

# PNEUMATIC PRODUCTS

 **ENDURANCE TECHNOLOGY**™

Air-Oil Systems, Inc. [www.airoil.com](http://www.airoil.com)



**MAXIMUM DURABILITY**

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ABT  
MXP  
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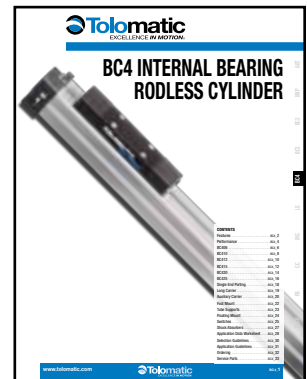
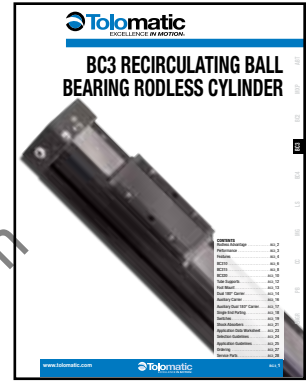
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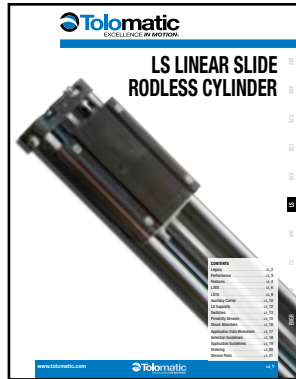
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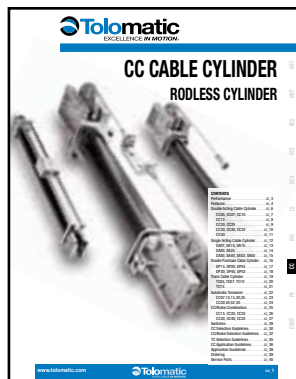
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## INNOVATIVE PRODUCTS

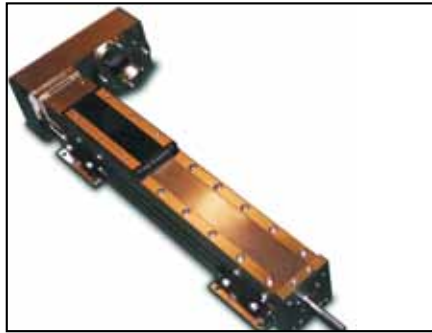
### STANDARD PRODUCTS



ISO 9001 quality procedures combined with **ENDURANCE TECHNOLOGY** for trouble-free installation and start-up.

- Over 35 distinct product lines detailed in over 4,000 web pages.
- User specified stroke length is standard.

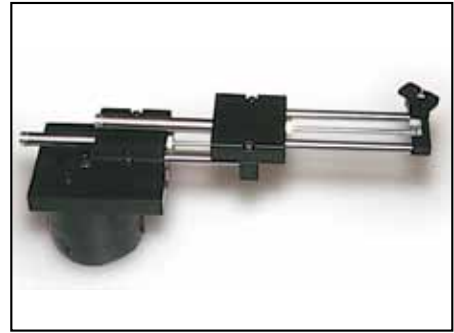
### MODIFIED PRODUCTS



Modified products, like this corrosion resistant B3S, extend the range of environments and applications where Tolomatic products can be found.

- Modifications include user specified tapped holes, materials, lubricants, coatings, and/or mounting brackets.

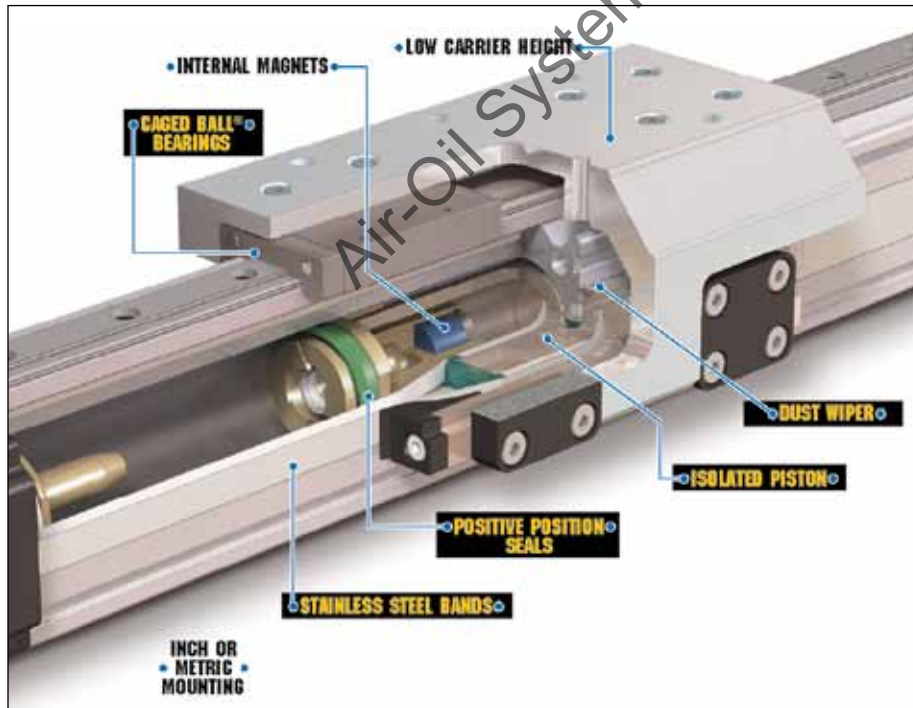
### CUSTOM PRODUCTS



Challenges like this multi-axis actuator built to fit a manufacturer's motion, space and accuracy requirements are a regular part of our daily activities.

- Custom solutions for unique motion requirements.
- We will work with you to design a motion product within your space, budget, and time requirements.

## QUALITY BUILT-IN WITH **ENDURANCE TECHNOLOGY**



- ENDURANCE TECHNOLOGY - our design principles are simple: make it durable and affordable. One recent customer remarked, "Your actuators are built like a tank and run like a deer!" We agree.
- 100% SATISFACTION GUARANTEE - customer satisfaction is the cornerstone of our business - and has been for over 50 years. Everything we do is for you.



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# DIFFERENCE

## CUSTOMER SERVICE



- JUST A PHONE CALL AWAY - Expect prompt, courteous replies to all of your application and product questions. Check us out at 1-800-328-2174



- 5 DAYS BUILT-TO-ORDER - products assembled, tested and out the door in five days or less. Many products are shipped same day.

Our products will be there when you need them. Depend on Tolomatic!



## TECHNICAL AND APPLICATION SUPPORT



- 3D models and 2D drawings on the web
- Available in all common formats.

**Tolomatic**  
EXCELLENCE IN MOTION.

Home | Products | Where To Buy | Company | Product Resources | Help | Contact Us

Pneumatic Rodless Actuators - MXP Band Cylinders - Base Actuator

P- Profiled Rail Bearing Actuator Dimensions: 25, 32 and 40 Bore

	MXP25	MXP32	MXP40
A	3.90	4.89	5.79
B	1.11	1.50	1.98
C	2.28	3.00	3.53
D	0.83	1.14	1.51
E	1.37	2.13	2.52
F	0.62	0.86	1.00
G	2.65	3.23	3.85
H	0.72	0.72	0.72
I	0.72	0.72	0.72
J	0.72	0.72	0.72
K	1.49	1.82	1.91
L	0.72	0.72	0.72
M	0.57	0.58	0.58
N	0.57	0.58	0.58
O	0.57	0.58	0.58
P	0.57	0.58	0.58
Q	0.57	0.58	0.58
R	0.57	0.58	0.58
S	0.57	0.58	0.58
T	0.57	0.58	0.58
U	0.57	0.58	0.58
V	0.57	0.58	0.58
W	0.57	0.58	0.58
X	0.57	0.58	0.58
Y	0.57	0.58	0.58
Z	0.57	0.58	0.58

- COMPLETE INFORMATION AVAILABLE ONLINE - [www.tolomatic.com](http://www.tolomatic.com) - your definitive source for everything you need to know about Tolomatic and our products.
- Sizing and selection support - step by step instructions, specifications and performance data for every pneumatic product.

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### BAND CYLINDERS

#### MXP-N INTERNAL BEARING



##### APPLICATIONS:

- Low to high thrust forces guiding and supporting light loads
- Good for vertical applications or with externally guided loads

##### FEATURES:

- Durable self-lubricating internal bearing performance tested for millions of cycles

#### MXP-S SOLID BEARING



##### APPLICATIONS:

- Low to high thrust forces guiding and supporting medium loads
- Loads with Mx (roll) moments

##### FEATURES:

- Mx (roll) moment capacity carrier design with self-lubricating bearings
- Trapezoidal bearing design maximizes bearing surface area for less pressure & less wear on bearing surfaces
- Isolated piston extends service life of the piston seals

#### MXP-P PROFILED RAIL BEARING



##### APPLICATIONS:

- Low to high thrust forces guiding and supporting heavy loads
- High speed and precision
- Vertical orientation or cantilevered loads

##### FEATURES:

- Long life THK® Caged Ball® bearings
- Largest moment load capacity
- Low carrier height
- Isolated piston extends service life of the piston seals

##### COMMON FEATURES:

- Non-wear stainless steel bands
- Adjustable internal end-of-stroke cushion
- Single piece high strength piston up to 28% stronger than competition

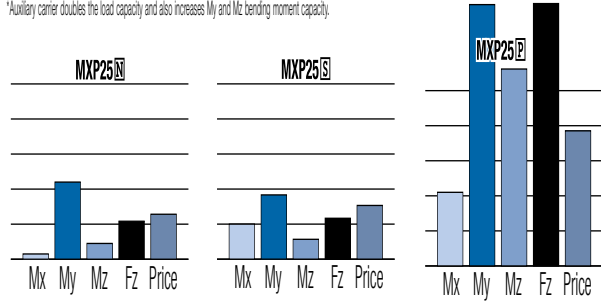
##### COMMON OPTIONS:

- Tube clamps
- Auxiliary carrier
- Adjustable and fixed shock absorbers
- Single end porting
- Reed or solid state position sensors
- Foot mount
- Inch or metric mounting
- Floating mount (N & S bearings only)

##### SPECIFICATIONS:

	16	25	32	40	50	63												
<b>BORE</b> in	.63	1.00	1.25	1.60	2.00	2.50												
<b>SIZE</b> mm	16	25	32	40	50	64												
<b>MAX.</b> in	206	206	205	203	168	103												
<b>STROKE</b> mm	5232	5232	5207	5156	4267	2616												
<b>MAX.</b> in	30.7	78.5	123	177	305	491												
<b>THRUST</b> N	136	349	546	786	1356	2184												
	16N	16S	16P	25N	25S	25P	32N	32S	32P	40N	40S	40P	50N	50P	63N	63S	63P	
<b>*MAX.</b> lb	30	35	217	65	70	449	115	150	569	195	225	736	270	315	1014	370	520	1292
<b>LOAD</b> N	133	156	965	289	311	1997	512	667	2531	867	1001	3274	1201	1401	4511	1646	2313	5747

\*Auxiliary carrier doubles the load capacity and also increases My and Mz bending moment capacity.



#### BC2 SOLID BEARING



##### APPLICATIONS:

- Low to high thrust forces, guiding and supporting medium loads

##### FEATURES:

- Mx moment capacity carrier design with self-lubricating bearings
- Adjustable carrier for maintaining consistent bearing surfaces
- Stainless steel retained bands
- Adjustable internal end-of-stroke cushion
- Formed steel piston bracket

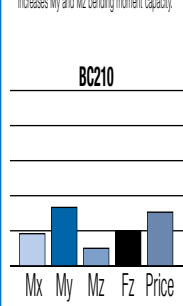
##### OPTIONS:

- Auxiliary carrier
- Four ported head
- Foot mount
- Adjustable shock absorbers
- Reed or solid state position sensors
- Inch or metric mounting
- Floating mount
- Tube support

##### SPECIFICATIONS:

	05	10	12	15	20	25
<b>BORE</b> in	0.50	1.00	1.25	1.50	2.00	2.50
<b>SIZE</b> mm	12	25	32	40	50	63
<b>MAX.</b> in	175	283	280	278	158	238
<b>STROKE</b> mm	4450	7193	7132	7071	4023	6066
<b>MAX.</b> in	16	78	120	176	310	495
<b>THRUST</b> N	71	347	534	783	1379	2202
<b>*MAX.</b> lb	5.0	60	120	180	300	400
<b>LOAD</b> N	22	267	534	801	1334	1779

\*Auxiliary carrier doubles the load capacity and also increases My and Mz bending moment capacity.



#### BC3 INTERNAL BALL BEARING



##### APPLICATIONS:

- Medium thrust forces, guiding and supporting heavy loads

##### FEATURES:

- Reliable, maintenance free bearing system
- Sealed integral ball bearings
- Hardened steel rail guides for high performance and repeatable accuracy
- Stainless steel retained bands
- Adjustable internal end-of-stroke cushion
- Integral mounting system
- Single end porting

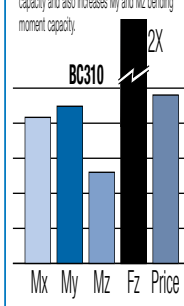
##### OPTIONS:

- Auxiliary carrier
- Adjustable shock absorbers
- Foot mount
- Tube supports
- Reed or solid state position sensors
- Inch or metric mounting
- Dual 180° carrier

##### SPECIFICATIONS:

	10	15	20
<b>BORE</b> in	1.00	1.50	2.00
<b>SIZE</b> mm	25	32	50
<b>MAX.</b> in	205	205	120
<b>STROKE</b> mm	5207	5207	3048
<b>MAX.</b> in	78	176	310
<b>THRUST</b> N	347	783	1379
<b>*MAX.</b> lb	591	1454	2008
<b>LOAD</b> N	2629	6469	8832

\*Auxiliary and dual 180° carrier doubles the load capacity and also increases My and Mz bending moment capacity.



#### BC4 INTERNAL BEARING



##### APPLICATIONS:

- Small to large thrust forces, guiding and supporting light loads

##### FEATURES:

- Durable, patented self-lubricating bearing performance tested for millions of cycles
- Stainless steel retained bands
- Adjustable internal end-of-stroke cushion
- Economical price

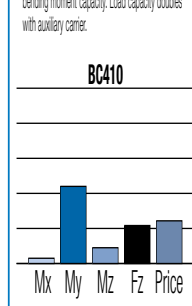
##### OPTIONS:

- Auxiliary carrier
- Single end porting
- Foot mount
- Shock absorbers
- Reed or solid state position sensors
- Metric or english mounting
- Long carrier
- Floating mount
- Tube support

##### SPECIFICATIONS:

	06	10	12	15	20	25
<b>BORE</b> in	0.63	1.00	1.25	1.50	2.00	2.50
<b>SIZE</b> mm	16	25	32	40	50	63
<b>MAX.</b> in	211	210	208	206	156	211
<b>STROKE</b> mm	5359	5334	5283	5232	3862	5359
<b>MAX.</b> in	32	78	120	176	310	495
<b>THRUST</b> N	142	347	534	783	1379	2202
<b>*MAX.</b> lb	30	65	115	195	270	370
<b>LOAD</b> N	133.6	293.5	522.2	883.5	1225.5	1678.8

\*Long and auxiliary carrier increases My and Mz bending moment capacity. Load capacity doubles with auxiliary carrier.



#### LS GUIDE RODS - BALL BEARING



##### APPLICATIONS:

- Low thrust forces, guiding and supporting medium loads

##### FEATURES:

- Load-bearing carrier design with linear guide rods and ball bearings
- Wide precision machined table surface
- Stainless steel retained bands
- Adjustable internal end-of-stroke cushion
- Lightweight aluminum design

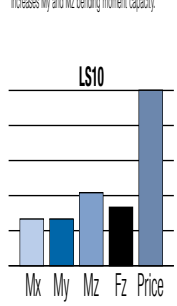
##### OPTIONS:

- Auxiliary carrier
- Base mounting plates
- Shock absorbers
- Proximity sensor
- Reed or solid state position sensors
- Inch or metric mounting

##### SPECIFICATIONS:

	05	10
<b>BORE</b> in	.50	1.00
<b>SIZE</b> mm	13	25
<b>MAX.</b> in	72	84
<b>STROKE</b> mm	1829	2194
<b>MAX.</b> in	16	79
<b>THRUST</b> N	71	351
<b>*MAX.</b> lb	10	100
<b>LOAD</b> N	44	445

\*Auxiliary carrier doubles the load capacity and also increases My and Mz bending moment capacity.



See bending moments diagram at right (under PB)

Graphs are general performance comparisons between cylinders of similar (\* bore) sizes with 12" stroke (PB2 6" stroke). Maximum thrust is based on air pressure of 100 PSI

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# MAG CYLINDERS

## MG CYLINDER



### APPLICATIONS:

- Environmentally sensitive applications that need low contamination
- If magnetic coupling strength is exceeded the piston and carrier will decouple - a safety benefit in many applications

### FEATURES:

- Field repairable to minimize downtime
- Fully enclosed design keeps contaminants from entering or lubricants from exiting actuator body
- Three coupling strengths available
- Stainless steel tubing

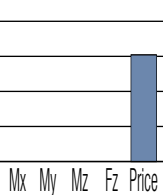
### OPTIONS:

- Pneumatic or hydraulic power
- Floating mount • Foot mount
- Reed or solid state position sensors

### SPECIFICATIONS:

	025	038	062	100	
BORE SIZE	in	.25	.38	.62	1.00
	mm	6	10	16	25
MAX. STROKE	in	26	32	39	56
	mm	660	813	991	1422
MAX. Wt	lb	5	11	28	72
	N	22	49	125	320
MAGNETIC STRENGTH	lb	5	14	38	100
	N	22	62	169	445

## MGC100



## MGS SLIDE



### APPLICATIONS:

- Environmentally sensitive applications that need low contamination
- If magnetic coupling strength is exceeded the piston and carrier will decouple - a safety benefit in many applications

### FEATURES:

- Fully enclosed design keeps contaminants from entering or lubricants from exiting actuator body
- Low profile rigid design
- Stainless steel tubing
- Hardened steel shafts

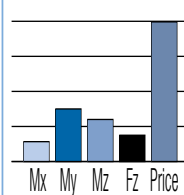
### OPTIONS:

- Pneumatic or hydraulic power
- Choose either sintered bronze or linear ball bearings
- Shock absorbers • Proximity sensors
- Reed or solid state position sensors

### SPECIFICATIONS:

	038	062	100	
BORE SIZE	in	.38	.63	1.00
	mm	10	16	25
MAX. STROKE	in	30	60	80
	mm	762	1524	2032
MAX. Wt	lb	11	28	72
	N	49	125	320
MAX. LOAD	lb	14	40	90
	N	62	178	400

## MGS100



# CABLE CYLINDERS

## CC DOUBLE-ACTING SA SINGLE-ACTING DP DOUBLE-PURCHASE



### APPLICATIONS:

- Low to high thrust forces for loads that are externally guided and supported

### APPLICATIONS:

- Used where gravity supplies return force
- Medium to high thrust forces for loads that are externally guided and supported

### APPLICATIONS:

- Effectively doubles stroke length and speed
- Medium to high thrust forces for loads that are externally guided and supported

### FEATURES:

- Nylon jacketed aircraft grade cables
- Unique gland seals provide tight seal for cables
- Adjustable internal end-of-stroke cushions
- Actuator may be located remotely from load and contamination
- Stroke lengths up to 60 feet with optional tube couplers

### OPTIONS:

- Pneumatic or hydraulic power
- 3 ported head
- Seals of Viton® material
- Reed position sensors
- Automatic tensioner\*\*\*
- Caliper disc brake\*\*\*
- Tube coupler\*\*\*
- \*\*\*Not available for SA

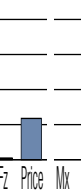
### SPECIFICATIONS:

	05	07	10	15	20	25	30	40	50	62	
BORE SIZE	in	.50	.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	2.00
	mm	13	19	25	38	51	64	76	102	127	51
MAX. STROKE	in	67	140	284	282	283	283	282	281	136	282
	mm	1708	3576	7231	7177	7188	7188	7175	7150	3454	7175
MAX. Wt	lb	19	43	78	174	618	972	1398	1249	1919	1532
	N	85	191	347	774	2749	4324	6219	5556	8336	6815
THRUST	lb	85	191	347	774	2749	4324	6219	5556	8336	6815
	N	377	854	1538	3438	12248	19218	27788	24788	37488	30388

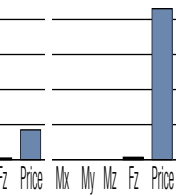
## CC10



## SA10



## DP15



## TC TRACK-GUIDE RODS & BEARING



### APPLICATIONS:

- Low to medium thrust forces, guiding and supporting light loads
- Pneumatic or hydraulic power

### FEATURES:

- Nylon jacketed aircraft grade cables
- Lightweight aluminum design
- Unique gland seals provide tight seal for cables
- Adjustable internal end-of-stroke cushion

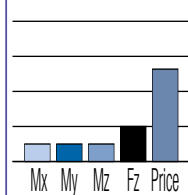
### OPTIONS:

- Automatic tensioner
- Caliper disc brake
- 3 ported head
- Steel tube
- Seals of Viton® material
- Reed position sensors

### SPECIFICATIONS:

	05	07	10	15	
BORE SIZE	in	.50	.75	1.00	1.50
	mm	13	19	25	38
MAX. STROKE	in	67	78	78	78
	mm	1702	1981	1981	1981
MAX. Wt	lb	19	43	78	174
	N	85	191	347	774
MAX. LOAD	lb	60	60	60	15
	N	267	267	267	67

## TC10



# ROD CYLINDER SLIDES

## PB POWER-BLOCK SLIDE



### APPLICATIONS:

- Withstands heavy side loads
- Great for conveyor line stops
- Load lifting applications

### FEATURES:

- Internal urethane bumpers
- Composite bearings
- Standard internal piston magnet for switch sensing
- Lightweight aluminum design

### OPTIONS:

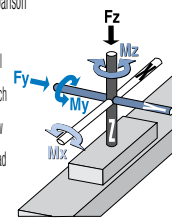
- Stop collars and bumpers
- Dual tooling plate option
- Reed or solid state position sensors

### SPECIFICATIONS:

	06	10	17	20	
BORE SIZE	in	.38	.63	1.06	1.25
	mm	9.5	16	27	32
MAX. STROKE	in	2	2	3	3
	mm	51	51	76	76
MAX. Wt	lb	11	30	88	123
	N	49	133	391	547
MAX. LOAD	lb	5.5	10	20	25
	N	24	44	76	89

### BENDING MOMENTS DIAGRAM

Reference for all comparison graphs  
 Mx = Roll  
 My = Pitch  
 Mz = Yaw  
 Fz = Load



## PB2 POWER-BLOCK2 SLIDE



### APPLICATIONS:

- Withstands heavy side loads
- Great for conveyor line stops
- Load lifting applications

### FEATURES:

- Internal urethane bumpers
- Operating pressure up to 150 PSI
- 10,000,000 cycle rating
- Standard internal piston magnet for switch sensing
- Lightweight aluminum design

### OPTIONS:

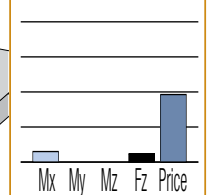
- Choose composite or linear ball bearings
- Reed or solid state position sensors

### SPECIFICATIONS:

	08	10	17	20	32	32	
BORE SIZE	in	.50	.63	1.06	1.25	2.00	3.25
	mm	13	16	27	32	51	83
MAX. STROKE	in	4	4	6	6	6	6
	mm	102	102	152	152	152	152
MAX. Wt	lb	29	46	132	184	471	1244
	N	129	205	587	818	2095	5534
MAX. LOAD	lb	8	16	38	49	70	100
	N	36	71	169	214	311	445

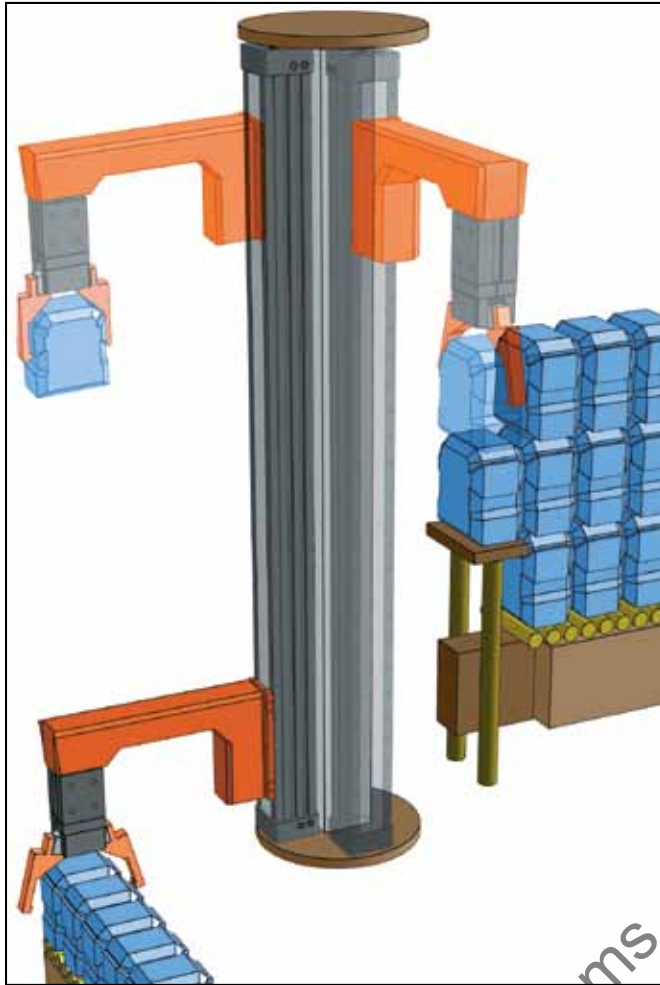
\*\* Maximum thrust at 150 PSI

## PB217



(PB2 rated up to 150 PSI). See [www.tolomatic.com](http://www.tolomatic.com) for complete performance information.

# APPLICATIONS



## **APPLICATION DESCRIPTION:**

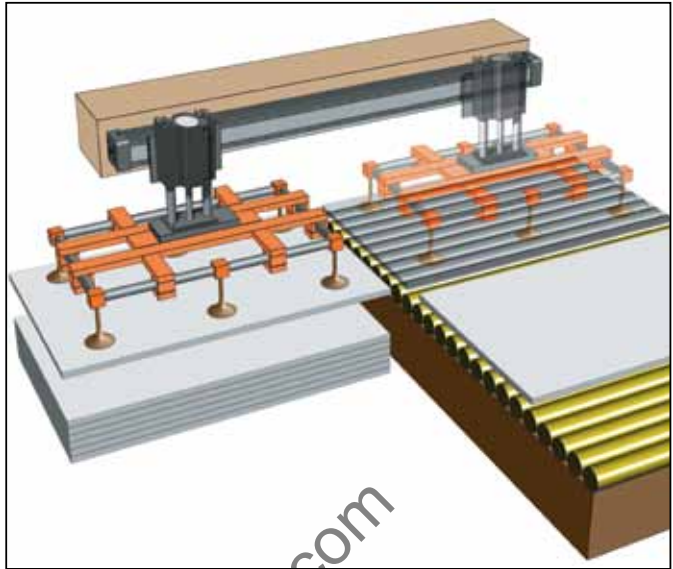
A manufacturer of ceramic blocks needed a method of stacking and moving heavy blocks for final packing. Speed, and power are critical; end-of-stroke position must be consistent. Tolomatic pneumatic products were chosen for this system.

## **APPLICATION REQUIREMENTS:**

- Fast response; 1 block must be moved and stacked each 3 seconds
- Movement from end-of-stroke to end-of-stroke with consistent positioning
- High power; able to move 43 lb. ceramic blocks
- Low cost

## **TOLOMATIC SOLUTION:**

This application uses a Tolomatic BC3 Band Cylinder. The BC3 was chosen because its high bending moment capacity allows it to support the high overhung load at the distance required.



## **APPLICATION DESCRIPTION:**

A manufacturer of battery chargers needed a method of taking sheet metal off of pallets and placing onto the assembly line. Speed is critical and end-of-stroke position must be consistent, thus, Tolomatic pneumatic products were chosen for this system.

## **APPLICATION REQUIREMENTS:**

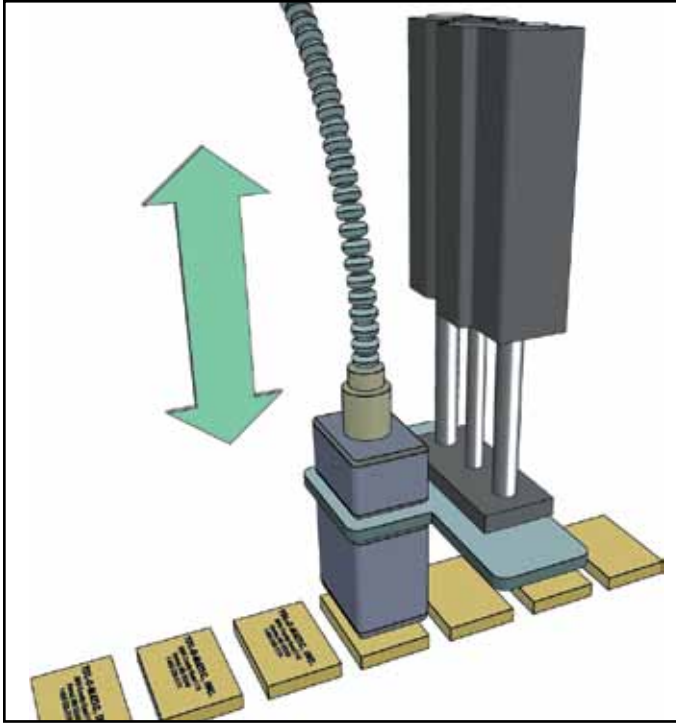
- Fast response, 1 part must be reoriented and moved each 3 seconds
- Movement from end-of-stroke to end-of-stroke with consistent positioning
- Low cost
- End-of-stroke adjustment

## **TOLOMATIC SOLUTION:**

This application uses a Tolomatic PB2 Rod Cylinder Slide, attached to a BC3 Band Cylinder with adjustable shocks. This actuator assembly moves the vacuum grid attachment that holds the sheet metal.



# APPLICATIONS



## **APPLICATION DESCRIPTION:**

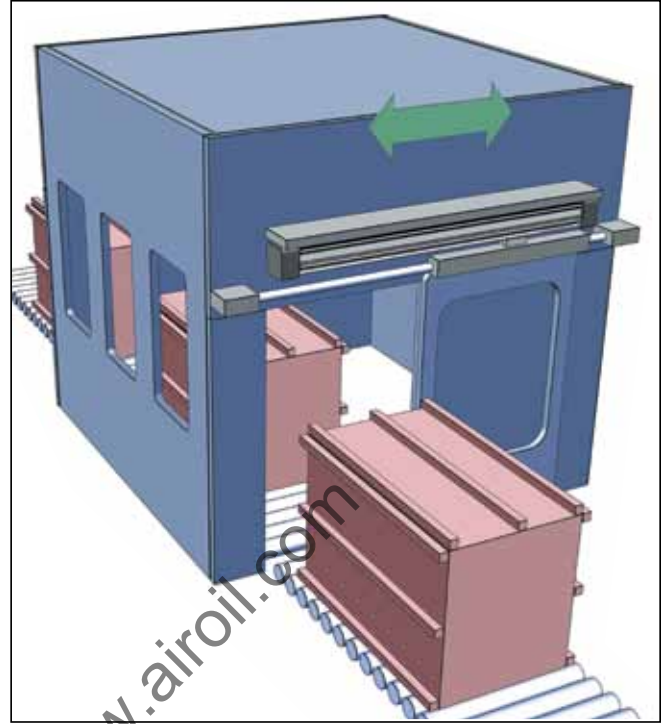
A manufacturer needed a method to stamp information on a plastic case.

## **APPLICATION REQUIREMENTS:**

- Fast response, less than 1 second
- Movement from end-of-stroke to end-of-stroke with consistent positioning
- Relatively high force applied

## **TOLOMATIC SOLUTION:**

This application uses a single Power-Block2 and custom adapter plate with customer's heat stamper.



## **APPLICATION DESCRIPTION:**

A manufacturer of automated spray booths needed actuators to open and close the doors on the spray booth. The doors were already guided and supported.

## **APPLICATION REQUIREMENTS:**

- Fast response; doors to open (close) within 2 seconds
- Movement from end-of-stroke to end-of-stroke with consistent positioning
- Low cost
- End-of-stroke cushioning

## **TOLOMATIC SOLUTION:**

This application had used a competitor's band cylinder in previous designs. The BC4 was chosen because it had the same envelope as the other band cylinder yet offered lower cost, with longer cylinder life. Because thousands of these spray booths are being made, the spray booth manufacturer was able to create a better product and improve its bottom line.

ABT

MXP

BCZ

BC3

BC4

LS

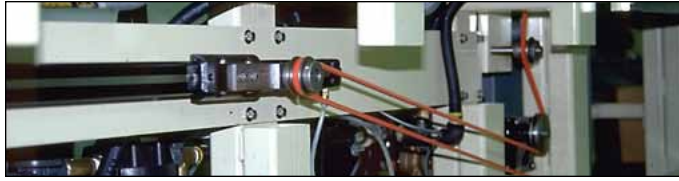
MG

CC

PB

ENGR

# APPLICATIONS



With over 50 years of application proven experience, Tolomatic pneumatic products are key components in the following industries and applications:

## INDUSTRY INSTALLATIONS

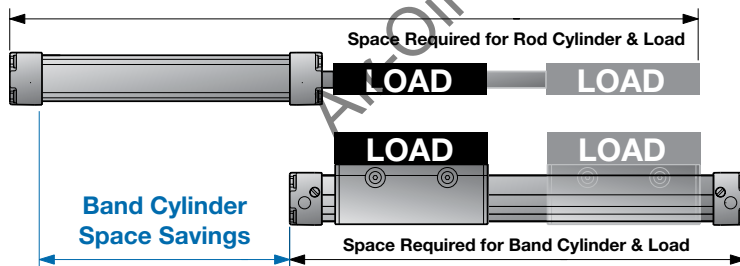
- Packaging
- Automotive
- Food and Beverage
- Material Handling & Conveying
- Plastic Injection Molding
- Metal Processing
- Paper and Textiles
- Medical
- Electronics
- Printing
- and More ...

## APPLICATIONS

- Material Handling
- Part Transfer
- Part Advancement
- Part Sorting
- Cutting
- Elevators
- Palletizing
- Door Closure
- Conveyors
- Robotics
- Machine Tools
- General Automation
- and More ...

## THE RODLESS ADVANTAGE

### TOLOMATIC RODLESS BAND CYLINDERS GET THE JOB DONE IN LESS SPACE THAN ROD STYLE CYLINDERS



**Consider this:** A rodless band cylinder contains its stroke within the cylinder itself. A 2" bore cylinder with a 24" stroke can provide a 43% space savings when compared to an equivalently sized rod cylinder. In addition, the load is supported throughout the entire stroke so there is minimal load deflection when compared to rod style cylinders.

With a Tolomatic Band Cylinder, there is no concern about rod rotation. Also, because rodless cylinders have equal piston areas in both directions, the cylinder experiences zero load variation in either direction.

**GO RODLESS AND SAVE SPACE!**

## ROD STYLE vs RODLESS FEATURE COMPARISON

Feature	Tolomatic Rodless	Rod Style
Integrated Load Support	✓	—
Space Saving Design	✓	—
Piston Seals Isolated from Load	✓	—
Internal Air Cushioning	✓	✓

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# WHAT YOU EXPECT FROM THE RODLESS LEADER



Tolomatic offers a complete line of linear motion products. We offer more rodless cylinder styles than any other company. Guided rod style actuators compliment our broad line of rodless pneumatic products.

## ● INNOVATIVE RODLESS PRODUCTS

Tolomatic created the rodless cylinder industry when we manufactured the original cable cylinder. For over 50 years, Tolomatic has been recognized as the rodless cylinder market leader. We earn that distinction daily by satisfying customers like you.

## ● ENDURANCE TECHNOLOGY<sup>SM</sup>

Every Tolomatic pneumatic product is designed and built with Endurance Technology<sup>SM</sup>. Material selection, from seals to finish, and every other design element is optimized for long life and excellent performance. The result is the best value and best performing pneumatic product in the market today. As one customer recently told us, "Your cylinders are built like a tank and run like a deer." Thank you!

## ● TRUST YOUR APPLICATION TO THE RODLESS LEADER

When you want the job done right, go with the experts. Long life. Durability. Ruggedness. Built to your specifications in 5 days or less. Only one company specializes in rodless technology. Tolomatic. The rodless leader.

Be sure to visit [www.tolomatic.com](http://www.tolomatic.com) for up-to-date product specifications, free sizing and selection software, and 3D CAD solid files.

ABT

IMXP

BC2

BC3

BC4

LS

MG

CC

PB

ENGR

# RODLESS CYLINDER COMPARISON



Use this table as a quick reference to help understand the differences and similarities of each product line

**ST** = Standard Feature      **OP** = Optional Feature      **-** = Not Available

FEATURE	MXP-N	MXP-S	MXP-P	BC4	BC2	BC3	LS	MG	MGS	CC
<b>Stainless Steel Band</b>	ST	ST	ST	ST	ST	ST	ST	-	-	-
<b>Internal Air Cushioning</b>	ST	ST	ST	ST	ST***	ST	-	-	-	ST
<b>Internal Polyurethane Bumper</b>	-	-	-	-	-	-	-	ST	-	-
<b>External Shock Absorbers</b>	OP	OP	OP	OP	OP*	OP	OP	-	OP	-
<b>Adjustable Shock Absorbers</b>	OP	OP	OP	-	OP*	OP	-	-	-	-
<b>Caliper Disc Brake</b>	-	-	-	-	-	-	-	-	-	OP
<b>Foot Mounts</b>	OP	OP	OP	OP	OP	OP	-	OP	-	-
<b>Tube Supports</b>	OP	OP	OP	OP	OP	OP	OP	-	-	-
<b>Floating Mount</b>	OP	OP	-	OP	OP	-	-	OP	-	-
<b>Auxiliary Carrier</b>	OP	OP	OP	OP	OP	OP	OP	-	-	-
<b>Dual 180° Carrier</b>	-	-	-	-	-	OP	-	-	-	-
<b>Proximity Sensors</b>	-	-	-	-	-	-	OP	-	OP	-
<b>Long Carrier</b>	-	-	-	OP	-	-	-	-	-	-
<b>Multi-Ported Head</b>	ST	ST	ST	ST	ST*	ST	ST	-	ST	OP
<b>Single End Porting</b>	OP	OP	OP	OP	-	ST	ST	-	-	-
<b>Sensors / Switches</b>	OP	OP	OP	OP	OP	OP	OP	OP	OP	OP**
<b>Carrier Bearing Type</b>	Engineered Resin	Engineered Resin	Profiled Rail	Engineered Resin	Engineered Resin	Recirculating Ball Bearing	LS05: Composite LS10: Ball Bearing	-	Composite, Sintered Bronze OR Ball Bearing	-
<b>Piston Isolated From Load</b>	ST	ST	ST	-	ST	ST	ST	ST	ST	ST
<b>Extruded Aluminum Tube</b>	ST	ST	ST	ST	ST	ST	ST	-	-	-

\*Not available for the BC205

\*\*Switches are not available for cable cylinders with steel tube

\*\*\*BC205 features external bumper

# MXP BAND CYLINDER

**ENDURANCE TECHNOLOGY<sup>SM</sup>**

- N** INTERNAL BEARING
- S** SOLID BEARING
- P** PROFILED RAIL



## CONTENTS

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ABT  
MXP  
BCB  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

ABT

MXP

BC2

BC3

BC4

LS

MG

CC

PB

ENGR



### Power Transmission

- *Float-A-Shaft®* and *Slide-Rite®* right-angle gearboxes turn power around any corner.
- *Caliper disc brakes* in mechanical, hydraulic, pneumatic and spring-applied models offer a wide variety of industrial stopping power.
- *Disc cone clutches* with high torque output and non-slip, dependable performance.

### Pneumatic Actuators

- *Largest selection of rodless cylinders* in band, cable, and magnetically coupled styles with a wide range of load capacities.
- *Rod slides* for maximum force in a short stroke package, perfect for conveyor stops or load lifting applications.
- *Vane rotary actuators* offer high torque density in a corrosion resistant housing.

### Electric Actuators

- *Rod screw actuators* for maximum thrust in short stroke applications. Guided screw models are available for applications that require additional guidance.
- *Integrated motor actuators* in both roller and ball screw technologies deliver high thrust capacities and 100% duty cycle.
- *Rodless screw and belt designs* solve a wide range of moment, load, precision, speed, and performance requirements.

# More solutions. Built to last.



## Drives & Motors

- *Brushless servo controllers, drives and motors* provide smooth, quiet operation and high performance.
- *Microstepping controllers, drives and motors* achieve precise positioning at economical prices.
- *Easy-to-use, Windows® based programming and setup software.*

## Customized Products

- *Quick turnaround on custom modifications* to Tolomatic standard products.
- *Linear motion solutions with custom design and prototype services.*
- *Your Motor Here* program matches a Tolomatic actuator to customer motor and supplies the in-line motor adapter plate free of charge, mounted and shipped with the actuator.

## Service & Tech Support

- *Fast service and full technical support.*
- *All catalog products are built-to-order and shipped in 5 days or less.*

**5 DAYS**  
BUILT-TO-ORDER

- *CAD files & sizing and selection software available online at [www.tolomatic.com](http://www.tolomatic.com)*



# INTRODUCING THE MXP BAND CYLINDER – DESIGNED TO OUTLAST EVERY RODLESS CYLINDER ON THE MARKET

The MXP pneumatic rodless cylinder is exactly what you expect from the industry's number one rodless supplier. Designed with our exclusive ENDURANCE TECHNOLOGY<sup>SM</sup> features, the MXP delivers superior performance to meet the most demanding applications. Nobody knows rodless like Tolomatic, and the MXP proves it.

- **DURABLE BEARINGS.** Three bearing choices to match your application needs. Profiled rail design uses THK<sup>®</sup> Caged Ball<sup>®</sup> technology to reduce friction and extend actuator life. Solid bearing design reduces stress concentration for optimum performance. Internal bearing design is permanently lubricated for long, trouble-free service.
- **DURABLE BANDS.** Stainless steel bands are stronger and will not elongate like elastomer (non-metallic) bands, providing reliable sealing over the life of the actuator.



## **[N]-INTERNAL BEARING**

- Low cost solution for applications with limited load and bending moment requirements
- Lowest breakaway pressure
- Best in many vertical applications
- Permanently lubed internal bearing

## **[S]-SOLID BEARING**

- Increased Mx moment capacity
- Large bearing surface contact area optimizes stress distribution on bearing for long service life
- Large carrier mounting pattern for more load stability and compatibility with existing BC2 applications
- Engineered bearing material does not require additional lubrication
- Solid bearings are field replaceable

## **[P]-PROFILED RAIL**

- THK<sup>®</sup> Caged Ball<sup>®</sup> bearings with reduced friction for reliable service life
- High load and bending moment capacities
- Low profile to fit your application
- High precision bearings feature smooth, low breakaway motion

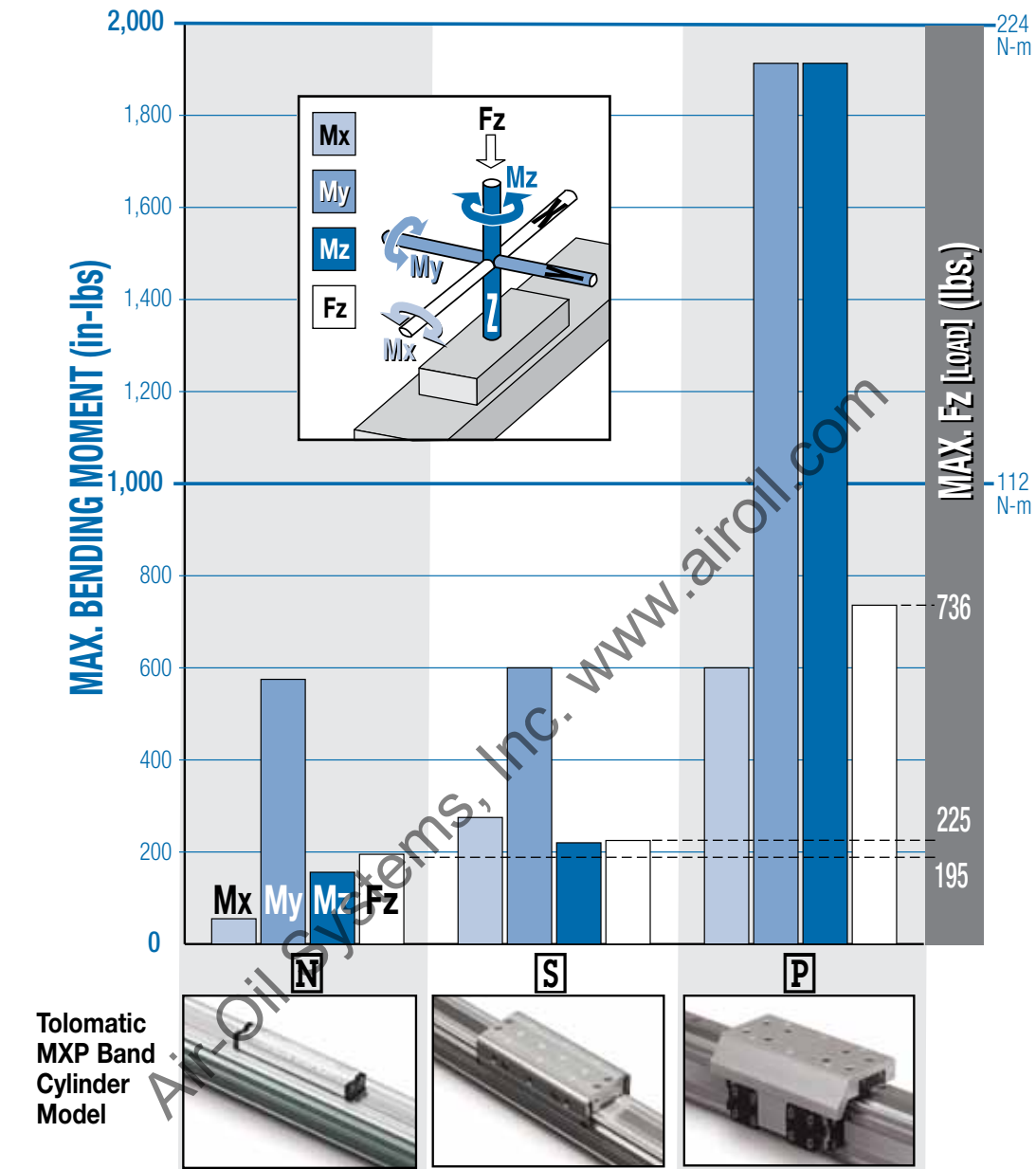


# SELECT THE PERFORMANCE YOU NEED

Choose from: • Three Bearing Models • Six Bore Sizes • Built to Your Specified Stroke Length!

## MOMENT & LOAD CAPACITY COMPARISON

Graph for model comparison, data from MXP40, 38mm (1.5") bore



Tolomatic  
MXP Band  
Cylinder  
Model

<b>Bearing Type</b>	Internal Bearing	Solid Bearing	Profiled Rail
<b>Moment Capacity</b>	Moderate	Moderate + Mx	High
<b>Isolated Piston</b>	No	Yes	Yes
<b>Ideal Applications</b>	<ul style="list-style-type: none"> <li>Guided Loads</li> <li>Vertical Orientation</li> </ul>	<ul style="list-style-type: none"> <li>Side Loads</li> <li>Impact Loads</li> </ul>	<ul style="list-style-type: none"> <li>High Moment Loads</li> <li>High Speeds with Heavy Loads</li> <li>High Precision</li> </ul>
<b>Product Details</b>	Page MXP_6	Page MXP_8	Page MXP_10

# INTERNAL BEARING

## ENDURANCE TECHNOLOGY<sup>SM</sup>

### STAINLESS STEEL BANDS

- Both interior sealing band and exterior dust band made of fatigue resistant stainless steel



STAINLESS STEEL IS DURABLE, FLEXIBLE AND CORROSION RESISTANT

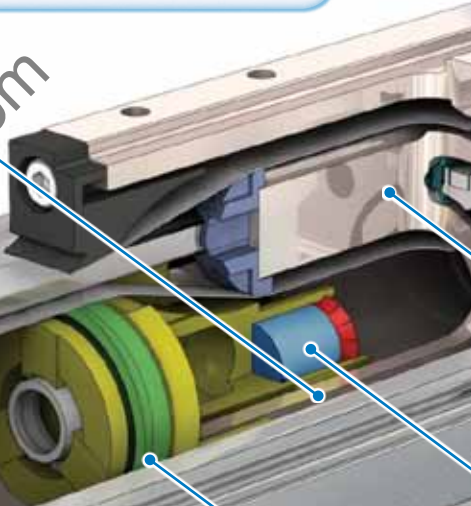
- Does not stretch like bands made of rubber or polymer materials
- Stainless steel sealing bands resist blow out during pressure spikes that may occur during high velocity cushioning

### RETAINED DUST BAND

- Retained dust band keeps contaminants from entering the cylinder interior, protecting components for reduced maintenance and increased uptime

### INTERNAL BEARINGS

- Design maximizes piston bearing surface area for less pressure on bearing surfaces, less pressure results in less wear
- Permanent lubrication for low friction and extended bearing life
- Internal location provides protection from external contaminants, extending life



### POSITIVE POSITION SEALS

- Sturdy U-cup base section assures positive positioning of seal lip for better sealing and less wear
- Made of custom formulated polyurethane for pliable, wear resistant seal lip



### DIRECT MOUNT

- Head bolts are tapped for direct mounting

### INCH OR METRIC MOUNTING

- Your choice of inch (US standard) or metric fasteners for carrier and head bolt mounting

### PORTING CHOICES

- 4-ported heads are standard to allow air connections on sides, end or bottom
- Single-end porting allows convenient one end air connection
- NPT, Metric Parallel (ISO-G/BSP) & Metric Taper (Rc/BST) available on both metric and inch (US standard) mount actuators

ABT

MXP

BC2

BC3

BC4

LS

MG

CC

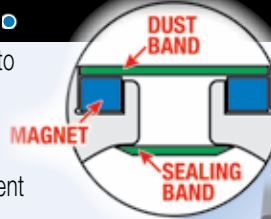
PB

ENGR

Air-Oil Systems, Inc. www.airoil.com

## NON-WEAR BAND RETENTION

- Magnetically retained bands are not subject to wear as are mechanically retained systems
- Immediate band engagement and release results in less drag on piston for lower breakaway force during initial carrier movement



## DUST WIPER

- Formed end cap and side dust wipers keep contaminants from entering the cylinder's internal area

## ADJUSTABLE CUSHIONS

- Easy screw adjustment for smooth deceleration protecting actuator from high stress at end-of-stroke
- Adjustable cushions with retained stainless steel needle screw for increased safety

NOTE: Boxed letters indicate ordering codes

## OPTIONS



### AUXILIARY CARRIER **D****W**

- 2X higher Fz (load) capacity
- High bending moment capacity



### FLOATING MOUNT **F****L**

- Compensates for non-parallelism between MXP band cylinder and externally guided load



### TUBE CLAMPS **T****C**

- Used for intermediate support
- Flush with bottom of actuator to retain low profile
- Drop-in, adjustable mounting locations



### FOOT MOUNTS **F****M**

- For end mounting of MXP band cylinder
- Use to bottom or side mount actuator



### SHOCK ABSORBERS **A****L** **S****L** **A****H** **S****H**

- Allows increased operating speed and load
- Self-compensates for load or speed changes
- Minimizes impact load to equipment
- Fixed or adjustable position shocks



### SINGLE-END PORTING **S**

- Convenient single-end air connection (not available on MXP16)



### SWITCHES

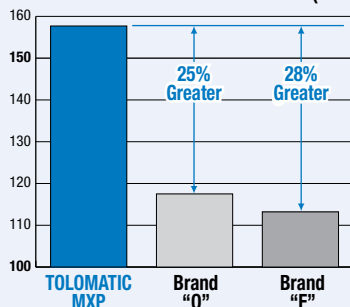
- Wide variety of sensing choices: Reed, Solid State PNP or NPN, all available normally open or normally closed
- Flush mount, drop-in installation, anytime
- Bright LEDs, power & signal indication
- CE rated, RoHS compliant

## HIGH STRENGTH PISTON

- Single piece extrusion for piston bracket and carrier reduces failure points
- Piston bracket neck cross-sectional area is up to 28% greater than competitive designs, providing increased durability



25mm PISTON BRACKET  
MINIMUM CROSS-SECTIONAL AREA (mm<sup>2</sup>)



## INTERNAL MAGNETS

- Standard feature that allows sensor installation on left, right or bottom of the extrusion

# S SOLID BEARING

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Endurance Technology features are designed for maximum durability to provide extended service life.

### STAINLESS STEEL BANDS

- Both interior sealing band and exterior dust band made of fatigue resistant stainless steel



STAINLESS STEEL IS DURABLE, FLEXIBLE AND CORROSION RESISTANT



- Does not stretch like bands made of rubber or polymer materials
- Stainless steel sealing bands resist blow out during pressure spikes that may occur during high velocity cushioning

### RETAINED DUST BAND

- Retained dust band keeps contaminants from entering the cylinder interior, protecting components for reduced maintenance and increased uptime

### POSITIVE POSITION SEALS

- Sturdy U-cup base section assures positive positioning of seal lip for better sealing and less seal wear
- Made of custom formulated polyurethane for pliable, wear resistant seal lip



### INTERNAL MAGNETS

- Standard feature that allows sensor installation on left, right or bottom of the extrusion

### ISOLATED PISTON

- Unique design isolates the piston from the applied load, extending the service life of the piston seals



- Piston remains isolated even when the carrier is deflected under load
- Piston bracket and carrier feature single piece extrusions, reducing failure points

### DIRECT MOUNT

- Head bolts are tapped for direct mounting

### INCH OR METRIC MOUNTING

- Your choice of inch (*US standard*) or metric fasteners for carrier and head bolt mounting

### PORTING CHOICES

- 4-ported heads are standard to allow air connections on sides, end or bottom
- Single-end porting allows convenient one end air connection
- NPT, Metric Parallel (ISO-G/BSP) & Metric Taper (Rc/BST) available on both metric and inch (*US standard*) mount actuators

ABT

MXP

BC2

BC3

BC4

LS

MG

CC

PB

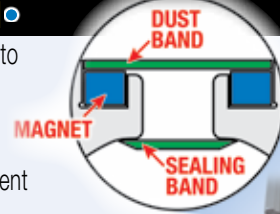
ENGR

## DUST WIPER

- Formed end cap and side dust wipers keep contaminants from entering the cylinder's internal area

## NON-WEAR BAND RETENTION

- Magnetically retained bands are not subject to wear as are mechanically retained systems
- Immediate band engagement and release results in less drag on piston for lower breakaway force during initial carrier movement



## ADJUSTABLE CUSHIONS

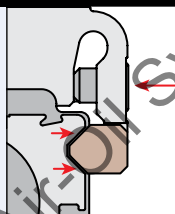
- Easy screw adjustment for smooth deceleration protecting actuator from high stress at end-of-stroke
- Adjustable cushions with retained stainless steel needle screw for increased safety

## LARGE FLEXIBLE MOUNTING PATTERN

- Carrier gives more load stability
- Compatibility with existing BC2 applications
- More fastening options

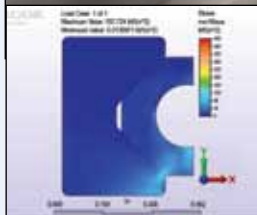
## NON-BINDING BEARING ARMS

- Bearings are tensioned indirectly, providing bind free adjustment



## TRAPEZOIDAL BEARINGS

- Trapezoidal design maximizes bearing surface area for less pressure on bearing surfaces; less pressure results in less wear
- Engineered bearing material has low static and dynamic friction with low wear properties for long lasting, smooth operation
- Bearings are field replaceable for extended service life



NOTE: Boxed letters indicate ordering codes

## OPTIONS



### AUXILIARY CARRIER **DW**

- 2X higher Fz (load) capacity
- High bending moment capacity



### FLOATING MOUNT **FL**

- Compensates for non-parallelism between MXP band cylinder and externally guided load



### TUBE CLAMPS **TC**

- Used for intermediate support
- Flush with bottom of actuator to retain low profile
- Drop-in, adjustable mounting locations



### FOOT MOUNTS **FM**

- For end mounting of MXP band cylinder
- Use to bottom or side mount actuator



### SHOCK ABSORBERS **AL SL AH SH**

- Allows increased operating speed and load
- Self-compensates for load or speed changes
- Minimizes impact load to equipment
- Fixed or adjustable position shocks



### SINGLE-END PORTING **S**

- Convenient single-end air connection (not available on MXP16)



### SWITCHES

- Wide variety of sensing choices: Reed, Solid State PNP or NPN, all available normally open or normally closed
- Flush mount, drop-in installation, anytime
- Bright LEDs, power & signal indication
- CE rated, RoHS compliant

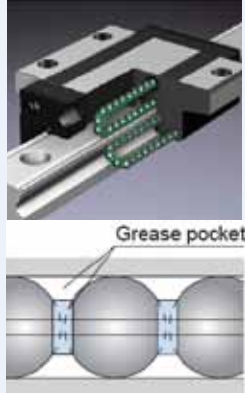
# P PROFILED RAIL

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Endurance Technology features are designed for maximum durability to provide extended service life.

### CAGED BALL<sup>®</sup> BEARINGS

- THK<sup>®</sup> Caged Ball<sup>®</sup> bearings are used to reduce friction and extend actuator life
- Caged Ball<sup>®</sup> technology creates a grease pocket between ball elements, reducing friction, noise and maintenance
- Large permissible moment loads
- Low profile caged ball bearings
- High speed operation, low heat generation
- High precision, smooth, low friction motion



### INTERNAL MAGNETS

- Standard feature that allows sensor installation on the open side or bottom of the extrusion

### POSITIVE POSITION SEALS

- Sturdy U-cup base section assures positive positioning of seal lip for better sealing and less seal wear
- Made of custom formulated polyurethane for pliable, wear resistant seal lip



### STAINLESS STEEL BANDS

- Both interior sealing band and exterior dust band made of fatigue resistant stainless steel



**STAINLESS STEEL IS DURABLE, FLEXIBLE AND CORROSION RESISTANT**

- Does not stretch like bands made of rubber or polymer materials
- Stainless steel sealing bands resist blow out during pressure spikes that may occur during high velocity cushioning

### PORTING CHOICES

- 4-ported heads are standard to allow air connections on side, top or end
- Single-end porting allows convenient one end air connection
- NPT, Metric Parallel (ISO-G/BSP) & Metric Taper (Rc/BST) available on both metric and inch (US standard) mount actuators

### DIRECT MOUNT

- Head bolts are tapped for direct mounting

### INCH OR METRIC MOUNTING

- Your choice of inch (US standard) or metric fasteners for carrier and head bolt mounting

## LOW CARRIER HEIGHT

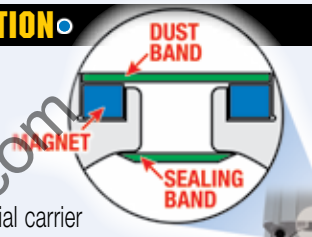
- Reduces overall cylinder envelope
- Large mounting pattern for high load stability

## ADJUSTABLE CUSHIONS

- Easy screw adjustment for smooth deceleration protecting actuator from high stress at end-of-stroke
- Adjustable cushions with retained stainless steel needle screw for increased safety

## NON-WEAR BAND RETENTION

- Magnetically retained bands are not subject to wear as are mechanically retained systems
- Immediate band engagement and release results in less drag on piston for lower breakaway force during initial carrier movement



## RETAINED DUST BAND

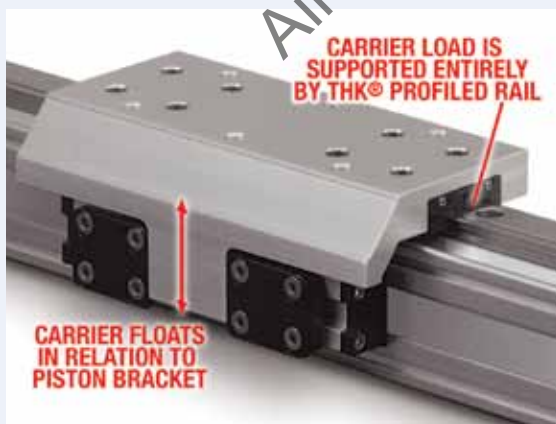
- Retained dust band keeps contaminants from entering the cylinder interior, protecting components for reduced maintenance and increased uptime

## DUST WIPER

- Formed end cap and side dust wipers keep contaminants from entering the cylinder's internal area

## ISOLATED PISTON

- Unique design isolates the piston from the applied load, extending the service life of the piston seals



- Piston remains isolated even when the carrier is deflected under load
- Piston bracket and carrier feature single piece extrusions, reducing failure points

NOTE: Boxed letters indicate ordering codes

## OPTIONS



### AUXILIARY CARRIER **D****W**

- 2X higher Fz (load) capacity
- High bending moment capacity



### TUBE CLAMPS **T****C**

- Used for intermediate support
- Flush with bottom of actuator to retain low profile
- Drop-in, adjustable mounting locations



### FOOT MOUNTS **F****M**

- For end mounting of MXP band cylinder
- Use to bottom or side mount actuator



### SHOCK ABSORBERS **A****L** **S****L** **A****H** **S****H**

- Allows increased operating speed and load
- Self-compensates for load or speed changes
- Minimizes impact load to equipment
- Fixed or adjustable position shocks



### SINGLE-END PORTING **S**

- Convenient single-end air connection (not available on MXP16)



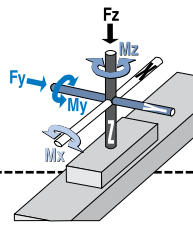
### SWITCHES

- Wide variety of sensing choices: Reed, Solid State PNP or NPN, all available normally open or normally closed
- Flush mount, drop-in installation, anytime
- Bright LEDs, power & signal indication
- CE rated, RoHS compliant

# SELECTION GUIDELINES

## 1 COMPILE APPLICATION REQUIREMENTS

### APPLICATION DATA WORKSHEET



#### STROKE LENGTH \_\_\_\_\_

inch (S I K) (U.S. Standard)     millimeters (S M) (Metric)

#### AVAILABLE AIR PRESSURE \_\_\_\_\_

PSI (U.S. Standard)     bar (Metric)

#### REQUIRED THRUST FORCE \_\_\_\_\_

lbf (U.S. Standard)     N (Metric)

#### LOAD \_\_\_\_\_

lb (U.S. Standard)     kg (Metric)

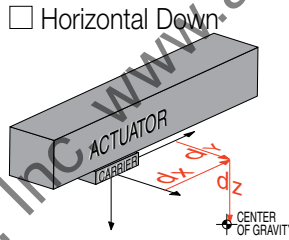
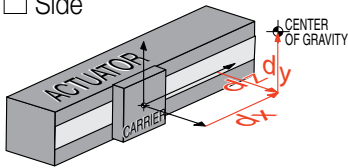
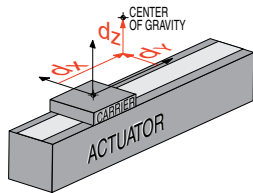
#### LOAD CENTER OF GRAVITY DISTANCE TO CARRIER CENTER

$d_x$  \_\_\_\_\_  
 $d_y$  \_\_\_\_\_  
 $d_z$  \_\_\_\_\_

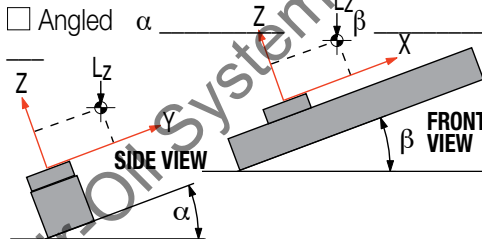
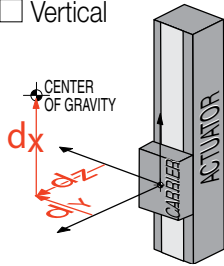
inch (U.S. Standard)     millimeters (Metric)

#### ORIENTATION

Horizontal     Side     Horizontal Down



Vertical



#### OTHER ISSUES:

(i.e. Environment, Temperature, Contamination, etc.)

#### FORCES APPLIED TO CARRIER

lbf (U.S. Standard)     N (Metric)

$F_z$  \_\_\_\_\_  
 $F_y$  \_\_\_\_\_

#### BENDING MOMENTS APPLIED TO CARRIER

in-lbs (U.S. Standard)     N-m (Metric)

$M_x$  \_\_\_\_\_  
 $M_y$  \_\_\_\_\_  
 $M_z$  \_\_\_\_\_

#### FINAL VELOCITY \_\_\_\_\_

in/sec (U.S. Standard)     mm/sec (Metric)

#### MOVE TIME sec. \_\_\_\_\_

#### NO. OF CYCLES \_\_\_\_\_

per minute     per hour

The process of selecting a load bearing actuator for a given application can be complex. **It is highly recommended that you contact Tolomatic for assistance in selecting the best actuator for your application.** The following overview of the selection guidelines are for educational purposes only.

## 2 DETERMINE BORE SIZE

- Consult the Theoretical Force vs. Pressure graph. (See graph at right)
- Find the intersection of the available pressure and required thrust force. If the intersection falls below the plotted bore size curve, the actuator will supply adequate force for the application. If the intersection is above the curve, a larger cylinder bore size will be required.

**NOTE:** Additional force may be required to obtain the necessary acceleration within desired cycle time.

## 3 COMPARE LOAD TO MAXIMUM LOAD CAPACITIES

Calculate the following static loads:  $M_x$ ,  $M_y$ ,  $M_z$ ,  $F_y$ ,  $F_z$

Loads = Applied Moments + Forces

If the load of your application exceeds figures indicated in the MOMENT AND LOAD CAPACITY tables (See pages MXP\_14-19) consider:

- 1.) Higher capacity bearing style, i.e. **N** to **S**, **S** to **P**
- 2.) Larger Bore Cylinder
- 3.) Auxiliary Carrier
- 4.) Add External Guides

Contact information: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**STOP** Fax (1-763-478-8080) or call Tolomatic (1-800-328-2174) with the above information. We will provide any assistance needed to determine the proper MXP Band Cylinder.

ABT

MXP

BC2

BC3

BC4

LS

MG

CC

PB

ENGR



# 4 CALCULATE LOAD FACTOR $L_F$

For combined loads the Load Factor ( $L_F$ ) must not exceed the value 1.

$$L_F = \frac{M_x}{M_{x_{max}}} + \frac{M_y}{M_{y_{max}}} + \frac{M_z}{M_{z_{max}}} + \frac{F_y}{F_{y_{max}}} + \frac{F_z}{F_{z_{max}}} \leq 1$$

If  $L_F$  exceeds the value 1, then consider the four choices listed in step #3.

## SHOCKS

If the intersection of the final velocity and load mass falls in the shaded regions, then shock absorbers should be used.

## 6 CONSIDER PEAK DYNAMIC INERTIA MOMENTS

When a rigidly attached load mass is accelerated or decelerated, its inertia induces

are excessive, consider the four choices listed in step #3 or consider these deceleration methods:

- Reduce final velocity with flow controls or reduced pressure.
- Pneumatic valve deceleration circuits. By reducing the speed before the cushion or shock is reached, the load can decelerate over a longer distance, thereby reducing the deceleration moments.
- Position shock absorbers at the load's center of gravity. This will greatly reduce the moment load applied to the carrier.

## PROFILED RAIL DECELERATION CONSIDERATIONS

While the **P** Profiled Rail MXP is capable of carrying very large loads, consideration must be given to how to stop the load at the end of stroke. If Tolomatic cushions or shocks are used, stay within the specifications defined. If another type of shock absorber is used, be sure that the deceleration of the load is smooth and over an adequate distance.

## 7 DETERMINE TUBE CLAMP REQUIREMENTS

- Consult the Tube Clamp Requirement chart for the model selected (page MXP\_23-24).
- Cross-reference the load force and maximum distance between supports.
- Divide stroke length by max. distance calculated above to determine number of tube clamps to order.

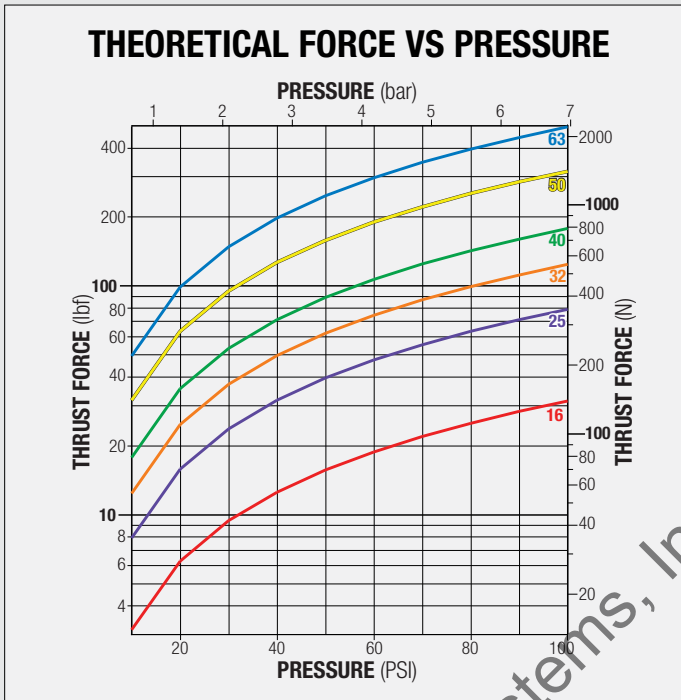
## 8 CONSIDER PORTING AND OPTIONS

- Choose Single End Porting or Dual End Porting

- Choose NPT, Metric Parallel (ISO-G/BSP) or Metric Taper (Rc/BST) Ports

### OPTIONS:

- Switches – Reed, Solid State PNP or NPN, all available normally open or normally closed
- Shock Absorbers – Heavy or light duty, fixed or adjustable mount – recommended for longer life in most applications
- Foot Mounts
- Floating Mount Bracket – used when lack of parallelism occurs between the cylinder and an externally guided and supported load. Available for **N** internal & **S** solid bearing styles



## 5 DETERMINE CUSHION & SHOCK CAPACITY

Consult the Cushion and Shock Absorber Performance charts for the model selected (see page MXP\_22). The velocities listed on the cushion charts are final or impact velocities. If the final or impact velocity is not known, use of valve deceleration circuits or shock absorbers should be considered.

### CUSHIONS

Find the intersection of the final velocity and load mass. If the intersection is below the diagonal lines, the internal cushions on the actuator may be used.

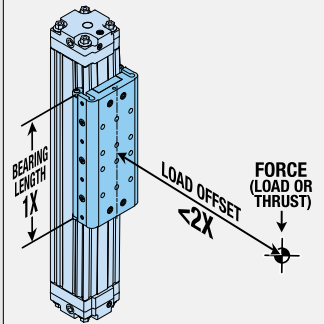
bending moments on the carrier. The magnitude of these inertia moments can be larger than the applied loads. Careful attention to how the load is decelerated at the end of stroke is required for extended actuator performance and application safety.

Evaluate the dynamic inertia moment data:

- 1.) The length of deceleration distance
- 2.) The load attached to the carrier
- 3.) The distance of the load mass center of gravity from the carrier, and
- 4.) The final velocity of the carrier.

If dynamic inertia moments

## S SOLID BEARING 2:1 RULE



For applications using **S** solid bearings, binding or interrupted motion may occur if the load offset is equal to or greater than twice the bearing length (1X). *LOAD OFFSET* is defined as: the distance from the applied force (or the load center of gravity) to the centerline of the carrier.

