BC3 BAND CYLINDER

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BC3 BAND CYLINDER

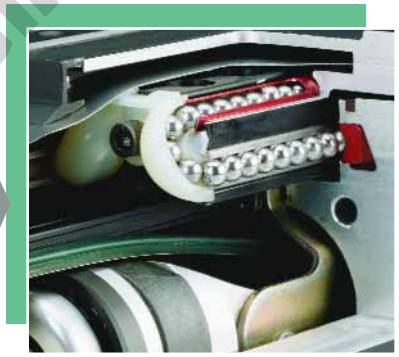
Designed specifically for large load capacity, the BC3 Band Cylinder is available in 1", 1-1/2" and 2" bore sizes. This patented* cylinder can handle high, off-center loads with consistently smooth motion.

At the heart of the BC3 cylinder is a uniquely designed, hard-working recirculating ball-bearing system. Bearings are factory pre-loaded to eliminate excess carrier deflection when subjected to loads. This bearing system offers the lowest possible breakaway pressure and one of the highest rated bending moments for their bore size.

Combining the load carrying capabilities of a ball-bearing type system together with the dependability of Tol-O-Matic's rodless band cylinder technology, makes the BC3 Series model a cost-effective alternative to auxiliary rail systems. Adapter Plates make the BC3 design fully adaptable to other Tol-O-Matic products.

Unique load-bearing carrier design rides on the bearing rails for smooth load movement with minimal play, resulting in one of the highest bending moment ratings for rodless cylinders in its class.

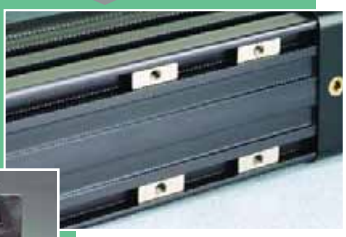
Ball-Bearing System utilizes precision rails attached to the cylinder tube with fasteners and T-Nuts. The resulting system, holds bearing way firmly in place for smooth bearing ride and lowest possible breakaway.



T-Slot Nuts provided on the underside of the cylinder can be used to mount the cylinder directly to a surface or used to mount tube supports if desired. All BC3 cylinders come with four nuts for the first 24 inches of stroke. Two nuts are provided for each additional 20 inches of stroke.

Compact profile with increased load capacities. The BC3 Band Cylinder has the same overall envelope size as Tol-O-Matic's BC2 Series Band Cylinder but allows much greater load carrying capacity.

Patented Wedge* guarantees that the raceways are parallel which insures a preload that is consistent throughout the length of the cylinder.



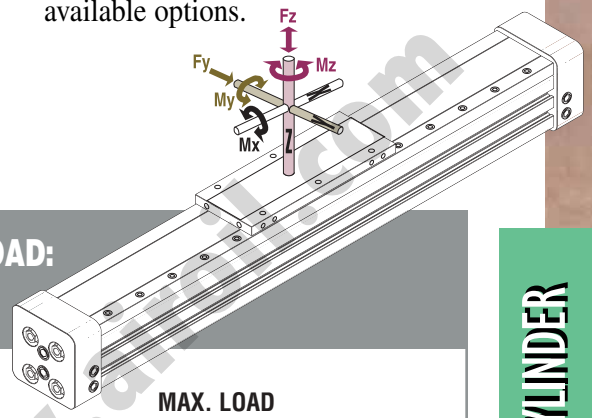
Unique tube design with T-Slot grooves accessible on three sides of cylinder tube allows insertion of T-Nuts for mounting flexibility.

*U.S. Patent No. 5,555,789 ** U.S. Patent No. 6,584,887

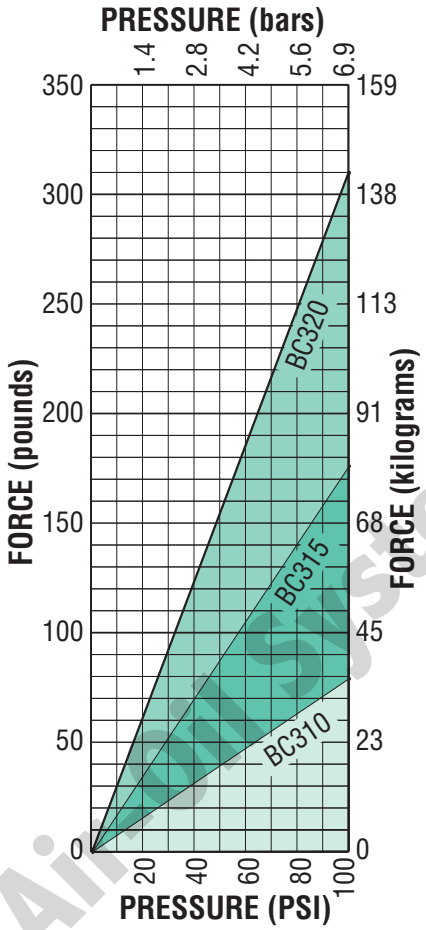
The graphs on this page are intended for a quick reference to help in determining the BC3 Band Cylinder that will work for your project.

Refer to page 88 in the Rodless Cylinder section to find step by step directions to size and select the best rodless cylinder for the job.

The following pages detail each of the three sizes of the BC3, giving bore size, weights, force, cushion data, tube support requirement and available options.

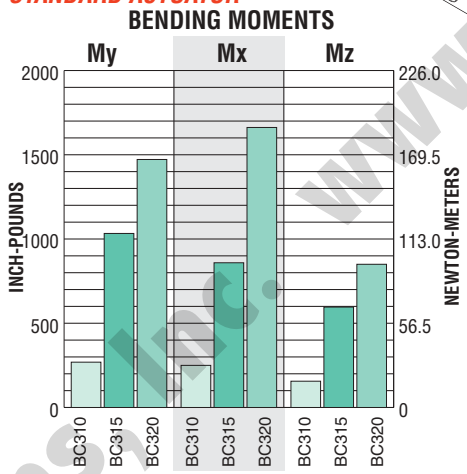


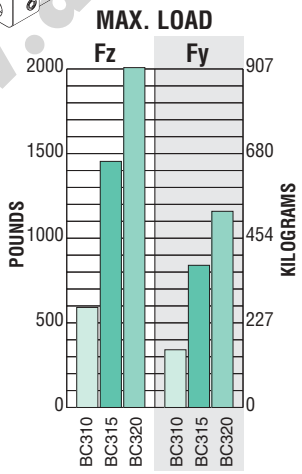
BC3 THEORETICAL FORCE VS PRESSURE: BC310, BC315, BC320



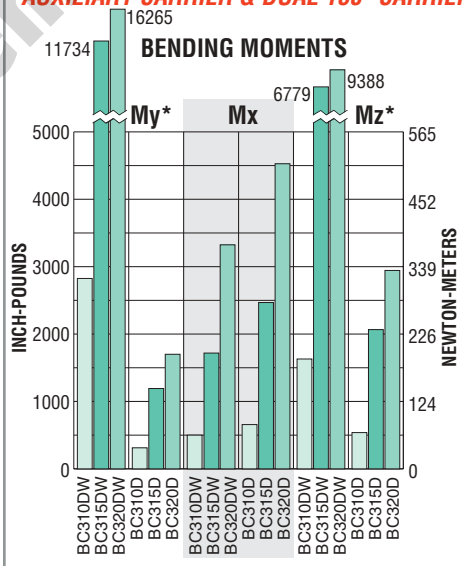
BC3 BENDING MOMENTS, LOAD: BC310, BC315, BC320

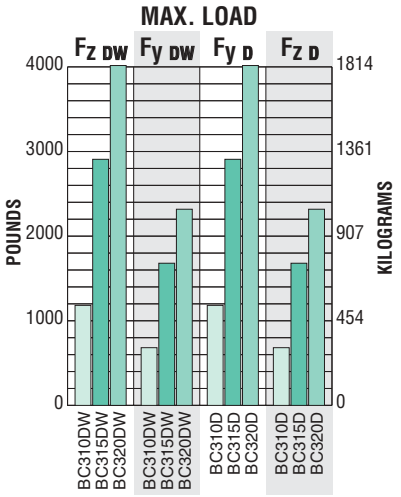
STANDARD ACTUATOR





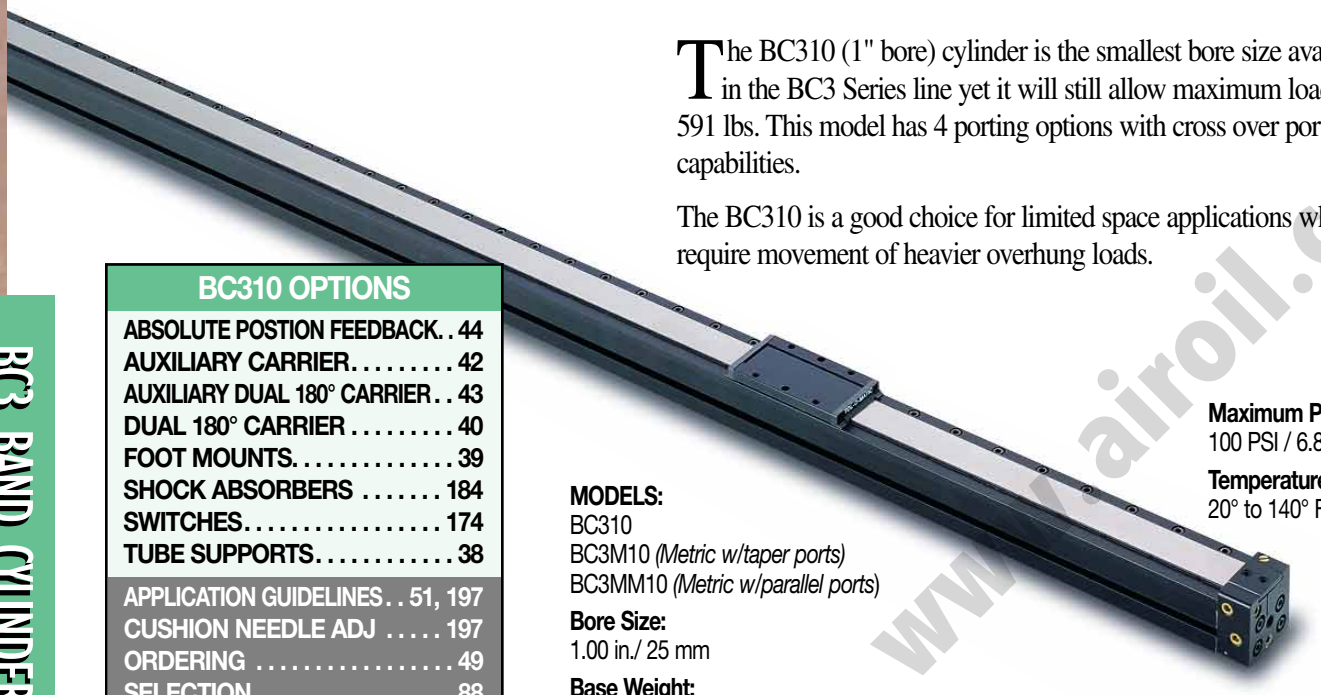
AUXILIARY CARRIER & DUAL 180° CARRIER OPTIONS**





*Auxiliary carrier bending moments indicated are at minimum center to center distance. Additional My + Mz load capacity can be obtained by increasing "D" dimension. Refer to auxiliary carrier data on page 42.

**Dual 180° carrier bending moments are not an exact comparison with other types of carriers. See page 40.



The BC310 (1" bore) cylinder is the smallest bore size available in the BC3 Series line yet it will still allow maximum loads of 591 lbs. This model has 4 porting options with cross over porting capabilities.

The BC310 is a good choice for limited space applications which require movement of heavier overhung loads.

MODELS:
BC310
BC3M10 *(Metric w/taper ports)*
BC3MM10 *(Metric w/parallel ports)*

Bore Size:
1.00 in./ 25 mm

Base Weight:
2.71 lb./1.23 kg.

Weight Per in. of Stroke:
.23 lb./.10 kg.

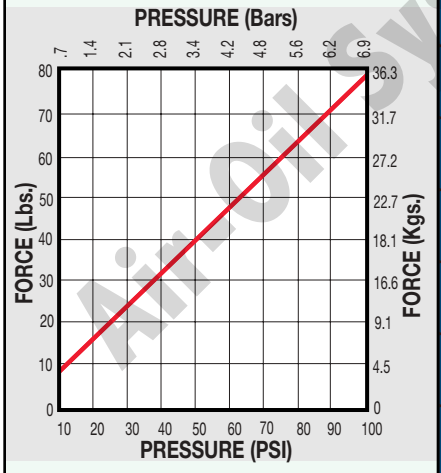
Maximum Pressure
100 PSI / 6.895 bar

Temperature Range
20° to 140° F / -7° to 60° C

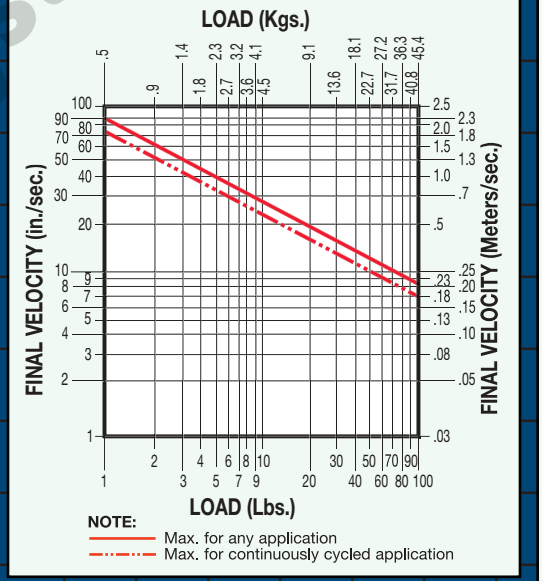
Maximum Stroke
17.08 ft./5.21 m
(For longer stroke lengths, please consult the factory.)

