommended safety factor: 1.5 (50%)
- Minimum supply pressure: 5.5 bar 80 psi
- Maximum supply pressure: 6.0 bar 87 psi

Calculation:

1. Because the recommended safety factor is 1.5, the sizing torques will be:
 - Break 150 Nm x 1.5 = 225 Nm 1991 lbf.in
 - Run open 45 Nm x 1.5 = 67.5 Nm 597 lbf.in
 - Run close 45 Nm x 1.5 = 67.5 Nm 597 lbf.in
 - Re-seat 90 Nm x 1.5 = 135 Nm 1195 lbf.in
2. Lookup in the Spring-Return Torque Table, in the "spring end" torque column, from top down, the first actuator size that generates more than 135 Nm (or 1195 lbf.in) of re-seat torque.
3. Size QS350 with spring set 40 is the first actuator that supplies more spring end torque (149 Nm or 1655 lbf.in).
4. Check now for the other three positions whether the actuator torque exceeds the valve torques.

Actuator stroke:	Valve Stroke:
Air-Start: 252 Nm	> Break open: 225 Nm
Air-End: 157 Nm	> Run open: 67.5 Nm
Spring-Start: 232 Nm	> Run close: 67.5 Nm
Spring-End: 149 Nm	> Re-seat: 135 Nm

5. The maximum torque output of a QS350 with springset 40 at maximum pressure of 6 bar is 291 Nm (2575 lbf.in). This is lower than the maximum stem torque of 375 Nm (3496 lbf.in).

Conclusion

Because QS350 n=40 supplies more torque than the sizing torque (see point 3) and less than the maximum stem torque (see point 5), size QS350 n=40 is suitable to operate this valve.

Notes:

- If the first found actuator does not exceed the valve torque at all the positions, check the next size actuator.
- If the next size actuator does exceed the valve torque at all the positions, but fails at maximum stem torque check whether the same actuator but with a higher spring set (i.e. 50 instead of 40) does meet this requirement.

Spring (Cartridge) Placement

Bettis Q-Series Spring-Return actuators are supplied with springs on each side of the actuator.

Throughout the Bettis Q-Series size range, there are two different spring designs:

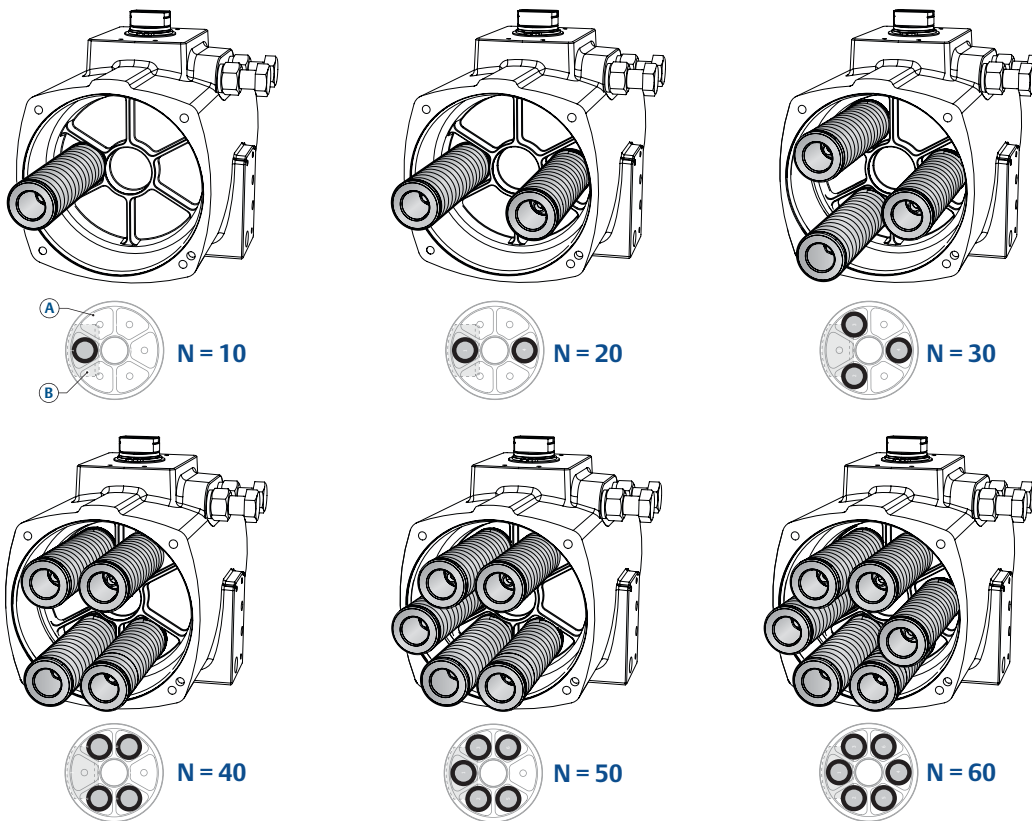
- Sizes Q40 to Q600 have 6 springs on each side (see Figure 1).
- Sizes F950 and Q1600 have 3 springs on each side (see Figure 2).

Check below Figures to see where to place the spring cartridges in case of spring set conversion.

When replacing spring cartridges in a Spring-Return actuator, ensure that the cartridges are replaced in their identical position from where they were removed.

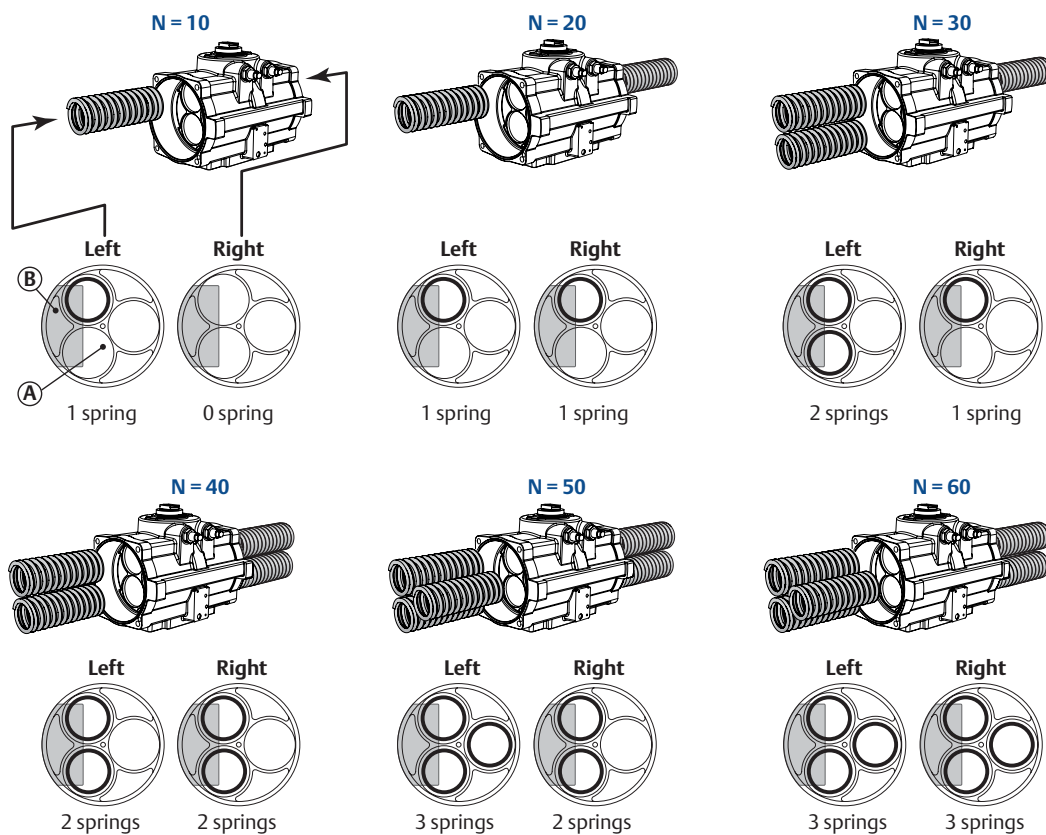
Before assembling the spring cartridges and end caps, make sure that the pistons are completely inwards.