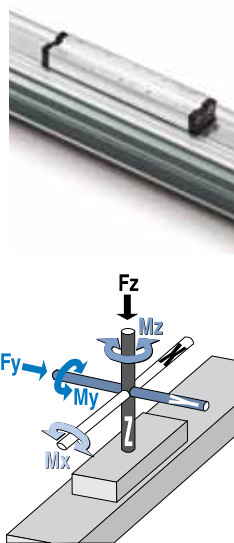
If the load offset cannot be changed consider:

- 1.) Higher capacity bearing style, i.e. **S** to **P**
- 2.) Larger Bore Cylinder
- 3.) Auxiliary Carrier
- 4.) Add External Guides

# MOMENT AND LOAD CAPACITY

**INTERNAL BEARING**

## STANDARD



BORE			MAXIMUM BENDING MOMENTS			MAX. LOAD	THRUST (at 100 PSI)
			Mx	My	Mz	Fz	
1 6	Inch	0.63 in	3 in-lbs	35 in-lbs	5 in-lbs	30 lbf	30.7 lbf
	Metric	16 mm	0.3 N-m	4.0 N-m	0.6 N-m	133 N	136 N
2 5	Inch	1.00 in	9 in-lbs	132 in-lbs	27 in-lbs	65 lbf	78.5 lbf
	Metric	25 mm	1.0 N-m	14.9 N-m	3.1 N-m	289 N	349 N
3 2	Inch	1.25 in	36 in-lbs	318 in-lbs	120 in-lbs	115 lbf	123 lbf
	Metric	32 mm	4.1 N-m	35.9 N-m	13.6 N-m	512 N	546 N
4 0	Inch	1.50 in	55 in-lbs	575 in-lbs	156 in-lbs	195 lbf	177 lbf
	Metric	38 mm	6.2 N-m	65 N-m	17.6 N-m	867 N	786 N
5 0	Inch	2.00 in	98 in-lbs	1,017 in-lbs	172 in-lbs	270 lbf	314 lbf
	Metric	50 mm	11.1 N-m	115 N-m	19.4 N-m	1,201 N	1,397 N
6 3	Inch	2.50 in	120 in-lbs	1,776 in-lbs	216 in-lbs	370 lbf	491 lbf
	Metric	64 mm	13.6 N-m	201 N-m	24.4 N-m	1,646 N	2,184 N

**⚠ Ratings are the maximum values for shock-free, vibration-free operation in a typical industrial environment. Contact Tolomatic for assistance in selecting the most appropriate actuator for your application.**

The moment and load capacity of the actuator's bearing system is based on an L10 life of 200,000,000 linear inches of travel. Life of the actuator will vary for each application depending on the combined loads, motion parameters and operating conditions. The load factor ( $L_F$ ) ratios for each application must not exceed a value of 1 (as calculated below). Exceeding a load factor of 1 will diminish the actuator's rated life.

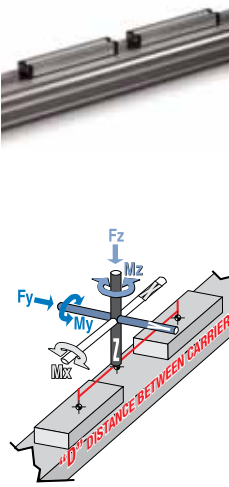
$$L_F = \frac{M_x}{M_{x_{max}}} + \frac{M_y}{M_{y_{max}}} + \frac{M_z}{M_{z_{max}}} + \frac{F_y}{F_{y_{max}}} + \frac{F_z}{F_{z_{max}}} \leq 1$$

With combined loads,  $L_F$  must not exceed the value 1.

# MOMENT AND LOAD CAPACITY

**IN** INTERNAL BEARING

**DW** AUXILIARY CARRIER



BORE			"D" MIN	MAXIMUM BENDING MOMENTS			MAX. LOAD FzA	THRUST (at 100 PSI)
	Inch	mm		MxA	MyA*	MzA*		
16	Inch	0.63 in	5.0 in	3 in-lbs	150 in-lbs	81 in-lbs	60 lbf	30.7 lbf
	Metric	16 mm	127 mm	0.3 N-m	16.9 N-m	9.1 N-m	267 N	136 N
25	Inch	1.00 in	6.0 in	9 in-lbs	390 in-lbs	143 in-lbs	130 lbf	78.5 lbf
	Metric	25 mm	152 mm	1.0 N-m	44.1 N-m	16.2 N-m	578 N	349 N
32	Inch	1.25 in	7.0 in	36 in-lbs	805 in-lbs	302 in-lbs	230 lbf	123 lbf
	Metric	32 mm	178 mm	4.1 N-m	91.0 N-m	34.1 N-m	1,023 N	546 N
40	Inch	1.50 in	8.5 in	55 in-lbs	1,658 in-lbs	413 in-lbs	390 lbf	177 lbf
	Metric	38 mm	216 mm	6.2 N-m	187 N-m	46.7 N-m	1,735 N	786 N
50	Inch	2.00 in	8.6 in	98 in-lbs	2,322 in-lbs	707 in-lbs	540 lbf	314 lbf
	Metric	50 mm	218 mm	11.1 N-m	262 N-m	79.8 N-m	2,402 N	1,397 N
63	Inch	2.50 in	13.0 in	120 in-lbs	4,810 in-lbs	808 in-lbs	740 lbf	491 lbf
	Metric	64 mm	330 mm	13.6 N-m	544 N-m	91.0 N-m	3,292 N	2,184 N

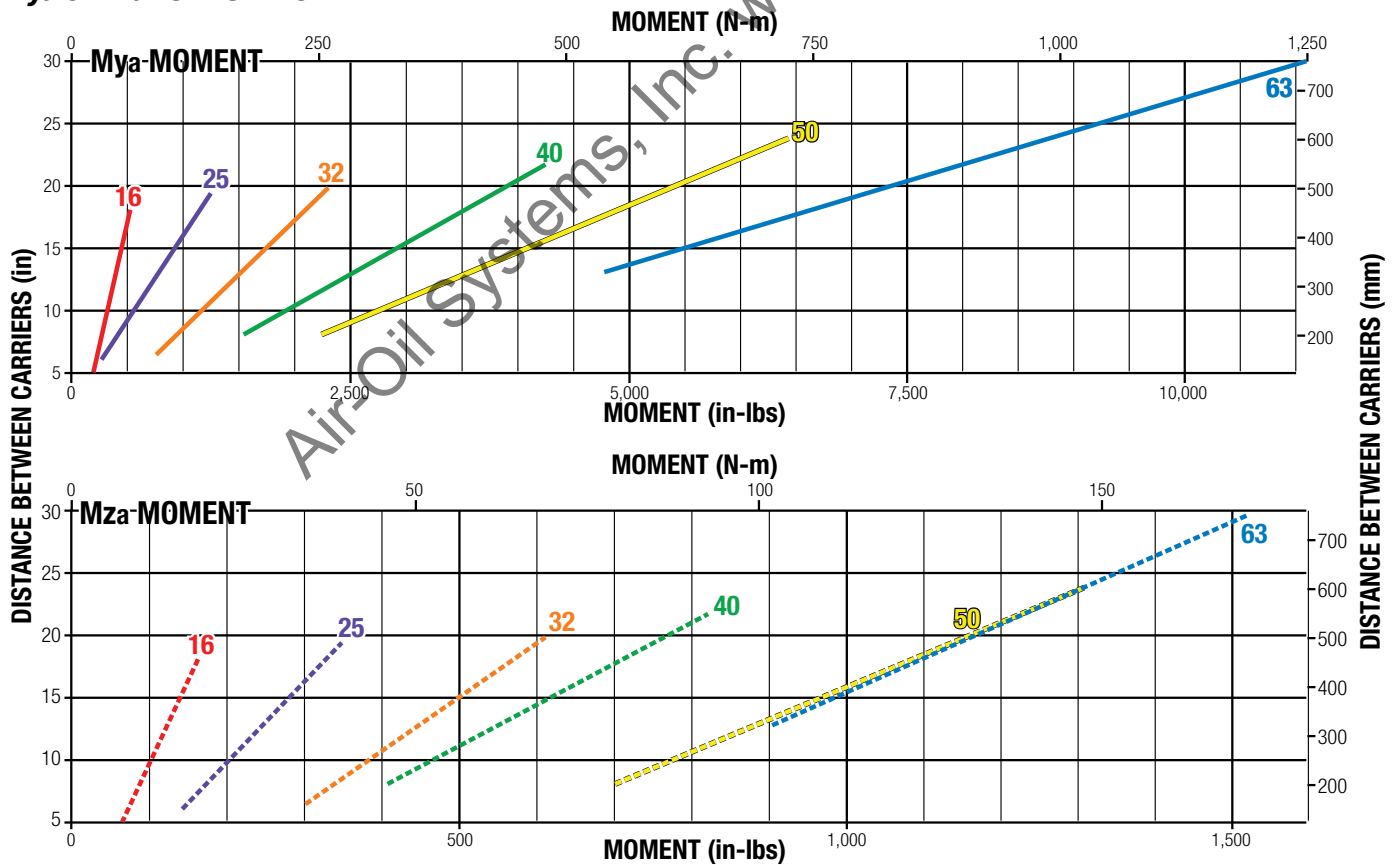
\*At minimum "D" distance between carriers see graph below for other distances

With combined loads,  $L_F$  must not exceed the value 1.

$$L_F = \frac{M_x}{M_{x_{max}}} + \frac{M_y}{M_{y_{max}}} + \frac{M_z}{M_{z_{max}}} + \frac{F_y}{F_{y_{max}}} + \frac{F_z}{F_{z_{max}}} \leq 1$$

**⚠** Ratings are the maximum values for shock-free, vibration-free operation in a typical industrial environment. Contact Tolomatic for assistance in selecting the most appropriate actuator for your application.

## Mya & Mza vs. DISTANCE



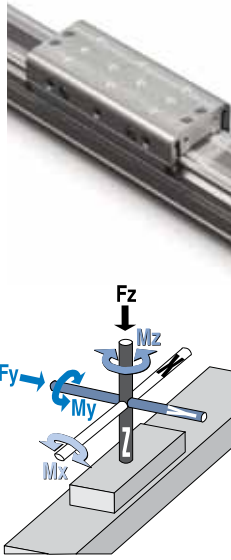
Ratings were calculated with the following conditions:

- 1.) Coupling between carriers is rigid.
- 2.) Load is equally distributed between carriers.
- 3.) Coupling device applies no misaligned loads to carriers.

# MOMENT AND LOAD CAPACITY

**S** SOLID BEARING

## STANDARD



BORE			MAXIMUM BENDING MOMENTS			MAX. LOAD	THRUST
			M <sub>x</sub>	M <sub>y</sub>	M <sub>z</sub>	F <sub>z</sub>	(at 100 PSI)
1 6	Inch	0.63 in	22 in-lbs	19 in-lbs	25 in-lbs	35 lbf	30.7 lbf
	Metric	16 mm	2.5 N-m	2.1 N-m	2.8 N-m	156 N	136 N
2 5	Inch	1.00 in	60 in-lbs	110 in-lbs	34 in-lbs	70 lbf	78.5 lbf
	Metric	25 mm	6.8 N-m	12.4 N-m	3.8 N-m	311 N	349 N
3 2	Inch	1.25 in	100 in-lbs	350 in-lbs	140 in-lbs	150 lbf	123 lbf
	Metric	32 mm	11.3 N-m	39.5 N-m	15.8 N-m	667 N	546 N
4 0	Inch	1.50 in	275 in-lbs	600 in-lbs	220 in-lbs	225 lbf	177 lbf
	Metric	38 mm	31.1 N-m	67.8 N-m	24.9 N-m	1,001 N	786 N
5 0	Inch	2.00 in	315 in-lbs	1,155 in-lbs	341 in-lbs	315 lbf	314 lbf
	Metric	50 mm	35.6 N-m	131 N-m	38.5 N-m	1,401 N	1,397 N
6 3	Inch	2.50 in	585 in-lbs	2,340 in-lbs	520 in-lbs	520 lbf	491 lbf
	Metric	64 mm	66.1 N-m	264 N-m	58.8 N-m	2,313 N	2,184 N

**!** Ratings are the maximum values for shock-free, vibration-free operation in a typical industrial environment. Contact Tolomatic for assistance in selecting the most appropriate actuator for your application.

The moment and load capacity of the actuator's bearing system is based on an L10 life of 200,000,000 linear inches of travel. Life of the actuator will vary for each application depending on the combined loads, motion parameters and operating conditions. The load factor ( $L_F$ ) ratios for each application must not exceed a value of 1 (as calculated below). Exceeding a load factor of 1 will diminish the actuator's rated life.

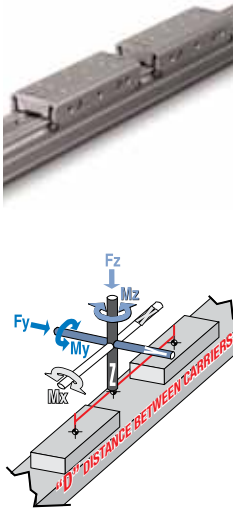
$$L_F = \frac{M_x}{M_{x_{max}}} + \frac{M_y}{M_{y_{max}}} + \frac{M_z}{M_{z_{max}}} + \frac{F_y}{F_{y_{max}}} + \frac{F_z}{F_{z_{max}}} \leq 1$$

With combined loads,  $L_F$  must not exceed the value 1.

# MOMENT AND LOAD CAPACITY

**S** SOLID BEARING

**DW** AUXILIARY CARRIER



BORE			"D" MIN	MAXIMUM BENDING MOMENTS*			MAX. LOAD	THRUST
				MxA	MyA	MzA	FzA	(at 100 PSI)
1 6	Inch	0.63 in	5.0 in	44 in-lbs	175 in-lbs	175 in-lbs	70 lbf	30.7 lbf
	Metric	16 mm	127 mm	5.0 N-m	19.8 N-m	19.8 N-m	311 N	136 N
2 5	Inch	1.00 in	6.0 in	120 in-lbs	420 in-lbs	420 in-lbs	140 lbf	78.5 lbf
	Metric	25 mm	152 mm	13.6 N-m	47.5 N-m	47.5 N-m	623 N	349 N
3 2	Inch	1.25 in	7.0 in	200 in-lbs	1,050 in-lbs	1,050 in-lbs	300 lbf	123 lbf
	Metric	32 mm	178 mm	22.6 N-m	119 N-m	119 N-m	1,334 N	546 N
4 0	Inch	1.50 in	8.5 in	550 in-lbs	1,913 in-lbs	1,913 in-lbs	450 lbf	177 lbf
	Metric	38 mm	216 mm	62.1 N-m	216 N-m	216 N-m	2,002 N	786 N
5 0	Inch	2.00 in	8.6 in	630 in-lbs	2,709 in-lbs	2,709 in-lbs	630 lbf	314 lbf
	Metric	50 mm	218 mm	71.2 N-m	306 N-m	306 N-m	2,802 N	1,397 N
6 3	Inch	2.50 in	13.0 in	1,170 in-lbs	6,760 in-lbs	6,760 in-lbs	1,040 lbf	491 lbf
	Metric	64 mm	330 mm	132 N-m	764 N-m	764 N-m	4,626 N	2,184 N

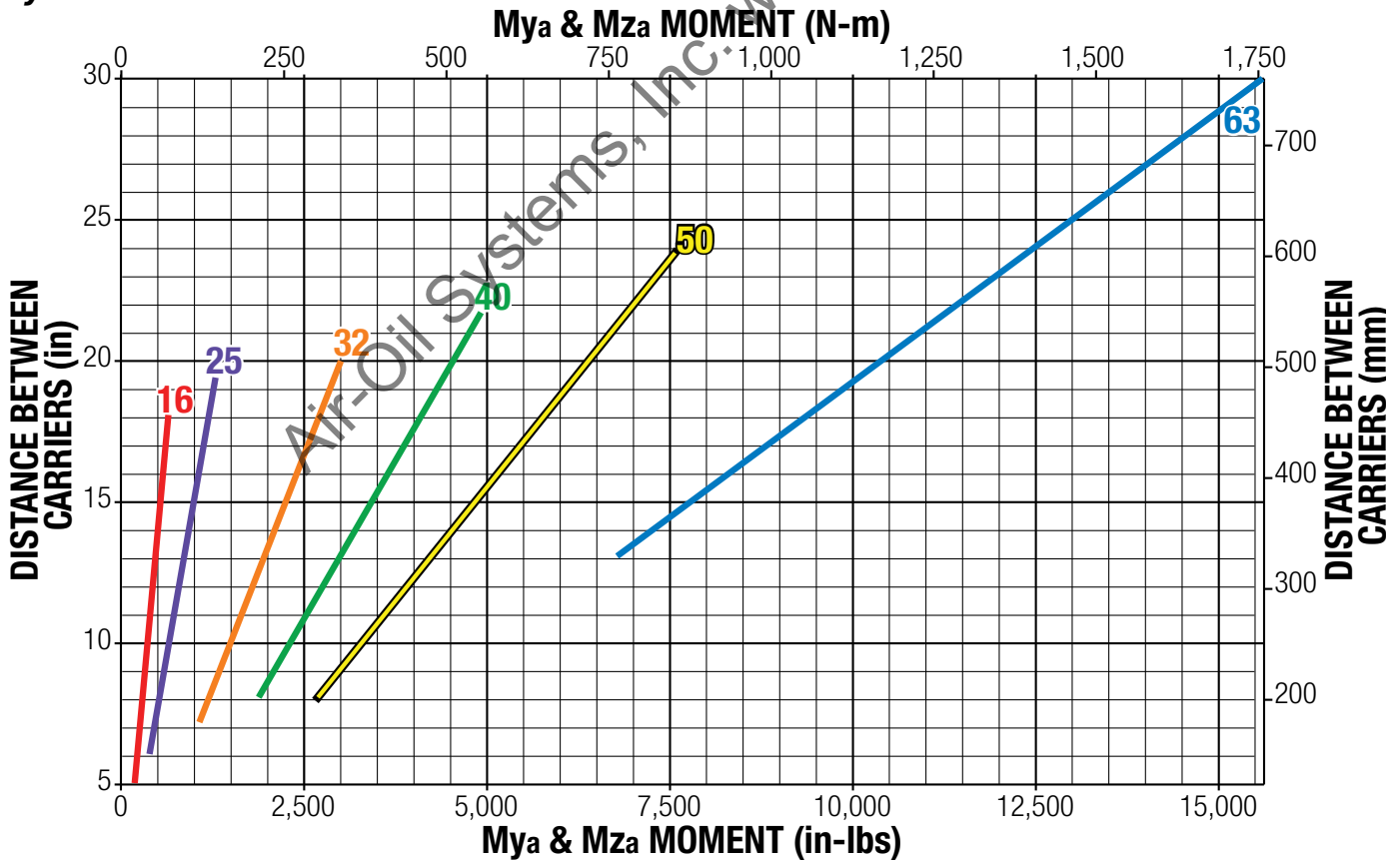
\*At minimum "D" distance between carriers see graph below for other distances

With combined loads, \$L\_f\$ must not exceed the value 1.

$$L_f = \frac{M_x}{M_{x_{max}}} + \frac{M_y}{M_{y_{max}}} + \frac{M_z}{M_{z_{max}}} + \frac{F_y}{F_{y_{max}}} + \frac{F_z}{F_{z_{max}}} \leq 1$$

**⚠** Ratings are the maximum values for shock-free, vibration-free operation in a typical industrial environment. Contact Tolomatic for assistance in selecting the most appropriate actuator for your application.

## Mya & Mza vs. DISTANCE



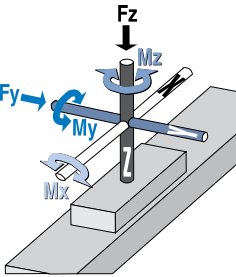
Ratings were calculated with the following conditions:

- 1.) Coupling between carriers is rigid.
- 2.) Load is equally distributed between carriers.
- 3.) Coupling device applies no misaligned loads to carriers.

# MOMENT AND LOAD CAPACITY

**P** PROFILED RAIL

## STANDARD



BORE		MAXIMUM BENDING MOMENTS			MAX. LOAD		THRUST (at 100 PSI)	
		M <sub>x</sub>	M <sub>y</sub>	M <sub>z</sub>	F <sub>y</sub>	F <sub>z</sub>		
1 6	Inch	0.63 in	39 in-lbs	339 in-lbs	339 in-lbs	217 lbf	217 lbf	30.7 lbf
	Metric	16 mm	4.5 N-m	38.3 N-m	38.3 N-m	966 N	966 N	136 N
2 5	Inch	1.00 in	126 in-lbs	502 in-lbs	377 in-lbs	449 lbf	449 lbf	78.5 lbf
	Metric	25 mm	14.3 N-m	56.7 N-m	42.6 N-m	1,996 N	1,996 N	349 N
3 2	Inch	1.25 in	226 in-lbs	1,344 in-lbs	1,344 in-lbs	569 lbf	569 lbf	123 lbf
	Metric	32 mm	25.6 N-m	152 N-m	152 N-m	2,531 N	2,531 N	546 N
4 0	Inch	1.50 in	600 in-lbs	1,913 in-lbs	1,913 in-lbs	736 lbf	736 lbf	177 lbf
	Metric	38 mm	67.8 N-m	216 N-m	216 N-m	3,274 N	3,274 N	786 N
5 0	Inch	2.00 in	811 in-lbs	3,483 in-lbs	3,483 in-lbs	1,014 lbf	1,014 lbf	314 lbf
	Metric	50 mm	91.7 N-m	394 N-m	394 N-m	4,510 N	4,510 N	1,397 N
6 3	Inch	2.50 in	1,019 in-lbs	5,339 in-lbs	5,339 in-lbs	1,292 lbf	1,292 lbf	491 lbf
	Metric	64 mm	115 N-m	603 N-m	603 N-m	5,745 N	5,745 N	2,184 N

**NOTE:** Mating surface of component mounted to carrier must maintain a flatness of at least 0.0015" (0.040 mm)

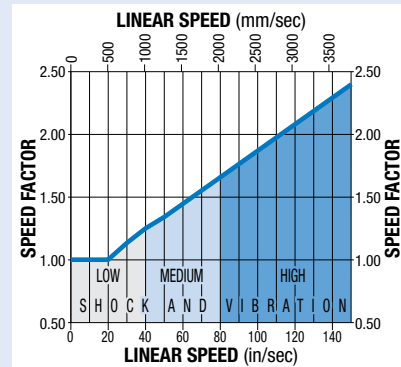
**Ratings are the maximum values for shock-free, vibration-free operation in a typical industrial environment. Contact Tolomatic for assistance in selecting the most appropriate actuator for your application.**



Use sizing software or call Tolomatic (1-800-328-2174) with application information. We will provide any assistance needed to determine the proper MXP band cylinder.

### SPEED FACTOR

FOR APPLICATIONS WITH HIGH SPEED OR SIGNIFICANT SHOCK AND VIBRATION: Calculated values of loads and bending moments must be increased by speed factor from the graph at right to obtain full rated life of profiled rail bearing system.



The moment and load capacity of the actuator's bearing system is based on an L10 life of 200,000,000 linear inches of travel. Life of the actuator will vary for each application depending on the combined loads, motion parameters and operating conditions. The load factor (L<sub>F</sub>) ratios for each application must not exceed a value of 1 (as calculated below). Exceeding a load factor of 1 will diminish the actuator's rated life.

$$L_F = \frac{M_x}{M_{x_{max}}} + \frac{M_y}{M_{y_{max}}} + \frac{M_z}{M_{z_{max}}} + \frac{F_y}{F_{y_{max}}} + \frac{F_z}{F_{z_{max}}} \leq 1$$

With combined loads, L<sub>F</sub> must not exceed the value 1.

### PROFILED RAIL LUBRICATION

Proper lubrication of profiled rail bearing system is essential for normal operation and achievement of full rated life of MX--P actuators. Lubrication should be performed at intervals of 4,000,000 inches of travel or once every year, whichever occurs first. **However, operating conditions such as high speed or significant shock and vibration may require more frequent lubrication.** Please consult Tolomatic for recommendations.

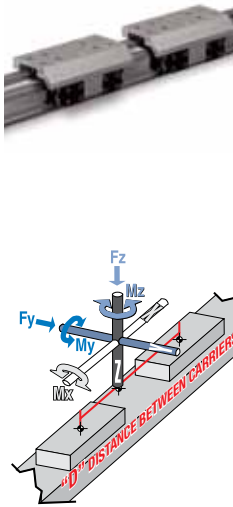
#### Recommended grease types:

1. Refined mineral oil-based multi-purpose grease with lithium thickening agent.
2. High-grade synthetic oil-based grease with urea thickening agent.

# MOMENT AND LOAD CAPACITY

**P** PROFILED RAIL

**DW** AUXILIARY CARRIER



BORE	"D" MIN		MAXIMUM BENDING MOMENTS*			MAX. LOAD		THRUST (at 100 PSI)	
	Inch	mm	MxA	MyA	MzA	FzA	FyA		
1 6	Inch	0.63 in	5.0 in	79 in-lbs	620 in-lbs	620 in-lbs	434 lbf	434 lbf	30.7 lbf
	Metric	16 mm	127 mm	8.9 N-m	70.1 N-m	70.1 N-m	1,932 N	1,932 N	136 N
2 5	Inch	1.00 in	6.0 in	252 in-lbs	1,610 in-lbs	1,610 in-lbs	898 lbf	898 lbf	78.5 lbf
	Metric	25 mm	152 mm	28.5 N-m	182 N-m	182 N-m	3,993 N	3,993 N	349 N
3 2	Inch	1.25 in	7.0 in	453 in-lbs	2,202 in-lbs	2,202 in-lbs	1,138 lbf	1,138 lbf	123 lbf
	Metric	32 mm	178 mm	51.1 N-m	249 N-m	249 N-m	5,063 N	5,063 N	546 N
4 0	Inch	1.50 in	8.5 in	1,208 in-lbs	3,601 in-lbs	3,601 in-lbs	1,472 lbf	1,472 lbf	177 lbf
	Metric	38 mm	216 mm	137 N-m	407 N-m	407 N-m	6,549 N	6,549 N	786 N
5 0	Inch	2.00 in	8.6 in	1,623 in-lbs	4,966 in-lbs	4,966 in-lbs	2,028 lbf	2,028 lbf	314 lbf
	Metric	50 mm	218 mm	183 N-m	561 N-m	561 N-m	9,020 N	9,020 N	1,397 N
6 3	Inch	2.50 in	13.0 in	2,038 in-lbs	9,508 in-lbs	9,508 in-lbs	2,583 lbf	2,583 lbf	491 lbf
	Metric	64 mm	330 mm	230 N-m	1,074 N-m	1,074 N-m	11,490 N	11,490 N	2,184 N

\*At minimum "D" distance between carriers see graph below for other distances

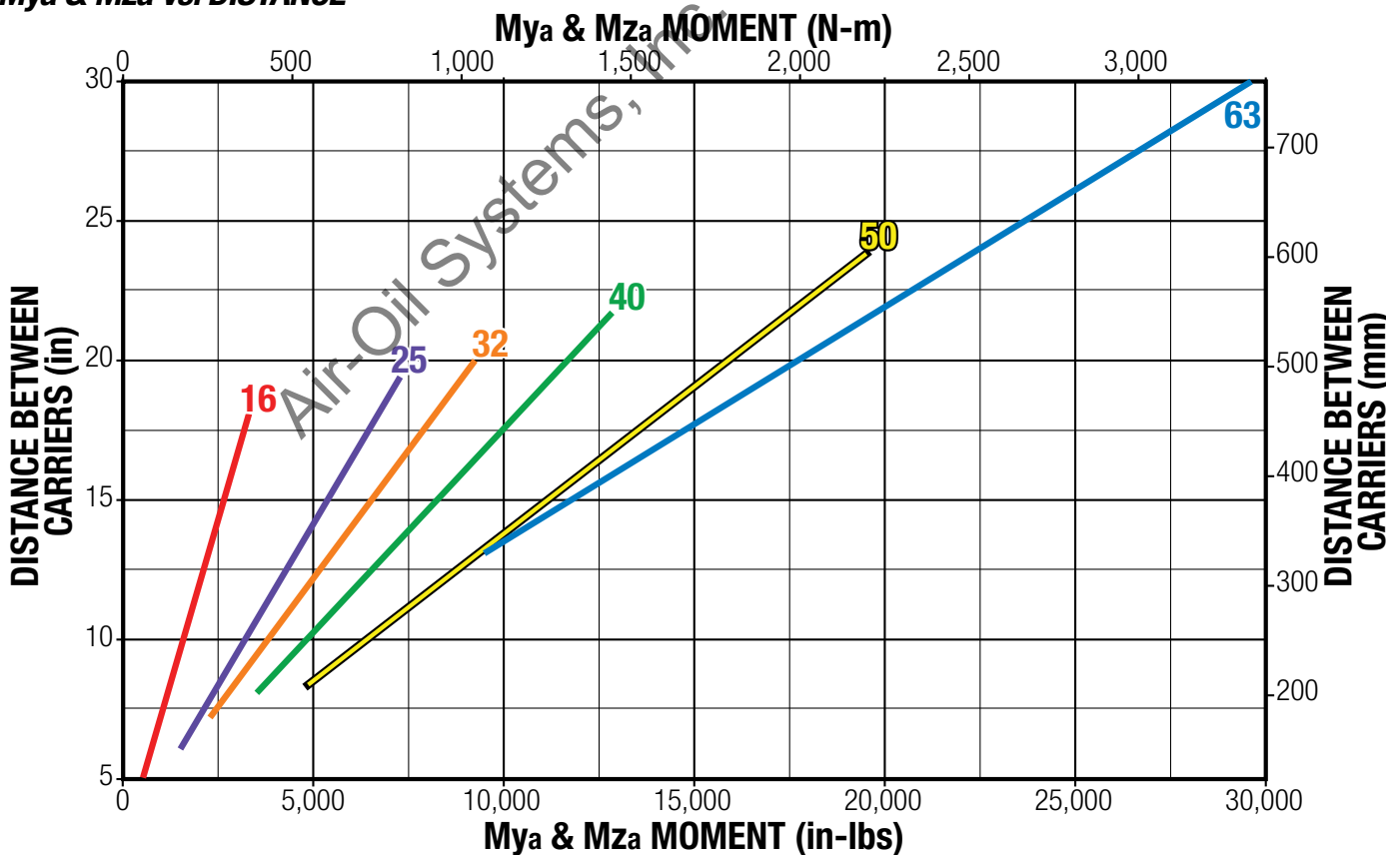
With combined loads,  $L_f$  must not exceed the value 1.

$$L_f = \frac{M_x}{M_{x_{max}}} + \frac{M_y}{M_{y_{max}}} + \frac{M_z}{M_{z_{max}}} + \frac{F_y}{F_{y_{max}}} + \frac{F_z}{F_{z_{max}}} \leq 1$$

**⚠** Ratings are the maximum values for shock-free, vibration-free operation in a typical industrial environment. Contact Tolomatic for assistance in selecting the most appropriate actuator for your application.

**⚠** NOTE: Mating surface of component mounted to carrier must maintain a flatness of at least 0.0015" (0.040 mm)

## Mya & Mza vs. DISTANCE

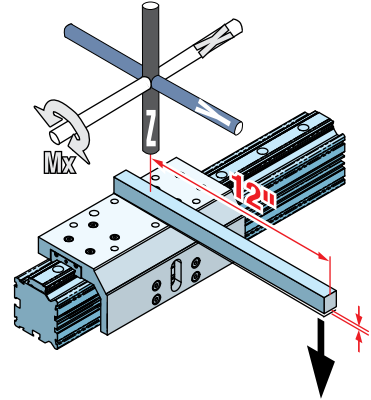
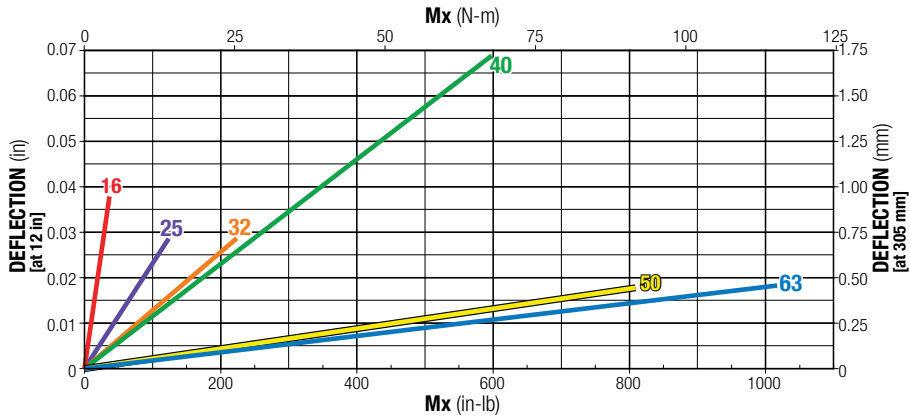


Ratings were calculated with the following conditions:

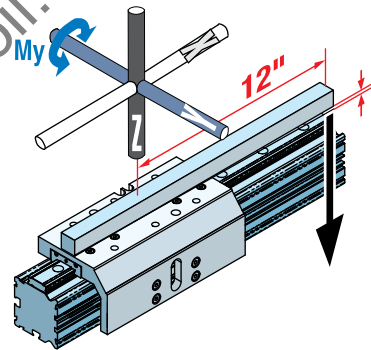
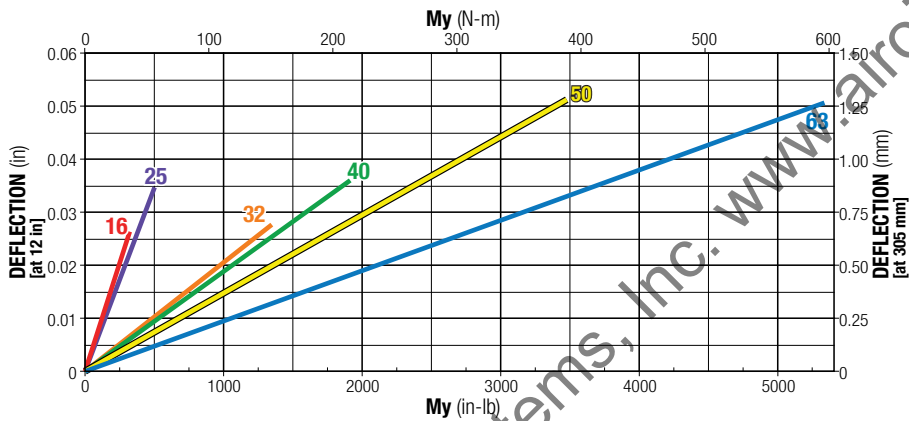
- 1.) Coupling between carriers is rigid.
- 2.) Load is equally distributed between carriers.
- 3.) Coupling device applies no misaligned loads to carriers.

# LOAD DEFLECTION

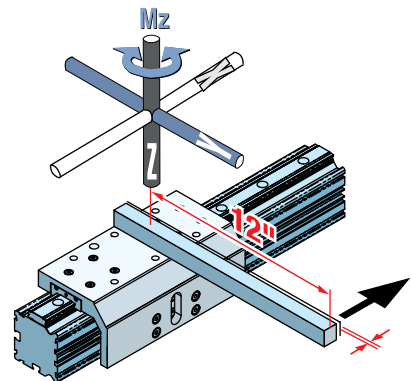
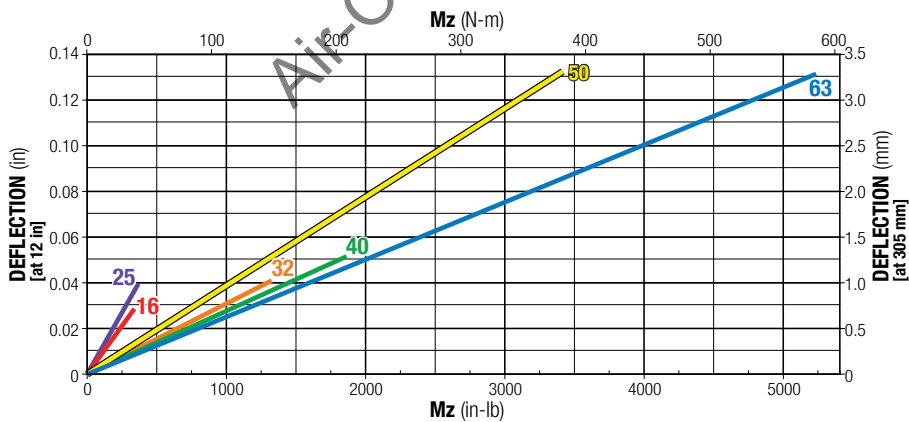
## DEFLECTION ABOUT X AXIS



## DEFLECTION ABOUT Y AXIS



## DEFLECTION ABOUT Z AXIS



### DEFLECTION TESTING WAS DONE UNDER THESE CRITERIA:

- 1.) Actuator was properly mounted with distance between mounting plates within recommendations (see Tube Clamp Requirements page MXP\_24)
- 2.) Deflection was measured at 12" from center of carrier as shown



# SPECIFICATIONS

		SIZE	16	25	32	40	50	63	
ACTUAL BORE SIZE		in	0.63	1.00	1.25	1.50	2.00	2.50	
		mm	16	25	32	38	50	64	
BASE WEIGHT	[N] INTERNAL BEARING	lb	0.73	1.70	3.58	5.57	11.07	22.59	
		kg	0.33	0.77	1.62	2.53	5.02	10.25	
	[S] SOLID BEARING	lb	1.07	2.30	4.68	7.64	14.03	30.78	
		kg	0.48	1.04	2.12	3.47	6.36	13.96	
	[P] PROFILED RAIL	lb	1.25	2.94	5.89	9.91	17.22	31.64	
		kg	0.57	1.33	2.67	4.5	7.81	14.35	
WEIGHT PER UNIT OF STROKE	[N] INTERNAL & [S] SOLID	lb/in	0.082	0.134	0.233	0.306	0.513	0.879	
		kg/mm	0.0015	0.0024	0.0042	0.0055	0.0092	0.0157	
	[P] PROFILED RAIL	lb/in	0.102	0.192	0.316	0.491	0.701	1.153	
		kg/mm	0.0018	0.0034	0.0056	0.0088	0.0125	0.0206	
MAXIMUM STROKE LENGTH		in	206	206	205	203	168	103	
		mm	5232	5232	5207	5156	4267	2616	
AUXILIARY CARRIER; MIN. "D" BETWEEN CARRIERS		in	5.00	6.00	7.00	8.50	8.60	13.00	
		mm	127.0	152.4	177.8	215.9	218.4	330.2	
MAXIMUM OPERATING PRESSURE		PSI	100						
		bar	6.9						
TEMPERATURE RANGE		°F	20 to 140						
		°C	-7 to 60						

## TIPS FOR MAXIMIZING BAND CYLINDER LIFE

TO GET THE MOST LIFE OUT OF YOUR MXP BAND CYLINDER FOLLOW THESE SIMPLE GUIDELINES WHEN SIZING A BAND CYLINDER FOR AN APPLICATION.

Four factors that affect the life of a band cylinder are **Load, Speed, Environment and Deceleration**. The following tips will help you select the appropriate band cylinder for a specific application's loads and speeds to maximize actuator life.

### 1 LOAD: KEEP THE LOAD FACTOR LESS THAN 1

Applications with multiple loads put additional stress on the band cylinder's bearing system. It is important to account for all these loads to make sure the bearing system is not over loaded. Both static and dynamic loads need to be addressed.

The formula below can be used to calculate the load factor:

$$L_f = \frac{M_x}{M_{x_{max}}} + \frac{M_y}{M_{y_{max}}} + \frac{M_z}{M_{z_{max}}} + \frac{F_y}{F_{y_{max}}} + \frac{F_z}{F_{z_{max}}} \leq 1$$

### 2 SPEED: REDUCE SPEEDS

High speeds and cycle rates stress the band cylinder's guidance system more than slower applications. Keeping speeds reduced will optimize the life of the actuator.

### 3 ENVIRONMENT: KEEP CONTAMINATION OFF BAND AND MOVING SURFACES

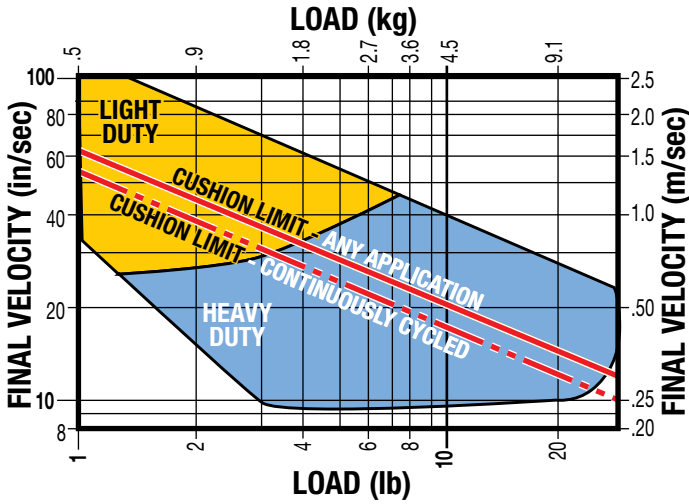
Contamination will decrease band cylinder service life. Service life can be improved by orienting the band and bearing system 180 degrees from the contamination source. For instance, if solid particulates are falling on the actuator, it is best to try to orient the band cylinder so that the band and bearing system are shielded from the particulates.

### 4 DECELERATION: DECELERATE WITH SHOCK ABSORBERS

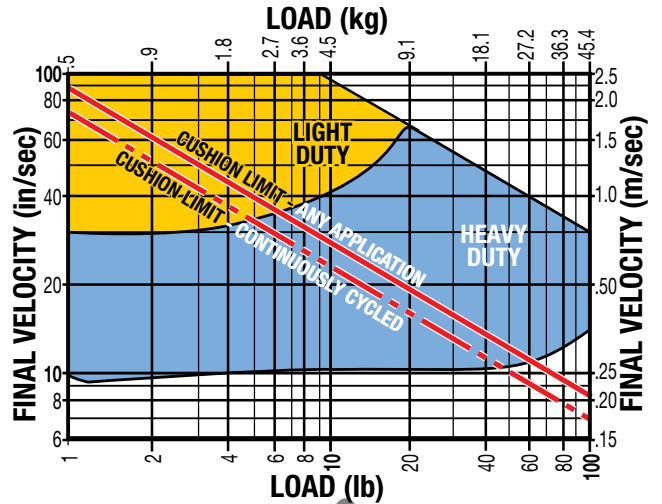
Shock absorbers provide the most controlled and reliable deceleration at the end of stroke. Stopping in a controlled fashion will significantly decrease the inertia loads on the carrier bearings, extending cylinder life. The best location for shock absorbers is at the center of gravity of the load.

# CUSHION & SHOCK ABSORBER PERFORMANCE

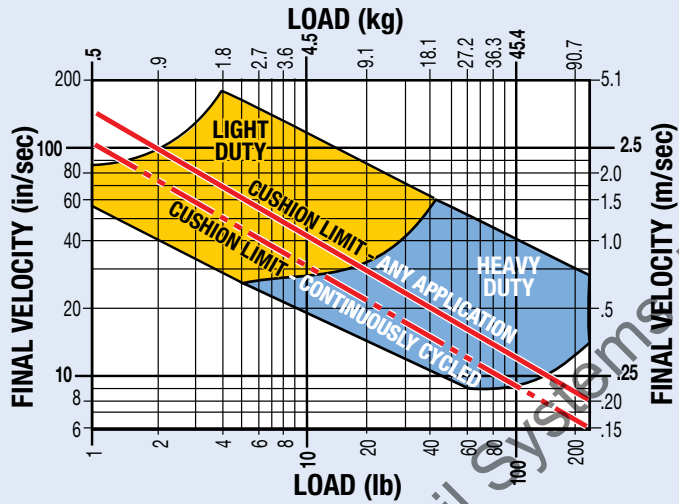
**MXP16 (ALL BEARINGS)**



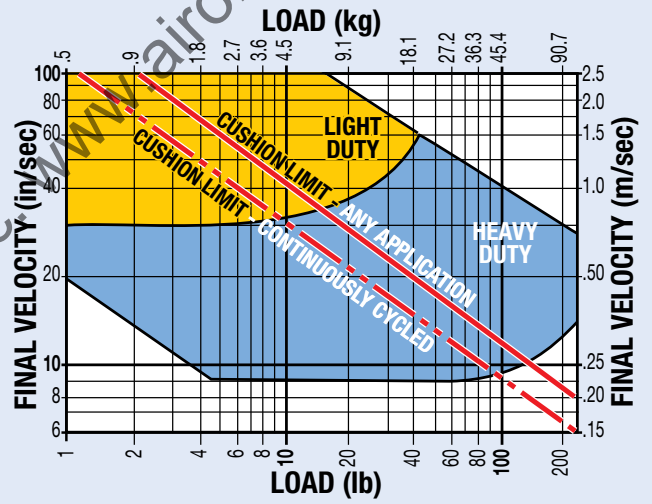
**MXP25 (ALL BEARINGS)**



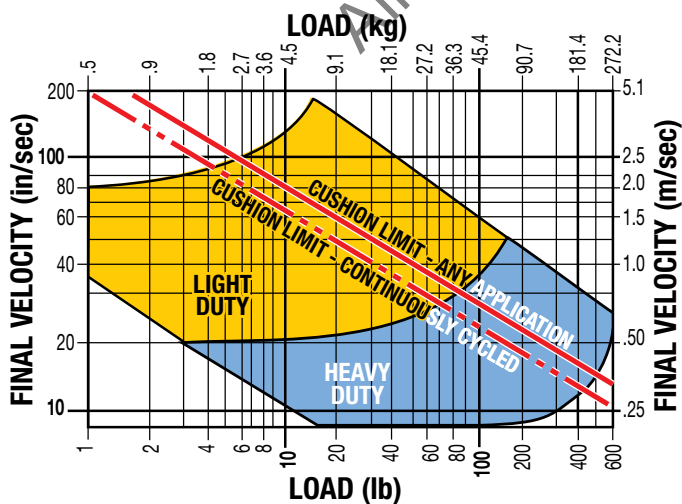
**MXP32 (ALL BEARINGS)**



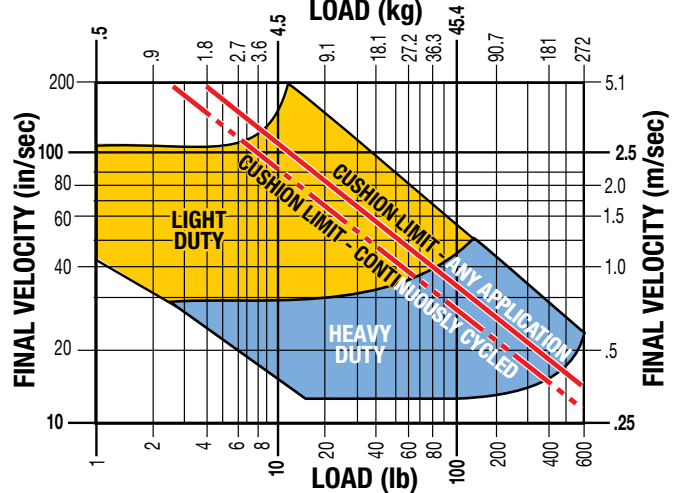
**MXP40 (ALL BEARINGS)**



**MXP50 (ALL BEARINGS)**



**MXP63 (ALL BEARINGS)**

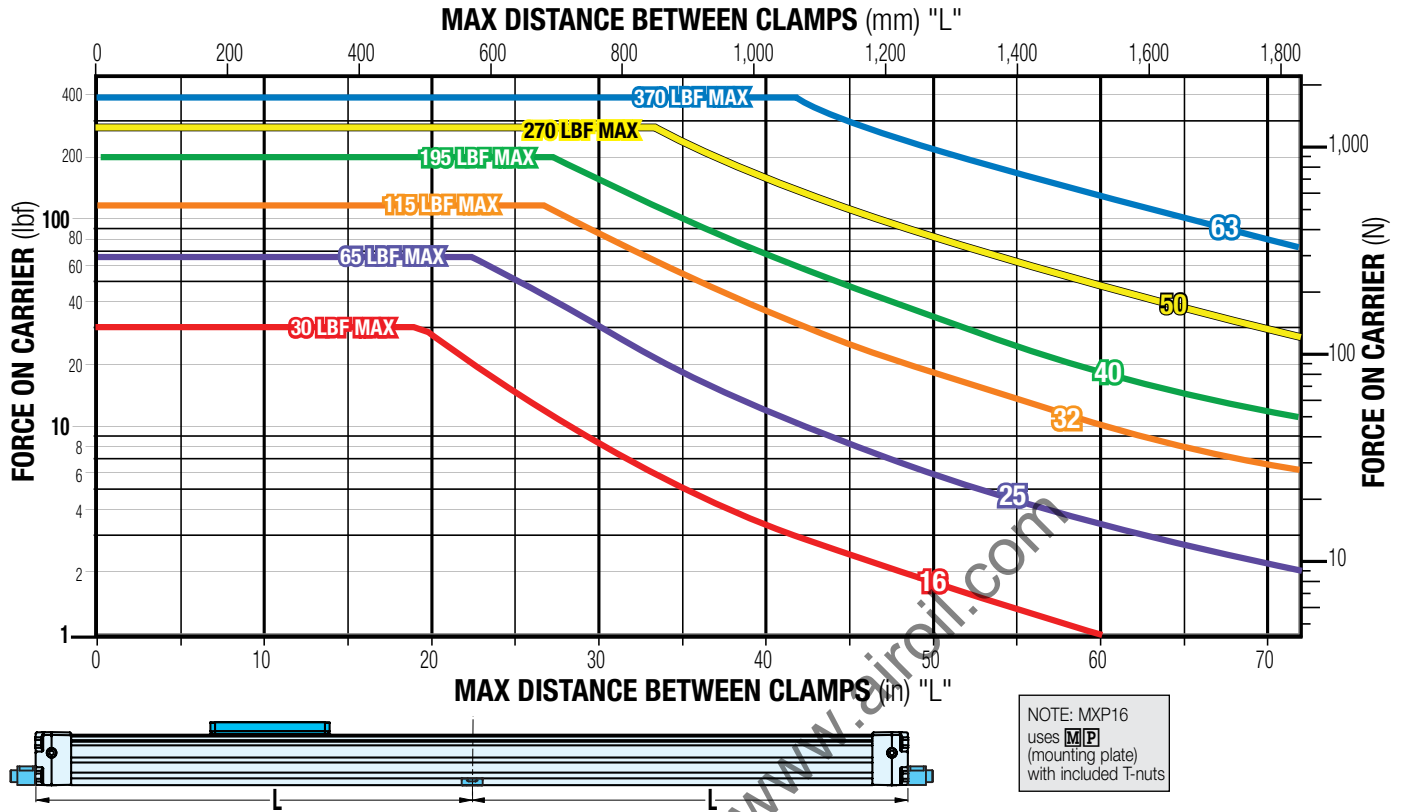


NOTE: If final (impact) velocity cannot be calculated directly, a reasonable guideline to use is 2X average velocity.

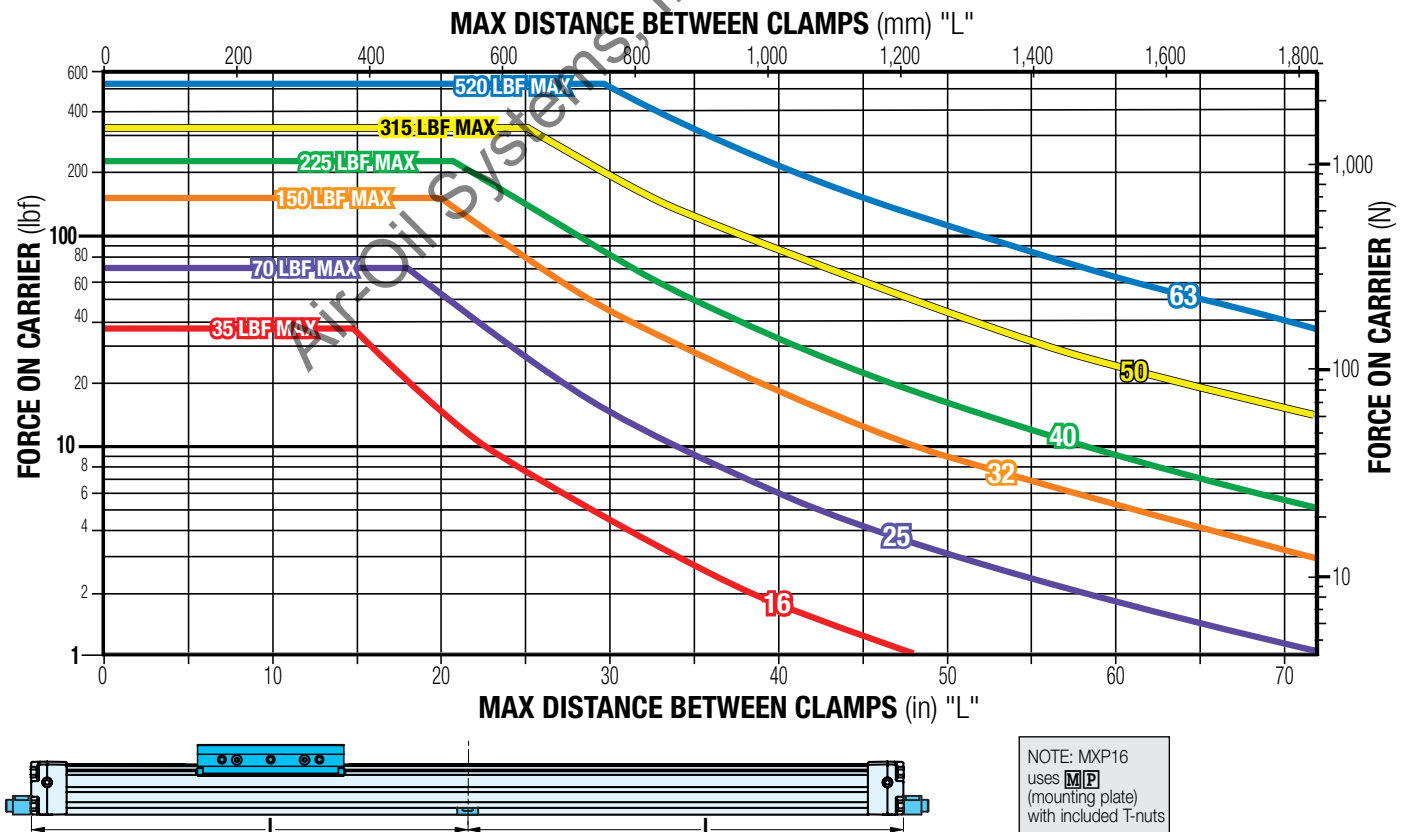
⚠ NOTE: When 2 shock absorbers are ordered, the MXP will be assembled with NO internal cushion seals.

# TUBE CLAMP REQUIREMENTS

## **N** - INTERNAL BEARING

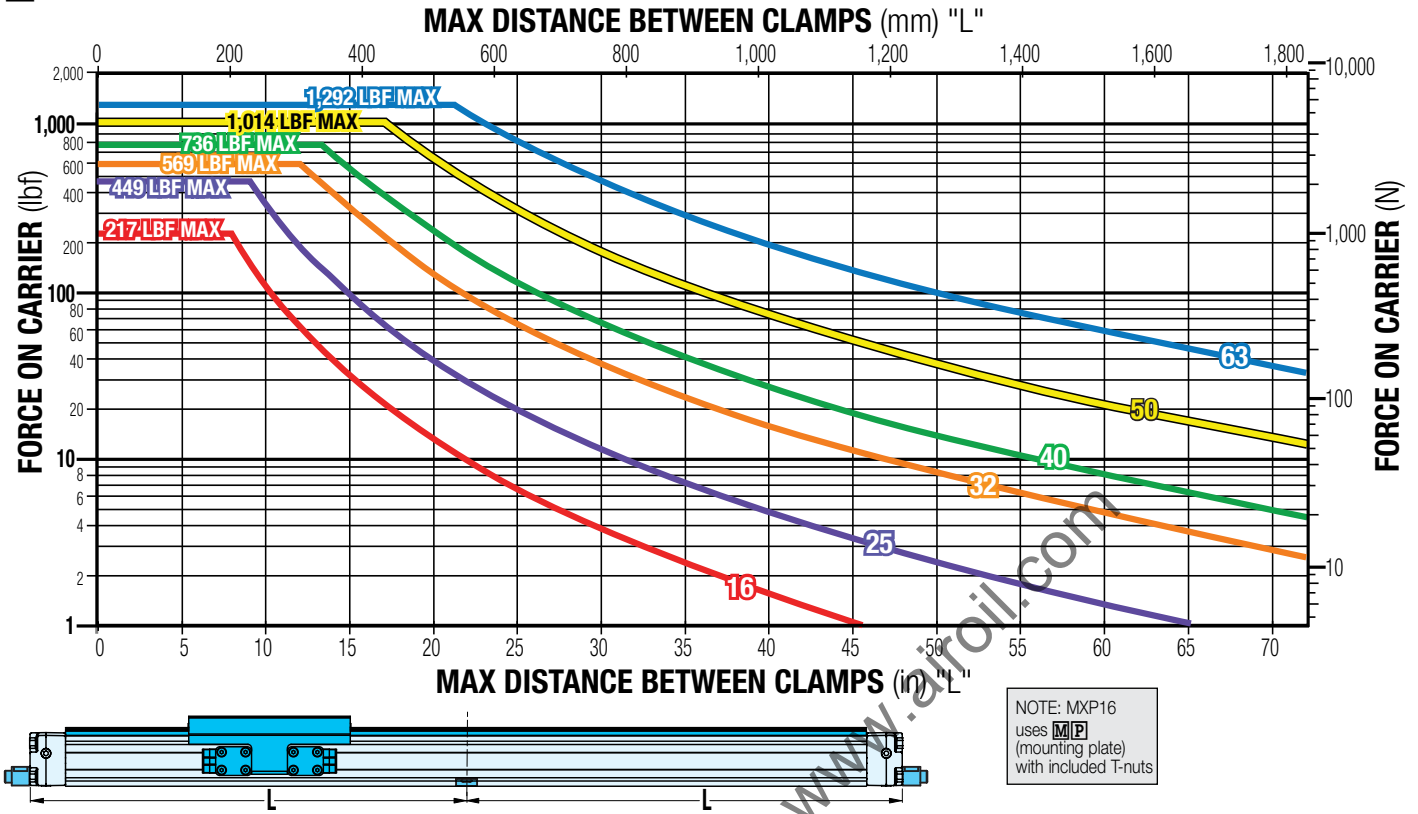


## **S** - SOLID BEARING



# TUBE CLAMP REQUIREMENTS

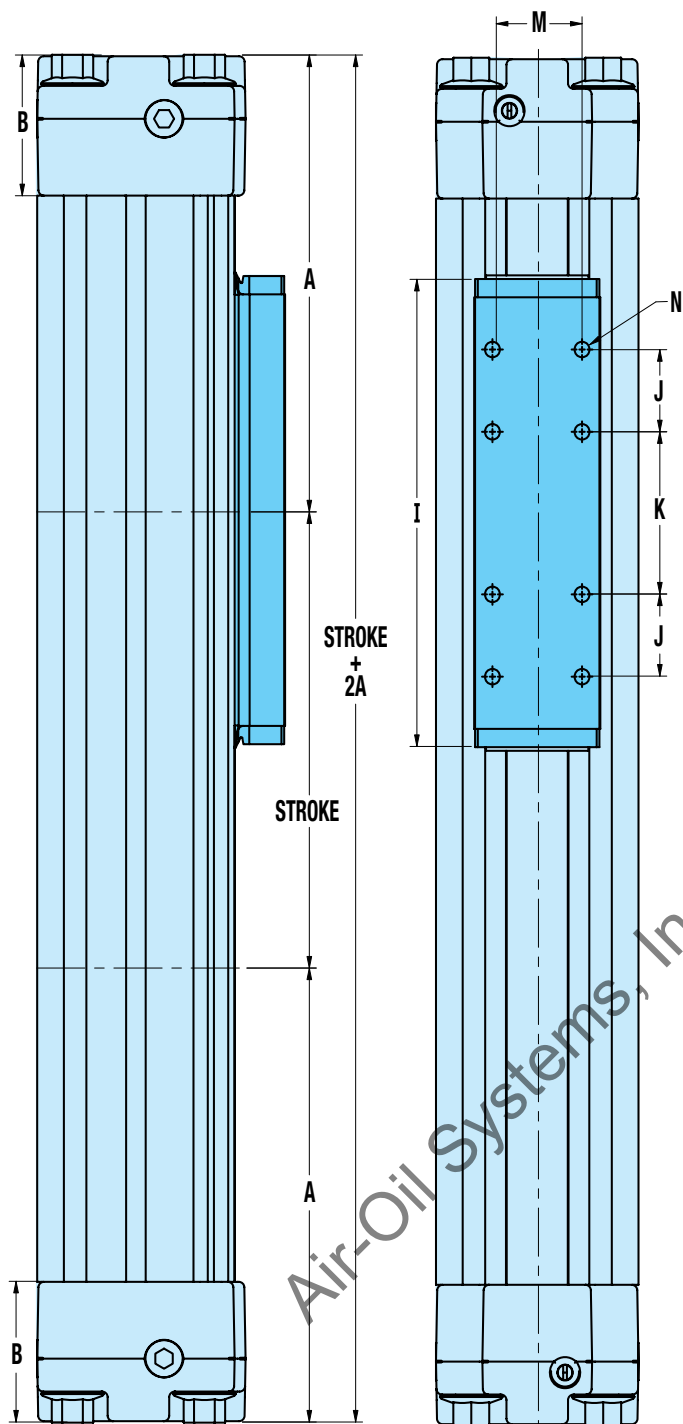
**P** - PROFILED RAIL



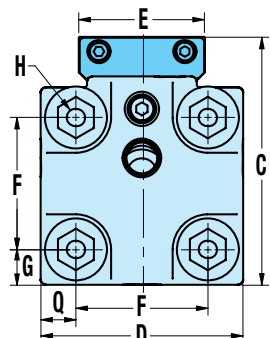
ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CG  
PB  
ENGR

Air-Oil Systems, Inc. www.airoil.com

# N-INTERNAL BEARING ACTUATOR DIMENSIONS



	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	3.13	3.94	4.89	5.79	6.26	8.42
<i>mm</i>	79.6	100.2	124.1	147.1	159.1	213.8
<b>B</b>	0.55	1.11	1.50	1.50	1.97	1.97
<i>mm</i>	14.0	28.3	38.1	38.0	50.0	50.0
<b>C</b>	1.55	2.07	2.67	2.98	3.86	4.76
<i>mm</i>	39.3	52.6	67.8	75.8	98.1	120.8
<b>D</b>	1.18	1.65	2.18	2.52	3.01	3.94
<i>mm</i>	30.0	42.0	55.4	64.0	78.7	100.0
<b>E</b>	0.83	0.83	1.36	1.61	2.13	2.44
<i>mm</i>	21.0	21.0	34.5	41.0	54.0	62.0
<b>F</b>	0.85	1.10	1.42	1.81	2.25	2.87
<i>mm</i>	21.5	27.9	36.1	46.0	57.2	73.0
<b>G</b>	0.17	0.25	0.38	0.35	0.43	0.53
<i>mm</i>	4.3	6.3	9.7	9.0	10.8	13.5
<b>H</b>	#8-32 (8)	#10-24 (8)	1/4-20 (8)	1/4-20 (8)	5/16-18 (8)	5/16-18 (8)
<i>mm</i>	M4x0.7 (8)	M5x0.8 (8)	M6x1.0 (8)	M6x1.0 (8)	M8x1.25 (8)	M8x1.25 (8)
<b>I</b>	3.78	4.45	5.04	5.87	6.57	9.69
<i>mm</i>	96.0	113.0	128.0	149.0	166.8	246.0
<b>J</b>	0.59	0.79	0.89	0.63	1.13	1.18
<i>mm</i>	15.0	20.0	22.5	15.9	28.6	30.0
<b>K</b>	1.18	1.57	1.75	3.00	2.25	4.33
<i>mm</i>	30.0	40.0	44.5	76.2	57.2	110.0
<b>M</b>	0.63	0.59	0.96	1.05	1.50	1.69
<i>mm</i>	16.0	15.0	24.5	26.7	38.1	43.0
<b>N</b>	#6-32 (8)	#8-32 (8)	#10-32 (8)	1/4-20 (8)	5/16-18 (8)	3/8-16 (8)
<i>mm</i>	M3x0.5 (8)	M4x0.7 (8)	M5x0.8 (8)	M6x1.0 (8)	M8x1.25 (8)	M10x1.5 (8)
<b>Q</b>	0.17	0.28	0.38	0.35	0.43	0.53
<i>mm</i>	4.3	7.0	9.7	9.0	10.8	13.5



ABT

MXP

BC2

BC3

BC4

LS

MG

CC

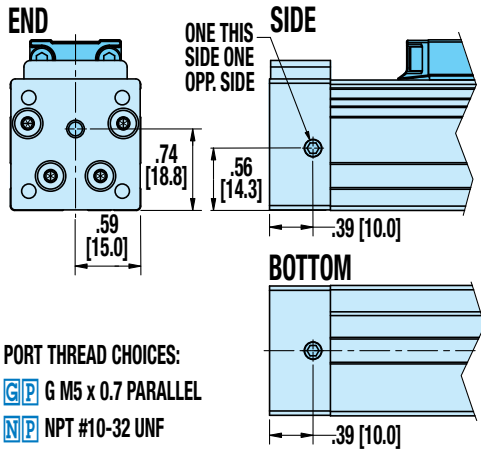
PB

ENGR

# N-INTERNAL BEARING PORTING DIMENSIONS MXP16N, MXP25N, MXP32N

## DUAL END PORTING

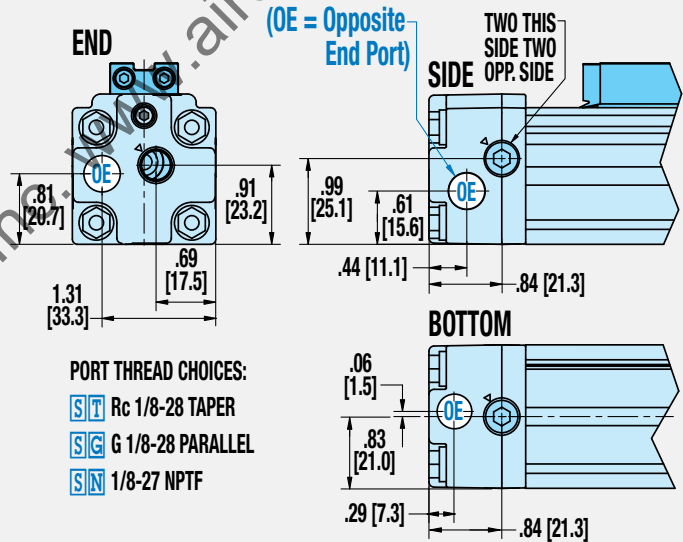
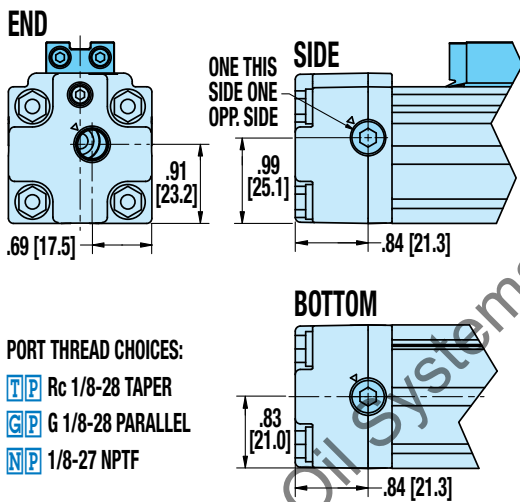
16mm BORE



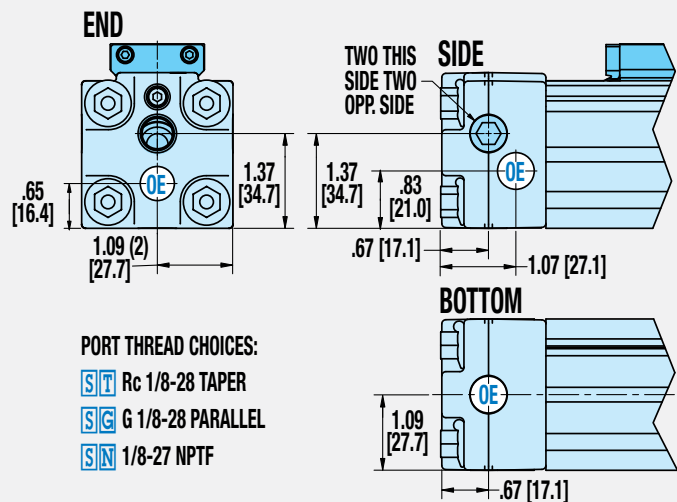
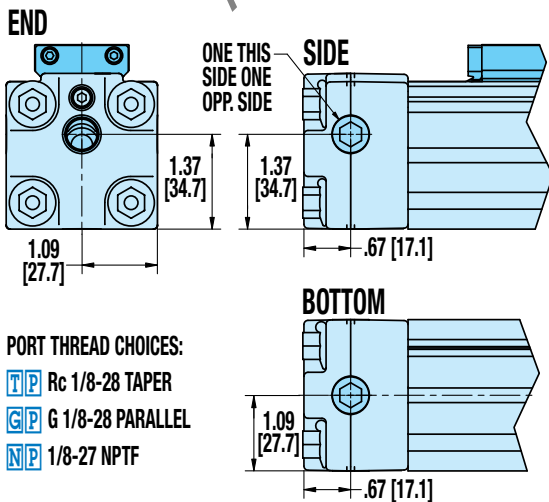
## SINGLE-END PORTING

Not Available for 16mm BORE

25mm BORE



32mm BORE



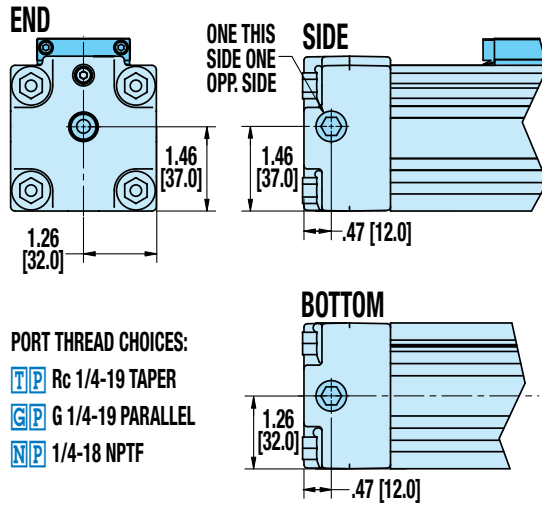
Dimensions in inches [brackets indicate dimensions in millimeters]



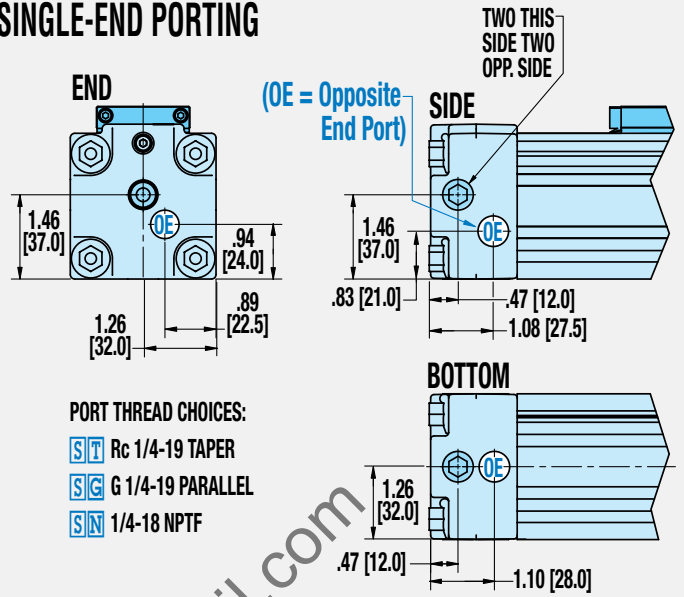
# N-INTERNAL BEARING PORTING DIMENSIONS MXP40N, MXP50N, MXP63N

40mm  
BORE

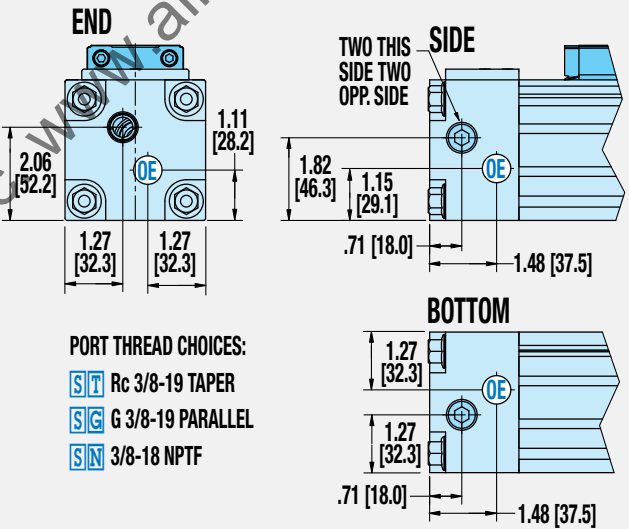
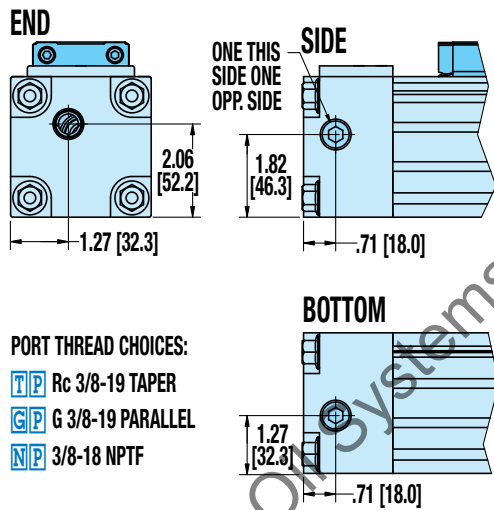
## DUAL END PORTING



