BRADFORD ACTUATORS

INSTALLATION OPERATION
AND
MAINTENANCE MANUAL

www.bradfordfittings.com

The Right Connection™

Bradford

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SAFETY

Warnings, cautions and notes are contained in this manual. To avoid serious injury and/or possible damage to equipment, pay attention to these messages.

WARNING Hazards or unsafe practices which COULD result in severe personal injury or death and how to avoid it.

CAUTION Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

NOTE Important information pertaining directly to the subject. (Information to be aware of when completing a task)

Do Not modify any Bradford product. Non-factory modifications could create hazardous conditions and void all warranties.
Do Not attempt to use a Bradford product in any application that exceeds the product rating.

Read and understand this manual prior to installing, operating or maintaining this valve.

LIMITED WARRANTY

Bradford, a Dixon Company, (herein called "Bradford") warrants the products described herein, and manufactured by Bradford to be free from defects in material and workmanship for a period of one (1) year from date of shipment by Bradford under normal use and service. It's sole obligation under this warranty being limited to repairing or replacing, as hereinafter provided, at its option any product found to Bradford's satisfaction to be defective upon examination by it, provided that such product shall be returned for inspection to Bradford within three (3) months after discovery of the defect. The repair or replacement of defective products will be made without charge for parts or labor. This warranty shall not apply to: (a) parts or products not manufactured exclusively for Bradford, the warranty of such items being limited to the actual warranty extended to Bradford by its supplier; (b) any product that has been subject to abuse, negligence, accident, or misapplication; (c) any product altered or repaired by others than Bradford; and (d) to normal maintenance services and the replacement of service items (such as gaskets and seats) made in connection with such services. To the extent permitted by State law, this limited warranty shall extend only to the buyer and any other person reasonably expected to use or consume the goods who is injured in person by any breach of the warranty. No action may be brought against Bradford for an alleged breach of warranty unless such action is instituted within one (1) year from the date the cause of action accrues. This limited warranty shall be construed and enforced to the fullest extent allowable by applicable State law.

OTHER THAN THE OBLIGATION OF BRADFORD SET FORTH HEREIN, BRADFORD DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ANY OTHER OBLIGATION OR LIABILITY. THE FOREGOING CONSTITUTES BRADFORD'S SOLE OBLIGATION WITH RESPECT TO DAMAGES, WHETHER DIRECT, INCIDENTAL OR CONSEQUENTIAL, RESULTING FROM THE USE OR PERFORMANCE OF THE PRODUCT.

Some products and sizes may be discontinued when stock is depleted, or may require a minimum quantity for ordering.

NOTE: Reasonable care has been taken in preparing the Illustrated Price List. Bradford, a Dixon Company, reserves the right to make corrections and price changes.

CARE OF STAINLESS STEEL

The stainless steel components in Bradford equipment are machined, welded and assembled by skilled craftsmen using manufacturing methods that preserve the corrosion-resistant quality of the stainless steel.

Retention of corrosion-resistant qualities under processing conditions requires regular attention to the precautions listed below.

1. Regularly check all electrical devices connected to the equipment for stray currents caused by-improper grounding, damaged insulation or other defects. Corrosion: "Pitting" often occurs when stray currents come in contact with moist stainless steel.

2. Never leave rubber mats, fittings, wrenches, etc. in contact with stainless steel. Corrosion: Pitting or galvanic action. Objects retard complete drying, preventing air from reforming the protective oxide film. Galvanic corrosion occurs when two dissimilar metals touch when wet

3. Immediately rinse equipment after use with warm water until the rinse water is clear. Clean the equipment (manual or CIP) as soon as possible after rinsing. Corrosion: discoloration, deposits, pitting. Product deposits often cause pitting beneath the particles.

4. Use only recommended cleaning compounds. Purchase chemicals from reputable and responsible chemical manufacturers familiar with stainless steel processing equipment They continuously check the effects of their products on stainless steel.

5. Use cleaning chemicals exactly as specified by the manufacturer. Do not use excessive concentrations, temperatures or exposure times. Corrosion: Pitting, discoloration, stress cracks. Permanent damage often occurs from excessive chemical concentrations, temperatures, or exposure times.

6. For manual cleaning, use only soft non-metallic brushes, sponges, or pads. Brush with the grain on polished surfaces, avoid scratching the surface. Corrosion: Pitting, scratches. Metal brushes or sponges will scratch the surface and promote corrosion over a period of time. Metal particles allowed to remain on a stainless steel surface will cause pitting.

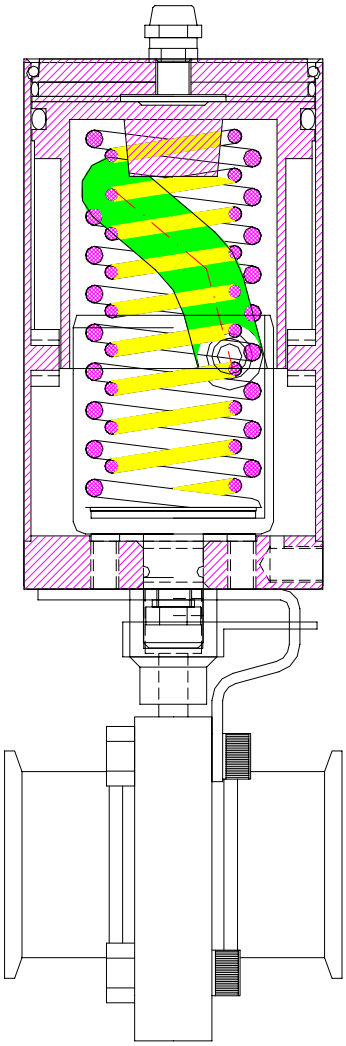
7. Use chemical bactericides exactly as prescribed by the chemical manufacturer in concurrence with local health authority. Use the lowest permissible concentration, temperature, and exposure time possible. Flush immediately after bacterial treatment. In no case should the solution be in contact with stainless steel more then 20 minutes. Corrosion: Protective film destroyed. Chlorine and other halogen bactericides can destroy the protective film. A few degrees increase in temperature greatly increases chemical activity, and accelerates corrosion.

8. Regularly inspect the joints in pipelines. Be sure all connections are tight fitting without binding. Corrosion: Crevice corrosion. Small crevices caused by improperly seated gaskets will promote crevice corrosion. Stainless steel under stress will develop stress cracking especially in the presence of bactericides containing chlorine.

9. Regularly inspect equipment for surface corrosion (i.e. pitting deposits, stress cracks, etc.). If deposit or color corrosion is detected, remove it immediately using mild scouring powder and detergents. Rinse thoroughly and allow to air dry. Review production and cleaning procedures to determine the cause. Note: If corrosion is not removed, the protective film cannot be restored and corrosion will continue at an accelerated rate.

VC-NR-100 SERIES

STAINLESS STEEL, VERTICAL CANISTER
PNEUMATIC ACTUATOR



BRADFORD VC-NR-100 SERIES ACTUATOR FEATURES SPECIFICATIONS & DIMENSIONS

FEATURES

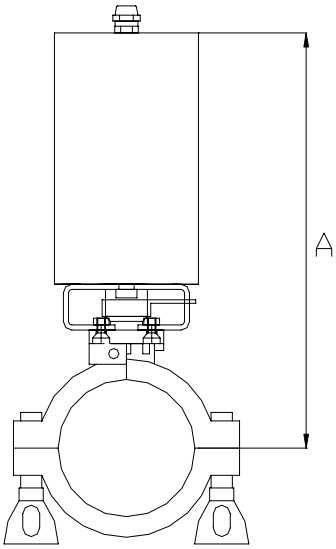
- Excellent protection and corrosion resistance
- Tested to 1 million cycles
- Available in ATO/ATC, ATO/STC, STO/ATC
- 100% Fully tested
- Backed by 1 year warranty
- Can be mounted on all Bradford butterfly valves up to 4".
- Each Bradford pneumatically actuated butterfly valve is shipped fully assembled, including pneumatic actuator and mounting bracket assembly.