Figure 1. Spring placement sizes 40 to 600



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

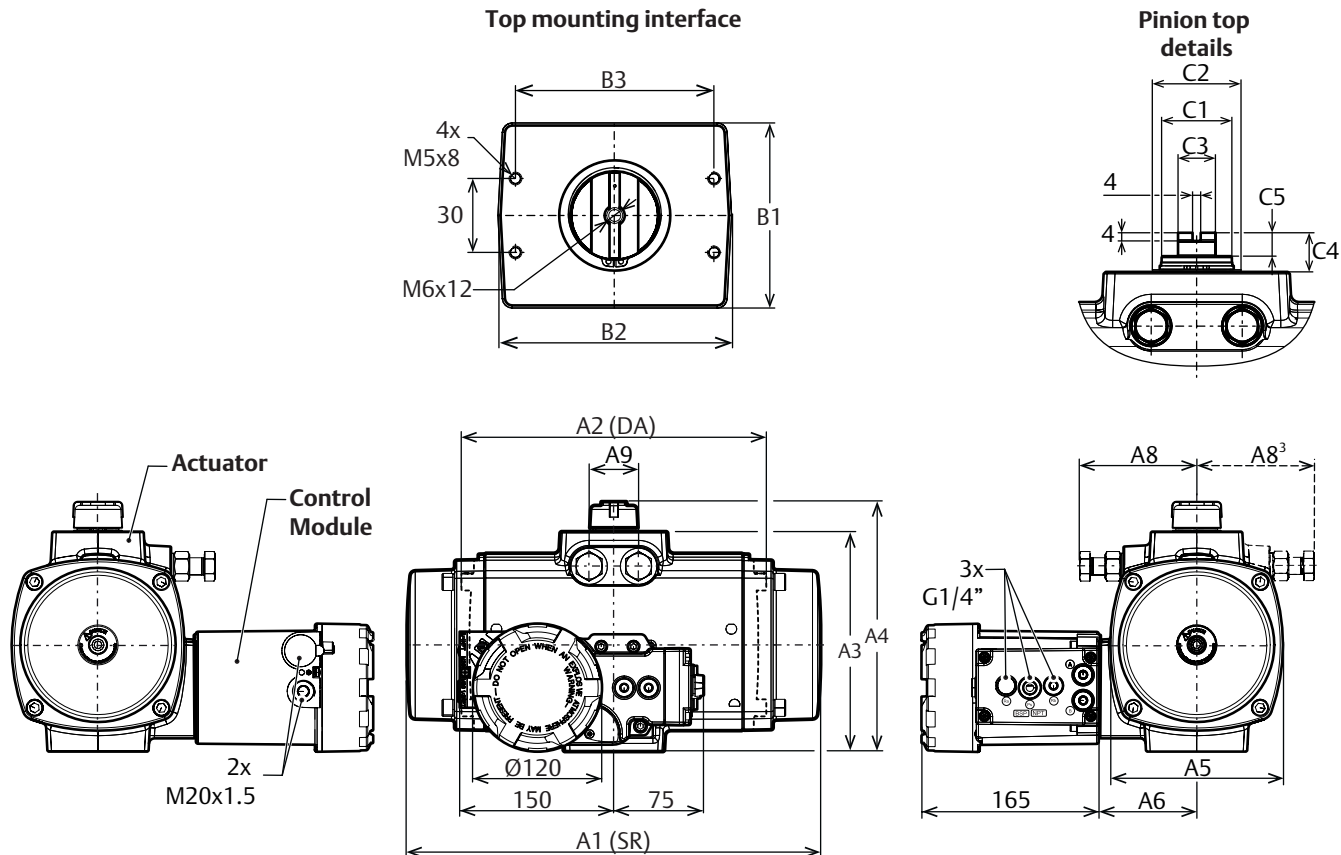
Figure 2. Spring placement sizes 950 to 1600



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

Dimensions - Metric (ISO5211)

Envelope Dimensions - Actuator with Control Modules - Sizes Q40 - Q600



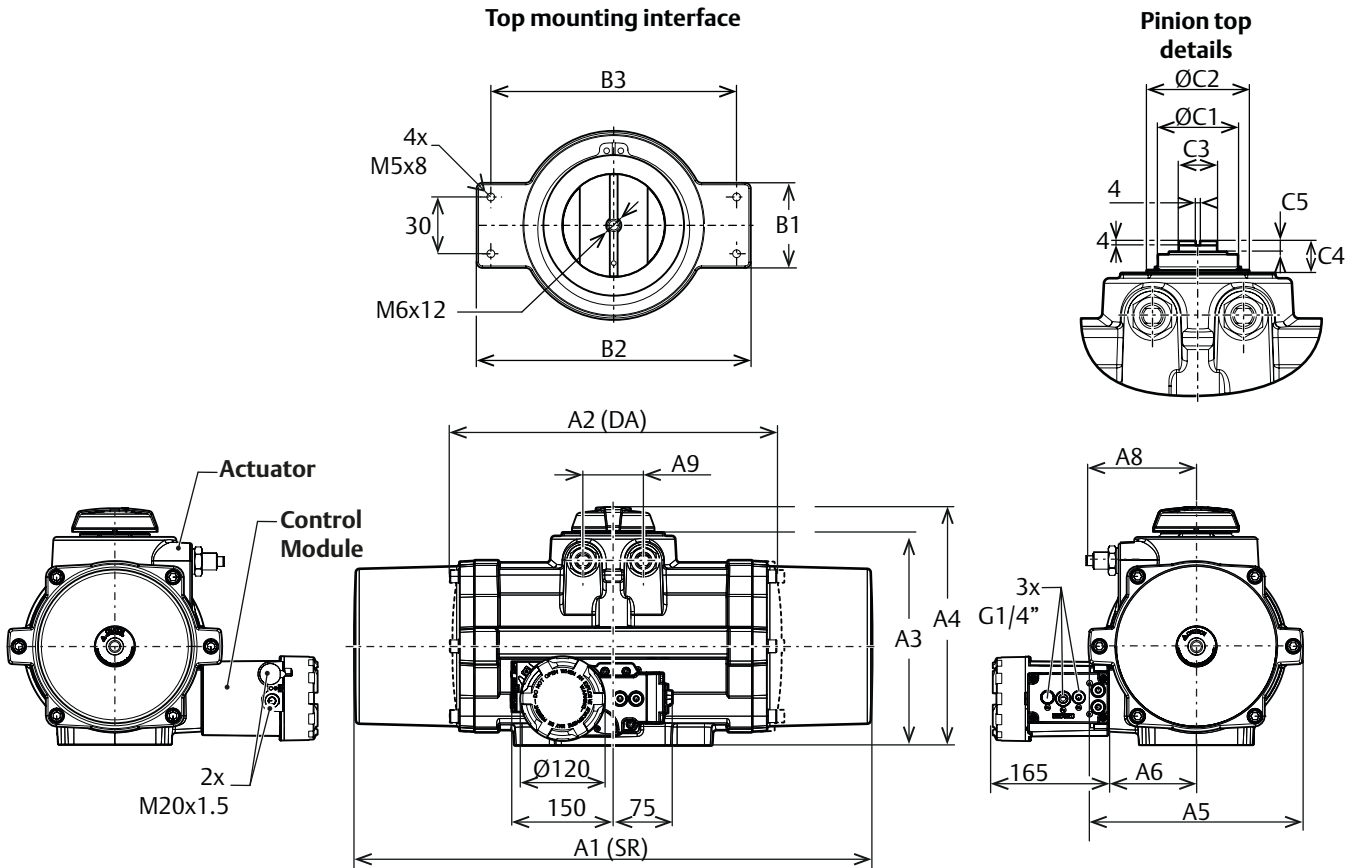
Dim. in mm	Actuator size						
	0040	0065	0100	0150	0200	0350	0600
A1	192	217	247	304	362	385	476
A2	192	217	247	235	265	284	356
A3	112	124	131	157	163	201	248
A4	139	151	158	185	191	230	292
A5	82	92	103	116	124	161	195
A6	47	53	60	69	41	91	106
A8	58	69	69	75	87	109	132
A9	25	27	28	46	46	46	60
B1	45	50	60	75	75	85	98
B2	94	94	97	94	94	100	148
B3	80	80	80	80	80	80	130
C1	22	22	22	34	36	36	55
C2	30	30	35	45	45	45	65
C3	14	14	14	19	19	19	36
C4	20	20	20	20	20	20	30
C5	12	12	12	12	12	12	10

Notes:

1. DA = Double-Acting
SR = Spring-Return
2. Top mounting interface according to VDI/VDE3845 (NAMUR).
3. For sizes Q40 to Q100 the limit stop screws are located on the opposite side of the actuator.