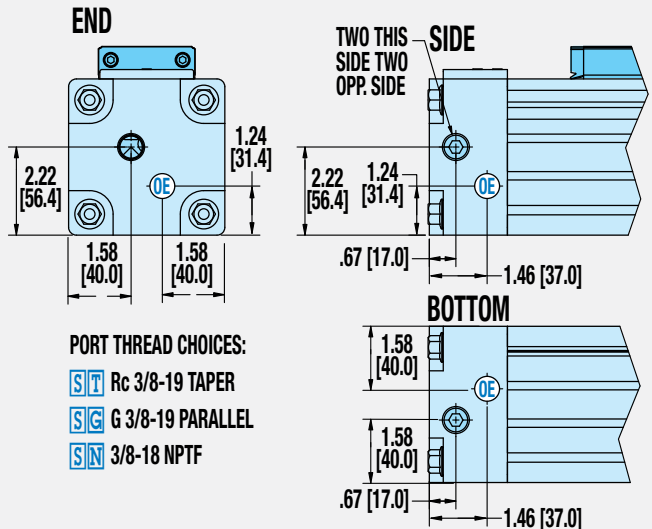
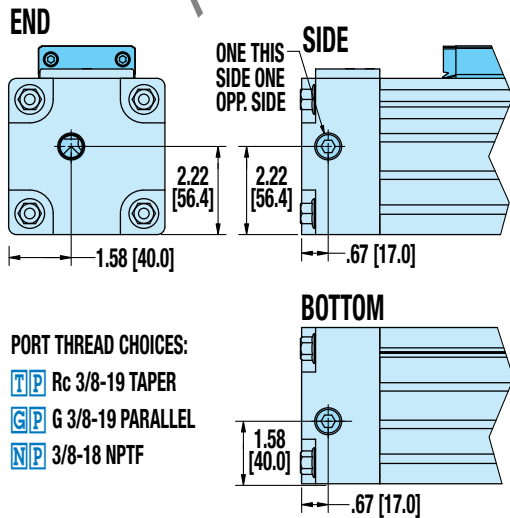
## SINGLE-END PORTING



50mm  
BORE



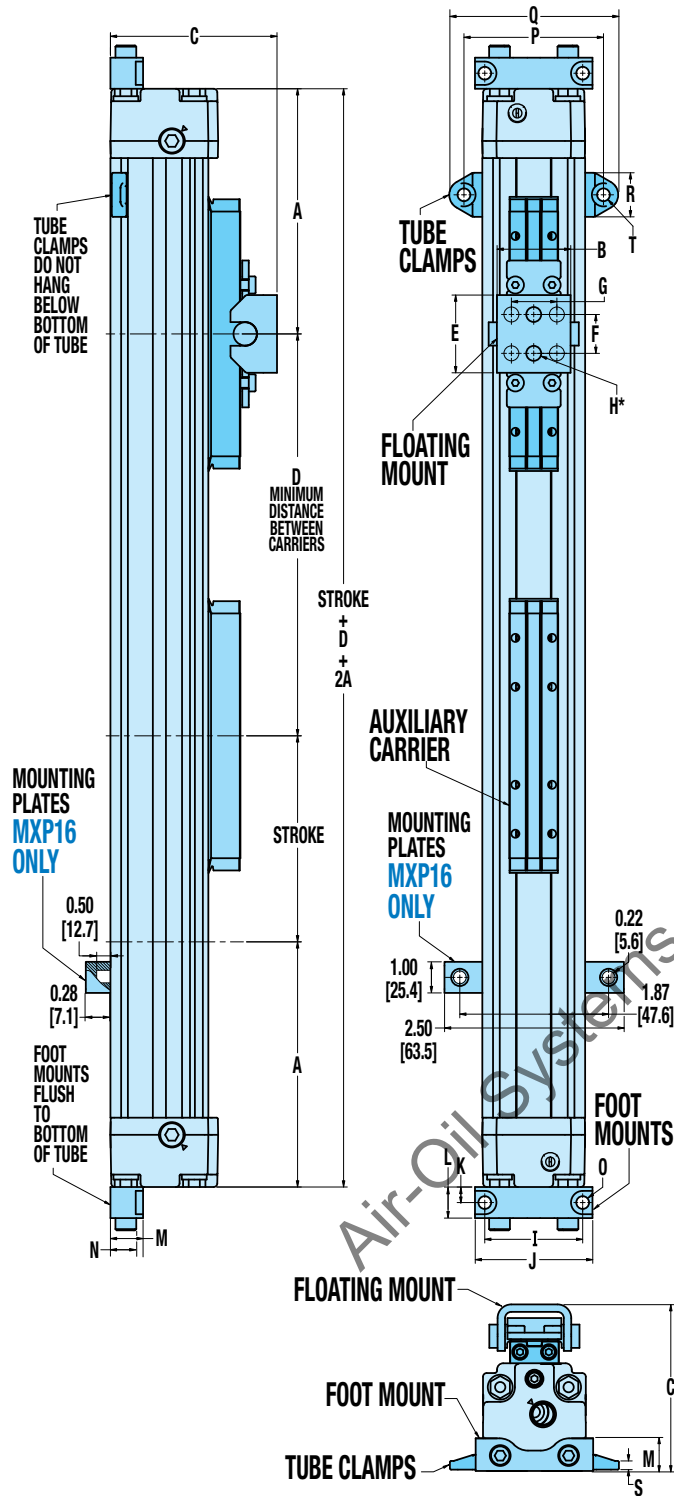
63mm  
BORE



Dimensions in inches [brackets indicate dimensions in millimeters]

# N-INTERNAL BEARING OPTION DIMENSIONS

## AUXILIARY CARRIER, FLOATING MOUNT, FOOT MOUNT, TUBE CLAMPS



	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	3.13	3.94	4.89	5.79	6.26	8.42
<i>mm</i>	79.6	100.2	124.1	147.1	159.1	213.8
<b>AUXILIARY CARRIER</b>						
<b>D</b>	5.00	6.00	7.00	8.50	8.60	13.00
<i>mm</i>	127.0	152.4	177.8	215.9	218.4	330.0
<b>FLOATING MOUNT</b>						
<b>B</b>	1.27	1.19	2.08	2.55	3.24	3.15
<i>mm</i>	32.2	30.1	52.8	64.7	82.3	80.0
<b>C</b>	1.97	2.66	3.70	4.07	4.66	5.57
<i>mm</i>	50.1	67.5	94.1	103.3	118.4	141.6
<b>E</b>	0.90	1.25	1.50	1.50	3.94	5.20
<i>mm</i>	22.9	31.8	38.1	38.1	100.1	132.0
<b>F</b>	0.50	0.63	0.75	0.79	3.15	4.33
<i>mm</i>	12.7	15.9	19.1	20.0	80.0	110.0
<b>G</b>	-	-	1.00	1.38	-	1.69
<i>mm</i>	-	-	25.4	35.0	-	43.0
<b>H*</b>	0.17(2)	0.24(2)	0.28(4)	0.28(4)	0.36(2)	0.34(4)
<i>mm</i>	4.3(2)	6.1(2)	7.1(4)	7.1(4)	9.1(2)	8.7(4)
<b>FOOT MOUNTS</b>						
<b>I</b>	1.26	1.57	2.01	2.52	3.11	3.94
<i>mm</i>	32.0	40.0	51.0	64.0	78.9	100.0
<b>J</b>	1.57	1.89	2.36	2.91	3.67	4.72
<i>mm</i>	40.0	48.0	60.0	74.0	93.2	120.0
<b>K</b>	0.16	0.25	0.37	0.47	0.50	0.59
<i>mm</i>	4.0	6.4	9.5	12.0	12.7	15.0
<b>L</b>	0.31	0.50	0.75	0.94	1.00	1.18
<i>mm</i>	8.0	12.7	19.0	24.0	25.4	30.0
<b>M</b>	0.35	0.52	0.91	0.73	1.00	1.06
<i>mm</i>	8.9	13.3	23.0	18.5	25.4	27.0
<b>N</b>	-	0.41	0.71	0.45	0.69	0.65
<i>mm</i>	-	10.3	18.0	11.4	17.4	16.5
<b>O</b>	0.18	0.20	0.22	0.28	0.35	0.42
<i>mm</i>	4.6	5.2	5.5	7.1	9.0	10.7
<b>TUBE CLAMPS</b>						
<b>P</b>	-	2.24	2.92	3.26	3.84	5.19
<i>mm</i>	-	57.0	74.1	82.7	97.5	131.7
<b>Q</b>	-	2.72	3.44	3.81	4.39	5.93
<i>mm</i>	-	69.0	87.4	96.7	111.5	150.7
<b>R</b>	-	0.71	0.63	0.55	0.55	0.75
<i>mm</i>	-	18.0	16.0	14.0	14.0	19.0
<b>S</b>	-	0.14	0.17	0.15	0.15	0.24
<i>mm</i>	-	3.6	4.3	3.8	3.8	6.1
<b>T</b>	-	0.20	0.28	0.28	0.28	0.42
<i>mm</i>	-	5.2	7.1	7.1	7.1	10.7

\*MXP16, 25 & 50 use 2 center holes,  
MXP32, 40 & 63 use 4 corner holes

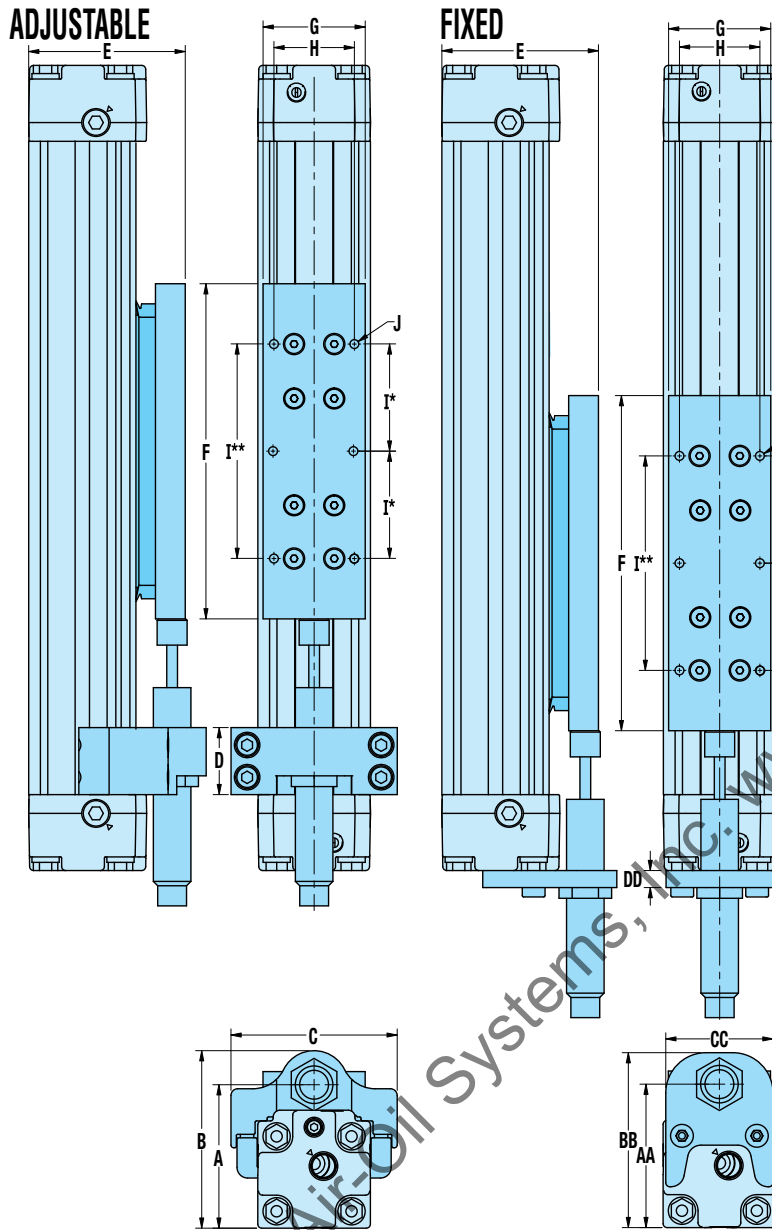
**NOTE:** Auxiliary carrier is N-Internal Bearing carrier, see page MXP\_25 for carrier size and mounting dimensions





# N-INTERNAL BEARING OPTION DIMENSIONS

## ADJUSTABLE AND FIXED SHOCK ABSORBERS



### ADJUSTABLE SHOCK ABSORBER

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	1.65	2.11	2.91	3.32	4.24	5.21
<b>mm</b>	42.0	53.5	73.8	84.4	107.6	132.4
<b>B</b>	1.97	2.61	3.35	3.87	4.87	5.91
<b>mm</b>	50.0	66.2	85.0	98.4	123.8	150.0
<b>C</b>	1.74	2.44	2.95	3.43	4.09	5.20
<b>mm</b>	44.3	62.0	74.9	87.0	103.9	132.0
<b>D</b>	0.71	0.98	1.25	0.98	1.22	1.26
<b>mm</b>	18.0	25.0	31.8	25.0	31.0	32.0

### Stroke Adder: Adjustable Shock Absorber

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>in</b>	0.49	1.06	1.17	0.76	0.81	0.51
<b>mm</b>	12.4	26.8	29.8	19.3	20.5	13.0

NOTE: For each adjustable shock absorber ordered, add Stroke Adder value to required stroke to determine configured actuator stroke.

$$\text{Required Stroke} + \frac{\text{Adj. Stroke Adder}}{\text{Quantity}} = \text{Configured Actuator Stroke}$$

Example: MXP25N, 500mm stroke required, 2 adjustable shocks  
 $500 + (2 \times 26.8) = 500 + 53.6 = 553.6\text{mm}$

### SHOCK PLATE

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>E</b>	1.81	2.28	3.17	3.61	4.55	5.65
<b>mm</b>	46.0	57.9	80.5	91.8	115.6	143.4
<b>F</b>	3.86	4.92	5.20	6.72***	6.65	10.29****
<b>mm</b>	98.0	125.0	132.0	170.8***	168.8	261.4****
<b>G</b>	0.94	1.50	1.32	1.61	2.13	2.44
<b>mm</b>	24.0	38.1	33.5	41.0	54.0	62.0
<b>H</b>	0.63	1.18	0.96	1.05	1.50	1.69
<b>mm</b>	16.0	30.0	24.5	26.7	38.1	43.0
<b>I*</b>	0.89	1.57	-	-	-	-
<b>mm</b>	22.5	40.0	-	-	-	-
<b>I**</b>	-	-	1.75	3.00	2.25	4.33
<b>mm</b>	-	-	44.5	76.2	57.2	110.0
<b>J</b>	#8-32 (6)	#8-32 (6)	#10-32 (4)	1/4-20 (4)	5/16-18 (4)	3/8-16 (4)
<b>mm</b>	M4x0.8 (6)	M4x0.8 (6)	M5x0.8 (4)	M6x1.0 (4)	M8x1.25 (4)	M10x1.5 (4)

\*MXP16 & 25 Shock plate has 6 mounting holes

\*\*MXP32, 40, 50 & 63 Shock plate has 4 mounting holes

\*\*\*MXP40 Shock Stop Plate has impact bolts. Actual plate length is 5.98" (152mm); Impact bolts, one on each end, add .74" (18.8mm) to total length

\*\*\*\*MXP63 Shock Stop Plate has impact bolts. Actual plate length is 9.84" (250mm); Impact bolts, one on each end, add .45" (11.4mm) to total length

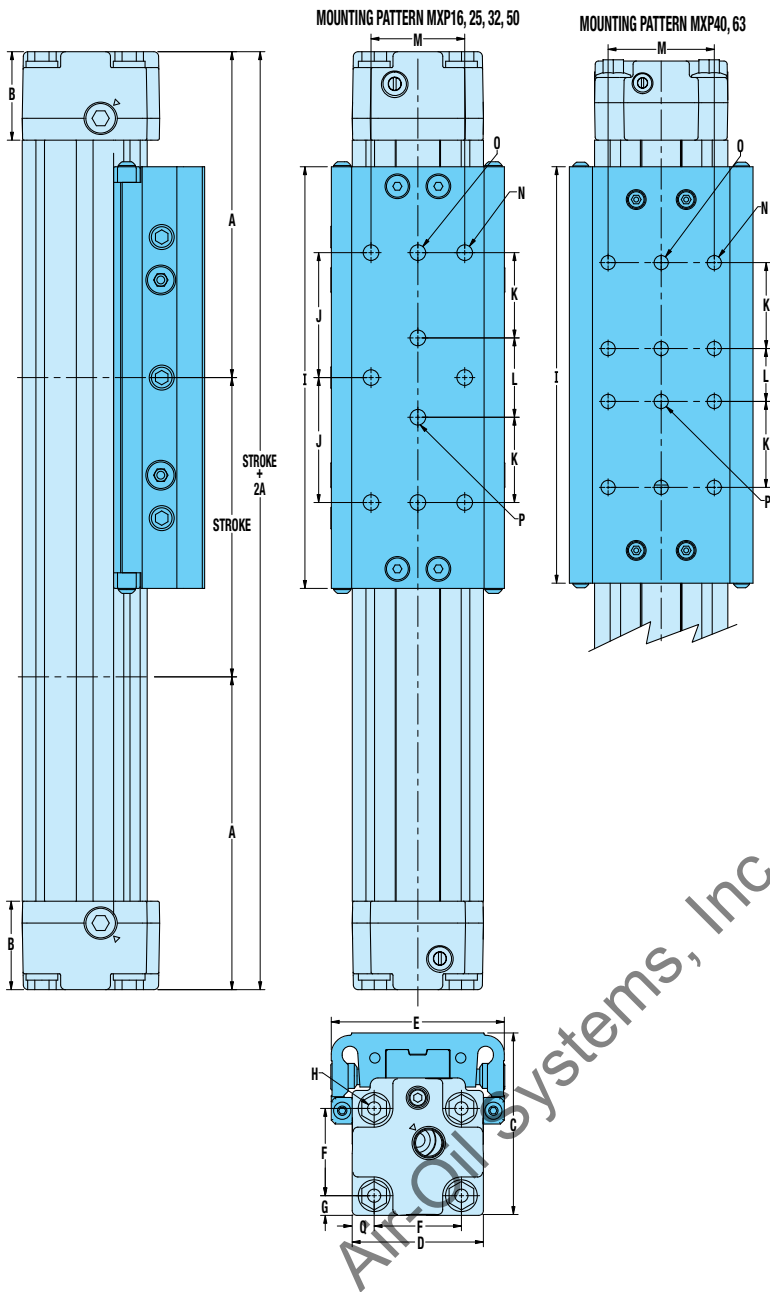
### FIXED SHOCK ABSORBER

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>AA</b>	1.65	2.11	2.91	3.32	4.24	5.21
<b>mm</b>	42.0	53.5	73.8	84.4	107.6	132.3
<b>BB</b>	1.95	2.57	3.42	3.87	5.09	5.92
<b>mm</b>	49.5	65.3	86.8	98.4	129.2	150.3
<b>CC</b>	1.17	1.57	2.00	2.44	2.83	3.66
<b>mm</b>	29.8	40.0	50.8	62.0	72.0	93.0
<b>DD</b>	0.13	0.25	0.25	0.25	0.50	0.50
<b>mm</b>	3.3	6.4	6.4	6.4	12.7	12.7



NOTE: Auxiliary carrier is N-Internal Bearing carrier, see page MXP\_25 for carrier size and mounting dimensions

# S-SOLID BEARING ACTUATOR DIMENSIONS



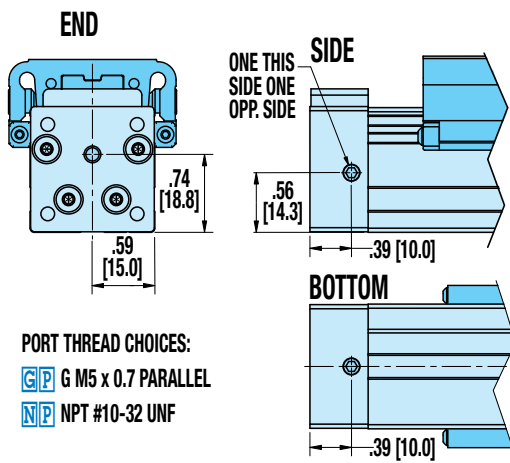
	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	3.13	3.94	4.89	5.79	6.26	8.42
<i>mm</i>	79.6	100.2	124.1	147.1	159.1	213.8
<b>B</b>	0.55	1.11	1.50	1.50	1.97	1.97
<i>mm</i>	14.0	28.3	38.1	38.0	50.0	50.0
<b>C</b>	1.80	2.30	3.06	3.51	4.44	5.48
<i>mm</i>	45.8	58.4	77.8	89.2	112.8	139.1
<b>D</b>	1.18	1.65	2.18	2.52	3.01	3.94
<i>mm</i>	30.0	42.0	55.4	64.0	78.7	100.0
<b>E</b>	2.18	2.18	2.86	3.47	4.01	5.59
<i>mm</i>	55.4	55.4	72.6	88.2	104.1	142.0
<b>F</b>	0.85	1.10	1.42	1.81	2.25	2.87
<i>mm</i>	21.5	27.9	36.1	46.0	57.2	73.0
<b>G</b>	0.17	0.25	0.38	0.35	0.43	0.53
<i>mm</i>	4.3	6.3	9.7	9.0	10.8	13.5
<b>H</b>	#8-32 (8)	#10-24 (8)	1/4-20 (8)	1/4-20 (8)	5/16-18 (8)	5/16-18 (8)
<i>mm</i>	M4x0.7 (8)	M5x0.8 (8)	M6x1.0 (8)	M6x1.0 (8)	M8x1.25 (8)	M8x1.25 (8)
<b>I</b>	4.12	5.31	6.02	7.87	7.91	12.11
<i>mm</i>	104.6	135.0	153.0	200.0	200.8	307.5
<b>J</b>	1.18	1.57	1.77	-	1.87	-
<i>mm</i>	30.0	40.0	45.0	-	47.6	-
<b>K</b>	-	1.07	1.10	1.63	1.25	1.50
<i>mm</i>	-	27.3	28.0	41.3	31.8	38.1
<b>L</b>	-	1.00	1.00	1.00	2.50	3.00
<i>mm</i>	-	25.4	25.4	25.4	63.5	76.2
<b>M</b>	1.18	1.18	1.73	2.01	2.59	3.25
<i>mm</i>	30.0	30.0	44.0	51.0	65.8	82.6
<b>N</b>	#8-32 (6)	1/4-20 (6)	1/4-20 (6)	5/16-18 (8)	3/8-16 (6)	3/8-16 (8)
<i>mm</i>	M4x0.7 (6)	M6x1.0 (6)	M8x1.25 (6)	M8x1.25 (8)	M10x1.5 (6)	M10x1.5 (8)
<b>O</b>	-	#10-32 (2)	1/4-20 (2)	5/16-18 (2)	3/8-16 (2)	3/8-16 (2)
<i>mm</i>	-	M6x1.0 (2)	M8x1.25 (2)	M8x1.25 (2)	M10x1.5 (2)	M10x1.5 (2)
<b>P</b>	-	1/4-20 (2)	1/4-20 (2)	1/4-20 (2)	3/8-16 (2)	3/8-16 (2)
<i>mm</i>	-	M6x1.0 (2)	M8x1.25 (2)	M8x1.25 (2)	M10x1.5 (2)	M10x1.5 (2)
<b>Q</b>	0.17	0.28	0.38	0.35	0.43	0.53
<i>mm</i>	4.3	7.0	9.7	9.0	10.8	13.5



# S-SOLID BEARING PORTING DIMENSIONS MXP16S, MXP25S, MXP32S

## DUAL END PORTING

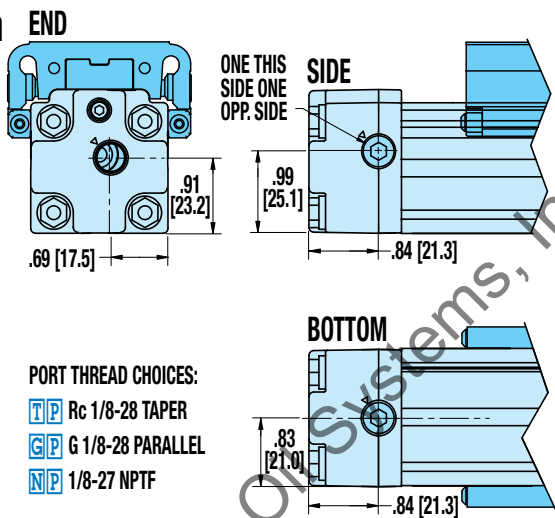
16mm  
BORE



## SINGLE-END PORTING

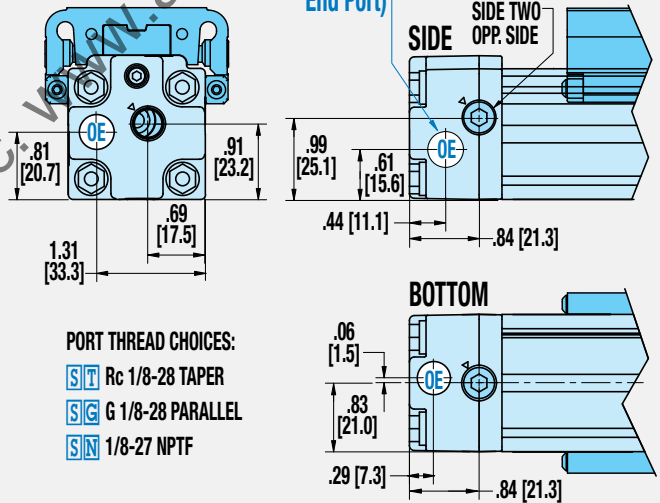
Not Available for 16mm BORE

25mm  
BORE

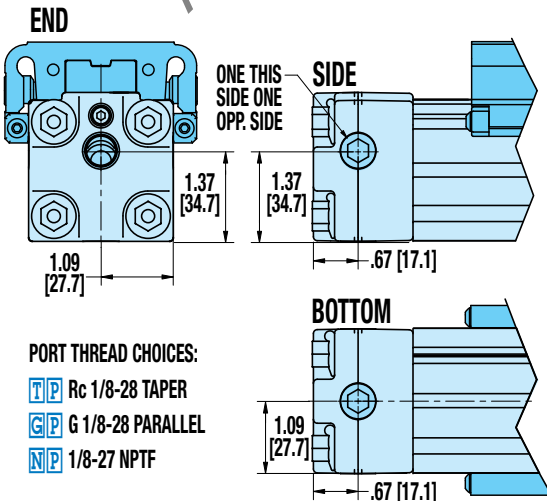


END

(OE = Opposite  
End Port)

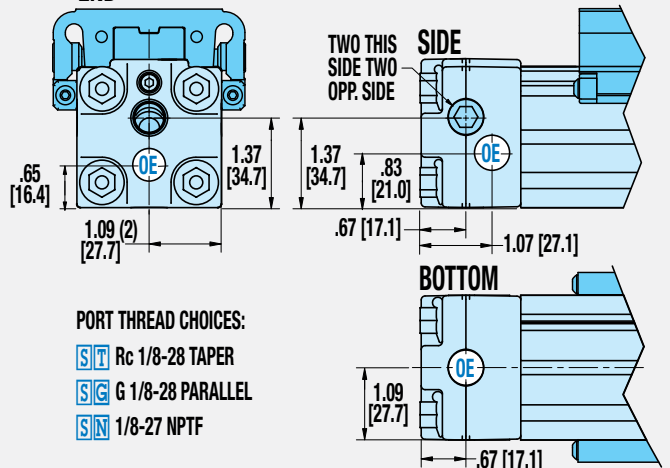


32mm  
BORE



END

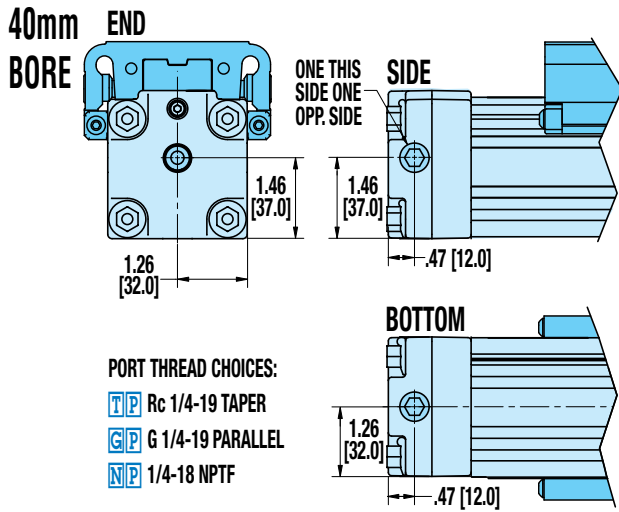
TWO THIS  
SIDE TWO  
OPP. SIDE



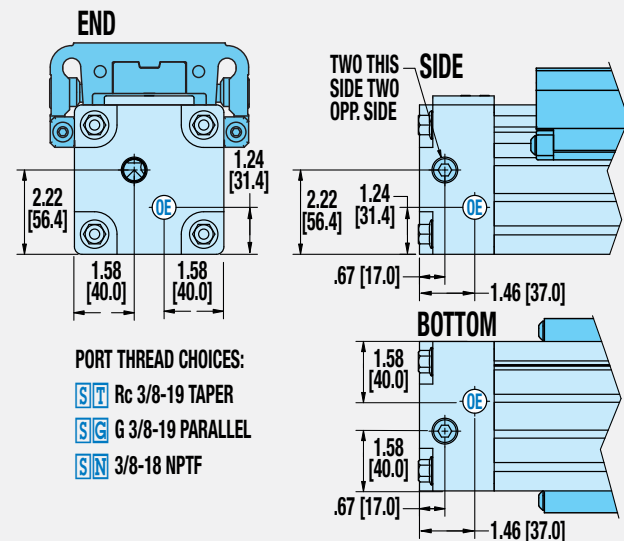
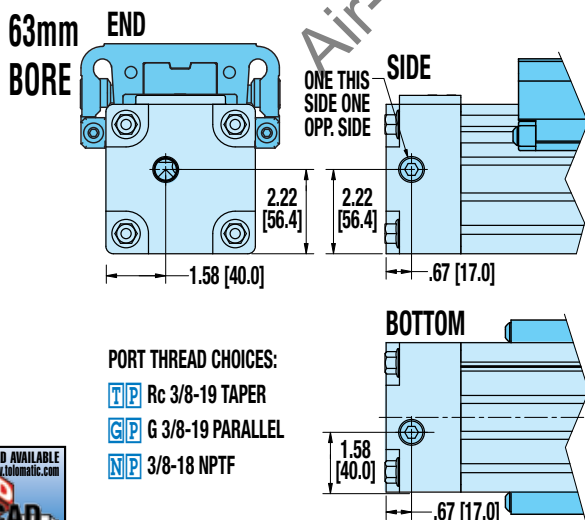
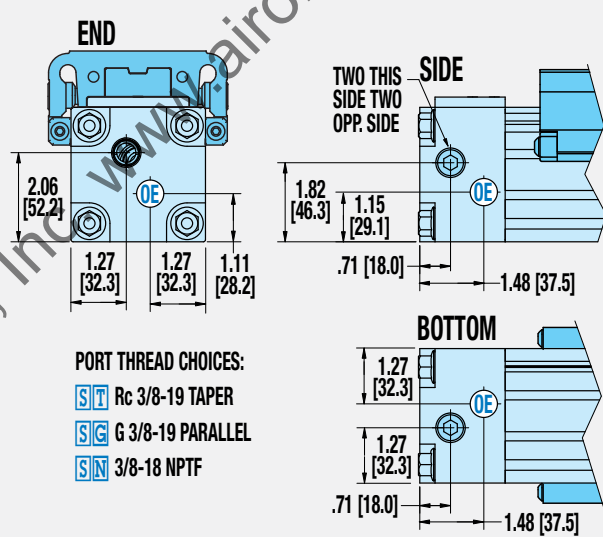
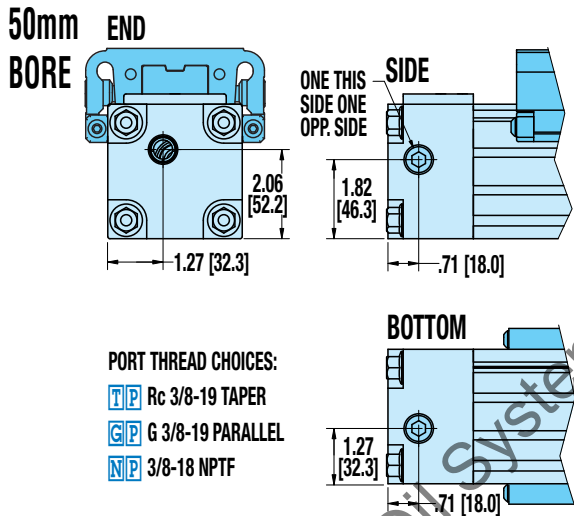
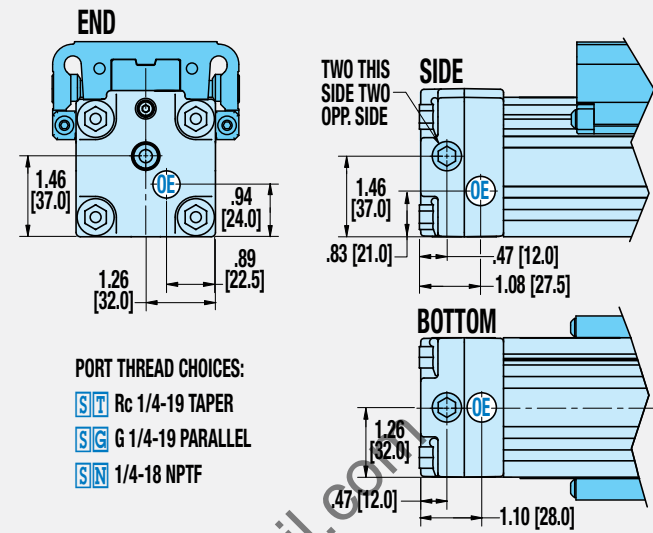
Dimensions in inches [brackets indicate dimensions in millimeters]

# S-SOLID BEARING PORTING DIMENSIONS MXP40S, MXP50S, MXP63S

## DUAL END PORTING



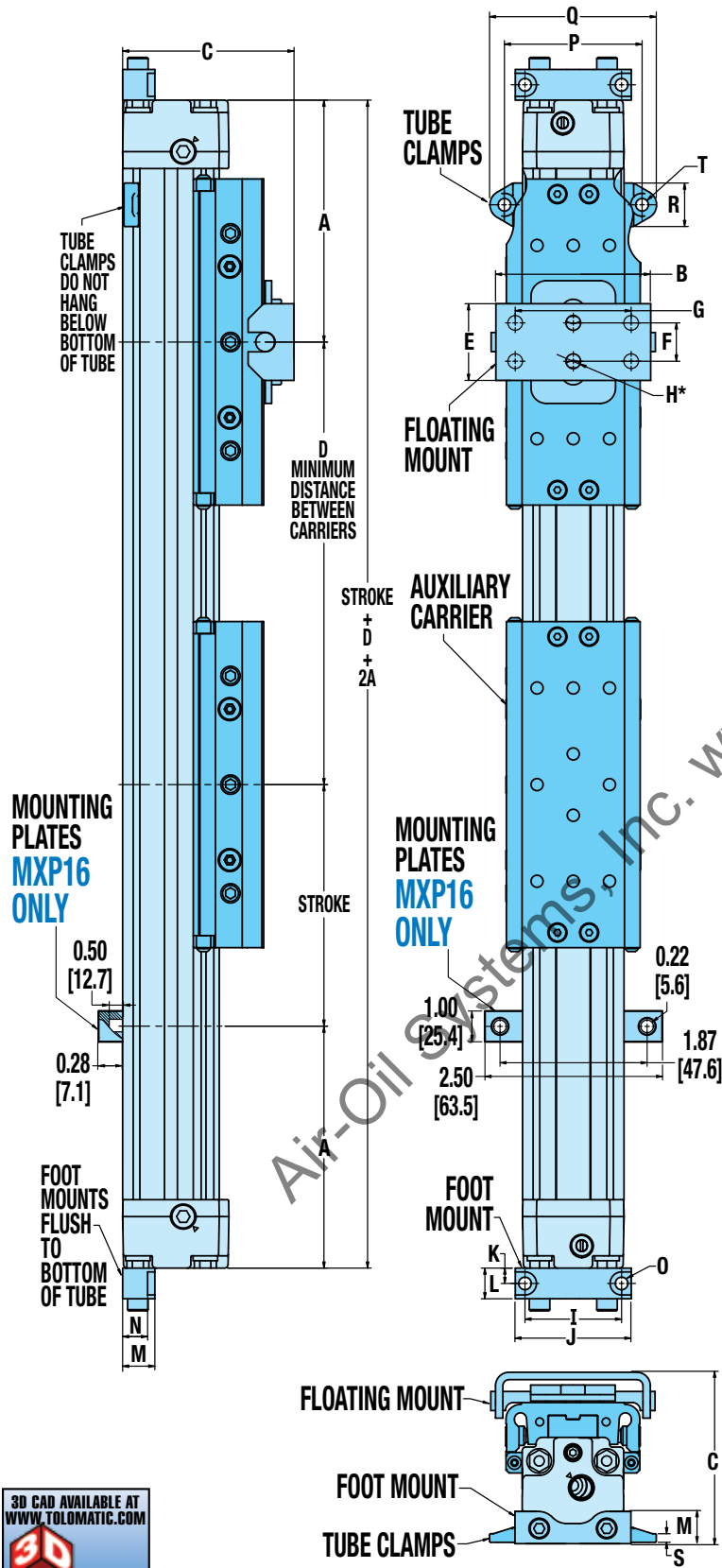
## SINGLE-END PORTING



Dimensions in inches [brackets indicate dimensions in millimeters]

# S-SOLID BEARING OPTION DIMENSIONS

## AUXILIARY CARRIER, FLOATING MOUNT, FOOT MOUNT, TUBE CLAMPS



	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	3.13	3.94	4.89	5.79	6.26	8.42
<i>mm</i>	79.6	100.2	124.1	147.1	159.1	213.8
<b>AUXILIARY CARRIER</b>						
<b>D</b>	5.00	6.00	7.00	8.50	8.60	13.00
<i>mm</i>	127.0	152.4	177.8	215.9	218.4	330.0
<b>FLOATING MOUNT</b>						
<b>B</b>	1.86	2.52	3.37	4.32	5.04	6.10
<i>mm</i>	47.3	64.1	85.6	109.7	128.0	155.0
<b>C</b>	2.31	2.80	3.67	4.26	5.24	6.17
<i>mm</i>	58.7	71.0	93.3	108.2	133.1	156.8
<b>E</b>	0.98	1.25	2.76	3.94	3.94	5.00
<i>mm</i>	25.0	31.8	70.1	100.0	100.1	127.0
<b>F</b>	0.47	0.63	1.97	2.95	3.15	3.94
<i>mm</i>	12.0	15.9	50.0	74.9	80.0	100.1
<b>G</b>	-	-	-	2.17	-	2.76
<i>mm</i>	-	-	-	55.1	-	70.1
<b>H*</b>	0.18(2)	0.24(2)	0.28(2)	0.28(4)	0.36(2)	0.34(4)
<i>mm</i>	4.5(2)	6.1(2)	7.1(2)	7.1(4)	9.1(2)	8.7(4)
<b>FOOT MOUNT</b>						
<b>I</b>	1.26	1.57	2.01	2.52	3.11	3.94
<i>mm</i>	32.0	40.0	51.0	64.0	78.9	100.0
<b>J</b>	1.37	1.89	2.36	2.91	3.67	4.72
<i>mm</i>	34.0	48.0	60.0	74.0	93.2	120.0
<b>K</b>	0.16	0.25	0.37	0.47	0.50	0.59
<i>mm</i>	4.0	6.4	9.5	12.0	12.7	15.0
<b>L</b>	0.31	0.50	0.75	0.94	1.00	1.18
<i>mm</i>	8.0	12.7	19.0	24.0	25.4	30.0
<b>M</b>	0.35	0.52	0.91	0.73	1.00	1.06
<i>mm</i>	8.9	13.3	23.0	18.5	25.4	27.0
<b>N</b>	-	0.41	0.71	0.45	0.69	0.65
<i>mm</i>	-	10.3	18.0	11.4	17.4	16.5
<b>O</b>	0.18	0.20	0.22	0.28	0.35	0.42
<i>mm</i>	4.6	5.2	5.5	7.1	9.0	10.7
<b>TUBE CLAMPS</b>						
<b>P</b>	-	2.24	2.92	3.26	3.84	5.19
<i>mm</i>	-	57.0	74.1	82.7	97.5	131.7
<b>Q</b>	-	2.72	3.44	3.81	4.39	5.93
<i>mm</i>	-	69.0	87.4	96.7	111.5	150.7
<b>R</b>	-	0.71	0.63	0.55	0.55	0.75
<i>mm</i>	-	18.0	16.0	14.0	14.0	19.0
<b>S</b>	-	0.14	0.17	0.15	0.15	0.24
<i>mm</i>	-	3.6	4.3	3.8	3.8	6.1
<b>T</b>	-	0.20	0.28	0.28	0.28	0.42
<i>mm</i>	-	5.2	7.1	7.1	7.1	10.7

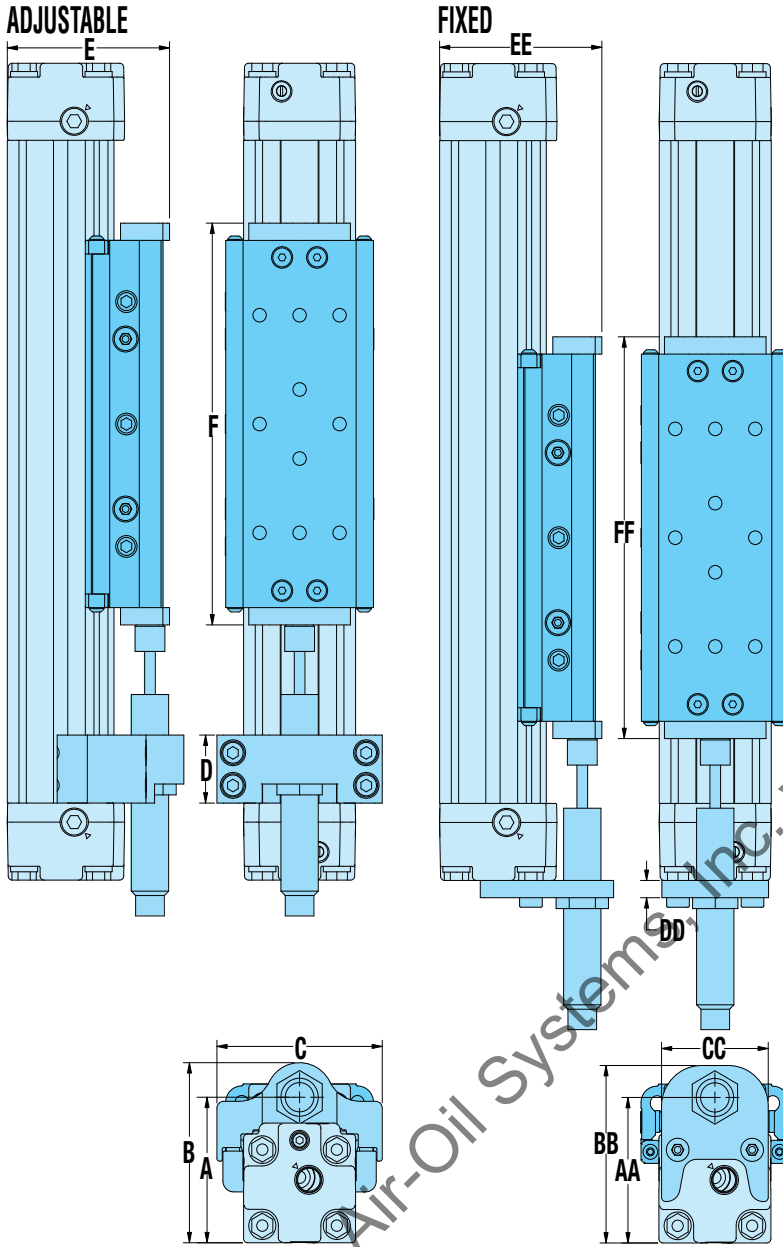
\*MXP16, 25, 32 & 50 use 2 center holes, MXP40 & 63 use 4 corner holes

**NOTE:** Auxiliary carrier is S-Solid Bearing carrier, see page MXP\_30 for carrier size and mounting dimensions



# S-SOLID BEARING OPTION DIMENSIONS

## ADJUSTABLE AND FIXED SHOCK ABSORBERS



### ADJUSTABLE SHOCK ABSORBER

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	1.65	2.11	2.91	3.32	4.24	5.21
<i>mm</i>	42.0	53.5	73.8	84.4	107.6	132.4
<b>B</b>	1.97	2.61	3.35	3.87	4.87	5.91
<i>mm</i>	50.0	66.2	85.0	98.4	123.8	150.0
<b>C</b>	1.74	2.44	2.95	3.43	4.09	5.20
<i>mm</i>	44.3	62.0	74.9	87.0	103.9	132.0
<b>D</b>	0.71	0.98	1.25	0.98	1.22	1.26
<i>mm</i>	18.0	25.0	31.8	25.0	31.0	32.0
<b>E</b>	1.80	2.39 <sup>1</sup>	3.20 <sup>2</sup>	3.57 <sup>3</sup>	4.53 <sup>4</sup>	5.50 <sup>5</sup>
<i>mm</i>	45.8	60.8 <sup>1</sup>	81.2 <sup>2</sup>	90.7 <sup>3</sup>	115.1 <sup>4</sup>	139.7 <sup>5</sup>
<b>F</b>	4.12	5.81 <sup>1</sup>	6.76 <sup>2</sup>	8.61 <sup>3</sup>	8.35 <sup>4</sup>	12.56 <sup>5</sup>
<i>mm</i>	104.6	147.7 <sup>1</sup>	171.8 <sup>2</sup>	218.8 <sup>3</sup>	212.2 <sup>4</sup>	318.9 <sup>5</sup>

### Stroke Adder: Adjustable Shock Absorber

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>in.</b>	0.62	1.50	1.96	1.70	1.66	1.65
<b>mm</b>	15.7	38.1	49.7	43.3	42.1	41.8

⚠ NOTE: For each adjustable shock absorber ordered, add Stroke Adder value to required stroke to determine configured actuator stroke.

$$\text{Required Stroke} + \left( \frac{\text{Adj. Stroke}}{\text{Shock Quantity}} \times \text{Adder value} \right) = \text{Configured Actuator Stroke}$$

Example: MXP25S, 500mm stroke required, 2 adjustable shocks  
 $500 + (2 \times 38.1) = 500 + 76.2 = 576.2\text{mm}$

### FIXED SHOCK ABSORBER

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>AA</b>	1.65	2.11	2.91	3.32	4.24	5.21
<i>mm</i>	42.0	53.5	73.8	84.4	107.6	132.4
<b>BB</b>	1.95	2.57	3.42	3.87	5.10	5.92
<i>mm</i>	49.5	65.3	86.8	98.4	129.6	150.3
<b>CC</b>	1.17	1.57	2.00	2.44	2.83	3.66
<i>mm</i>	29.8	40.0	50.8	62.0	72.0	93.0
<b>DD</b>	0.13	0.25	0.25	0.25	0.50	0.50
<i>mm</i>	3.3	6.4	6.4	6.4	12.7	12.7
<b>EE</b>	1.80	2.39 <sup>1</sup>	3.20 <sup>2</sup>	3.57 <sup>3</sup>	4.53 <sup>4</sup>	5.50 <sup>5</sup>
<i>mm</i>	45.8	60.8 <sup>1</sup>	81.2 <sup>2</sup>	90.7 <sup>3</sup>	115.1 <sup>4</sup>	139.7 <sup>5</sup>
<b>FF</b>	4.12	5.81 <sup>1</sup>	6.76 <sup>2</sup>	8.61 <sup>3</sup>	8.35 <sup>4</sup>	12.56 <sup>5</sup>
<i>mm</i>	104.6	147.7 <sup>1</sup>	171.8 <sup>2</sup>	218.8 <sup>3</sup>	212.2 <sup>4</sup>	318.9 <sup>5</sup>

<sup>1</sup>Carrier is standard MXP25S, 2.30" (58.4mm) high X 5.31" (135.0mm) long, Impact plates on each end of carrier add .09" (2.4mm) to total height and .50" (12.7mm) to total length

<sup>2</sup>Carrier is standard MXP32S, 3.06" (77.8mm) high X 6.02" (153.0mm) long, Impact bolts on each end of carrier add .13" (3.4mm) to total height and .74" (18.8mm) to total length

<sup>3</sup>Carrier is standard MXP40S, 3.51" (89.2mm) high X 7.87" (200.0mm) long, Impact bolts on each end of carrier add .06" (1.5mm) to total height and .74" (18.8mm) to total length

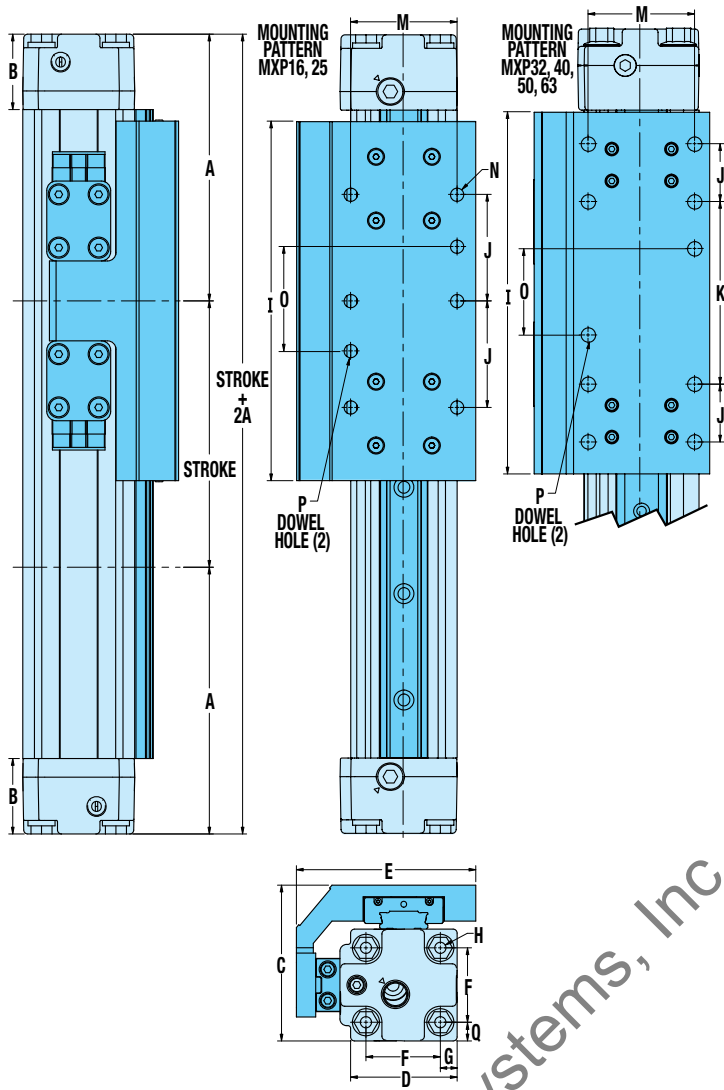
<sup>4</sup>Carrier is standard MXP50S, 4.44" (112.8mm) high X 7.91" (200.8mm) long, Impact bolts on each end of carrier add .09" (2.3mm) to total height and .45" (11.4mm) to total length

<sup>5</sup>Carrier is standard MXP63S, 5.48" (139.1mm) high X 12.11" (307.5mm) long, Impact bolts on each end of carrier add .45" (11.4mm) to total length

NOTE: Auxiliary carrier is S-Solid Bearing carrier, see page MXP\_30 for carrier size and mounting dimensions



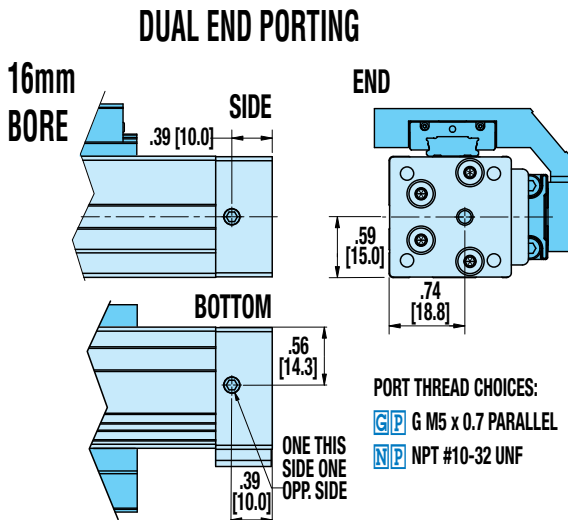
# P-PROFILED RAIL ACTUATOR DIMENSIONS



	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	3.13	3.94	4.89	5.79	6.26	8.42
<i>mm</i>	79.6	100.2	124.1	147.1	159.1	213.8
<b>B</b>	0.55	1.11	1.50	1.50	1.97	1.97
<i>mm</i>	14.0	28.3	38.1	38.0	50.0	50.0
<b>C</b>	1.81	2.30	3.05	3.53	4.71	5.51
<i>mm</i>	46.0	58.5	77.4	89.7	119.7	140.0
<b>D</b>	1.19	1.57	2.13	2.52	3.01	2.87
<i>mm</i>	30.3	40.0	54.0	64.0	78.7	73.0
<b>E</b>	1.78	2.65	3.25	3.85	4.62	5.65
<i>mm</i>	45.3	67.4	82.5	97.8	117.4	143.6
<b>F</b>	0.85	1.10	1.42	1.81	2.25	2.87
<i>mm</i>	21.5	27.9	36.1	46.0	57.2	73.0
<b>G</b>	0.17	0.28	0.38	0.35	0.43	0.53
<i>mm</i>	4.3	7.0	9.7	9.0	10.8	13.5
<b>H</b>	#8-32 (8)	#10-24 (8)	1/4-20 (8)	1/4-20 (8)	5/16-18 (8)	5/16-18 (8)
<i>mm</i>	M4x0.7 (8)	M5x0.8 (8)	M6x1.0 (8)	M6x1.0 (8)	M8x1.25 (8)	M8x1.25 (8)
<b>I</b>	4.33	5.31	6.69	7.87	8.50	12.00
<i>mm</i>	110.0	135.0	170.0	200.0	216.0	304.8
<b>J</b>	1.57	1.57	1.07	1.00	1.00	1.57
<i>mm</i>	40.0	40.0	27.1	25.4	25.4	40.0
<b>K</b>	-	-	3.37	4.50	2.75	5.12
<i>mm</i>	-	-	85.7	114.3	69.9	130.0
<b>M</b>	1.10	1.57	1.97	2.83	3.13	3.87
<i>mm</i>	28.0	40.0	50.0	72.0	79.4	98.3
<b>N</b>	#8-32 (6)	1/4-20 (6)	5/16-18 (8)	5/16-18 (8)	5/16-18 (10)	3/8-16 (8)
<i>mm</i>	M4x0.7 (6)	M6x1.0 (6)	M8x1.25 (8)	M8x1.25 (8)	M8x1.25 (10)	M10x1.5 (8)
<b>O</b>	1.57	1.57	1.77	2.50	1.50	2.56
<i>mm</i>	40.0	40.0	45.0	63.5	38.1	65.0
<b>P</b>	5/32" (2)	1/4" (2)	5/16" (2)	5/16" (2)	5/16" (2)	3/8" (2)
<i>mm</i>	M4 (2)	M6 (2)	M8 (2)	M8 (2)	M8 (2)	M8 (2)
<b>Q</b>	0.17	0.28	0.38	0.35	0.43	0.53
<i>mm</i>	4.3	7.0	9.7	9.0	10.8	13.5

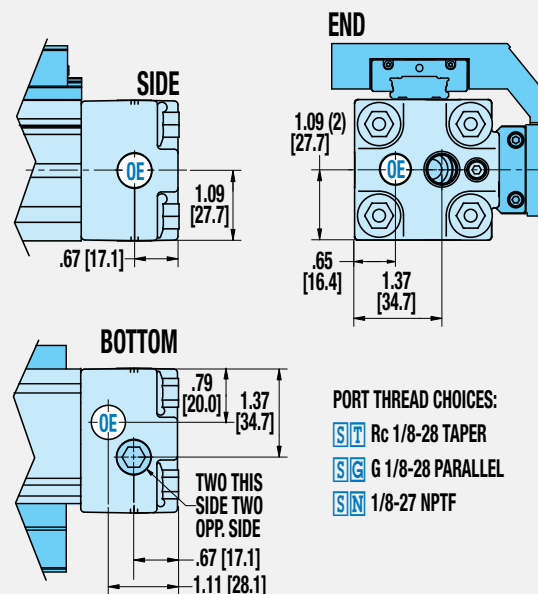
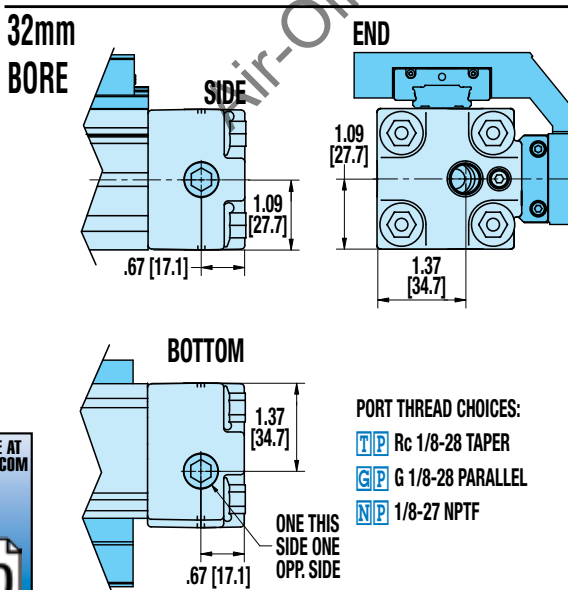
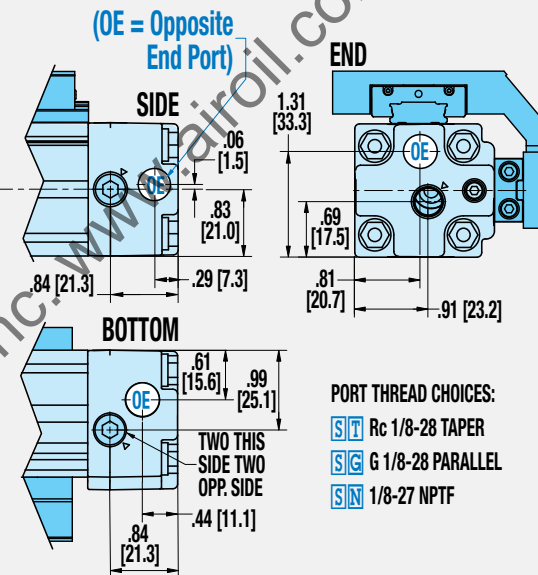
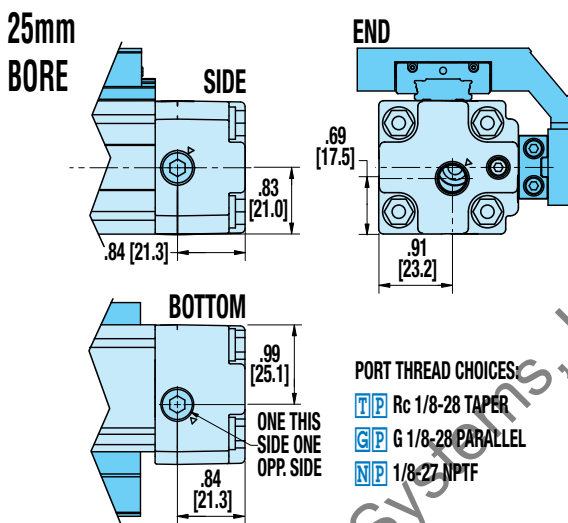


# P-PROFILED RAIL PORTING DIMENSIONS MXP16P, MXP25P, MXP32P



### SINGLE-END PORTING

Not Available for 16mm BORE



ABT

MXP

BC2

BC3

BC4

LS

MG

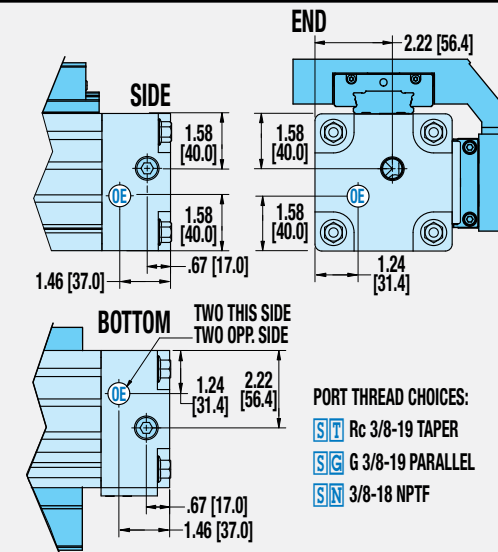
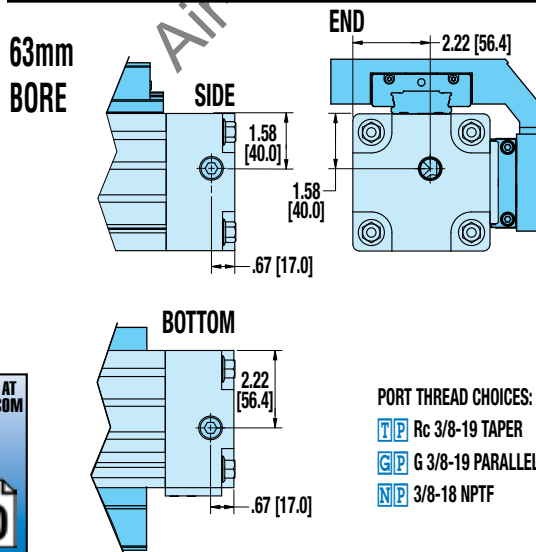
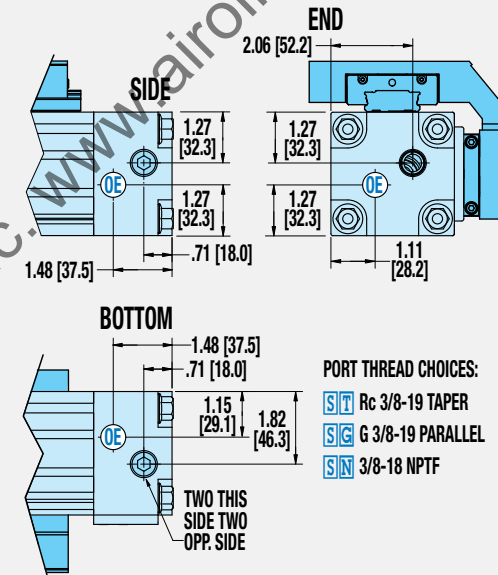
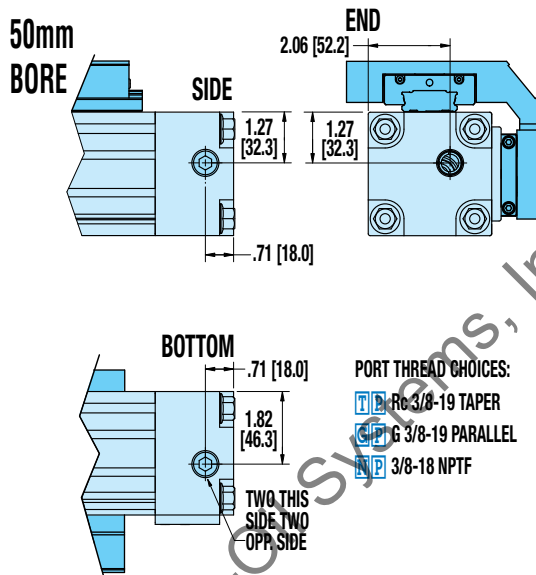
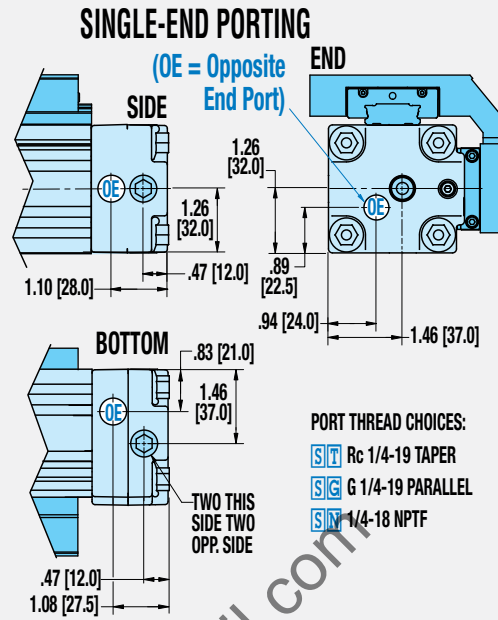
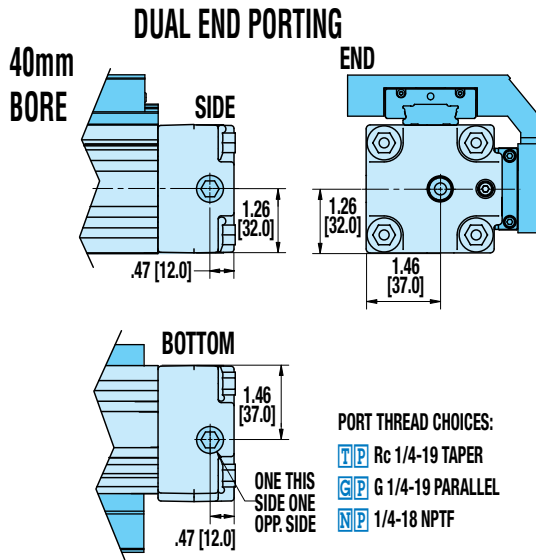
CG

PB

ENGR



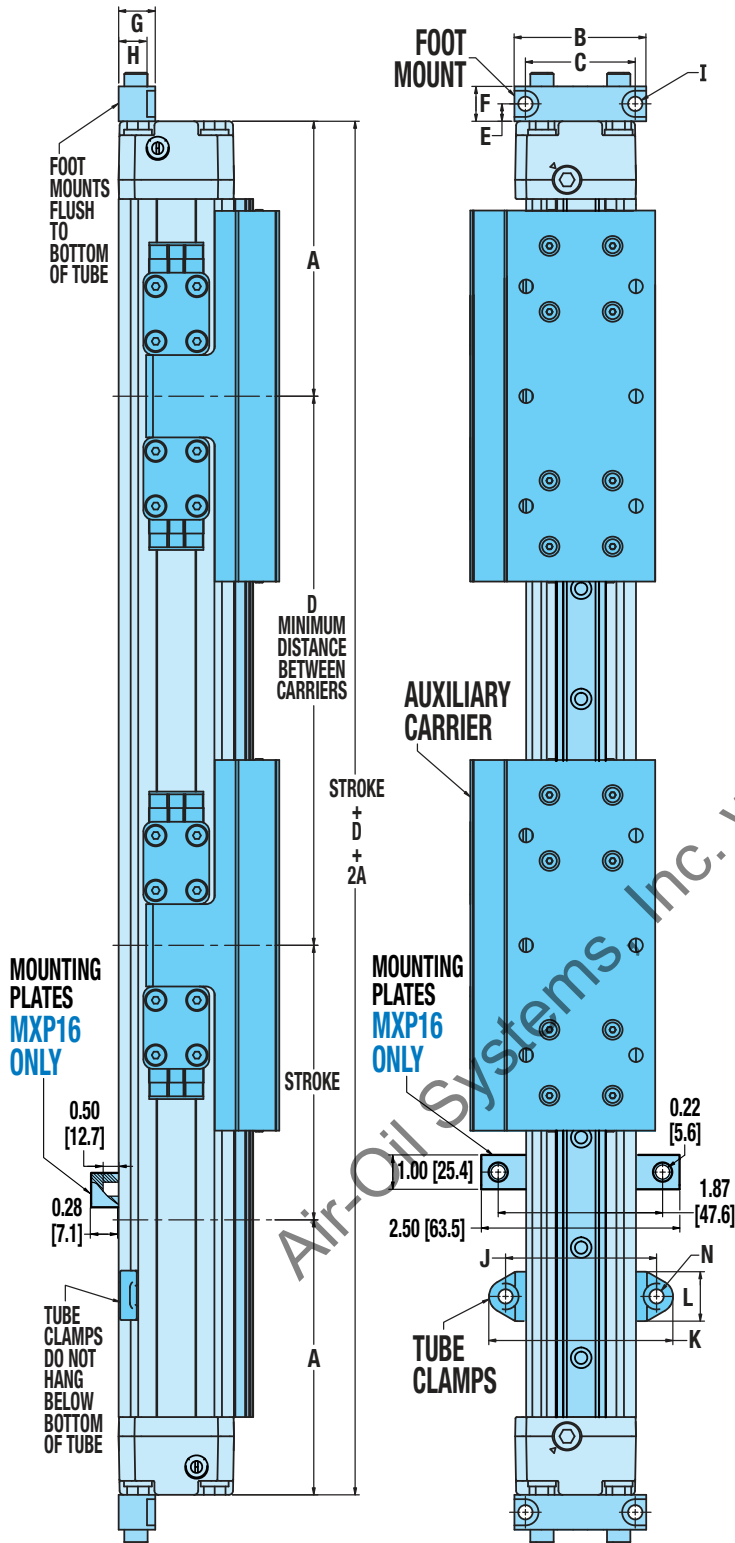
# P-PROFILED RAIL PORTING DIMENSIONS MXP40P, MXP50P, MXP63P



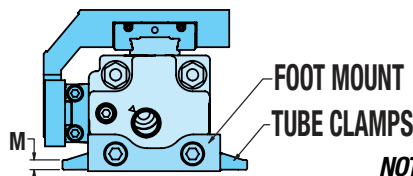
# P-PROFILED RAIL OPTION DIMENSIONS

## AUXILIARY CARRIER, FOOT MOUNT, TUBE CLAMPS

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CG  
PB  
ENGR



	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	3.13	3.94	4.89	5.79	6.26	8.42
<i>mm</i>	79.6	100.2	124.1	147.1	159.1	213.8
<b>AUXILIARY CARRIER</b>						
<b>D</b>	5.00	6.00	7.00	8.50	8.60	13.00
<i>mm</i>	127.0	152.4	177.8	215.9	218.4	330.0
<b>FOOT MOUNT</b>						
<b>B</b>	1.57	1.89	2.36	2.91	3.67	4.72
<i>mm</i>	40.0	48.0	60.0	74.0	93.2	120.0
<b>C</b>	1.26	1.57	2.01	2.52	3.11	3.94
<i>mm</i>	32.0	40.0	51.0	64.0	78.9	100.0
<b>E</b>	0.16	0.25	0.37	0.47	0.50	0.59
<i>mm</i>	4.0	6.4	9.5	12.0	12.7	15.0
<b>F</b>	0.31	0.50	0.75	0.94	1.00	1.18
<i>mm</i>	8.0	12.7	19.0	24.0	25.4	30.0
<b>G</b>	0.35	0.52	0.91	0.73	1.00	1.06
<i>mm</i>	8.9	13.3	23.0	18.5	25.4	27.0
<b>H</b>	-	0.41	0.71	0.45	0.69	0.65
<i>mm</i>	-	10.3	18.0	11.4	17.4	16.5
<b>I</b>	0.18	0.20	0.22	0.28	0.35	0.42
<i>mm</i>	4.6	5.2	5.5	7.1	9.0	10.7
<b>TUBE CLAMPS</b>						
<b>J</b>	-	2.17	2.86	3.26	3.84	5.19
<i>mm</i>	-	55.0	72.7	82.7	97.5	131.7
<b>K</b>	-	2.64	3.39	3.81	4.39	5.93
<i>mm</i>	-	67.0	86.0	96.7	111.5	150.7
<b>L</b>	-	0.71	0.63	0.55	0.55	0.75
<i>mm</i>	-	18.0	16.0	14.0	14.0	19.0
<b>M</b>	-	0.14	0.17	0.15	0.15	0.24
<i>mm</i>	-	3.6	4.3	3.8	3.8	6.1
<b>N</b>	-	0.20	0.28	0.28	0.28	0.42
<i>mm</i>	-	5.2	7.1	7.1	7.1	10.7

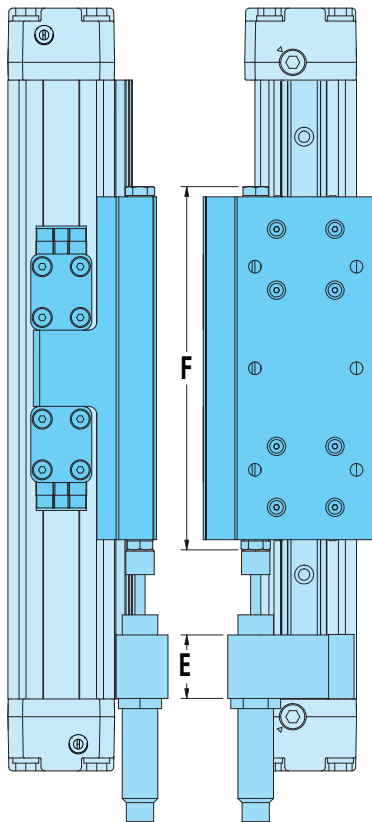


**NOTE:** Auxiliary carrier is P-Profiled Rail carrier, see page MXP\_35 for carrier size and mounting dimensions

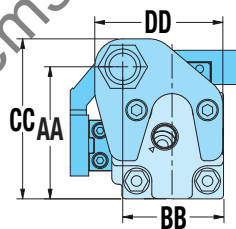
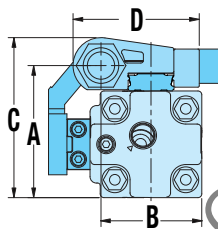
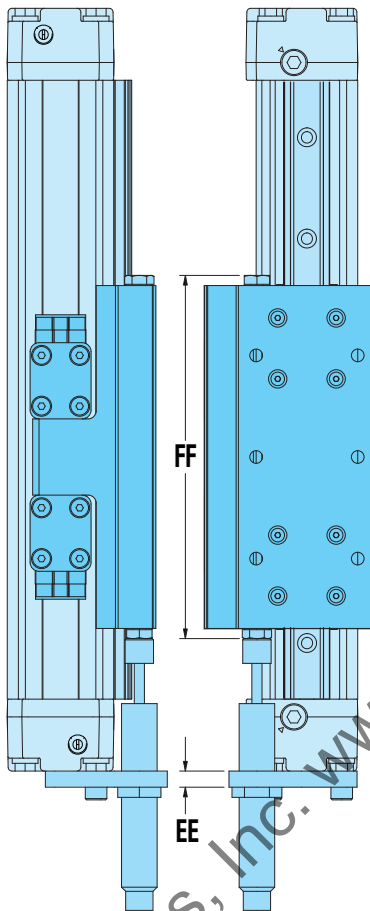
# P-PROFILED RAIL OPTION DIMENSIONS

## ADJUSTABLE AND FIXED SHOCK ABSORBERS

### ADJUSTABLE



### FIXED



### ADJUSTABLE SHOCK ABSORBER

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>A</b>	1.51	2.05	2.87	3.28	4.20	5.04
<i>mm</i>	<i>38.3</i>	<i>52.0</i>	<i>72.9</i>	<i>83.2</i>	<i>106.7</i>	<i>128.0</i>
<b>B</b>	1.38	1.56	2.25	2.63	3.55	3.97
<i>mm</i>	<i>35.0</i>	<i>39.7</i>	<i>57.2</i>	<i>66.8</i>	<i>90.2</i>	<i>100.8</i>
<b>C</b>	1.75	2.48	3.46	3.90	4.80	5.73
<i>mm</i>	<i>44.5</i>	<i>63.0</i>	<i>87.9</i>	<i>99.0</i>	<i>121.8</i>	<i>145.5</i>
<b>D</b>	1.54	1.96	2.63	3.17	3.55	4.07
<i>mm</i>	<i>39.2</i>	<i>49.7</i>	<i>66.7</i>	<i>80.6</i>	<i>90.2</i>	<i>103.3</i>
<b>E</b>	0.79	0.98	1.00	0.98	1.26	1.26
<i>mm</i>	<i>20.0</i>	<i>25.0</i>	<i>25.4</i>	<i>25.0</i>	<i>32.0</i>	<i>32.0</i>
<b>F</b>	4.65 <sup>1</sup>	5.63 <sup>2</sup>	7.43 <sup>3</sup>	8.61 <sup>4</sup>	8.95 <sup>5</sup>	12.45 <sup>6</sup>
<i>mm</i>	<i>118.0<sup>1</sup></i>	<i>143.0<sup>2</sup></i>	<i>188.8<sup>3</sup></i>	<i>218.8<sup>4</sup></i>	<i>227.4<sup>5</sup></i>	<i>316.2<sup>6</sup></i>

### Stroke Adder: Adjustable Shock Absorber

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>in</b>	0.96	2.10	2.73	2.40	3.15	2.74
<i>mm</i>	<i>24.4</i>	<i>53.3</i>	<i>69.3</i>	<i>61.0</i>	<i>80.0</i>	<i>69.6</i>

**NOTE:** For each adjustable shock absorber ordered, add Stroke Adder value to required stroke to determine configured actuator stroke.

$$\text{Required Stroke} + \left( \begin{matrix} \text{Adj. Stroke} \\ \text{Shock} \times \\ \text{Quantity} \end{matrix} \times \begin{matrix} \text{Adder} \\ \text{value} \end{matrix} \right) = \text{Configured Actuator Stroke}$$

Example: MXP25P, 500mm stroke required, 2 adjustable shocks  
 $500 + (2 \times 53.3) = 500 + 106.6 = 606.6\text{mm}$

### FIXED SHOCK ABSORBER

	MXP16	MXP25	MXP32	MXP40	MXP50	MXP63
<b>AA</b>	1.51	2.05	2.89	3.32	4.38	5.22
<i>mm</i>	<i>38.3</i>	<i>52.0</i>	<i>73.4</i>	<i>84.4</i>	<i>111.2</i>	<i>132.5</i>
<b>BB</b>	1.38	1.56	—	—	—	—
<i>mm</i>	<i>35.0</i>	<i>39.7</i>	—	—	—	—
<b>CC</b>	1.80	2.48	3.41	3.87	5.09	5.93
<i>mm</i>	<i>45.8</i>	<i>63.0</i>	<i>86.5</i>	<i>98.4</i>	<i>129.2</i>	<i>150.5</i>
<b>DD</b>	1.66	1.98	2.00	2.44	2.83	3.66
<i>mm</i>	<i>42.2</i>	<i>50.4</i>	<i>50.8</i>	<i>62.0</i>	<i>72.0</i>	<i>93.0</i>
<b>EE</b>	0.13	0.25	0.25	0.25	0.50	0.50
<i>mm</i>	<i>3.3</i>	<i>6.4</i>	<i>6.4</i>	<i>6.4</i>	<i>12.7</i>	<i>12.7</i>
<b>FF</b>	4.65 <sup>1</sup>	5.63 <sup>2</sup>	7.43 <sup>3</sup>	8.61 <sup>4</sup>	8.95 <sup>5</sup>	12.45 <sup>6</sup>
<i>mm</i>	<i>118.0<sup>1</sup></i>	<i>143.0<sup>2</sup></i>	<i>188.8<sup>3</sup></i>	<i>218.8<sup>4</sup></i>	<i>227.4<sup>5</sup></i>	<i>316.2<sup>6</sup></i>

<sup>1</sup>Carrier is standard MXP16P, 4.33" (110.0mm) long, Impact bolts on each end of carrier add .31" (8.0mm) to total length

<sup>2</sup>Carrier is standard MXP25P, 5.31" (135.0mm) long, Impact bolts on each end of carrier add .31" (8.0mm) to total length

<sup>3</sup>Carrier is standard MXP32P, 6.69" (170.0mm) long, Impact bolts on each end of carrier add .74" (18.8mm) to total length

<sup>4</sup>Carrier is standard MXP40P, 7.87" (200.0mm) long, Impact bolts on each end of carrier add .74" (18.8mm) to total length

<sup>5</sup>Carrier is standard MXP50P, 8.50" (216.0mm) long, Impact bolts on each end of carrier add .45" (11.4mm) to total length

<sup>6</sup>Carrier is standard MXP63P, 12.00" (304.8mm) long, Impact bolts on each end of carrier add .45" (11.4mm) to total length



**NOTE:** Auxiliary carrier is P-Profiled Rail carrier, see page MXP\_35 for carrier size and mounting dimensions

# SWITCHES

## SPECIFICATIONS



MX products offer a large number of sensing choices. There are 12 switch choices: reed, solid state PNP (sourcing) or solid state NPN (sinking); in normally open or normally closed; with flying leads or quick-disconnects.