SPECIFICATIONS

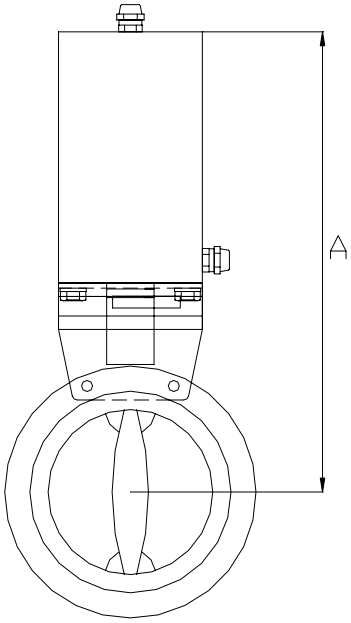
PART NUMBER--------→	DOUBLE ACTING VC-NR-100-DA	SPRING RETURN VC-NR-100-SR
WEIGHT (lb)	5.1	6.0
AIR CONSUMPTION (in^3) [Down stroke – CW]	8.5	8.5
AIR CONSUMPTION (in^3) [Upstroke – CCW]	20	18.5
TEMPERATURE RATING MAXIMUM (˚F)	+250	+250
TEMPERATURE RATING MINIMUM (˚F)	-4	-4
OUTPUT TORQUE (in-lb)	350	350
MAXIMUM PRESSURE RATING (psi)	120	120
SUPPLY PRESSURE REQUIRED (psi)	80-100	80-100
DIAMETER (in)	3.35	3.35
HEIGHT (in)	5.83	5.83
AIR FITTING PORTS	1/8" NPT	1/8" NPT

BUTTERFLY VALVE Size (inch)	Minimum Operation Air Pressure
1	50 psi (3.5 kg/cm^2)
1 1/2	57 psi (4 kg/cm^2)
2	57 psi (4 kg/cm^2)
2 1/2	66 psi (4.6 kg/cm^2)
3	71 psi (5 kg/cm^2)
4	80 psi (5.8 kg/cm^2)

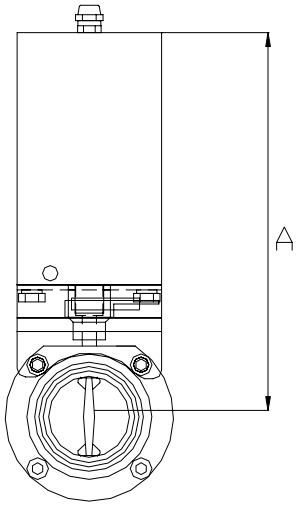
DIMENSIONS WITH BRADFORD BUTTERFLY VALVES



B5102 SERIES



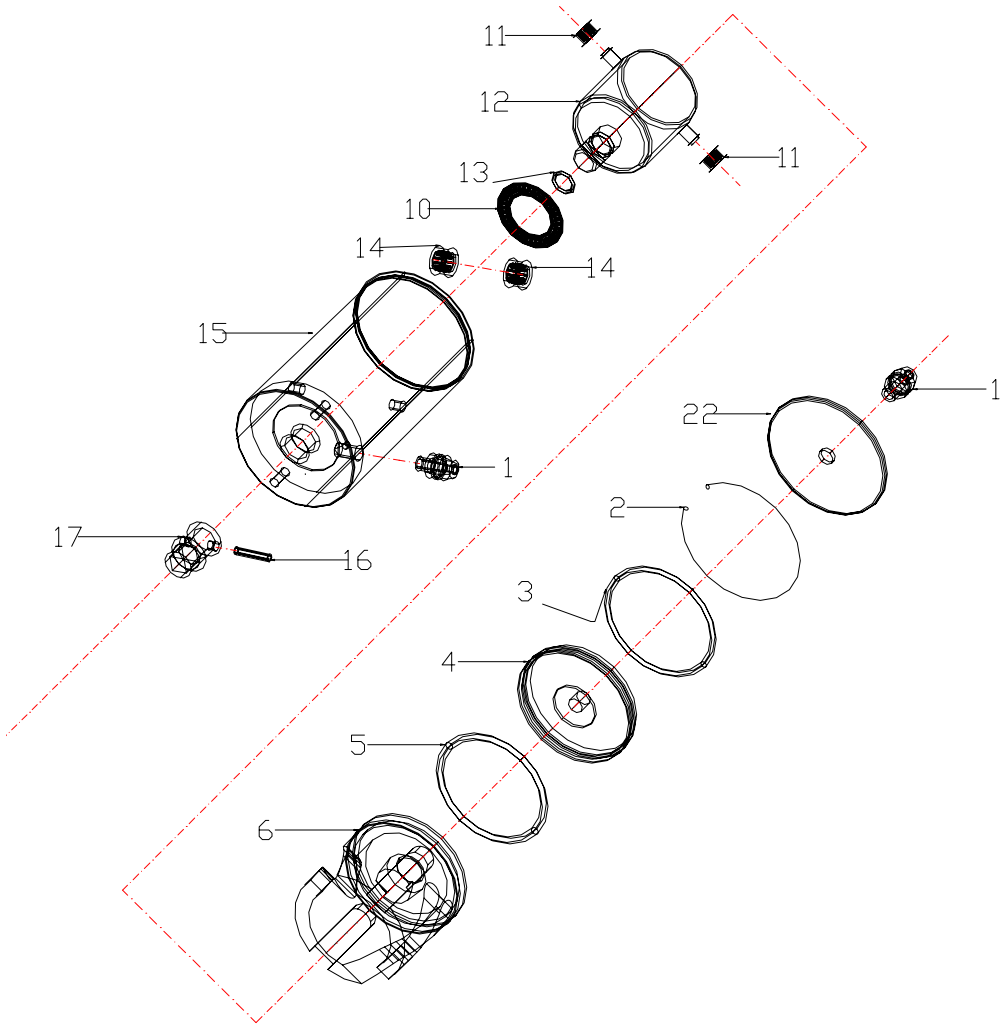
B5103 SERIES



B5101 SERIES

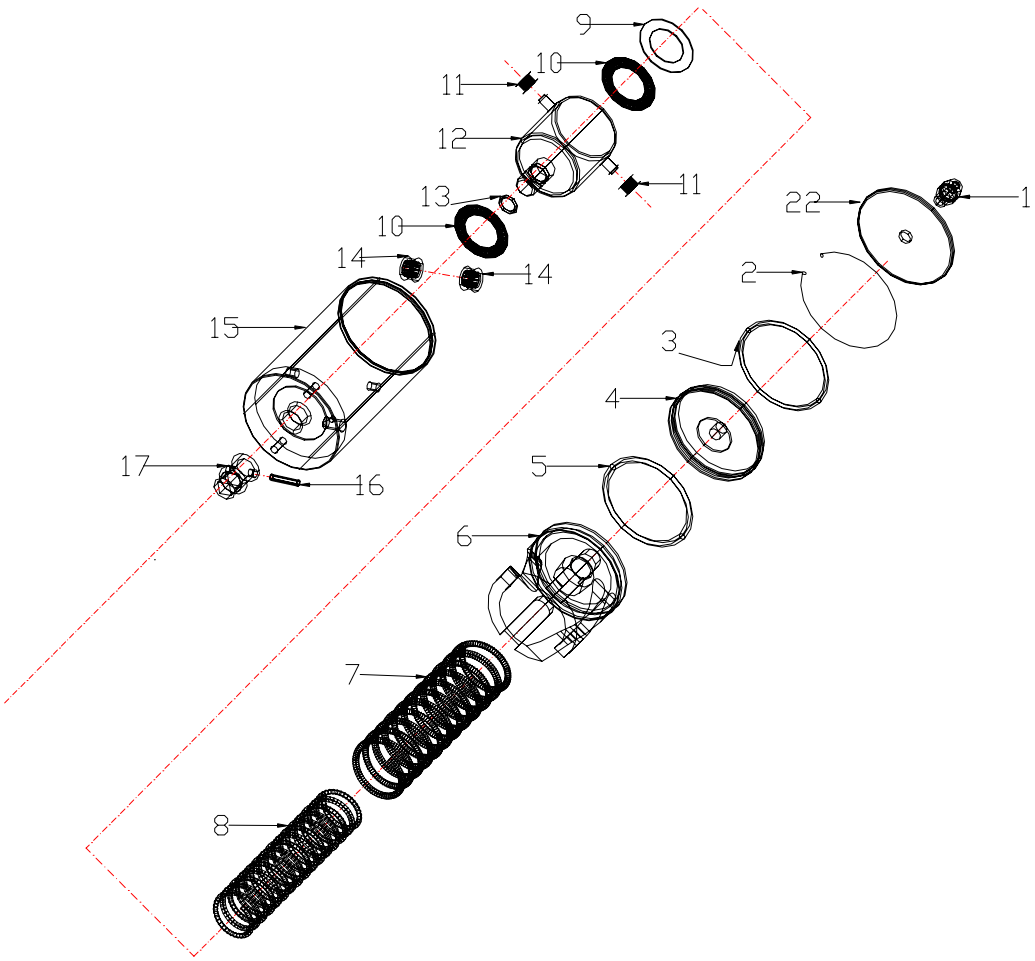
VALVE SIZE (IN)	B5101 A (in)	B5102 A (in)	B5103 A (in)
1	8.57	8.4	8.96
1.5	8.57	8.4	8.96
2	8.97	8.74	9.13
2.5	9.37	9.05	9.45
3	9.51	9.30	9.74
4	10.37	9.85	10.67

PARTS BREAKDOWN FOR VC-NR-100-DA



ITEM #	DESCRIPTION	MATERIAL	QUANTITY
1	AIR FITTING	304	2
2	RETAINING RING	304	1
3	O-RING (Ø80mm x 4mm)	EPDM	1
4	END CAP	304	1
5	O-RING (Ø80mm x 5mm)	EPDM	1
6	PISTON	ALUMINUM	1
10	THRUST BEARING (Ø47mm x Ø30mm x 2mm)	304	2
11	NEEDLE BEARING (Ø19mm x Ø10mm x 10mm)	304	2
12	DRIVE ASSEMBLY	304	1
13	O-RING (Ø17mm x 2.5mm)	EPDM	1
14	NEEDLE BEARING (Ø16mm x Ø7mm x 8mm)	304	2
15	BODY	304	1
16	SPLIT PIN	304	1
17	COUPLER	304	1
22	TOP CAP	304	1