PERFORMANCE DATA

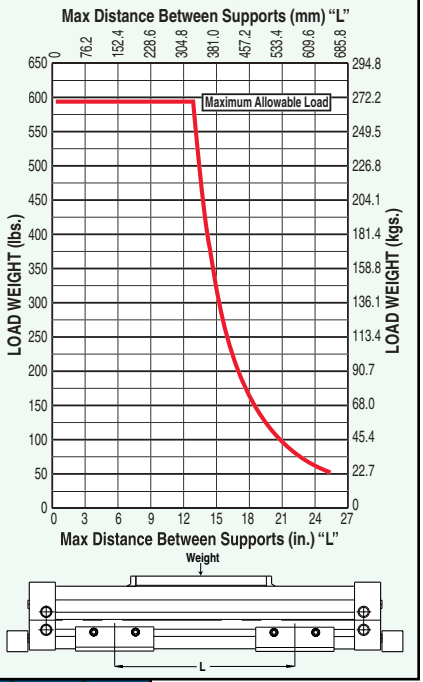
THEORETICAL FORCE VS. PRESSURE



CUSHION DATA

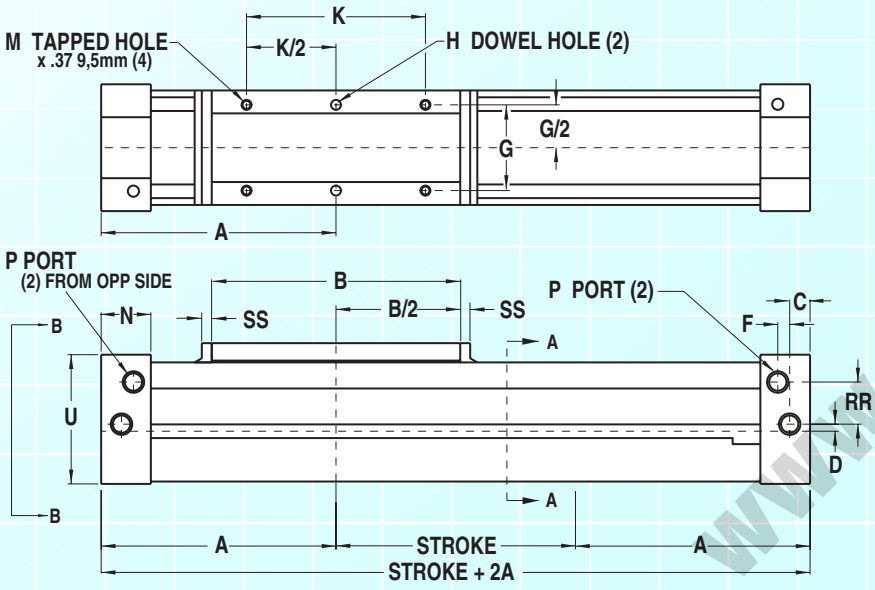


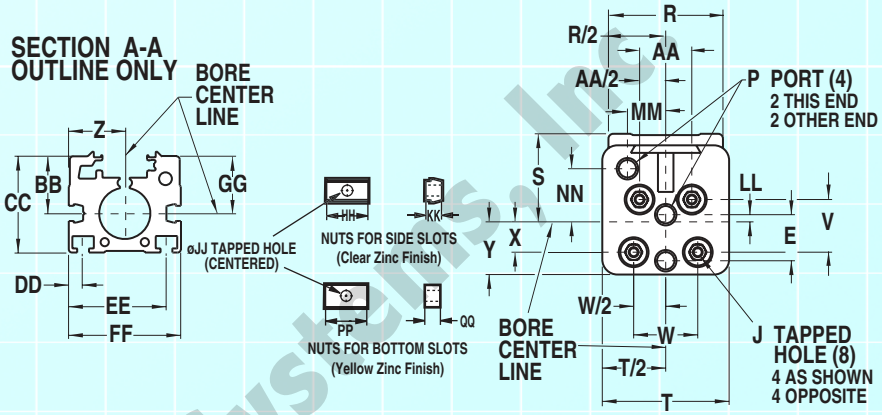
TUBE SUPPORT REQUIREMENTS



DIMENSIONAL DATA

3D CAD AVAILABLE AT WWW.TOLOMATIC.COM

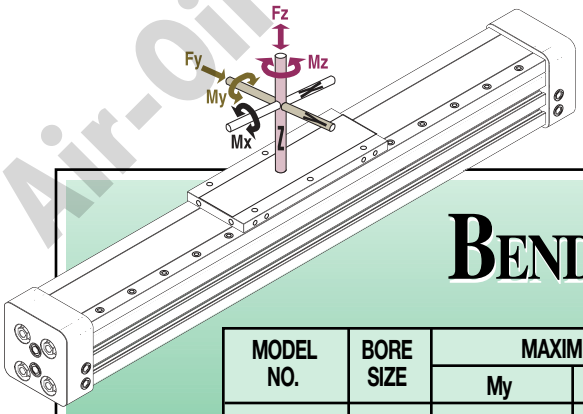




VIEW B-B

	MODELS	
	BC310	BC3M/MM10
A	3.94	100.0
B	3.67	93.3
C	.437	11.10
D	.047	1.19
E	.611	15.52
F	.281	7.14
G	1.781	45.24
H*	.252/.251 x .25	6.045/6.020 x 6.4
J	10-24 x .43	M5-0.8 x 11.0
K	2.250	57.15
M	1/4-20	M6-1.0
N	1.00	25.4
P	1/8-27 NPT	**M** 1/8-28 BSPT **MM** 1/8-28 BSPP
R	2.16	54.8
S	1.54	39.1
T	2.19	55.6
U	2.17	55.1
V	.750	19.05
W	1.250	31.75
X	.328	8.33
Y	.76	19.3
Z	1.094	27.79
AA	1.063	27.00
BB	1.12	28.45
CC	1.88	47.8
DD	.266	6.76
EE	1.922	48.82
FF	2.19	55.6
GG	1.12	28.45
HH	.66	16.8
JJ	10-24	M5-0.8
KK	.25	6.4
LL	.142	3.61
MM	.547	13.89
NN	.890	22.6
PP	.75	19.1
QQ	.188	4.8
RR	.845	21.46
SS	.203	5.2
	INCHES	MILLIMETERS

*DOWEL PINS ⌖ .003 Ⓜ



BENDING MOMENTS

MODEL NO.	BORE SIZE	MAXIMUM BENDING MOMENT			MAX. LOAD	
		My	Mx	Mz	Fz	Fy
BC310	1.00 in.	269 in.-lbs.	250 in.-lbs.	156 in.-lbs.	591 lbs.	341 lbs.
BC3M10	25 mm	30.4 N-m	28.2 N-m	17.9 N-m	268.1 kgs.	154.7 kgs.

The BC315 (1-1/2" bore) cylinder offers a compact space-saving profile, capable of carrying maximum loads of 1454 lbs. Both the BC315 and BC320 models have 6 porting options along with cross over porting capabilities.

The high bending moment rating allows heavy load carrying capacity with consistently smooth load positioning along the entire length of the stroke. Able to deliver forces of 175 lbs. at a maximum pressure of 100 PSI, the BC315 cylinder will fill a wide variety of application requirements.

MODELS:
BC315
BC3M15 *(Metric w/taper ports)*
BC3MM15 *(Metric w/parallel ports)*

Bore Size:
1.50 in./ 40 mm

Base Weight:
10.94 lb./4.96 kg.

Weight Per in. of Stroke:
.53 lb./.24 kg.

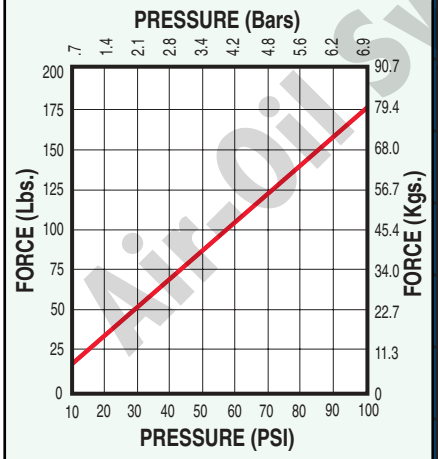
Maximum Stroke:
17.08 ft./5.21 m
(For longer stroke lengths, please consult the factory.)

Maximum Pressure
100 PSI / 6.895 bar

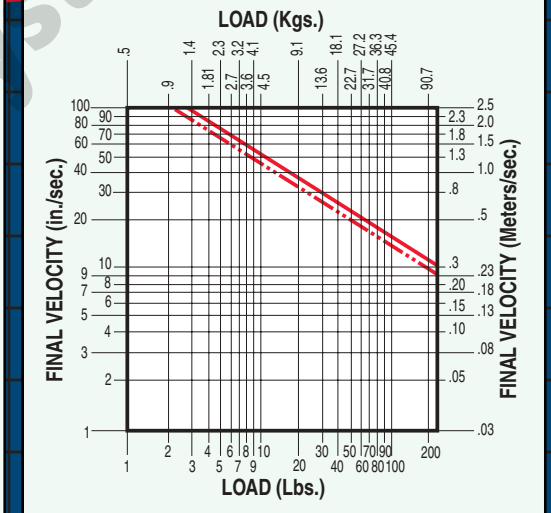
Temperature Range
20° to 140° F / -7° to 60° C

PERFORMANCE DATA

THEORETICAL FORCE VS. PRESSURE

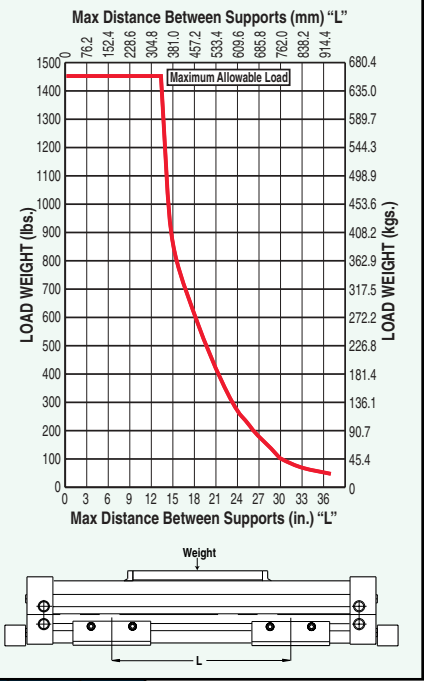


CUSHION DATA



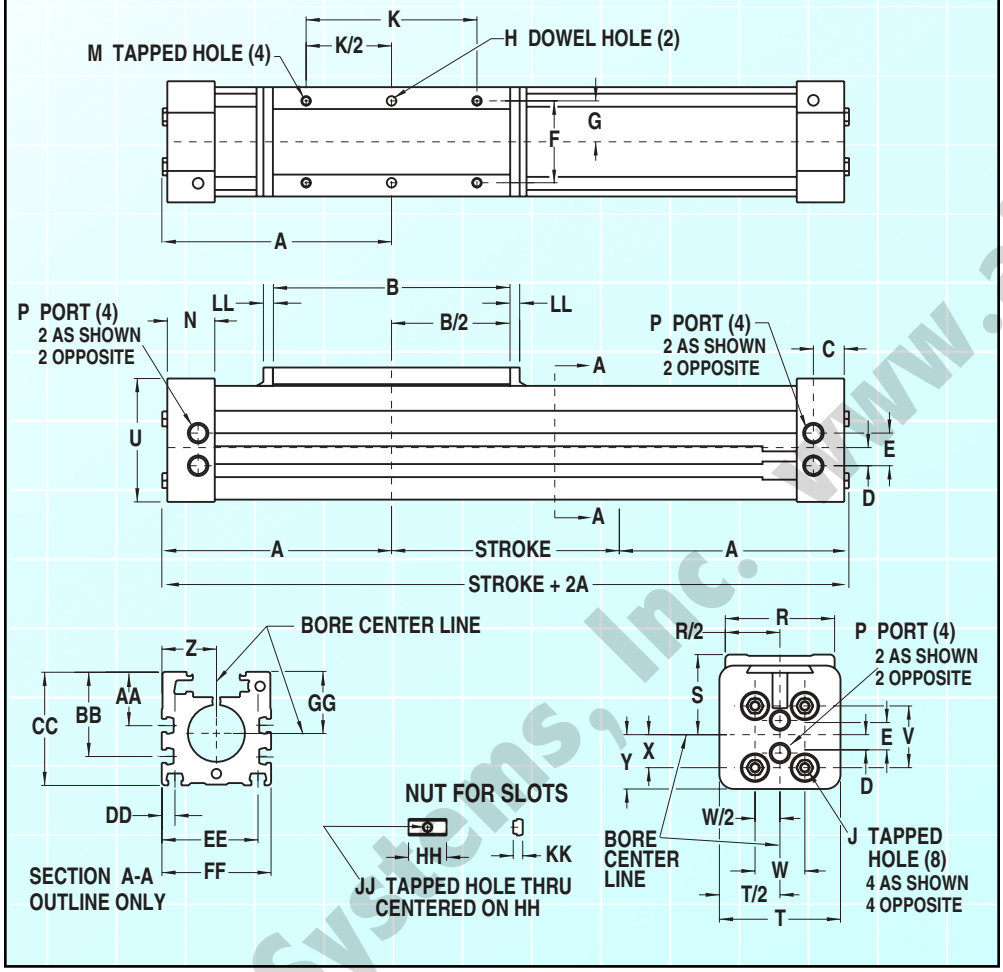
NOTE:
Max. for any application
Max. for continuously cycled application