Dimensions - Metric (ISO5211)

Envelope Dimensions - Actuator with Control Modules - Sizes Q950 - Q1600



Dim. in mm	Actuator size	
	0950	1600
A1	658	732
A2	400	462
A3	268	302
A4	305	339
A5	239	306
A6	119	136
A7	121	137
A8	131	156
A9	64	85
B1	45	45
B2	145	145
B3	130	130
C1	65	75
C2	83	96
C3	36	36
C4	30	30
C5	10	10

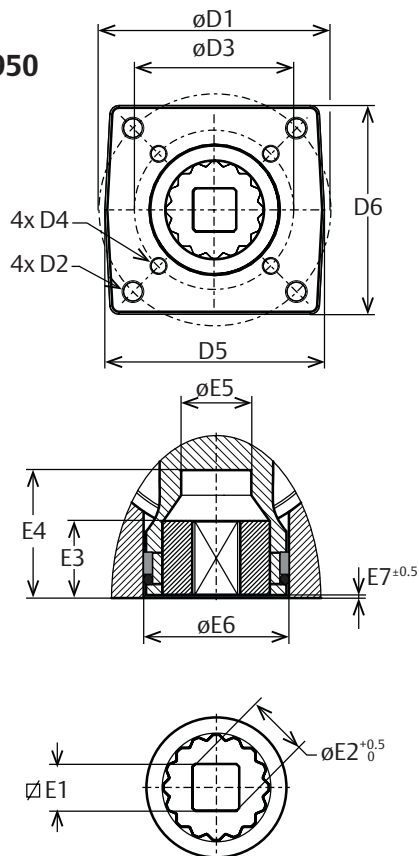
Notes:

1. DA = Double-Acting
SR = Spring-Return
2. Top mounting interface is according to VDI/VDE3845 (NAMUR).

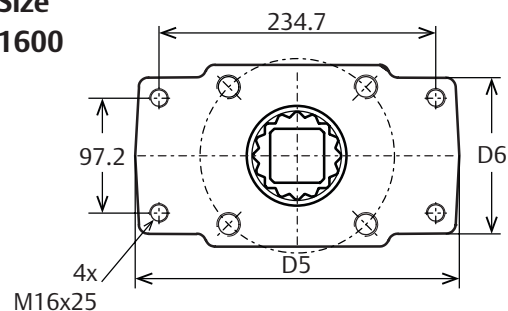
Dimensions - Metric (ISO5211)

Valve Flange and Drive Details Sizes Q40 - Q1600

Sizes
40 - 950



Size
1600



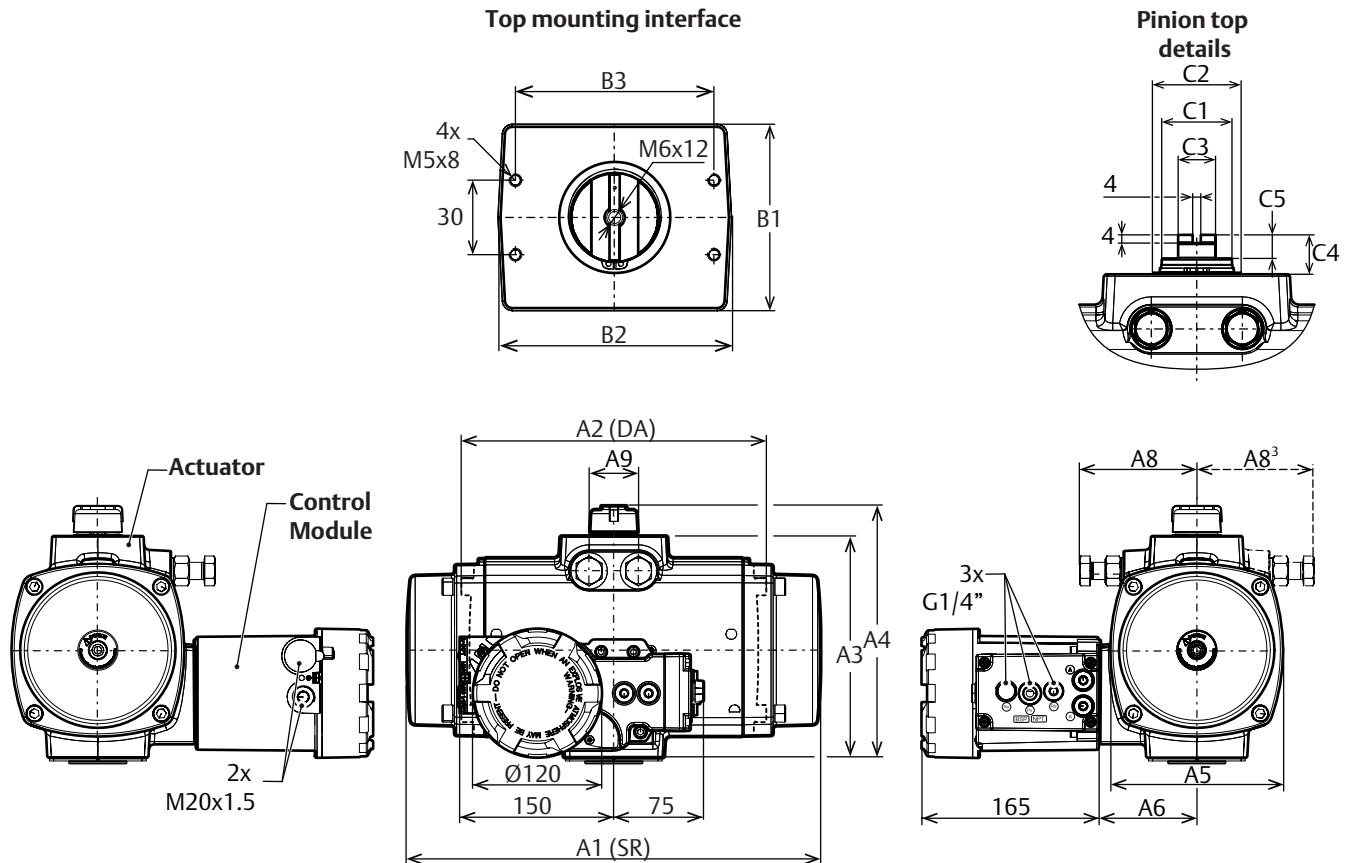
Notes:

1. Flange and square drive according to ISO 5211
2. F25* = For size 1600 drilling pattern 234.7 x 97.2 represents 4 holes of a F25 drilling pattern.