PARTS BREAKDOWN FOR VC-NR-100-SR



ITEM #	DESCRIPTION	MATERIAL	QUANTITY
1	AIR FITTING	304	1
2	RETAINING RING	304	1
3	O-RING (Ø80mm x 4mm)	EPDM	1
4	END CAP	304	1
5	O-RING (Ø80mm x 5mm)	EPDM	1
6	PISTON	ALUMINUM	1
7	OUTER SPRING	302	1
8	INNER SPRING	302	1
9	THRUST DRIVE	304	1
10	THRUST BEARING (Ø47mm x Ø30mm x 2mm)	304	2
11	NEEDLE BEARING (Ø19mm x Ø10mm x 10mm)	304	2
12	DRIVE ASSEMBLY	304	1
13	O-RING (Ø17mm x 2.5mm)	EPDM	1
14	NEEDLE BEARING (Ø16mm x Ø7mm x 8mm)	304	2
15	BODY	304	1
16	SPLIT PIN	304	1
7	COUPLER	304	1
22	TOP CAP	304	1

VC-NR-100 SERIES MAINTENANCE & OPERATING INSTRUCTIONS

Assembly steps for Actuator with B5101 and B5103 Series Butterfly Valves:

1. Assemble the coupler to actuator body and secure with split pin.
2. Assemble the bracket onto actuator body with 2 hex bolts and lock washers. NOTE: do not tighten the bolts and nuts yet.
3. Put the indicator onto the coupler of the actuator and then tighten the bolts onto the actuator (the coupler should be at the center of bracket).
4. Adjust the position of the indicator.
5. Assemble the actuator (bracket, coupler and indicator) with Butterfly Valve.
6. Connect actuator/bracket assembly and coupler to the valve body. Insert the two top body bolts through bracket assembly, then through the two body halves. Thread nuts onto ends of screws and tighten as required.
7. Check to be sure that valve position indicator is in alignment with the valve disc.

Assembly steps for Actuator with 5102 Butterfly Valve:

1. Assemble the coupler to actuator body and secure with split pin.
2. Assemble the bracket adapter plate onto the bracket and fix with 4 bolts and nuts.
3. Adjust the position of the bracket adapter plate to be in the center of the bracket.
4. Assemble the indicator and bracket together onto the actuator body.
5. Fix the bracket onto the actuator with bolts (open wrench).
6. Assemble the Butterfly Valve onto the bracket adapter plate and tighten the two set screws on the sides of the plate.
7. Check to be sure that valve position indicator is in alignment with the valve disc.

For the B5101, B5102 and B5103 assembly with actuator, the final steps are as follows:

1. When assembling the air fittings, wind sealing tape around the threads first and tighten as required. (Using open wrench).
2. When testing actuator with Butterfly Valves, insure the disc is in the desired position.
3. Connect air supply to the fittings on the top or the actuator for spring return units and on both fittings for double acting units in accordance with air supply specification.

Actuator Operation:

NOTE: For optimal operation, BRADFORD actuators should be run with a supply of clean, lubricated air.

VC-NR-100-SR (Spring Return Actuators)

Air to the port on the top of the actuator causes the actuator to turn CW. Loss of air to this port cause the air to exhaust and the actuator turns CCW. This is the FAIL operation and can be set up as Fail Close or Fail Open.

VC-NR-100-DA (Double Acting Actuators)
Air to the port on the top of the actuator causes the actuator to turn CW. Air to the port on the base of the actuator causes the actuator to turn CCW.

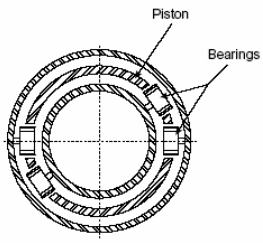
Disassembly procedure of Spring Return Actuators:

1. Remove the actuator from the valve mounting bracket.
2. Remove the (16) split pin and (17) coupler.
3. Remove (1) air fitting and (22) top cap.
4. Place the actuator in a manual press with the ram rod centered on the (4) end cap. The coupler drive must be free to rotate.
5. Push the end cap down one inch into the (15) actuator body and lock the press ram.
6. Remove the (2) split wire retaining ring from its groove.
7. Release the ram slowly until the springs stop pushing. The piston and end cap will rise above the cylinder before the (7&8) springs reach free length. However, if the end cap does not freely rise above the body, use a screw driver to aid in the motion. Make sure the ram is moved in very small increments when using the screwdriver to aid in removal.
8. Remove the components from inside the actuator.

Assembly procedure of Spring Return Actuators:

1. Lubricate and install all the o-rings on the piston, end cap, and drive shaft.
2. Lubricate and install all the Needle and thrust bearings.
    a. Put (10) Thrust Bearing into the bottom of (15) Body (please note the lubricated Thrust Bearing should be face up).
    b. Assemble (14) Needle Bearings at two inner sides of (15) Body (lubricate Bearing).
    c. Assemble (13) O-ring onto (12) Drive Assembly (lubricate O-ring).
    d. Assemble (11) Needle Bearing at the sides of (12) Drive Assembly (lubricate Bearing).
    e. Put (10) Thrust Bearing into (12) Drive Assembly (please note the lubricated Bearing should be face up).
    f. Assemble (5) O-ring onto (6) Piston (lubricate O-ring)
    g. Put (3) O-ring with (4) End Cap (lubricate O-ring).
3. Put (9) Thrust Drive into (12) Drive Assembly.
4. Put (12) Drive Assembly into (15) Body.
5. Put (7 and 8) Spring into (12) Drive Assembly.
6. Put (6) Piston onto (7 and 8) Springs.

IMPORTANT: All the bearings must be aligned with the grooves in the cylinder. Refer to Fig. A.



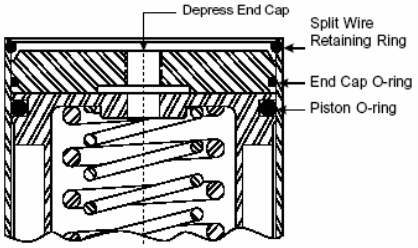


Fig A. Fig B.

If the position of (6) Piston and (12) Drive Assembly are correct. The distance between(14 and 11) Needle Bearing is about 0.236" (6.0m/m).
If there is resistance when the straight groove of (6) Piston is aimed at the air exhaust hole on the (15) Body, it should not be tightened. Re-assemble it again from step 6.

9. Put (4) End Cap onto (6) Piston.
10. Place actuator in a manual press. Locate the end cap on top of the piston.
11. Center the press ram on the end cap and depress it into the cylinder.

IMPORTANT Press the assembly slowly and with minimal force. If the assembly does not descend into the cylinder, realign the bearings with the piston grooves.

12. Depress the assembly into the cylinder until the split wire retaining ring can be located in its groove. Lock the press in this position.
13. Install the split wire retaining ring.
14. Release the press and let the assembly rise until the End Cap stops on the split wire retaining ring.
15. Replace (22) top cap and secure with (1) air fitting.

Disassembly procedure of Double Acting Actuators:

1. Remove the actuator from the valve mounting bracket.
2. Remove the (16) split pin and (17) coupler.
3. Remove (1) air fitting and (22) top cap.
4. Place the actuator in a manual press with the ram rod centered on the (4) end cap. The coupler drive must be free to rotate.
5. Push the end cap down one inch into the (15) actuator body.
6. Remove the (2) split wire retaining ring from its groove.
7. Remove the components from inside the actuator.

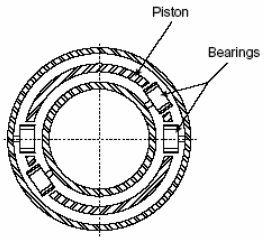
Assembly procedure of Double Acting Actuators:

1. Lubricate and install all the o-rings on the piston, end cap, and drive shaft.
2. Lubricate and install all the Needle and thrust bearings.
    a. Put (10) Thrust Bearing into the bottom of (15) Body (please note the lubricated Thrust Bearing should be face up).
    b. Assemble (14) Needle Bearings at two inner sides of (15) Body (lubricate Bearing).

c. Assemble (13) O-ring onto (12) Drive Assembly (lubricate O-ring).
d. Assemble (11) Needle Bearing at the sides of (12) Drive Assembly (lubricate Bearing).
e. Assemble (5) O-ring onto (6) Piston (lubricate O-ring)
f. Assemble (3) O-ring with (4) End Cap (lubricate O-ring).

3. Put (12) Drive Assembly into (15) Body.
4. Put (6) Piston into (15) Body.

IMPORTANT: All the bearings must be aligned with the grooves in the cylinder. Refer to Fig. A.



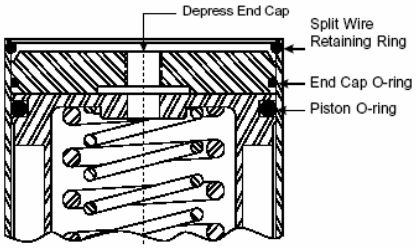


Fig A. Fig B.