Commonly used for end-of-stroke positioning, these switches allow drop-in installation anywhere along the entire actuator length. The one-piece design includes the retained fastening hardware and is designed for any open side or bottom slot on the MX. The internal piston magnet is a standard feature, therefore these switches can be installed in the field at anytime.

Switches are used to send digital signals to PLC (programmable logic controller), TTL, CMOS circuit or other controller device. Switches contain reverse polarity protection. Solid state QD cables are shielded; shield should be terminated at flying lead end.

All switches are CE rated and are RoHS compliant. Switches feature bright red or yellow LED signal indicators; solid state switches also have green LED power indicators.



	Order Code	Part Number	Lead	Switching Logic	Power LED	Signal LED	Operating Voltage	*Power Rating (Watts)	Switching Current (mA max.)	Current Consumption	Voltage Drop	Leakage Current	Temp. Range	Shock / Vibration
REED	<b>R Y</b>	8100-9082	5m	SPST Normally Open	—	Red	5 - 240 AC/DC	*10.0	100mA	—	3.0 V max.	—	14 to 158°F [-10 to 70°C]	50 G / 9 G
	<b>R K</b>	8100-9083	Quick Disconnect											
	<b>N Y</b>	8100-9084	5m	SPST Normally Closed	—	Yellow	5 - 110 AC/DC							
	<b>N K</b>	8100-9085	Quick Disconnect											
SOLID STATE	<b>T Y</b>	8100-9088	5m	PNP (Sourcing) Normally Open	Green	Yellow	10 - 30 Vdc	*3.0	100mA	20 mA @ 24V	2.0 V max.	0.05 mA max.		
	<b>T K</b>	8100-9089	Quick Disconnect											
	<b>K Y</b>	8100-9090	5m	NPN (Sinking) Normally Open	Green	Red								
	<b>K K</b>	8100-9091	Quick Disconnect											
	<b>P Y</b>	8100-9092	5m	PNP (Sourcing) Normally Closed	Green	Yellow								
	<b>P K</b>	8100-9093	Quick Disconnect											
	<b>H Y</b>	8100-9094	5m	NPN (Sinking) Normally Closed	Green	Red								
	<b>H K</b>	8100-9095	Quick Disconnect											

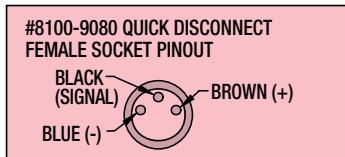
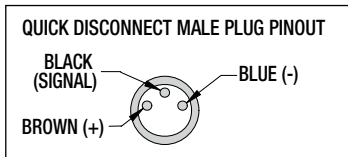
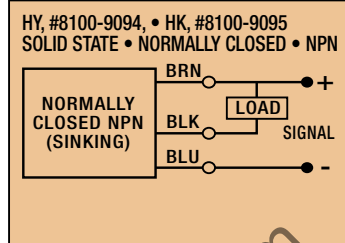
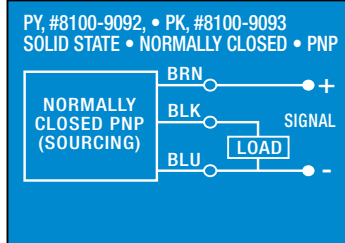
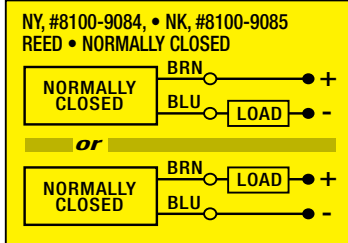
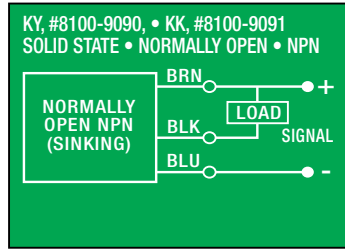
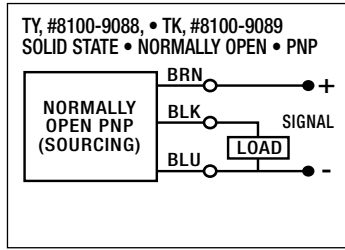
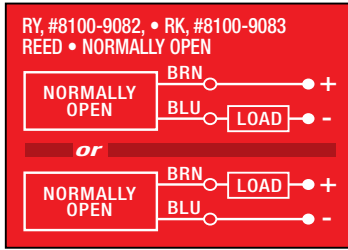
Enclosure classification IEC 529 IP67 (NEMA 6)

CABLES: Robotic grade, oil resistant polyurethane jacket, PVC insulation

**⚠️ \*WARNING:** Do not exceed power rating (Watt = Voltage x Amperage). Permanent damage to sensor will occur.

# SWITCHES

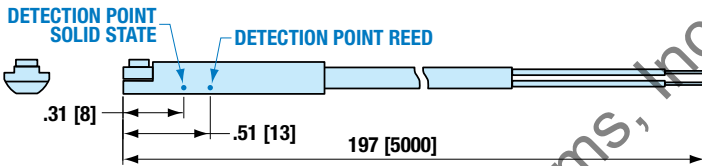
## WIRING DIAGRAMS



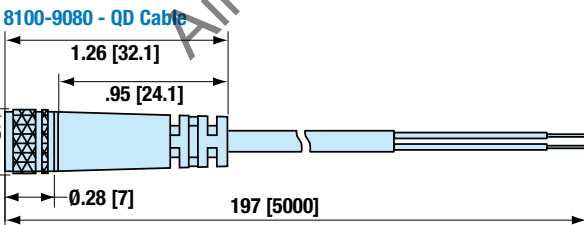
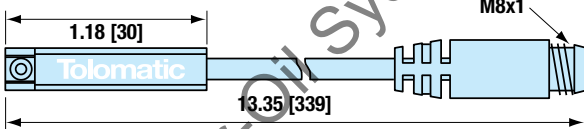
## DIMENSIONS

### SWITCH DIMENSIONS

[Y] - direct connect



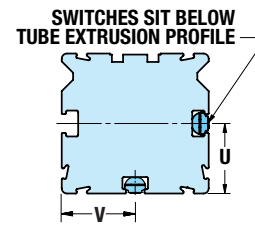
[Z] - QD (Quick-disconnect) switch



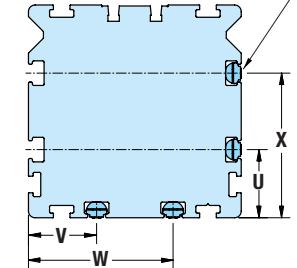
Dimensions in inches [brackets indicate dimensions in millimeters]

### MOUNTING DIMENSIONS

16, 25, 32



40, 50, 63 SWITCHES SIT BELOW TUBE EXTRUSION PROFILE

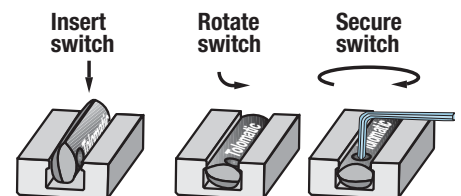


### SWITCH MOUNTING

	16	25	32	40	50	63
U	0.31	0.79	1.06	0.81	1.08	1.50
mm	7.9	20.0	27.0	20.5	27.4	38.0
V	0.59	0.83	1.09	0.81	1.08	1.50
mm	15.0	21.0	27.7	20.5	27.4	38.0
W	-	-	-	1.71	2.02	2.44
mm	-	-	-	43.5	51.4	62.0
X	-	-	-	1.71	2.02	2.44
mm	-	-	-	43.5	51.4	62.0

## SWITCH INSTALLATION AND REPLACEMENT

Place switch in side groove on tube at desired location with "Tolomatic" facing outward. While applying light pressure to the switch, rotate the switch is halfway into the groove. Maintaining light pressure, rotate the switch in the opposite direction until the it is fully inside the groove with "Tolomatic" visible. Re-position the switch to the exact location and lock the switch securely into place by tightening the screw on the switch.



# ADJUSTMENT PROCEDURES

## CUSHION NEEDLE ADJUSTMENT

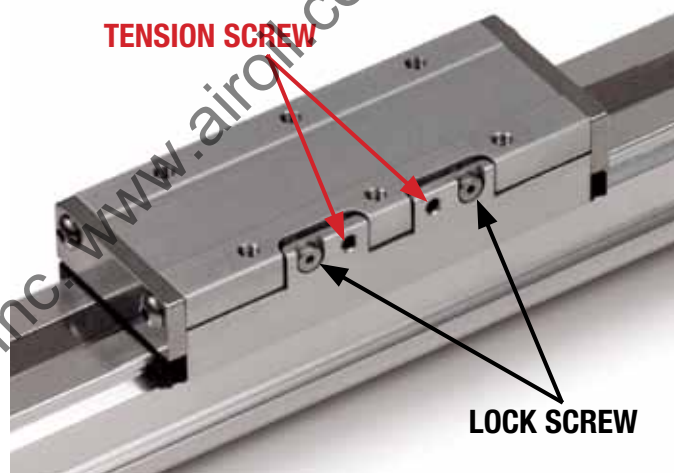
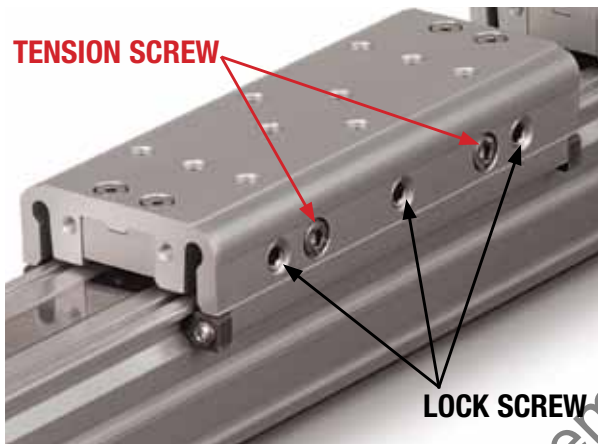


Adjust the cushion needle in the cylinder heads carefully to obtain proper deceleration for your particular application. Proper cushion needle adjustment is achieved when the carrier reaches the end of travel at a velocity approaching

zero. If the carrier reaches the end of stroke at velocity, then the cushion needs to be increased by turning the cushion needle screw clockwise. If the carrier stalls or bounces (quickly oscillating directions) before it reaches the end of stroke, then the cushion needs to be decreased by turning the cushion needle screw counterclockwise. Improper cushion adjustment may cause premature failure of the actuator. Call Tolomatic with any questions.

## **S** SOLID BEARING CARRIER ADJUSTMENT

The **S** solid bearing carrier will provide for maximum life when properly adjusted. The carrier design contains both tension and lock screws. The tension screws control the amount of pressure placed on the carrier bearings. The lock screws lock the tension screws in place and provide fine adjustment of the carrier bearings. The number of tension and lock screws will vary depending on the bore size of the actuator.



1. Fully loosen all tension and lock screws. They do not need to be removed, just fully loosened.
2. Tighten tension screws on both sides of carrier roughly 1/8 to 1/4 turn clockwise past where the screw starts to feel snug. The carrier should be very difficult or impossible to move by hand.
3. Next, adjust the lock screws on both sides of the carrier roughly 1/8 to 1/4 turn clockwise past where the screw starts to engage.
4. Ideal carrier tension is achieved when the carrier feels snug in relation to the tube. No rocking motion should be present. The carrier should be loose enough to be moved by hand over the entire length of the actuator. If after this process the carrier has become too loose, equally adjust all of the lock screws with a slight 1/32 turn counterclockwise. A carrier that is adjusted too tight will increase the breakaway pressure required for motion; in extreme cases no motion will occur when air is applied.

**MXP16** **NOTE: MXP16S requires a different carrier adjustment procedure, see below.**

- Tools Required:
- Inch Models: 1/16 inch and 2.5mm Hex Wrench (Key)
  - Metric Models: 2 and 2.5 mm Hex Wrench (Key)
1. Loosen endplate screws on both ends of the carrier.
  2. Fully loosen all tension and lock screws. They do not need to be removed, just fully loosened.

3. Tighten tension screws by turning them clockwise until the carrier is just tight enough so that no side-to-side rocking motion is present and it can easily be moved by hand over the entire stroke length with no hesitation. Very little torque on the screws is required to obtain this condition.

Note: The Tension Screws are the small set screw style fastener. The Lock Screws are the larger, low head, hex drive screws.

4. Tighten lock screws by turning them clockwise until tight. The carrier should feel snug in relation to the tube, with no side-to-side rocking motion present. If the carrier becomes too loose, loosen the lock screws, tighten the tension screws and then retighten the lock screws.

### Allen wrench sizes for carrier adjustment, Solid bearing actuators

	Tension Screw		Lock Screw	
	in	mm	in	mm
<b>16</b>	1/16	2	1/16	2
<b>25</b>	5/32	4	1/8	3
<b>32</b>	5/32	4	3/32	2
<b>40</b>	5/32	4	1/8	3
<b>50</b>	3/16	4	3/32	2.5
<b>63</b>	1/4	5	3/16	5

6. Once ideal carrier tension is achieved, fully tighten end plate screws on both ends of the carrier.

During the service life, this process may need to be repeated. Keeping the carrier properly adjusted will prolong the life of the **S** solid bearing system.

# SERVICE PARTS

## REPAIR KITS

Repair kit includes: dust band, seal band, end caps, internal soft seals (piston seals, cushion seals, wipers), [Also for **S** style: bearings and bearing caps]

The part number for a repair kit begins with RK followed by model, bore size, bearing type, and stroke length (**SJK** = inch/US Standard, **SM** = metric) (NOTE: If unit has an auxiliary carrier also include DW and distance between carriers)

REPAIR KIT	MODEL	BORE SIZE	BEARING TYPE	STROKE METRIC	STROKE LENGTH	AUXILIARY CARRIER	DISTANCE BETWEEN CARRIERS
<b>RK</b>	<b>MXP</b>	<b>40</b>	<b>S</b>	<b>SM</b>	<b>2007.02</b>	<b>DW</b>	<b>215.9</b>

## SWITCHES

### TO ORDER SERVICE PARTS SWITCHES:

Switches for MXP include retained mounting hardware and are the same for all bore sizes and bearing styles

Code	Part Number	Lead	Normally	Sensor Type
<b>R</b> <b>Y</b>	8100-9082	5m (197 in)	Open	Reed
<b>R</b> <b>K</b>	8100-9083*	Quick-disconnect		
<b>N</b> <b>Y</b>	8100-9084	5m (197 in)	Closed	Reed
<b>N</b> <b>K</b>	8100-9085*	Quick-disconnect		
<b>T</b> <b>Y</b>	8100-9088	5m (197 in)	Open	Solid State PNP
<b>T</b> <b>K</b>	8100-9089*	Quick-disconnect		
<b>K</b> <b>Y</b>	8100-9090	5m (197 in)	Open	Solid State NPN
<b>K</b> <b>K</b>	8100-9091*	Quick-disconnect		
<b>P</b> <b>Y</b>	8100-9092	5m (197 in)	Closed	Solid State PNP
<b>P</b> <b>K</b>	8100-9093*	Quick-disconnect		
<b>H</b> <b>Y</b>	8100-9094	5m (197 in)	Closed	Solid State NPN
<b>H</b> <b>K</b>	8100-9095*	Quick-disconnect		

\*Also order mating QD cable #8100-9080

	8100-9080	Mating QD (Quick-disconnect) cable 197 in. (5m)
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To order switches using configured parts string (will include mating female QD cable if required)

SWITCH KIT	MODEL	BORE SIZE	BEARING TYPE	SWITCH CODE	QUANTITY
<b>SW</b>	<b>MXP</b>	<b>25</b>	<b>N</b>	<b>RK</b>	<b>2</b>

# SERVICE PARTS MXP16, MXP25, MXP32

MOUNTING OPTIONS		1 6			2 5			3 2		
		N Internal	S Solid	P Profiled Rail	N Internal	S Solid	P Profiled Rail	N Internal	S Solid	P Profiled Rail
<b>Foot Mount</b> (1 bracket, 2 bolts)	Inch	8116-9519	8116-9519	8116-9519	8125-9519	8125-9519	8125-9519	8132-9519	8132-9519	8132-9519
	Metric	8116-9019	8116-9019	8116-9019	8125-9019	8125-9019	8125-9019	8132-9019	8132-9019	8132-9019
<b>Tube Clamp</b> (2 clamps)		NA	NA	NA	8125-9018	8125-9018	8125-9018	8132-9018	8132-9018	8132-9018
<b>Floating Mount</b> (brackets, pin, mounting fasteners)	Inch	8116-9535	8116-9536	NA	8125-9535	8125-9536	NA	8132-9535	8132-9536	NA
	Metric	8116-9035	8116-9036	NA	8125-9035	8125-9036	NA	8132-9035	8132-9036	NA
<b>Mounting Plate</b> (1 plate, 2 bolts)	Inch	8316-9016	8316-9016	8316-9016						
	Metric	8316-9016	8316-9016	8316-9016						

SHOCK ABSORBER KITS		1 6			2 5			3 2		
		N Internal	S Solid	P Profiled Rail	N Internal	S Solid	P Profiled Rail	N Internal	S Solid	P Profiled Rail
<b>Fixed Shock Absorber Kit - Light Duty</b> (1 shock absorber, all required hardware)	Inch	8116-9510	8116-9511	8116-9512	8125-9510	8125-9511	8125-9512	8132-9510	8132-9511	8132-9512
	Metric	8116-9010	8116-9011	8116-9012	8125-9010	8125-9011	8125-9012	8132-9010	8132-9011	8132-9012
<b>Fixed Shock Absorber Kit - Heavy Duty</b> (1 shock absorber, all required hardware)	Inch	8116-9525	8116-9526	8116-9527	8125-9525	8125-9526	8125-9527	8132-9525	8132-9526	8132-9527
	Metric	8116-9025	8116-9026	8116-9027	8125-9025	8125-9026	8125-9027	8132-9025	8132-9026	8132-9027
<b>*Adjustable Shock Absorber Kit - Light Duty</b> (1 shock absorber, all required hardware)	Inch	8116-9515	8116-9016	8116-9517	8125-9515	8125-9016	8125-9517	8132-9515	8132-9016	8132-9517
	Metric	8116-9015	8116-9016	8125-9017	8125-9015	8125-9016	8125-9017	8132-9015	8132-9016	8132-9017
<b>*Adjustable Shock Absorber Kit - Heavy Duty</b> (1 shock absorber, all required hardware)	Inch	8116-9530	8116-9031	8116-9032	8125-9530	8125-9031	8125-9532	8132-9530	8132-9031	8132-9532
	Metric	8116-9030	8116-9031	8116-9032	8125-9030	8125-9031	8125-9032	8132-9030	8132-9031	8132-9032

SHOCK PARTS		1 6			2 5			3 2		
		N Internal	S Solid	P Profiled Rail	N Internal	S Solid	P Profiled Rail	N Internal	S Solid	P Profiled Rail
<b>Fixed Shock Absorber Mounting Hardware</b> (1 shock mount)	Inch	8116-9520	8116-9520	8116-9522	8125-9520	8125-9520	8125-9522	8132-9520	8132-9520	8132-9522
	Metric	8116-9020	8116-9020	8116-9022	8125-9020	8125-9020	8125-9022	8132-9020	8132-9020	8132-9022
<b>*Adj. Shock Absorber Mounting Hardware</b> (1 shock mount)		8116-9023	8116-9023	8116-9024	8125-9023	8125-9023	8125-9024	8132-9023	8132-9023	8132-9024
<b>Shock Stop Kit</b> (Hardware needed for shock to strike carrier)	Inch	8116-9521	NA	8116-9034	8125-9521	8125-9013	8125-9534	8132-9521	4912-1063	8132-9534
	Metric	8116-9021	NA	8116-9034	8125-9021	8125-9013	8125-9034	8132-9021	4912-1063	8132-9034
<b>Shock Absorber - Heavy Duty</b> (1 shock absorber)		7906-1066	7906-1066	7906-1066	4910-1338	4910-1338	4910-1338	4912-1068	4912-1068	4912-1068
<b>Shock Absorber - Light Duty</b> (1 shock absorber)		7906-1065	7906-1065	7906-1065	4910-1337	4910-1337	4910-1337	4912-1067	4912-1067	4912-1067

\*NOTE: **N** Internal bearing: Adjustable shock absorbers will decrease actuator stroke, see ▲ Stroke Adder note on page MXP\_29 for more information.  
**S** Solid bearing: Adjustable shock absorbers will decrease actuator stroke, see ▲ Stroke Adder note on page MXP\_34 for more information.  
**P** Profiled rail: Adjustable shock absorbers will decrease actuator stroke, see ▲ Stroke Adder note on page MXP\_39 for more information.



# SERVICE PARTS MXP40, MXP50, MXP63

MOUNTING OPTIONS		40			50			63		
		I Internal	S Solid	P Profiled Rail	I Internal	S Solid	P Profiled Rail	I Internal	S Solid	P Profiled Rail
<b>Foot Mount</b> (1 bracket, 2 bolts)	Inch	8140-9519	8140-9519	8140-9519	8150-9519	8150-9519	8150-9519	8163-9519	8163-9519	8163-9519
	Metric	8140-9019	8140-9019	8140-9019	8150-9019	8150-9019	8150-9019	8163-9019	8163-9019	8163-9019
<b>Tube Clamp</b> (2 clamps)		8140-9018	8140-9018	8140-9018	8140-9018	8140-9018	8140-9018	8163-9018	8163-9018	8163-9018
<b>Floating Mount</b> (brackets, pin, mounting fasteners)	Inch	8140-9535	8140-9536	NA	8150-9535	8150-9536	NA	8163-9535	8163-9536	NA
	Metric	8140-9035	8140-9036	NA	8150-9035	8150-9036	NA	8163-9035	8163-9036	NA

SHOCK ABSORBER KITS		40			50			63		
		I Internal	S Solid	P Profiled Rail	I Internal	S Solid	P Profiled Rail	I Internal	S Solid	P Profiled Rail
<b>Fixed Shock Absorber Kit - Light Duty</b> (1 shock absorber, all required hardware)	Inch	8140-9510	8140-9511	8140-9512	8150-9510	8150-9511	8150-9512	8163-9510	8163-9511	8163-9512
	Metric	8140-9010	8140-9011	8140-9012	8150-9010	8150-9011	8150-9012	8163-9010	8163-9011	8163-9012
<b>Fixed Shock Absorber Kit - Heavy Duty</b> (1 shock absorber, all required hardware)	Inch	8140-9525	8140-9526	8140-9527	8150-9525	8150-9526	8150-9527	8163-9525	8163-9526	8163-9527
	Metric	8140-9025	8140-9026	8140-9027	8150-9025	8150-9026	8150-9027	8163-9025	8163-9026	8163-9027
<b>*Adjustable Shock Absorber Kit - Light Duty</b> (1 shock absorber, all required hardware)	Inch	8140-9515	8140-9016	8140-9517	8150-9515	8150-9016	8150-9517	8163-9515	8163-9016	8163-9517
	Metric	8140-9015	8140-9016	8140-9017	8150-9015	8150-9016	8150-9017	8163-9015	8163-9016	8163-9017
<b>*Adjustable Shock Absorber Kit - Heavy Duty</b> (1 shock absorber, all required hardware)	Inch	8140-9530	8140-9031	8140-9532	8150-9530	8150-9031	8150-9532	8163-9530	8163-9031	8163-9532
	Metric	8140-9030	8140-9031	8140-9032	8150-9030	8150-9031	8150-9032	8163-9030	8163-9031	8163-9032

SHOCK PARTS		40			50			63		
		I Internal	S Solid	P Profiled Rail	I Internal	S Solid	P Profiled Rail	I Internal	S Solid	P Profiled Rail
<b>Fixed Shock Absorber Mounting Hardware</b> (1 shock mount)	Inch	8140-9520	8140-9520	8140-9520	8150-9520	8150-9520	8150-9522	8163-9520	8163-9520	8163-9520
	Metric	8140-9020	8140-9020	8140-9020	8150-9020	8150-9020	8150-9022	8163-9020	8163-9020	8163-9020
<b>*Adj. Shock Absorber Mounting Hardware</b> (1 shock mount)		8140-9023	8140-9023	8140-9024	8150-9023	8150-9023	8163-9024	8163-9023	8163-9023	8163-9024
<b>Shock Stop Kit</b> (Hardware needed for shock to strike carrier)	Inch	8140-9521	4912-1068	8140-9534	8150-9521	4415-1003	8150-9034	8163-9521	4915-1003	8150-9034
	Metric	8140-9021	4912-1063	8140-9034	8150-9021	4415-1003	8150-9034	8163-9021	4915-1003	8150-9034
<b>Shock Absorber - Heavy Duty</b> (1 shock absorber)		4912-1068	4912-1068	4912-1068	4920-1069	4920-1069	4920-1069	4920-1069	4920-1069	4920-1069
<b>Shock Absorber - Light Duty</b> (1 shock absorber)		4912-1067	4912-1067	4912-1067	4920-1068	4920-1068	4920-1068	4920-1068	4920-1068	4920-1068

\*NOTE: **I** Internal bearing: Adjustable shock absorbers will decrease actuator stroke, see ▲ Stroke Adder note on page MXP\_29 for more information.  
**S** Solid bearing: Adjustable shock absorbers will decrease actuator stroke, see ▲ Stroke Adder note on page MXP\_34 for more information.  
**P** Profiled rail: Adjustable shock absorbers will decrease actuator stroke, see ▲ Stroke Adder note on page MXP\_39 for more information.

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# ORDERING

MODEL SELECTION (MUST BE IN THIS ORDER)

**MXP40PSN SM2007.02**

OPTIONS (IN ANY ORDER)

**DW215.9 FM2 TC8 TK2 AH2**

ABT

MXP

BC2

BC3

BC4

LS

MG

CG

PB

ENGR

**MODEL**  
**MXP** MXP Pneumatic Band Cylinder

**BORE**

**16** 16 mm (5/8-inch) bore  
**25** 25 mm (1-inch) bore  
**32** 32 mm (1 1/4-inch) bore  
**40** 38 mm (1 1/2-inch) bore  
**50** 50 mm (2-inch) bore  
**63** 64 mm (2 1/2-inch) bore

**BEARING**

**N** Internal Bearing  
**S** Solid Bearing  
**P** Profiled Rail

**PORTING**

**TP** Metric Taper (Rc/BST), Dual-end  
**GP** Metric Parallel (ISO-G/BSP), Dual-end  
**NP** NPT, Dual-end  
**ST** Single-end, Metric Taper  
**SG** Single-end, Metric Parallel  
**SN** Single-end, NPT

⚠ Single End Porting **ST SG SN** is not available for MXP16  
 ⚠ Metric Taper Porting **TP** is not available for MXP16

**STROKE LENGTH & MOUNTING TYPE**

**SK** \_\_\_\_\_ Stroke, enter desired stroke length in **inches**  
**SM** \_\_\_\_\_ Stroke, enter desired stroke length in **millimeters**

**NOTE: Actuator mounting threads and mounting fasteners will be either inch or metric; depending on how stroke length is indicated**

**SK=inch mounting**  
**SM= metric mounting**

**AUXILIARY CARRIER**

**DW** \_\_\_\_\_ Auxiliary Carrier, enter center-to-center spacing desired in **inches (SK)** or **millimeters (SM)**

(Same unit of measure as stroke length is required)

⚠ **Center-to-center spacing between carriers adds to overall length of the actuator, this distance will not be subtracted from stroke length specified in the previous step**

**MOUNTING**

**FM** Foot Mount, enter quantity desired  
**TC** Tube Clamps, enter number of pairs (Not available on MXP16)  
**MP** Mounting Plate (includes T-Nuts) for MXP16 ONLY  
**FL** Floating Mount

⚠ **NOTE: Floating Mount is not available with "P" Profiled Rail**  
 ⚠ **NOTE: Shock Absorbers are not available with Floating Mount**

**SWITCHES**

**RY** Reed Switch (Normally Open) with 5-meter lead, & enter quantity desired  
**RK** Reed Switch (Normally Open) with 5-meter lead/QD, & quantity  
**NY** Reed Switch (Normally Closed) with 5-meter lead, & quantity  
**NK** Reed Switch (Normally Closed) with 5-meter lead/QD, & quantity  
**TY** Solid State Switch PNP (Normally Open) w/ 5-meter lead, & quantity  
**TK** Solid State Switch PNP (Normally Open) w/ 5-meter lead/QD, & quantity  
**KY** Solid State Switch NPN (Normally Open) w/ 5-meter lead, & quantity  
**KK** Solid State Switch NPN (Normally Open) w/ 5-meter lead/QD, & quantity  
**PY** Solid State Switch PNP (Normally Closed) w/ 5-meter lead, & quantity  
**PK** Solid State Switch PNP (Normally Closed) w/ 5-meter lead/QD, & quantity  
**HY** Solid State Switch NPN (Normally Closed) w/ 5-meter lead, & quantity  
**HK** Solid State Switch NPN (Normally Closed) w/ 5-meter lead/QD, & quantity

**SHOCK ABSORBER**

**SD** Fixed Shock Hardware & enter quantity desired  
**SL** Fixed Shock Light Duty & enter quantity desired  
**SH** Fixed Shock Heavy Duty & enter quantity desired  
**AD** Adjustable Shock Hardware & enter quantity desired  
**AL** Adjustable Shock Light Duty & enter quantity desired  
**AH** Adjustable Shock Heavy Duty & enter quantity desired

⚠ **NOTE: Adjustable Shock Absorbers reduce usable stroke length of the actuator. Please see the following pages for required stroke adder.**  
**IN** Internal Bearing.....pg. MXP\_29  
**SI** Solid Bearing.....pg. MXP\_34  
**PI** Profiled Rail .....pg. MXP\_39

⚠ **NOTE: Floating Mount is not available with Shock Absorbers**

**VISIT [www.tolomatic.com/mxp](http://www.tolomatic.com/mxp) FOR COMPLETE, UP-TO-DATE INFORMATION**

⚠ **Not all codes listed are compatible with all options.**

**Call Tolomatic to determine available options and accessories based on your application requirements.**

# CUSTOM, MODIFIED AND STANDARD PRODUCT SOLUTIONS

## CUSTOM CAPABILITIES



Tolomatic's custom model shop can create first-piece prototypes with the industry's fastest turnaround times.

### Custom Solutions are Standard Business

Hundreds of customers partner with Tolomatic to solve unique automation application challenges. We are geared to handle design requests—from our Model Shop (for fast prototypes) all the way through our ISO 9001:2000 certified

manufacturing facility. Over 33% of our total business is based on products not found in our standard catalog.

With an innovation mindset, years of solid industry experience, and fast response times, let Tolomatic help you get the job done. If you are looking for linear motion solutions—pneumatic or electromechanical—and you cannot find a catalog product, get with Tolomatic. You will experience what we mean by

**Excellence in Motion.**

## MATERIAL HANDLING



Conveying machinery with built-in lane diverters offer a compact footprint with optimal performance.

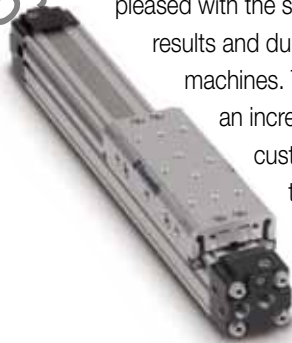
### Customer Challenge:

The traditional method of using tie rod cylinders to operate diverters required too much space to fit in space-restrictive production areas.

### Tolomatic Solution:

Tolomatic recommended a series of pneumatic rodless band cylinders that could be easily retrofitted into production lines by offering a variety of mounting options.

The manufacturer's customers were pleased with the space saving results and durability of the machines. The result was an increase of repeat customers for the manufacturer.



## PACKAGING



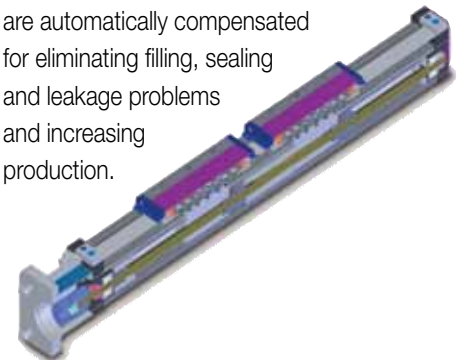
Modular bagging system fills and seals a wide range of materials and bag sizes.

### Customer Challenge:

A leader in packaging technology was faced with the problem of compensating for inconsistent bag dimensions on its modular bag filling and sealing system. Irregularly sized bags required manual setup and were slowing the production process which required high-speed accuracy and flexibility.

### Tolomatic Solution:

Tolomatic supplied a series of customized electric screw drive actuators that precisely positioned the incoming bags before insertion into the filling/sealing line. Two actuators adjust the vertical position and two others center the bags in the tray. The results: variations in bag lengths and widths are automatically compensated for eliminating filling, sealing and leakage problems and increasing production.



*The best motion control and linear motion solutions for your applications.*

# BC2 SOLID BEARING RODLESS CYLINDER

ABT

IMXP

**BC2**

BC3

BC4

LS

MG

CC

PB

ENGR

Air-Oil Systems, Inc. www.airoil.com

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# BC2 BAND CYLINDER

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Endurance Technology features are designed for maximum durability to provide extended service life.

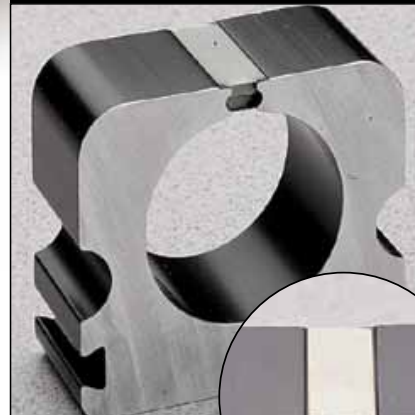
### FORMED STEEL PISTON BRACKET

- Provides maximum strength at major stress points
- Heat treated carbon steel withstands the toughest dynamic forces
- Strongest bracket design in the industry assures long life with less maintenance



### STAINLESS STEEL SEALING BAND SYSTEM

- Fatigue resistant stainless steel bands are specifically made to provide longer life and will not elongate, like elastomers
- Outer band keeps out contaminants for extended performance
- Inner band provides a smooth surface for less seal wear

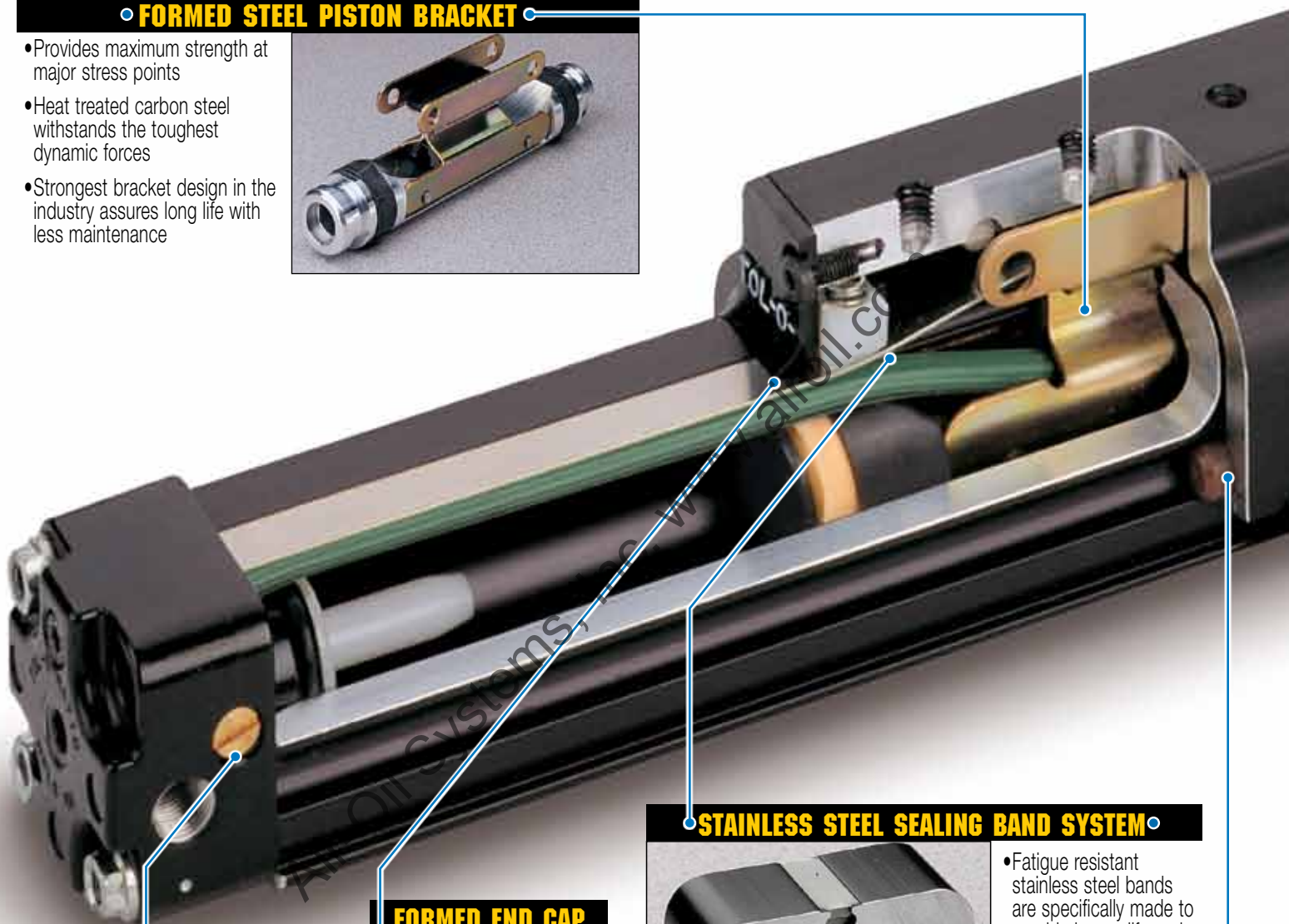


### FORMED END CAP WIPER SEAL

- Keeps contaminants from entering the sealing area
- Protects internal components
- Reduces maintenance while increasing productivity

### ADJUSTABLE CUSHIONS

- Adjustable cushions are standard, not optional
- Easy screw adjustment for end-of-stroke deceleration
- Protects actuator and load from damage



ABT  
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BC2  
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BC4  
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# TOLOMATIC... THE RODLESS CYLINDER LEADER



## 3-PORTED HEADS

- Standard feature
- Simplifies air connections

## RIGID BLACK-ANODIZED EXTRUDED ALUMINUM TUBE

- Stronger, stiffer tube retains tolerance specs when chamber is pressurized
- Keeps sealing band in place for maximized air efficiency
- Tube supports are minimized
- Solid structural support provides durability and long life performance

## ADJUSTABLE CARRIER BRACKET



- 2-bolt adjustment instead of a series of set screws
- Easy to set tension for freer running of stiffer systems
- Minimizes free play while maintaining a higher level of load guidance

## LOAD-BEARING CARRIER DESIGN

- Load and piston are independent - piston floats, resulting in less friction and longer seal life
- Engineered resin load bearings offer consistently low friction and long wear



## OPTIONS



### AUXILIARY CARRIER

- Substantially higher load capacity
- Substantially higher bending moment capacity



### FLOATING MOUNT

- Compensates for non-parallelism between band cylinder and externally guided load



### TUBE SUPPORT MOUNTS

- Used for intermediate support



### FOOT MOUNTS

- For end mounting of band cylinder



### SHOCK ABSORBERS

- Smooth deceleration
- Allows increased operating speed
- Self-compensates for load or speed changes
- Minimizes impact load to equipment
- Higher equipment productivity
- Adjustable position shocks available



### SWITCHES

- Available in Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers

ABT

MXP

BC2

BC3

BC4

LS

MG

CC

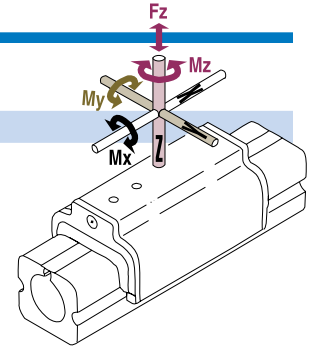
PB

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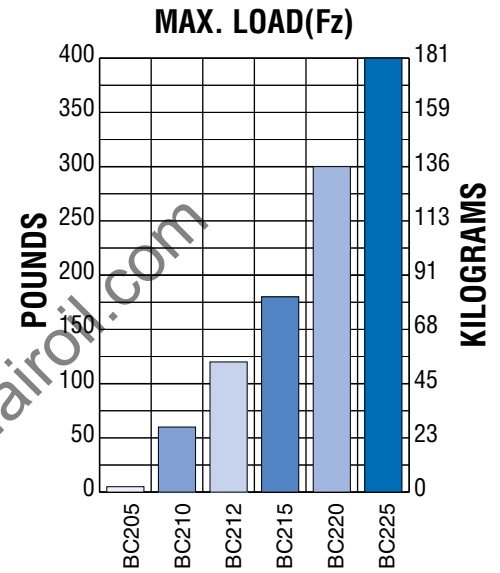
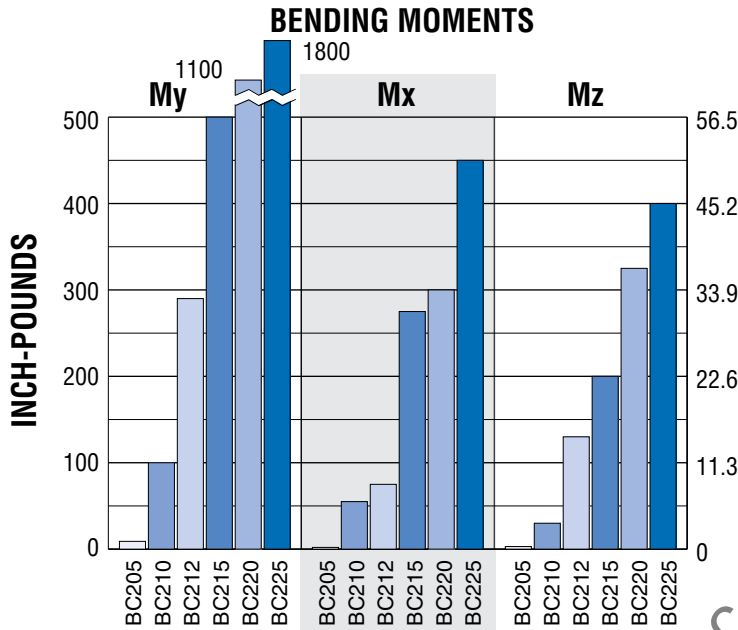
# BC2 Solid Bearing Rodless Cylinder

## PERFORMANCE

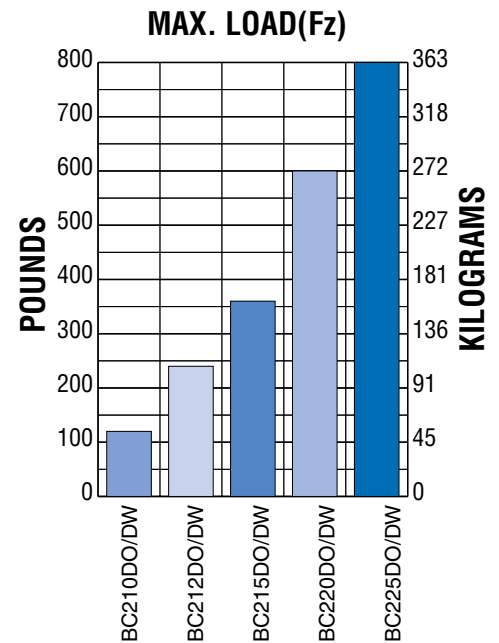
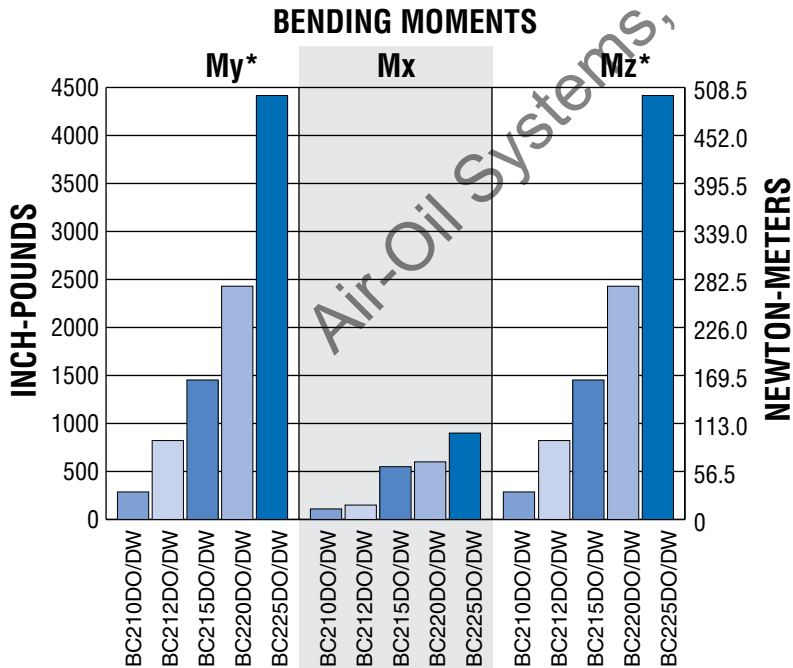
### BC2 BENDING MOMENTS AND LOAD, ALL SIZES



#### STANDARD ACTUATOR



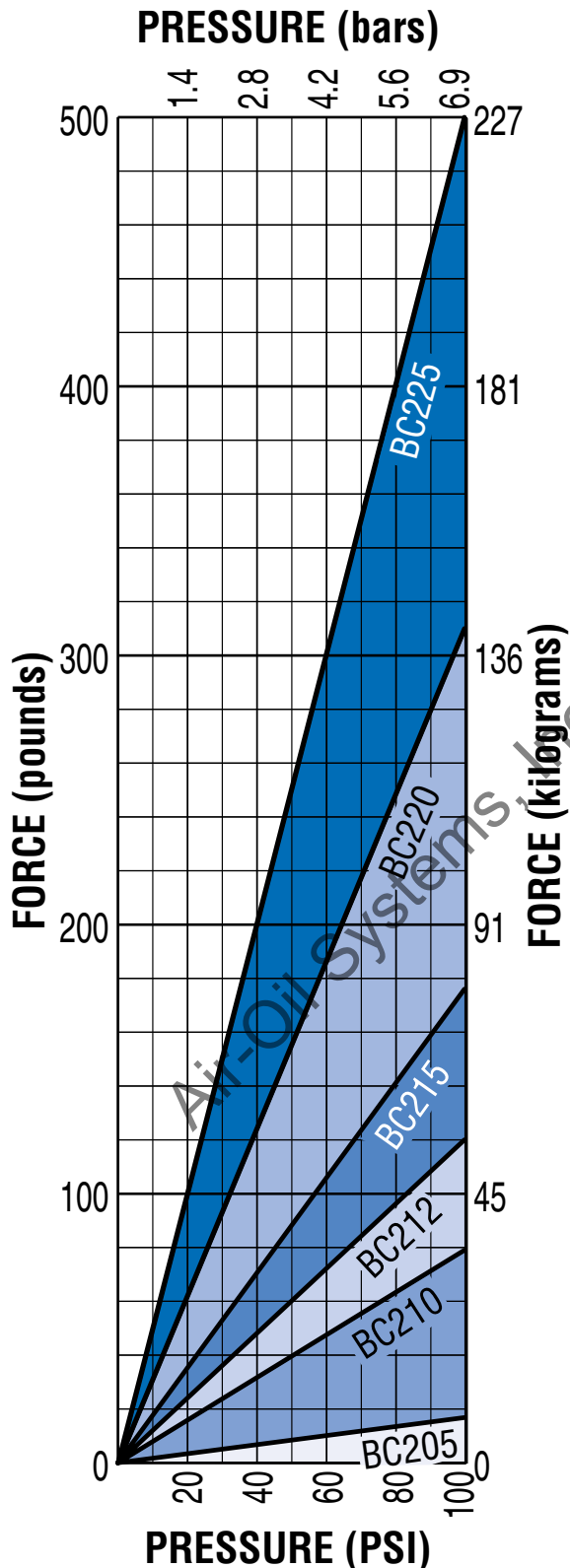
#### AUXILIARY CARRIER OPTION



# BC2 Solid Bearing Rodless Cylinder

## PERFORMANCE

### BC2 THEORETICAL FORCE vs PRESSURE



## GUIDELINES

### BC2 CARRIER BRACKET BOLT ADJUSTMENT



BC2 carrier bracket adjustment bolts should be adjusted to suit each individual application, depending on the degree of rigidity required. A good starting point is to tighten the nut on the bolt until there is no lateral movement of the bolt. Then, equally tighten each nut on the carrier bolt while moving the carrier by hand along the length of the stroke. When all lateral play in the carrier is eliminated and free movement along the length of the stroke is maintained, your carrier bracket is adjusted properly. Some applications may require fine tuning of this adjustment to gain more lateral play or a higher degree of rigidity. In demanding applications, carrier adjustments should be done periodically.

ABT

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BC4

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# BC205 Solid Bearing Rodless Cylinder

## PERFORMANCE

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BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

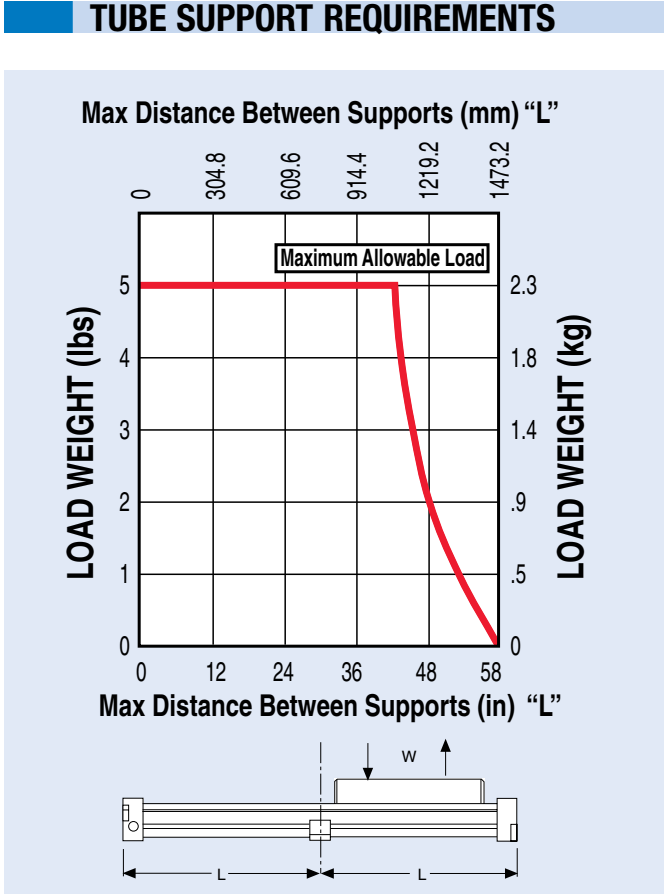
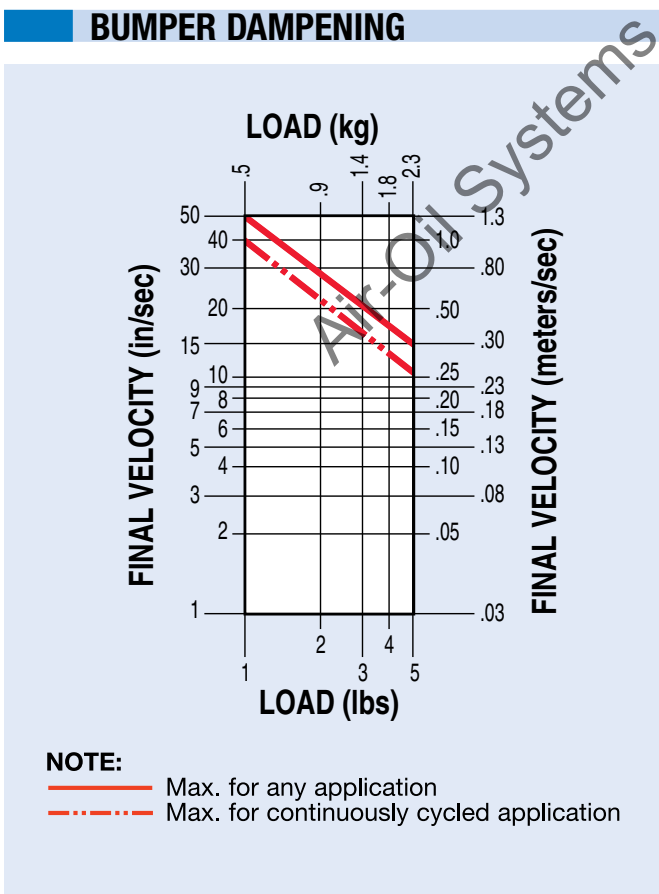
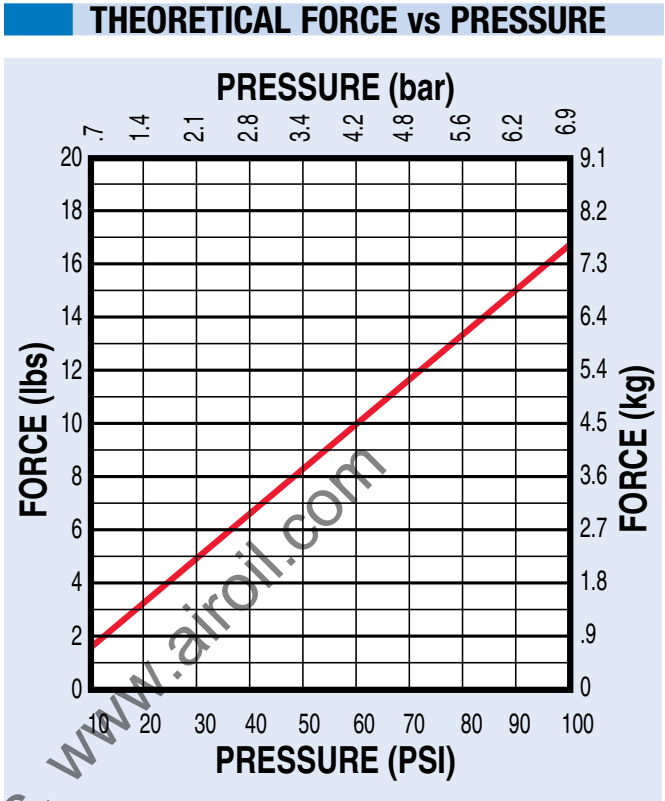
BC205

ORDER CODES

**BC205**  
*inch (U.S. Standard)*

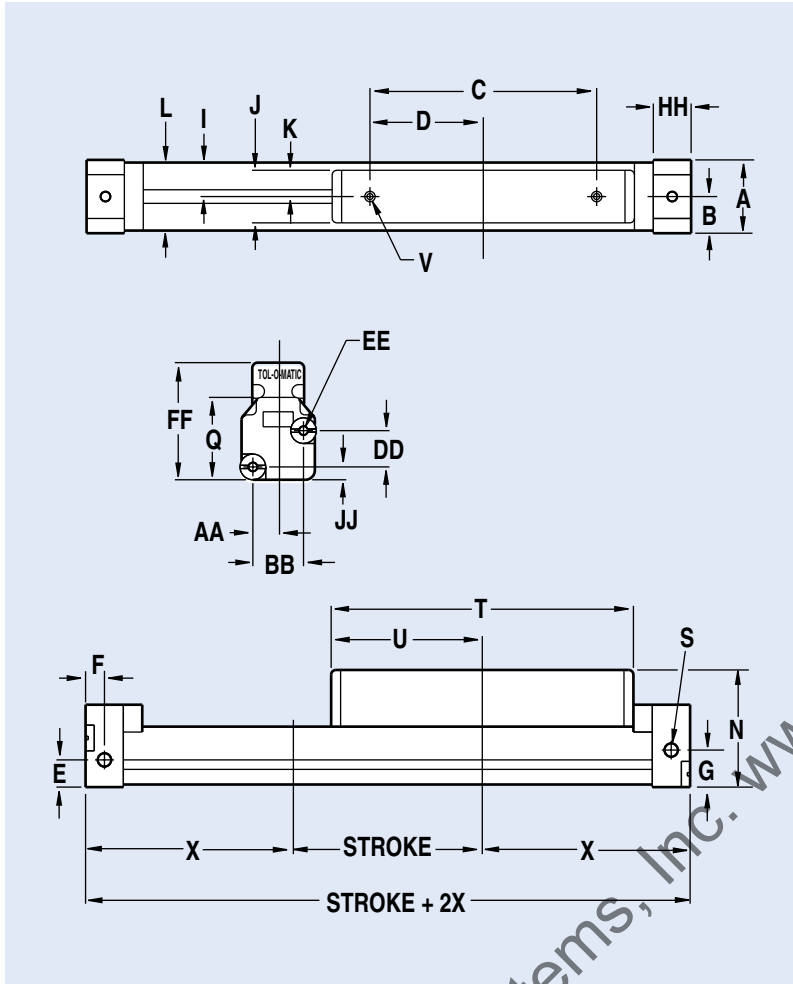
**BC2M05**  
*(metric with taper port)*

BC205 OPTIONS	Page
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Tube Supports	BC2_16
MORE INFORMATION	Page
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# BC205 Solid Bearing Rodless Cylinder

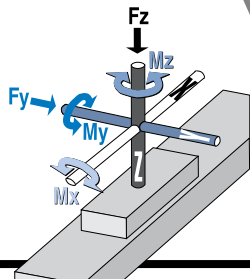
## DIMENSIONS



	05	M05
A	0.97	24.6
B	0.48	12.3
C	3.00	76.2
D	1.50	38.1
E	0.36	9.1
F	0.25	6.35
G	0.49	12.4
I	0.45	11.45
J	0.70	17.8
K	0.35	8.9
L	0.90	22.9
N	1.55	39.4
Q	1.09	27.7
S	#10-32 UNF	M5
T	4.00	101.6
U	2.00	50.8
V	2x #6-32 UNC x .38 DEEP	M3 x 9.7 DEEP
X*	2.60 @ 80-100 PSI	66.0 @ 80-100 PSI
	2.66 @ 40-80 PSI	67.6 @ 40-80 PSI
	2.71 @ 0-40 PSI	68.8 @ 0-40 PSI
AA	0.33	8.4
BB	0.66	16.8
DD	0.48	12.2
EE	4x #6-32UNC x .25 DEEP	M3 x 6.4 DEEP
FF	1.55	39.4
HH	0.50	12.7
JJ	0.17	4.3
	INCHES	MILLIMETERS

## SPECIFICATIONS

### BC205 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
05	0.50 in	9.0 in-lbs	2.0 in-lbs	3.0 in-lbs	5.0 lbs
M05	12 mm	1.01 N-m	0.22 N-m	0.33 N-m	2.27 kg

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
05	0.50 in	0.38 lb	0.036 lb/in	175 in	100 PSI	20° to 140° F
M05	12 mm	0.169 kg	0.0164 kg/mm	4450 mm	6.895 bar	-7° to 60° C

**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# BC210 Solid Bearing Rodless Cylinder

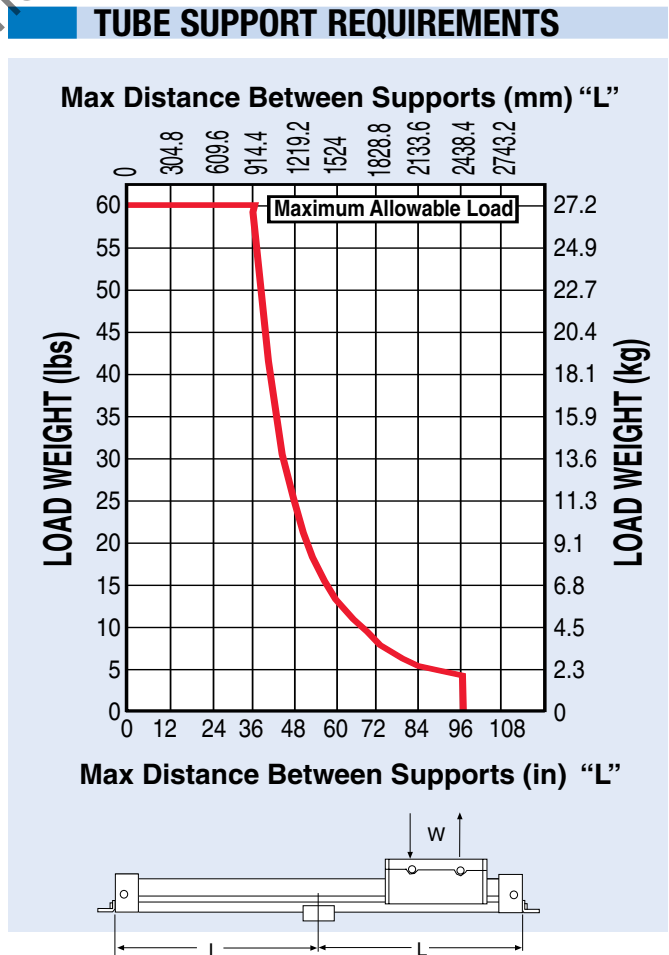
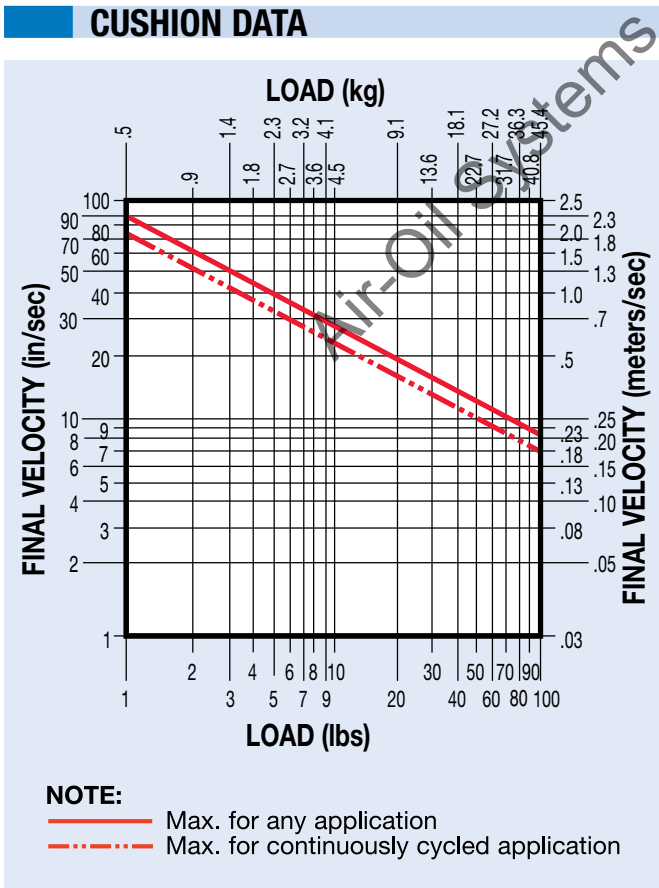
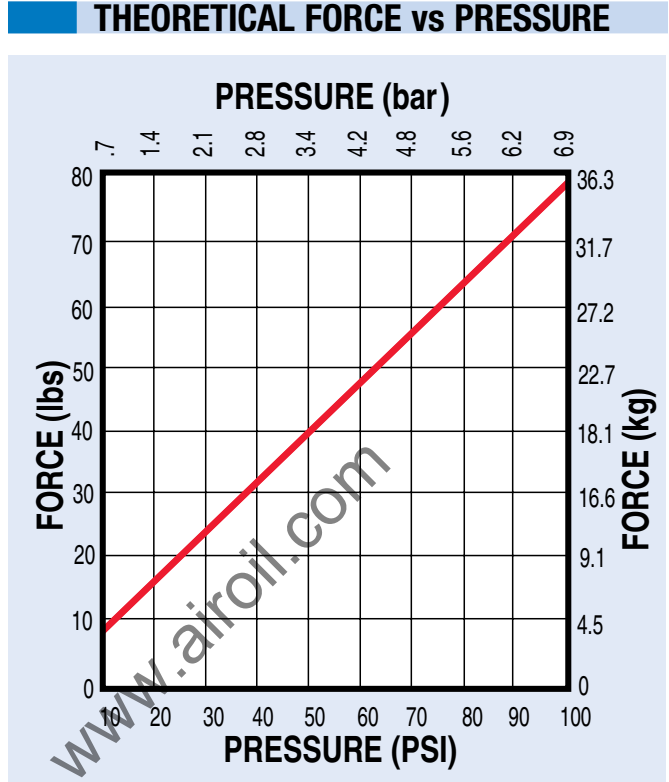
## PERFORMANCE



BC210	
<b>ORDER CODES</b>	
<b>BC210</b>	inch (U.S. Standard)
<b>BC2M10</b>	(metric with taper port)
<b>BC2MM10</b>	(metric with parallel port)