TUBE SUPPORT REQUIREMENTS



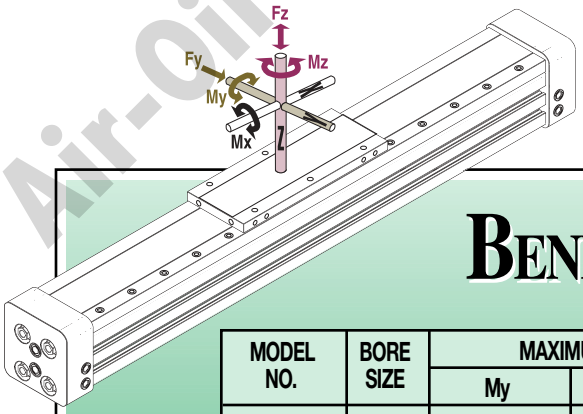
DIMENSIONAL DATA

3D CAD AVAILABLE AT WWW.TOLOMATIC.COM



	MODELS	
	BC315	BC3M/MM15
A	5.93	150.7
B	6.25	158.8
C	.832	21.13
D	.484	12.29
E	.859	21.82
F	2.156	54.76
G	1.078	27.38
H*	.252-.251 x .25	6.045-6.020 x 6.4
J	1/4-20 x .47	M6-1 x 12
K	4.500	114.30
M	1/4-20 X .44	M6- x 11
N	1.27	32.3
P	1/4-18 NPT	M 1/4-19 BSPT MM 1/4-19 BSPP
R	2.88	73.0
S	2.109	53.57
T	3.19	81.0
U	3.31	84.1
V	1.625	41.28
W	1.312	33.32
X	.875	22.23
Y	1.46	37.1
Z	1.44	36.5
AA	1.41	35.81
BB	2.22	56.38
CC	2.99	75.95
DD	.34	8.7
EE	2.53	64.3
FF	2.88	73.0
GG	1.62	41.15
HH	.94	23.9
JJ	1/4-20	M6-1
KK	.25	6.4
LL	.25	6.4
	INCHES	MILLIMETERS

*DOWEL PINS ⌖ .003 Ⓜ



BENDING MOMENTS

MODEL NO.	BORE SIZE	MAXIMUM BENDING MOMENT			MAX. LOAD	
		My	Mx	Mz	Fz	Fy
BC315	1.50 in.	1033 in.-lbs.	859 in.-lbs.	596 in.-lbs.	1454 lbs.	840 lbs.
BC3M15	40 mm	116.7 N-m	97.1 N-m	67.3 N-m	659.5 kgs.	381.0 kgs.

With maximum load capacities of 2008 lbs. and able to deliver forces of 314 lbs. at maximum pressure of 100 PSI, the BC320 is the powerhouse of the BC3 Series line.

Choose this cylinder for its extreme load carrying capacities and low, space saving profile.

MODELS:
BC320
BC3M20 *(Metric w/taper ports)*
BC3MM20 *(Metric w/parallel ports)*

Bore Size:
2.00 in./ 50 mm

Base Weight:
17.00 lb../7.71 kg.

Weight Per in. of Stroke:
.86 lb./.38 kg.

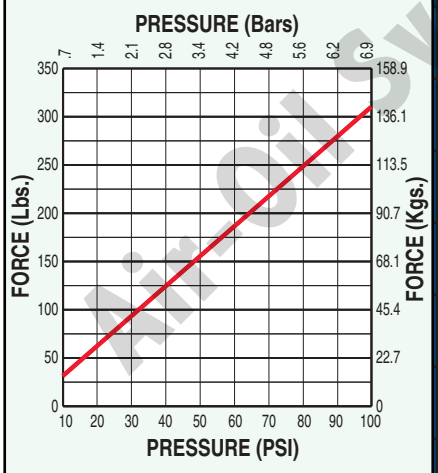
Maximum Stroke:
10.0 ft. / 3.05 m
(For longer stroke lengths, please consult the factory.)

Maximum Pressure
100 PSI / 6.895 bar

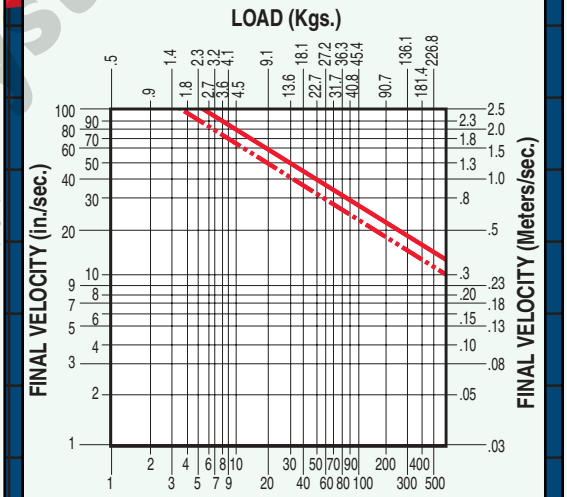
Temperature Range
20° to 140° F / -7° to 60° C

PERFORMANCE DATA

THEORETICAL FORCE VS. PRESSURE

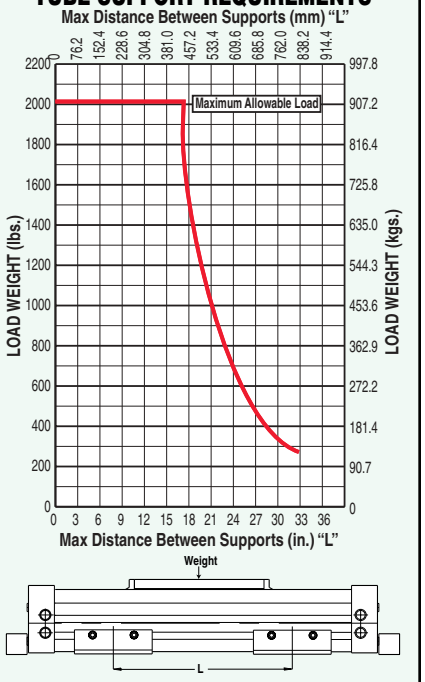


CUSHION DATA



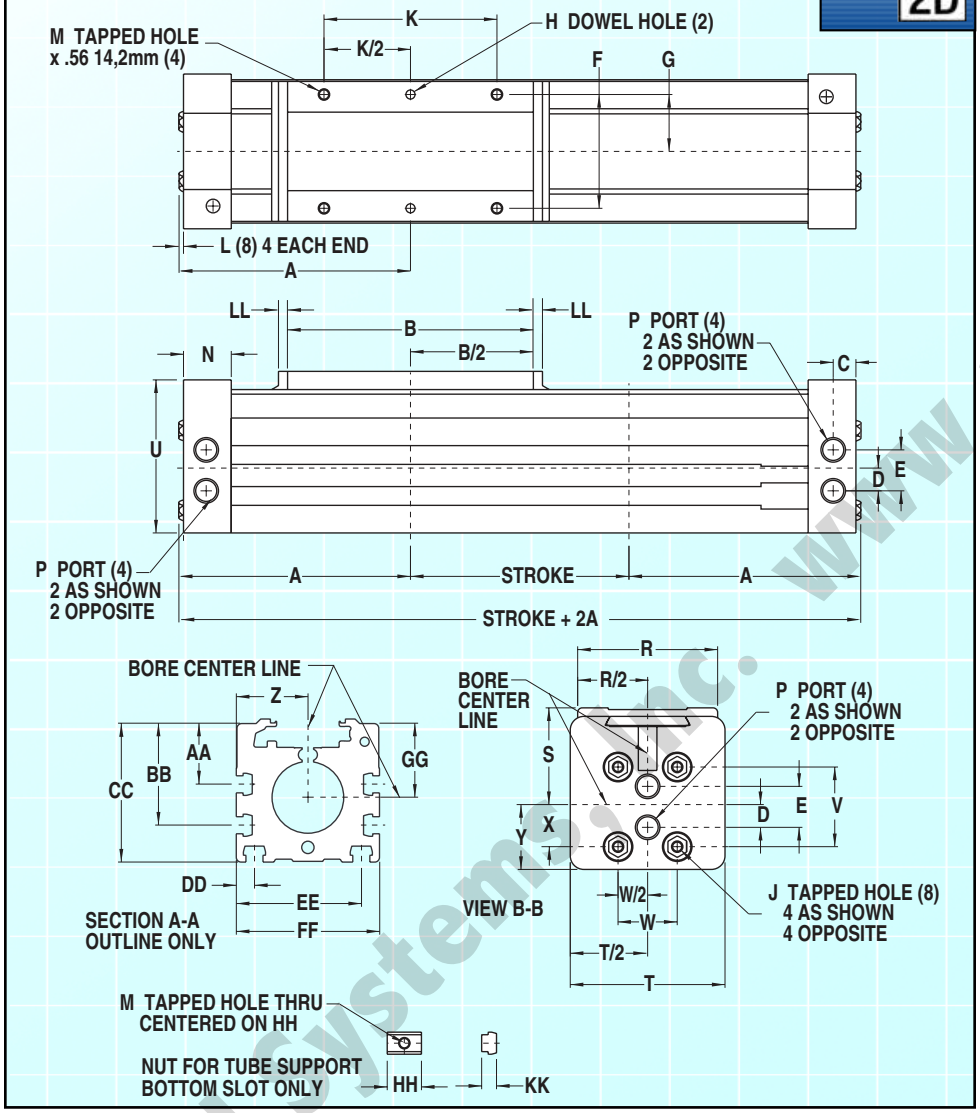
NOTE:
Max. for any application
Max. for continuously cycled application

TUBE SUPPORT REQUIREMENTS



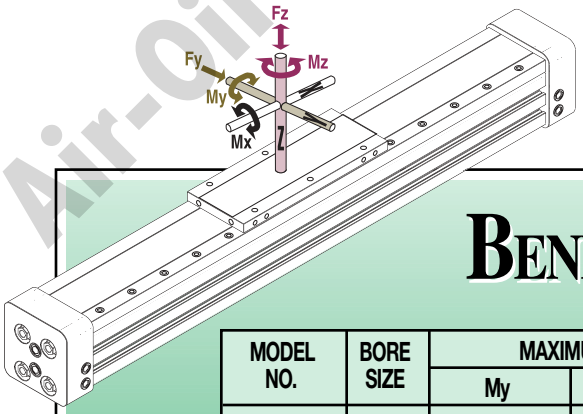
DIMENSIONAL DATA

3D CAD AVAILABLE AT WWW.TOLOMATIC.COM



	MODELS	
	BC320	BC3M/MM20
A	6.27	159.0
B	6.75	171.5
C	0.625	15.88
D	0.625	15.88
E	1.125	28.58
F	3.125	79.38
G	1.563	39.70
H*	.252/.251 x .25	6.045/6.020 x 6.4
J	5/16-18 x .88	M8-1.25 x 22
K	4.750	120.65
L	0.063	1.60
M	5/16-18	M8-1.25
N	1.31	33.3
P	3/8-18 NPT	**M** 3/8-19 BSPT **MM** 3/8-19 BSPP
R	3.84	97.5
S	2.656	67.46
T	4.25	108.0
U	4.20	106.7
V	2.188	55.58
W	1.625	41.28
X	1.156	29.36
Y	1.78	45.2
Z	1.969	50.01
AA	1.67	42.4
BB	2.80	71.0
CC	3.81	96.7
DD	0.500	12.70
EE	3.438	87.33
FF	3.94	100.1
GG	2.03	51.6
HH	0.94	23.9
JJ	5/16-18	M8-1.25
KK	.41	10.4
LL	.25	6.4
	INCHES	MILLIMETERS

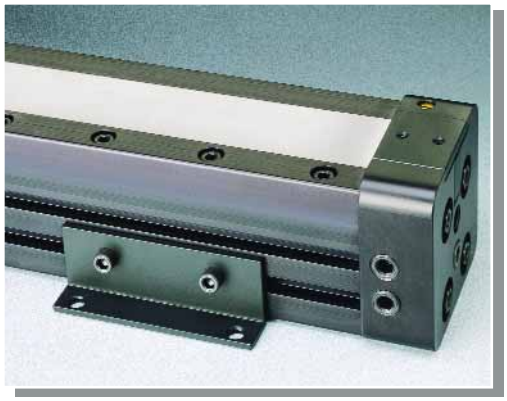
*DOWEL PINS ⌖ .003 Ⓜ



BENDING MOMENTS

MODEL NO.	BORE SIZE	MAXIMUM BENDING MOMENT			MAX. LOAD	
		My	Mx	Mz	Fz	Fy
BC320	2.00 in.	1472 in.-lbs.	1662 in.-lbs.	850 in.-lbs.	2008 lbs.	1159 lbs.
BC3M20	50 mm	166.3 N-m	187.8 N-m	96.0 N-m	910.8 kgs.	525.77 kgs.