If the position of (6) Piston and (12) Drive Assembly are correct. The distance between(14 and 11) Needle Bearing is about 0.236" (6.0m/m).
If there is resistance when the straight groove of (6) Piston is aimed at the air exhaust hole on the (15) Body, it should not be tightened. Re-assemble it again from step 6.

5. Put (4) End Cap onto (6) Piston.
6. Place actuator in a manual press. Locate the end cap on top of the piston.
7. Center the press ram on the end cap and depress it into the cylinder.

IMPORTANT Press the assembly slowly and with minimal force. If the assembly does not descend into the cylinder, realign the bearings with the piston grooves.

8. Depress the assembly into the cylinder until the split wire retaining ring can be located in its groove.
9. Install the split wire retaining ring.
10. Add a small amount of air pressure to the lower air fitting (10-15 psi) until the (4) end cap rises to the top of the actuator body.

CAUTION: Step 10 must be exercised in a protective cage.

11. Replace (22) top cap and secure with (1) air fitting.

MAINTENANCE

The actuator should be inspected yearly under normal service and every three to six months for severe applications. The bearings should be lubricated and replaced if worn. O-rings should be replaced. Piston should be cleaned and inspected.

BRADFORD

RP-BA SERIES

RACK AND PINION

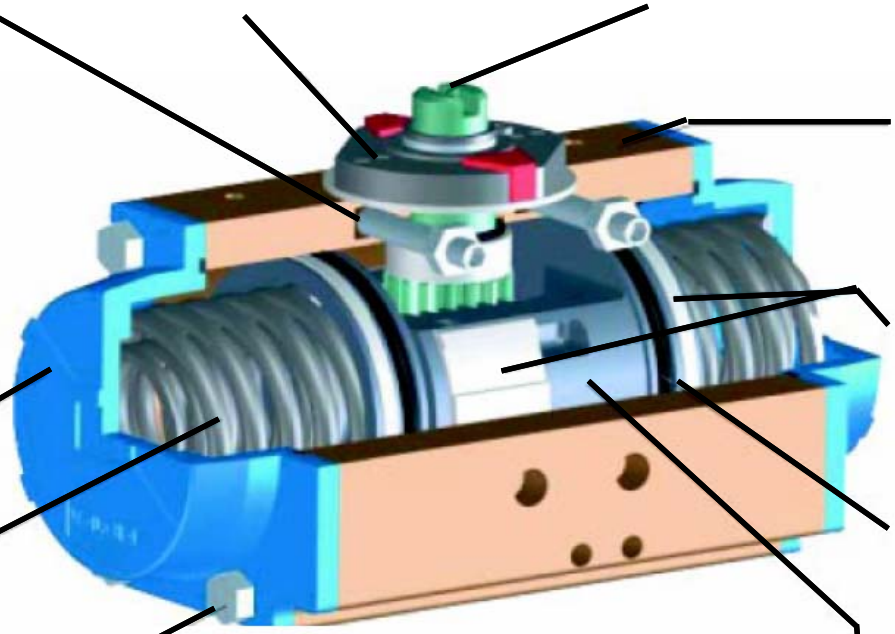
ALUMINUM ACTUATORS

Bradford Pneumatic Actuator Features

INDICATOR
A disc indicator is standard on the 052 through 125 models. A high visibility open-closed dome indicator is available on all Bradford actuators.

PINION
The hardened steel pinion is precision ground and then nickel plated in order to reduce friction, provide maximum wear resistance, and proctect against corrision under severe conditions. An optional stainless steel pinion is available for corrosive elements.

ROTATION ADJUSTMENT
052 through 125 Models
Standard adjustment is +5° in both the open and closed positions through easily accessible external adjustment screws.
160
Standard adjustment is ±5° in the open position. An adapter kit is available for ±5° adjustment in the closed position.



ACTUATOR BODY
The aluminum extrusion is hard anodized to 45-50 microns to protect against wear and corrosion while reducing piston friction to the absolute minimum.

PISTON GUIDES
Large contact areas and self-lubricating, highly-durable materials provide high thrust stability with minimum friction.

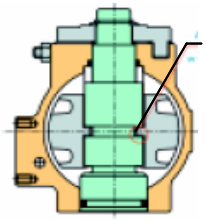
END CAPS
Epoxy coated die cast aluminum end caps provide maximum resistance against potentially corrosive elements.

PINION SEALS
NBR-70 rubber pinion seals provide trouble-free operation at standard temperature ranges. Viton and HNBR seals are available to high or low temperature extremes.

HEAVY DUTY SPRINGS
True-rated spring sets create absolute confidence in all of the fail safe spring return models. The high tensile steel springs are coated with zinc phosphate for corrosion resistance. Springs can be safely and quickly modified into sets ranging from 40 pounds to 80 pounds. Full length end cap bolts allow for easy and safe disassembly.

PISTONS
The precisely-balanced die cast aluminum pistons are fitted with high-quality rings and guides, resulting in high ratios of output torque vs. input air pressure. The twin rack and piston design creates a constant torque output on all models.

ANTI-BLOWOUT SYSTEM



All pistons are provided with anti-blowout flat key

ROTATION VARIATIONS

All Bradford actuators use a counterclockwise rotation to open and a clockwise rotation to close. The piston racks also can be rotated to achieve a fail open (counterclockwise to close) rotation.

Standard Rotation

Closed Open

Reverse Rotation

OPTIONS FOR CORROSIVE ENVIRONMENTS

BODY: nickel plated or double epoxy coated bodies available upon request
PINION: stainless steel
END CAPS: nickel plated

ALL 316 STAINLESS STEEL ACTUATORS ALSO AVAILABLE. PLEASE CONTACT OUR SALES STAFF FOR INFORMATION.

STANDARD FEATURES

MAXIMUM PRESSURE RATING
120 PSI / 8 BAR

STANDARD TEMPERATURE RATING*
-4°F / -20°C to +180 °F / +85 °C

MAXIMUM TEMPERATURE RATING**
-40°F / -40°C to +350 °F / +180 °C

*with standard NBR70 seals

**with Viton or HNBR seals (available upon request)

- 100% FACTORY TESTED
- TWIN RACK AND PINION DESIGN FOR CONSISTENT TORQUE OUTPUT
- PRE-LUBRICATED FOR LIFE OF ACTUATOR

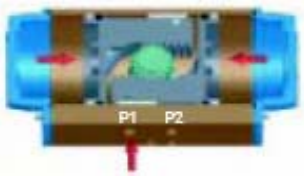
MOUNTING OPTIONS

VALVE MOUNTING: True ISO 5211 standard base mounting bolt patterns and a double square female output shaft provid mulitple options for direct mounting to valve stems and a greater flexibility of actuator rotation. Double D pinions are also available for additonal direct mount options.

ACCESSORY MOUNTING: The top mounting pad is drilled and taped to international NAMUR and ISO standards, providing for quick and economical accessory mounting in conjunction with the NAMUR pinion shaft. The standard NAMUR slotted and threaded shaft allows for direct mounting of NAMUR limit switches, valve positioners, and position monitors.

SOLENOID MOUNTING: All Bradford actuators have an international NAMUR solenoid pattern that permits direct mounting of a wide range of solenoid models. The NAMUR mount eliminates the need for pipe nipples or solenoid brackets.

Double Acting Actuators

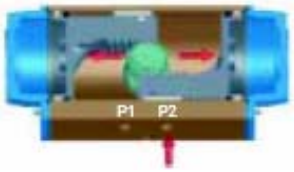


CLOSED

Air to Port 1 (P1) forces the pistons inwards, causing the pinion to turn clockwise.

ACTUATOR OVERVIEW

- All listed output torques are expressed in inch pounds of torque (in. lbs.)
- Charts for available air pressure are expressed in pounds per square inch (P.S.I.).
- Bradford actuators offer±5° °adjustment is in the open and closed positions on 052 through 125 models. For all other models, adjustment is in the open position only. The closed position is 0°fixed. Optional retrofit kits are available to allow for adjustment in both open and closed positions on the 160.



OPEN

Air to Port 2 (P2) forces the pistons outwards, causing the pinion t turn counterclockwise.

DOUBLE ACTING ACTUATOR SIZING *(PLEASE SEE DOUBLE ACTING TORQUE CHART)*

1. Establish the valve manufacturer's breakaway or seating / unseating torque, then add 20% as a safety factor (e.g. 115 in. lbs. Valve breakaway torque x 20% = 138 in. lbs.).

2. Determine available air pressure to actuator (e.g. 60 P.S.I.).

3. Refer to the chart, find the 60 P.S.I. Column and scan down until a torque value greater than the valve torque is found (e.g. 141 in. lbs.). Then go to the left to determine the Bradford model number. In this sample case, the selected actuator would be the 052.

NOTE: The Bradford double acting actuator has no torque drop through the full 90 stroke.°

Spring Return Actuators

CLOSED

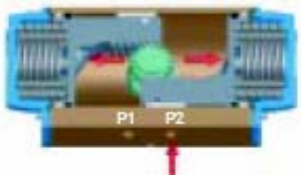
Loss of air pressure on Port 2 causes springs to drive the pistons inward. The pinion turn clockwise to close while air exhausts from Port 2.