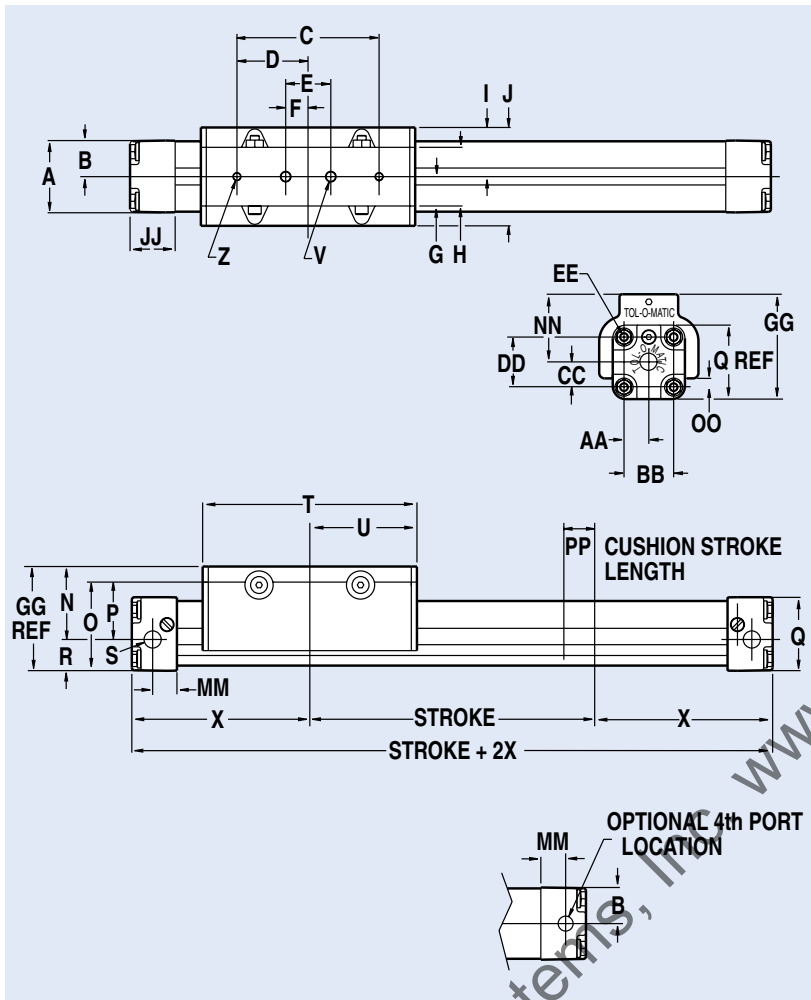
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<b>MORE INFORMATION</b>	
Application Guidelines	BC2_5, BC2_25
Ordering	BC2_26
Selection	BC2_24



ABT  
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 BC4  
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 ENGR

# BC210 Solid Bearing Rodless Cylinder

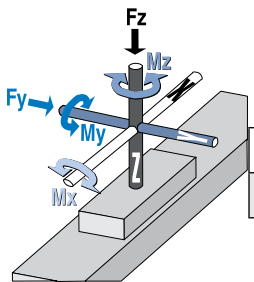
## DIMENSIONS



	10	M(MM)10
A	1.58	40.1
B	0.79	20.1
C	3.15	80.0
D	1.57	40.0
E	1.00	25.4
F	0.50	12.7
G	0.65	16.5
H	1.30	33.0
I	1.09	27.7
J	2.18	55.4
N	1.62	41.2
O	1.88	47.7
P	1.20	30.5
Q	1.64	41.5
R	0.68	17.3
S	1/8 NPT (3)	M 1/8 BSPT(3) MM1/8 BSPP(3)
T	4.75	120.7
U	2.37	60.2
V	1/4-20 UNC X .25 DEEP	M6 X 6 DEEP
X	3.94	100.1
Z	10-32 UNC X .25 DEEP	M6 X 6 DEEP
AA	0.55	14.0
BB	1.10	27.9
CC	0.55	14.0
DD	1.10	27.9
EE	10-24 X .43 DEEP	M5 X 11.0 DEEP
GG	2.30	58.4
JJ	1.00	25.4
MM	0.55	14.0
NN	1.50	38.1
OO	0.18	4.7
PP	0.68	17.3
	INCHES	MILLIMETERS

## SPECIFICATIONS

### BC210 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
10	1.00 in	100 in-lbs	55 in-lbs	30 in-lbs	60 lbs
M(MM)10	25 mm	11.29 N-m	6.21 N-m	3.39 N-m	27.21 kg


	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
10	1.00 in	2.26 lbs	0.14 lbs/in	283 in	100 PSI	20° to 140° F
M(MM)10	25 mm	1.025 kg	0.0024 kg/mm	7193 mm	6.895 bar	-7° to 60° C

**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# BC212 & BC215 Solid Bearing Rodless Cylinder

## PERFORMANCE

— BC212  
— BC215



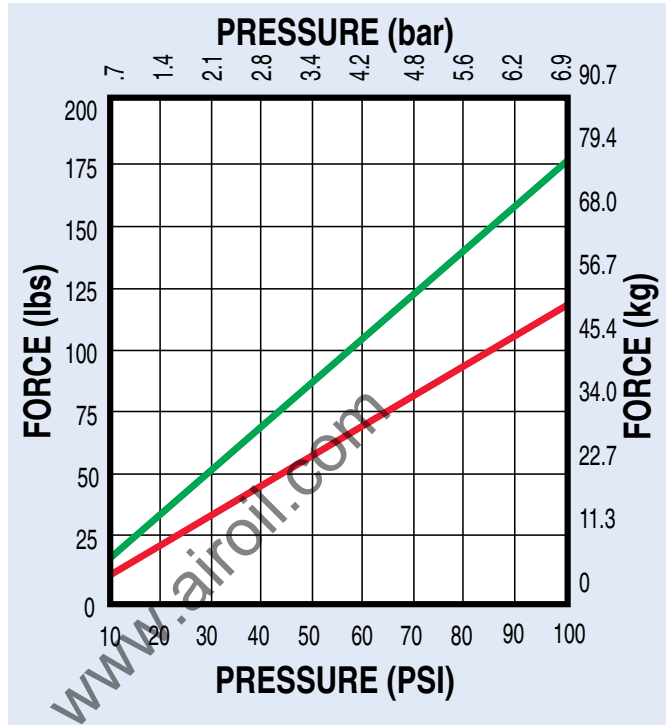
ORDER CODES	
<b>BC215</b> inch (U.S. Standard)	
<b>BC2M15</b> (metric with taper port)	
<b>BC2MM15</b> (metric with parallel port)	

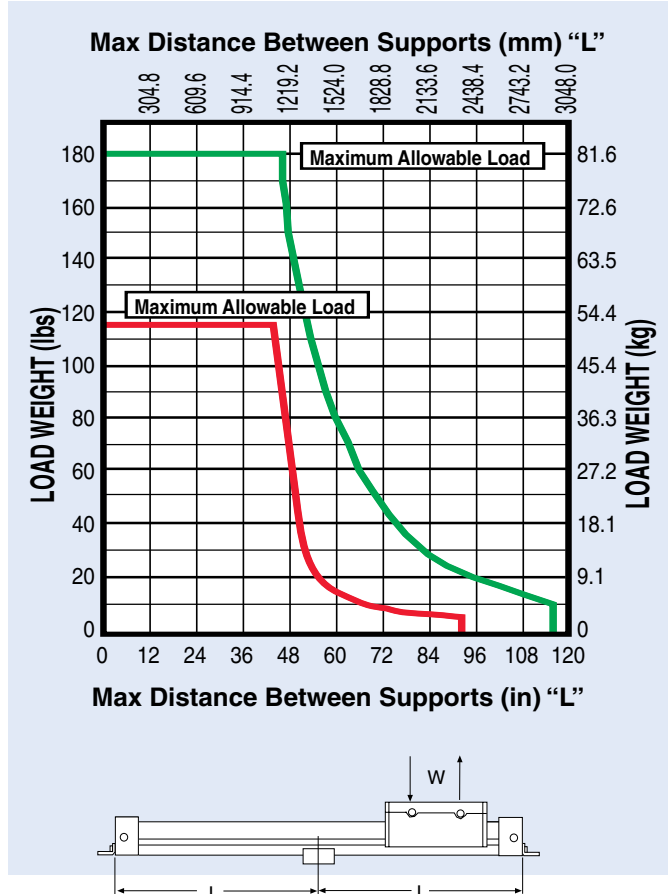
ORDER CODES	
<b>BC212</b> inch (U.S. Standard)	
<b>BC2M12</b> (metric with taper port)	
<b>BC2MM12</b> (metric with parallel port)	

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Ordering	BC2_26
Selection	BC2_24

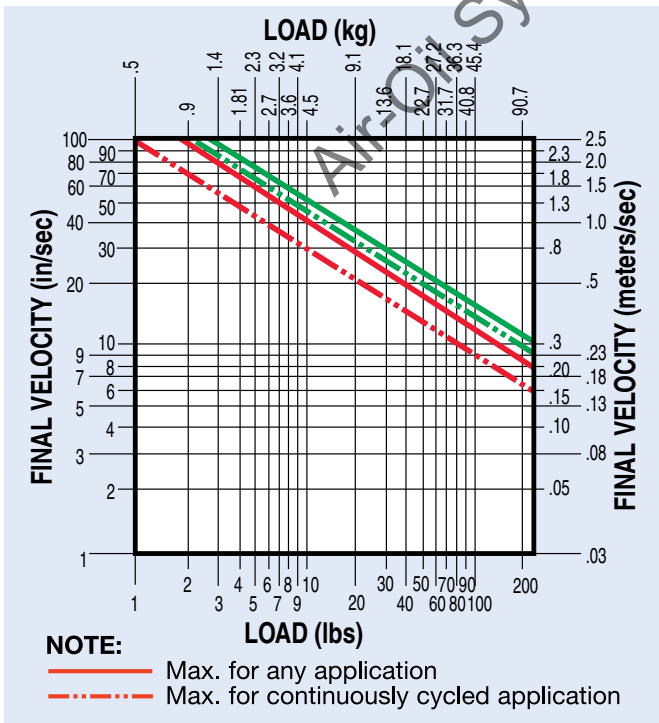
## THEORETICAL FORCE vs PRESSURE



## TUBE SUPPORT REQUIREMENTS



## CUSHION DATA

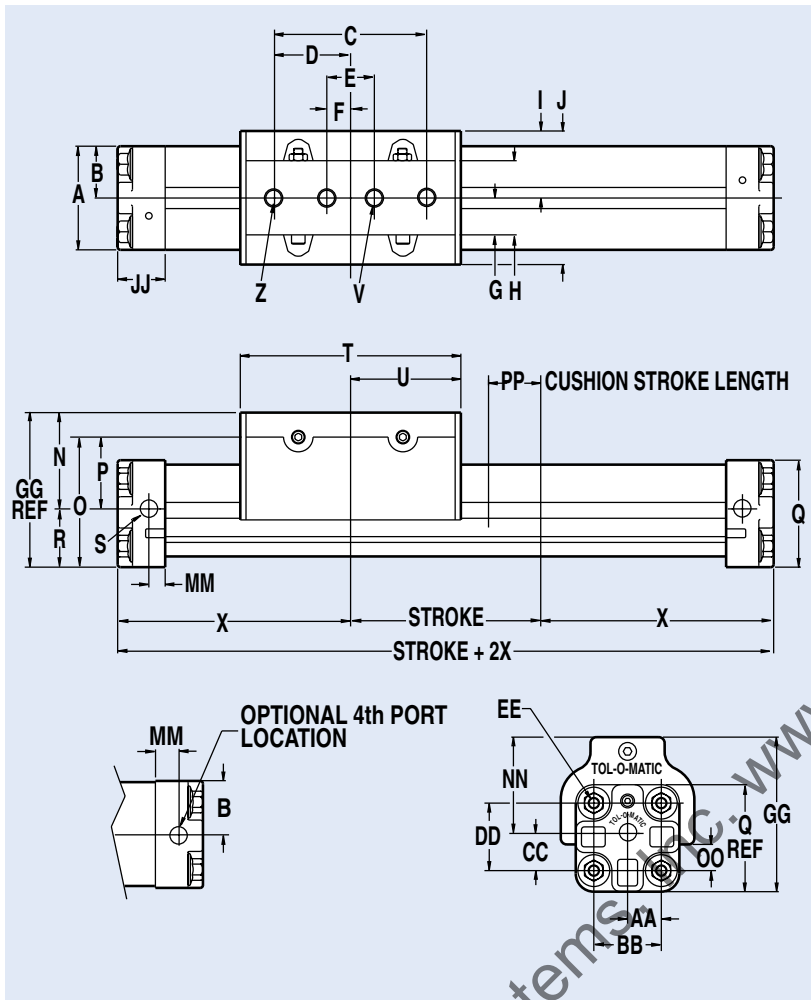


**NOTE:**  
— Max. for any application  
- - - Max. for continuously cycled application

# BC212 & BC215 Solid Bearing Rodless Cylinder



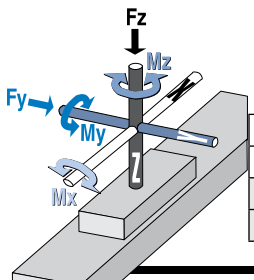
## DIMENSIONS



	12	15	M(MM)12	M(MM)15
A	2.18	2.85	55.4	72.4
B	1.09	1.42	27.7	36.1
C	3.20	4.25	81.3	108.0
D	1.60	2.12	40.6	53.8
E	1.00	1.00	25.4	25.4
F	0.50	0.50	12.7	12.7
G	0.78	0.90	19.8	22.9
H	1.56	1.80	39.6	45.7
I	1.41	1.75	35.8	44.5
J	2.82	3.50	71.6	89.0
N	1.83	2.13	46.5	54.1
O	2.48	2.95	63.0	74.9
P	1.25	1.51	31.0	38.4
Q	2.25	2.59	57.2	65.8
R	1.23	1.41	31.2	36.6
S	1/4 NPT (3)	1/4 NPT (3)	M 1/4 BSPT(3)	M 1/4 BSPT(3)
T	4.64	5.91	117.9	150.1
U	2.32	2.96	58.9	75.1
V	5/16-18 UNC x .31 DP	1/4-20 UNC x .38 DP	M8 x 7 DP	M8 x 10 DP
X	4.90	5.91	124.5	150.1
Z	1/4-20 UNC x .31 DP	5/16-18 UNC x .38 DP	M8 x 7 DP	M8 x 10 DP
AA	0.71	0.91	18.0	23.1
BB	1.42	1.81	36.1	46.0
CC	0.78	1.03	19.8	26.2
DD	1.42	1.81	36.1	46.0
EE	1/4-20 x .47 DP	1/4-20 x .47 DP	M6 x 12 DP	M6 x 12 DP
GG	3.06	3.54	77.7	90.7
JJ	1.00	1.25	25.4	31.8
MM	0.34	0.50	8.6	12.7
NN	1.83	2.13	46.5	54.1
OO	0.35	0.28	9.0	7.0
PP	1.10	1.29	27.9	32.7
	INCHES		MILLIMETERS	

## SPECIFICATIONS

### BC212/15 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
12	1.25 in	290 in-lbs	75 in-lbs	130 in-lbs	120 lbs
15	1.50 in	500 in-lbs	275 in-lbs	200 in-lbs	180 lbs
M(MM)12	32 mm	32.77 N-m	8.47 N-m	14.69 N-m	54.42 kg
M(MM)15	40 mm	56.49 N-m	31.07 N-m	22.60 N-m	81.63 kg

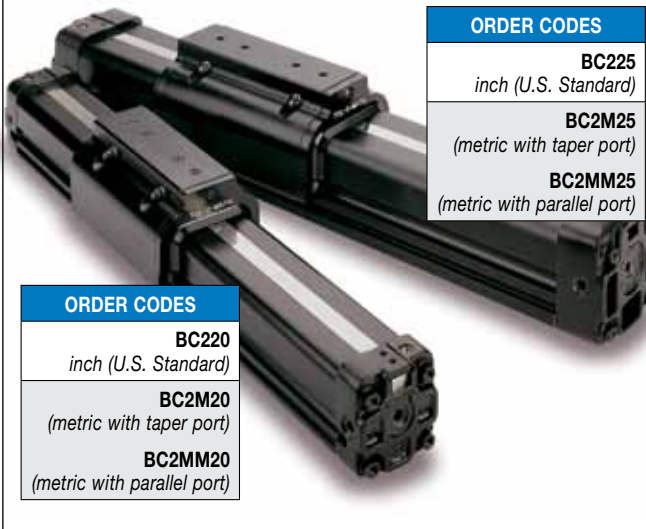
	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
12	1.25 in	4.56 lbs	0.21 lbs/in	280 in	100 PSI	20° to 140° F
15	1.50 in	8.18 lbs	0.34 lbs/in	278 in	100 PSI	20° to 140° F
M(MM)12	32 mm	2.068 kg	0.0036 kg/mm	7132 mm	6.895 bar	-7° to 60° C
M(MM)15	40 mm	3.7 kg	0.0058 kg/mm	7071 mm	6.895 bar	-7° to 60° C

\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic

# BC220 & BC225 Solid Bearing Rodless Cylinder

## PERFORMANCE

— BC220  
— BC225



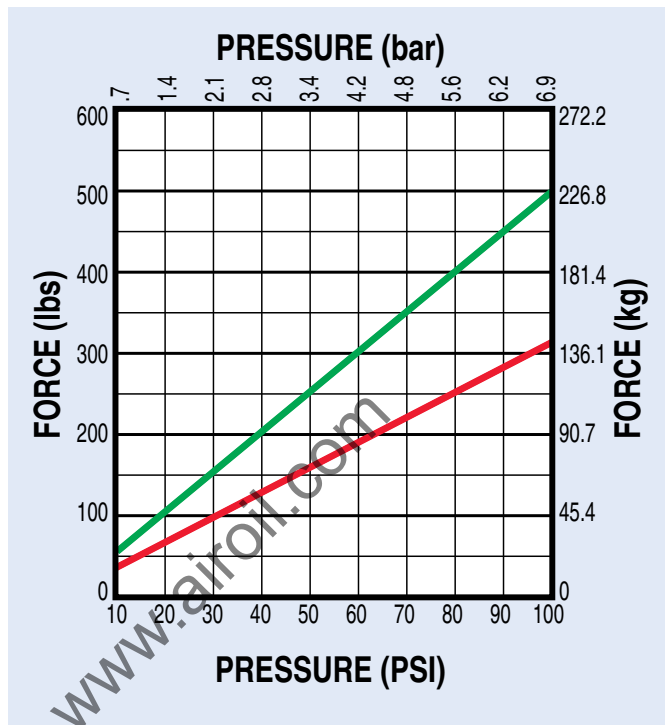
BC220 & BC225	
<b>ORDER CODES</b>	
<b>BC225</b> <i>inch (U.S. Standard)</i>	
<b>BC2M25</b> <i>(metric with taper port)</i>	
<b>BC2MM25</b> <i>(metric with parallel port)</i>	

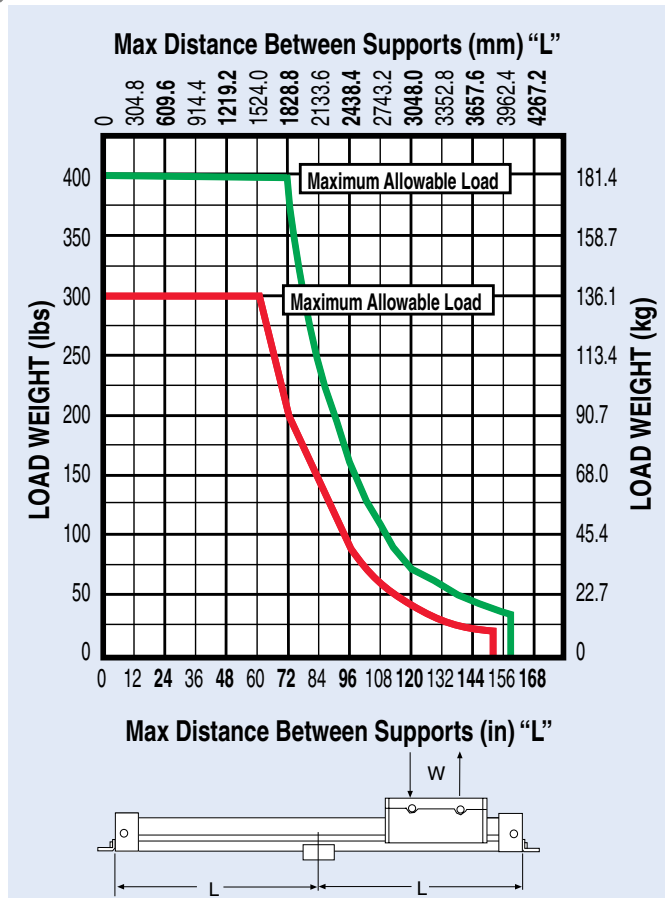
ORDER CODES	
<b>BC220</b> <i>inch (U.S. Standard)</i>	
<b>BC2M20</b> <i>(metric with taper port)</i>	
<b>BC2MM20</b> <i>(metric with parallel port)</i>	

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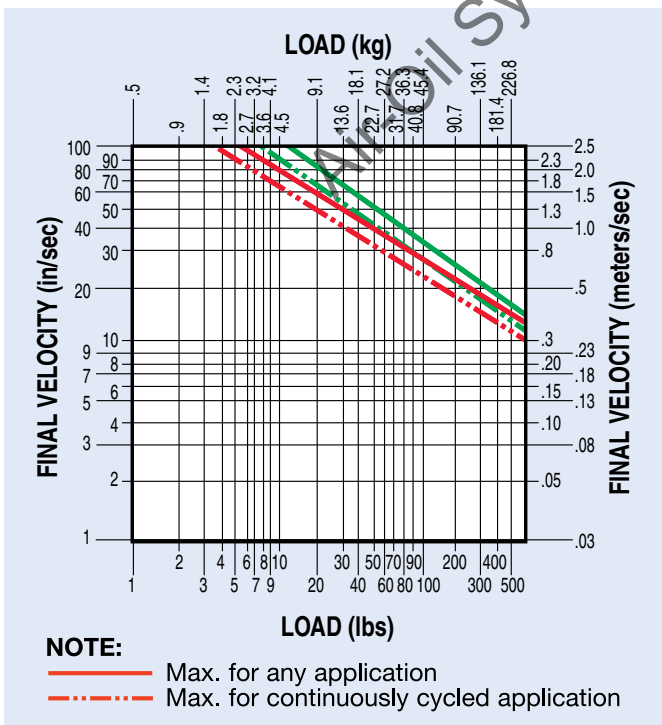
## THEORETICAL FORCE vs PRESSURE



## TUBE SUPPORT REQUIREMENTS



## CUSHION DATA

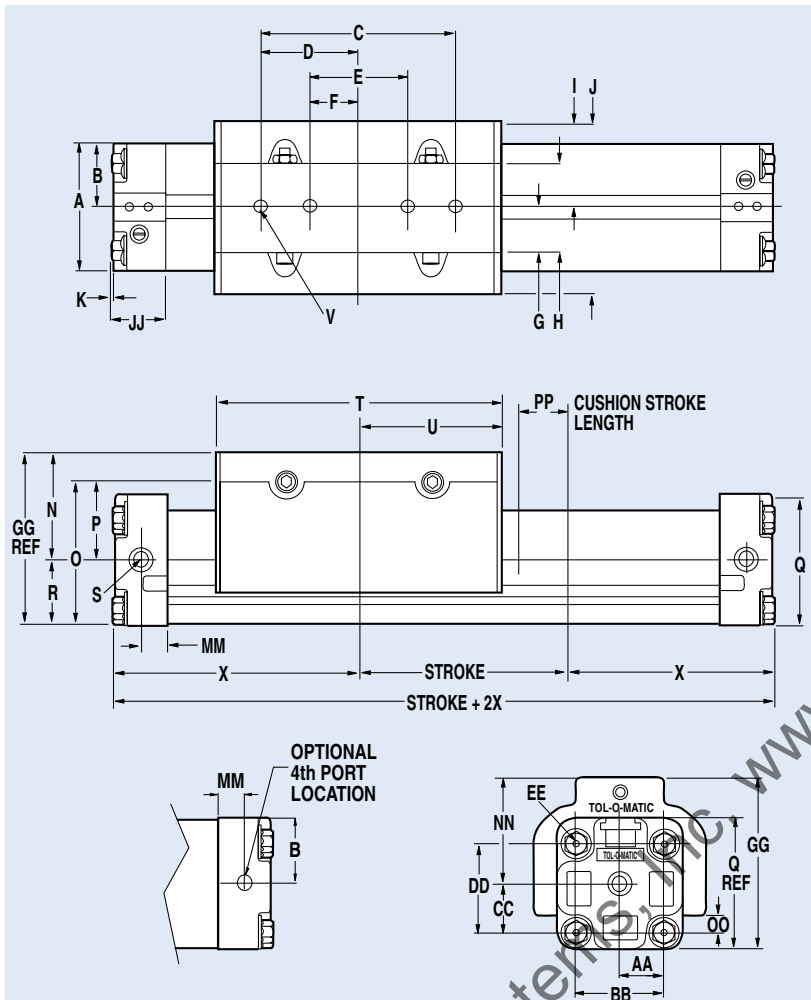


NOTE:

- Max. for any application
- - - - - Max. for continuously cycled application

# BC220 & BC225 Solid Bearing Rodless Cylinder

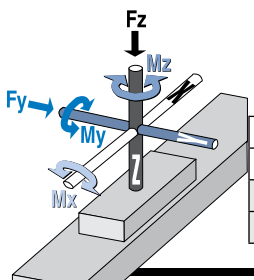
## DIMENSIONS



	20	25	M(MM)20	M(MM)25
A	3.25	4.25	82.6	108.0
B	1.62	2.13	41.1	54.1
C	5.00	6.00	127.0	152.4
D	2.50	3.00	63.5	76.2
E	2.50	3.00	63.5	76.2
F	1.25	1.50	31.8	38.1
G	1.16	1.27	29.5	32.4
H	2.30	2.55	58.4	64.8
I	2.22	2.81	56.4	71.4
J	4.44	5.62	112.8	142.8
K	0.06	0.03	1.5	0.8
N	2.75	3.20	69.9	81.3
O	3.69	4.67	93.7	118.6
P	2.00	2.37	50.8	60.2
Q	3.38	4.37	85.9	111.0
R	1.69	2.30	42.9	58.4
S	3/8 NPT (3)	3/8 NPT (3)	M 3/8 BSPT(3)	M 3/8 BSPT(3)
T	7.37	8.86	187.2	225.0
U	3.68	4.43	93.5	112.5
V	3/8-16 UNC x .44 DP	3/8-16 UNC x .50 DP	M10 x 11 DP	M10 x 12 DP
X	6.30	8.45	160.0	214.6
AA	1.12	1.44	28.5	36.6
BB	2.25	2.88	57.2	73.2
CC	1.25	1.75	31.8	44.5
DD	2.25	2.88	57.2	73.2
EE	5/16-18 x .88 DP	5/16-18 x .88 DP	M8 x 22 DP	M8 x 22 DP
GG	4.44	5.50	112.8	139.7
JJ	1.44	2.06	36.6	52.3
MM	0.69	1.00	17.5	25.4
NN	2.75	3.20	69.9	81.3
OO	0.43	0.76	10.9	19.3
PP	1.35	1.97	34.3	50.0
	INCHES		MILLIMETERS	

## SPECIFICATIONS

### BC220/25 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD	
		My	Mx	Mz	Fz	
	20	2.00 in	1,100 in-lbs	300 in-lbs	325 in-lbs	300 lbs
	25	2.50 in	1,800 in-lbs	450 in-lbs	400 in-lbs	400 lbs
	M(MM)20	50 mm	124.28 N-m	33.90 N-m	36.72 N-m	136.05 kg
	M(MM)25	63 mm	203.37 N-m	50.84 N-m	45.19 N-m	181.4 kg

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE	
		BASE	PER UNIT OF STROKE				
	20	2.00 in	14.12 lbs	0.54 lbs/in	158 in	100 PSI	20° to 140° F
	25	2.50 in	31.90 lbs	1.01 lbs/in	238 in	100 PSI	20° to 140° F
	M(MM)20	50 mm	6.4 kg	0.0093 kg/mm	4023 mm	6.895 bar	-7° to 60° C
	M(MM)25	63 mm	14.467 kg	0.0173 kg/mm	6066 mm	6.895 bar	-7° to 60° C

\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic



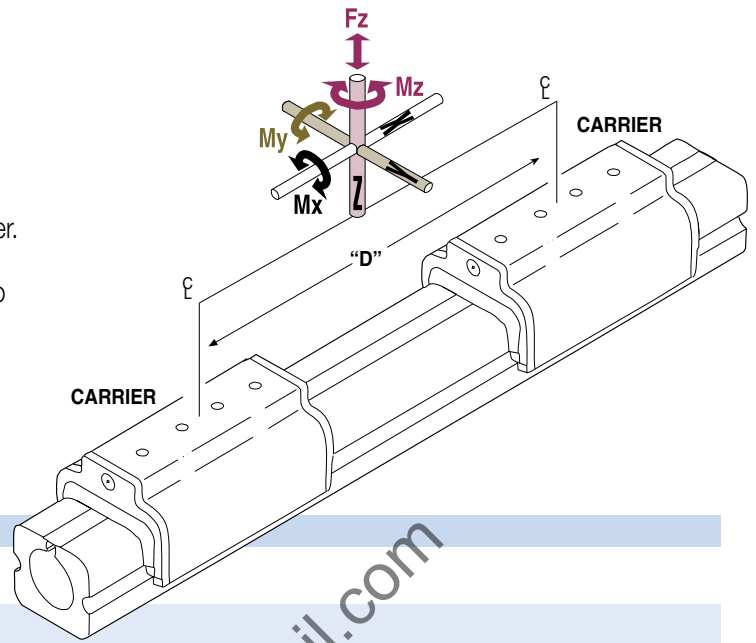
# BC2 Auxiliary Carrier - 10, 12, 15, 20, 25 Sizes

## PERFORMANCE

The auxiliary carrier option substantially increases load carrying and bending moments capacity over the standard single carrier models. As a general rule, the auxiliary carrier option is highly recommended in vertical applications ( $M_y$ ) if the distance from the carrier mounting surface to the load center of gravity (CG) exceeds the overall length of the carrier. Auxiliary carriers can be ordered with (DW) or without (DO) an internal piston. (Auxiliary carriers without a piston have no cushion on the cylinder end closest to the auxiliary carrier.)

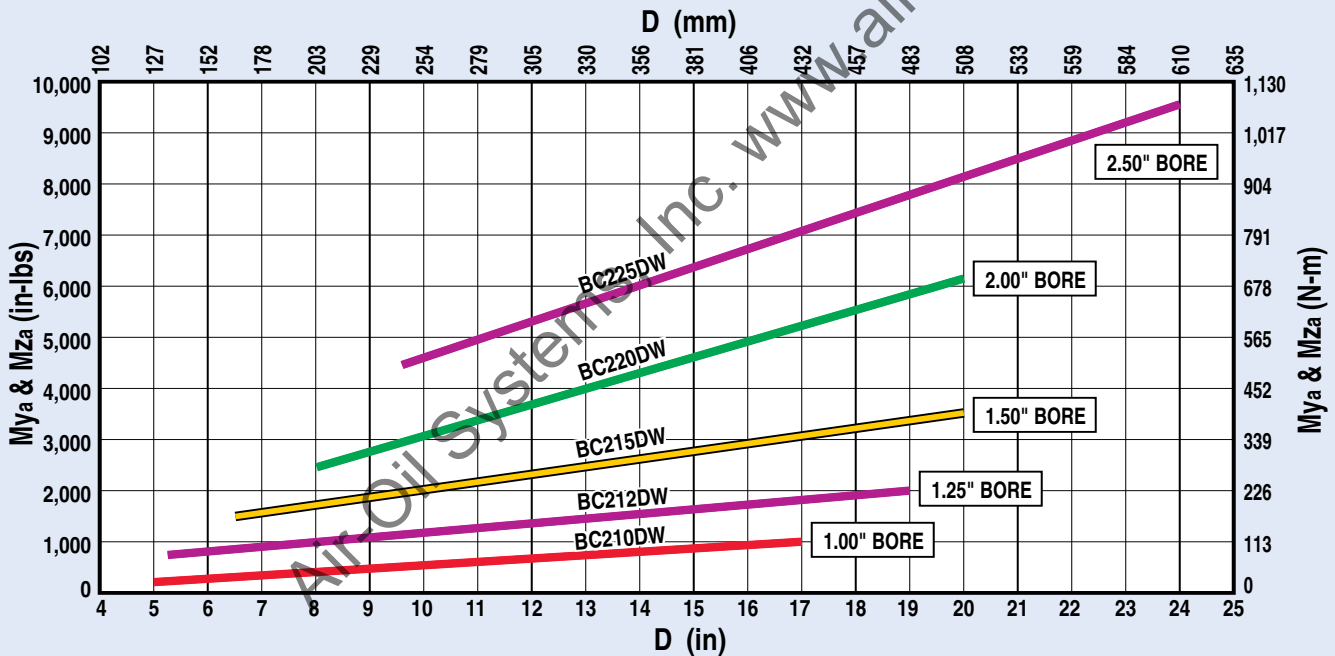


NOTE: breakaway pressure will increase when using auxiliary carrier.



## BENDING MOMENTS

### MOMENT LOAD vs. DISTANCE



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.

	BORE SIZE		"D" MINIMUM *				MAX. BENDING MOMENT						MAX. LOAD	
			(w/o Piston)		(w/ Piston)		$M_y^{**}$		$M_x$		$M_z^{**}$		$F_z$	
	in	mm	in	mm	in	mm	in-lbs	N-m	in-lbs	N-m	in-lbs	N-m	lbs	kg
<b>10</b>	1.00	25	5.07	129.0	5.07	129.0	287	32.4	110	12.4	287	32.4	120	54.4
<b>12</b>	1.25	32	5.17	131.0	6.85	174.0	822	92.9	150	16.9	822	92.9	240	108.9
<b>15</b>	1.50	40	6.46	164.0	8.07	205.0	1,453	164.1	550	62.1	1,453	164.1	360	163.3
<b>20</b>	2.00	50	8.10	206.0	8.10	206.0	2,430	274.6	600	67.8	2,430	274.6	600	272.2
<b>25</b>	2.50	63	9.62	244.0	11.06	281.0	4,416	498.9	900	101.7	4,416	498.9	800	362.9

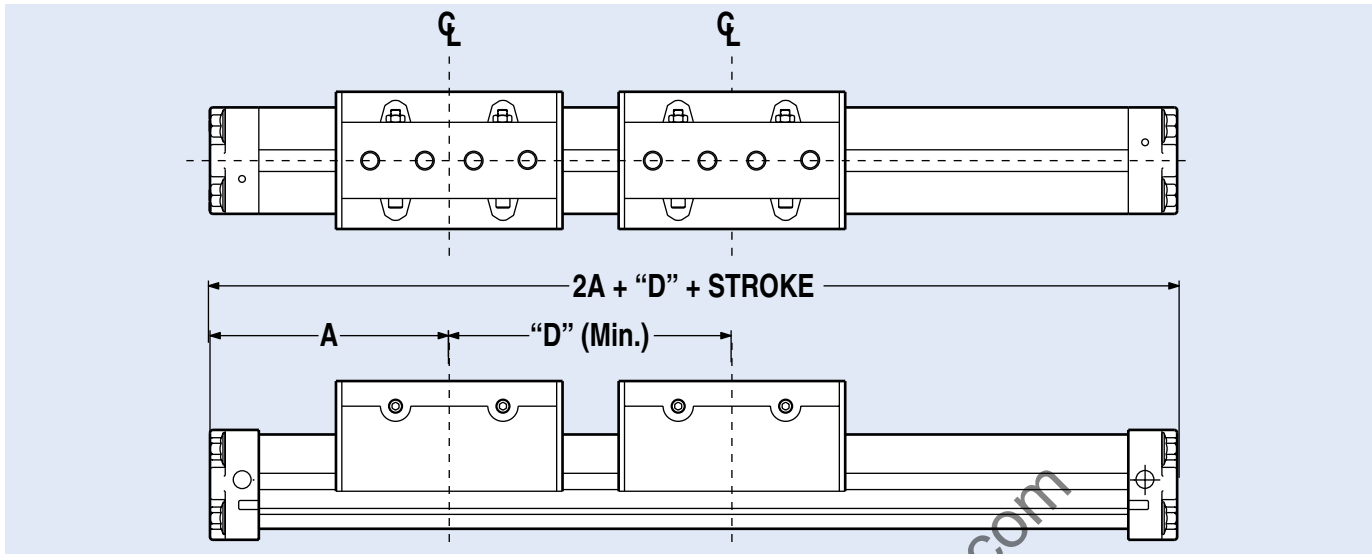
\* "D" is distance between carriers

\*\* Loads calculated are at minimum "D", for substantially higher  $M_y$  and  $M_z$  loads increase "D" and refer to graph above

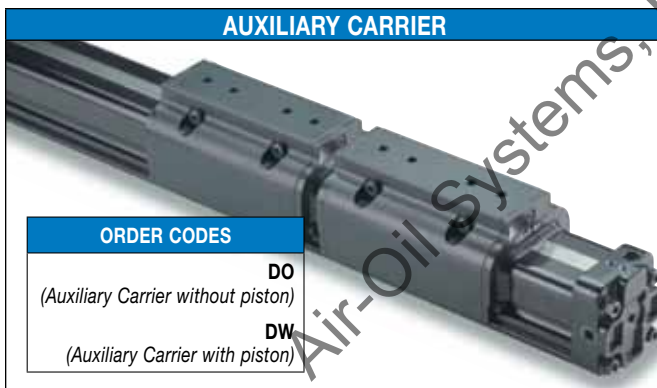
# BC2 Auxiliary Carrier - 10, 12, 15, 20, 25 Sizes



## DIMENSIONS



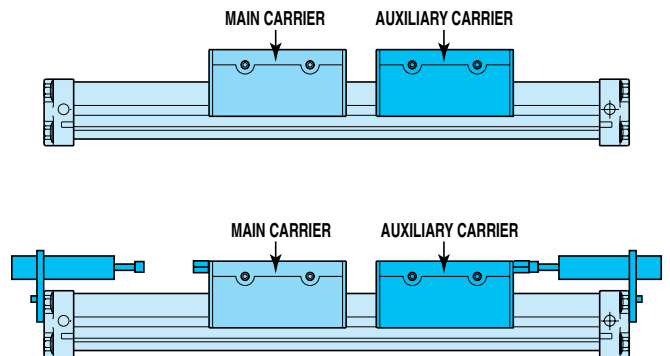
	BORE SIZE		A		"D" MINIMUM *			
	in	mm	in	mm	(w/o Piston)		(w/ Piston)	
					in	mm	in	mm
10	1.00	25	3.94	100.1	5.07	129.0	5.07	129.0
12	1.25	32	4.90	124.5	5.17	131.0	6.85	174.0
15	1.50	40	5.91	150.1	6.46	164.0	8.07	205.0
20	2.00	50	6.30	160.0	8.10	206.0	8.10	206.0
25	2.50	63	8.46	214.9	9.62	244.0	11.06	281.0



## ASSEMBLY INFORMATION

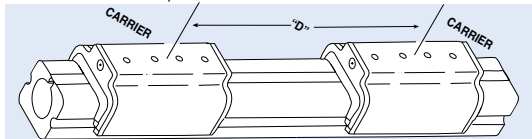
**IMPORTANT INFORMATION REGARDING AUXILIARY CARRIER PLACEMENT**

When a BC2 cylinder is ordered with auxiliary carrier, it is always placed to the right (while facing the switch mounted or open port side) of the main carrier. This is for auxiliary carriers with (DW)/or without (DO) piston and for units with/ or without shock absorbers. When the auxiliary carrier is ordered without (DO) piston the carrier without piston will be marked.



## ORDERING INFORMATION

When ordering, determine the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart).



Determine your working stroke and your "D" dimension, then enter these into your configuration string. (Example: BC215SK50.00DW15.00RT2) The configurator will calculate the overall length of the actuator.

# BC2 Tube Supports - ALL Sizes

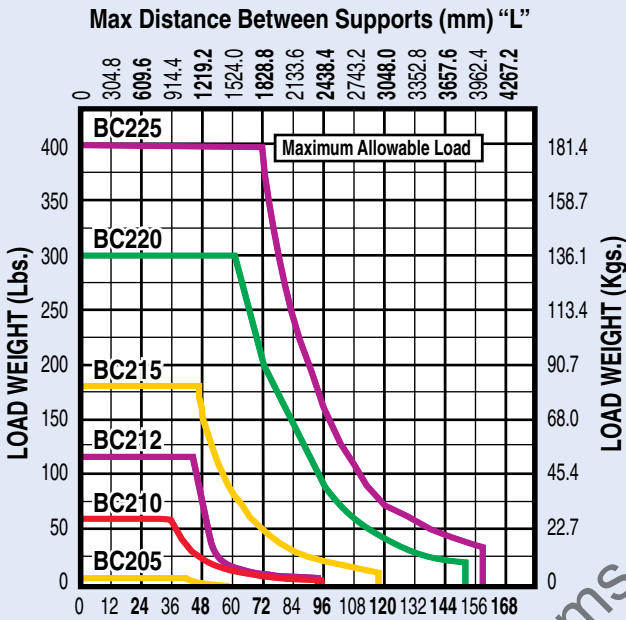


Tube supports are mounted to the BC2 band cylinder during assembly procedure. Made of black-anodized aluminum, tube supports are designed to fit into dovetail grooves which run the length of the cylinder tube. Refer to the tube support graph to determine the number of tube supports required.

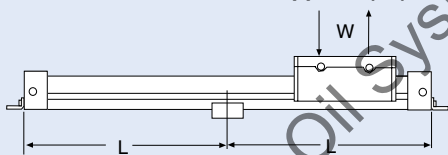
**NOTE:** Switches cannot be mounted on the same face of the actuator as tube supports.

## PERFORMANCE

### TUBE SUPPORT REQUIREMENTS

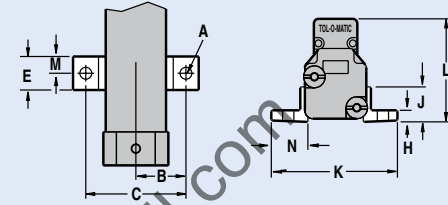


Max Distance Between Supports (in.) "L"

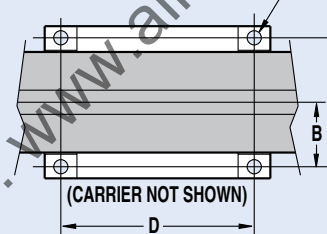


## DIMENSIONS

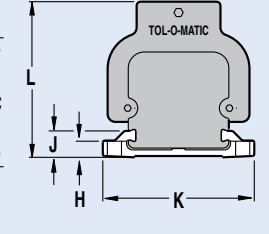
05



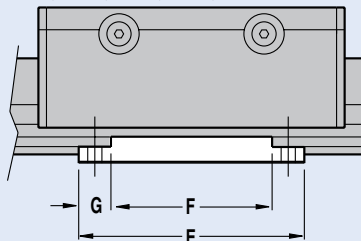
10, 12, 15, 20, 25



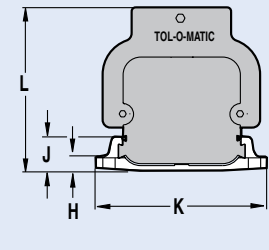
10, 12, 15, 20



10, 12, 15, 20, 25



25



	BORE SIZE	A Ø	E	C	D	E	F	G	H	J	K	L	M	N
05	0.50	0.18	0.75	1.50	-	0.50	-	-	0.18	0.54	1.88	1.60	0.65	0.50
10	1.00	0.22	1.00	2.00	3.00	3.50	2.50	0.50	0.25	0.41	2.36	2.43	-	-
12	1.25	0.27	1.31	2.63	4.50	5.00	4.00	0.50	0.40	0.81	3.12	3.23	-	-
15	1.50	0.27	1.50	3.00	4.50	5.00	4.00	0.50	0.31	0.70	3.50	3.62	-	-
20	2.00	0.41	1.875	3.750	5.75	6.38	5.00	0.69	0.375	0.87	4.44	4.53	-	-
25	2.50	0.42	2.563	5.125	7.75	8.50	7.00	0.75	0.437	1.17	6.00	5.56	-	-

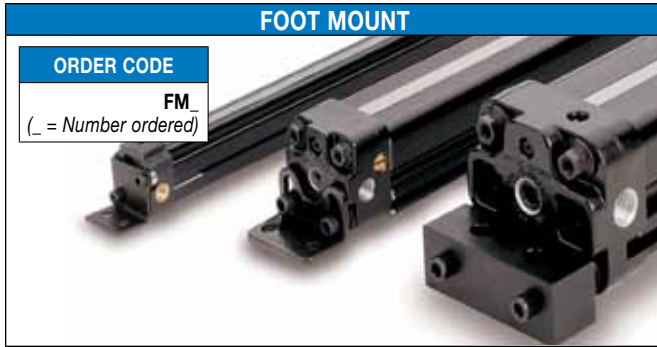
Dimensions in inches

	BORE SIZE	A Ø	B	C	D	E	F	G	H	J	K	L	M	N
M(MM)05	12	4.6	19.1	38.1	-	12.7	-	-	4.6	13.7	47.7	40.6	16.5	12.7
M(MM)10	25	5.6	25.4	50.8	76.2	88.9	63.5	12.7	6.3	10.4	59.9	61.7	-	-
M(MM)12	32	6.7	33.3	66.8	114.3	127.0	101.6	12.7	10.2	20.6	79.2	82.0	-	-
M(MM)15	40	6.7	38.1	76.2	114.3	127.0	101.6	12.7	7.9	17.8	88.9	91.9	-	-
M(MM)20	50	10.5	47.6	95.3	146.1	162.1	127.0	17.5	9.5	22.1	112.8	115.1	-	-
M(MM)25	63	10.7	65.1	130.2	196.9	215.9	177.8	19.1	11.1	29.7	152.4	141.2	-	-

Dimensions in millimeters

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# BC2 Foot Mounts - ALL Sizes



For mounting other than flush. Foot mounts may be specified on one or both ends of the cylinder.

ABT

MXP

BC2

BC3

BC4

LS

MG

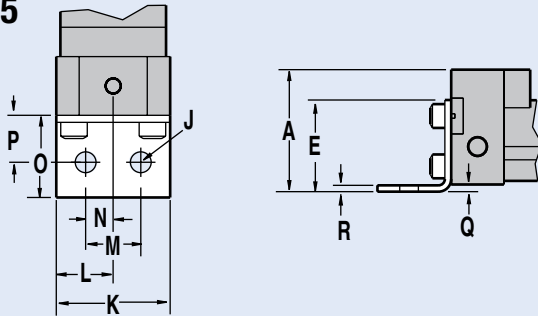
CC

PB

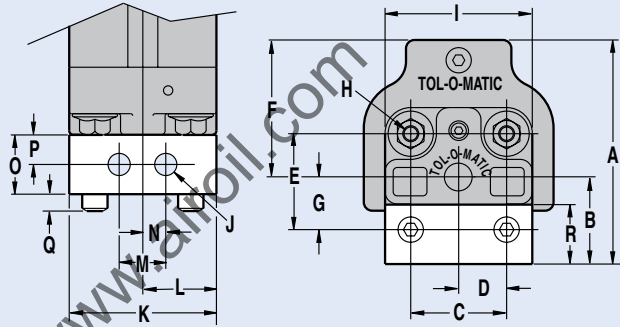
ENGR

## DIMENSIONS

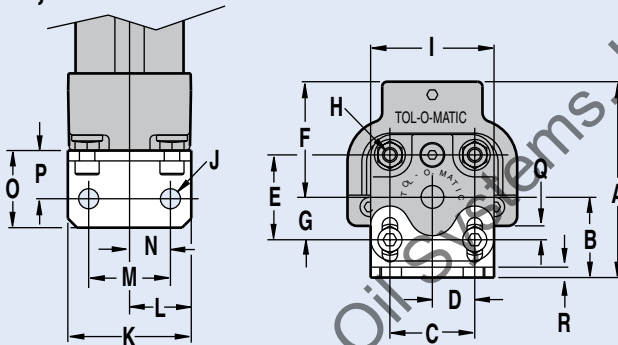
05



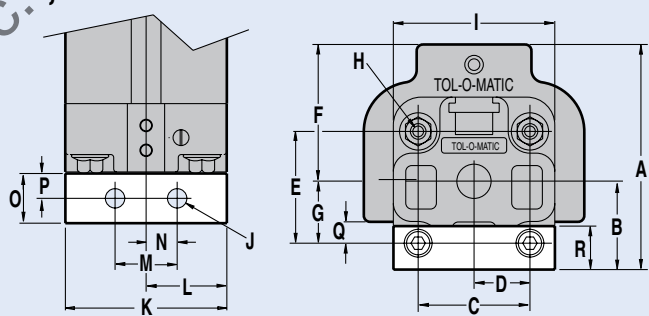
15



10, 12



20,25



BORE SIZE	A	B	C	D	E	F	G	H	I	J Ø	K	L	M	N	O	P	Q	R	
05	0.50	1.62	-	-	0.87	-	-	-	-	0.180	0.97	0.49	0.47	0.24	0.70	0.40	0.06	0.06	
10	1.00	2.36/2.73	0.86/1.23	1.10	0.55	1.10	1.50	0.55	#10-24 x .43 DP	1.58	0.260	1.60	0.80	1.06	0.53	1.00	0.63	0.18	0.14
12	1.25	3.21/3.71	1.38/1.88	1.42	0.71	1.42	1.83	0.78	1/4-20 x .47 DP	2.18	0.328	2.09	1.05	1.42	0.71	0.84	0.49	0.35	0.13
15	1.50	3.69	1.56	1.82	0.91	1.81	2.13	1.03	1/4-20 x .47 DP	2.85	0.328	2.83	1.42	1.18	0.59	1.00	0.50	0.25	1.00
20	2.00	4.53	1.78	2.25	1.13	2.25	2.75	1.25	5/16-18 x 1.0 DP	3.25	0.390	3.25	1.63	1.25	0.63	1.00	0.50	0.43	0.88
25	2.50	5.65	2.45	2.88	1.44	2.88	3.20	1.75	5/16-18 x 1.0 DP	4.25	0.437	4.25	2.13	1.89	0.95	1.18	0.59	0.76	1.00

Dimensions in inches

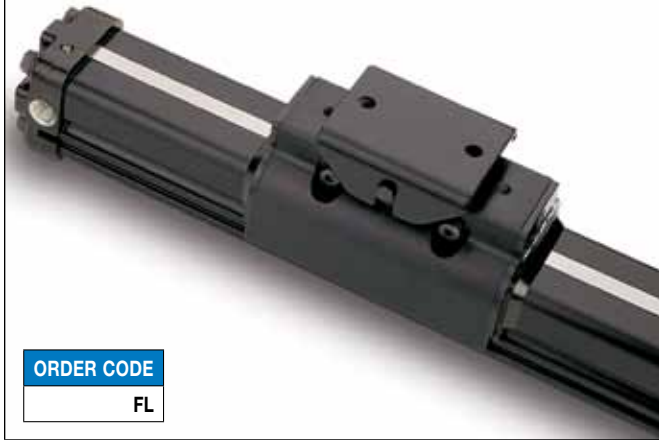
BORE SIZE	A	B	C	D	E	F	G	H	I	J Ø	K	L	M	N	O	P	Q	R	
M(MM)05	12	41.1	-	-	22.1	-	-	-	-	4.6	24.6	12.3	11.9	6.0	20.4	10.2	1.5	1.5	
M(MM)10	25	59.7/69.3	21.8/31.2	27.9	14.0	27.9	38.1	14.0	M5 x 11 DP	40.1	6.6	40.6	20.3	26.9	13.5	25.4	15.9	4.7	3.4
M(MM)12	32	81.5/94.2	35.1/47.8	36.1	18.0	36.1	46.5	19.8	M6 x 12 DP	55.4	8.3	53.1	26.7	36.1	18.0	21.3	12.4	9.0	3.2
M(MM)15	40	93.7	39.6	46.2	23.1	46.0	54.1	26.2	M6 x 12 DP	72.4	8.3	71.9	36.1	30.0	15.0	25.4	12.7	6.0	25.4
M(MM)20	50	115.1	45.7	57.2	28.7	57.2	69.9	31.8	M8 x 25 DP	82.6	9.9	82.6	41.2	31.8	16.0	25.4	12.7	10.9	22.2
M(MM)25	63	143.5	62.2	73.2	35.6	73.2	81.3	44.5	M8 x 25 DP	108.0	11.1	108.0	54.1	48.0	24.1	30.0	15.0	19.3	25.4

Dimensions in millimeters

# BC2 Floating Mount Bracket - ALL Sizes



## FLOATING MOUNT BRACKET



ORDER CODE

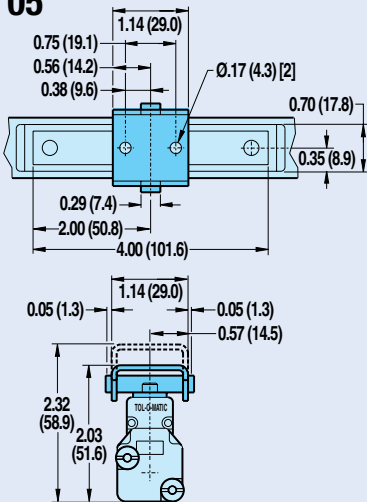
FL

For applications where a BC2 band cylinder is moving a load that is externally guided and supported. An externally guided load, not parallel to the BC2 band cylinder may result in cylinder binding. The floating mount bracket compensates for nonparallelism between the cylinder and the external guide.

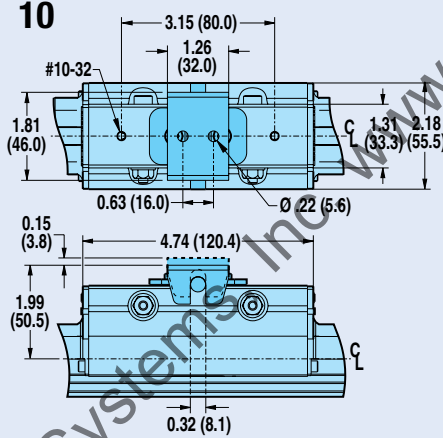
⊗ (Floating mount brackets are not to be used in conjunction with shock absorbers)

## DIMENSIONS

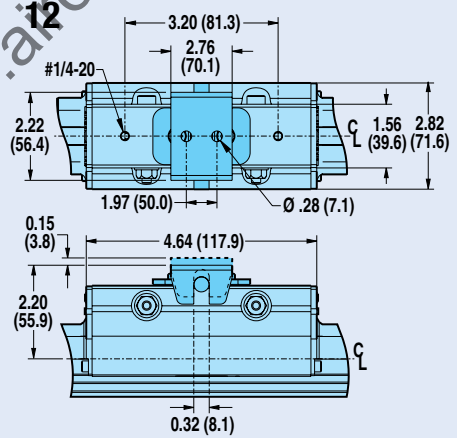
05



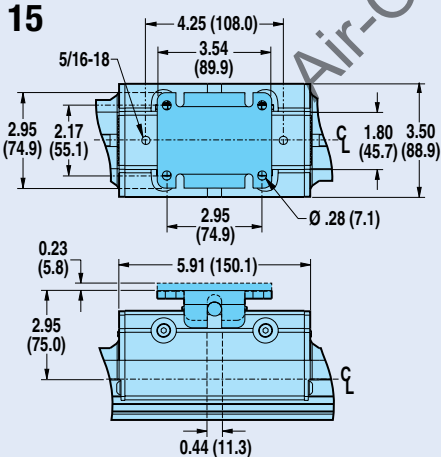
10



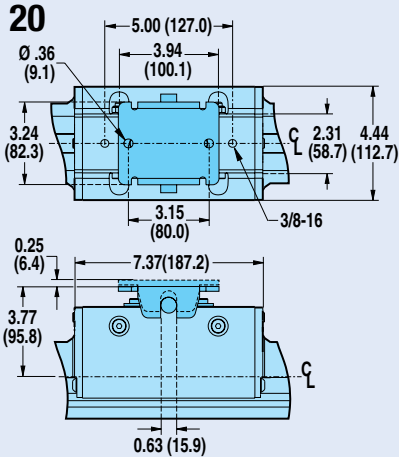
12



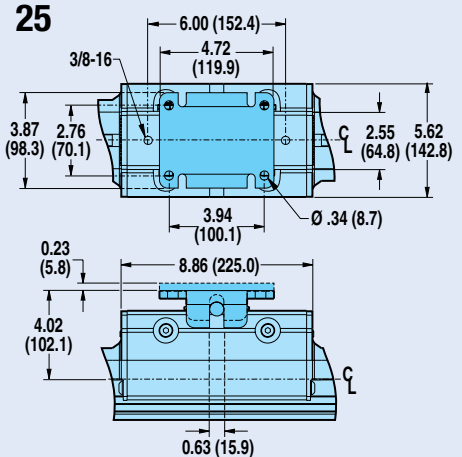
15



20



25



Dimensions in inches (parenthesis indicate dimensions in millimeters)

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# BC2 Switches - ALL Sizes

## SWITCHES



There are 10 sensing choices: DC reed, form A (open) or form C (open or closed); AC reed (Triac, open); Hall-effect, sourcing, PNP (open); Hall-effect, sinking, NPN (open); each with either flying leads or QD (quick disconnect). Commonly used to send analog signals to PLC (programmable logic controllers), TLL, CMOS circuit or other controller device. These switches are activated by the actuator's magnet.

Switches contain reverse polarity protection. QD cables are shielded; shield should be terminated at flying lead end.

If necessary to remove factory installed switches, be sure to reinstall on the same side of actuator with scored face of switch toward internal magnet.

## SPECIFICATIONS

ORDER CODE	REED DC				REED AC		HALL-EFFECT DC			
	R T	R M	B T	B M	C T	C M	T T	T M	K T	K M
PART NUMBER	3600-9082	3600-9083	3600-9084	3600-9085	3600-9086	3600-9087	3600-9088	3600-9089	3600-9090	3600-9091
LEAD	5m	QD*	5m	QD*	5m	QD*	5m	QD*	5m	QD*
CABLE SHIELDING	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†
SWITCHING LOGIC	"A" Normally Open		"C" Normally Open or Closed		Triac Normally Open		PNP (Sourcing) Normally Open		NPN (Sinking) Normally Open	
MECHANICAL CONTACTS	Single-Pole Single-Throw		Single-Pole Double-Throw		Single-Pole Single-Throw		NO, These Are Solid State Components			
COIL DIRECT	Yes		Yes		Yes		—			
POWER LED	None	None		None		None	None		None	
SIGNAL LED	Red	Red		Red		Red	Red		Red	
OPERATING VOLTAGE	200 Vdc max.		120 Vdc max.		120 Vac max.		5 - 25 Vdc			
OUTPUT RATING	—		—		—		25 Vdc, 200mA dc			
OPERATING TIME	0.6 msec max. (including bounce)		0.7 msec max. (including bounce)		—		< 10 micro sec.			
OPERATING TEMPERATURE	-40°F [-40°C] to 158°F [70°C]						0°F [-18°C] to 150°F [66°C]			
RELEASE TIME	1.0 msec. max.		—		—		—			
ON TRIP POINT	—		—		—		150 Gauss maximum			
OFF TRIP POINT	—		—		—		40 Gauss minimum			
**POWER RATING (WATTS)	10.0 §		3.0 §§		10.0		5.0			
VOLTAGE DROP	2.6 V typical at 100 mA		NA		—		—			
RESISTANCE	0.1 Ω Initial (Max.)		—		—		—			
CURRENT CONSUMPTION	—		—		1 Amp at 86°F [30°C]		0.5 Amp at 140°F [60°C]		200 mA at 25 Vdc	
FREQUENCY	—		—		47 - 63 Hz		—			
CABLE MIN. BEND RADIUS	STATIC		0.630" [16mm]							
	DYNAMIC		Not Recommended							

**CAUTION: DO NOT OVER TIGHTEN SWITCH HARDWARE WHEN INSTALLING!**

**\*\* WARNING:** Do not exceed power rating (Watt = Voltage X Amperage). Permanent damage to sensor will occur.

\*QD = Quick Disconnect; Male coupler is located 6" [152mm] from sensor, Female coupler to flying lead (part #2503-1025) distance is 197" [5m] also see Cable Shielding specification above

**REPLACEMENT OF QD SWITCHES MANUFACTURED BEFORE JULY 1, 1997:** It will be necessary to replace or rewire the female end coupler.



**Reed Switch Life Expectancy:** Up to 200,000,000 cycles (depending on load current, duty cycle and environmental conditions)

†Shielded from the female quick disconnect coupler to the flying leads. Shield should be terminated at flying lead end.

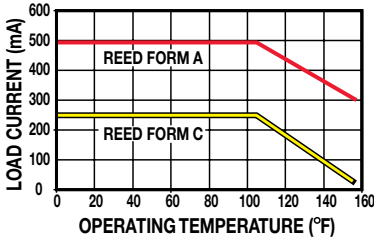
§ Maximum current 500mA (not to exceed 10VA) Refer to Temperature vs. Current graph and Voltage Derating graph

§§ Maximum current 250mA (not to exceed 3VA) Refer to Temperature vs. Current graph and Voltage Derating graph

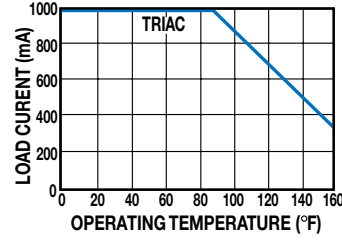
# BC2 Switches - ALL Sizes

## PERFORMANCE

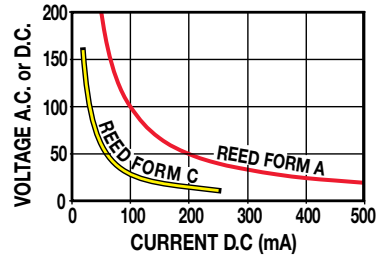
TEMP. vs CURRENT, DC REED



TEMP. vs CURRENT, AC REED

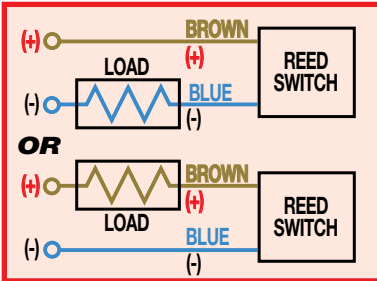


VOLTAGE DERATING, DC REED

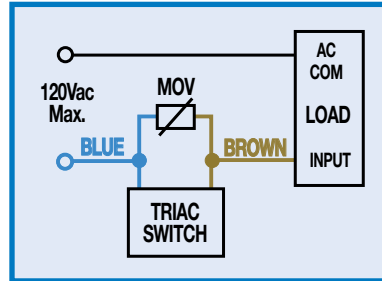


## WIRING DIAGRAMS

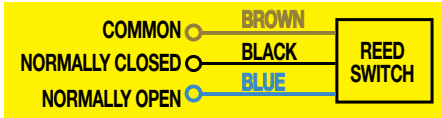
**R**T & **R**M DC REED, FORM A



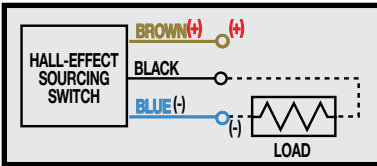
**C**T & **C**M AC REED, TRIAC



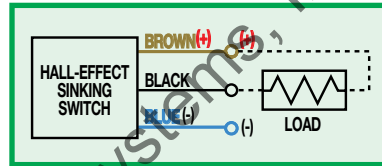
**B**T & **B**M DC REED, FORM C



**T**T & **T**M HALL-EFFECT, SOURCING, PNP



**K**T & **K**M HALL-EFFECT, SINKING, NPN



## INSTALLATION INFORMATION

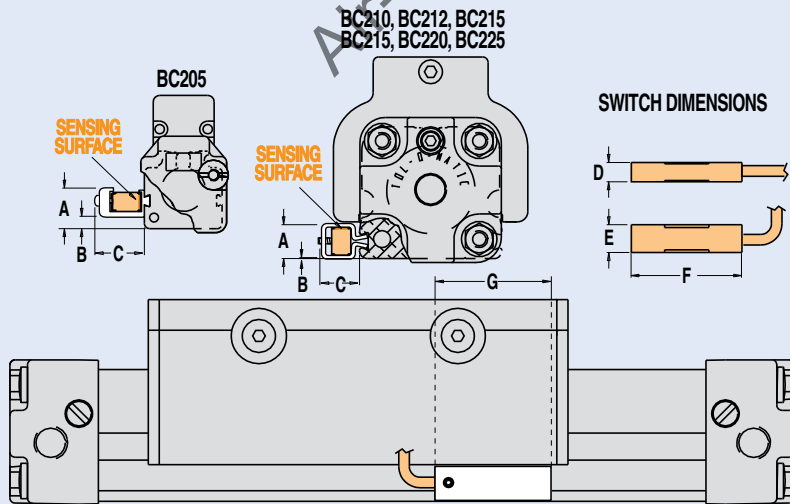


**⚠** THE NOTCHED FACE OF THE SWITCH INDICATES THE SENSING SURFACE AND MUST FACE TOWARD THE MAGNET.

**📌** HALL-EFFECT SWITCHES ARE NOT AVAILABLE FOR BC205

**📌** Some actuators may require switch mounting on a specific side of the assembly. Call Tolomatic for details.

## DIMENSIONS



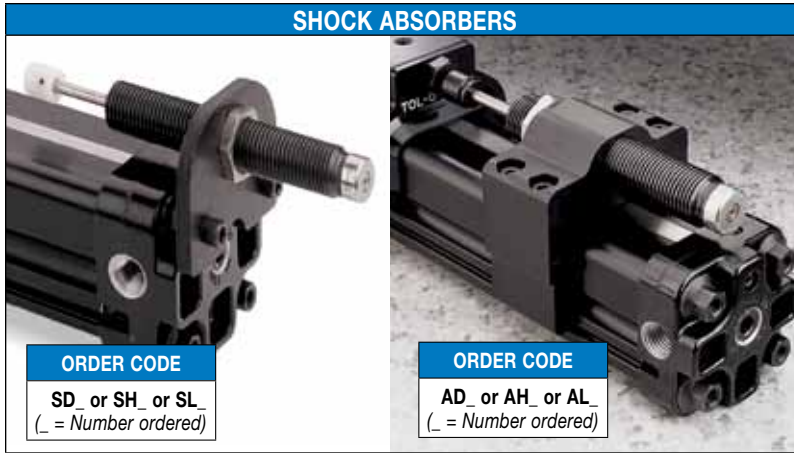
SIZE	BORE	A	B	C	D	E	F	G
05	0.50	0.445	0.157	0.518	0.219	0.315	1.25	1.45
10	1.00	0.383	0.011	0.448	0.219	0.315	1.25	1.45
12	1.25	0.541	0.169	0.448	0.219	0.315	1.25	1.45
15	1.50	0.548	0.161	0.432	0.219	0.315	1.25	1.45
20	2.00	0.732	0.344	0.448	0.219	0.315	1.25	1.45
25	2.50	1.082	0.710	0.432	0.219	0.315	1.25	1.45

Dimensions in inches

SIZE	BORE	A	B	C	D	E	F	G
M05	12	11.30	3.99	13.16	5.56	8.00	31.75	36.83
M10	25	9.73	0.28	11.38	5.56	8.00	31.75	36.83
M12	32	13.74	4.29	11.38	5.56	8.00	31.75	36.83
M15	40	13.92	4.09	10.97	5.56	8.00	31.75	36.83
M20	50	18.59	8.74	11.38	5.56	8.00	31.75	36.83
M25	63	27.48	18.03	10.97	5.56	8.00	31.75	36.83

Dimensions in millimeters

# BC2 Shock Absorbers - 10, 12, 15, 20, 25 Sizes



Rodless cylinders with standard internal cushion offer an effective method of decelerating loads. However, all Tolomatic rodless cylinders are capable of carrying heavier loads at higher velocities than the cylinder cushion can absorb. Optional shock absorbers can be used to increase the cylinder's life and broaden the application range for the cylinder model you have chosen.

Tolomatic offers two types of shock absorber options for use with rodless cylinders. Standard shock absorbers, which are positioned on the cylinder heads for end-of-stroke deceleration and adjustable shock absorbers which allows the shock to be positioned at any point along the cylinder.

Typical shock absorber life varies between 1-2 million cycles (depending on environment) appropriate preventative maintenance should be considered in high cyclic applications.

**NOTE:** When 2 shock absorbers are ordered, the unit will be assembled with NO internal cushions.

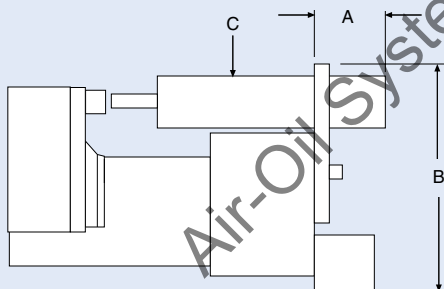
**NOTE:** Adjustable shock absorbers will reduce stroke length. To maintain desired stroke length: when ordering increase stroke length by the dimension in the table below for each adjustable shock absorber ordered.

10	12	15	20	25
0.75" [19.0mm]	0.03" [0.7mm]	0.35" [8.9mm]	0.85" [21.6mm]	0.85" [21.6mm]

**CAUTION:** In applications which result in a load bending moment at deceleration, care should be taken to decelerate the load rather than the carrier of the band cylinder.

## DIMENSIONS

### STANDARD SHOCK



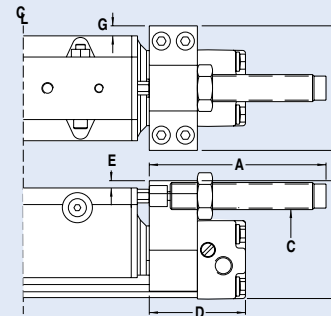
SIZE	BORE	A	B	C (Thread Size)
10	1.00	2.35	2.50	9/16-18 UNF-2B
12	1.25	2.23	3.50	3/4-16 UNF-2B
15	1.50	2.23	4.00	3/4-16 UNF-2B
20	2.00	2.62	4.70	1-12 UNF-2B
25	2.50	1.17	6.00	1-12 UNF-2B

Dimensions in inches

SIZE	BORE	A	B	C (Thread Size)
M10	25	59.7	63.5	M14x1.5-6g
M12	32	56.6	88.9	M20x1.5-6g
M15	40	56.6	101.6	M20x1.5-6g
M20	50	66.5	119.4	M25x1.5-6g
M25	63	29.7	152.4	M25x1.5-6g

Dimensions in millimeters

### ADJUSTABLE POSITION SHOCK



SIZE	BORE	A	B	C (Thread Size)	D	E	F	G
10	1.00	3.68	2.45	9/16-18 UNF-2B	2.00	0.15	2.59	0.21
12	1.25	4.39	3.19	3/4-16 UNF-2B	2.25	0.13	2.82	0
15	1.50	4.39	3.62	3/4-16 UNF-2B	2.50	0.05	3.50	0
20	2.00	4.75	4.60	1-12 UNF-2B	3.13	0.16	4.44	0
25	2.50	4.75	5.63	1-12 UNF-2B	4.47	0.17	5.63	0

Dimensions in inches

SIZE	BORE	A	B	C (Thread Size)	D	E	F	G
M10	25	93.5	62.2	M14x1.5-6g	50.8	3.8	65.8	5.3
M12	32	111.5	81.0	M20x1.5-6g	57.2	3.3	71.6	0
M15	40	111.5	92.0	M20x1.5-6g	63.5	1.3	88.9	0
M20	50	120.7	116.8	M25x1.5-6g	79.5	4.1	112.8	0
M25	63	120.7	143.0	M25x1.5-6g	113.5	4.3	143.0	0

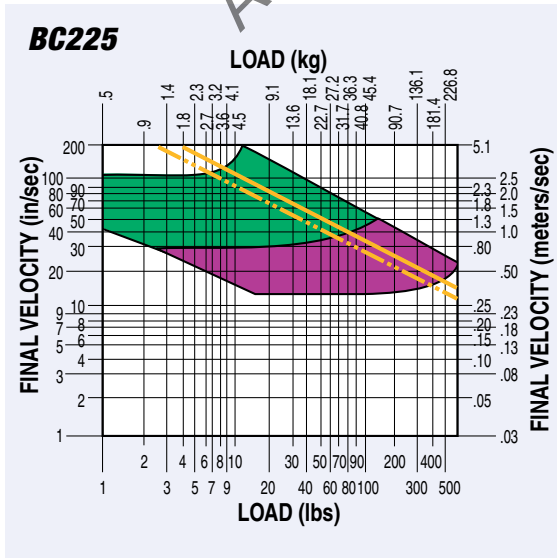
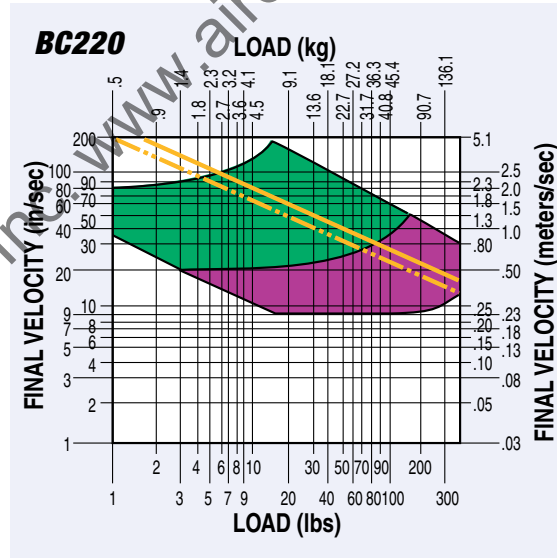
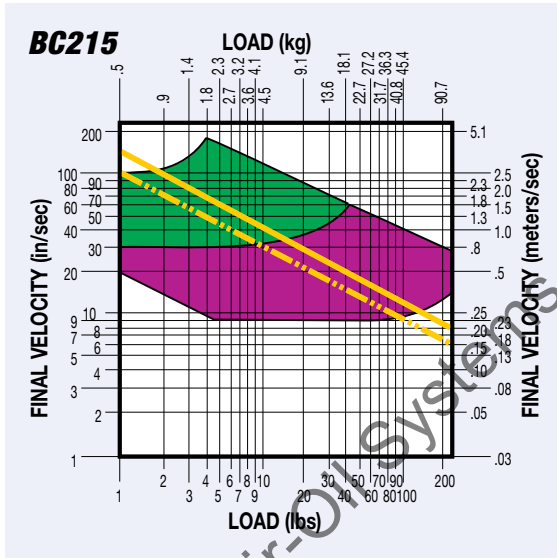
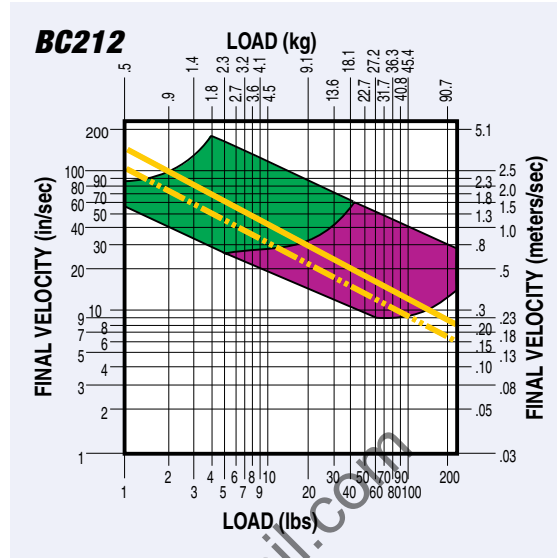
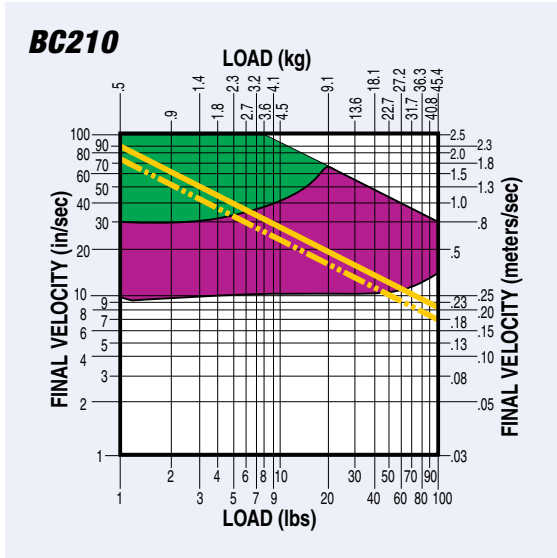
Dimensions in millimeters



# BC2 Shock Absorbers - 10, 12, 15, 20, 25 Sizes

## PERFORMANCE

### VELOCITY vs LOAD



- LIGHT DUTY (Light load/High velocity)
- HEAVY DUTY (Heavy load/Low velocity)
- AIR CUSHION DATA



NOTE: If final (or impact) velocity cannot be calculated directly, a reasonable guideline to use is 2 x average velocity.