TUBE SUPPORTS

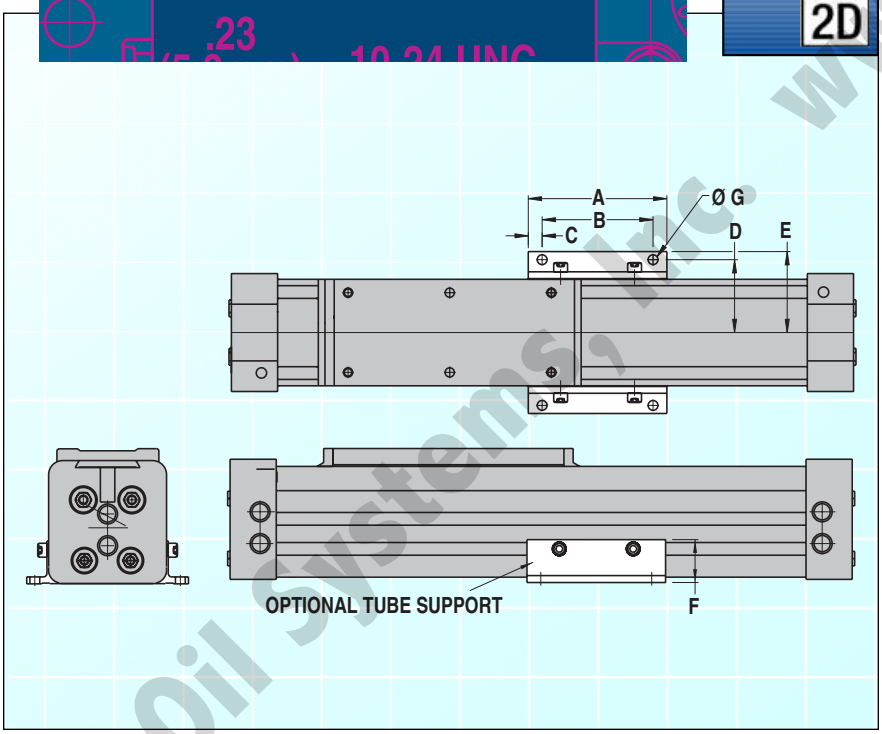


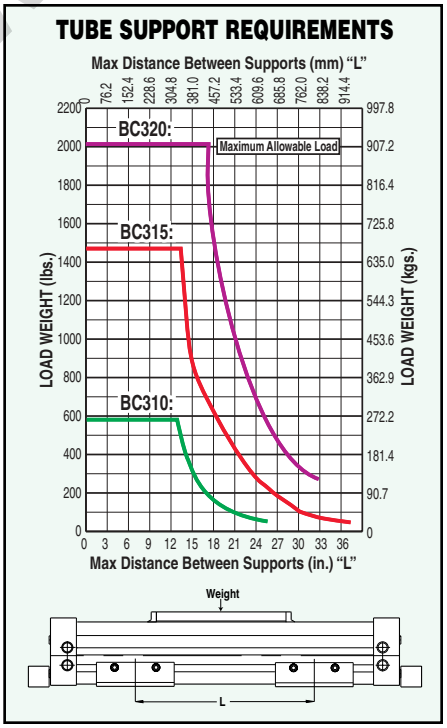
For intermediate support, tube support brackets can be mounted to the BC3 model. Made of black-anodized aluminum, the brackets are attached to the bottom and sides of the cylinder tube with rail nuts. The number of tube support brackets required and their placement depends on the overall length of the BC3 model and the load weight being moved and supported. Refer to the tube support data chart below.

Note: Switches cannot be mounted on the same face of the actuator as tube supports.

DIMENSIONAL DATA

3D CAD AVAILABLE AT WWW.TOLOMATIC.COM





MODELS	BORE	A	B	C	D	E	F	G
BC310	1.0 in.	2.75	2.250	.25	1.53	1.76	1.09	.206
BC315	1.5 in.	3.75	3.000	.38	1.97	2.19	1.16	.266
BC320	2.0 in.	4.00	3.375	.31	2.56	2.84	1.50	.328

Dimensions in inches

MODELS	BORE	A	B	C	D	E	F	G
BC3M(MM)10	25 mm	69.85	57.15	6.4	38.9	44.7	27.7	5.232
BC3M(MM)15	40 mm	95.3	76.20	9.7	50.0	55.6	29.5	6.756
BC3M(MM)20	50 mm	101.6	85.73	7.9	65.0	72.1	38.1	8.331

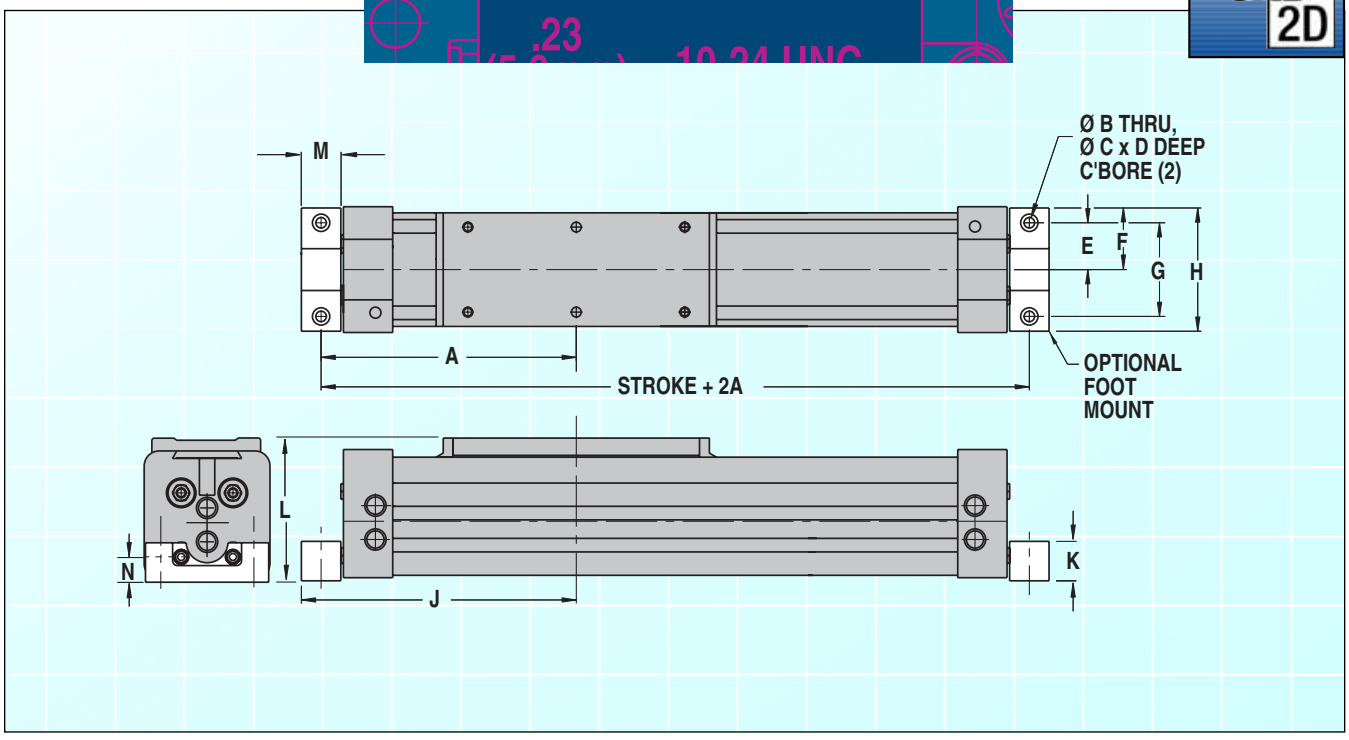
Dimensions in millimeters

FOOT MOUNT KIT

Foot mounts are an option on BC3 Series Band Cylinders when an application requires the mounting to be different than flush. They may be specified on one or both ends of the cylinder.

DIMENSIONAL DATA

3D CAD AVAILABLE AT WWW.TOLOMATIC.COM



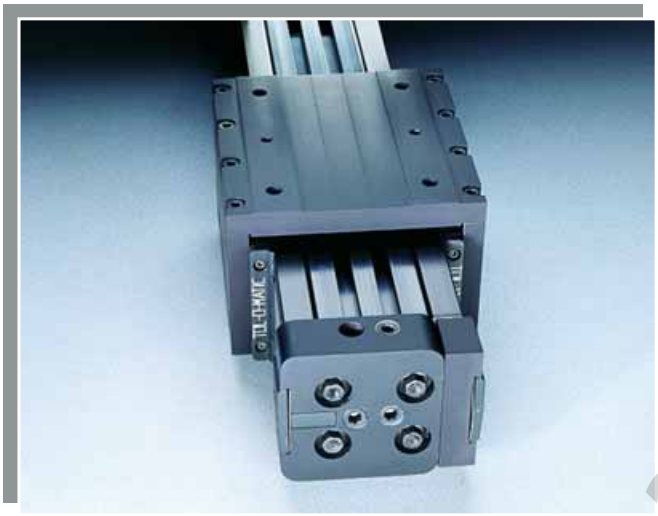
MODELS	BORE SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N
BC310	1.0 in.	4.31	Ø.206	Ø .38	.22	.906	1.095	1.812	2.19	4.69	.88	2.44	.75	.574
BC315	1.5 in.	6.43	Ø .266	Ø .44	.28	1.188	1.56	2.375	3.13	6.93	1.00	3.63	1.00	.641
BC320	2.0 in.	6.80	Ø .328	Ø .53	.34	1.5	2.00	3.0	4.00	7.30	1.13	4.53	1.00	.719

Dimensions in inches

MODELS	BORE SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N
BC3M(MM)10	25 mm	109.5	Ø 5.23	Ø 9.7	5.6	23.01	27.8	46.02	55.6	119.1	22.4	62.0	19.1	14.6
BC3M(MM)15	40 mm	163.4	Ø 6.76	Ø 11.2	7.1	30.18	39.7	60.33	79.4	176.1	25.4	92.2	25.4	16.3
BC3M(MM)15	50 mm	172.7	Ø 8.33	Ø 13.5	8.6	38.10	50.8	76.20	101.6	185.4	28.7	115.1	25.4	18.3

Dimensions in millimeters

DUAL 180° CARRIER



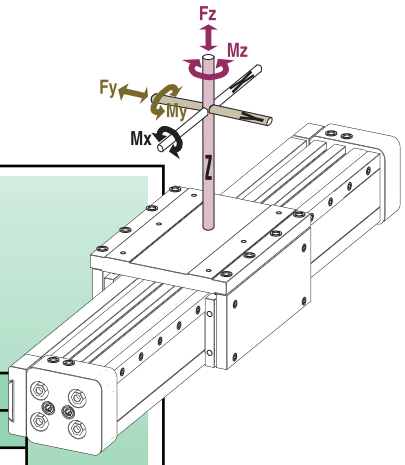
DUAL 180° CARRIER

The Dual 180° Carrier option may be used when load factors exceed those of a single carrier actuator. This option allows the load to be rotated 90° from the cylinder's carrier providing an additional load bearing mounting surface.

NOTE: The Dual 180° Carrier option requires its own proprietary tube supports and foot mounts. See dimensional information below. Breakaway pressure will increase when using the Dual 180° Carrier option.

DUAL 180° CARRIER OPTION WEIGHTS*		
MODEL	BASE WEIGHT	WEIGHT per in. of Stroke
BC310D	5.37 lbs.	.32 lbs.
BC315D	17.2 lbs.	.69 lbs.
BC320D	28.9 lbs.	1.12 lbs.
BC3M(MM)10D	2.43 kgs.	.14 kgs.
BC3M(MM)15D	7.76 kgs.	.31 kgs.
BC3M(MM)20D	13.11 kgs.	.50 kgs.