SPRING RETURN ACTUATOR TERMINOLOGY

1. AIR STROKE: When air is supplied to the actuator, the pistons compress the springs. The greater the spring compression, the less torque output the actuator can supply.

2. SPRING STROKE: When air is removed from the actuator, the stored energy in the springs forces the pistons inward. At full compression, the spring is at its maximum torque output. This is the SPRING START. When springs are decompressed, this is the SPRING END.

3. FAIL POSITION: Standard Bradford actuators are preset for fail closed (CW) operation, but can be adjusted easily for fail open (CCW) rotation.



OPEN

Air to port 2 (P2) forces the pistons outwards, causing the springs to compress. The pinion turns counterclockwise.

SPRING RETURN ACTUATOR SIZING *(PLEASE SEE SPRING RETURN TORQUE CHART)*

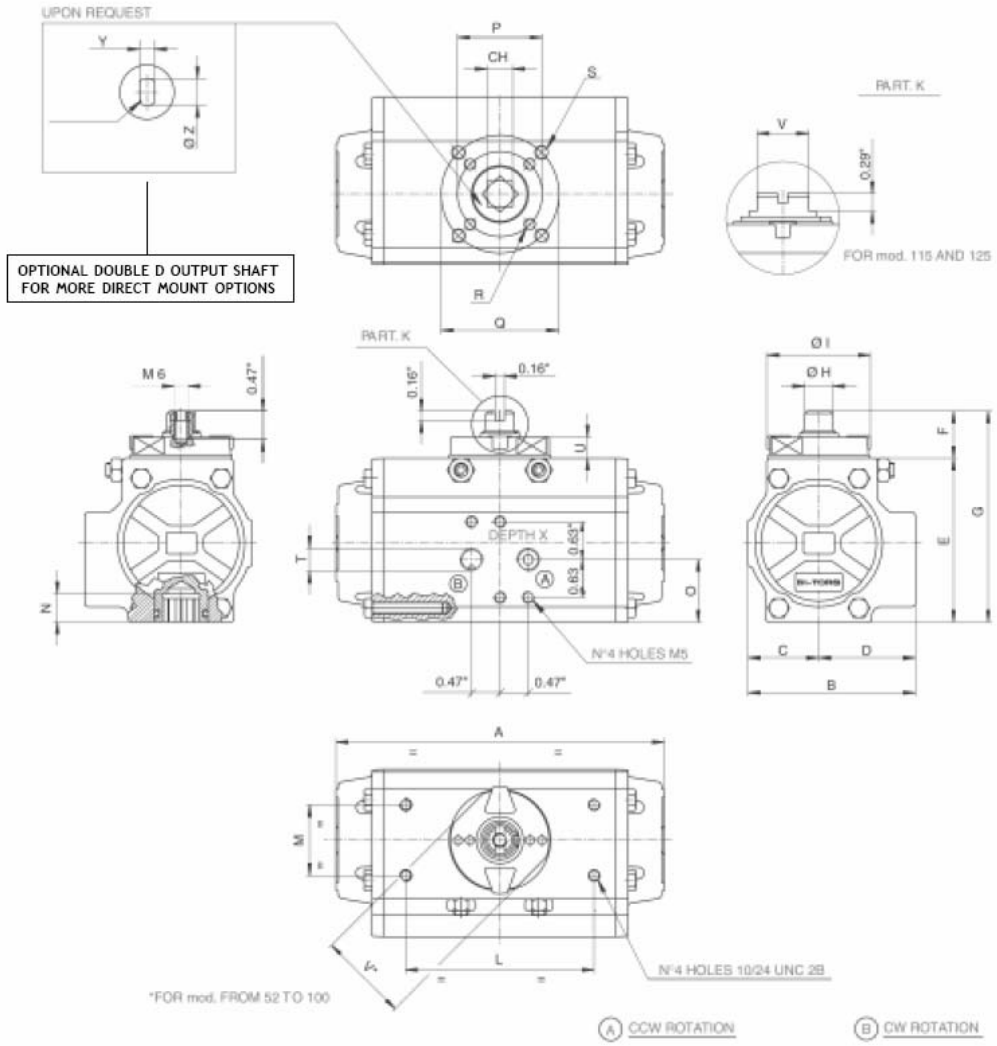
1. Establish the valve manufacturer's seating torque (closing) and breakaway torque (opening) Add a 20% safety factor (e.g. a valve torque of 80 in. lbs. x 20% = 96 in. lbs.).

2. Refer to the spring torque column and select the SPRING END TORQUE that equals or exceeds the reqired valve torque (i.e. the Bradford model 063 with a 80# spring set, which has a spring end of 111 in. lbs. And a**spring start** of 196 in. lbs.).

3. Determine the available air line pressure to the actuator (e.g. 80 P.S.I.). Refer to the 80 P.S.I. column and scan down to where it intersects with the 063 with an 80# spring. In this case, the end spring torque is 111in. lbs., which exceeds the required 96 in. lbs. required.