Dim. in mm	Actuator size								
	0040	0065	0100	0150	0200	0350	0600	0950	1600
ISO 1	F07	F07	F07	F10	F10	F10	F12	F14	F16
D1	70	70	70	102	102	102	125	140	165
D2	M8x13	M8x13	M8x13	M10x15	M10x15	M10x15	M12x18	M16x25	M20x30
ISO 2	F05	F05	F05	F07	F07	F07	F10	F10	F25*
D3	50	50	50	70	70	70	102	102	-/-
D4	M6x10	M6x10	M6x10	M8x13	M8x13	M8x13	M10x16	M10x16	-/-
D5	68	68	66	97	94	94	118	135	280
D6	65	65	63	92	90	94	113	130	132
E1 Max.	14.08	14.08	19.08	19.08	22.10	27.11	27.11	36.16	46.16
E1 Min.	14.00	14.00	19.00	19.00	22.00	27.00	27.00	36.00	46.00
E2	18.1	18.1	25.2	25.5	28.2	36.2	36.2	48.2	60.2
E3	15	15	18	27.5	27.5	27.5	27.5	48.5	59.5
E4	34	34	34	50	50	50	50	65.5	81.5
E5	18.1	21.1	23.5	28.5	32.1	32.1	36.5	48	60
E6	34.5	34.5	38	56.5	56.5	56.5	67.5	86	104
E7	1	1	1	1.2	1.2	1.2	1.2	1	1

Dimensions - Metric (DIN3337)

Envelope Dimensions - Actuator with Control Modules - Sizes Q40 - Q600



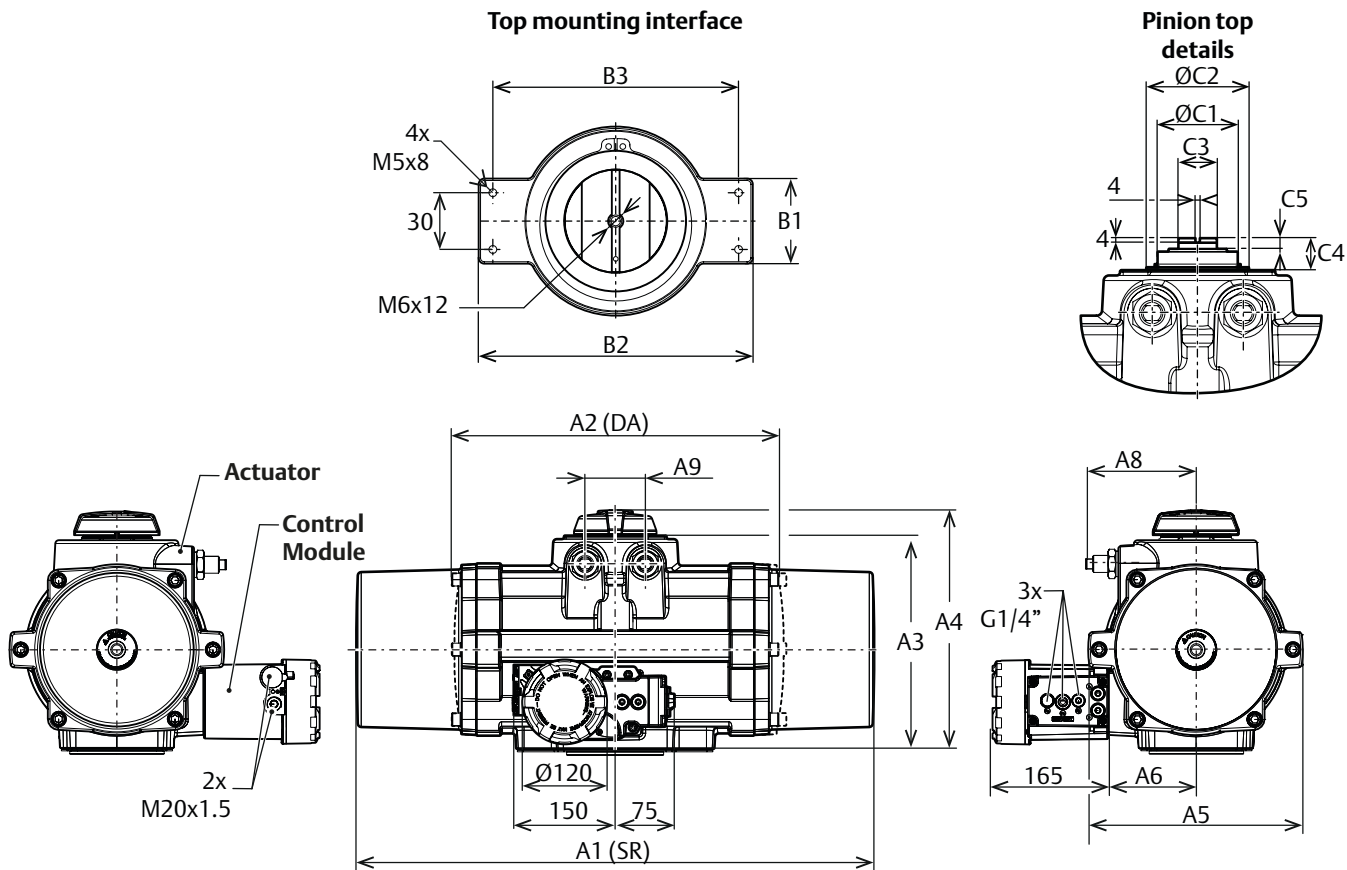
Dim. in mm	Actuator size						
	0040	0065	0100	0150	0200	0350	0600
A1	192	217	247	304	362	385	476
A2	192	217	247	235	265	284	356
A3	112	124	131	157	163	201	248
A4	139	151	158	185	191	230	292
A5	82	92	103	116	124	161	195
A6	47	53	60	69	41	91	106
A7	34	38	38	49	49	42	67
A8	58	69	69	75	87	109	132
A9	25	27	28	46	46	46	60
B1	45	50	60	75	75	85	98
B2	94	94	97	94	94	100	148
B3	80	80	80	80	80	80	130
C1	22	22	22	34	36	36	55
C2	30	30	35	45	45	45	65
C3	14	14	14	19	19	19	36
C4	20	20	20	20	20	20	30
C5	12	12	12	12	12	12	10

Notes:

1. DA = Double-Acting
SR = Spring-Return
2. Top mounting interface according to VDI/VDE3845 (NAMUR).
3. For sizes Q40 to Q100 the limit stop screws are located on the opposite side of the actuator.

Dimensions - Metric (DIN3337)

Envelope Dimensions - Solenoid and Top Mounting Interface Sizes 950 - 1600



Dim. in mm	Actuator size	
	950	1600
A1	658	732
A2	400	462
A4	305	339
A5	239	306
A6	119	136
A7	121	137
A8	131	156
A9	64	85
B1	45	45
B2	145	145
B3	130	130
C1	65	75
C2	83	96
C3	36	36
C4	30	30
C5	10	10

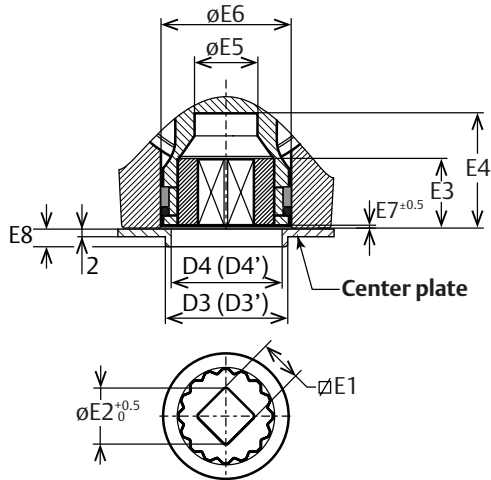
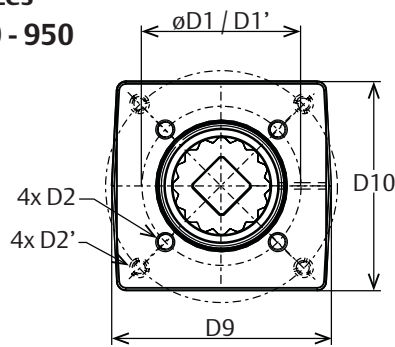
Notes:

1. DA = Double-Acting
SR = Spring-Return
2. Top mounting interface is according to VDI/VDE3845 (NAMUR).

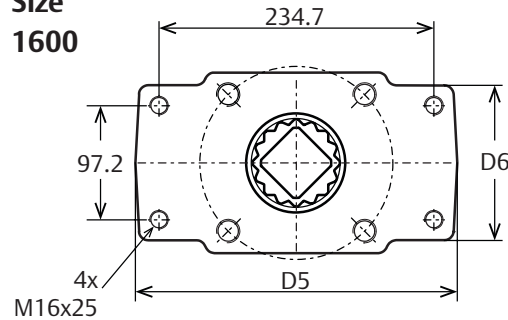
Dimensions - Metric (DIN3337)