*Use instead of standard weights



DUAL 180° CARRIER BENDING MOMENTS

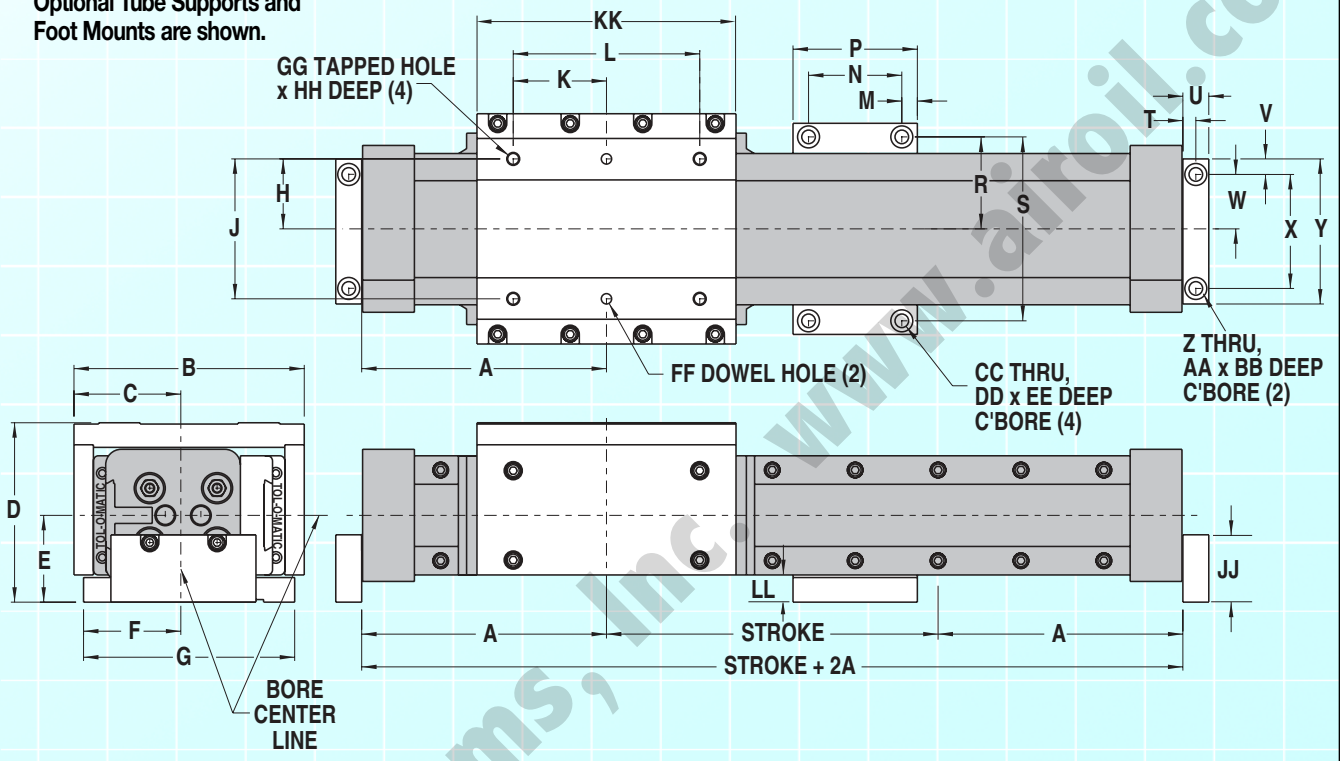
MODEL NO.	BORE SIZE	MAXIMUM BENDING MOMENT			MAX. LOAD	
		M_Y	M_X	M_Z	F_Y	F_Z
BC310D	1.00 in.	312 in.-lbs.	657 in.-lbs.	538 in.-lbs.	1182 lbs.	682 lbs.
BC315D	1.50 in.	1192 in.-lbs.	2468 in.-lbs.	2066 in.-lbs.	2908 lbs.	1680 lbs.
BC320D	2.00 in.	1700 in.-lbs.	4527 in.-lbs.	2944 in.-lbs.	4016 lbs.	2318 lbs.
BC3M(MM)10D	25mm	35.3 N-m	74.2 N-m	60.8 N-m	536.1 kgs.	309.3 kgs.
BC3M(MM)15D	40mm	134.7 N-m	278.9 N-m	233.4 N-m	1319.0 kgs.	762.0 kgs.
BC3M(MM)20D	50mm	192.1 N-m	511.5 N-m	332.6 N-m	1821.6 kgs.	1051.4 kgs.

DIMENSIONAL DATA
FOR DUAL 180° OPTION

3D CAD AVAILABLE AT WWW.TOLOMATIC.COM

NOTE: In vertical mounting applications, supplemental mounting may be required besides factory foot mounts.

Optional Tube Supports and Foot Mounts are shown.



MODELS	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S
BC310	1.0 in.	3.94	4.31	2.13	3.33	1.61	1.75	3.50	1.192	2.437	1.531	3.062	.28	2.563	3.12	1.469	2.937
BC315	1.5 in.	5.91	6.00	2.58	4.33	2.09	2.35	5.09	1.488	3.375	2.250	4.500	.38	2.250	3.00	2.019	4.437
BC320	2.0 in.	6.30	7.41	3.50	5.30	2.59	2.80	6.00	2.358	5.125	3.000	6.000	.38	2.250	3.00	2.422	5.250

MODELS	BORE	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF*	GG	HH	JJ	KK	LL
BC310	1.0 in.	.312	.62	.28	.891	1.688	2.25	.266	.44	.28	.266	.44	.28	.252/.251 x .25	1/4-20	.47	1.25	3.67	.5
BC315	1.5 in.	.312	.62	.38	1.312	2.750	3.50	.266	.44	.28	.328	.53	.34	.252/.251 x .25	5/16-18	.59	1.62	6.25	.66
BC320	2.0 in.	.312	.62	.31	1.625	3.375	4.00	.328	.53	.34	.391	.63	.41	.252/.251 x .25	3/8-16	.66	2.00	6.75	.63

Dimensions in inches

MODELS	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S
BC3M(MM)10	25 mm	100.1	109.5	54.1	84.6	40.9	44.5	88.9	30.28	61.90	38.89	77.77	7.1	65.10	79.2	37.31	74.60
BC3M(MM)15	40 mm	150.0	152.4	65.5	110.0	53.1	59.7	129.3	37.80	85.73	57.15	114.30	9.7	57.15	76.2	51.28	112.70
BC3M(MM)20	50 mm	160.0	188.2	88.9	135.6	68.8	71.1	152.4	59.89	130.18	76.20	152.40	9.7	57.15	76.2	61.52	133.35

MODELS	BORE	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF*	GG	HH	JJ	KK	LL
BC3M(MM)10	25 mm	7.92	15.7	7.1	22.63	42.88	57.2	6.76	11.2	7.1	6.8	11.2	7.1	6.045/6.020 x 6.4	M6 x 1.00	11.9	31.8	93.2	12.7
BC3M(MM)15	40 mm	7.92	15.7	9.7	33.32	69.85	88.9	6.76	11.2	7.1	8.33	13.5	8.6	6.045/6.020 x 6.4	M8 x 1.25	15.0	41.1	158.8	16.8
BC3M(MM)20	50 mm	7.92	15.7	7.9	41.28	85.73	101.6	8.33	13.5	8.6	9.93	16.0	10.4	6.045/6.020 x 6.4	M10 x 1.50	16.8	50.8	171.8	16.0

Dimensions in millimeters

AUXILIARY CARRIER

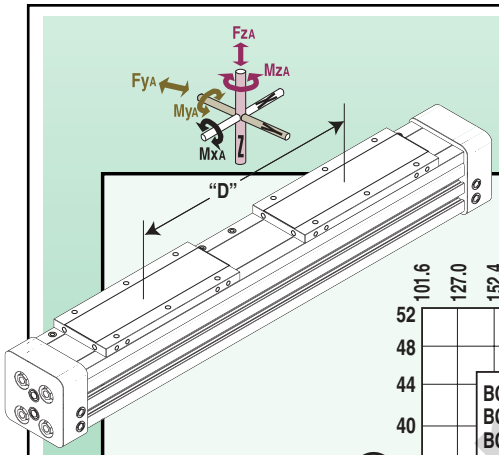
AUXILIARY CARRIER OPTION

The auxiliary carrier option substantially increases load carrying capacity and bending moments. Auxiliary carriers can **only** be ordered with an internal piston. When ordering, determine the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart below). Determine your working stroke. Enter these into your configuration string. (Example BC315SK50.00DW10.00) the configurator will calculate the overall length of the actuator. Refer to page 49 for ordering information.

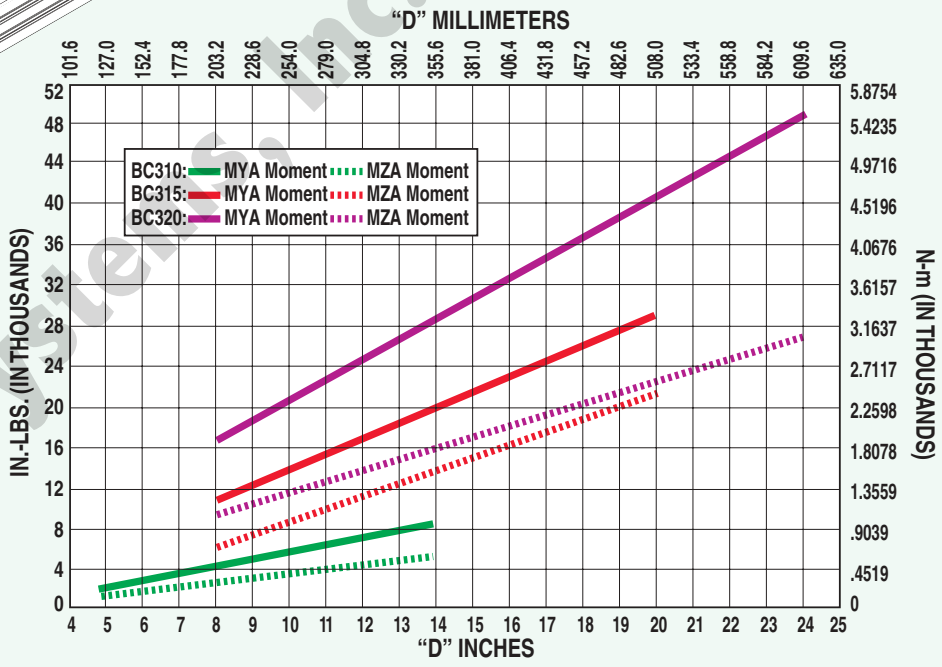
ORDERING PROCEDURE

NOTE: Breakaway pressure will increase when using auxiliary carriers.

AUXILIARY CARRIER BENDING MOMENTS



LOAD vs. DISTANCE BC3 SERIES



Rates were calculated with the following assumptions:

1.) Coupling between carriers is rigid.

2.) Load is equally distributed between carriers.

3.) Coupling device applies no misalignment loads to carriers.

MODEL NO.	"D"* MIN.	MAXIMUM BENDING MOMENT			MAXIMUM LOAD	
		M_{YA}**	M_{XA}	M_{ZA}**	F_{ZA}	F_{YA}
BC310DW	4.88 in.	2825 in.-lbs.	500 in.-lbs.	1630 in.-lbs.	1182 lbs.	682 lbs.
BC315DW	8.07 in.	11734 in.-lbs.	1718 in.-lbs.	6779 in.-lbs.	2908 lbs.	1680 lbs.
BC320DW	8.10 in.	16265 in.-lbs.	3324 in.-lbs.	9388 in.-lbs.	4016 lbs.	2318 lbs.
BC3M(MM)10DW	124.0mm	319.2 N-m	56.5 N-m	184.2 N-m	536.1 kgs.	309.3 kgs.
BC3M(MM)15DW	205.0mm	1325.8 N-m	194.1 N-m	765.9 N-m	1319.0 kgs.	762.0 kgs.
BC3M(MM)20DW	205.7mm	1837.8 N-m	375.6 N-m	1060.8 N-m	1821.6 kgs.	1051.4 kgs.

*** D is distance between carriers.**

**** Loads calculated are at minimum "D", for substantially higher My + Mz loads increase "D' and refer to graph at left**

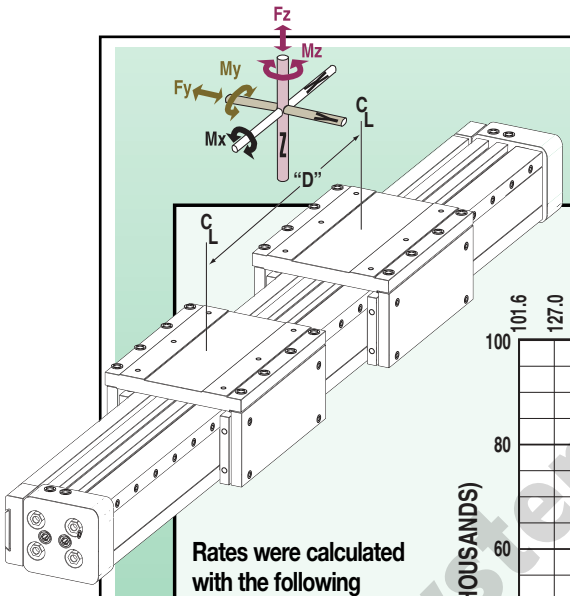
AUXILIARY DUAL 180° CARRIER

AUXILIARY DUAL 180° CARRIER OPTION

The auxiliary dual 180° carrier option substantially increases load carrying capacity and bending moments. Auxiliary carriers can **only** be ordered with an internal piston. When ordering, determine the minimum distance required between carriers (dimension "D" in Auxiliary Dual 180° Carrier Bending Moments chart below). Determine your working stroke. Enter these into your configuration string. (Example BC3D15SK50.00DW10.00) the configurator will calculate the overall length of the actuator. Refer to page 49 for ordering information.