Bradford Pneumatic Actuator Dimensions

FOR ACTUATOR MODELS 052 THROUGH 125

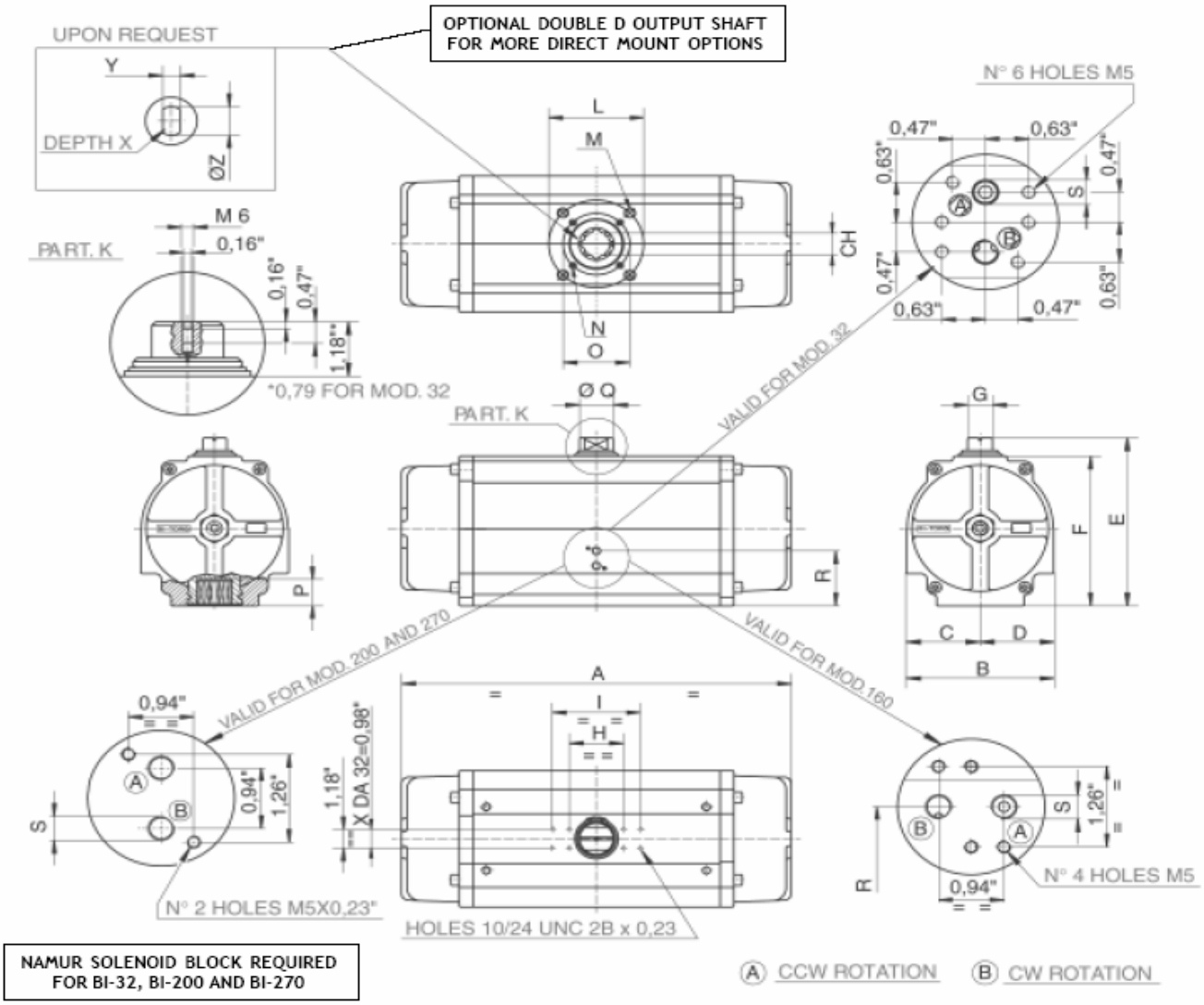


DIMENSIONAL DATA

	ISO 5211	CH	A	B	C	D	E	F	G	H0	I0	L0	M	N	O	P	Q	R (UNC)	S (UNC)	T (NPT)	U	V	Z0	Y	X
052	F03/F05*	0.433	5.49	2.8	1.18	1.61	2.74	0.79	3.52	0.47	1.73	3.15	1.18	0.47	1.04	1.42	1.97	10-24 x 0.29	1/4-20 x 0.35	1/8"	0.32	1.49	0.55	0.43	0.47
063	F05/F07	0.551	6.38	3.17	1.40	1.77	3.17	0.79	3.96	0.58	1.97	3.15	1.18	0.63	1.08	1.97	2.76	1/4-20 x 0.31	5/16-18 x 0.47	1/8"	0.32	1.61	0.71	0.55	0.63
075	F05/F07	0.669	8.15	3.72	1.65	2.07	3.82	0.79	4.61	0.71	2.48	3.15	1.18	0.75	1.38	1.97	2.76	1/4-20 x 0.31	5/16-18 x 0.47	1/8"	0.35	1.97	0.87	0.67	0.75
085	F05/F07	0.669	9.35	4.17	1.87	2.3	4.27	0.79	5.06	0.79	2.48	3.15	1.18	0.75	1.65	1.97	2.76	1/4-20 x 0.31	5/16-18 x 0.47	1/8"	0.35	1.97	0.87	0.67	1.18
100	F07/F10	0.669	10.69	4.84	2.17	2.68	4.78	0.79	5.57	0.79	2.48	3.15	1.18	0.81	1.97	2.76	4.02	5/16-18 x 0.31	3/8-16 x 0.55	1/4"	0.35	1.97	0.87	0.67	1.18
115	F07/F10	0.869	12.91	5.39	2.52	2.87	5.57	1.18	6.75	1.26	3.39	5.12	1.18	0.94	1.97	2.76	4.02	5/16-18 x 0.47	3/8-16 x 0.59	1/4"	0.57	0.86	1.11	0.86	1.53
125	F07/F10	0.869	14.41	5.83	2.68	3.15	6.04	1.18	7.22	1.26	3.39	5.12	1.18	0.94	2.40	2.76	4.02	5/16-18 x 0.47	3/8-16 x 0.59	1/4"	0.57	0.86	1.11	0.86	1.53

Bradford Pneumatic Actuator Dimensions

FOR ACTUATOR MODELS 032 and 160



DIMENSIONAL DATA

	ISO 5211	CH	A	B	C	D	E	F	G	H	I	L	M (UNC)	N (UNC)	O	P	Q0	R	S (NPT)	T	U	V	W	Z0	Y	X
032	F03	0.35	4.33	1.77	0.89	0.89	2.56	1.77	0.39	1.97	- -	1.42	10-24 x 0.29	- - - - -	- -	0.47	0.46	- -	1/8"	- -	- -	- -	- -	0.47	0.35	0.63
160	F10-F12	1.06	20.55	7.36	3.94	3.94	8.58	7.40	1.18	3.15	5.12	4.92	1/2-13 x 0.71	3/8-16 x 0.59	4.72	1.26	1.38	3.21	1/4"	6.29	1.77	2.20	2.5	1.42	1.06	1.89

Bradford Spring Return Actuator Sizing

MODEL	SPRING SET	SPRING TORQUE START-END	40 PSI AIR TORQUE START-END	50 PSI AIR TORQUE START-END	60 PSI AIR TORQUE START-END	70 PSI AIR TORQUE START-END	80 PSI AIR TORQUE START-END	90 PSI AIR TORQUE START-END	100 PSI AIR TORQUE START-END	115 PSI AIR TORQUE START-END
	01	44-32	48-23	72-47	95-70					
	02	59-42		61-31	84-54	108-77				
RP-BA-052-SR	03	66-46			80-47	104-70	127-94	150-117		
	04	82-57			70-31	93-55	116-78	140-101	163-125	
	05	105-72				78-32	101-55	125-78	148-102	183-137
	01	85-44	92-38	134-80	176-122					
	02	109-58		120-56	162-98	204-140				
RP-BA-063-SR	03	128-71			149-79	191-121	233-162	275-204		
	04	152-82			136-54	177-96	219-138	261-180	303-222	
	05	196-111				151-53	193-95	235-136	276-178	339-241
	01	172-89	168-63	244-138	319-214					
	02	226-118		215-85	291-160	366-235				
RP-BA-075-SR	03	249-133			275-137	351-212	426-288	502-363		
	04	303-162			247-83	322-158	398-234	473-309	549-385	
	05	380-205				279-81	354-157	430-232	505-308	618-421
	01	242-143	238-109	349-219	460-330					
	02	298-176		316-163	427-274	537-384				
RP-BA-085-SR	03	361-215			387-211	498-322	609-432	720-543		
	04	417-248			354-155	465-265	576-376	687-487	797-633	
	05	536-321				392-146	503-257	614-368	725-478	891-645
	01	395-218	384-154	556-326	728-499					
	02	521-288		485-199	658-372	830-544				
RP-BA-100-SR	03	564-318			628-329	801-502	973-674	1146-847		
	04	691-389			558-203	730-375	903-548	1075-720		
	05	860-489				630-206	802-378	975-551	1147-723	1406-982
	01	658-363	650-270	935-555	1220-840					
	02	835-449		848-378	1133-663	1419-949				
RP-BA-115-SR	03	957-538			1044-541	1329-827	1615-1112	1900-1397		
	04	1133-625			958-365	1243-650	1528-935	1813-1220	2098-1505	
	05	1432-800				1067-352	1352-637	1638-922	1923-1207	2350-1635
	01	877-470	850-328	1224-703	1599-1077					
	02	1040-560		1135-539	1509-914	1883-1288				
RP-BA-125-SR	03	1313-718			1351-640	1725-1015	2099-1389	2474-1763		
	04	1477-808			1261-477	1636-851	2010-1226	2384-1600	2758-1974	
	05	1913-1055				1388-415	1762-789	2136-1164	2511-1538	3072-2099
	01	1345-885	1921-1390	2644-2140						
	02	1991-1301		2228-1503	2952-2217					
	03	2336-1531		1980-1131	2713-1854	3419-2569				
RP-BA-160-SR	04	2841-1770			2447-1350	3162-2074	3886-2779			
	05	3327-2230				2737-1507	3452-2240	4175-2963		
	06	4186-2655					2983-1443	3715-2167	4421-2828	5475-3865

ACTUATOR TORQUE OUTPUT (IN. LBS.)

Bradford Double Acting Actuator Sizing

AVAILABLE AIR SUPPLY PRESSURE (PSI)

	40 PSI	50 PSI	60 PSI	70 PSI	80 PSI	90 PSI	100 PSI	115 PSI
RP-BA-032-DA	34	43	55	64	71	82	87	101
RP-BA-052-DA	86	110	133	156	179	203	226	261
RP-BA-063-DA	154	196	238	280	321	363	405	468
RP-BA-075-DA	284	360	435	511	586	661	737	850
RP-BA-085-DA	408	518	629	740	851	962	1072	1238
RP-BA-100-DA	646	818	991	1163	1336	1508	1681	1939
RP-BA-115-DA	1070	1355	1640	1925	2210	2495	2780	3208

ACTUATOR TORQUE OUTPUT (IN. LBS.)

FOR TORQUE VALUES OR AIR SUPPLY PRESSURES NOT LISTED PLEASE CONSULT FACTORY

Technical Data

ACTUATOR WEIGHTS (LBS.)

ACT.	032	052	063	075	085	100	115	125	160
DOUBLE ACTING	1.05	2.30	3.30	5.60	7.50	11.15	17.60	- - - -	- - - -
SPRING RETURN	- - - -	2.65	3.95	7.05	9.50	14.45	22.35	29.50	53.80

ACTUATOR CYCLE TIME (SECONDS)

ACT.	032	052	063	075	085	100	115	125	160
CCW (DA)	0.03	0.03	0.06	0.12	0.20	0.30	0.53	- - - -	- - - -
CW (DA)	0.03	0.04	0.08	0.12	0.19	0.27	0.47	- - - -	- - - -
CCW (SR)	- - - -	0.09	0.14	0.22	0.31	0.44	0.83	1.08	1.75
CW (SR)	- - - -	0.09	0.14	0.22	0.33	0.46	0.78	0.90	1.34