Valve Flange and Drive Details Sizes 40 - 1600

Sizes
40 - 950



Size
1600



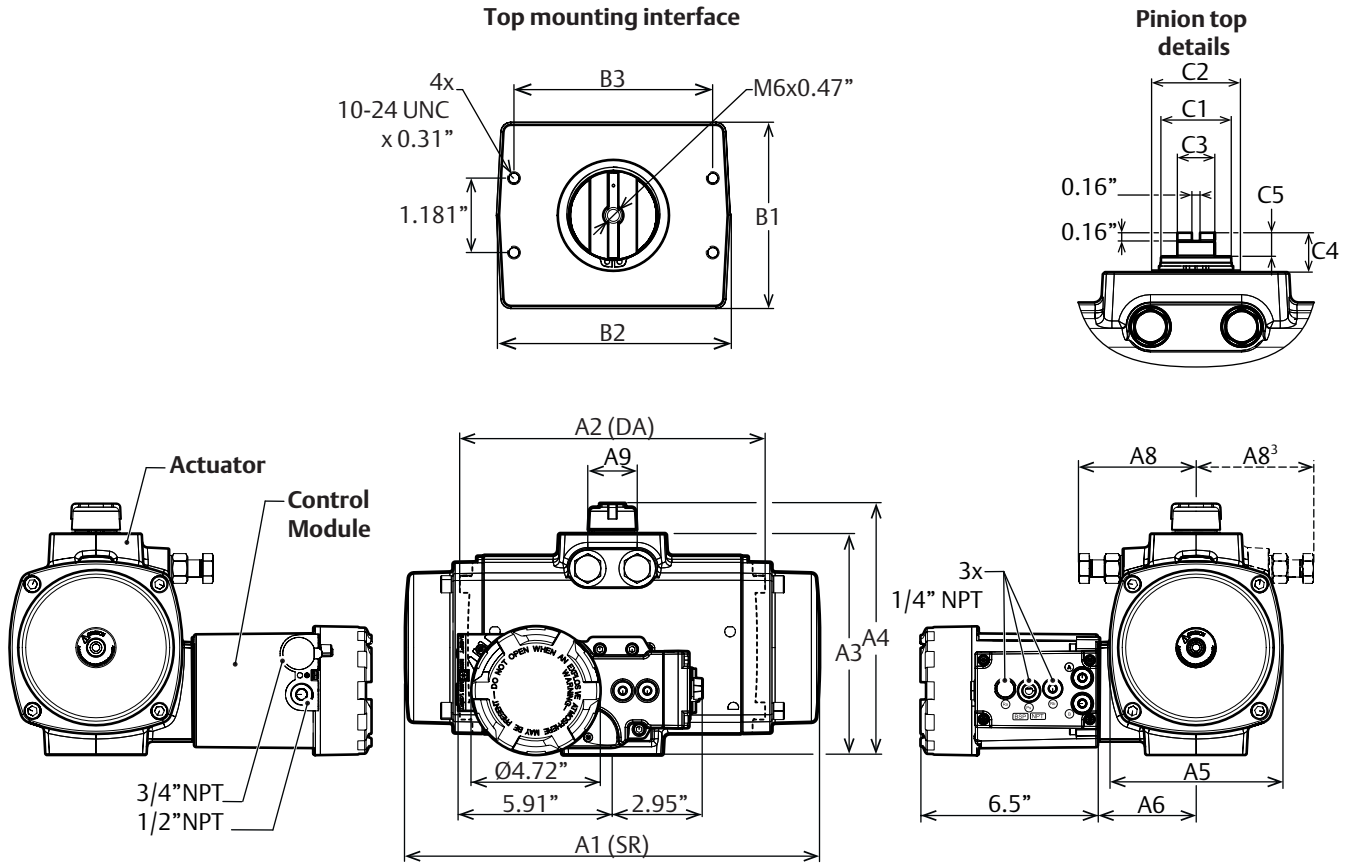
Notes:

1. Flange and square drive according to ISO 5211
2. F25* = For sizes 1600 drilling pattern 234.7 x 97.2 represent 4 holes of a F25 drilling pattern.
3. Drilling patterns DIN 1 are standard. Drilling patterns DIN 2 are optional.

Dim. in mm	Actuator size								
	0040	0065	0100	0150	0200	0350	0600	0950	1600
DIN 1	F05	F05	F07	F07	F10	F10	F12	F14	F16
D1	50	50	70	70	102	102	125	140	165
D2	M6x10	M6x10	M8x13	M8x13	M10x15	M10x15	M12x18	M16x25	M20x30
D3	35	35	55	55	70	70	85	100	130
D4	32	32	40	50	54	54	68	75	95
DIN 2	F07	F07	F05	F10	F07	F07	F10	F10	F25*
D1'	70	70	50	102	70	70	102	102	-/-
D2'	M8x13	M8x13	M6x10	M10x15	M8x13	M8x13	M10x15	M10x15	-/-
D3'	40	40	32	54	50	50	-/-	-/-	-/-
D4'	55	55	35	70	55	55	-/-	-/-	-/-
D9	68	68	66	97	94	94	118	135	280
D10	65	65	63	92	90	94	113	130	132
E1 Max	14.08	14.08	17.08	17.08	22.10	22.10	27.11	36.16	46.16
E1 Min	14.00	14.00	17.00	17.00	22.00	22.00	27.00	36.00	46.00
E2	18.1	18.1	25.2	25.5	28.2	36.2	36.2	48.2	60.2
E3	15.0	15.0	18.0	27.5	27.5	27.5	27.5	48.5	59.5
E4	34.0	34.0	34.0	50.0	50.0	50.0	50.0	65.5	81.5
E5	18.1	21.1	23.5	28.5	32.1	32.1	36.5	48	60
E6	34.5	34.5	38.0	56.5	56.5	56.5	67.5	86	104
E7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1	1
E8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6	7

Dimensions - Imperial (ISO5211)