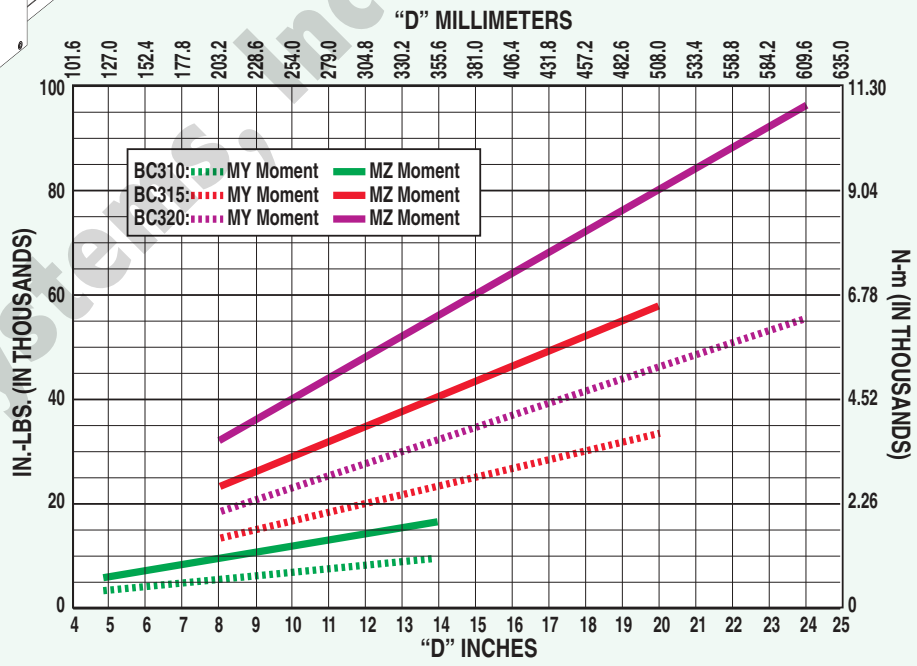
ORDERING PROCEDURE

NOTE: Breakaway pressure will increase when using auxiliary dual 180° carriers.



AUXILIARY DUAL 180° CARRIER BENDING MOMENTS

LOAD vs. DISTANCE BC3 SERIES



Rates were calculated with the following assumptions:

1.) Coupling between carriers is rigid.

2.) Load is equally distributed between carriers.

3.) Coupling device applies no misalignment loads to carriers.

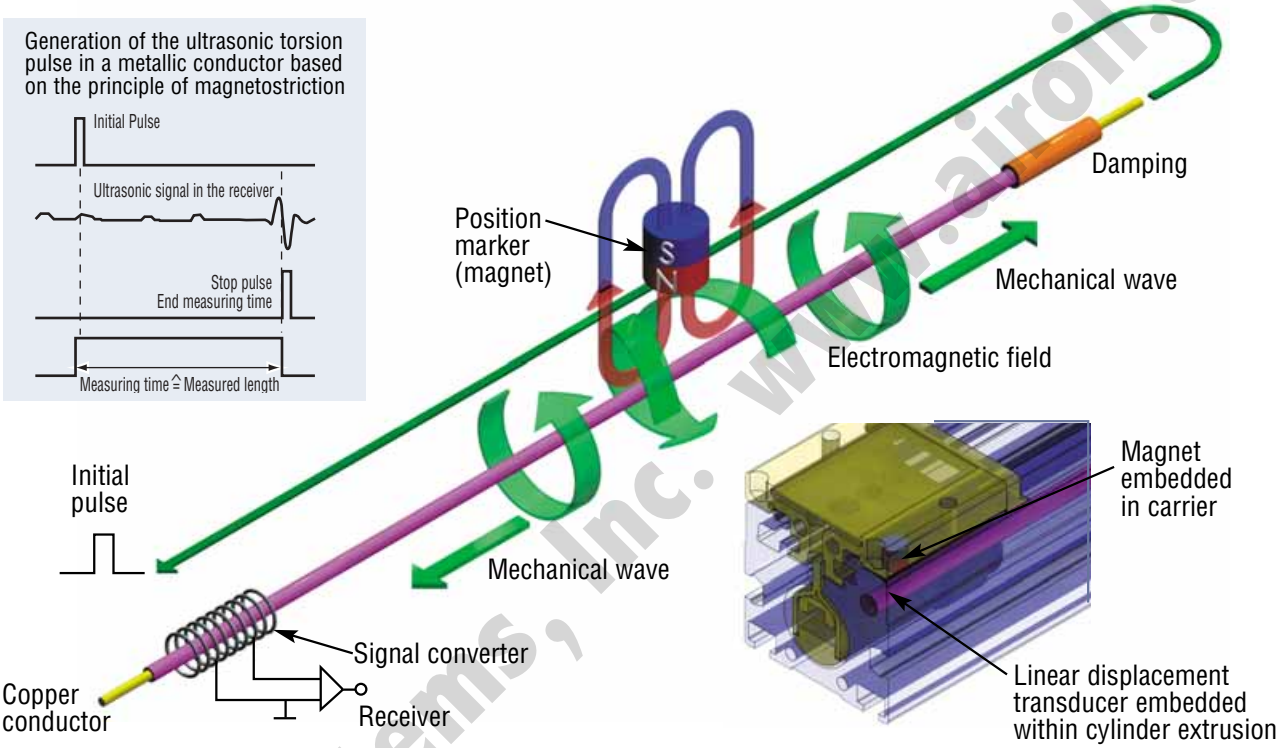
MODEL NO.	"D"* MIN.	MAXIMUM BENDING MOMENT			MAXIMUM LOAD	
		M_Y**	M_X	M_Z**	F_Z	F_Y
BC3D10DW	4.88 in.	3328 in.-lbs.	1314 in.-lbs.	5768 in.-lbs.	1364 lbs.	2364 lbs.
BC3D15DW	8.07 in.	13558 in.-lbs.	4936 in.-lbs.	23468 in.-lbs.	3360 lbs.	5816 lbs.
BC3D20DW	8.10 in.	18776 in.-lbs.	9054 in.-lbs.	32530 in.-lbs.	4636 lbs.	8032 lbs.
BC3M(MM)D10DW	124.0mm	373 N-m	147 N-m	646 N-m	619 kgs.	1072 kgs.
BC3M(MM)D15DW	205.0mm	1518 N-m	553 N-m	2628 N-m	1524 kgs.	2638 kgs.
BC3M(MM)D20DW	205.7mm	2103 N-m	1014 N-m	3643 N-m	2103 kgs.	3643 kgs.

*** D is distance between carriers.**

**** Loads calculated are at minimum "D", for substantially higher My + Mz loads increase "D' and refer to graph at left**

HOW IT WORKS

- An initial pulse is generated that runs through the length of the linear transducer. This pulse generates a circular magnetic field which rotates around the length of the transducer.
- A permanent magnet (embedded in the carrier) is mounted so its lines of field run at right angles to the electromagnetic field induced in the transducer.
- At the point where the two fields intersect, a magnetostrictive effect causes an elastic deformation of the transducer.
- This deformation moves in both directions from the magnet in the form of a mechanical wave.
- The velocity of the mechanical wave is 9285 feet per second and is nearly insensitive to environmental effects (temperature, shock, etc.)
- The mechanical wave that moves to the far end of the band cylinder is dampened.
- The mechanical wave that moves to the signal converter is changed to an electric signal. The wave travel time is directly proportional to the distance between the magnet and the signal converter.
- By measuring the travel time, the position of the carrier can be determined with extremely high accuracy.



DESIGN ADVANTAGES

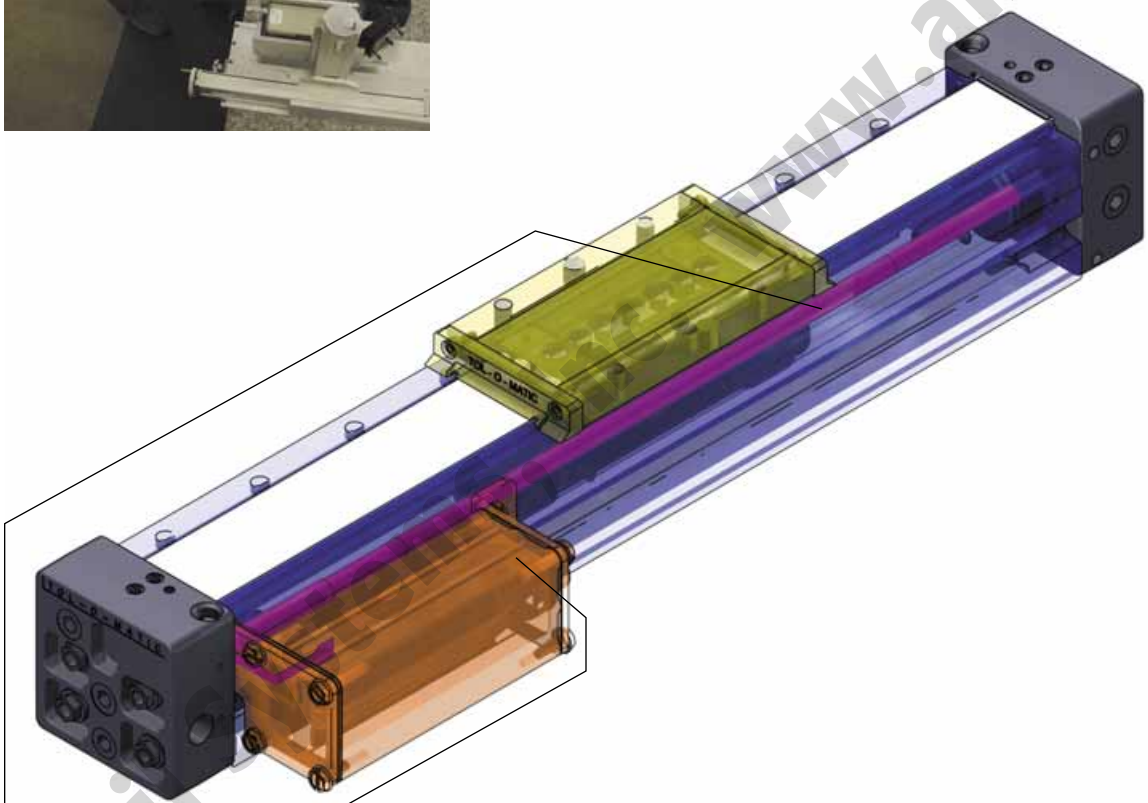
- Linear displacement transducer is embedded within the extrusion of the band cylinder for protection and space savings. The carrier protects the permanent magnet.
- An extruded aluminum housing protects the electronics. Compact design does not interfere with carrier movement or mounting.
- Performance is factory verified for each unit before shipping.

ALTERNATE TECHNOLOGIES

	TECHNOLOGY	DISADVANTAGE
Linear Potentiometers	• Conductive "wiper" rides on resistive element	• Wear spots often form, impacting performance
Incremental Linear Encoders	• Measures position by counting lines from reference point "home"	• Requires reference run to determine absolute position • Any interruption in power requires reference run before work is resumed
Cable Extension Transducers "String Pots"	• Metal cable connected to rotary feedback device	• Prone to mechanical inaccuracies (backlash) • Exposed to environment
Linear Variable Differential Transformers "LVDT's"	• Moveable core changes inductance of transformer	• AC operated, requiring additional electronics to convert signal to required DC
Optical Type Sensor	• Sensor attached to carrier tracks position	• External cables attached to moving carrier and sensor required for power and sending signals

APF FEATURES

FEATURE	ADVANTAGE	BENEFIT
• Absolute position feedback – signal sent as analog output to control system or PLC	• Provides load position feedback	• Accommodates work point variances without stoppage for manual set-ups • Work events can be programmed with PLC eliminating the need to physically move trigger switches
• Each APF option installed is factory tested before shipping	• Transducer performance has been tested, after installation, on each cylinder	• Assurance that each cylinder will meet specifications



FEATURE	ADVANTAGE	BENEFIT
• Analog signal of 0 to +10Vdc or -10 to +10Vdc	• Select appropriate voltage based on control device	• Makes full use of controller's A to D resolution capacity
• Transducer is embedded within the band cylinder	• Reduces chance of damage to the transducer	• Eliminates need for complex external mounting and offers protection
• Non-contact linear displacement transducer	• Magnetostrictive system has no mechanical wear • Transducer directly measures load position	• High life expectancy, speed, linearity and repeatability when compared to linear potentiometers
• Transducer may be ordered in any length	• Does not limit stroke	• Order in any incremental stroke length from 2 to 156 inches