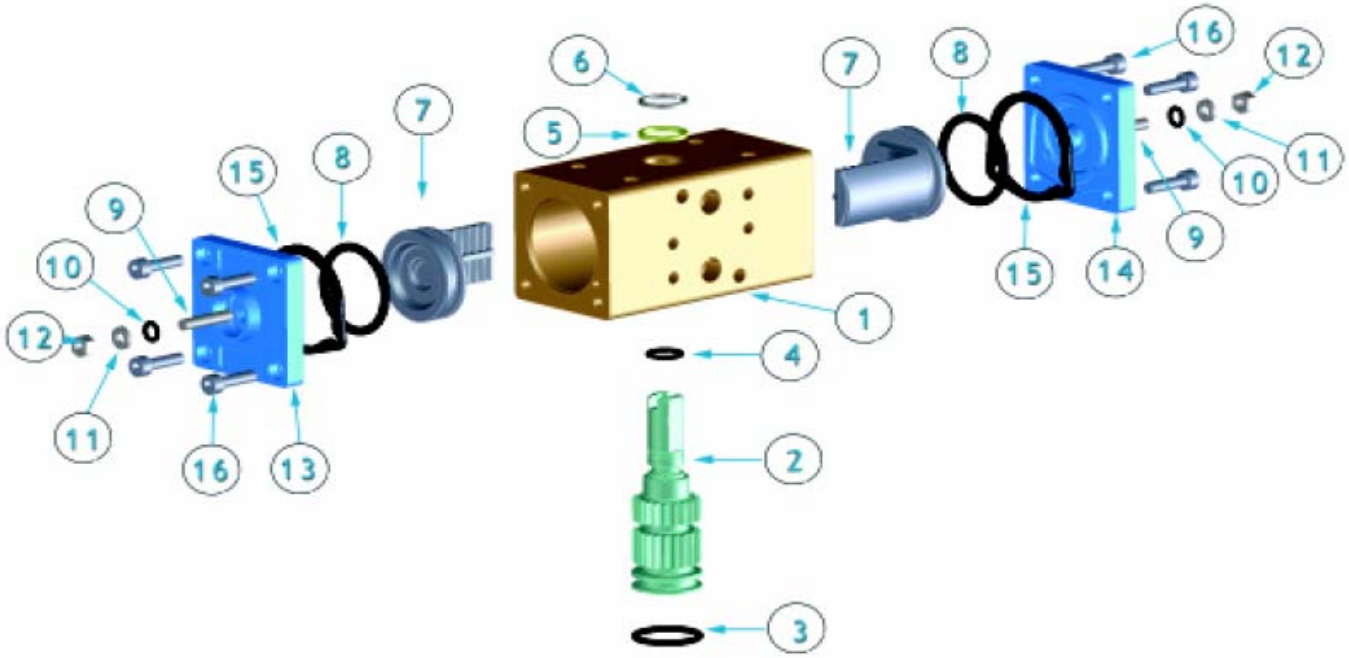
NOTE: ALL CYCLE TIMES ARE DERIVED INDEPENDENTLY OF VALVES AND ACTUATOR ACCESSORIES THAT MIGHT AFFECT OVERALL TIME PERFORMANCE.

CYCLE TIMES ARE BASED ON **80 PSI** AIR SUPPLY.

ACTUATOR AIR CONSUMPTION (CUBIC INCHES)

ACT.	032	052	063	075	085	100	115	125	160
CCW (DA & SR)	2.318	6.590	12.143	16.232	30.206	45.340	61.023	106.852	220.052
CCW (DA)	1.708	9.336	17.208	20.504	39.543	66.760	103.740	- - - -	- - - -
CCW (DA)	- - - -	7.689	14.218	17.147	32.403	54.372	85.433	122.047	215.109

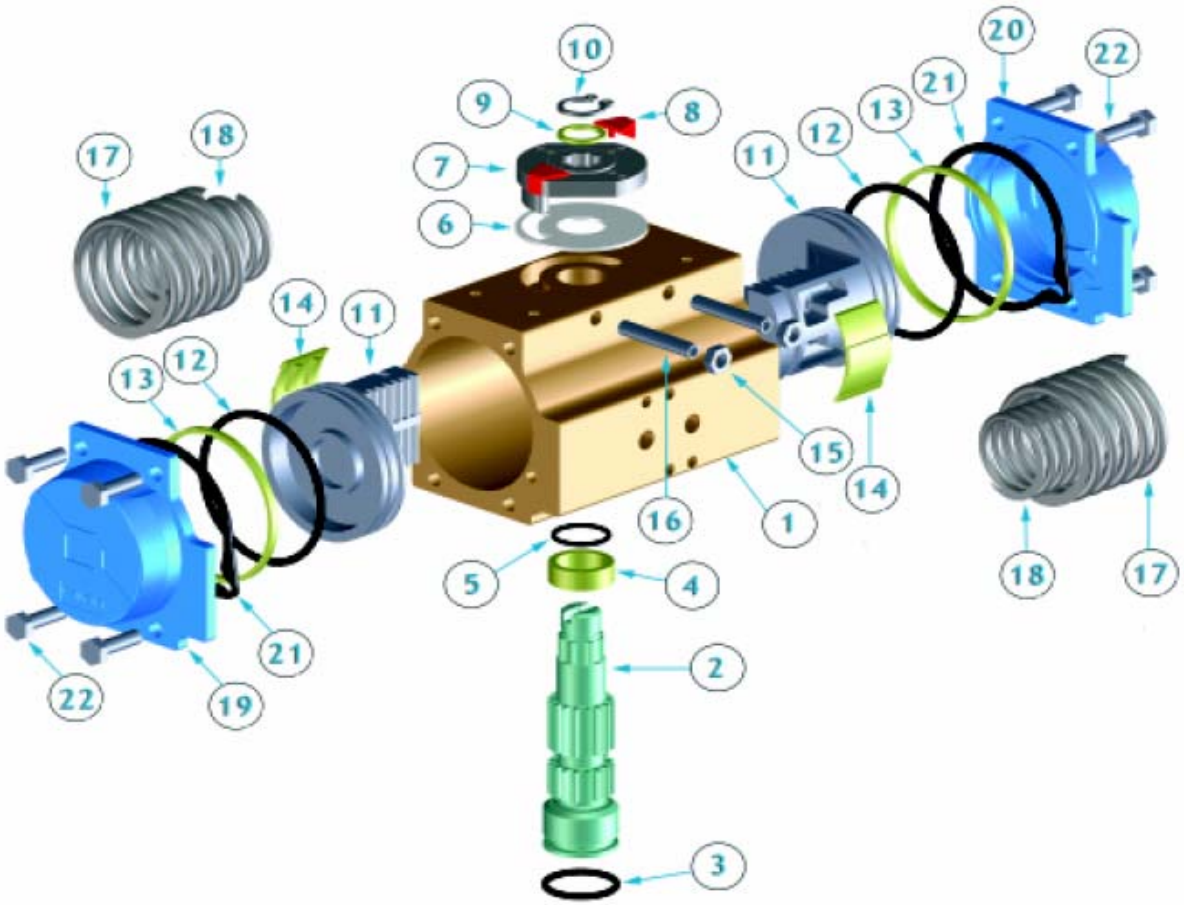
Parts Breakdown for RP-BA-032



PART #	DESCRIPTION	MATERIAL	TREATMENT	QTY (DA)
1	BODY	EXTRUDED ALUMINUM	HARD ANODIZED	1
2	ANTI-BLOWOUT PINION	STEEL	NICKEL PLATED	1
3	LOWER PINION O-RING*	NBR70		1
4	TOP PINION O-RING*	NBR70		1
5	PINION SPACER RING*	PTFE+15% GRAPHITE		1
6	PINION SNAP RING	STEEL	NICKEL PLATED	1
7	PISTON	DIE CAST ALUMINUM		2
8	PISTON O-RING*	NBR70		2
9	STOP BOLT	STAINLESS STEEL		2
10	STOP BOLT O-RING*	NBR70		2
11	STOP BOLT WASHER	STAINLESS STEEL		2
12	STOP BOLT RETAINING NUT	STAINLESS STEEL		2
13	LEFT END CAP	DIE CAST ALUMINUM	EPOXY COATED	1
14	RIGHT END CAP	DIE CAST ALUMINUM	EPOXY COATED	1
15	END CAP SEAL	NBR70		2
16	END CAP BOLT	STAINLESS STEEL		8