Envelope Dimensions - Actuator with Control Modules - Sizes Q40 - Q600



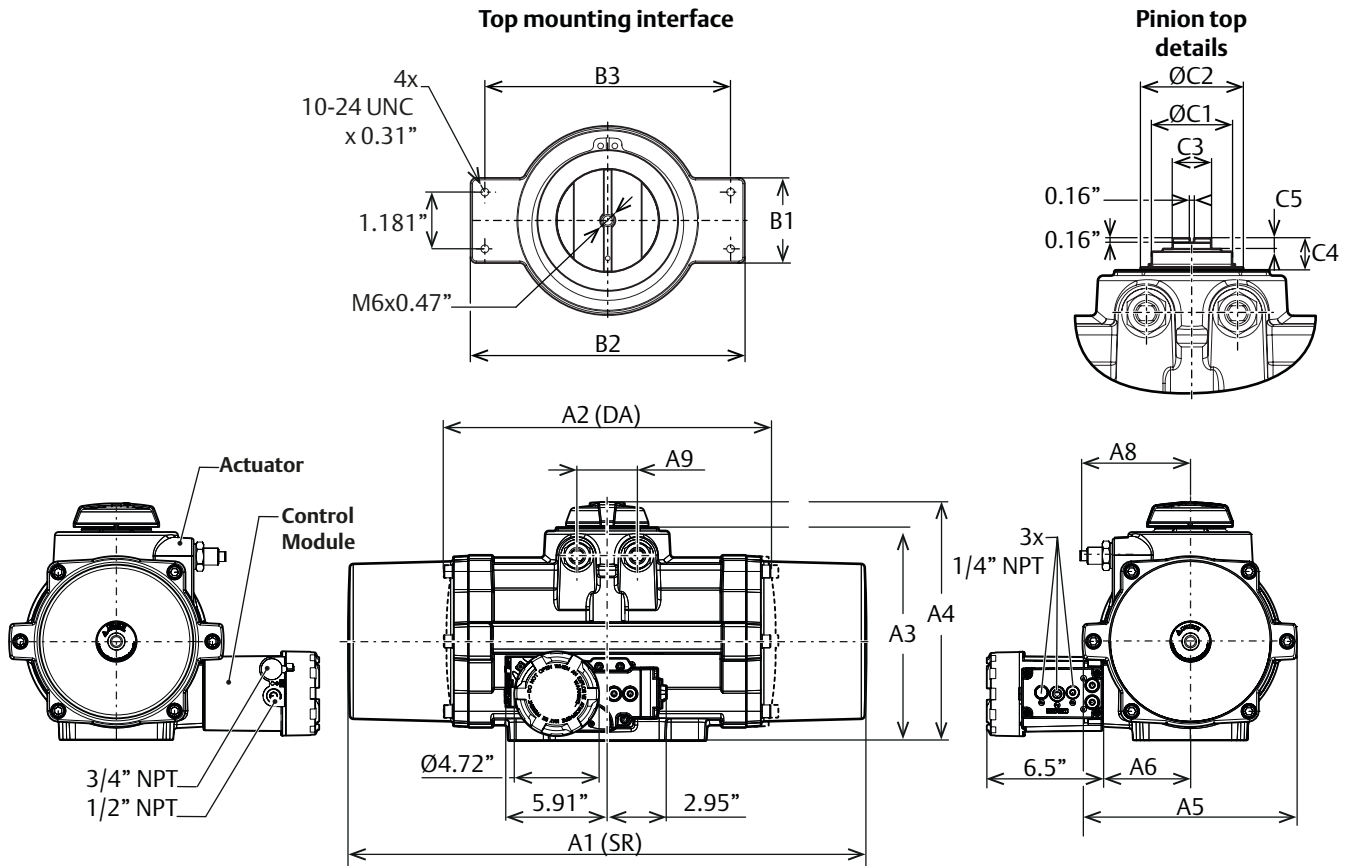
Dim. in Inches	Actuator size						
	0040	0065	0100	0150	0200	0350	0600
A1	7.55	8.53	9.72	11.97	14.23	15.15	18.73
A2	7.55	8.53	9.72	9.25	10.43	11.18	14.02
A3	4.39	4.86	5.14	6.19	6.42	7.92	9.77
A4	5.47	5.94	6.22	7.28	7.52	9.06	11.50
A5	3.23	3.62	4.06	4.57	4.88	6.34	7.68
A6	1.83	2.09	2.36	2.72	2.78	3.56	4.17
A7	1.34	1.48	1.50	1.93	1.92	1.65	2.64
A8	2.28	2.72	2.72	2.95	3.43	4.29	5.20
A9	0.98	1.06	1.10	1.81	1.81	1.81	2.36
B1	1.77	1.97	2.36	2.95	2.95	3.35	3.86
B2	3.70	3.70	3.82	3.70	3.70	3.94	5.83
B3	3.15	3.15	3.15	3.15	3.15	3.15	5.12
C1	0.87	0.87	0.87	1.34	1.42	1.42	2.17
C2	1.18	1.18	1.38	1.77	1.77	1.77	2.56
C3	0.55	0.55	0.55	0.75	0.75	0.75	1.42
C4	0.79	0.79	0.79	0.79	0.79	0.79	1.18
C5	0.47	0.47	0.47	0.47	0.47	0.47	0.39

Notes:

1. DA = Double-Acting
SR = Spring-Return
2. Top mounting interface according to VDI/VDE3845 (NAMUR).
3. For sizes Q40 to Q100 the limit stop screws are located on the opposite side of the actuator.
4. Imperial threads are UNC for fastener thread holes and NPT for air connection ports.

Dimensions - Imperial (ISO5211)

Envelope Dimensions - Actuator with Control Modules - Sizes Q950 - Q1600



Dim. in Inches	Actuator size	
	0950	1600
A1	25.91	28.82
A2	15.75	18.19
A3	10.55	11.89
A4	12.01	13.35
A5	9.41	12.05
A6	4.69	5.35
A7	4.76	5.39
A8	5.16	6.14
A9	2.52	3.35
B1	1.77	1.77
B2	5.71	5.71
B3	5.12	5.12
C1	2.56	2.95
C2	3.27	3.78
C3	1.42	1.42
C4	1.18	1.18
C5	0.39	0.39

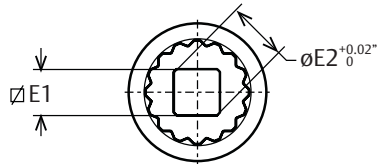
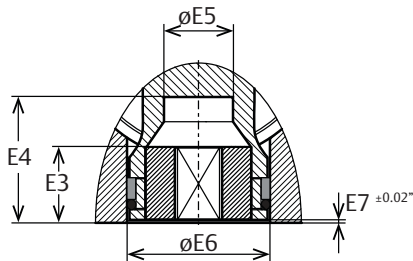
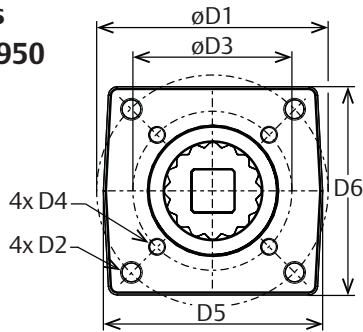
Notes:

1. DA = Double-Acting
SR = Spring-Return
2. Top mounting interface is according to VDI/VDE3845 (NAMUR).

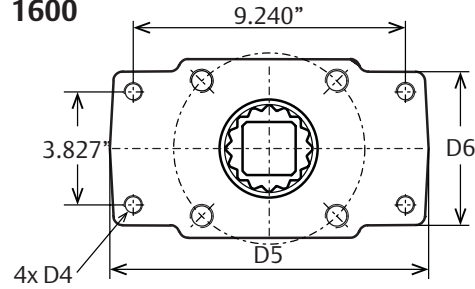
Dimensions - Imperial (ISO5211)

Valve Flange and Drive Details Sizes 40 - 1600

Sizes
40 - 950



Size
1600



Notes:

1. Flange and square drive according to ISO 5211
2. F25* = For size 1600 drilling pattern 9.240" x 3.827" represent 4 holes of a F25 drilling pattern.
3. Imperial threads are UNC for fastener thread holes and NPT for air connection ports.

Dim. in Inches	Actuator size								
	0040	0065	0100	0150	0200	0350	0600	0950	1600
ISO 1	F07	F07	F07	F10	F10	F10	F12	F14	F16
D1	2.756	2.756	2.756	4.016	4.016	4.016	4.921	5.512	6.496
D2	5/16"-18 x0.47	5/16"-18 x0.47	5/16"-18 x0.47	3/8"-16 x0.59	3/8"-16 x0.59	3/8"-16 x0.59	1/2"-13 x0.71	5/8"-11 x0.94	3/4"-10 x1.18
ISO 2	F05	F05	F05	F07	F07	F07	F10	F10	F25*
D3	1.969	1.969	1.969	2.756	2.756	2.756	4.016	4.016	-/-
D4	1/4"-20 x0.35	1/4"-20 x0.35	1/4"-20 x0.35	5/16"-18 x0.47	5/16"-18 x0.47	5/16"-18 x0.47	3/8"-16 x0.59	3/8"-16 x0.59	5/8"-11 x0.94
D5	2.68	2.68	2.62	3.82	3.7	3.7	4.65	5.31	11.02
D6	2.56	2.56	2.48	3.62	3.54	3.7	4.45	5.12	5.2
E1 Max.	0.554	0.554	0.751	0.751	0.87	1.067	1.067	1.424	1.817
E1 Min.	0.551	0.551	0.748	0.748	0.866	1.063	1.063	1.417	1.811
E2	0.713	0.713	0.992	1.004	1.11	1.425	1.425	1.898	2.37
E3	0.591	0.591	0.709	1.083	1.083	1.083	1.083	1.909	2.343
E4	1.34	1.34	1.34	1.97	1.97	1.97	1.97	2.58	3.21
E5	0.71	0.83	0.93	1.12	1.26	1.26	1.44	1.89	2.36
E6	1.36	1.36	1.5	2.22	2.22	2.22	2.66	3.39	4.09
E7	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.04	0.04

Visual Indicator Bettis Q-Series Actuators

Description

Bettis Q-Series actuators have a large visual position indicator which allows clear indication of the valve's position at almost any position.

The Bettis Q-Series actuator's indicator is designed for position indication of actuators mounted "in line" with the pipe line and mounted "cross line" with the pipe line.