SPECIFICATIONS

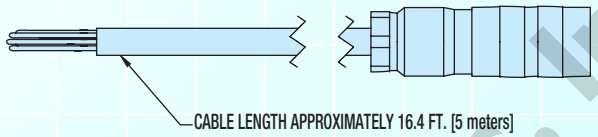
Sensor Type:	Magnetostrictive Linear Displacement Transducer
Stroke Range:	2 in. to 156 in. [51 mm to 3,962 mm]
Operating Temperature:	-40 to 185°F [-40 to 85°C]
Supply/Operating Voltage:	24 Vdc ±20%
Output Signal Interface/Type:	Analog/Voltage (0 to +10 Vdc -or- ±10 Vdc)
Resolution:	<0.1 mV
***Linearity:**	±.005 in. [.13 mm] up to 20 in. [508 mm] stroke, ±.025% (of full stroke) over 20 in. [508 mm] stroke
***Repeatability:**	<.003 in. [.08 mm]

**Linearity and repeatability specifications are based on empirical data.*

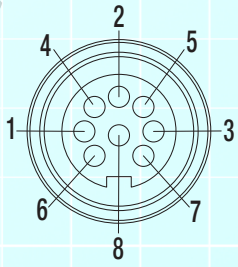
DIMENSIONAL DATA FOR APF OPTION

3D CAD AVAILABLE AT WWW.TOLOMATIC.COM

CABLE DIMENSION

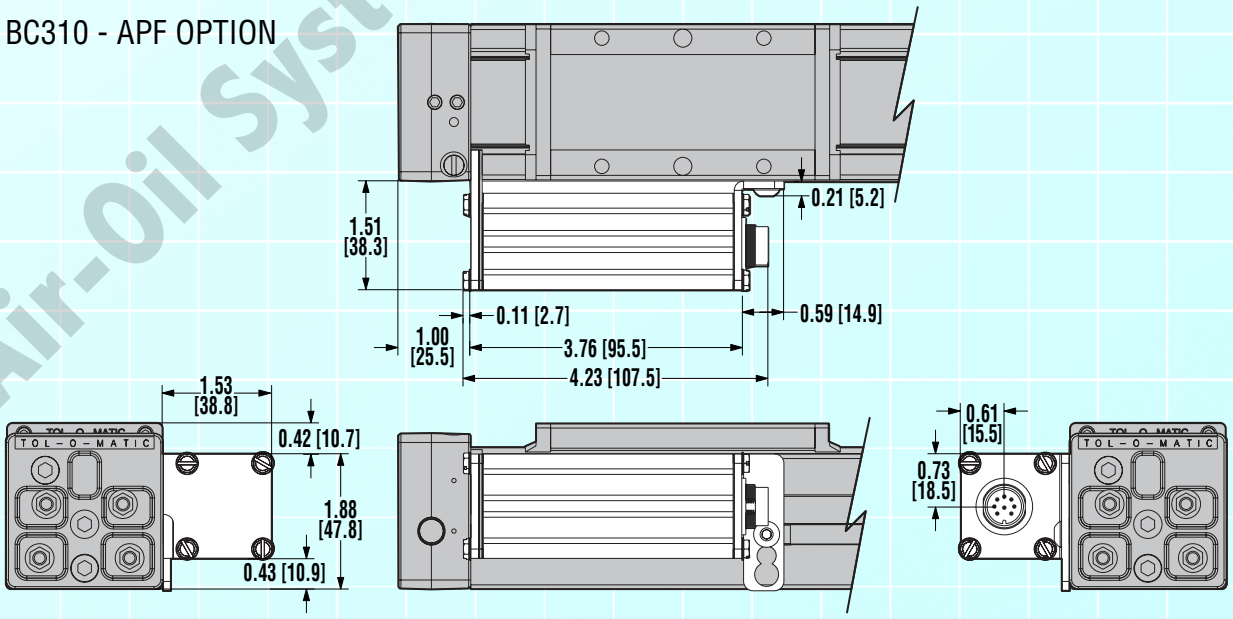


CABLE PINOUT - APF OPTION



1	Yellow:	— —
2	Gray:	Analog Common
3	Pink:	Analog Output, Falling
4	— —	Not Used
5	Green:	Analog Output, Rising
6	Blue:	Ground
7	Brown:	+24 V
8	White:	Ground

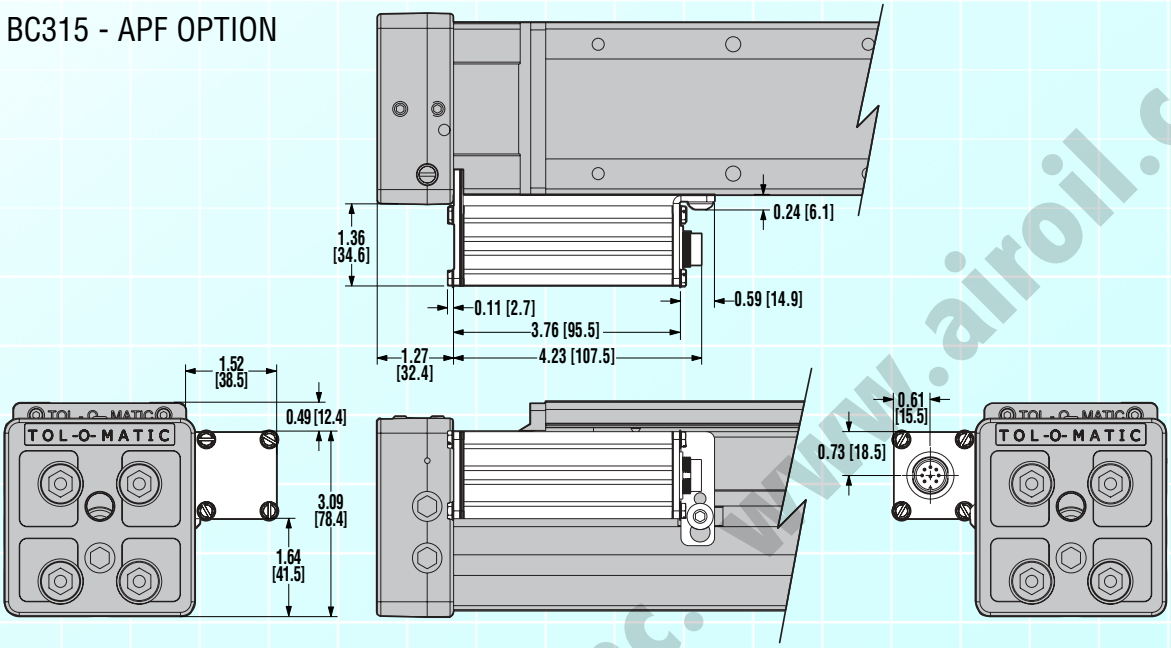
BC310 - APF OPTION



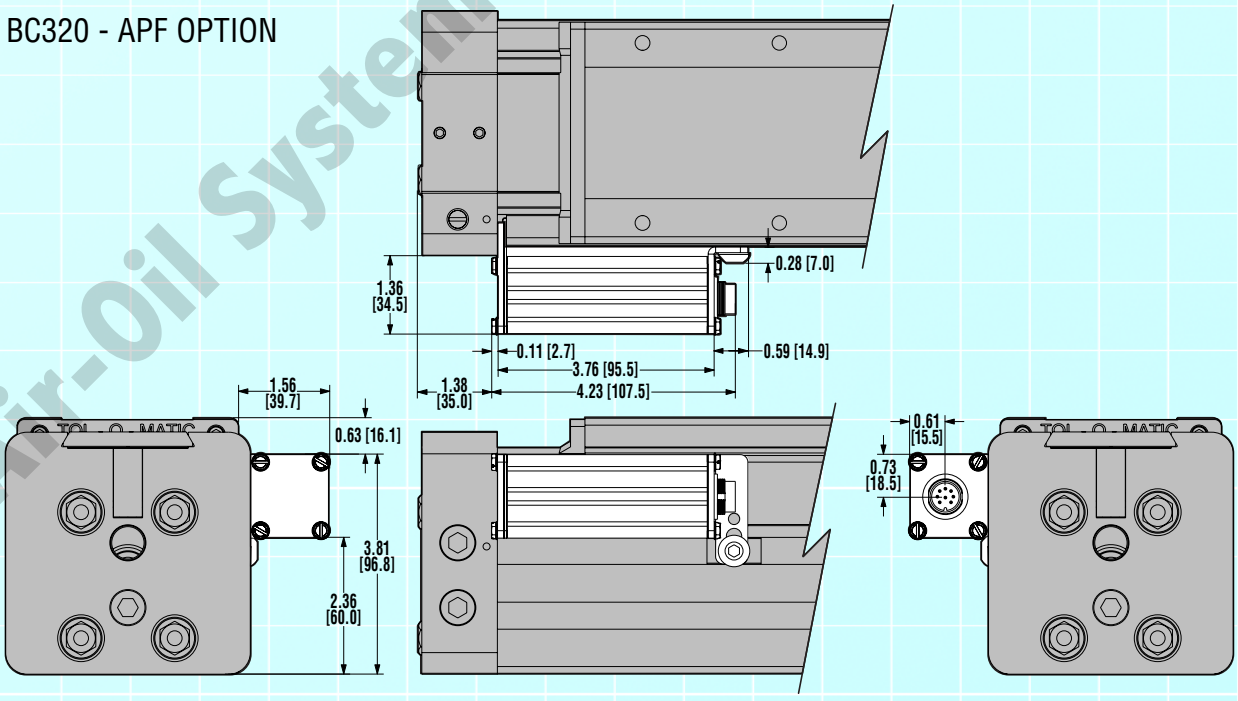
DIMENSIONAL DATA FOR APF OPTION

3D CAD AVAILABLE AT WWW.TOLOMATIC.COM

BC315 - APF OPTION



BC320 - APF OPTION



SINGLE END PORTING

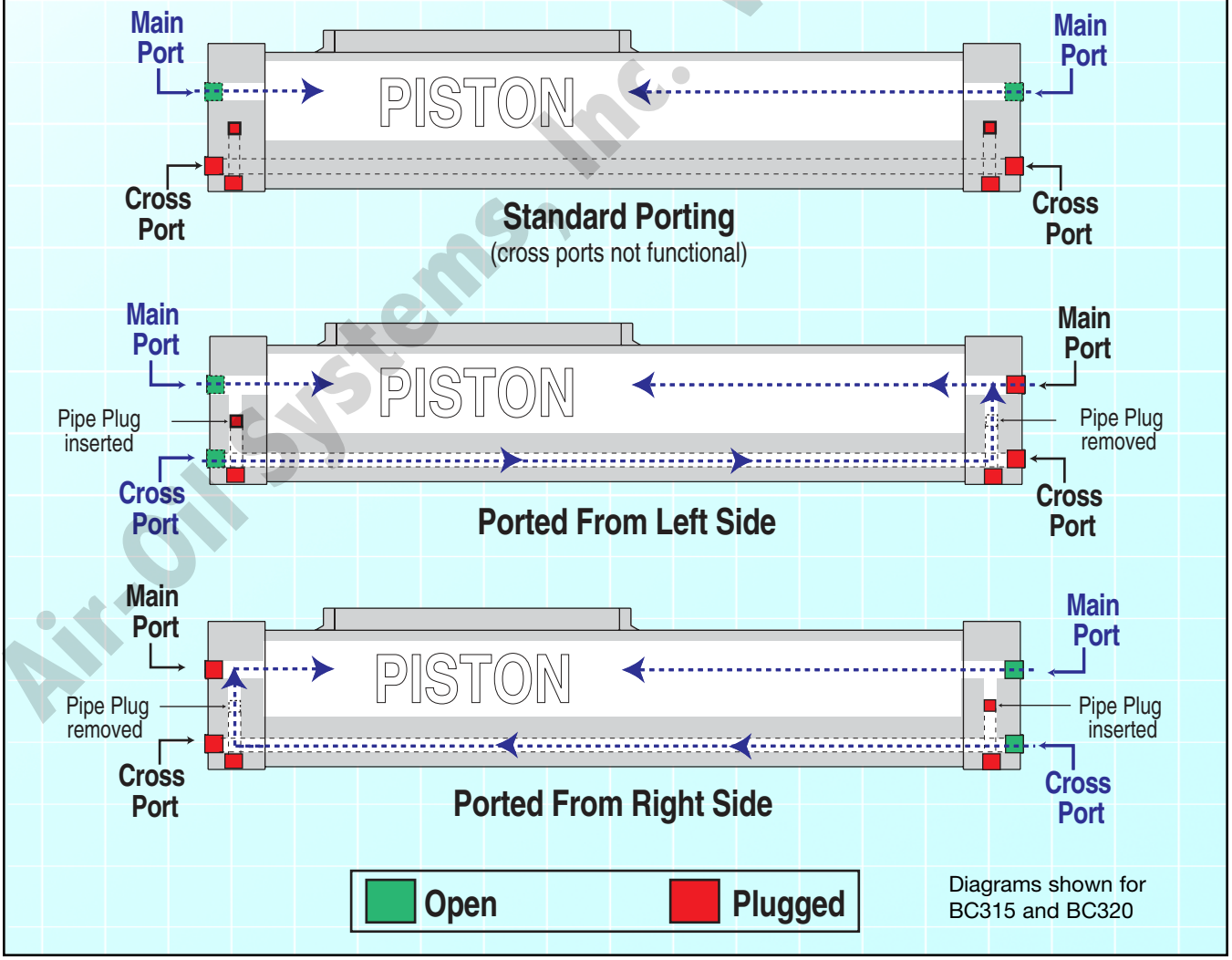
The BC3 is uniquely designed for multiple port locations including single end porting. This is a **standard** feature on all bore sizes of the BC3. The lower ports on the head assembly only function when used to cross port the cylinder for single end porting.