ABT

MXP

BC2

BC3

BC4

LS

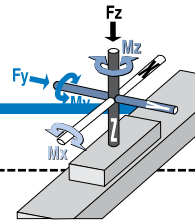
MG

CC

PB

ENGR

# Application Data Worksheet



## STROKE LENGTH \_\_\_\_\_

inch (S/K)  millimeters  
(U.S. Standard) (Metric)

## AVAILABLE AIR PRESSURE \_\_\_\_\_

PSI  bar  
(U.S. Standard) (Metric)

## REQUIRED THRUST FORCE \_\_\_\_\_

lbf  N  
(U.S. Standard) (Metric)

## LOAD \_\_\_\_\_

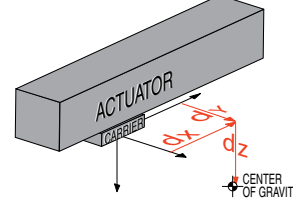
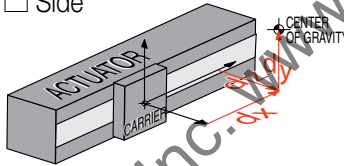
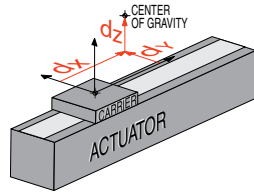
lb  kg  
(U.S. Standard) (Metric)

## LOAD CENTER OF GRAVITY DISTANCE TO CARRIER CENTER

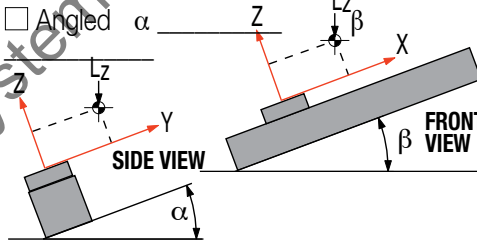
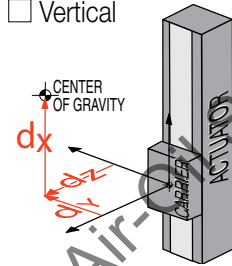
$d_x$  \_\_\_\_\_  
 $d_y$  \_\_\_\_\_  
 $d_z$  \_\_\_\_\_  
 inch  millimeters  
(U.S. Standard) (Metric)

## ORIENTATION

Horizontal  Side  Horizontal Down



Vertical



## OTHER ISSUES:

(i.e. Environment, Temperature, Contamination, etc.)

## FORCES APPLIED TO CARRIER

lbf  N  
(U.S. Standard) (Metric)

$F_z$  \_\_\_\_\_  
 $F_y$  \_\_\_\_\_

## BENDING MOMENTS APPLIED TO CARRIER

in-lbs  N-m  
(U.S. Standard) (Metric)

$M_x$  \_\_\_\_\_  
 $M_y$  \_\_\_\_\_  
 $M_z$  \_\_\_\_\_

## FINAL VELOCITY \_\_\_\_\_

in/sec  mm/sec  
(U.S. Standard) (Metric)

## MOVE TIME sec. \_\_\_\_\_

## NO. OF CYCLES \_\_\_\_\_

per minute  per hour

Contact information: \_\_\_\_\_



Fax (1-763-478-8080) or call Tolomatic (1-800-328-2174) with the above information. We will provide any assistance needed to determine the proper actuator.

# Rodless Cylinder Selection Guidelines - BC2, BC3, BC4, LS - All Sizes

## PROVIDING LOAD GUIDANCE AND SUPPORT

The process of selecting a load bearing actuator for a given application can be complex. It is highly recommended that you contact Tolomatic or a Tolomatic Distributor for assistance in selecting the best actuator for your application. The following overview of the selection guidelines are for educational purposes only.

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Band Cylinder or Linear Slide model for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs or kg)
- Orientation of load (lbs or kgs)
- Velocity of load (in/sec or mm/sec)
- Stroke length (in or mm)

HINT: Use Tolomatic sizing and selection software, download at: [tolomatic.com](http://tolomatic.com)

### 2 SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 3), the actuator will accommodate the application.

If the intersection is above the diagonal line, a larger cylinder bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 DETERMINE NATURE OF LOAD AND THE EFFECT OF BENDING MOMENTS

If the cylinder will guide and support a load located directly over the center of carrier, bending moments will not be a factor in the cylinder selection.

NOTE: The maximum load "L" must not exceed the capacity limits of the cylinder selected.

- Bending Moments

For off center or side loads, determine the distance from the center of mass of the load to the center of the carrier bracket. This measurement is needed to calculate the torque for bending moments. (Refer to Bending Moment chart for each model.)

Should the resulting maximum bending moment exceed figures indicated on the chart, external guides, auxiliary carrier/s or a larger cylinder should be considered.

- Auxiliary Carrier Bending Moments

The auxiliary carrier option (available on most models) increases load carrying capacity and bending moments. Auxiliary carriers can be ordered with or without an internal piston. (Auxiliary

carriers without a piston have no internal cushion on the cylinder end closest to the auxiliary carrier.)

IMPORTANT: When ordering, determine the working stroke, then the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart). When ordered, Tolomatic's configurator will calculate the overall length of the actuator.

NOTE: breakaway pressure will increase when using auxiliary carriers.

### 4 DETERMINE INTERNAL CUSHION CAPACITY

- Consult the Cushion Data chart for the model selected. The velocities listed on the cushion charts are final or cushion impact velocities. On applications where the internal cushions or bumpers are to be used, be sure the actual, final or impact velocity is known. If the velocity is not known, use of limit switches with valve deceleration circuits or shock absorbers should be considered. NOTE: The BC205 uses external bumpers in place of internal cushions, LS05 & LS10 do not have cushions or bumpers.

- Cross-reference the final velocity and weight of the load. If the intersection is below the diagonal lines, the internal cushions on the actuator may be used. If the point falls above the dashed diagonal line or if the velocity is not known, use deceleration circuits, external shock absorbers or select a

larger cylinder with greater cushion capacity. On high-cyclic applications, use of external stops is strongly recommended.

### 5 DETERMINE TUBE SUPPORT REQUIREMENTS

- Consult the Tube Support chart for the model selected.
- Cross reference the load weight and maximum distance between supports.

### 6 CONSIDER OPTIONS

- Switches— dc Reed, Hall-effect or ac Triac

Band Cylinders and Linear Slides each have different standard features and options. Check the options section for the actuator you have selected.

- Shock Absorbers— if needed.
- Foot Mounting Kits
- Floating Mount Bracket – use when lack of parallelism occurs between the cylinder and an external guided and supported load.
- Single End Porting (BC3, BC4)
- Long Carrier (BC4)
- Proximity Sensors (LS)
- Dual 180° Carrier (BC3)

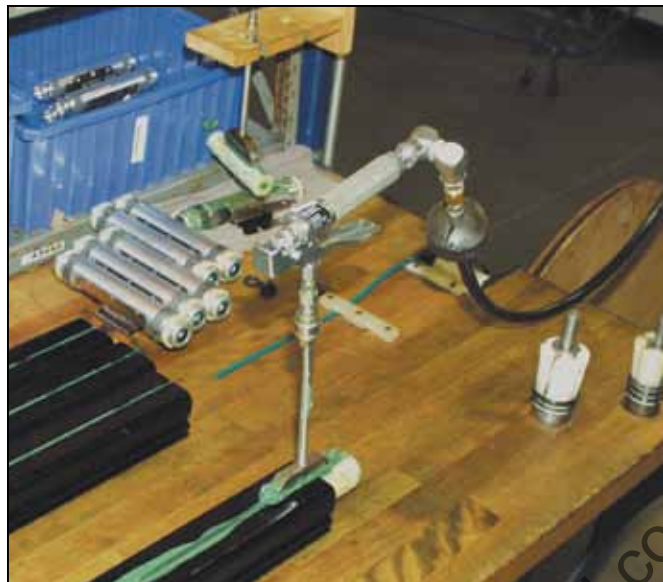
# Application Guidelines

The following conditional statements are intended as general guidelines for use of Tolomatic actuators. Since all applications have their own specific operating requirements, consult Tolomatic, Inc. or your local Tolomatic distributor if an application is unconventional or if questions arise regarding the selection process.

## CUSHION NEEDLE ADJUSTMENT (BC2, BC3, BC4, CC, SA, DP, TC ONLY)



Adjust the cushion needles in the cylinder heads carefully to obtain a smooth, hesitation free deceleration for your particular application. If there are questions on proper adjustment, please consult Tolomatic, Inc.



## LUBRICATION GUIDELINES

All Tolomatic actuators (except Cable Cylinders) are prelubricated at the factory. To ensure maximum actuator life, the following guidelines should be followed.

### • Filtration

We recommend the use of dry, filtered air in our products. "Filtered air" means a level of 10 Micron or less. "Dry" means air should be free of appreciable amounts of moisture. Regular maintenance of installed

filters will generally keep excess moisture in check.


### • External Lubricators (optional)

The factory prelubrication of Tolomatic actuators will provide optimal performance without the use of external lubrication. However, external lubricators can further extend service life of pneumatic actuators if the supply is kept constant.

Oil lubricators, (mist or drop) should supply a minimum of 1 drop per 20 standard cubic feet per minute to the

cylinder. As a rule of thumb, double that rate if water in the system is suspected. Demanding conditions may require more lubricant.

If lubricators are used, we recommend a non-detergent, 20cP @ 140°F 10-weight lubricant. Optimum conditions for standard cylinder operation are +32° to +150°F (+0° to 65.5°C).

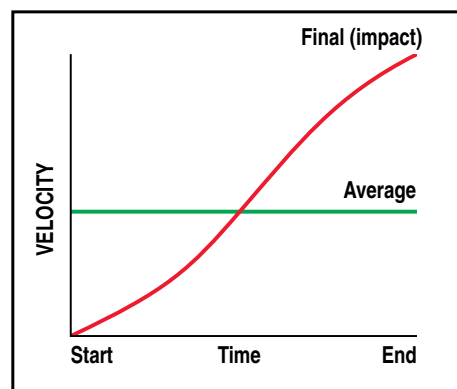
 NOTE: Use of external lubricators may wash away the factory installed lubrication. External lubricants must be maintained in a constant supply or the results will be a dry actuator prone to premature wear.

### • Sanitary Environments

Oil mist lubricators must dispense "Food Grade" lubricants to the air supply. Use fluids with ORAL LD50 toxicity ratings of 35 or higher such as Multitherm® PG-1 or equivalent. Demanding conditions can require a review of the application.

## FINAL VELOCITY CALCULATION

Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Stroking a 100-inch BC3 model in one second yields an average velocity of 100 inches per second. To properly determine the inertial forces for cushioning, it is important to know the



final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered (see diagram).

If final (or impact) velocity cannot be calculated directly, a reasonable guideline is to use 2 x average velocity.

# BC2 Ordering - ALL Sizes

## MODEL, BORE, STROKE

## OPTIONS

BC2 10 SK100-250 DW6-0 TS3 FM2 SH2 BM2

### MODEL & MOUNTING

**BC2** BC2 Band Cylinder - inch (U.S. Standard)  
**BC2M** metric mounting with taper port  
**BC2MM** metric mounting with parallel port

### BORE SIZE

**05** 0.50" (12mm)  
**10** 1.00" (25mm)  
**12** 1.25" (32mm)  
**15** 1.50" (40mm)  
**20** 2.00" (50mm)  
**25** 2.50" (63mm)

### STROKE LENGTH

**SK**\_\_\_ Enter desired stroke length in decimal inches

#### MAXIMUM STROKE

SIZE	MAXIMUM STROKE	
	BC2 in	BC2M(MM)
05	175	4,450
10	283	7,193
12	280	7,132
15	278	7,071
20	158	4,023
25	238	6,066

### AUXILIARY CARRIER (BC2\_14)

**DW** Auxiliary carrier With piston & "D" distance  
**DO** Auxiliary carrier Without piston & "D" distance  
 \_\_\_ "D" Distance between carriers

✗ Not available for 05 size

#### MINIMUM "D" DISTANCE BETWEEN CARRIERS

	(DO) w/o Piston		(DW) w/ Piston	
	in	mm	in	mm
10	5.07	129	5.07	129
12	5.17	131	6.85	174
15	6.46	164	8.07	205
20	8.10	206	8.10	206
25	9.62	244	11.06	281

✎ \*When ordering auxiliary carrier option, enter the distance required between carriers. The configurator will calculate the overall length of the actuator.

### TUBE SUPPORTS (BC2\_16)

**TS** Tube Support & number required

### FOOT MOUNT (BC2\_17)

**FM** Foot Mount & number required (1 or 2)

### FLOATING MOUNT (BC2\_18)

**FL** Floating Mount Bracket

✗ Not compatible with shock absorbers

### PORTING OPTION

**HDL** 4-Ported Head - Left End  
**HDR** 4-Ported Head - Right End  
**HDB** 4-Ported Head - Both Ends

✗ Not available for 05 size

### SHOCK ABSORBERS (BC2\_21)

**SD** Shock hardware Only and number required  
**SH** Shock, Heavy duty and number required  
**SL** Shock, Light duty and number required  
**\*AD** Adjustable shock hardware Only and number required  
**\*AH** Adjustable shock, Heavy duty and number required  
**\*AL** Adjustable shock, Light duty and number required

✗ Not available for 05 size

📌 \*NOTE: Adjustable Shock will reduce working stroke (see page BC2\_21)

### SWITCHES (BC2\_19)

TYPE		QUICK-DISCONNECT	CODE	QUANTITY	LEAD LENGTH
REED	Form A	QD	<b>RM</b>	After code enter quantity desired	5 meters
		no	<b>RT</b>		
Form C	QD	<b>BM</b>			
	no	<b>BT</b>			
HALL-EFFECT	Sinking	QD	<b>*KM</b>		
		no	<b>*KT</b>		
Sourcing	QD	<b>*TM</b>			
	no	<b>*TT</b>			
TRIAC	QD	<b>CM</b>			
	no	<b>CT</b>			

**MDR** Dual Magnet (Reed, Hall-effect, Triac)

\* ✗ Not available for 05 size

✎ Not all codes listed are compatible with all options. Contact Tolomatic with any questions.



Use the Tolomatic Sizing Software to determine available options and accessories based on your application requirements.

# BC2 Service Parts Ordering - ALL Sizes

Inch (U.S. Standard) SIZE	05	10	12	15	20	25
Aux. Carrier Assembly (w/piston) (each)	NA	0510-9057	0512-9057	0515-9057	0520-9057	0525-9057
Aux. Carrier Assembly (wo/piston) (each)	NA	0510-9095	0512-9095	0515-9095	0520-9095	0525-9095
Floating Mount Bracket Kit	0905-9115	0510-9007	0512-9007	0515-9007	0520-9007	0525-9007
Foot Mount Kit <sup>1</sup>	0905-9010	0510-9125	0512-9125	0515-9125	0520-9125	0525-9125
Shock Field Retrofit Kit – Heavy Duty <sup>2,8</sup>	NA	0510-9090	0512-9090	0515-9090	0520-9090	0525-9090
Shock Field Retrofit Kit – Light Duty <sup>2,8</sup>	NA	0510-9091	0512-9091	0515-9091	0520-9091	0525-9091
Shock Field Mount Kit (Hardware Only) <sup>3,8</sup>	NA	0510-9092	0512-9092	0515-9092	0520-9092	0525-9092
Adj. Shock Field Retrofit Kit – Heavy Duty <sup>2</sup>	NA	0510-9048	0512-9011	0515-9011	0520-9011	0525-9011
Adj. Shock Field Retrofit Kit – Light Duty <sup>2</sup>	NA	0510-9049	0512-9012	0515-9012	0520-9012	0525-9012
Adj. Shock Field Mount Kit (Hardware Only) <sup>3</sup>	NA	0510-9072	0512-9072	0515-9072	0520-9013	0525-9013
Tube Supports <sup>4</sup>	0905-1034	4510-1010	4512-1010	4515-1010	4520-1010	4525-1010
Switch Hardware Only	0505-9999	0510-9999	0512-9999	0515-9999	0520-9999	0525-9999
Repair Kits <sup>5,6,7</sup>	RKBC205	RKBC210	RKBC212	RKBC215	RKBC220	RKBC225

Metric SIZE	M(MM)05	M(MM)10	M(MM)12	M(MM)15	M(MM)20	M(MM)25
Aux. Carrier Assembly (w/piston) (each)	NA	4510-9057	4512-9057	4515-9057	4520-9057	4525-9057
Aux. Carrier Assembly (wo/piston) (each)	NA	4510-9095	4512-9095	4515-9095	4520-9095	4525-9095
Floating Mount Bracket Kit	4905-9115	4510-9007	4512-9007	4515-9007	4520-9007	4525-9007
Foot Mount Kit <sup>1</sup>	4905-9010	4510-9125	4512-9125	4515-9125	4520-9125	4525-9125
Shock Field Retrofit Kit – Heavy Duty <sup>2,8</sup>	NA	4510-9090	4512-9090	4515-9090	4520-9090	4525-9090
Shock Field Retrofit Kit – Light Duty <sup>2,8</sup>	NA	4510-9091	4512-9091	4515-9091	4520-9091	4525-9091
Shock Field Mount Kit (Hardware Only) <sup>3,8</sup>	NA	4510-9092	4512-9092	4515-9092	4520-9092	4525-9092
Adj. Shock Field Retrofit Kit – Heavy Duty <sup>2</sup>	NA	4510-9013	4512-9013	4515-9013	4520-9013	4525-9013
Adj. Shock Field Retrofit Kit – Light Duty <sup>2</sup>	NA	4510-9014	4512-9014	4515-9014	4520-9014	4525-9014
Adj. Shock Field Mount Kit (Hardware Only) <sup>3</sup>	NA	4510-9025	4512-9025	4515-9025	4520-9025	4525-9025
Tube Supports <sup>4</sup>	0905-1034	4510-1010	4512-1010	4515-1010	4520-1010	4525-1010
Switch Hardware Only	0505-9999	0510-9999	0512-9999	0515-9999	0520-9999	0525-9999
Repair Kits <sup>5,6,7</sup>	RKBC2M(MM)05	RKBC2M(MM)10	RKBC2M(MM)12	RKBC2M(MM)15	RKBC2M(MM)20	RKBC2M(MM)25

PART NUMBER ORDERING		CONFIG. CODE ORDERING
No Mounting Hardware or FE conn. included		Mounting Hardware & FE conn. included
PART NO.	DESCRIPTION	CODE
3600-9084	Switch Only, Reed, Form C, 5m	BT
3600-9085	Switch Only, Reed, Form C, Male Conn.	BM
3600-9082	Switch Only, Reed, Form A, 5m	RT
3600-9083	Switch Only, Reed, Form A, Male Conn.	RM
3600-9086	Switch Only, Triac, 5m	CT
3600-9087	Switch Only, Triac, Male Conn.	CM
3600-9090	Switch Only, Hall-effect, Sinking, 5m	KT
3600-9091	Switch Only, Hall-effect, Sinking, Male Conn.	KM
3600-9088	Switch Only, Hall-effect, Sourcing, 5m	TT
3600-9089	Switch Only, Hall-effect, Sourcing, Male Conn.	TM
2503-1025	Connector (Female) 5 meter lead	

NOTE: When ordered by Config. Code Female connector & all mounting hardware is included

## Switch Ordering NOTES:

To order field retrofit switch and hardware kits for all Tolomatic actuators: SW (Then the model and bore size, and type of switch required)

### Example: SWBC215RT

(Hardware and Form A Reed switch with 5 meter lead for 1.5" bore BC2 band cylinder)

⚠ Mounting hardware is required if replacing switch for any actuator manufactured before 7/1/97



## Service Parts Ordering NOTES:

- Foot Mount Kit contains two foot mount brackets and mounting hardware
- Shock Field Retrofit Kit contains one Shock Absorber and mounting hardware
- Shock Field Mount Kit contains one set of mounting hardware only
- A minimum of 2 (two) Tube Supports required per cylinder
- Repair Kit for 05 size contains O-rings, U-Cups, End Caps, Wear Strips, Band Inserts, Spring Clamps, Sealing Band, Dust Band and Shock Absorbing Pads
- Repair Kit for 10, 12, 15, 20 & 25 size contains End Caps, Bearing Rods, O-rings, U-cups, Wear Rings, Cushion Seals, Band Inserts, Spring Clamps, Sealing Band and Dust Band.
- When ordering repair kits, specify stroke as "SK" then indicate the desired length in decimal inches after the order code indicated above. EXAMPLE: RKBC210SK10.00
- Standard end-of-stroke shock absorbers are designed to operate without the assistance of the standard band cylinder cushion. To ensure proper shock absorber performance, make sure the air cushion is disabled.

NA = Not Available

# BC3 RECIRCULATING BALL BEARING RODLESS CYLINDER



Air-Oil Systems, Inc. www.airoil.com

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ABT

IMXP

BC2

**BC3**

BC4

LS

MG

CC

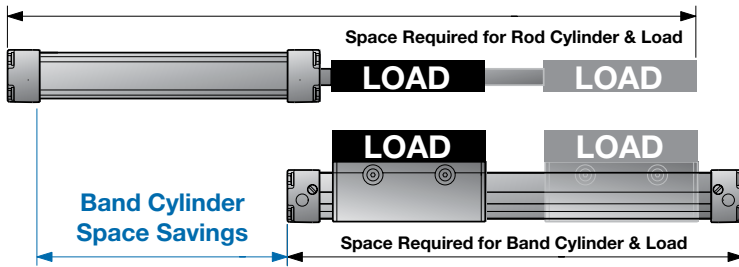
PB

ENGR

# BC3 Recirculating Ball Bearing Rodless Cylinder

## THE RODLESS ADVANTAGE

### TOLOMATIC RODLESS BAND CYLINDERS GET THE JOB DONE IN LESS SPACE THAN ROD STYLE CYLINDERS



**Consider this:** A rodless band cylinder contains its stroke within the cylinder itself. A 2" bore cylinder with a 24" stroke can provide a 43% space savings when compared to an equivalently sized tie rod cylinder. In addition, the load is supported throughout the entire stroke so there is minimal bearing wear and load deflection when compared to rod style cylinders.

With a Tolomatic Band Cylinder, there is no concern about rod rotation. Because rodless cylinders have equal piston areas in both directions, the cylinder experiences zero load variation in either direction.

*Go rodless and save space!*

## ROD STYLE vs RODLESS FEATURE COMPARISON

Feature	Tolomatic Rodless	Rod Style
Integrated Load Support	✓	—
Space Saving Design	✓	—
Piston Seals Isolated From Load	✓	—
Internal Air Cushioning	✓	✓

### ● INNOVATIVE RODLESS PRODUCTS

Tolomatic created the rodless cylinder industry when it manufactured the original cable cylinder. We continually add innovative products to our portfolio, offering industry leading pneumatic rodless products. For over 50 years, Tolomatic has been recognized as the rodless cylinder world market leader, and with good reason.

### ● ENDURANCE TECHNOLOGY<sup>SM</sup>

Every Tolomatic pneumatic band cylinder is designed and built with Endurance Technology<sup>SM</sup>. Material selection, from seals to finish, and every other design element is optimized for long life and excellent performance. The result is the best value and best performing rodless cylinder on the market today. As one customer recently told us, "Your cylinders are built like a tank and run like a deer." Thank you!

### ● TRUST YOUR APPLICATION TO THE RODLESS LEADER

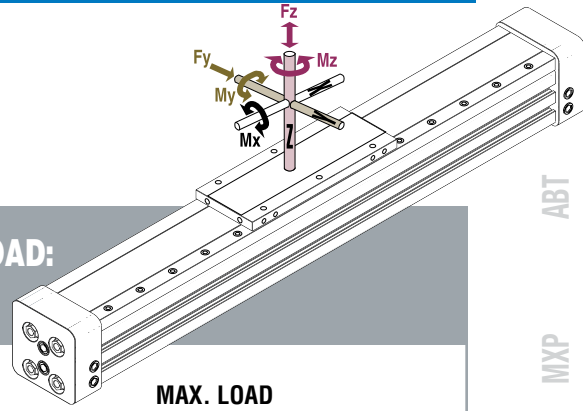
When you want the job done right, go with the experts. Long life. Durability. Ruggedness. Built to your specifications in 5 days or less. Only one company specializes in rodless technology. Tolomatic. Endurance Technology<sup>SM</sup>. The rodless leader.

Be sure to visit [www.tolomatic.com](http://www.tolomatic.com) for up-to-date product specifications, free sizing and selection software, and 3D CAD solid files.

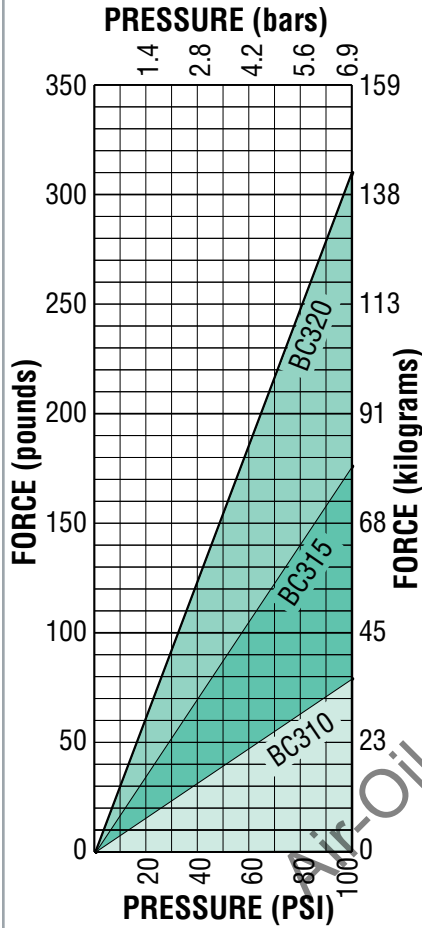


# BC3 Recirculating Ball Bearing Rodless Cylinder

## PERFORMANCE



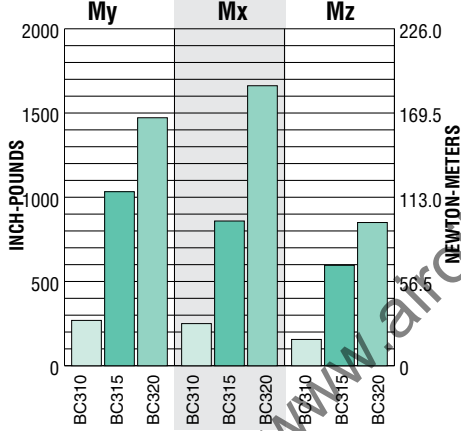
**BC3 THEORETICAL FORCE VS PRESSURE: BC310, BC315, BC320**



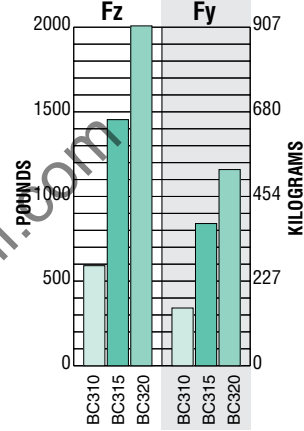
**BC3 BENDING MOMENTS, LOAD: BC310, BC315, BC320**

**STANDARD ACTUATOR**

**BENDING MOMENTS**

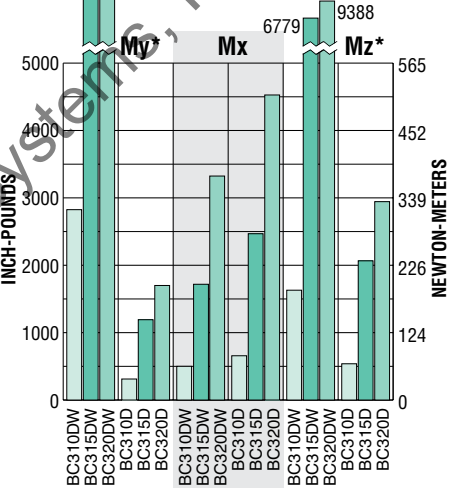


**MAX. LOAD**

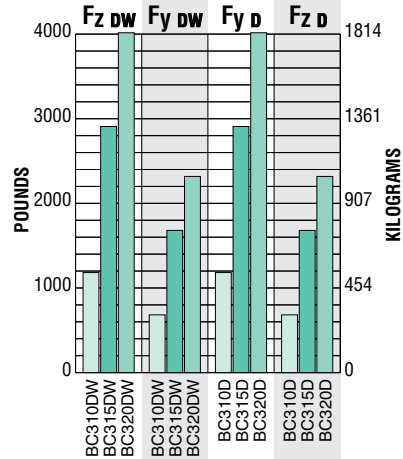


**AUXILIARY CARRIER & DUAL 180° CARRIER OPTIONS**

**BENDING MOMENTS**



**MAX. LOAD**



\*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 BC3\_16.

\*\*Dual 180° carrier bending moments are not an exact comparison with other types of carriers. See page BC3\_14.

ABT  
MXP  
BCZ  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# BC3 BAND CYLINDER

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Look for this endurance technology symbol indicating our durability design features

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

### FORMED END CAP WIPER SEAL

- Keeps contaminants from entering the sealing area
- Protects internal components
- Reduces maintenance while increasing productivity

### SEALED BALL BEARING SYSTEM

- All bearing components covered by seal strip
- Bearing components are sealed and lubricated at the factory
- Assures maximum resistance to contamination

### STAINLESS STEEL SEALING BAND SYSTEM

- Fatigue resistant stainless steel bands are specifically made to provide longer life and will not elongate, like elastomers
- Outer band keeps out contaminants for extended performance
- Inner band provides a smooth surface for less seal wear

### FORMED STEEL PISTON BRACKET

- Provides maximum strength at major stress points
- Heat treated carbon steel withstands the toughest dynamic forces
- Strongest bracket design in the industry assures long life with less maintenance



# TOLOMATIC... THE RODLESS CYLINDER LEADER

## LOAD-BEARING CARRIER DESIGN

- Load and piston are independent - piston floats, resulting in less friction and longer seal life
- Recirculating ball bearing system guides and supports load for consistent long term performance
- Constant level of friction is maintained even when load orientation changes

## ADJUSTABLE CUSHIONS

- Adjustable cushions are standard, not optional
- Easy screw adjustment for end-of-stroke deceleration
- Protects actuator and load from damage

## PATENTED WEDGE BEARING SYSTEM

- Bearing surfaces adjusted at the factory for optimum pre-load
- Bearing surfaces adjusted by and supported by a steel wedge assuring long term stability



## OPTIONS



### AUXILIARY CARRIER

- Substantially higher load capacity
- Substantially higher bending moment capacity



### TUBE SUPPORT MOUNTS

- Used for intermediate support



### FOOT MOUNTS

- For end mounting of band cylinder



### SHOCK ABSORBERS

- Smooth deceleration, higher productivity
- Allows increased operating speed
- Self-compensates for load or speed changes
- Minimizes impact load to equipment
- Adjustable position shocks available



### SWITCHES

- Available in Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers

ABT

IMXP

BCZ

BC3

BC4

LS

MG

CC

PB

ENGR

# BC310 Band Cylinder

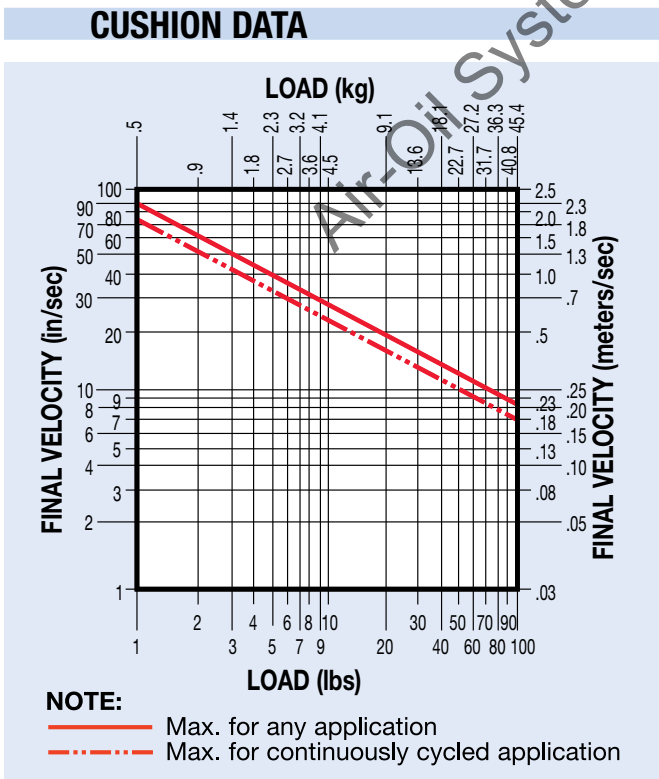
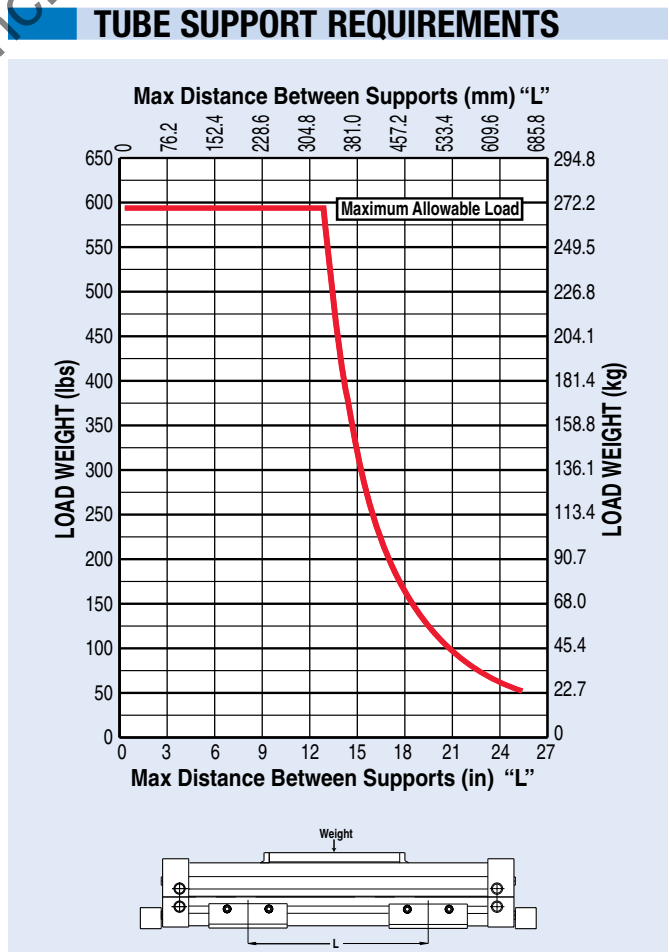
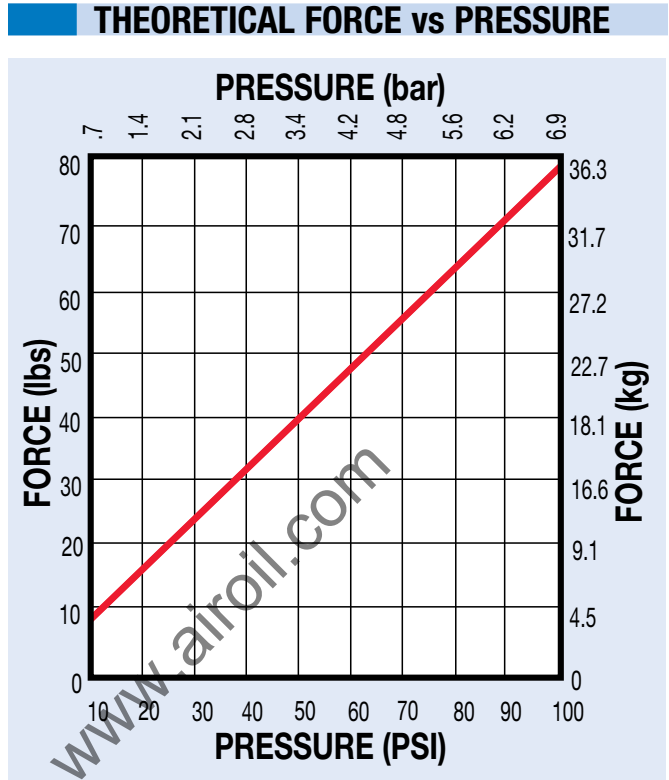
## PERFORMANCE



**BC310**

ORDER CODES	
<b>BC310</b>	inch (U.S. Standard)
<b>BC3M10</b>	(metric with taper port)
<b>BC3MM10</b>	(metric with parallel port)

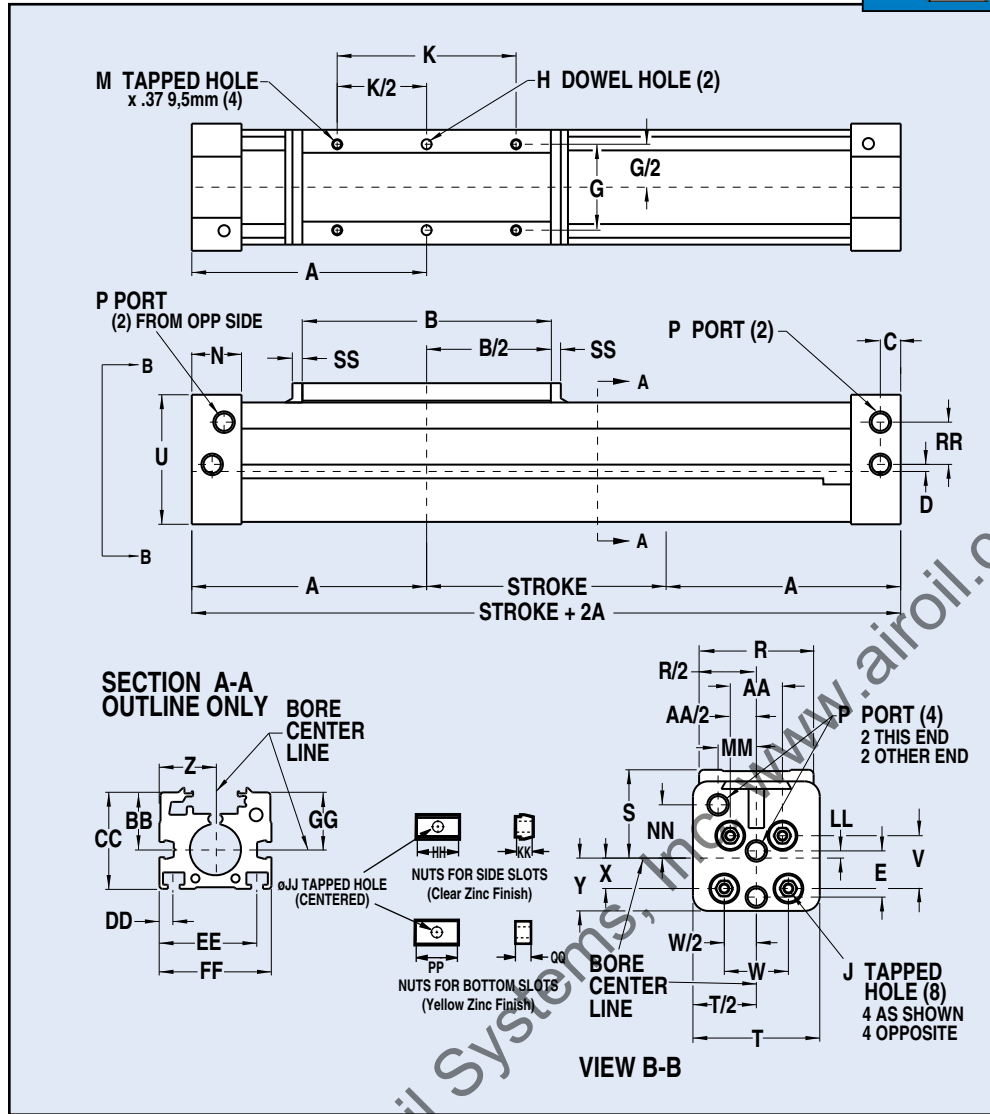
BC310 OPTIONS	Page
Auxiliary Carrier	BC3_16
Auxiliary Dual 180° Carrier	BC3_17
Dual 180° Carrier	BC3_14
Foot Mounts	BC3_13
Shock Absorbers	BC3_21
Switches	BC3_19
Tube Supports	BC3_12
MORE INFORMATION	
Application Guidelines	BC3_25
Cushion Needle Adjustment	BC3_25
Ordering Selection	BC3_24
STANDARD FEATURE	
Single End Porting	BC3_18



# BC310 Band Cylinder



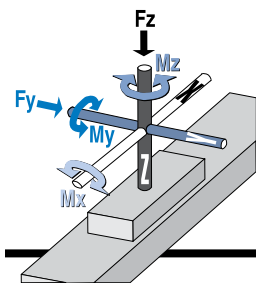
## DIMENSIONS



	MODELS	
	BC310	BC3M/MM10
A	3.94	100.0
B	3.67	93.3
C	.45	11.4
D	.047	1.19
E	.611	15.52
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	.330	8.38
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

## SPECIFICATIONS

### BC310 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD	
		My	Mx	Mz	Fz	Fy
<b>10</b>	1.00 in	269 in-lbs	250 in-lbs	156 in-lbs	591 lbs	341 lbs
<b>M10</b>	25 mm	30.4 N-m	28.2 N-m	17.9 N-m	268.1 kg	154.7 kg

*DOWEL PINS	⊕ .003	Ⓜ
	⊕ .076	Ⓜ

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH**	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
<b>10</b>	1.00 in	2.71 lbs	0.23 lbs/in	205 in	100 PSI	20° to 140° F
<b>M(MM)10</b>	25 mm	1.23 kg	0.0041 kg/mm	5207 mm	6.895 bar	-7° to 60° C

**\*\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# BC315 Band Cylinder

## PERFORMANCE



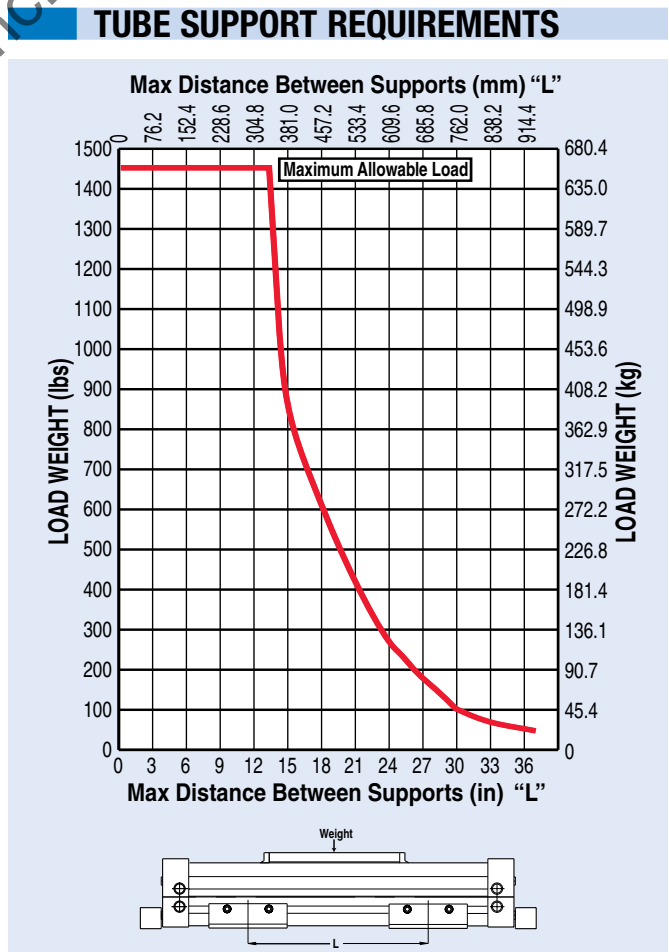
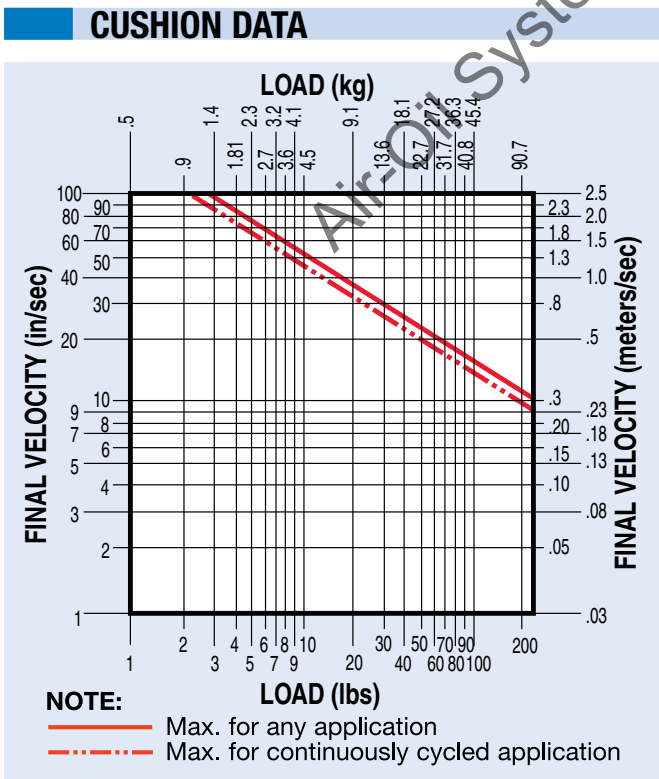
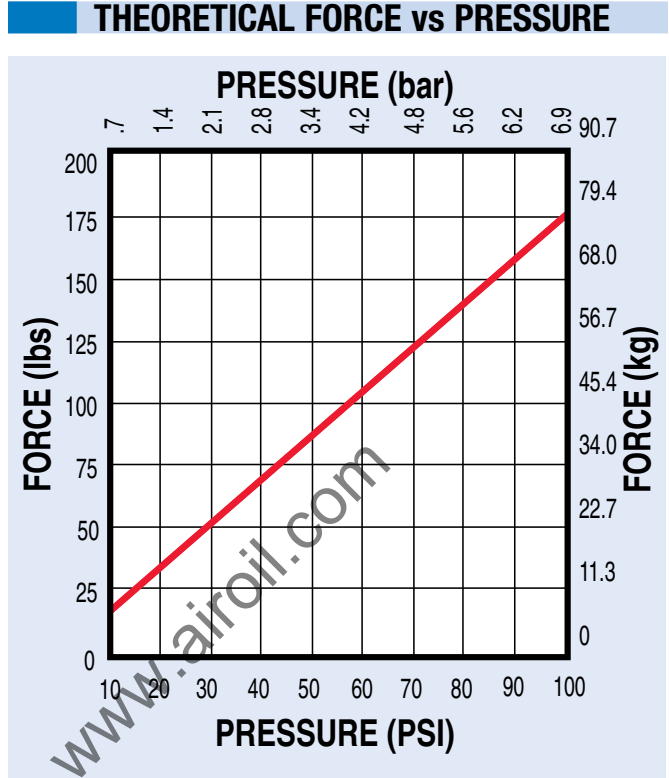
**BC315**

ORDER CODES	
<b>BC315</b>	inch (U.S. Standard)
<b>BC3M15</b>	(metric with taper port)
<b>BC3MM15</b>	(metric with parallel port)

BC315 OPTIONS	Page
Auxiliary Carrier	BC3_16
Auxiliary Dual 180° Carrier	BC3_17
Dual 180° Carrier	BC3_14
Foot Mounts	BC3_13
Shock Absorbers	BC3_21
Switches	BC3_19
Tube Supports	BC3_12

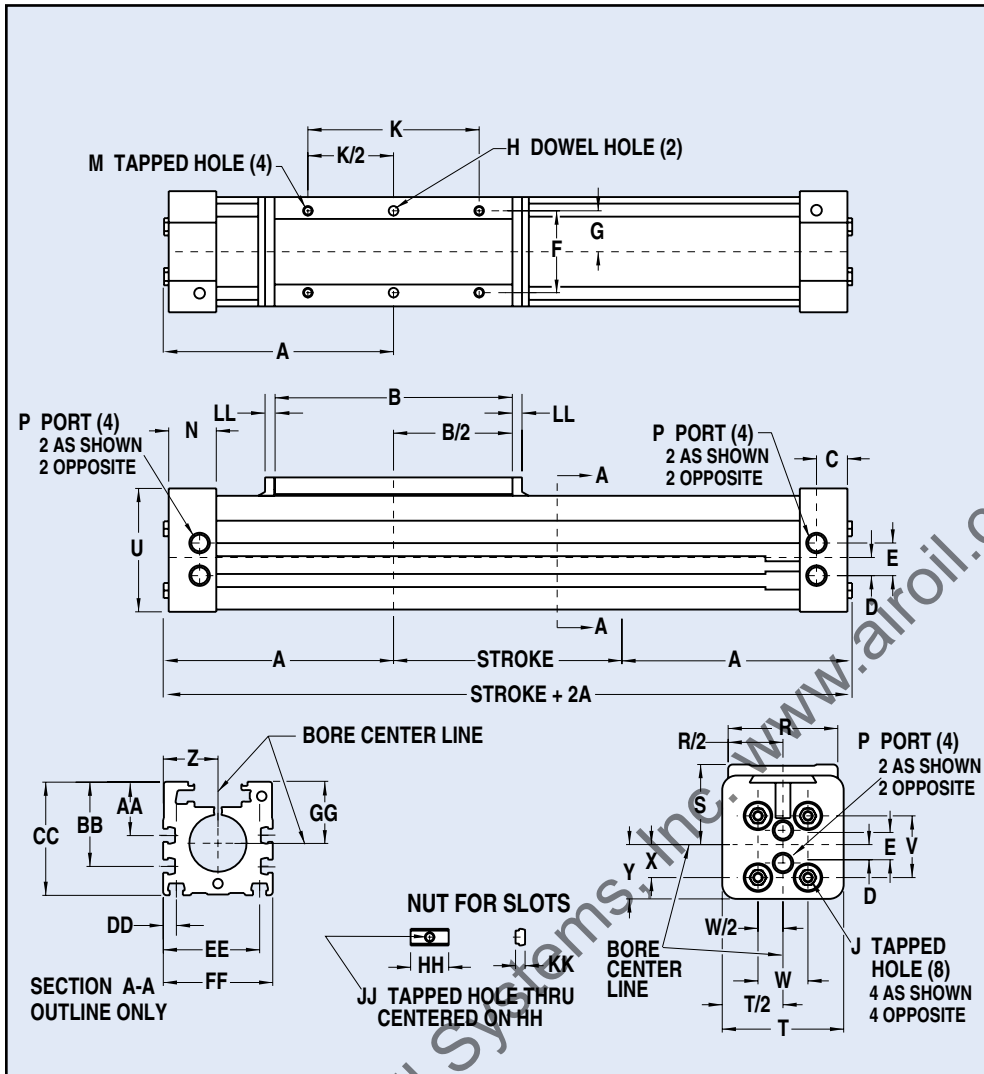
MORE INFORMATION	Page
Application Guidelines	BC3_25
Cushion Needle Adjustment	BC3_25
Ordering	BC3_27
Selection	BC3_24

STANDARD FEATURE	Page
Single End Porting	BC3_18



# BC315 Band Cylinder

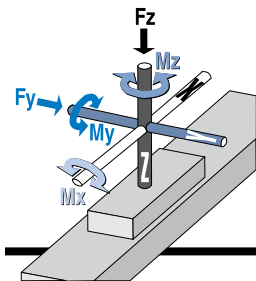
## DIMENSIONS



	MODELS	
	BC315	BC3M/MM15
A	5.93	150.7
B	6.25	158.8
C	.84	21.3
D	.48	12.2
E	.86	21.8
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	3.25	82.6
V	1.625	41.28
W	1.313	33.35
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	.35	8.9
EE	2.53	64.3
FF	2.88	73.0
GG	1.62	41.15
HH	.75	19.1
JJ	1/4-20	M6-1
KK	.25	6.4
LL	.25	6.4
	INCHES	MILLIMETERS

## SPECIFICATIONS

### BC315 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD	
		My	Mx	Mz	Fz	Fy
15	1.50 in	1033 in-lbs	859 in-lbs	596 in-lbs	1454 lbs	840 lbs
M15	40 mm	116.7 N-m	97.1 N-m	67.3 N-m	659.5 kg	381.0 kg

\*DOWEL PINS

⌀	.003	Ⓜ
⌀	.076	Ⓜ

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH**	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
15	1.50 in	10.94 lbs	0.53 lbs/in	205 in	100 PSI	20° to 140° F
M(MM)15	40 mm	4.96 kg	0.0095 kg/mm	5207 mm	6.895 bar	-7° to 60° C

**\*\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# BC320 Band Cylinder

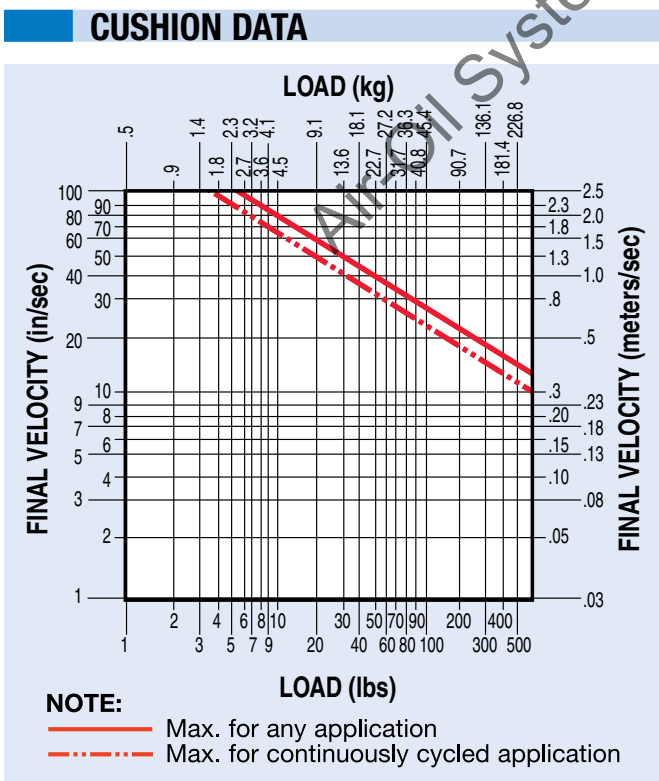
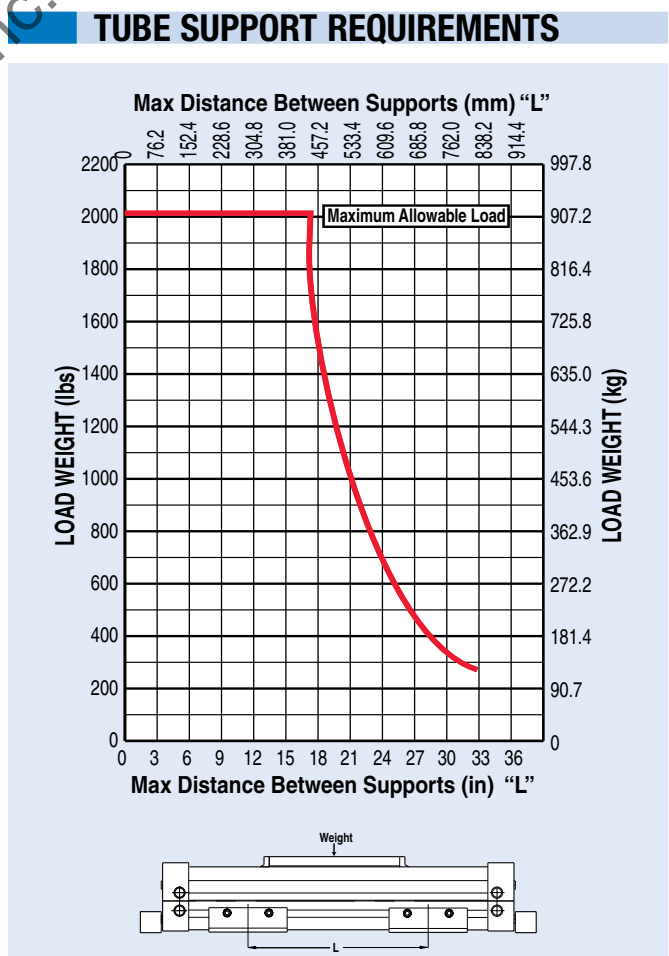
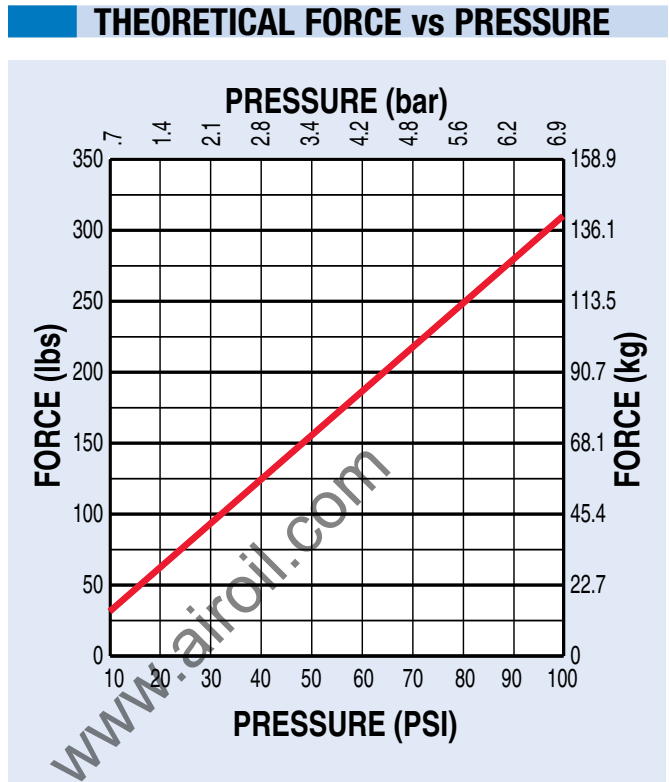
## PERFORMANCE



**BC320**

ORDER CODES	
<b>BC320</b>	inch (U.S. Standard)
<b>BC3M20</b>	(metric with taper port)
<b>BC3MM20</b>	(metric with parallel port)

BC320 OPTIONS	Page
Auxiliary Carrier	BC3_16
Auxiliary Dual 180° Carrier	BC3_17
Dual 180° Carrier	BC3_14
Foot Mounts	BC3_13
Shock Absorbers	BC3_21
Switches	BC3_19
Tube Supports	BC3_12
<b>MORE INFORMATION</b>	
Application Guidelines	BC3_25
Cushion Needle Adjustment	BC3_25
Ordering Selection	BC3_27
Selection	BC3_24
<b>STANDARD FEATURE</b>	
Single End Porting	BC3_18



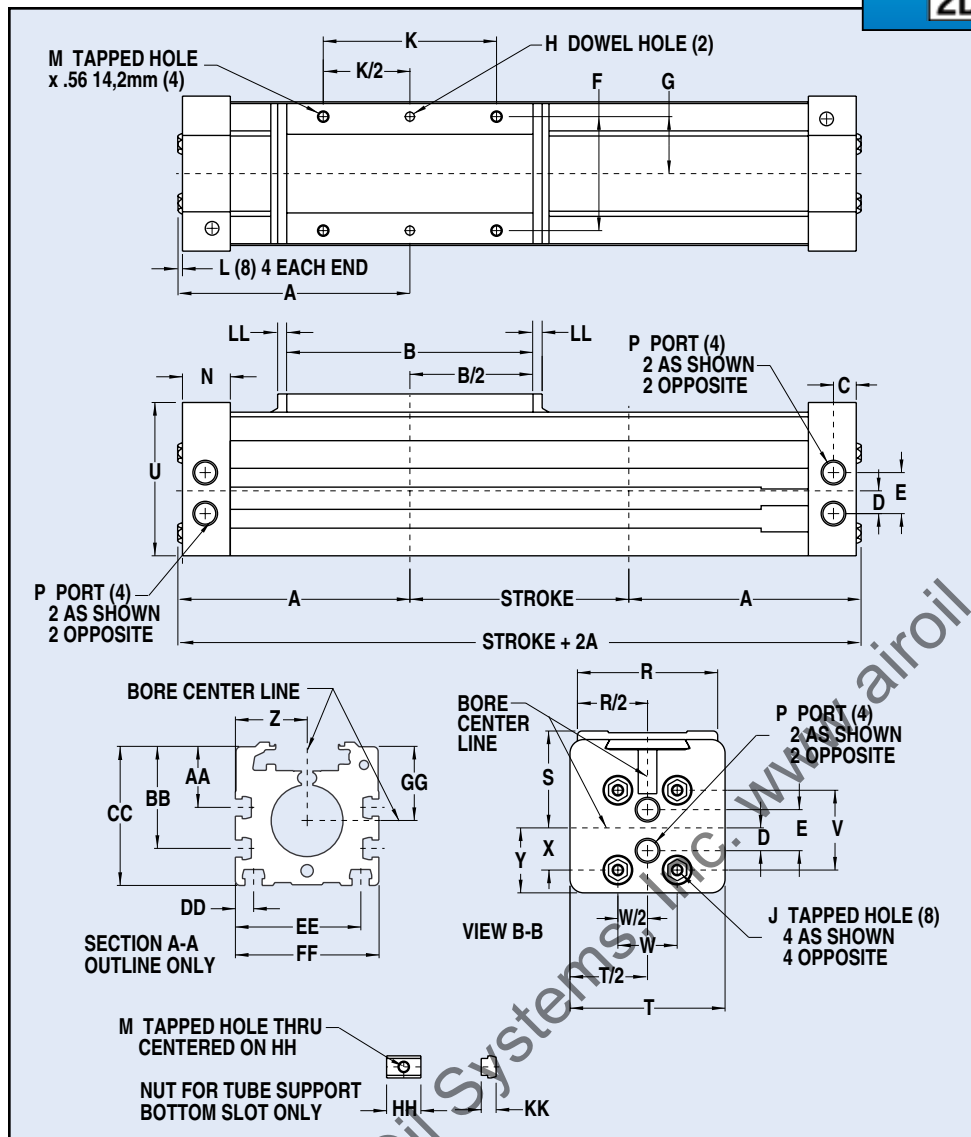


# BC320 Band Cylinder

3D CAD AVAILABLE AT  
WWW.TOLOMATIC.COM



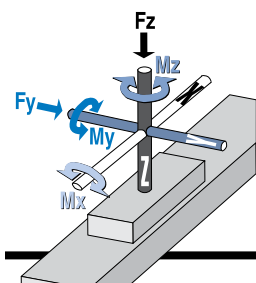
## DIMENSIONS



	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	2.663	67.64
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

## SPECIFICATIONS

### BC320 BENDING MOMENTS AND LOAD



BORE SIZE	MAX. BENDING MOMENT	MAX. BENDING MOMENT		MAX. LOAD		
		My	Mx	Fz	Fy	
20	2.00 in	1472 in-lbs	1662 in-lbs	850 in-lbs	2008 lbs	1159 lbs
M20	50 mm	166.3 N-m	187.8 N-m	96.0 N-m	910.8 kg	525.77 kg

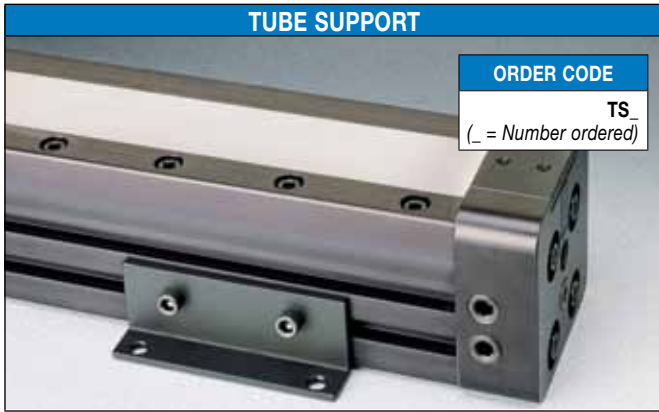
\*DOWEL PINS

$\text{H}^{\oplus}$	.003	$\text{M}$
$\text{H}^{\oplus}$	.076	$\text{M}$

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH**	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
20	2.00 in	17.00 lbs	0.86 lbs/in	120 in	100 PSI	20° to 140° F
M(MM)20	50 mm	7.71 kg	0.0154 kg/mm	3048 mm	6.895 bar	-7° to 60° C

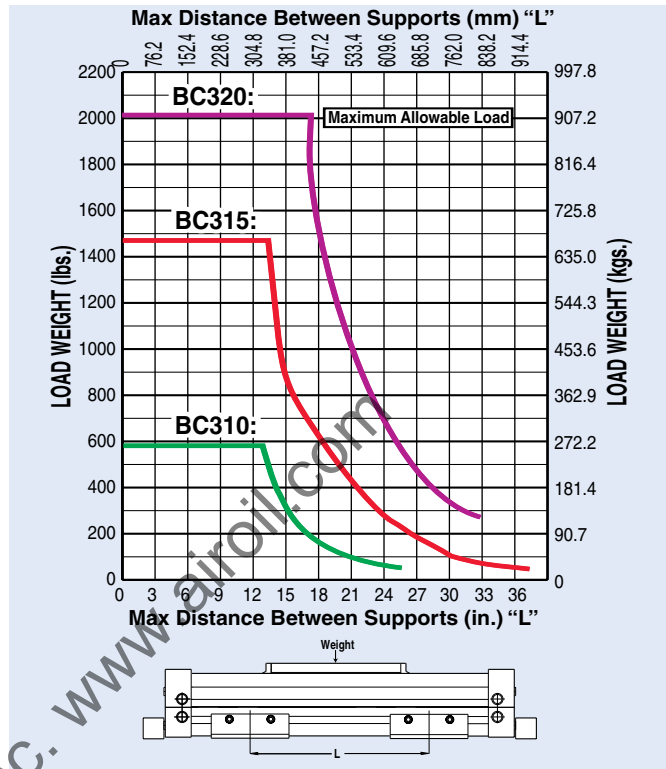
**\*\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# BC3 TUBE SUPPORTS - All Sizes



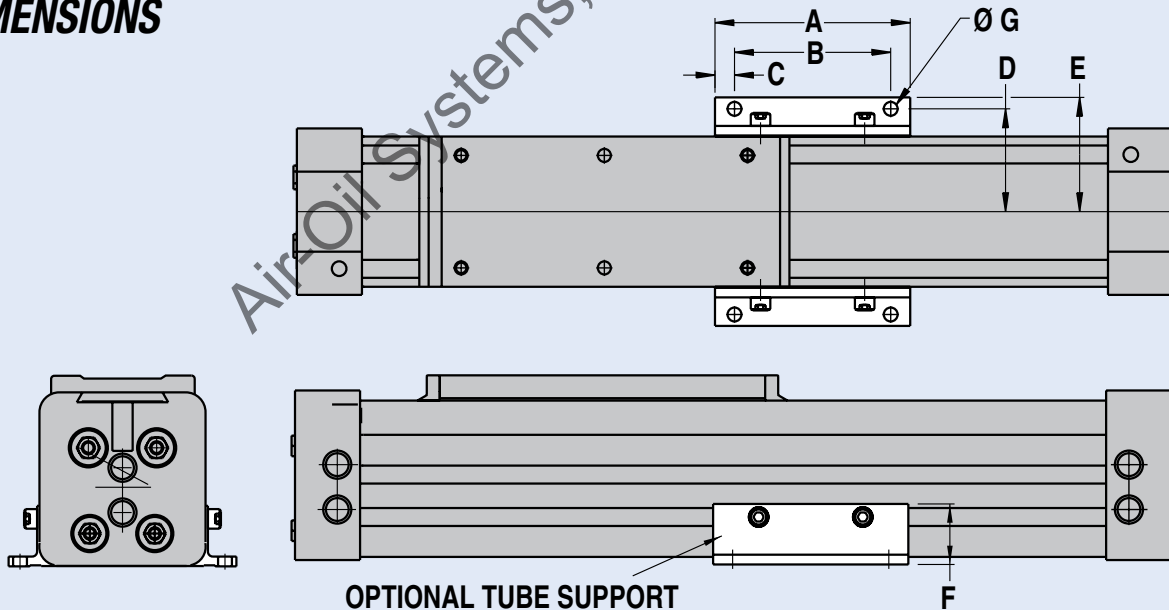
## PERFORMANCE

### TUBE SUPPORT REQUIREMENTS



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.

## DIMENSIONS



	BORE SIZE	A	B	C	D	E	F	G	
	10	1.00	2.75	2.250	0.25	1.53	1.76	1.09	0.206
	15	1.50	3.75	3.000	0.38	1.97	2.19	1.16	0.266
	20	2.00	4.00	3.375	0.31	2.56	2.84	1.50	0.328

Dimensions in inches

	BORE SIZE	A	B	C	D	E	F	G	
	M10	25	69.85	57.15	6.4	38.9	44.7	27.7	5.232
	M15	40	95.30	76.20	9.7	50.0	55.6	29.5	6.756
	M20	50	101.60	85.73	7.9	65.0	72.1	38.1	8.331

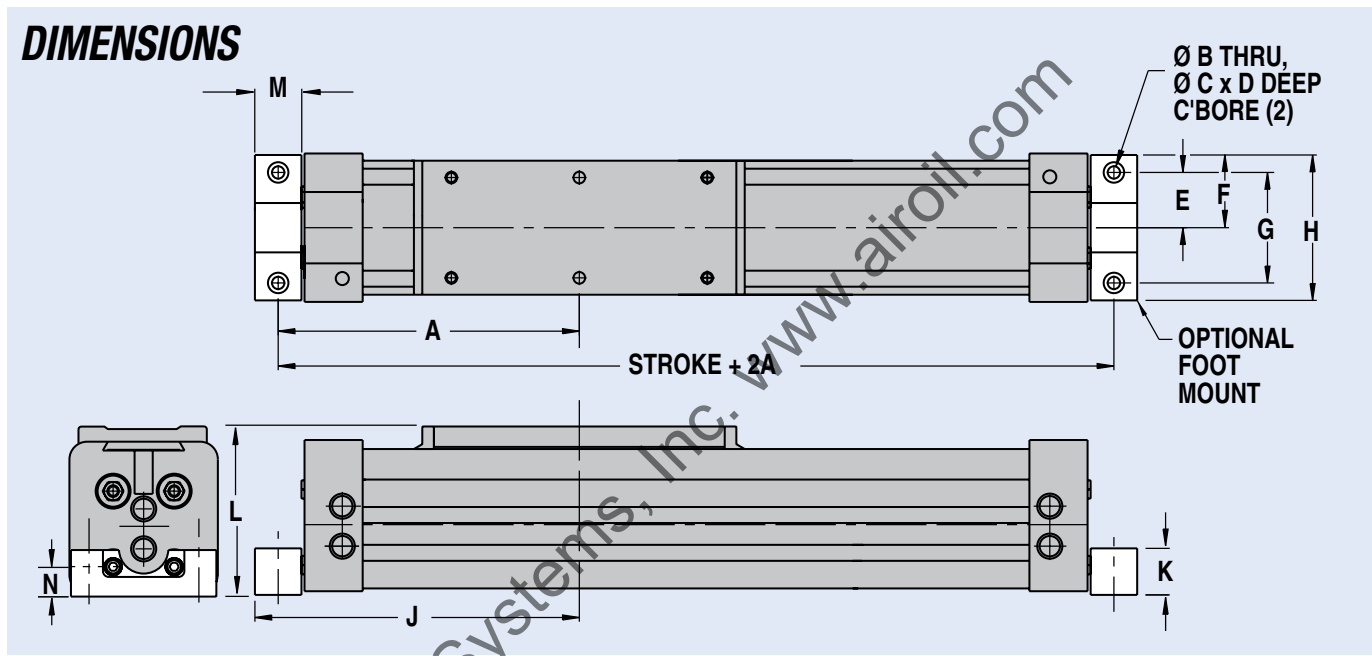
Dimensions in millimeters

# BC3 FOOT MOUNT KIT - All Sizes



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.