Conversion is easily done by turning the indicator 90° and reassemble back in place. Default, the position indicator will be mounted "in line".

Specifications

Materials

- Indicator knob: ABS, Black
- Indicator arrow: ABS, White
- Indicator screw: SS Head cap screw M6x12

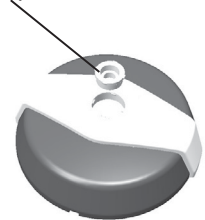
Center Piece of Large Indicator

The large indicator, for sizes 600 - 1600, is designed with a press fitting onto the pinion top. This way, the indicator will stay also on the pinion top without the indicator screw fitted. This press fitting feature together with the option to punch out the center piece of the vane of the large indicator, offers a passageway for a switch box or positioner shaft, up to a diameter of 20 mm (0.787").

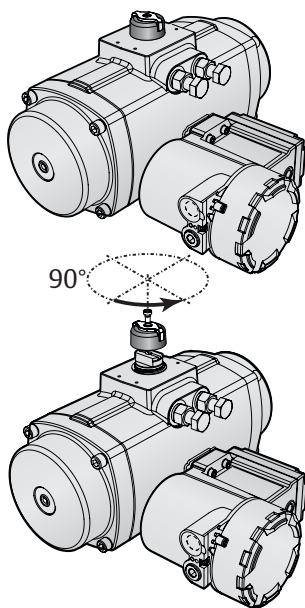
Ø 20 mm (0.787")



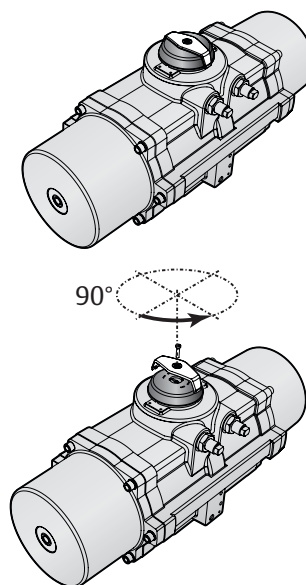
Punched out center piece



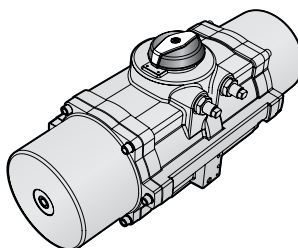
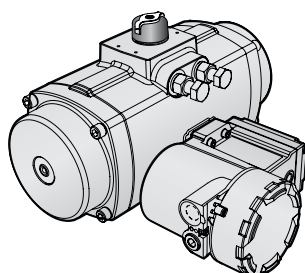
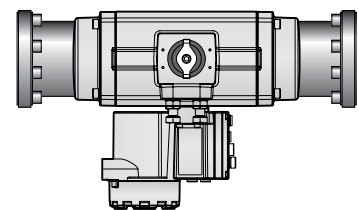
Size 40 - 600



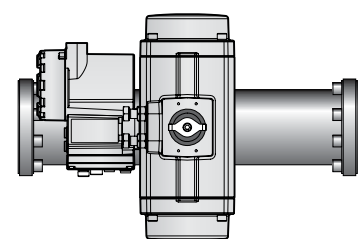
Size 950- 1600



Indicator Mounting "In-line"



Indicator Mounting "Across Line"



Drive Inserts

Key Features

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

Description

The Bettis Q-Series actuators are fitted with drive inserts. These drive inserts allow actuators to be directly mounted onto suitable valves in accordance with ISO 5211 and eliminates the need for a bracket and coupling type mounting kit. The use of direct mounts significantly cuts the cost of the valve/actuator assembly.

Standard actuators are fitted with square drive inserts in accordance with ISO 5211. The ISO 5211 standard covers parallel and diagonal oriented inner squares (as per old DIN3337 standard).

Additionally, a wide variety of other inserts are also available. Special inserts may have oversized or undersized squares, double-D and shaft key way forms.

Drive inserts can be supplied on factory-built actuators or as loose items and are easily replaceable at distributor or end user level.

Where direct mounts are not possible, for instance on valves with exposed gland packing, the use of inserts often simplifies the design of the mounting kit.

- Material: Aluminium alloy
- Finish: Anodized

Notes:

1. Page 2 and 3 shows an overview of the default insert sizes and the most common square shaped insert sizes. Please contact your local Bettis Q-Series representative for all available insert sizes.

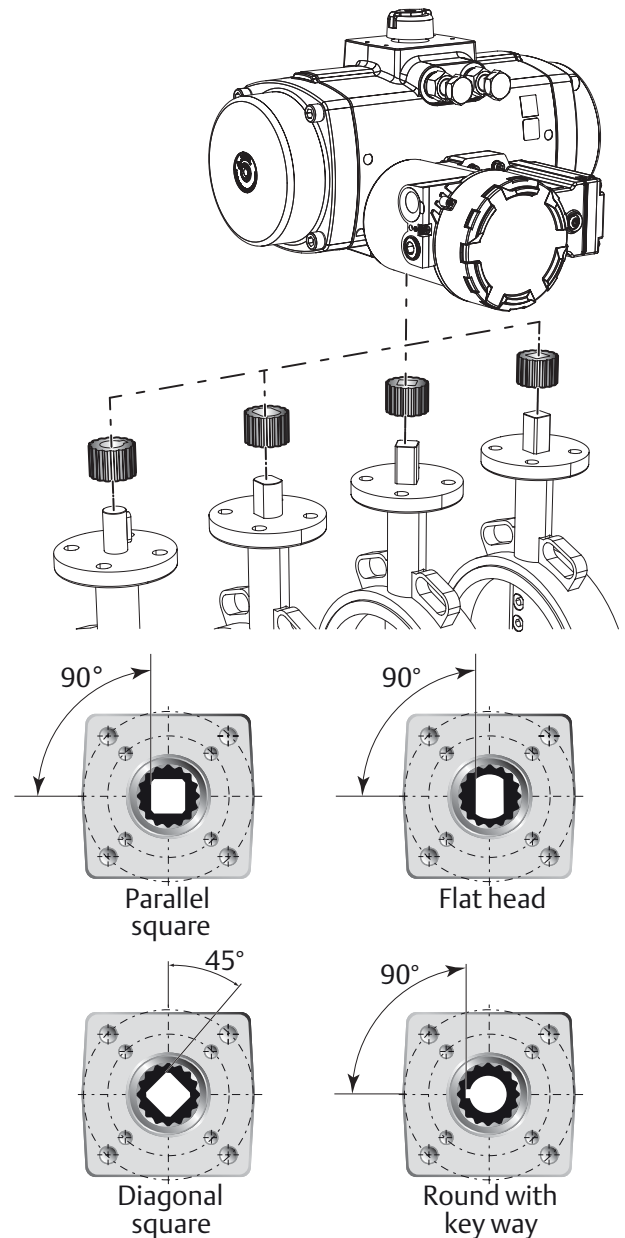


Table 1. Metric Drive Square Overview

Dim. in mm	Inserts with inner-square-dimensions per actuator type							
	0040/0065	0100	0150	0200	0350	0600	0950	1600
Standard square drive dimensions								
Type	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Insert
Parallel ■	14	19	19	22	27	27	36	46
Diagonal ◆	14	17	17	22	22	27	36	46
Optional square insert dimensions (Note 1)								
	8	9	9	9	9	9	14	22
	9	10	10	10	10	10	19	27
	10	11	11	11	11	11	22	30
	11	12	12	12	12	12	27	36
	12	14	14	14	14	14	30	
	16	16	16	16	16	16		
			22	17	17	17		
			24	19	19	19		
			25	24	24	22		
			27	25	25	24		
				27		25		
Maximum adaptor/valve stem dimensions								
M1	34.5	34.5	50	50	50	52	64.5	81
M2	-	27.5	-	37	37	-	-	-
P1	18.1/21.2	23.5	28.5	32.2	32.2	36.8	48.3	60.2
P2	-	25.2	-	36.3	36.3	-	-	-
Sq. max.	16	19	27	27	27	27	36	46
D max.	21	23.6	33.6	33.6	33.6	33.6	45	60

1. Above Table shows an overview of the default insert sizes and the most common square shaped insert sizes. Please contact your local Bettis Q-Series representative for all available insert sizes.