To convert to single end porting, remove access pipe plug fitting from the opposite head assembly that the air lines will be installed into. Then remove the internal port pipe plug. Reinstall access pipe plug into the bottom of the head. Remove pipe plug from the head that the air lines will be installed.

AIR FLOW DIAGRAMS

SINGLE END PORTING ALLOWS THE GREATEST FLEXIBILITY IN AIR HOOK UP

Converting from **Standard** porting to **Left** or **Right** side porting can be achieved if plugs are placed as in the diagram below.



Note: Standard porting may be field converted to ported from left or ported from right. For complete instructions refer to parts sheet.

BC3 - ORDERING

CONFIGURATOR EXAMPLE

MODEL, BORE, AND STROKE | **ACCESSORIES AND OPTIONS**

1.		2.	3.	4.												5.										
B	C	3				1	5	S	K	1	0	0	.	2	5	A	P	F	G	F	C	A	T	S	2	

The above example describes a BC3 Series Band Cylinder with a 1-1/2 in. (40mm) bore size and a stroke of 100.250 inches. Options include the absolute position feedback -10 to +10Vdc range, cable for the APF and two tube supports.

Boxes above represent the number of fields available for each section and not all of them will be used in every application. Omit empty boxes when you construct your configurator number (placeholders are not required). For the above example, the order string would appear as follows: **BC315SK100.25APFGFCATS2.**

First, determine the model, the bore size and the stroke required.

1. MODEL TYPE

Enter:

BC3 for U.S. standard version
BC3M for metric version with taper port
BC3MM for metric version with parallel port

2. DUAL 180˚ CARRIER OPTION

Enter:

§ **D** for Dual 180˚ Carrier

3. BORE SIZE

Enter:

10 for 1.0 in./25 mm
15 for 1.5 in./40 mm
20 for 2.0 in./50 mm

4. STROKE LENGTH

Enter

SK then required stroke length in **inches**
Example:
SK100.25 for 100.250 inch stroke

NOTE: Prelubrication is standard on all BC3 Band Cylinders (see Application Guidelines on page 197)

*Each TS includes two (2) tube support halves

+ When shocks are ordered, cushion seals are removed.

§ Not available with APF option

§§ APF option replaces switches in most uses

5. ACCESSORIES AND OPTIONS

Once the model, bore size and stroke have been determined, you can add any of the options or accessory items shown below in any order. If the optional item indicates an "x", specify quantity.

When ordered with any BC3 Series model, all options and accessories listed will be factory installed unless specified. For special model and option requirements not shown, consult Tol-O-Matic, Inc.

OPTIONS AND ACCESSORIES CODES
"x" indicates quantity.

APFB	BC310, Linear Transducer, 0 to +10Vdc
APFA	BC315, BC320 Linear Transducer, 0 to +10Vdc
APFH	BC310, Linear Transducer, -10 to +10Vdc
APFG	BC315, BC320 Linear Transducer, -10 to +10Vdc
FCA	Cable, Connects APF to external device (3m)
§§ **BTx**	Form C Reed Switch with 5-meter lead
§§ **BMx**	Form C Reed Switch with 5-meter lead Quick-Disconnect
§§ **RTx**	Form A Reed Switch with 5-meter lead
§§ **RMx**	Form A Reed Switch with 5-meter lead Quick-Disconnect
§§ **CTx**	AC Triac Reed Switch with 5-meter lead
§§ **CMx**	AC Triac Form A Reed Switch w/ 5-meter lead Quick-Disconnect
§§ **KTx**	Hall-effect (Sinking) Switch with 5-meter lead
§§ **KMx**	Hall-effect (Sinking) Switch with 5-meter lead Quick-Disconnect
§§ **TTx**	Hall-effect (Sourcing) Switch with 5-meter lead
§§ **TMx**	Hall-effect (Sourcing) Switch with 5-meter lead Quick-Disconnect
FMx	Foot Mount (ea.)
***TSx**	Tube Support (ea.)
§ **+ADx**	Standard Shock, Hardware Only (ea.)
§ **+AHx**	Standard Shock, Heavy Duty (ea.)
§ **+ALx**	Standard Shock, Lite Duty (ea.)
TN	T - Nuts (ea.)
****DW**	Auxiliary Carrier (with piston)

NOTE: BC3 pneumatic rodless cylinders with the APF option are custom engineered to your specifications in just 10 working days.

****When ordering auxiliary **carrier option,** determine the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart, page 42). Determine your working stroke and your "D" dimension, then enter these into your configuration string. (Example: BC315SK50.00DW15.00RT2) **The configurator will calculate the overall length of the actuator.**

ORDERING PROCEDURE

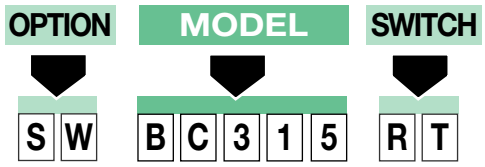
BC3 - FIELD RETROFIT

U.S. STANDARD OPTIONAL ACCESSORIES	BC310	BC3D10	BC315	BC3D15	BC320	BC3D20
Cable for APF option 9.8 ft. (3m)	3604-1573	—	3604-1573	—	3604-1573	—
Foot Mount Kits[1]	3410-9005	3410-9025	3415-9005	3415-9025	3420-9005	3420-9025
Shock Mount Kit w/ Shock[2] – Heavy Duty	3410-9013	3410-9013	3415-9013	3415-9013	3420-9013	3420-9013
Shock Mount Kit w/ Shock[2] – Lite Duty	3410-9010	3410-9010	3415-9010	3415-9010	3420-9010	3420-9010
Shock Mount Kit w/o Shock[3] (Hardware Only)	3410-9003	3410-9003	3415-9003	3415-9003	3420-9003	3420-9003
Shock Stop Plate Kit[4]	3410-9004	3410-9004	3415-9004	3415-9004	3420-9004	3420-9004
Tube Supports[5] (without APF option)	3410-9006	3410-9026	3415-9006	3415-9026	3420-9006	3420-9026
Tube Supports[5] (with APF option)	3410-9361	—	3415-9006	—	3420-9006	—
Switch Hardware Only	3410-9999	3410-9999	3415-9999	3415-9999	3420-9999	3420-9999

METRIC OPTIONAL ACCESSORIES	BC3M(MM)10	BC3M(MMD)10	BC3M(MM)15	BC3M(MM)D15	BC3M(MM)20	BC3M(MM)D20
Cable for APF option 9.8 ft. (3m)	3604-1573	—	3604-1573	—	3604-1573	—
Foot Mount Kits[1]	4410-9005	4410-9025	4415-9005	4415-9025	4420-9005	4420-9025
Shock Mount Kit w/ Shock[2] – Heavy Duty	4410-9013	4410-9013	4415-9013	4415-9013	4420-9013	4420-9013
Shock Mount Kit w/ Shock[2] – Lite Duty	4410-9010	4410-9010	4415-9010	4415-9010	4420-9010	4420-9010
Shock Mount Kit w/o Shock[3] (Hardware Only)	4410-9003	4410-9003	4415-9003	4415-9003	4420-9003	4420-9003
Shock Stop Plate Kit[4]	4410-9004	4410-9004	4415-9004	4415-9004	4420-9004	4420-9004
Tube Supports[5] (without APF option)	4410-9006	4410-9026	4415-9006	4415-9026	4420-9006	4420-9026
Tube Supports[5] (with APF option)	4410-9361	—	4415-9006	—	4420-9006	—
Switch Hardware Only	3410-9999	3410-9999	3415-9999	3415-9999	3420-9999	3420-9999

[1] Foot Mount Kit contains one bracket and mounting hardware.
[2] Contains one shock and mounting hardware.
[3] Contains one set of mounting hardware only.
[4] Contains shock plate, impact bolts, screws and dowel pins.
[5] Contains one tube support and mounting hardware.

KIT (HARDWARE & SWITCH)	DESCRIPTION	SWITCH ONLY (NO HARDWARE)
BT	Form C Reed Switch with 5 meter lead	3600-9084
BM	Form C Reed Switch with Quick-disconnect Coupler (Male)	3600-9085
RT	Form A Reed Switch with 5 meter lead	3600-9082
RM	Form A Reed Switch with Quick-disconnect Coupler (Male)	3600-9083
CT	ac Triac Reed Switch with 5 meter lead	3600-9086
CM	ac Triac Reed Switch with Quick-disconnect Coupler (Male)	3600-9087
KT	Hall-effect (Sinking) Switch with 5 meter lead	3600-9090
KM	Hall-effect (Sinking) Switch with Quick-disconnect Coupler (Male)	3600-9091
TT	Hall-effect (Sourcing) Switch with 5 meter lead	3600-9088
TM	Hall-effect (Sourcing) Switch with Q-D Coupler (Male)	3600-9089
	Connector (Female) 5 meter lead	2503-1025



To order field retrofit switch and hardware kits for all Tol-O-Matic actuators: SW (Then the model and bore size, and type of switch needed)

Example: SWBC315RT
(Hardware and Form A Reed switch with 5 meter lead for 1.5" bore BC3 band cylinder)

(NOTE: Mounting hardware is required if replacing switch for any actuator manufactured before 7/1/97.)

U.S. STANDARD CONFIGURATED REPAIR KITS			METRIC CONFIGURATED REPAIR KITS		
BC310	BC315	BC320	BC3M(MM)10	BC3M(MM)15	BC3M(MM)20
RKBC310	RKBC315	RKBC320	RKBC3M10	RKBC3M15	RKBC3M20
RKBC3D10	RKBC3D15	RKBBC3D20	RKBC3DM10	RKBC3DM15	RKBC3DM20

NOTE: Specify stroke as "SK" then desired length in decimal inches after the configurated model listed. "RKBC3D" denotes Dual 180° Carrier Kit.

BC3 APPLICATION GUIDELINES

BC3 DECELERATION CONSIDERATIONS

While the BC3 is capable of carrying very large loads, consideration must be given to how to stop the load at the end of stroke. If Tol-O-Matic cushions or shocks are to be used, please stay within the application guidelines on page 197. If you should decide to utilize another type of shock absorber, be sure that the deceleration of the load is smooth and over adequate distance.

BC3 BEARING LUBRICATION

The bearing system for the BC3 is prelubricated at the factory with a high quality No. 2 lithium-soap base grease. Relubrication is recommended every 10 million linear feet using a lithium-soap base grease for optimal bearing performance. To relubricate, lift back upper sealing band and apply grease directly to the stationary ball ways. Applications that are exposed to moisture or dirt, may require more frequent relubrication.

ALSO SEE

CUSHION NEEDLE ADJUSTMENT . . . 197
SELECTION (BC2, BC3, BC4, LS) 88
LUBRICATION GUIDELINES 197
FINAL VELOCITY CALCULATIONS . . . 197

The following example illustrates this:

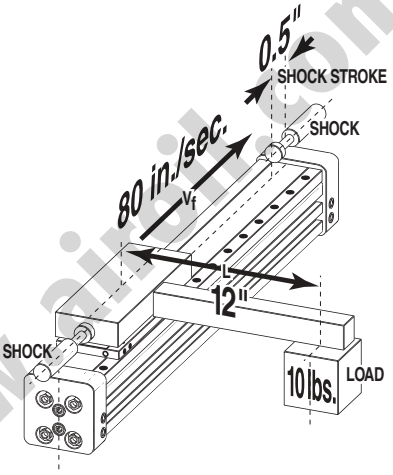
Upon hitting the shock absorber, a load of 10 lbs. is travelling at a final velocity of 80 inches/second. It must be brought to rest over the shock absorber stroke of 0.50 inches. To determine the Mz and g forces on the carrier at this point:

Mz = moment about z-axis V = velocity (final) a = deceleration rate
g = 386.4 in./sec.^{2} (standard gravity) s = shock stroke

$$a = \frac{v_f^2}{2s} \quad \frac{(80\ \text{in./sec.})^2}{2 \times 0.50\text{in.}} = 6400\ \text{in./sec.}^2\ \text{(Deceleration Rate)}$$

$$\text{force equivalent} = \frac{a}{g} \times L = \frac{6400\ \text{in./sec.}^2}{386.4\ \text{in./sec.}^2} \times 10\ \text{lbs.} = 165.6\ \text{lbs.}$$

Therefore the Mz created during stopping is:
Mz = (force ea) x L = 165.6 lbs. x 12 in. = 1987.2 in. lbs.



Although an Mz = 1992 is over our catalog ratings, this is acceptable during stopping of the load, if it is less than three (3) times the catalog rated moment load. However, ***moment values should never exceed 3 times catalog ratings*** during stopping. If this cannot be accomplished, then a deceleration circuit should be utilized.