*Parts subject to wear

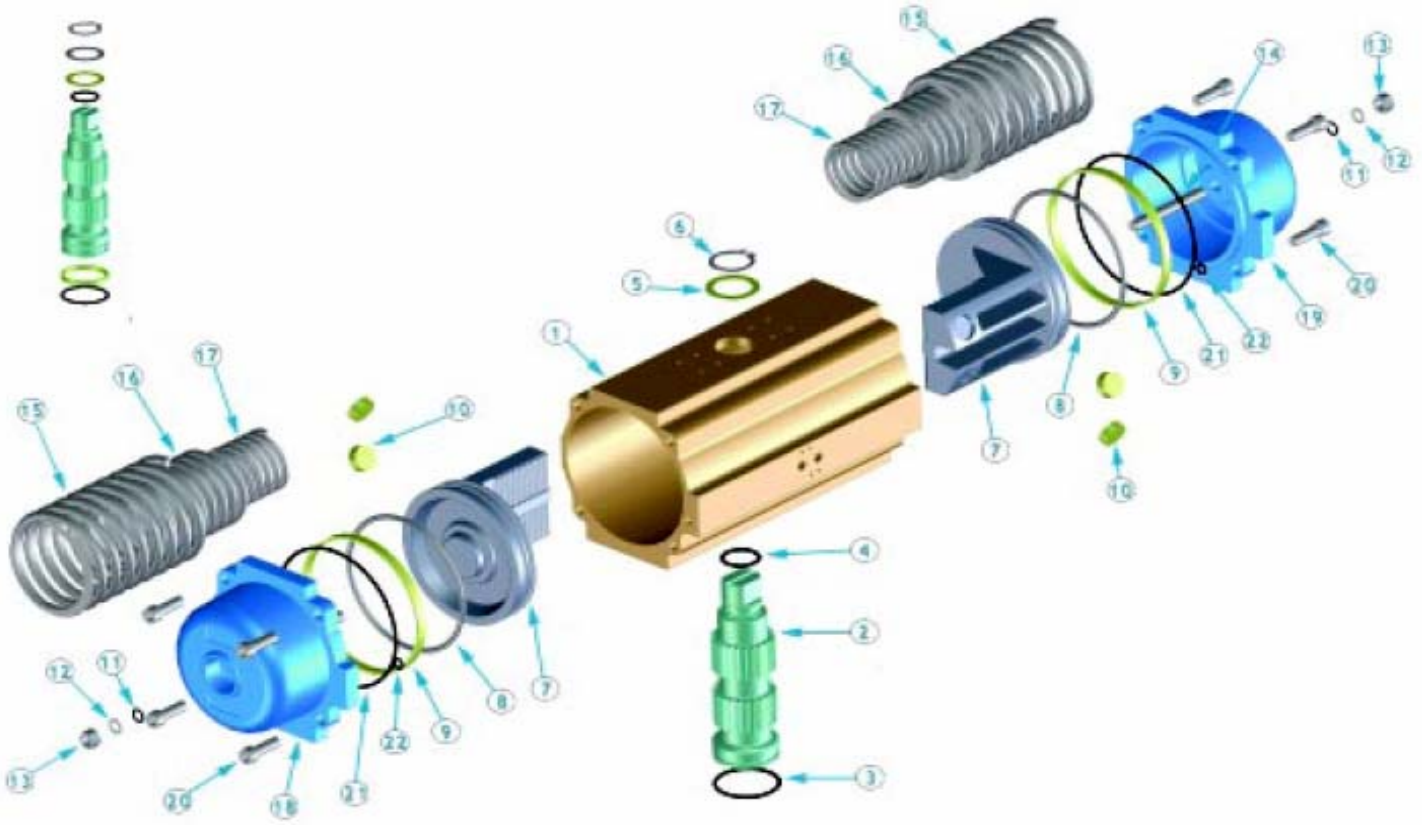
Parts Breakdown for BA-052 through BA-125



PART #	DESCRIPTION	MATERIAL	TREATMENT	QTY (DA)	QTY (SR)
1	BODY	EXTRUDED ALUMINUM	HARD ANODIZED	1	1
2	ANTI-BLOWOUT PINION	STEEL	NICKEL PLATED	1	1
3	LOWER PINION O-RING*	NBR70		1	1
4	PINION SPACER RING*	PTFE+15% GRAPHITE		1	1
5	TOP PINION O-RING*	NBR70		1	1
6	CAM SPACER RING*	PTFE+15% GRAPHITE		1	1
7	CAM	STAINLESS STEEL		1	1
8	POSITION INDICATOR	NYLON		1	1
9	PINION WASHER	STAINLESS STEEL		1	1
10	PINION SNAP RING	STEEL	NICKEL PLATED	1	1
11	PISTON	DIE CAST ALUMINUM		2	2
12	PISTON O-RING*	NBR70		2	2
13	ANTIFRACTION RING*	PTFE+15% GRAPHITE		2	2
14	PISTON THRUST BLOCK*	PTFE+15% GRAPHITE		2	2
15	STOP BOLT RETAINING NUT	STAINLESS STEEL		2	2
16	STOP BOLT	STAINLESS STEEL		2	2
17	EXTERNAL SPRING	STEEL	ZINC PHOSPHATE COATED	N/A	2
18	INTERNAL SPRING	STEEL	ZINC PHOSPHATE COATED	N/A	2
19	LEFT END CAP	DIE CAST ALUMINUM	EPOXY COATED	1	1
20	RIGHT END CAP	DIE CAST ALUMINUM	EPOXY COATED	1	1
21	END CAP SEATS	NBR70		2	2
22	END CAP BOLTS	STAINLESS STEEL		8	8

*Parts subject to wear

Parts Breakdown for BI-160



PART #	DESCRIPTION	MATERIAL	TREATMENT	QTY (DA)	QTY (SR)
1	BODY	EXTRUDED ALUMINUM	HARD ANODIZED	1	1
2	ANTI-BLOWOUT PINION	STEEL	NICKEL PLATED	1	1
3	LOWER PINION O-RING*	NBR70		1	1
4	TOP PINION O-RING*	NBR70		1	1
5	PINION SPACER RING*	PTFE+15% GRAPHITE		1	1
6	PINION SNAP RING	STEEL	NICKEL PLATED	1	1
7	PISTON	DIE CAST ALUMINUM		2	2
8	PISTON O-RING*	NBR70		2	2
9	ANTIFRICTION RING*	PTFE+15% GRAPHITE		2	2
10	PISTON THRUST BLOCK	PTFE+15% GRAPHITE		4	4
11	STOP BOLT O-RING*	NBR70		2	2
12	STOP BOLT WASHER	STAINLESS STEEL		2	2
13	STOP BOLT RETAINING NUT	STAINLESS STEEL		2	2
14	STOP BOLT	STAINLESS STEEL		2	2
15	EXTERNAL SPRING	STEEL	ZINC PHOSPHATE COATED	N/A	2
16	CENTRAL SPRING	STEEL	ZINC PHOSPHATE COATED	N/A	2
17	INTERNAL SPRING	STEEL	ZINC PHOSPHATE COATED	N/A	2
18	LEFT END CAP	DIE CAST ALUMINUM	EPOXY COATED	1	1
19	RIGHT END CAP	DIE CAST ALUMINUM	EPOXY COATED	1	1
20	END CAP BOLTS	STAINLESS STEEL		8	8
21	END CAP O-RING	NBR70		2	2
22	SUPPLY HOLE O-RING	NBR70		2	2

*Parts subject to wear

MAINTENANCE & OPERATING INSTRUCTIONS

BRADFORD ACTUATOR OPERATION

NOTE: For optimal operation, BRADFORD actuators should be run with a supply of clean, lubricated air.

SPRING RETURN ACTUATORS
Air to PORT 2 (the right hand port) causes the actuator to turn CCW. Loss of air to PORT 2 causes air to exhaust and the actuator turns CW. This is the FAIL CLOSE operation.

DOUBLE ACTING ACTUATORS
Air to PORT 2 (the right hand port) causes the actuator to turn CCW. Air to PORT 1 (the left hand port) causes the actuator to turn CW.

ADJUSTING OPEN AND CLOSED STOPS
BRADFORD actuators allow for ± 10˚ adjustment in both the open and closed positions. The stop adjustment bolts are located above the air ports (15 & 16). The right hand bolt allows for adjustment in the closed position; the left hand bolt allows for adjustment in the open position. A clockwise turn of the bolt results in clockwise movement of the pinion; a counterclockwise turn of the bolt results in counterclockwise movement of the pinion.

DISASSEMBLING STANDARD ACTUATORS

IMPORTANT: Before beginning disassembly, ensure that the air supply to the actuator has been disconnected, all accessories have been removed and that the actuator has been dismounted from the valve.

1. Loosen the end cap fasteners (22) with a wrench (size varies depending on actuator model). On the spring return actuator, alternate 3 to 5 turns on each fastener until the springs are completely decompressed. Use caution in removing the cap since the springs are under load until the fasteners are fully extended.

2. Remove the pinion snap ring (10) with a lock ring tool. The indicator (7) may now be removed.

3. Turn the pinion shaft (2) CCW until the pistons are at the full end of travel. Disengage the pistons (11) from the pinion. (NOTE: Low pressure air--3 to 5 P.S.I. MAXIMUM--might be required to force the pistons completely from the body.) Note the position of the pistons before removing them from the

actuator body. The part numbers of the pistons are located on the side and should be right-side up on an actuator with a standard orientation.

4. Remove the pinion through the bottom of the actuator. The actuator is now completely disassembled. All replacement parts may now be put in. BRADFORD recommends that all wear parts (3, 4, 5, 6, 12, 13, 14) be replaced before reassembly.

REASSEMBLING STANDARD ACTUATORS

IMPORTANT: Be sure that the actuator surfaces are free of grit and scratches before reassembling.

1. Apply a light film of grease to all o-rings and the pinion before replacing.

2. Put the pinion (2) back through the actuator with the flats of the pinion shaft running parallel with the body.

3. When reassembling the actuator, make sure that the piston racks are square to the actuator body and returned to their original orientation. (NOTE: The normal operation of all BRADFORD actuators is FAIL CLOSED. If you want to change the orientation to FAIL OPEN, rotate the racks 180º to create a reverse operation.

4. When replacing springs in a spring return actuator, ensure that the springs are replaced in their identical position in the end cap from which they were removed. (NOTE: In some circumstances, you might want to change the standard 80 pound spring set to fit your application and available air pressure. Changing the spring sets on BRADFORD actuators requires no special tools. Please refer to the spring combination torque chart in our catalog for the inner and outer spring combinations that will allow you to operate with the spring set that you desire.

5. Seal the end caps with a petroleum lubricant and bolt to actuator body.

6. Check the seal of the actuator by covering seal areas (pinion, end caps) with soapy water and using low pressure air to the actuator to ensure that no bubbles are produced.