## DIMENSIONS



	BORE SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N
10	1.00	4.31	Ø.206	Ø.38	0.22	0.906	1.095	1.812	2.19	4.69	0.88	2.44	0.75	0.574
12	1.25	6.43	Ø.266	Ø.44	0.28	1.188	1.560	2.375	3.13	6.93	1.00	3.63	1.00	0.641
15	1.50	6.80	Ø.328	Ø.53	0.34	1.500	2.000	3.000	4.00	7.30	1.13	4.53	1.00	0.719

Dimensions in inches

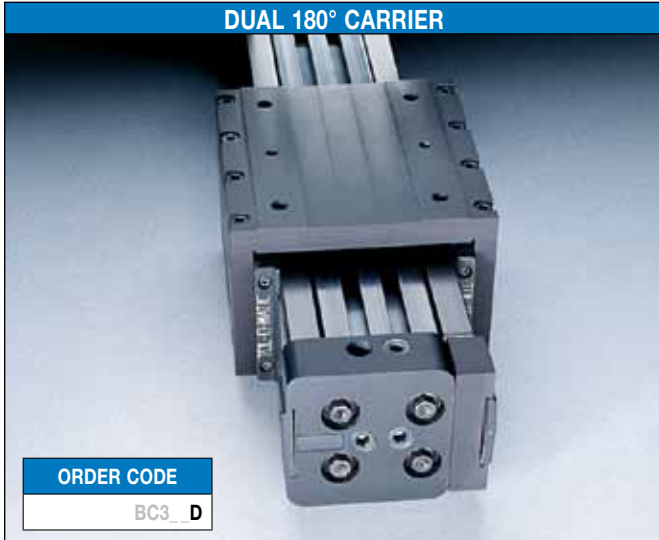
	BORE SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N
M10	25	109.5	Ø 5.23	Ø 9.7	5.6	23.01	27.8	46.02	55.6	119.1	22.4	62.0	19.1	14.6
M12	32	163.4	Ø 6.76	Ø 11.2	7.1	30.18	39.7	60.33	79.4	176.1	25.4	92.2	25.4	16.3
M15	40	172.7	Ø 8.33	Ø 13.5	8.6	38.10	50.8	76.20	101.6	185.4	28.7	115.1	25.4	18.3

Dimensions in millimeters

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
PB  
ENGR

# BC3 DUAL 180° CARRIER - All Sizes

DUAL 180° CARRIER



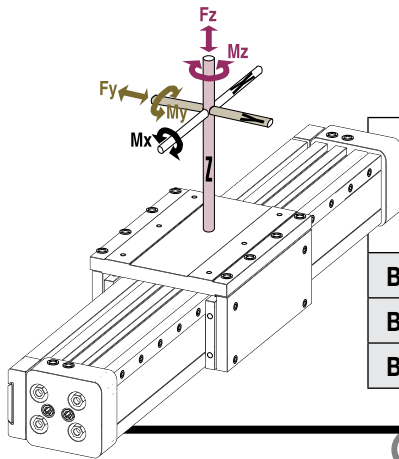
## DUAL 180° CARRIER

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.

## SPECIFICATIONS

### BC3D (DUAL 180° CARRIER) BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD	
		My	Mx	Mz	Fz	Fy
<b>BC310D</b>	1.00 in.	312 in.-lbs.	657 in.-lbs.	538 in.-lbs.	1182 lbs.	682 lbs.
<b>BC315D</b>	1.50 in.	1192 in.-lbs.	2468 in.-lbs.	2066 in.-lbs.	2908 lbs.	1680 lbs.
<b>BC320D</b>	2.00 in.	1700 in.-lbs.	4527 in.-lbs.	2944 in.-lbs.	4016 lbs.	2318 lbs.
<b>BC3M(MM)10D</b>	25mm	35.3 N-m	74.2 N-m	60.8 N-m	536.1 kgs.	309.3 kgs.
<b>BC3M(MM)15D</b>	40mm	134.7 N-m	278.9 N-m	233.4 N-m	1319.0 kgs.	762.0 kgs.
<b>BC3M(MM)20D</b>	50mm	192.1 N-m	511.5 N-m	332.6 N-m	1821.6 kgs.	1051.4 kgs.

	BORE SIZE	WEIGHT**		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
<b>BC310D</b>	1.00 in.	5.37 lbs.	0.32 lbs.	205 in	100 PSI	20° to 140° F
<b>BC315D</b>	1.50 in.	17.2 lbs.	0.69 lbs.	205 in		
<b>BC320D</b>	2.00 in.	28.9 lbs.	1.12 lbs.	120 in		
<b>BC3M(MM)10D</b>	25mm	2.43 kgs.	0.14 kgs.	5207 mm	6.895 bar	-7° to 60° C
<b>BC3M(MM)15D</b>	40mm	7.76 kgs.	0.31 kgs.	5207 mm		
<b>BC3M(MM)20D</b>	50mm	13.11 kgs.	0.50 kgs.	3048 mm		

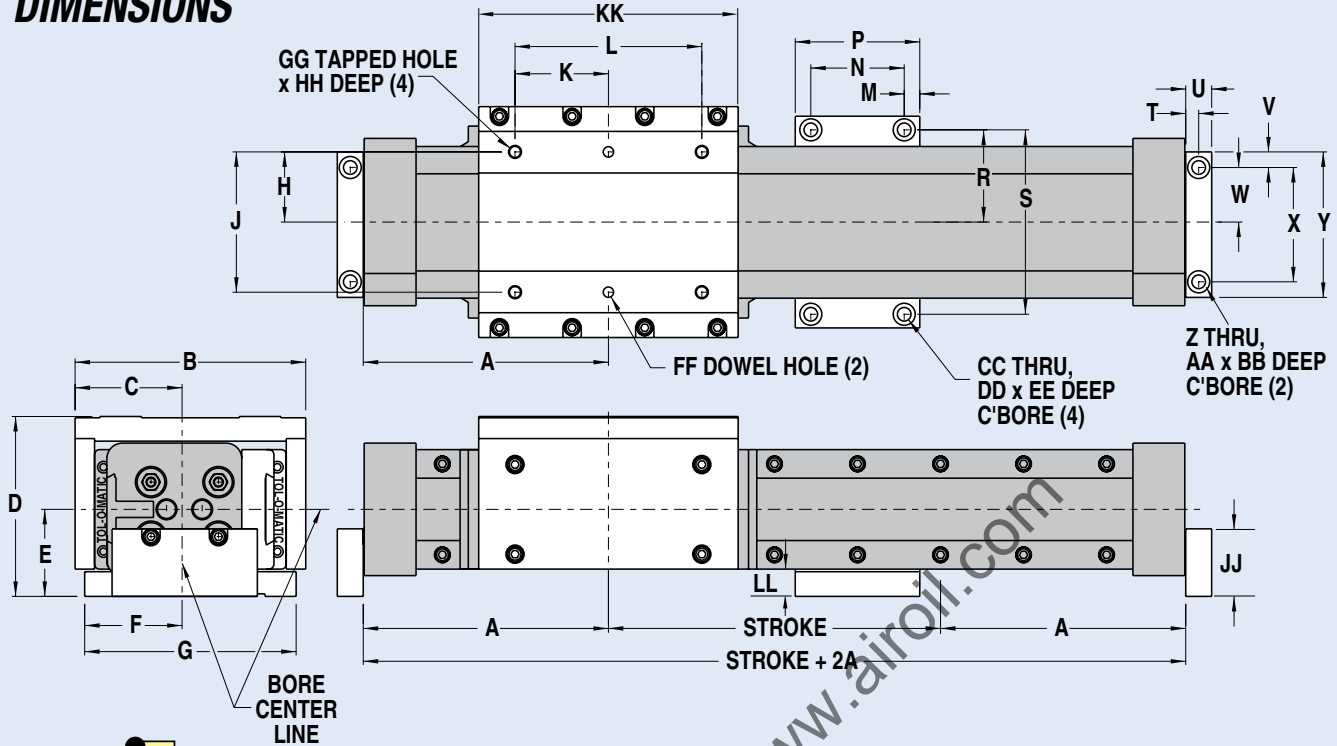
**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**



\*\*Use these figures to calculate actuator weight instead of standard weights on pages BC3\_7, BC3\_9, BC3\_11

# BC3 DUAL 180° CARRIER - All Sizes

## DIMENSIONS



**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.	3.93	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.	5.93	6.00	2.78	4.33	2.09	2.35	5.09	1.48	3.375	2.250	4.500	.38	2.250	3.00	2.02	4.437
BC320	2.0 in.	6.27	7.41	3.51	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.	.307	.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	.52
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	99.8	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	150.6	152.4	70.61	110.0	53.1	59.7	129.3	37.59	85.73	57.15	114.30	9.7	57.15	76.2	51.31	112.70
BC3M(MM)20	50 mm	159.3	188.2	89.15	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

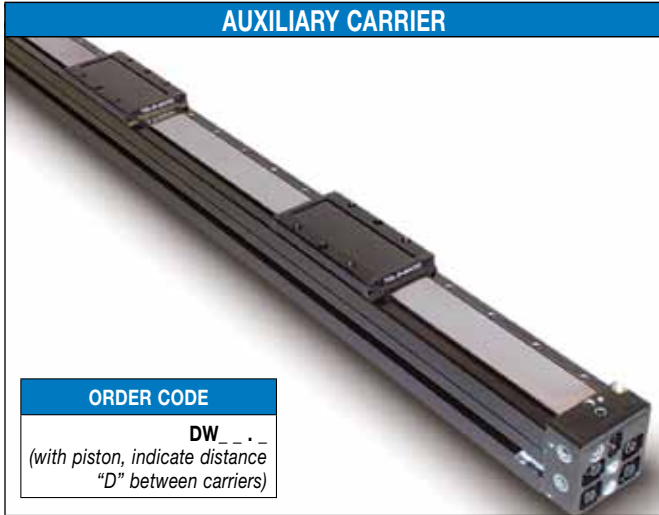
MODELS	BORE	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF*	GG	HH	JJ	KK	LL
BC3M(MM)10	25 mm	7.80	15.7	7.1	22.63	42.88	57.2	6.76	11.2	7.1	6.8	11.2	7.1	6.045/6.020 x 6.4	M6 x 1.00	11.9	31.8	93.2	13.2
BC3M(MM)15	40 mm	7.92	15.7	9.7	33.32	69.85	88.9	6.76	11.2	7.1	8.33	13.5	8.6	6.045/6.020 x 6.4	M8 x 1.25	15.0	41.1	158.8	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

*DOWEL PINS	$\pm$	.003	$\text{M}$
	$\pm$	.076	$\text{M}$

# BC3 AUXILIARY CARRIER - All Sizes

## AUXILIARY CARRIER



### ORDER CODE

**DW** . . .  
(with piston, indicate distance  
"D" between carriers)

## AUXILIARY CARRIER

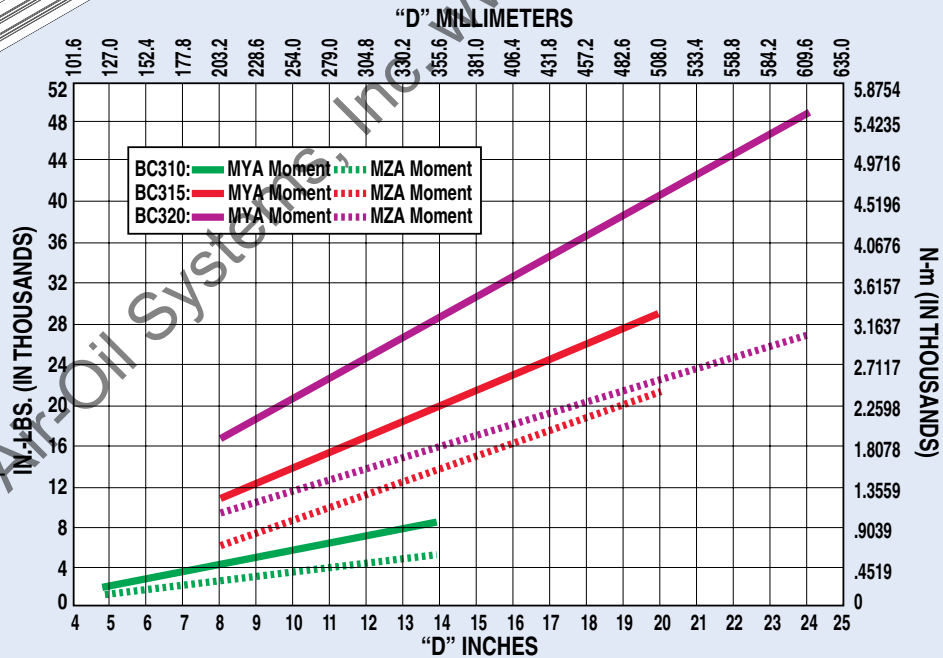
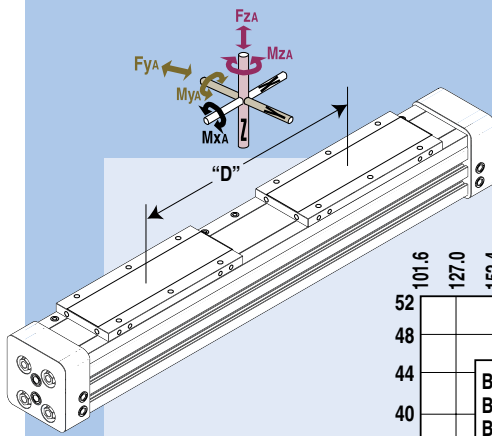
The auxiliary carrier option substantially increases load carrying capacity and bending moments. Auxiliary carriers can only be ordered with an internal piston. When ordering, determine the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart below). Determine

**ORDERING PROCEDURE** your working stroke. Enter these into your configuration string. (Example BC315SK50.00DW10.00) the configurator will calculate the overall length of the actuator.

**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:

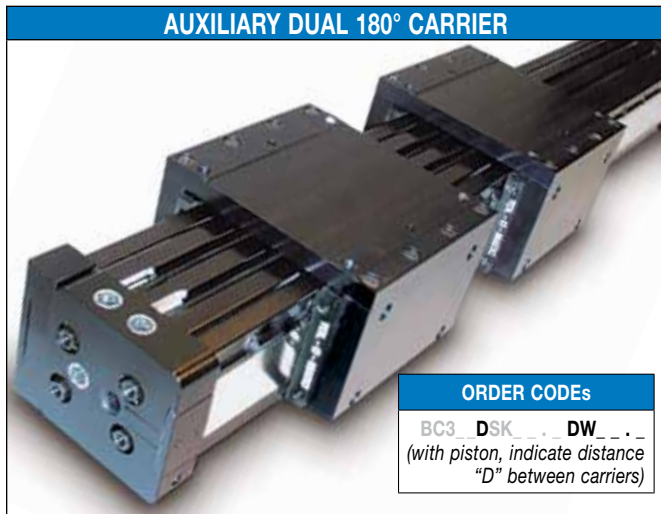
- 1.) Coupling between carriers is rigid.
- 2.) Load is equally distributed between carriers.
- 3.) Coupling device applies no misalignment loads to carriers.

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  $M_y + M_z$  loads increase "D" and refer to graph at left

# BC3 AUXILIARY DUAL 180° CARRIER - All Sizes

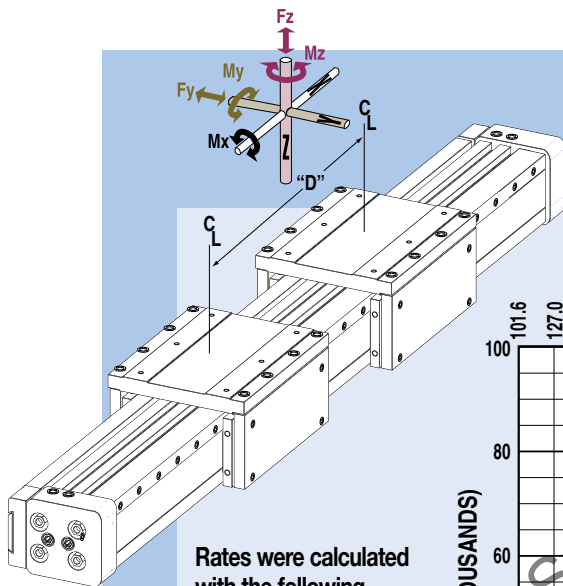


## AUXILIARY DUAL 180° CARRIER

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

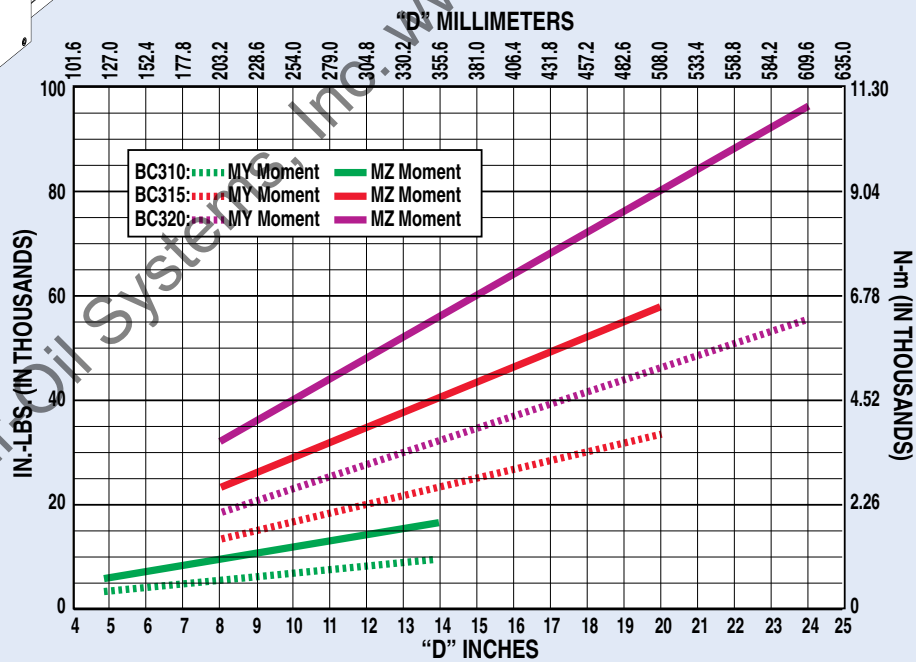
these into your configuration string. (Example BC3D15SK50.00DW10.00) The configurator will calculate the overall length of the actuator.

**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 <sub>y</sub> **	M <sub>x</sub>	M <sub>z</sub> **	F <sub>z</sub>	F <sub>y</sub>
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

ABT  
MXP  
BCZ  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# BC3 SINGLE END PORTING - All Sizes

## SINGLE END PORTING



ORDER CODE: NONE

STANDARD FEATURE  
(No code required)

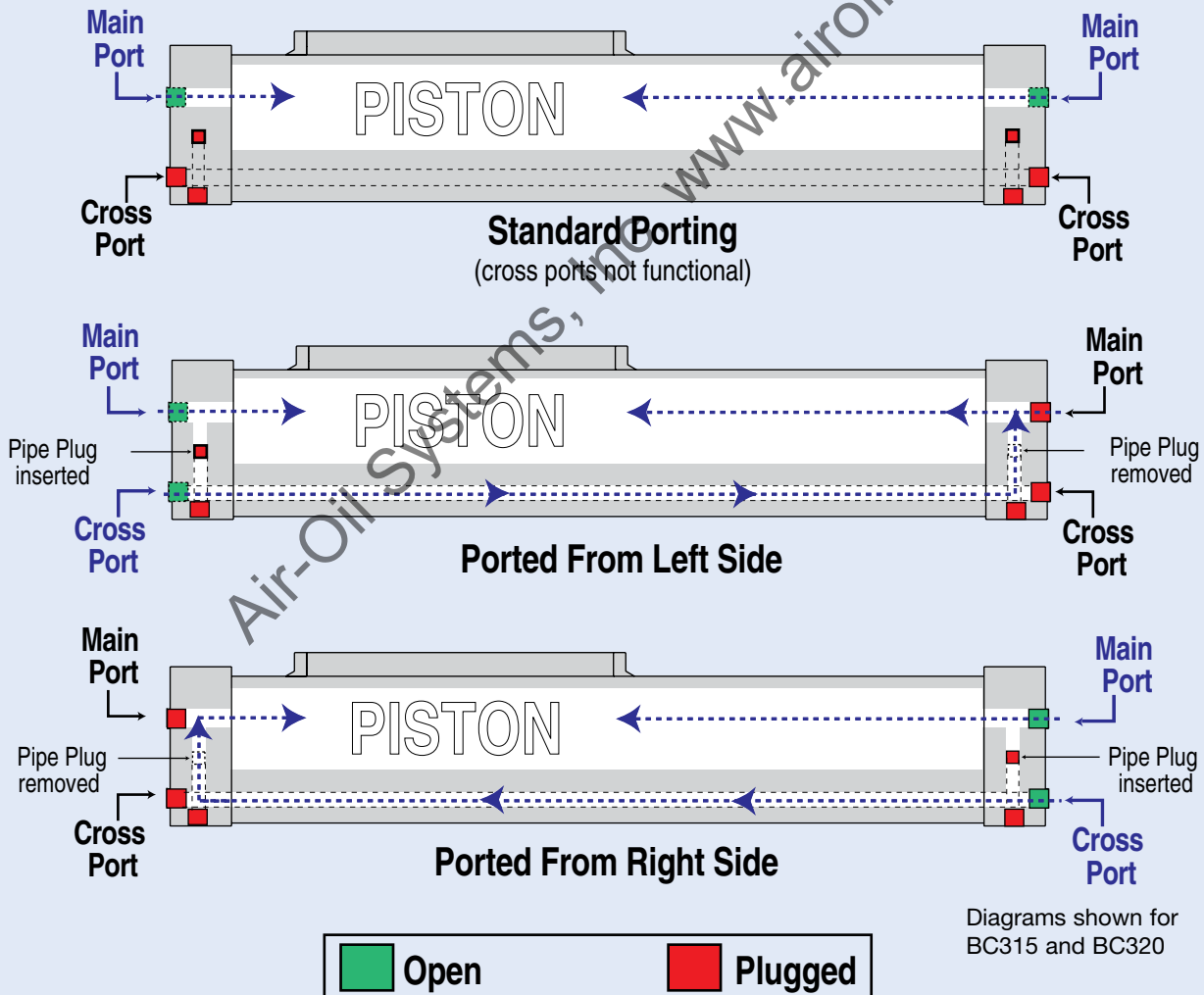
The BC3 is uniquely designed for multiple port locations including single end porting. This is a standard feature on all bore sizes of the BC3. The lower ports on the head assembly only function when used to cross port the cylinder for single end porting.

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 SWITCHES - All Sizes

## SWITCHES






There are 10 sensing choices: DC reed, form A (open) or form C (open or closed); AC reed (Triac, open); Hall-effect, sourcing, PNP (open); Hall-effect, sinking, NPN (open); each with either flying leads or QD (quick disconnect). Commonly used to send analog signals to PLC (programmable logic controllers), TLL, CMOS circuit or other controller device. These switches are activated by the actuator's magnet.

Switches contain reverse polarity protection. QD cables are shielded; shield should be terminated at flying lead end.

If necessary to remove factory installed switches, be sure to reinstall on the same side of actuator with scored face of switch toward internal magnet.

## SPECIFICATIONS

ORDER CODE	REED DC				REED AC		HALL-EFFECT DC			
	<b>R T</b>	<b>R M</b>	<b>B T</b>	<b>B M</b>	<b>C T</b>	<b>C M</b>	<b>T T</b>	<b>T M</b>	<b>K T</b>	<b>K M</b>
PART NUMBER	3600-9082	3600-9083	3600-9084	3600-9085	3600-9086	3600-9087	3600-9088	3600-9089	3600-9090	3600-9091
LEAD	5m	QD*	5m	QD*	5m	QD*	5m	QD*	5m	QD*
CABLE SHIELDING	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†
SWITCHING LOGIC	"A" Normally Open		"C" Normally Open or Closed		Triac Normally Open		PNP (Sourcing) Normally Open		NPN (Sinking) Normally Open	
MECHANICAL CONTACTS	Single-Pole Single-Throw		Single-Pole Double-Throw		Single-Pole Single-Throw		NO, These Are Solid State Components			
COIL DIRECT	Yes		Yes		Yes		—			
POWER LED	None		None		None		None		None	
SIGNAL LED	Red						Red		Red	
OPERATING VOLTAGE	200 Vdc max.		120 Vdc max.		120 Vac max.		5 - 25 Vdc			
OUTPUT RATING	—		—		—		25 Vdc, 200mA dc			
OPERATING TIME	0.6 msec max. (including bounce)		0.7 msec max. (including bounce)		—		< 10 micro sec.			
OPERATING TEMPERATURE	-40°F [-40°C] to 158°F [70°C]						0°F [-18°C] to 150°F [66°C]			
RELEASE TIME	1.0 msec. max.		—		—		—			
ON TRIP POINT	—		—		—		150 Gauss maximum			
OFF TRIP POINT	—		—		—		40 Gauss minimum			
**POWER RATING (WATTS)	10.0 §		3.0 §§		10.0		5.0			
VOLTAGE DROP	2.6 V typical at 100 mA		NA		—		—			
RESISTANCE	0.1 Ω Initial (Max.)		—		—		—			
CURRENT CONSUMPTION	—		—		1 Amp at 86°F [30°C]   0.5 Amp at 140°F [60°C]		200 mA at 25 Vdc			
FREQUENCY	—		—		47 - 63 Hz		—			
CABLE MIN. BEND RADIUS	STATIC	0.630" [16mm]								
	DYNAMIC	Not Recommended								

**CAUTION: DO NOT OVER TIGHTEN SWITCH HARDWARE WHEN INSTALLING!**

**\*\* WARNING:** Do not exceed power rating (Watt = Voltage X Amperage). Permanent damage to sensor will occur.

\*QD = Quick Disconnect; Male coupler is located 6" [152mm] from sensor, Female coupler to flying lead (part #2503-1025) distance is 197" [5m] also see Cable Shielding specification above

**REPLACEMENT OF QD SWITCHES MANUFACTURED BEFORE JULY 1, 1997:** It will be necessary to replace or rewire the female end coupler.



**Reed Switch Life Expectancy:** Up to 200,000,000 cycles (depending on load current, duty cycle and environmental conditions)

†Shielded from the female quick disconnect coupler to the flying leads. Shield should be terminated at flying lead end.

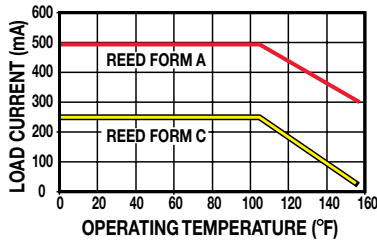
§ Maximum current 500mA (not to exceed 10VA) Refer to Temperature vs. Current graph and Voltage Derating graph

§§ Maximum current 250mA (not to exceed 3VA) Refer to Temperature vs. Current graph and Voltage Derating graph

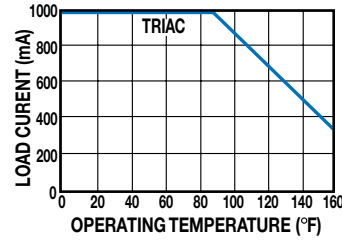
# BC3 SWITCHES - All Sizes

## PERFORMANCE

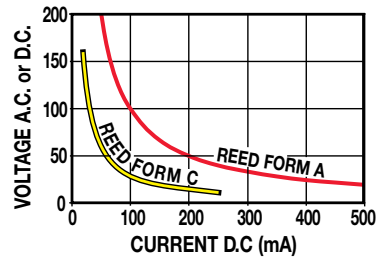
TEMP. vs CURRENT, DC REED



TEMP. vs CURRENT, AC REED

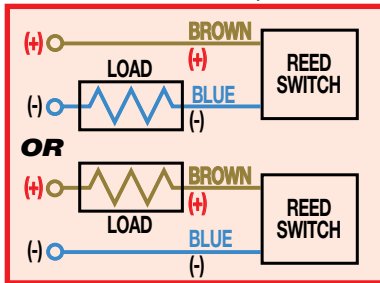


VOLTAGE DERATING, DC REED

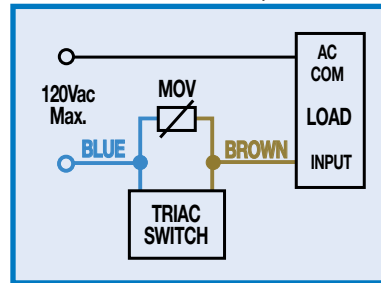


## WIRING DIAGRAMS

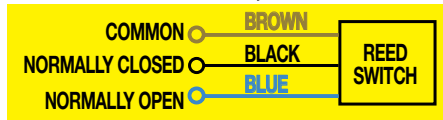
**R**T & **R**M DC REED, FORM A



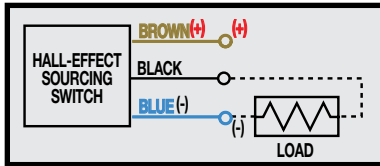
**C**T & **C**M AC REED, TRIAC



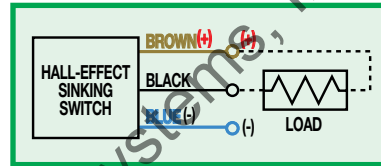
**B**T & **B**M DC REED, FORM C



**T**T & **T**M HALL-EFFECT, SOURCING, PNP



**K**T & **K**M HALL-EFFECT, SINKING, NPN



## INSTALLATION INFORMATION



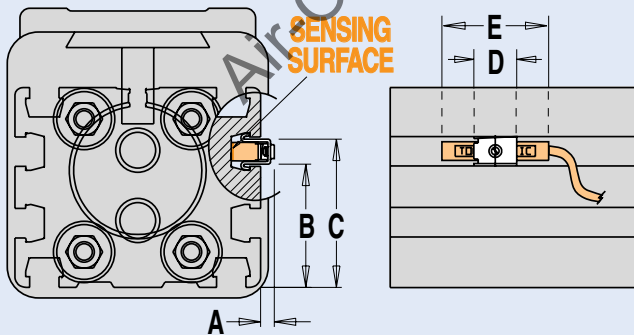
**⚠** THE NOTCHED FACE OF THE SWITCH INDICATES THE SENSING SURFACE AND MUST FACE TOWARD THE MAGNET.



**⚠** THE NOTCHED GROOVE IN THE ACTUATOR INDICATES THE GROOVE TO INSTALL THE SWITCH. CONTACT TOLOMATIC IF SWITCHES ARE REQUIRED ON ANOTHER SIDE OF ACTUATOR.

**📝** Some actuators may require switch mounting on a specific side of the assembly. Call Tolomatic for details.

## DIMENSIONS



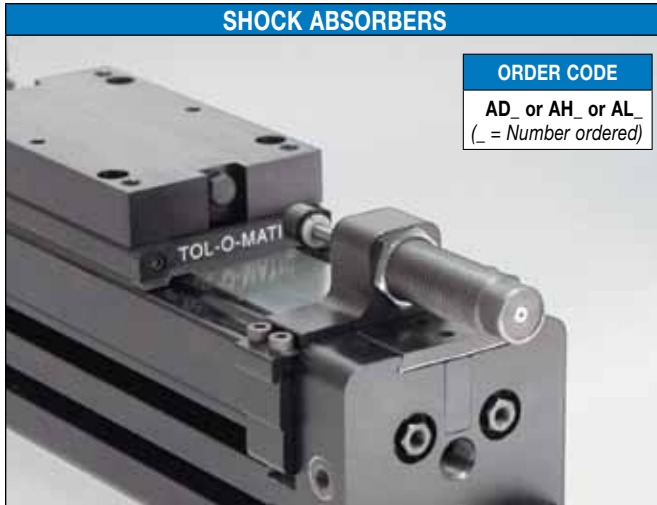
SIZE	BORE	A	B	C	D	E
10	1.000	0.194	0.822	0.906	0.500	1.250
15	1.500	0.160	1.428	1.721	0.500	1.250
20	2.000	0.036	1.994	2.287	0.500	1.250

Dimensions in inches

SIZE	BORE	A	B	C	D	E
M10	25	4.93	20.88	23.01	12.70	31.75
M15	40	4.06	36.27	43.71	12.70	31.75
M20	50	0.91	50.65	58.09	12.70	31.75

Dimensions in millimeters

# BC3 SHOCK ABSORBERS - All Sizes



## SHOCK ABSORBERS

### ORDER CODE

AD\_ or AH\_ or AL\_  
 (\_ = Number ordered)

Rodless cylinders with standard internal cushion offer an effective method of decelerating loads. However, all Tolomatic rodless cylinders are capable of carrying heavier loads at higher velocities than the cylinder cushion can absorb. Optional shock absorbers can be used to increase the cylinder's life and broaden the application range for the cylinder model you have chosen.

Tolomatic offers adjustable shock absorbers for the BC3. They allow the shock to be positioned at any point along the cylinder.

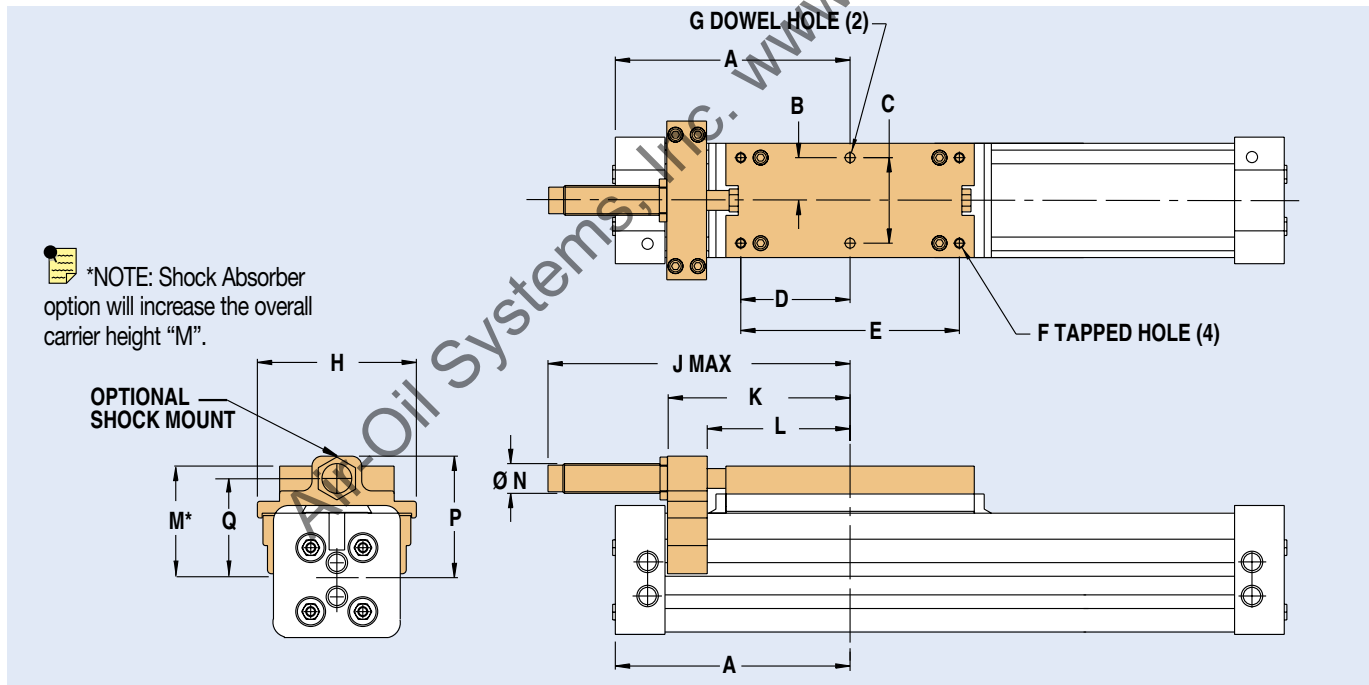
A shock stop plate must be used in conjunction with the BC3 shock to provide a stopping surface on the carrier.

Typical shock absorber life varies between 1-2 million cycles (depending on environment) appropriate preventative maintenance should be considered in high cyclic applications.

**NOTE:** When 2 shock absorbers are ordered, the unit will be assembled with NO internal cushions.

**CAUTION:** In applications which result in a load bending moment at deceleration, care should be taken to decelerate the load rather than the carrier of the band cylinder.

## DIMENSIONS



**\*NOTE:** Shock Absorber option will increase the overall carrier height "M".

SIZE	BORE	A	B	C	D	E	F	G**	H	J	K	L	M	N	P	Q
10	1.00	3.93	0.890	1.781	1.562	3.125	1/4-20 x .50DP	.252-.251 x .25	3.09	5.47	2.91	2.22	2.223	0.50	2.46	1.964
15	1.50	5.93	1.078	2.156	2.750	5.500	1/4-20 x .50DP	.252-.251 x .25	4.00	7.65	4.59	3.59	2.812	0.75	3.06	2.495
20	2.00	6.27	1.563	3.125	2.938	5.875	5/16-18 x .75DP	.252-.251 x .69	5.06	8.14	4.88	3.88	3.594	1.00	3.88	3.230

\*\*DOWEL PINS  $\pm .003$   $\text{M}$

Dimensions in inches

SIZE	BORE	A	B	C	D	E	F	G**	H	J	K	L	M	N	P	Q
M10	25	99.8	22.62	45.24	39.69	79.38	M6-1.0 x 12.7DP	6.05-6.02 x 6.4	78.5	138.9	73.9	56.4	56.46	14.0	62.5	49.89
M15	40	150.7	27.38	54.76	69.85	139.70	M6-1.0 x 12.7DP	6.05-6.02 x 6.4	101.6	194.2	116.6	91.2	71.42	20.0	77.7	63.37
M20	50	159.3	39.69	79.38	76.62	149.23	M8-1.25 x 19.1DP	6.05-6.02 x 17.5	128.5	206.8	124.0	98.6	91.29	25.4	98.6	82.04

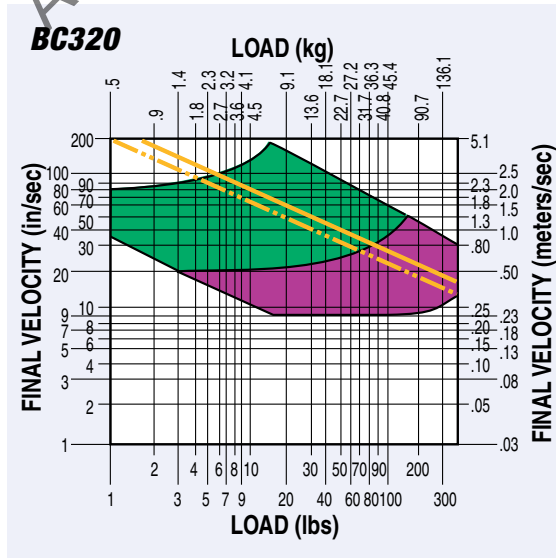
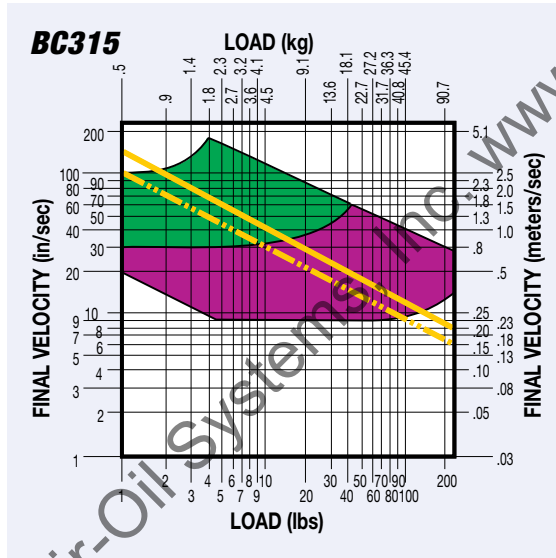
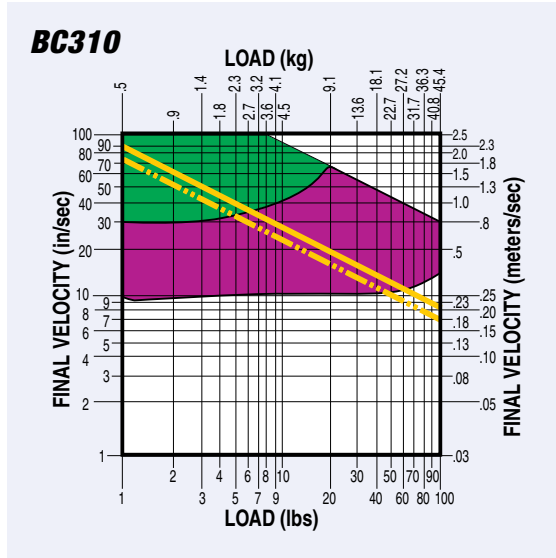
\*\*DOWEL PINS  $\pm .076$   $\text{M}$


Dimensions in millimeters

# BC3 Shock Absorbers - All Sizes

## PERFORMANCE

### VELOCITY vs LOAD



 **NOTE:** If final (or impact) velocity cannot be calculated directly, a reasonable guideline to use is 2 x average velocity.

ABT

MXR

BC2

**BC3**

BC4

LS

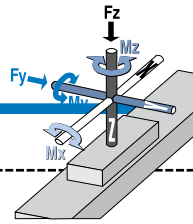
MG

CC

PB

ENGR

# Application Data Worksheet



## STROKE LENGTH \_\_\_\_\_

inch (S I K)  millimeters  
(U.S. Standard) (Metric)

## AVAILABLE AIR PRESSURE \_\_\_\_\_

PSI  bar  
(U.S. Standard) (Metric)

## REQUIRED THRUST FORCE \_\_\_\_\_

lbf  N  
(U.S. Standard) (Metric)

## LOAD \_\_\_\_\_

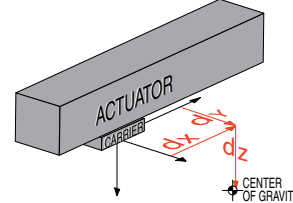
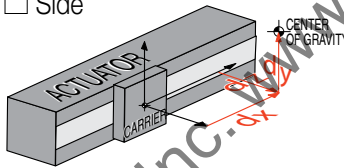
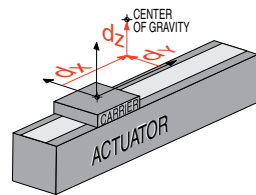
lb  kg  
(U.S. Standard) (Metric)

## LOAD CENTER OF GRAVITY DISTANCE TO CARRIER CENTER

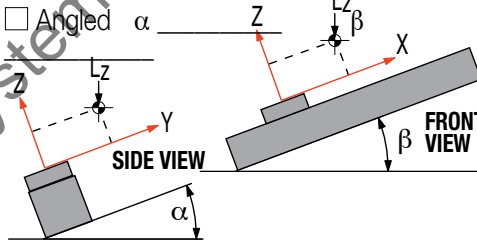
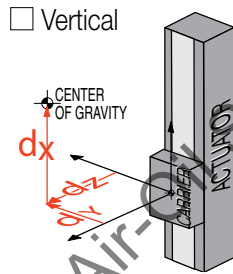
$d_x$  \_\_\_\_\_  
 $d_y$  \_\_\_\_\_  
 $d_z$  \_\_\_\_\_  
 inch  millimeters  
(U.S. Standard) (Metric)

## ORIENTATION

Horizontal  Side  Horizontal Down



Vertical



## OTHER ISSUES:

(i.e. Environment, Temperature, Contamination, etc.)

## FORCES APPLIED TO CARRIER

lbf  N  
(U.S. Standard) (Metric)

$F_z$  \_\_\_\_\_  
 $F_y$  \_\_\_\_\_

## BENDING MOMENTS APPLIED TO CARRIER

in-lbs  N-m  
(U.S. Standard) (Metric)

$M_x$  \_\_\_\_\_  
 $M_y$  \_\_\_\_\_  
 $M_z$  \_\_\_\_\_

## FINAL VELOCITY \_\_\_\_\_

in/sec  mm/sec  
(U.S. Standard) (Metric)

## MOVE TIME sec. \_\_\_\_\_

## NO. OF CYCLES \_\_\_\_\_

per minute  per hour

Contact information: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Fax (1-763-478-8080) or call Tolomatic (1-800-328-2174) with the above information. We will provide any assistance needed to determine the proper actuator.

# Rodless Cylinder Selection Guidelines - BC2, BC3, BC4, LS - All Sizes

## PROVIDING LOAD GUIDANCE AND SUPPORT

The process of selecting a load bearing actuator for a given application can be complex. It is highly recommended that you contact Tolomatic or a Tolomatic Distributor for assistance in selecting the best actuator for your application. The following overview of the selection guidelines are for educational purposes only.

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Band Cylinder or Linear Slide model for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs or kg)
- Orientation of load (lbs or kgs)
- Velocity of load (in/sec or mm/sec)
- Stroke length (in or mm)

HINT: Use Tolomatic sizing and selection software, download at: [tolomatic.com](http://tolomatic.com)

### 2 SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 3), the actuator will accommodate the application.

If the intersection is above the diagonal line, a larger cylinder bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 DETERMINE NATURE OF LOAD AND THE EFFECT OF BENDING MOMENTS

If the cylinder will guide and support a load located directly over the center of carrier, bending moments will not be a factor in the cylinder selection.

NOTE: The maximum load "L" must not exceed the capacity limits of the cylinder selected.

- Bending Moments

For off center or side loads, determine the distance from the center of mass of the load to the center of the carrier bracket. This measurement is needed to calculate the torque for bending moments. (Refer to Bending Moment chart for each model.)

Should the resulting maximum bending moment exceed figures indicated on the chart, external guides, auxiliary carrier/s or a larger cylinder should be considered.

- Auxiliary Carrier Bending Moments

The auxiliary carrier option (available on most models) increases load carrying capacity and bending moments. Auxiliary carriers can be ordered with or without an internal piston. (Auxiliary

carriers without a piston have no internal cushion on the cylinder end closest to the auxiliary carrier.)

IMPORTANT: When ordering, determine the working stroke, then the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart). When ordered, Tolomatic's configurator will calculate the overall length of the actuator.

NOTE: breakaway pressure will increase when using auxiliary carriers.

### 4 DETERMINE INTERNAL CUSHION CAPACITY

- Consult the Cushion Data chart for the model selected. The velocities listed on the cushion charts are final or cushion impact velocities. On applications where the internal cushions or bumpers are to be used, be sure the actual, final or impact velocity is known. If the velocity is not known, use of limit switches with valve deceleration circuits or shock absorbers should be considered. NOTE: The BC205 uses external bumpers in place of internal cushions, LS05 & LS10 do not have cushions or bumpers.

- Cross-reference the final velocity and weight of the load. If the intersection is below the diagonal lines, the internal cushions on the actuator may be used. If the point falls above the dashed diagonal line or if the velocity is not known, use deceleration circuits, external shock absorbers or select a

larger cylinder with greater cushion capacity. On high-cyclic applications, use of external stops is strongly recommended.

### 5 DETERMINE TUBE SUPPORT REQUIREMENTS

- Consult the Tube Support chart for the model selected.
- Cross reference the load weight and maximum distance between supports.

### 6 CONSIDER OPTIONS

- Switches— dc Reed, Hall-effect or ac Triac

Band Cylinders and Linear Slides each have different standard features and options. Check the options section for the actuator you have selected.

- Shock Absorbers— if needed.
- Foot Mounting Kits
- Floating Mount Bracket – use when lack of parallelism occurs between the cylinder and an external guided and supported load.
- Single End Porting (BC3, BC4)
- Long Carrier (BC4)
- Proximity Sensors (LS)
- Dual 180° Carrier (BC3)

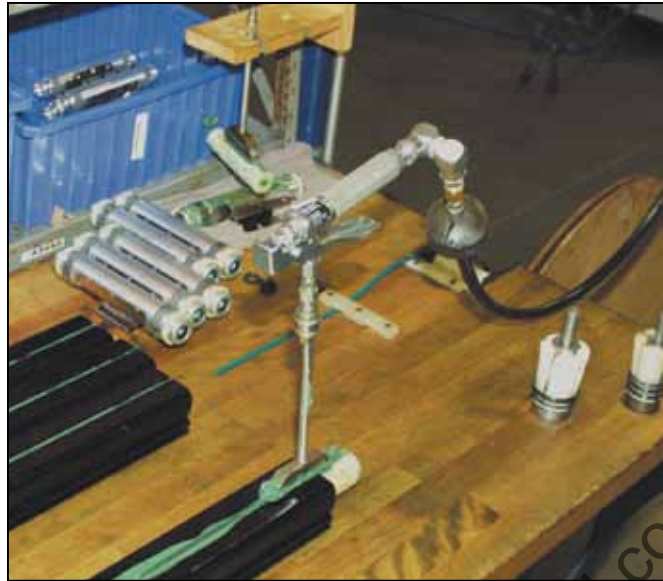
# Application Guidelines

The following conditional statements are intended as general guidelines for use of Tolomatic actuators. Since all applications have their own specific operating requirements, consult Tolomatic, Inc. or your local Tolomatic distributor if an application is unconventional or if questions arise regarding the selection process.

## CUSHION NEEDLE ADJUSTMENT (BC2, BC3, BC4, CC, SA, DP, TC ONLY)



Adjust the cushion needles in the cylinder heads carefully to obtain a smooth, hesitation free deceleration for your particular application. If there are questions on proper adjustment, please consult Tolomatic, Inc.



## LUBRICATION GUIDELINES

All Tolomatic actuators (except Cable Cylinders) are prelubricated at the factory. To ensure maximum actuator life, the following guidelines should be followed.

### • Filtration

We recommend the use of dry, filtered air in our products. "Filtered air" means a level of 10 Micron or less. "Dry" means air should be free of appreciable amounts of moisture. Regular maintenance of installed

filters will generally keep excess moisture in check.


### • External Lubricators (optional)

The factory prelubrication of Tolomatic actuators will provide optimal performance without the use of external lubrication. However, external lubricators can further extend service life of pneumatic actuators if the supply is kept constant.

Oil lubricators, (mist or drop) should supply a minimum of 1 drop per 20 standard cubic feet per minute to the

cylinder. As a rule of thumb, double that rate if water in the system is suspected. Demanding conditions may require more lubricant.

If lubricators are used, we recommend a non-detergent, 20cP @ 140°F 10-weight lubricant. Optimum conditions for standard cylinder operation are +32° to +150°F (+0° to 65.5°C).

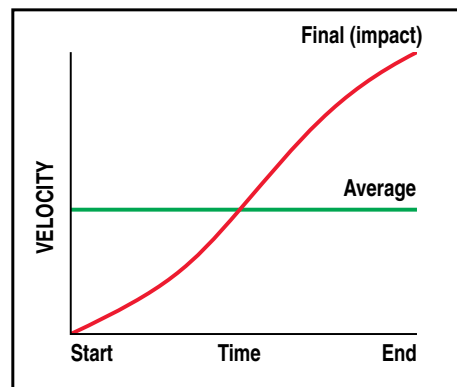
 NOTE: Use of external lubricators may wash away the factory installed lubrication. External lubricants must be maintained in a constant supply or the results will be a dry actuator prone to premature wear.

### • Sanitary Environments

Oil mist lubricators must dispense "Food Grade" lubricants to the air supply. Use fluids with ORAL LD50 toxicity ratings of 35 or higher such as Multitherm® PG-1 or equivalent. Demanding conditions can require a review of the application.

## FINAL VELOCITY CALCULATION

Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Stroking a 100-inch BC3 model in one second yields an average velocity of 100 inches per second. To properly determine the inertial forces for cushioning, it is important to know the



final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered (see diagram).

If final (or impact) velocity cannot be calculated directly, a reasonable guideline is to use 2 x average velocity.

# 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 Tolomatic cushions or shocks are to be used, please stay within the specifications on page BC3\_22. 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.

**CAUTION:** In applications which result in a load bending moment at deceleration, care should be taken to decelerate the load rather than the carrier of the band cylinder.

## 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.

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.<sup>2</sup> (standard gravity)    s = shock stroke

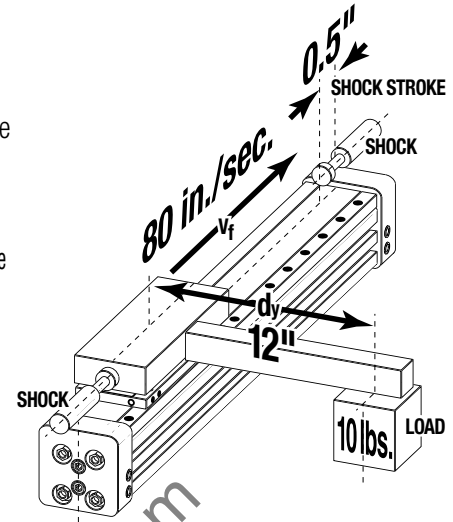
$$a = \frac{v_f^2}{2s} = \frac{(80 \text{ in./sec.})^2}{2 \times 0.50 \text{ in.}} = 6400 \text{ in./sec.}^2 \text{ (Deceleration Rate)}$$

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

Therefore the Mz created during stopping is:

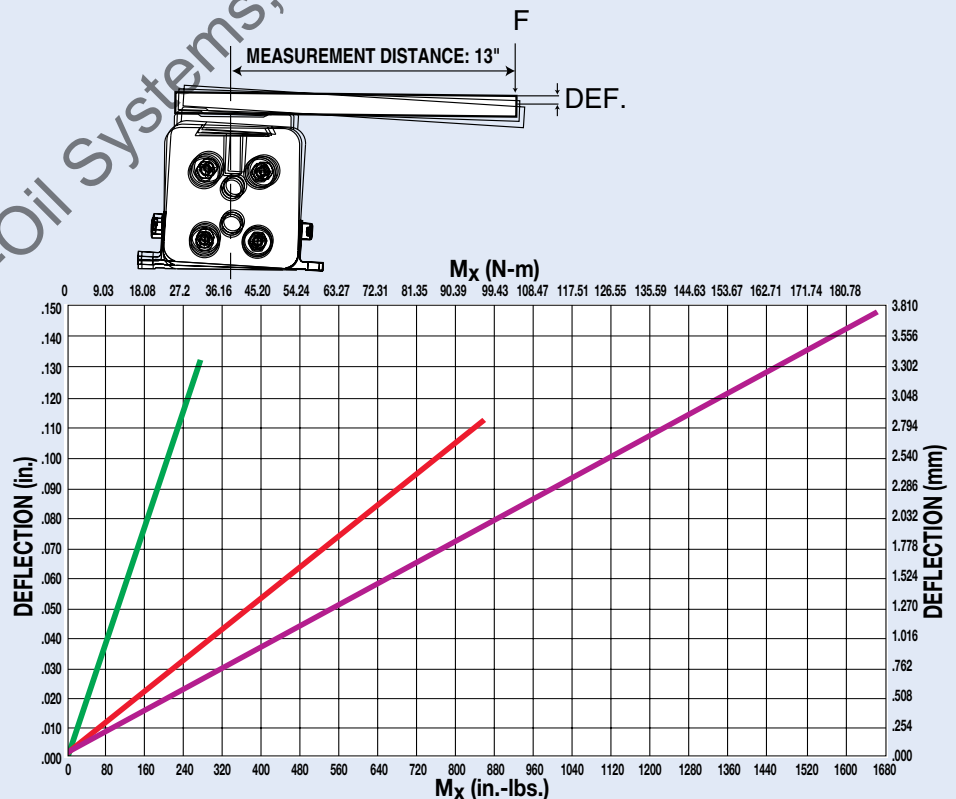
$$Mz = (\text{force eq.}) \times dy = 165.6 \text{ lbs.} \times 12 \text{ in.} = 1987.2 \text{ in.-lbs.}$$

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.



## PERFORMANCE

### BC3 CYLINDER/LOAD DEFLECTION



BC310: —  
 BC315: —  
 BC320: —

Deflection figures were calculated with the following considerations:  
 1.) Tube supports spaced at minimum distances for each bore size.  
 2.) Measurement distance from center of carrier is 13 inches.



# BC3 Ordering - ALL Sizes

**MODEL, BORE, STROKE**      **OPTIONS**

BC3 **D** 10 SK100.250 DW6.0 TS3 FM2 AH2 BM2

**MODEL & MOUNTING**

**BC3** BC3 Band Cylinder - inch (U.S. Standard)

**BC3M** metric mounting with taper port

**BC3MM** metric mounting with parallel port

**DUAL 180° CARRIER (BC3\_14)**

**D** Dual 180° Carrier Option

**BORE SIZE**

**10** 1.00" (25mm)

**15** 1.50" (40mm)

**20** 2.00" (50mm)

**STROKE LENGTH**

**SK** \_\_\_ Enter desired stroke length in decimal inches

**MAXIMUM STROKE**

SIZE	MAXIMUM STROKE	
	BC3 in	BC3M(MM) mm
<b>10</b>	205	5,207
<b>15</b>	205	5,207
<b>20</b>	120	3,048

**AUXILIARY CARRIER (BC3\_16)**

**DW** Auxiliary carrier With piston & "D" distance

\_\_\_ "D" Distance between carriers

**MINIMUM "D" DISTANCE BETWEEN CARRIERS**

	with Piston	
	in	mm
<b>10</b>	4.88	124.0
<b>15</b>	8.07	205.0
<b>20</b>	8.10	205.7

When ordering auxiliary carrier option, enter the distance required between carriers. The configurator will calculate the overall length of the actuator.

**TUBE SUPPORTS (BC3\_12)**

**TS** \_\_\_ Tube Support & number required

Each TS includes two (2) tube support halves

**T-NUTS**

**TN** \_\_\_ additional T-Nuts (see individual dimensional drawings for sizes)

**FOOT MOUNT (BC3\_13)**

**FM** \_\_\_ Foot Mount & number required (1 or 2)

**SHOCK ABSORBERS (BC3\_21)**

**\*AD** \_\_\_ Shock hardware Only and number required

**\*AH** \_\_\_ Shock, Heavy duty and number required

**\*AL** \_\_\_ Shock, Light duty and number required

\*NOTE: When shock absorbers are ordered cushion seals are removed.

**SWITCHES (BC3\_19)**

TYPE		QUICK-DISCONNECT	CODE	QUANTITY	LEAD LENGTH
REED	Form A	QD	<b>RM</b>	After code enter quantity desired	5 meters
		no	<b>RT</b>		
Form C		QD	<b>BM</b>		
		no	<b>BT</b>		
HALL-EFFECT	Sinking	QD	<b>KM</b>		
		no	<b>KT</b>		
Sourcing		QD	<b>TM</b>		
		no	<b>TT</b>		
TRIAC		QD	<b>CM</b>		
		no	<b>CT</b>		

**NOTE: Prelubrication is standard on all BC3 Band Cylinders (see Application Guidelines on page BC3\_25)**

**Not all codes listed are compatible with all options. Contact Tolomatic with any questions.**



Use the Tolomatic Sizing Software to determine available options and accessories based on your application requirements.

ABT

MXP

BC2

BC3

BC4

LS

MG

CC

PB

ENGR

# BC3 Service Parts Ordering - ALL Sizes

Inch (U.S. Standard) SIZE	10	D10	15	D15	20	D20
Foot Mount Kits <sup>1</sup>	3410-9005	3410-9025	3415-9005	3415-9025	3420-9005	3420-9025
Shock Mount Kit w/ Shock <sup>2</sup> – Heavy Duty	3410-9013	3410-9013	3415-9013	3415-9013	3420-9013	3420-9013
Shock Mount Kit w/ Shock <sup>2</sup> – Lite Duty	3410-9010	3410-9010	3415-9010	3415-9010	3420-9010	3420-9010
Shock Mount Kit w/o Shock <sup>3</sup> (Hardware Only)	3410-9003	3410-9003	3415-9003	3415-9003	3420-9003	3420-9003
Shock Stop Plate Kit <sup>4</sup>	3410-9004	3410-9004	3415-9004	3415-9004	3420-9004	3420-9004
Tube Supports <sup>5</sup>	3410-9006	3410-9026	3415-9006	3415-9026	3420-9006	3420-9026
Switch Hardware Only	3410-9999	3410-9999	3415-9999	3415-9999	3420-9999	3420-9999
Repair Kit <sup>6</sup>	RKBC310	RKBC3D10	RKBC315	RKBC3D15	RKBC320	RKBC3D20

Metric SIZE	M10	MD10	M15	MD15	M20	MD20
Foot Mount Kits <sup>1</sup>	4410-9005	4410-9025	4415-9005	4415-9025	4420-9005	4420-9025
Shock Mount Kit w/ Shock <sup>2</sup> – Heavy Duty	4410-9013	4410-9013	4415-9013	4415-9013	4420-9013	4420-9013
Shock Mount Kit w/ Shock <sup>2</sup> – Lite Duty	4410-9010	4410-9010	4415-9010	4415-9010	4420-9010	4420-9010
Shock Mount Kit w/o Shock <sup>3</sup> (Hardware Only)	4410-9003	4410-9003	4415-9003	4415-9003	4420-9003	4420-9003
Shock Stop Plate Kit <sup>4</sup>	4410-9004	4410-9004	4415-9004	4415-9004	4420-9004	4420-9004
Tube Supports <sup>5</sup>	4410-9006	4410-9026	4415-9006	4415-9026	4420-9006	4420-9026
Switch Hardware Only	3410-9999	3410-9999	3415-9999	3415-9999	3420-9999	3420-9999
Repair Kit <sup>6</sup>	RKBC3M10	RKBC3DM10	RKBC3M15	RKBC3DM15	RKBC3M20	RKBC3DM20

PART NUMBER ORDERING		CONFIG. CODE ORDERING	
No Mounting Hardware or FE conn. included		Mounting Hardware & FE conn. included	
PART NO.	DESCRIPTION	CODE	
3600-9084	Switch Only, Reed, Form C, 5m	BT	
3600-9085	Switch Only, Reed, Form C, Male Conn.	BM	
3600-9082	Switch Only, Reed, Form A, 5m	RT	
3600-9083	Switch Only, Reed, Form A, Male Conn.	RM	
3600-9086	Switch Only, Triac, 5m	CT	
3600-9087	Switch Only, Triac, Male Conn.	CM	
3600-9090	Switch Only, Hall-effect, Sinking, 5m	KT	
3600-9091	Switch Only, Hall-effect, Sinking, Male Conn.	KM	
3600-9088	Switch Only, Hall-effect, Sourcing, 5m	TT	
3600-9089	Switch Only, Hall-effect, Sourcing, Male Conn.	TM	
2503-1025	Connector (Female) 5 meter lead		

NOTE: When ordered by Config. Code Female connector & all mounting hardware is included

## Switch Ordering NOTES:

To order field retrofit switch and hardware kits for all Tolomatic actuators: SW (Then the model and bore size, and type of switch required)

**Example: SWBC315RT**

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

**!** Mounting hardware is required if replacing switch for any actuator manufactured before 7/1/97



## Service Parts Ordering NOTES:

- 1 Foot Mount Kit contains one bracket and mounting hardware.
- 2 Shock Field Retrofit Kit contains one shock absorber and mounting hardware.
- 3 Shock Field Mount Kit contains one set of mounting hardware.
- 4 Shock Stop Plate Kit contains shock plate, impact bolts, screws and dowel pins.
- 5 Contains one tube support and mounting hardware.
- 6 Repair Kit contains external dust band, internal seal band, wipers, end caps and internal soft seals. Stroke length must be indicated after repair kit code.