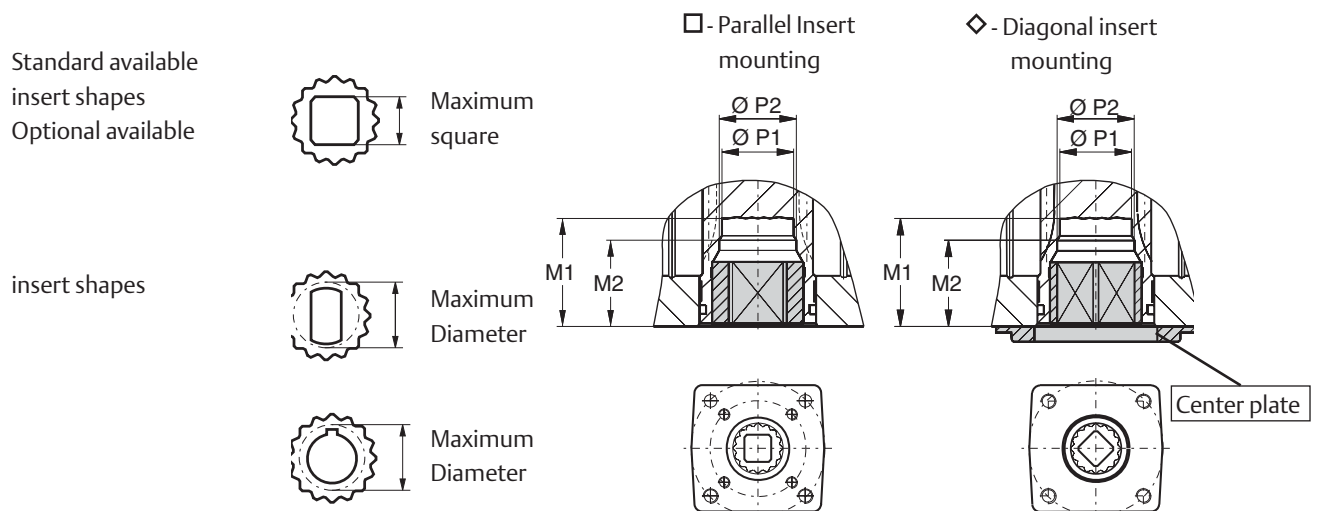
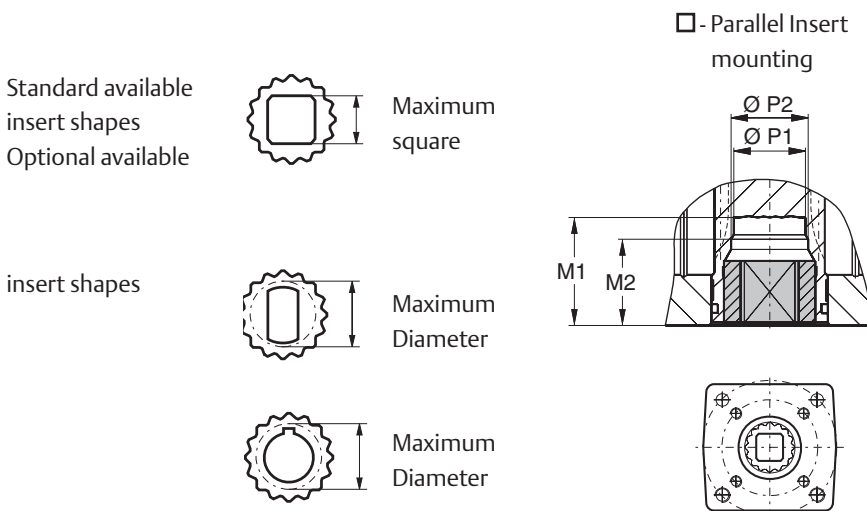


Table 2. Imperial Drive Square Overview

Dim. in inches	0040/0065	100	150	200	350	600	950	1600
Standard square drive dimensions								
Type	Insert	Insert	Insert	Insert	Insert	Insert	Insert	Insert
Parallel ■	0.551	0.748	0.748	0.866	1.063	1.063	1.417	1.811
Diagonal ◆	0.551	0.669	0.669	0.866	0.866	1.063	1.417	1.811
Optional square insert dimensions (Note 1)								
	0.315	0.354	0.354	0.354	0.354	0.354	0.551	0.866
	0.354	0.394	0.394	0.394	0.394	0.394	0.748	1.063
	0.394	0.433	0.433	0.433	0.433	0.433	0.866	1.181
	0.433	0.472	0.472	0.472	0.472	0.472	1.063	1.417
	0.472	0.551	0.551	0.551	0.551	0.551	1.181	
	0.630	0.630	0.630	0.630	0.630	0.630		
			0.866	0.669	0.669	0.669		
			0.945	0.748	0.748	0.748		
			0.984	0.945	0.945	0.866		
			1.063	0.984	0.984	0.945		
				1.063		0.984		
Maximum adaptor/valve stem dimensions								
M1	1.358	1.358	1.969	1.969	1.969	2.047	2.539	3.189
M2	-	27.5	-	37	37	-	-	-
P1	0.717/ 0.835	0.925	1.122	1.268	1.268	1.449	1.902	2.37
P2	-	0.992	-	1.429	1.429	-	-	-
Sq. max.	0.630	0.748	1.063	1.063	1.063	1.063	1.417	1.811
D max.	0.827	0.929	1.323	1.323	1.323	1.323	1.772	2.362

1. Above Table shows an overview of the default insert sizes and the most common square shaped insert sizes. Please contact your local Bettis Q-Series representative for all available insert sizes.



Center Plate / Center Ring

Key Features

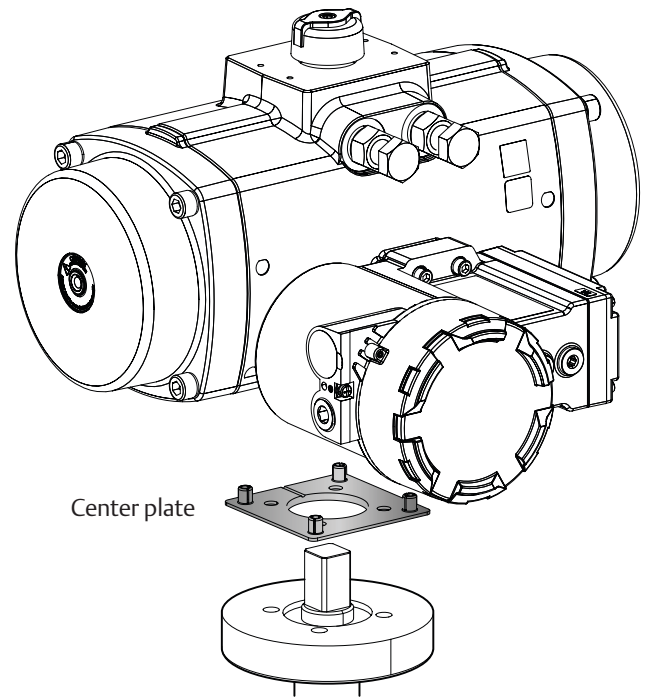
- Durable design allows good alignment of actuator and valve.
- Prevents wear on valve spindle or mounting kit due to misalignment.
- Center plates can easily be added to standard actuator.
- Most actuators are available with two center plates for flexible valve mounting.
- Equipped with slot to release pressure, trapped between valve and actuator.

Description

Bettis Q-Series actuators can be equipped with a center plate which takes care that actuator and valve (or valve mounting kit) are aligned when mounted. For most of the actuator sizes two centering plates are available.

Specifications

- Material plate: Nylon PA6, Black



Q-Series actuator models ⁽¹⁾									
	0040	0065	0100	0150	0200	0350	0600	0950	1600
Default ⁽¹⁾	F05	F05	F07	F07	F10	F10	F12	F14	F16
Option	F07	F07	F05	F10	F07	F07	F10	-/-	-/-

Notes:

1. Default selection if actuator needs to comply to DIN3337, see Dimension Sheet BQD.04.01.EN.

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