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# BC4 INTERNAL BEARING RODLESS CYLINDER



Air-Oil Systems, Inc. www.airoil.com

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Auxiliary Carrier .....	BC4_20
Foot Mount .....	BC4_22
Tube Supports .....	BC4_23
Floating Mount .....	BC4_24
Switches .....	BC4_25
Shock Absorbers .....	BC4_27
Application Data Worksheet .....	BC4_28
Selection Guidelines .....	BC4_30
Application Guidelines .....	BC4_31
Ordering .....	BC4_32
Service Parts .....	BC4_33

ABT

MXP

BCZ

BC3

**BC4**

LS

MG

CC

PB

CAGR

# BC4 BAND CYLINDER

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Look for this endurance technology symbol indicating our durability design features

ABT  
MXP  
BC2  
BC3  
**BC4**  
LS  
MG  
CC  
PB  
ENGR

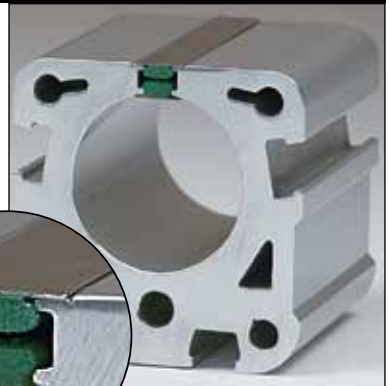
### LOAD-SUPPORTING BEARING DESIGN

- Self-lubricating bearing runs the length of carrier web for maximum bearing surface, this patented floating bearing system provides smooth movement and maximum transverse load resistance
- Durable, engineered resin piston has 50% greater bearing area
- Thicker and longer web has 60% greater material for increased robustness
- Maximum bearing life for millions of cycles



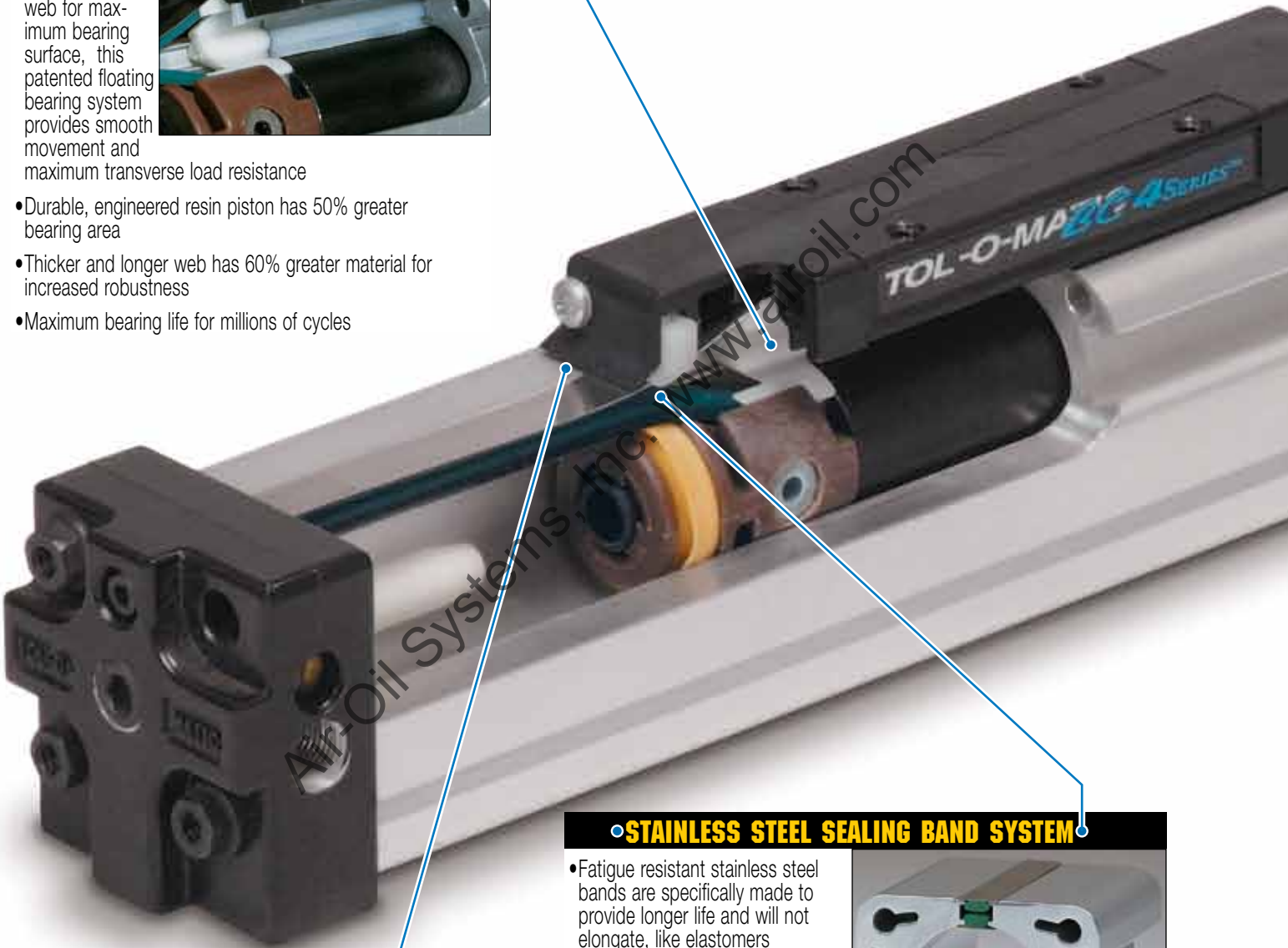
### STAINLESS STEEL SEALING BAND SYSTEM

- Fatigue resistant stainless steel bands are specifically made to provide longer life and will not elongate, like elastomers
- Outer band keeps out contaminants for extended performance
- Inner band provides a smooth surface for less seal wear

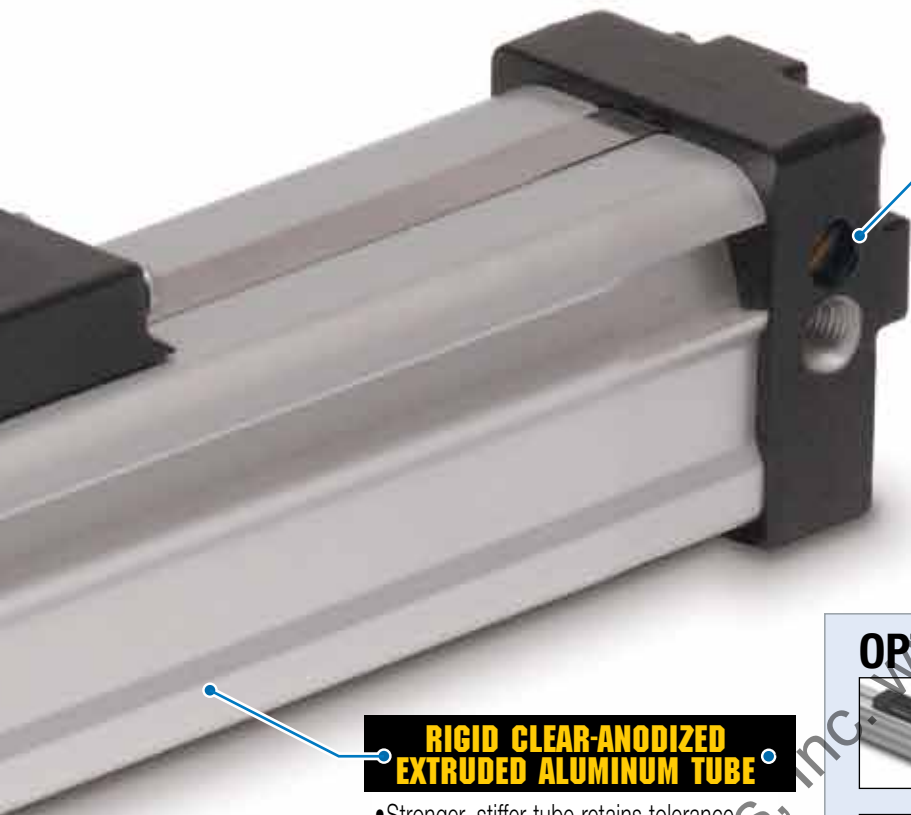


### FORMED END CAP WIPER SEAL

- Keeps contaminants from entering the sealing area
- Protects internal components
- Reduces maintenance while increasing productivity



# TOLOMATIC... THE RODLESS CYLINDER LEADER



## ADJUSTABLE CUSHIONS

- Adjustable cushions are standard, not optional
- Easy screw adjustment for end-of-stroke deceleration
- Protects actuator and load from damage

## RIGID CLEAR-ANODIZED EXTRUDED ALUMINUM TUBE

- Stronger, stiffer tube retains tolerance specifications when chamber is pressurized
- Keeps sealing band in place for maximized air efficiency
- Tube supports are minimized
- Solid structural support provides durability and long life performance

## OPTIONS



### AUXILIARY CARRIER

- Substantially higher load capacity
- Substantially higher bending moment capacity



### LONG CARRIER

- Substantially higher My and Mz bending moment capacity
- Larger load bearing mounting surface



### FLOATING MOUNT

- Compensates for non-parallelism between band cylinder and externally guided load



### TUBE SUPPORT MOUNTS

- Used for intermediate support



### FOOT MOUNTS

- For end mounting of band cylinder



### SHOCK ABSORBERS

- Smooth deceleration, higher productivity
- Allows increased operating speed
- Self-compensates for load or speed changes
- Minimizes impact load to equipment
- Adjustable position shocks available



### SINGLE END PORTING

- Simplifies air connections



### SWITCHES

- Available in Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers

ABT

IMXP

BCZ

BC3

BC4

LS

MG

CC

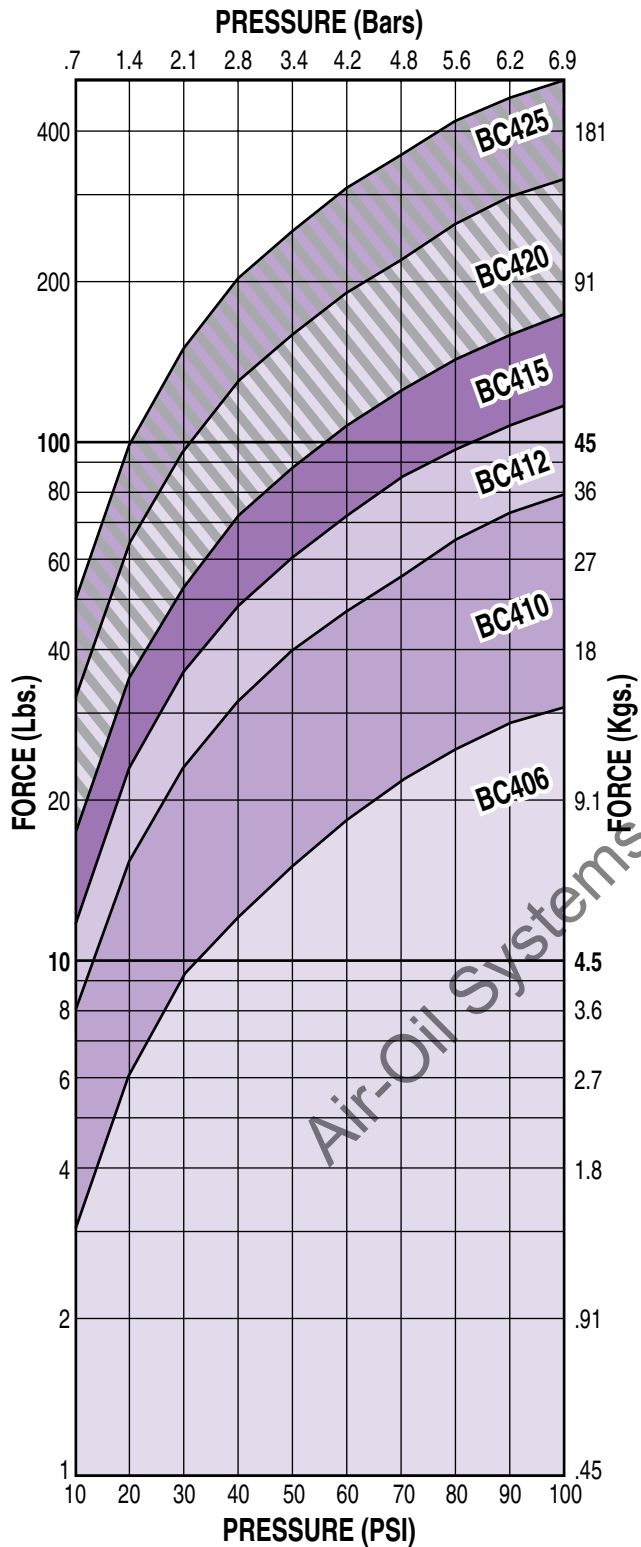
PB

ENGR

# BC4 Internal Bearing Rodless Cylinder

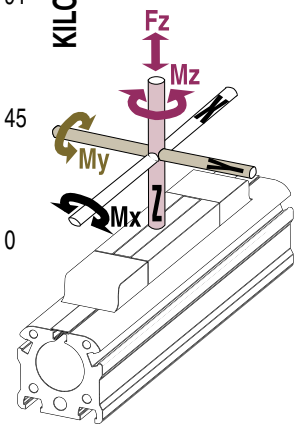
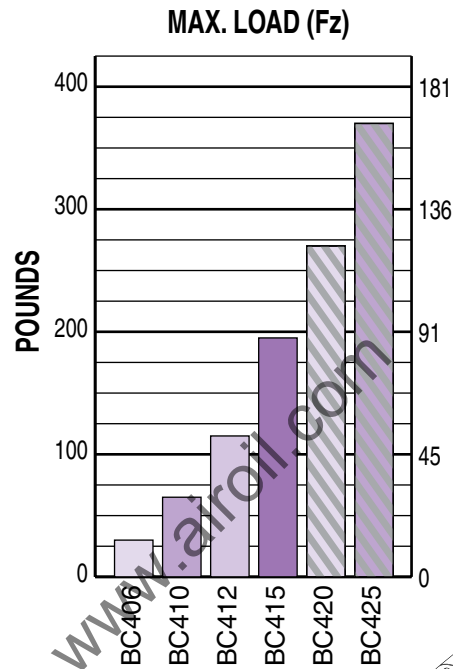
## PERFORMANCE

### BC4 THEORETICAL FORCE vs PRESSURE

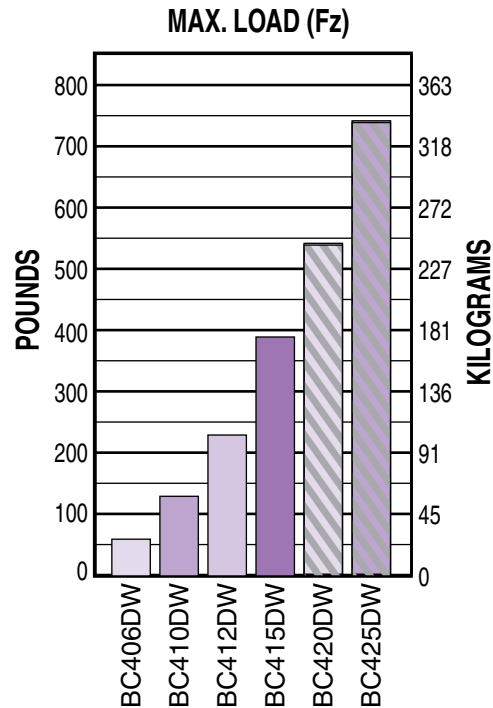


### BC4 MAX. LOAD

#### STANDARD ACTUATOR



#### AUXILIARY CARRIER & LONG CARRIER OPTIONS

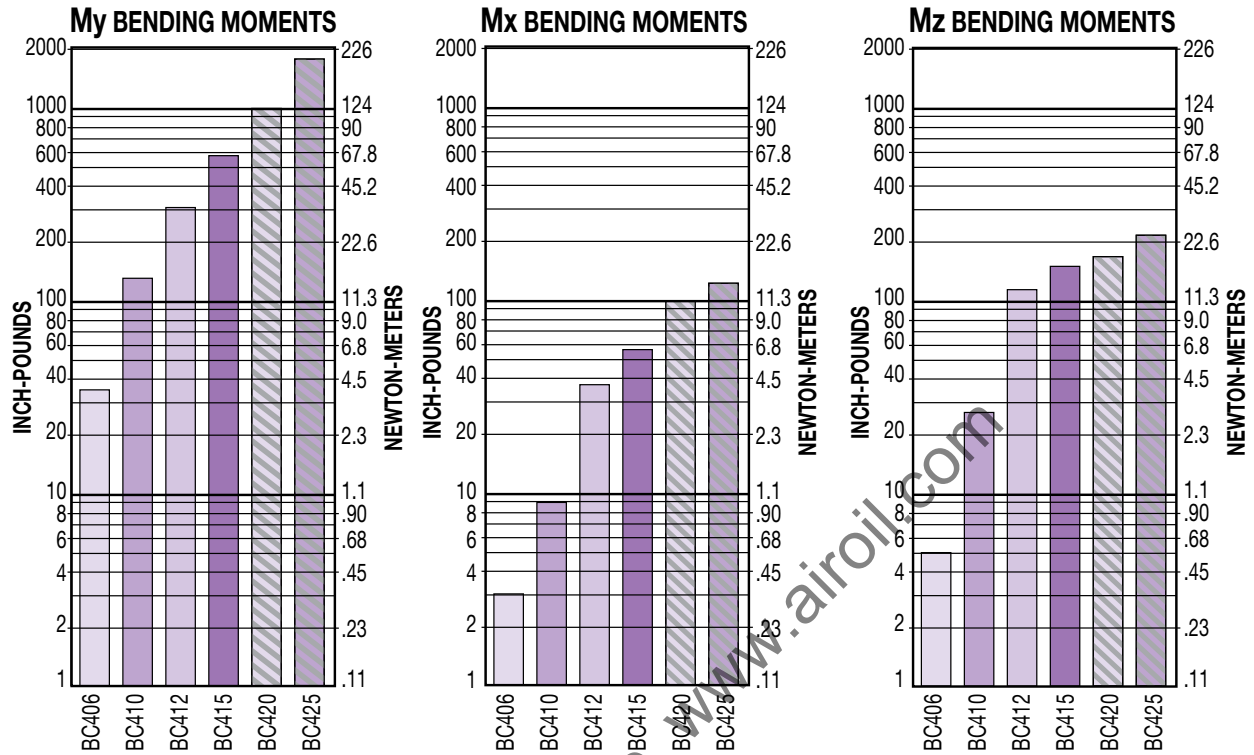


# BC4 Internal Bearing Rodless Cylinder

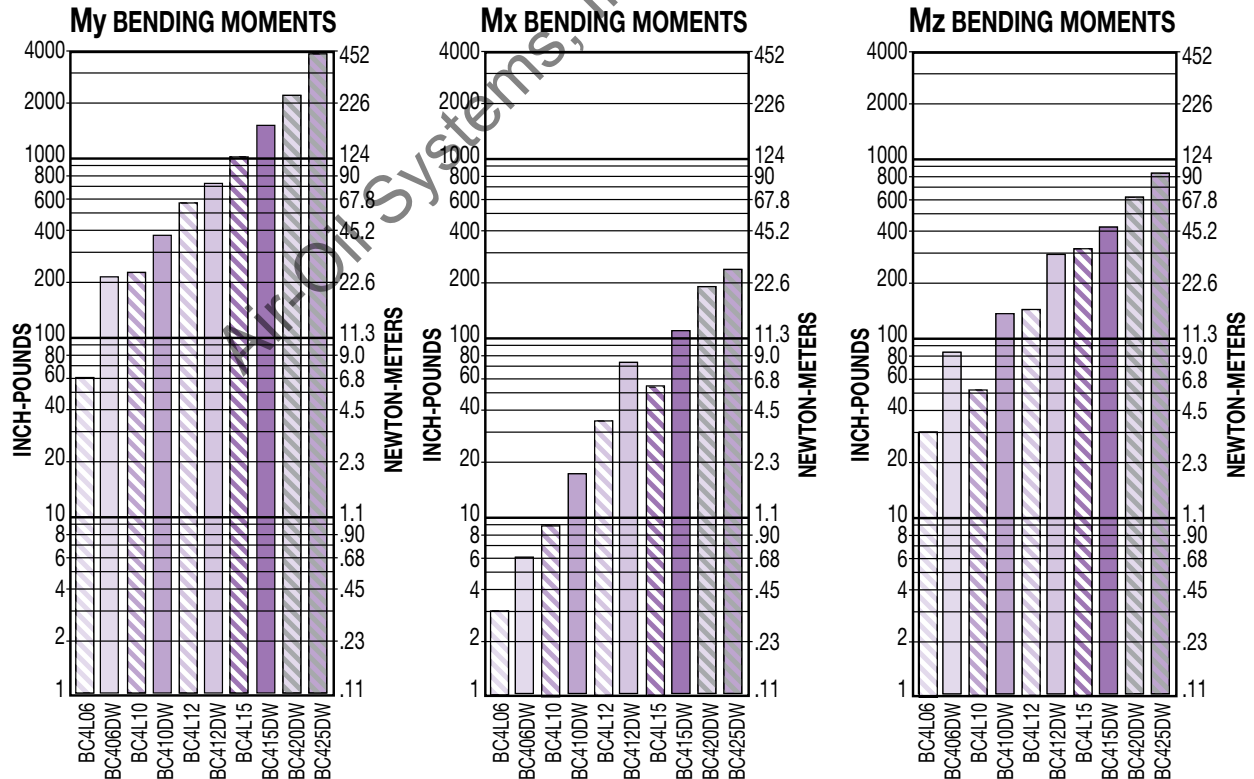
## PERFORMANCE

### BC4 BENDING MOMENTS AND LOAD

#### STANDARD ACTUATOR



#### AUXILIARY CARRIER & LONG CARRIER OPTIONS

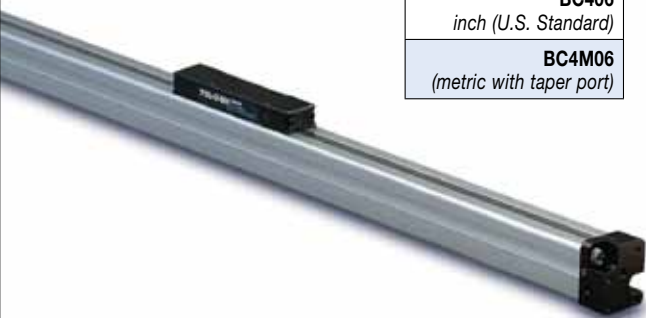


\*Auxiliary carrier bending moments indicated are at minimum center to center distance. Additional My + Mz load capacity can be obtained by increasing "D" dimension. Refer to auxiliary carrier data on page BC4\_20.

# BC406 Internal Bearing Rodless Cylinder

## PERFORMANCE

BC406

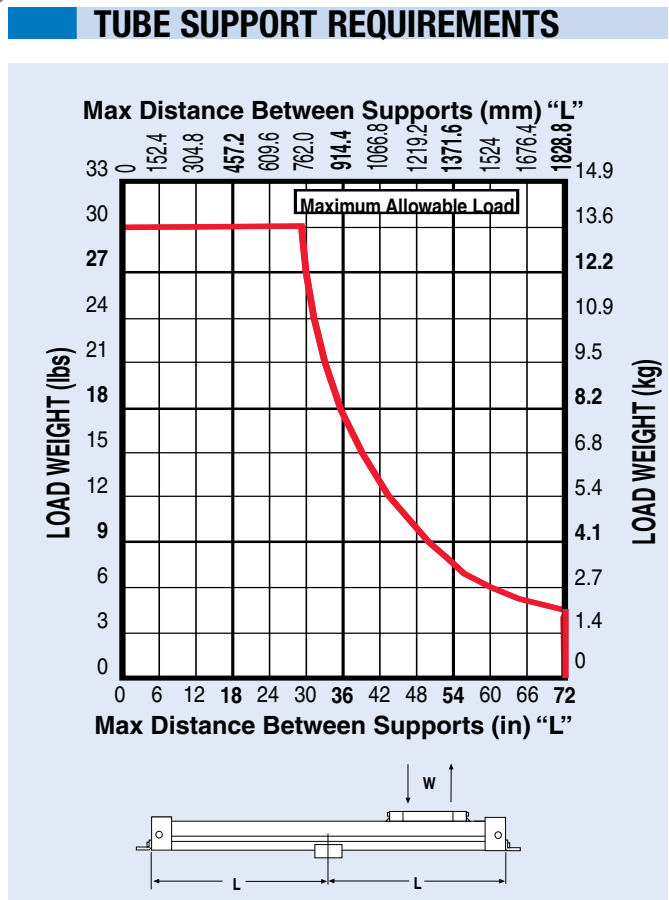
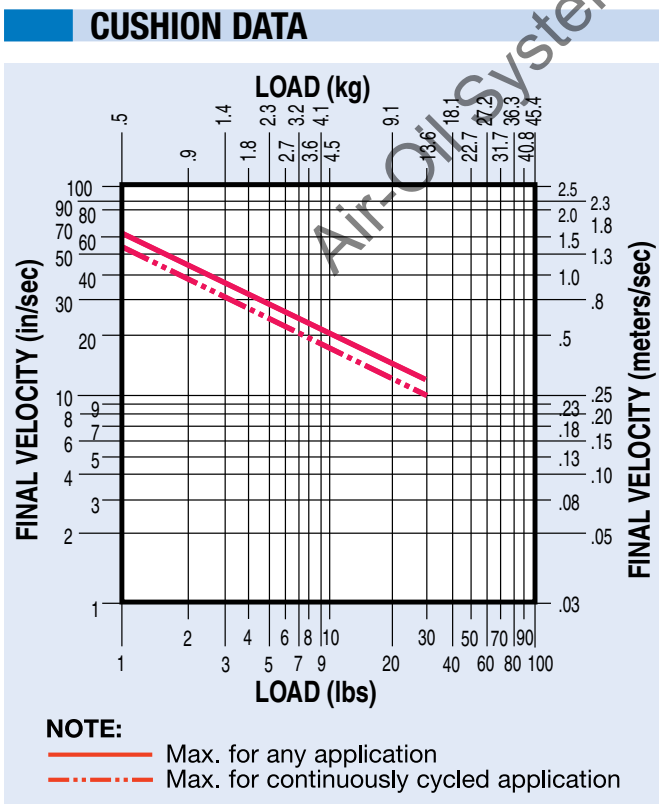
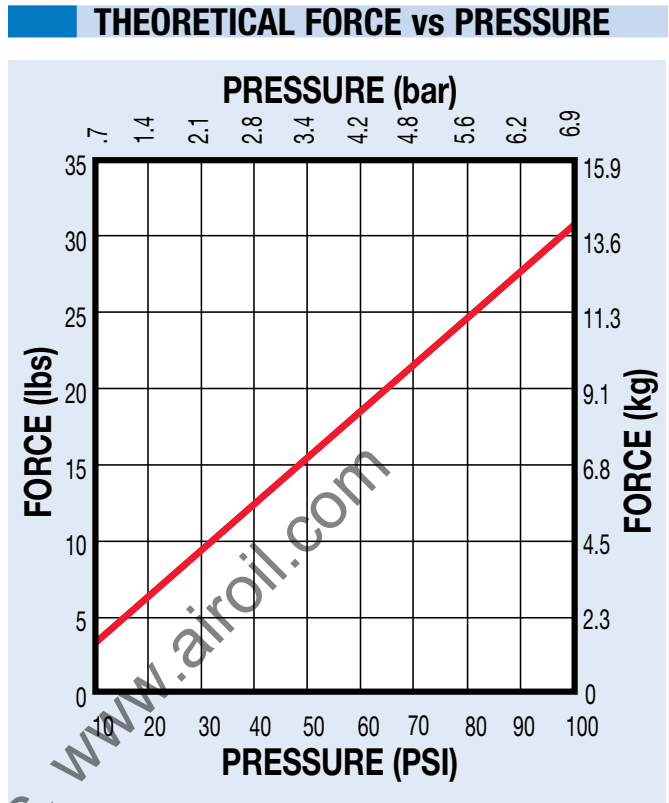


**ORDER CODES**

**BC406**  
*inch (U.S. Standard)*

**BC4M06**  
*(metric with taper port)*

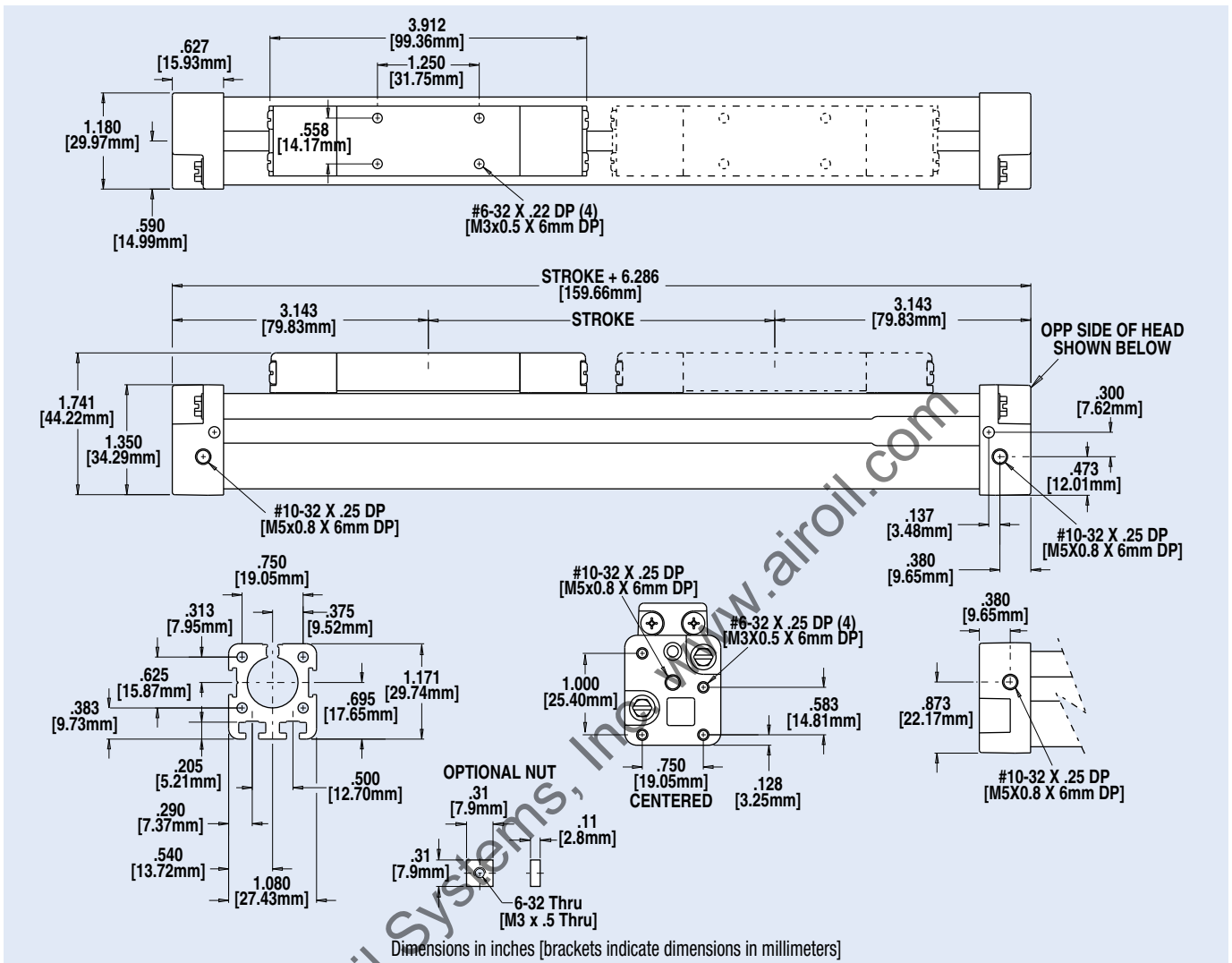
BC406 OPTIONS	Page
Auxiliary Carrier	BC4_20
Floating Mount Bracket	BC4_24
Foot Mounts	BC4_22
Long Carrier	BC4_19
Shock Absorbers	BC4_27
Switches	BC4_25
Tube Supports	BC4_23
MORE INFORMATION	Page
Application Guidelines	BC4_31
Cushion Needle Adjustment	BC4_31
Ordering	BC4_25
Selection	BC4_30





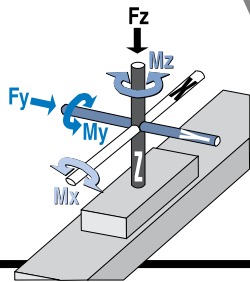
# BC406 Internal Bearing Rodless Cylinder

## DIMENSIONS



## SPECIFICATIONS

### BC406 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
<b>06</b>	0.625 in	35 in-lbs	3.0 in-lbs	5.0 in-lbs	30.0 lbs
<b>M06</b>	16 mm	3.95 N-m	0.34 N-m	0.56 N-m	13.61 kg

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
<b>06</b>	0.625 in	0.68 lb	0.063 lb/in	211 in	100 PSI	20° to 140° F
<b>M06</b>	16 mm	0.31 kg	0.028 kg/mm	5359 mm	6.895 bar	-7° to 60° C

\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic

# BC410 Internal Bearing Rodless Cylinder

## PERFORMANCE



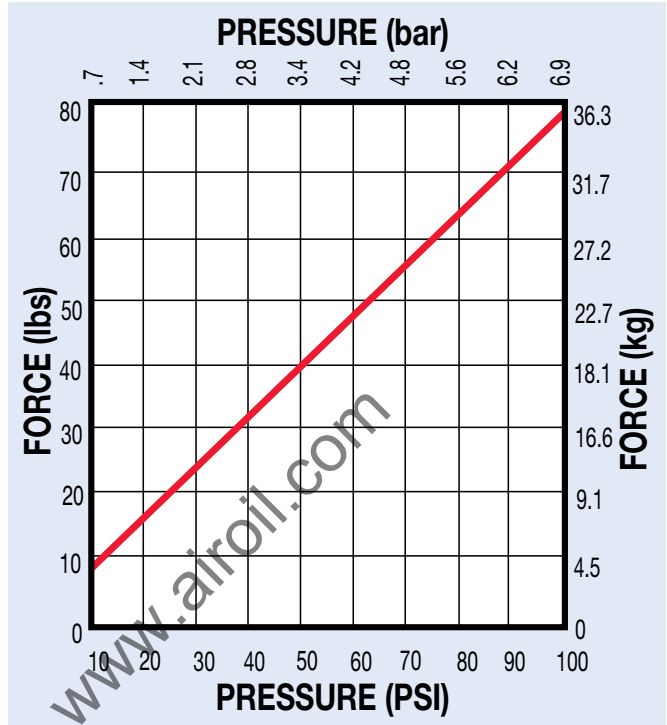
BC410

### ORDER CODES

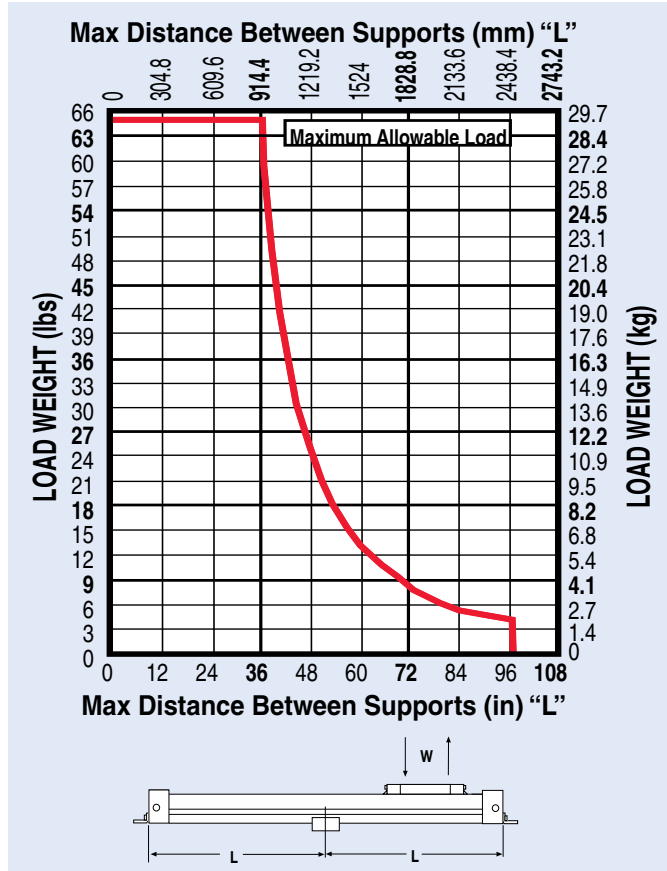
- BC410**  
inch (U.S. Standard)
- BC4M10**  
(metric with taper port)
- BC4MM10**  
(metric with parallel port)

BC410 OPTIONS	Page
Auxiliary Carrier	BC4_20
Floating Mount Bracket	BC4_24
Foot Mounts	BC4_22
Long Carrier	BC4_19
Shock Absorbers	BC4_27
Single End Porting	BC4_18
Switches	BC4_25
Tube Supports	BC4_23
MORE INFORMATION	Page
Application Guidelines	BC4_31
Cushion Needle Adjustment	BC4_31
Ordering	BC4_25
Selection	BC4_30

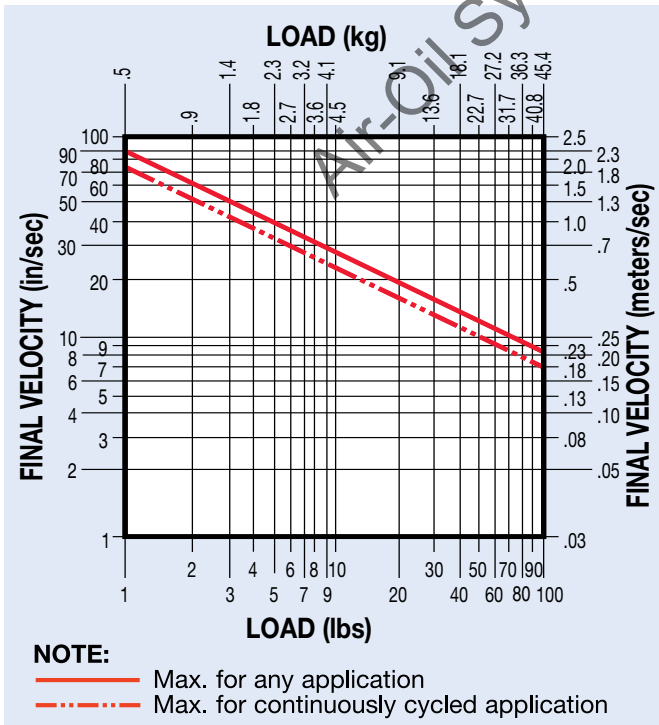
## THEORETICAL FORCE vs PRESSURE



## TUBE SUPPORT REQUIREMENTS



## CUSHION DATA

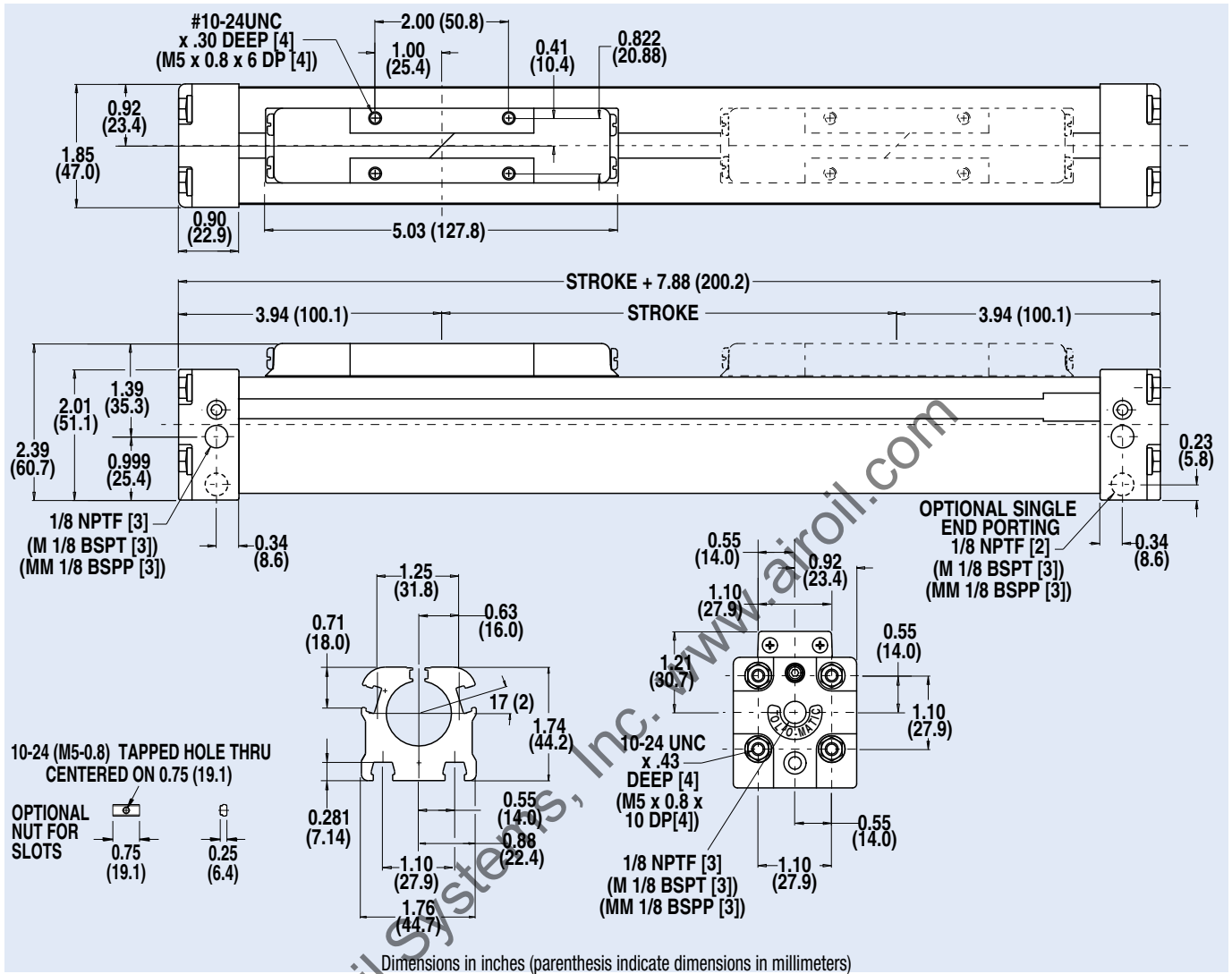


### NOTE:

- Max. for any application
- - - Max. for continuously cycled application

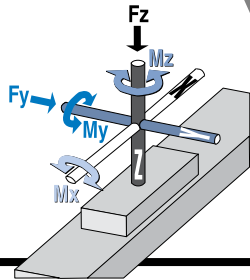
# BC410 Internal Bearing Rodless Cylinder

## DIMENSIONS



## SPECIFICATIONS

### BC410 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
<b>10</b>	1.00 in	132 in-lbs	9 in-lbs	27.0 in-lbs	65 lbs
<b>M(MM)10</b>	25 mm	14.91 N-m	1.02 N-m	3.05 N-m	29.48 kg

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
<b>10</b>	1.00 in	2.36 lbs	0.17 lbs/in	210 in	100 PSI	20° to 140° F
<b>M(MM)10</b>	25 mm	1.07 kg	0.0771 kg/mm	5334 mm	6.895 bar	-7° to 60° C

**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# BC412 Internal Bearing Rodless Cylinder

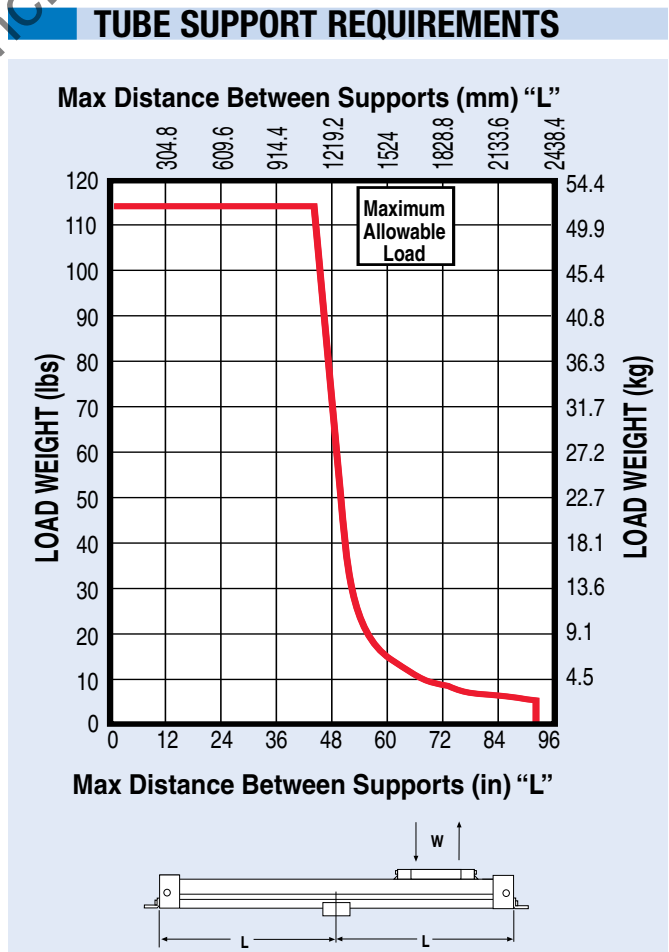
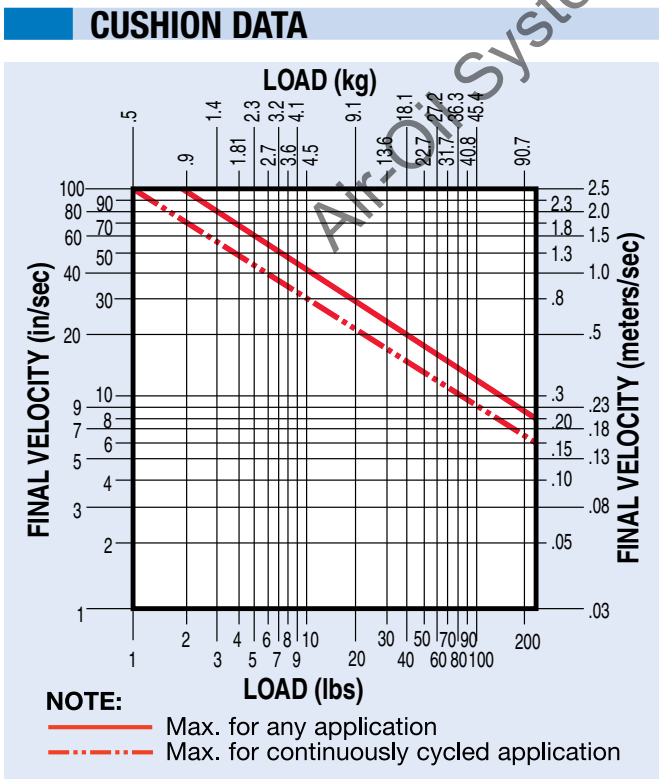
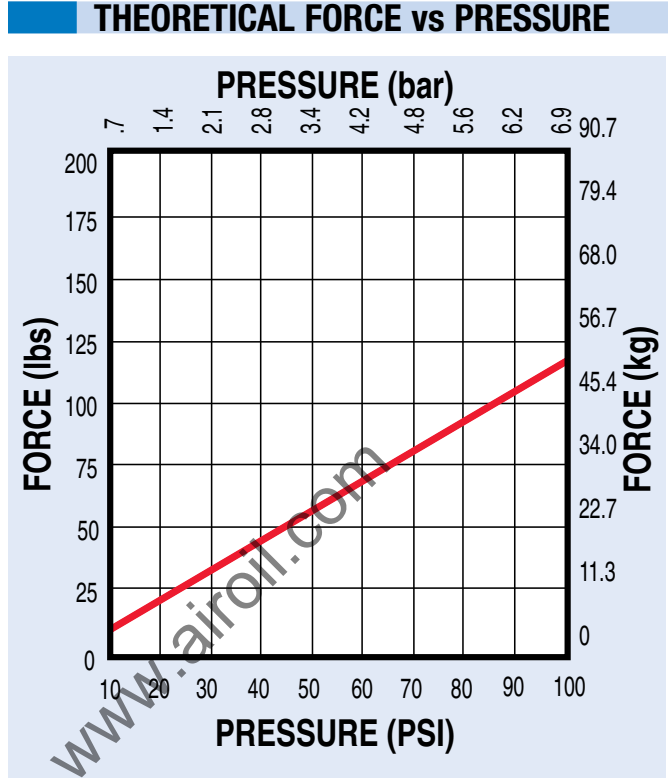
## PERFORMANCE

**BC412**



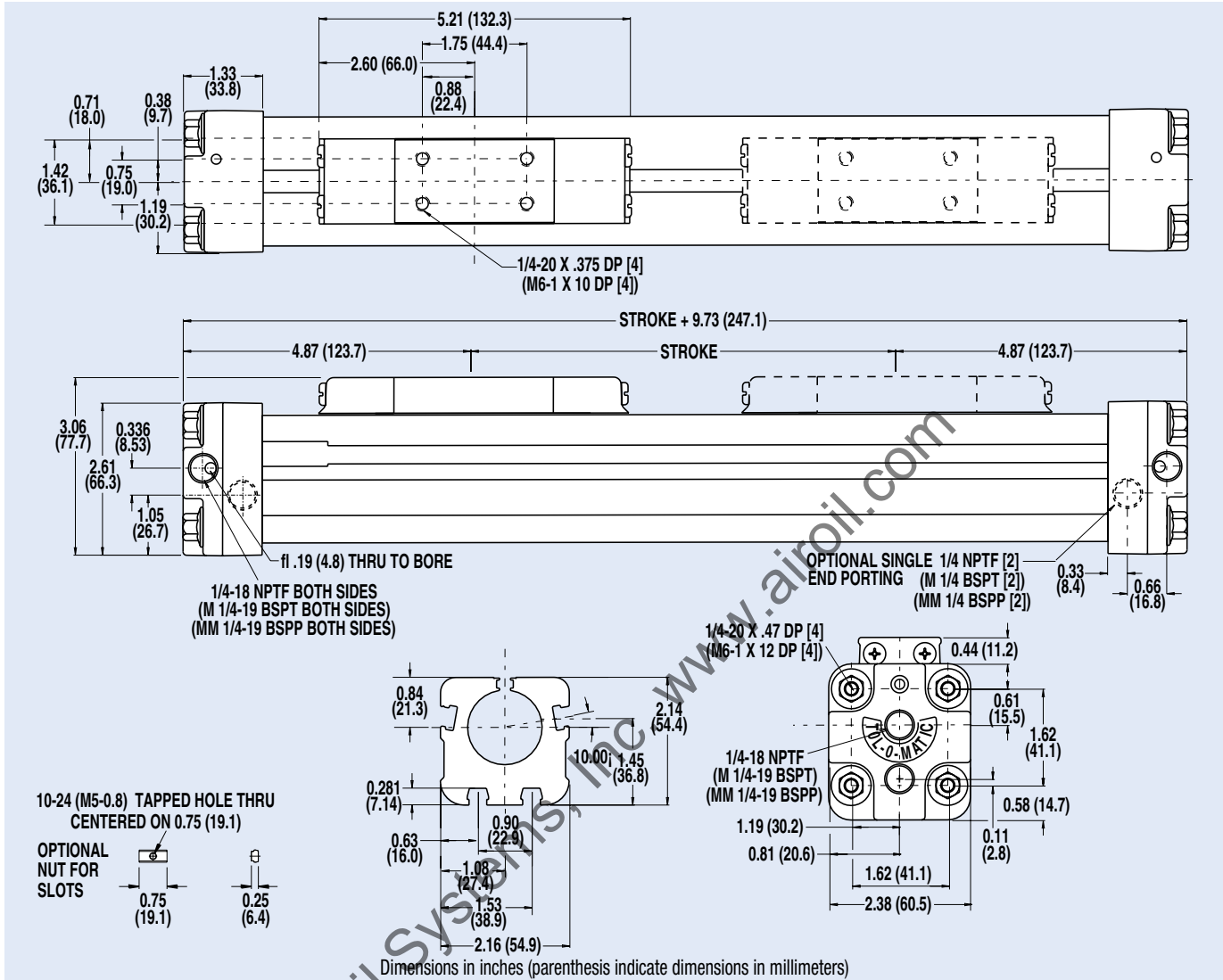
ORDER CODES	
<b>BC412</b>	inch (U.S. Standard)
<b>BC4M12</b>	(metric with taper port)
<b>BC4MM12</b>	(metric with parallel port)

BC412 OPTIONS	Page
Auxiliary Carrier	BC4_20
Floating Mount Bracket	BC4_24
Foot Mounts	BC4_22
Long Carrier	BC4_19
Shock Absorbers	BC4_27
Single End Porting	BC4_18
Switches	BC4_25
Tube Supports	BC4_23
MORE INFORMATION	Page
Application Guidelines	BC4_31
Cushion Needle Adjustment	BC4_31
Ordering	BC4_25
Selection	BC4_30



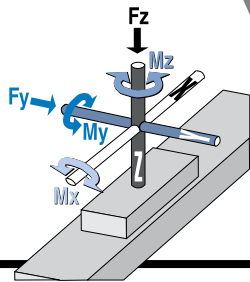
# BC412 Internal Bearing Rodless Cylinder

## DIMENSIONS



## SPECIFICATIONS

### BC412 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
<b>12</b>	1.25 in	318 in-lbs	36 in-lbs	120 in-lbs	115 lbs
<b>M(MM)12</b>	32 mm	35.93 N-m	3.95 N-m	13.56 N-m	52.16 kg

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
<b>12</b>	1.25 in	3.98 lbs	0.27 lbs/in	208 in	100 PSI	20° to 140° F
<b>M(MM)12</b>	32 mm	1.81 kg	0.1225 kg/mm	5283 mm	6.895 bar	-7° to 60° C

\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic

# BC415 Internal Bearing Rodless Cylinder

## PERFORMANCE

BC415



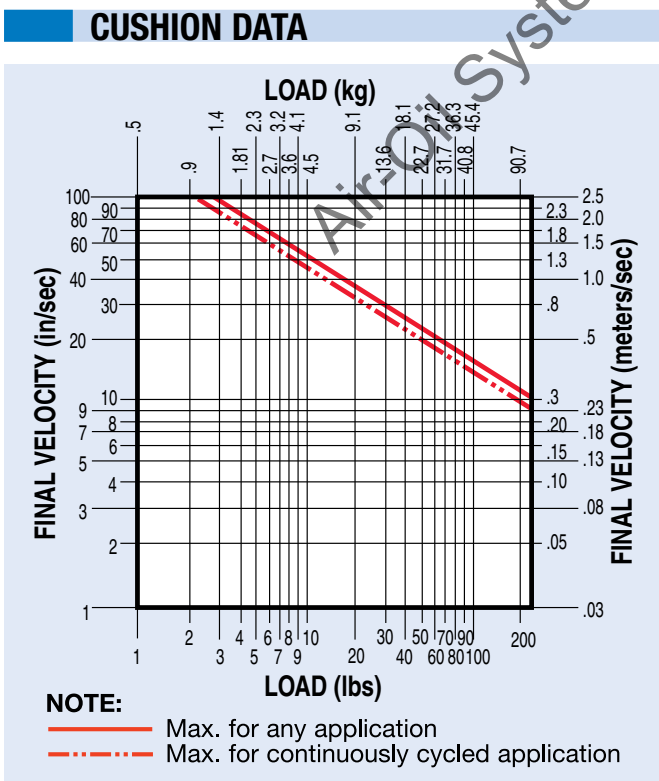
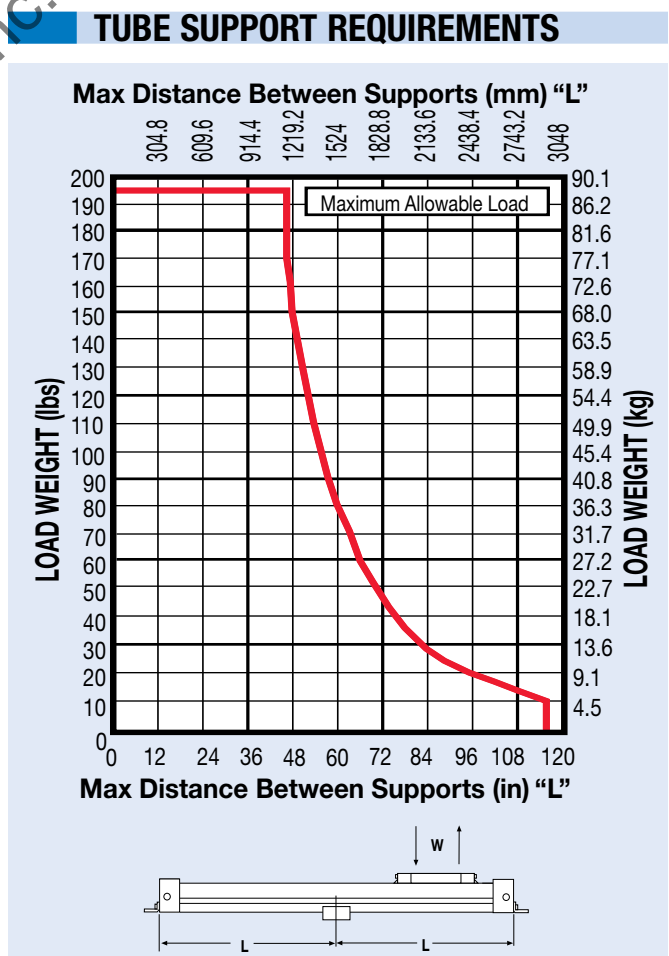
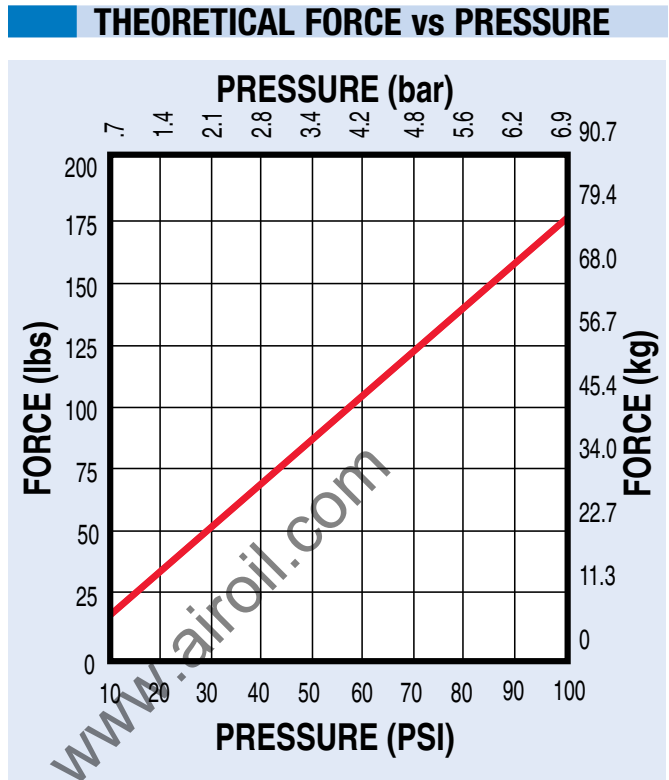
**ORDER CODES**

**BC415**  
inch (U.S. Standard)

**BC4M15**  
(metric with taper port)

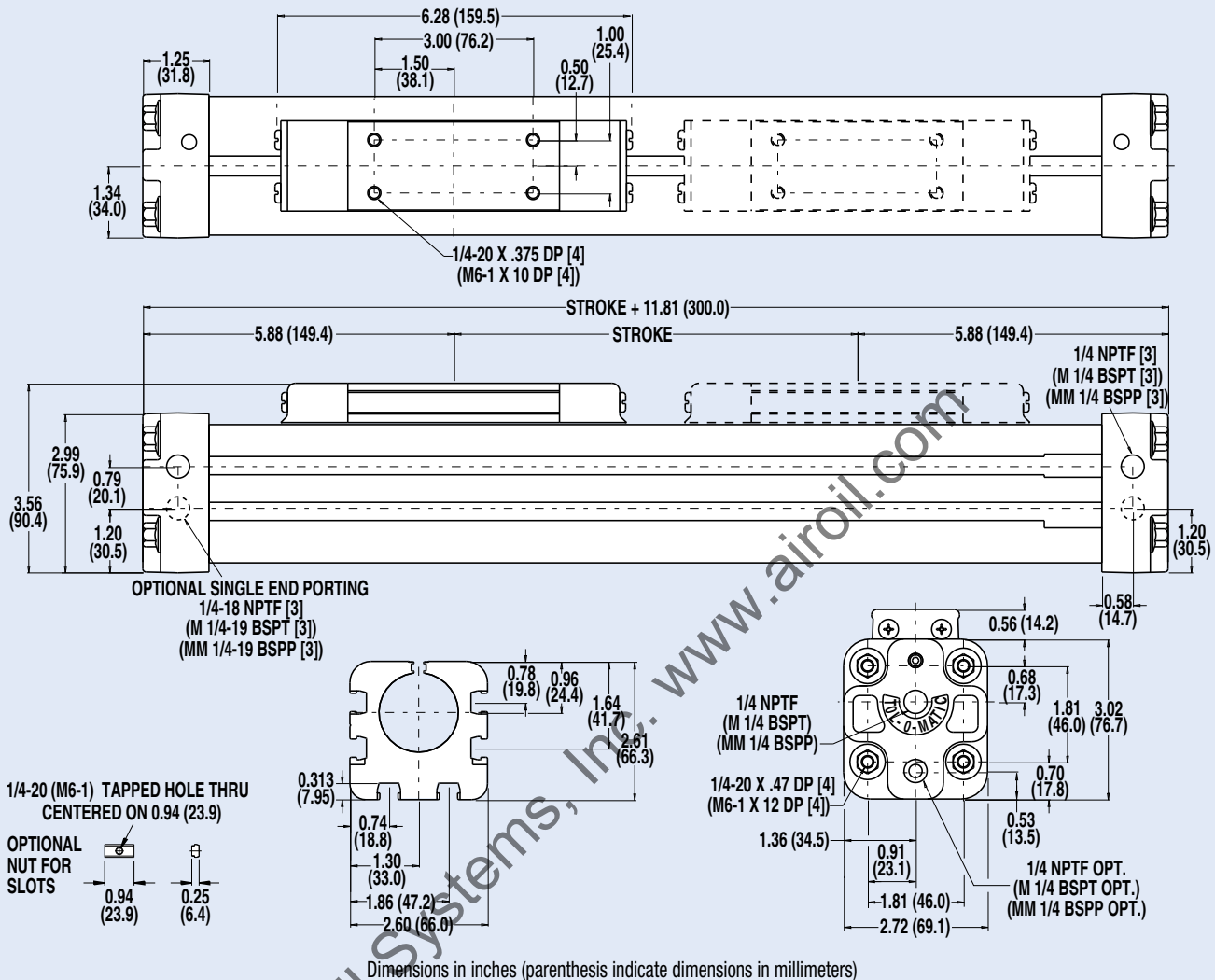
**BC4MM15**  
(metric with parallel port)

BC415 OPTIONS	Page
Auxiliary Carrier	BC4_20
Floating Mount Bracket	BC4_24
Foot Mounts	BC4_22
Long Carrier	BC4_19
Shock Absorbers	BC4_27
Single End Porting	BC4_18
Switches	BC4_25
Tube Supports	BC4_23
MORE INFORMATION	Page
Application Guidelines	BC4_31
Cushion Needle Adjustment	BC4_31
Ordering	BC4_25
Selection	BC4_30



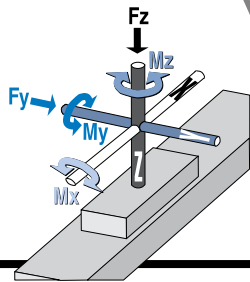
# BC415 Internal Bearing Rodless Cylinder

## DIMENSIONS



## SPECIFICATIONS

### BC415 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
15	1.50 in	575 in-lbs	55 in-lbs	156 in-lbs	195 lbs
M(MM)15	40 mm	64.97 N-m	6.21 N-m	17.63 N-m	88.45 kg


	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
15	1.50 in	7.56 lbs	0.41 lbs/in	206 in	100 PSI	20° to 140° F
M(MM)15	40 mm	3.43 kg	0.1860 kg/mm	5232 mm	6.895 bar	-7° to 60° C

\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic

# BC420 Internal Bearing Rodless Cylinder

## PERFORMANCE

**BC420**



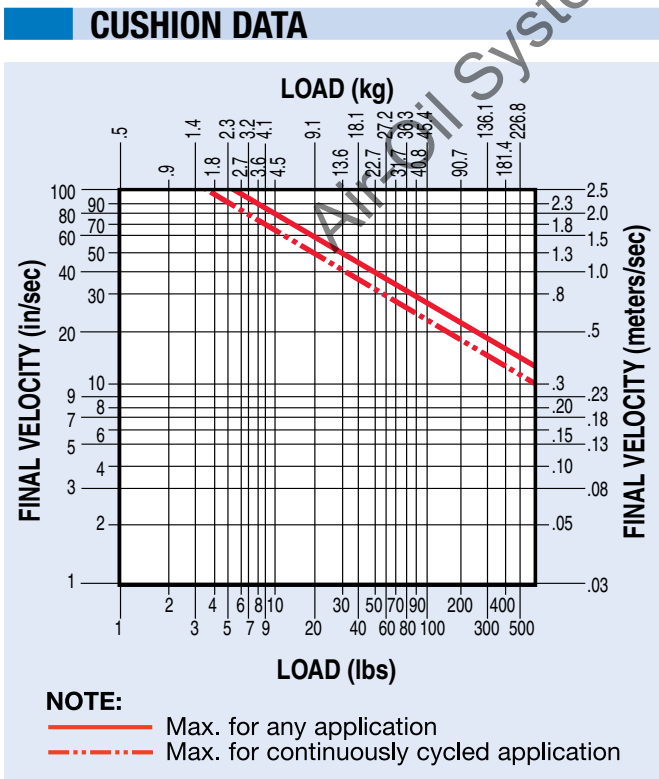
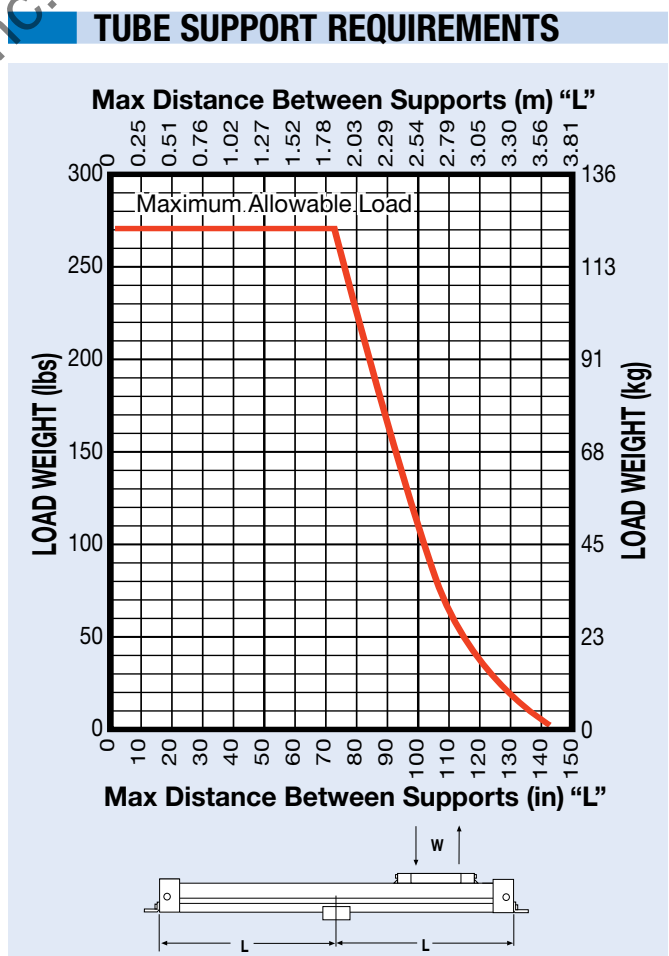
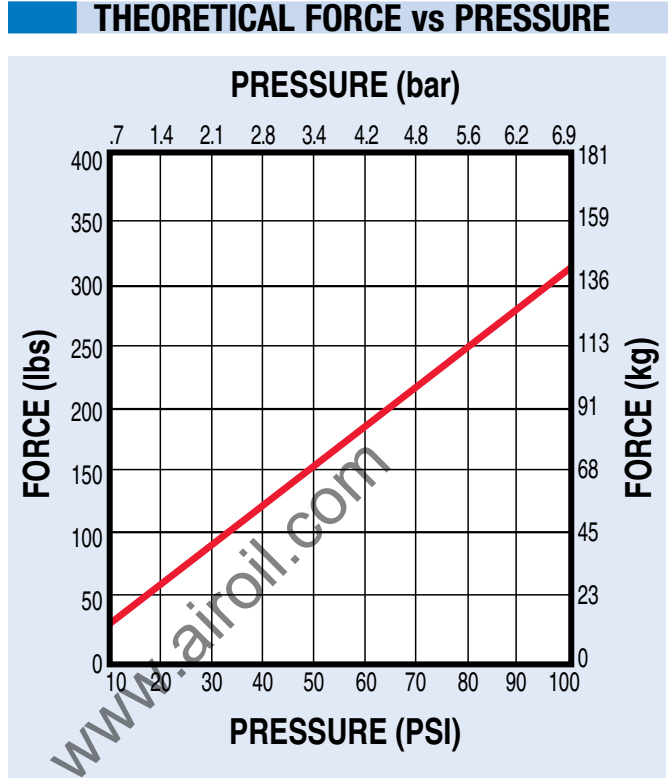
**ORDER CODES**

**BC420**  
*inch (U.S. Standard)*

**BC4M20**  
*(metric with taper port)*

**BC4MM20**  
*(metric with parallel port)*

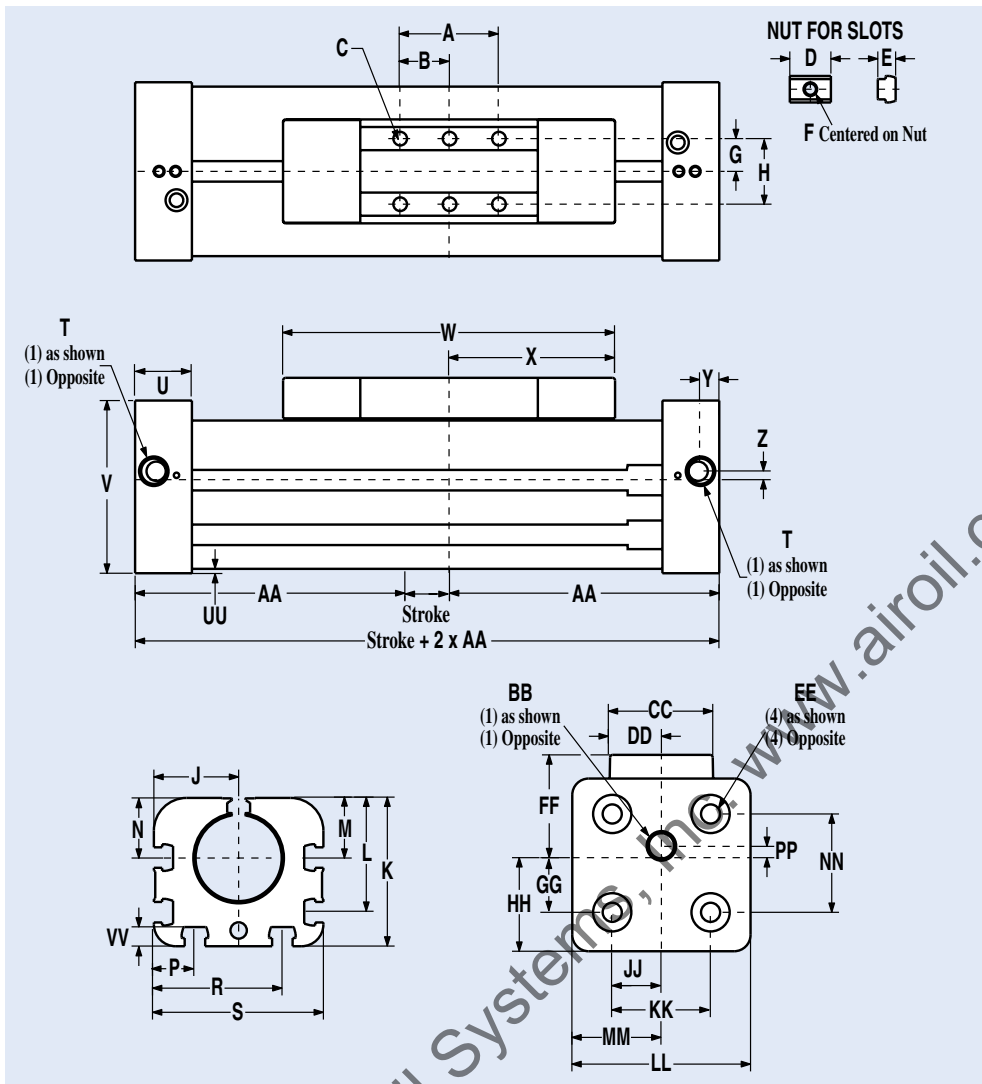
BC420 OPTIONS	Page
Auxiliary Carrier	BC4_20
Floating Mount Bracket	BC4_24
Foot Mounts	BC4_22
Long Carrier	BC4_19
Shock Absorbers	BC4_27
Single End Porting	BC4_18
Switches	BC4_25
Tube Supports	BC4_23
MORE INFORMATION	Page
Application Guidelines	BC4_31
Cushion Needle Adjustment	BC4_31
Ordering	BC4_25
Selection	BC4_30





# BC420 Internal Bearing Rodless Cylinder

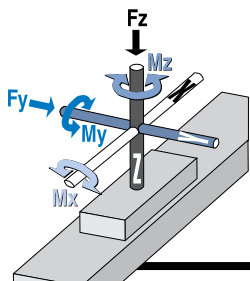
## DIMENSIONS



	20	M(MM)20
A	2.250	57.15
B	1.125	28.58
B2	-	-
C	5/16-18 x .47 DP	M8-1.25 x 13 DP
D	0.940	23.88
E	0.408	10.36
F	5/16-18 UNC-2B	M8-1.25
G	0.750	19.05
H	1.500	38.10
J	1.939	49.25
K	3.393	86.18
L	2.625	66.68
M	1.375	34.93
N	1.375	34.93
P	0.939	23.85
R	2.939	74.65
S	3.878	98.50
T	3/8-18 NPT	3/8-19 BSP(P)T
U	1.300	33.02
V	3.951	100.36
W	7.594	192.89
X	3.797	96.44
Y	0.428	10.87
Z	0.193	4.90
AA	6.181	157.00
BB	3/8-18 NPT	3/8-19 BSP(P)T
CC	2.347	59.61
DD	1.173	29.79
EE	5/16 - 18 x 0.88 DP	M8 x 22 DP
FF	2.352	59.74
GG	1.210	30.73
HH	2.101	53.37
JJ	1.125	28.58
KK	2.250	57.15
LL	4.078	103.58
MM	2.039	51.79
NN	2.250	57.15
PP	0.270	6.86
UU	0.101	2.57
VV	0.438	11.11
	INCHES	MILLIMETERS

## SPECIFICATIONS

### BC420 BENDING MOMENTS AND LOAD



	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
20	2.00 in	1017 in-lbs	98 in-lbs	172 in-lbs	270 lbs
M(MM)20	50 mm	114.92 N-m	11.07 N-m	19.43 N-m	122.47 kg

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
20	2.00 in	11.90 lbs	0.67 lbs/in	156 in	100 PSI	20° to 140° F
M(MM)20	50 mm	5.40 kg	0.30 kg/mm	3962 mm	6.895 bar	-7° to 60° C

**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# BC425 Internal Bearing Rodless Cylinder

## PERFORMANCE

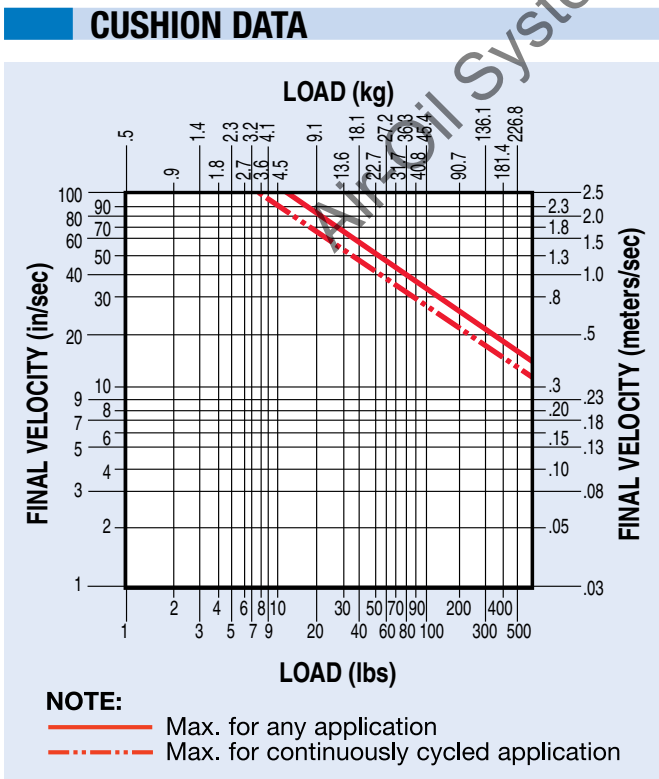
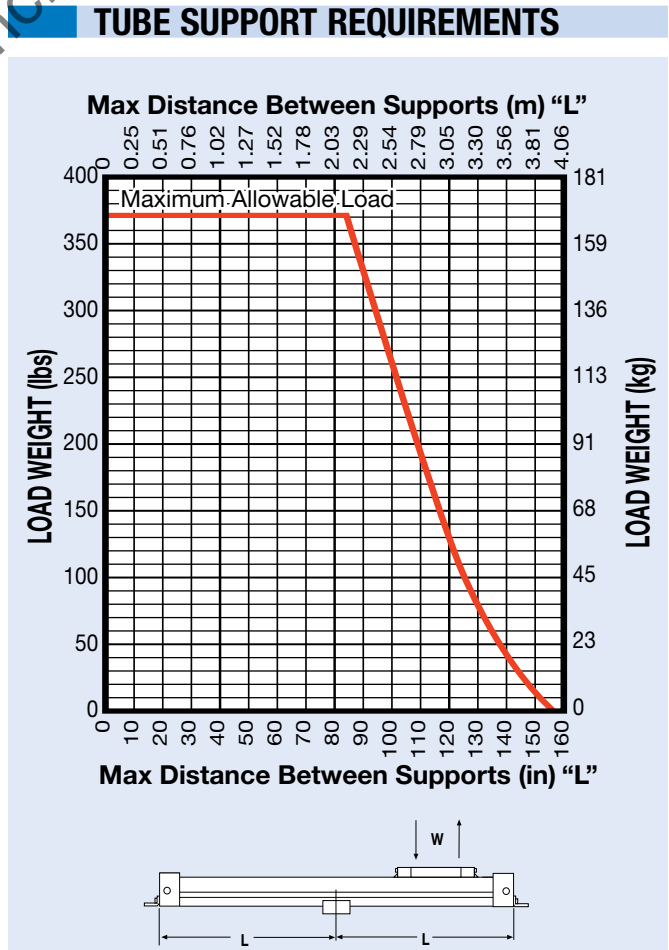
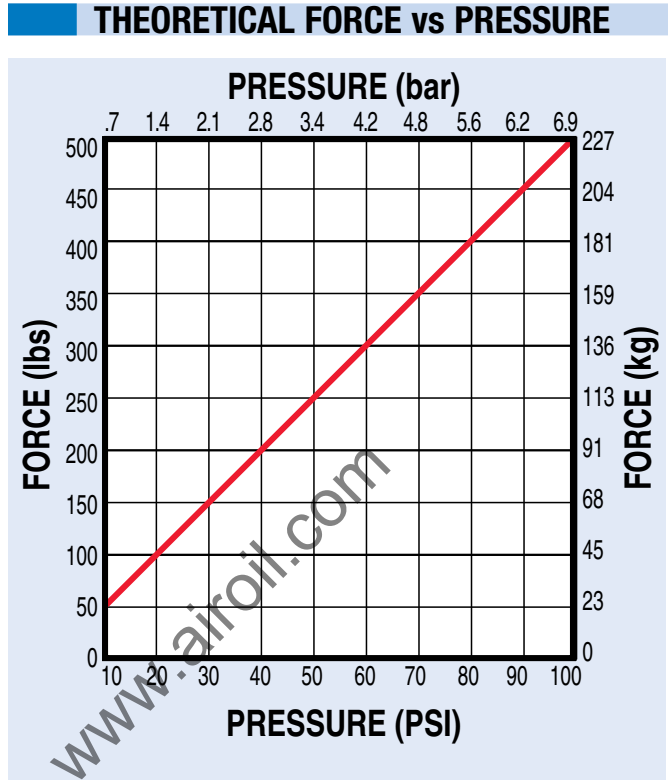


**BC425**

ORDER CODES	
<b>BC425</b>	inch (U.S. Standard)
<b>BC4M25</b>	(metric with taper port)
<b>BC4MM25</b>	(metric with parallel port)

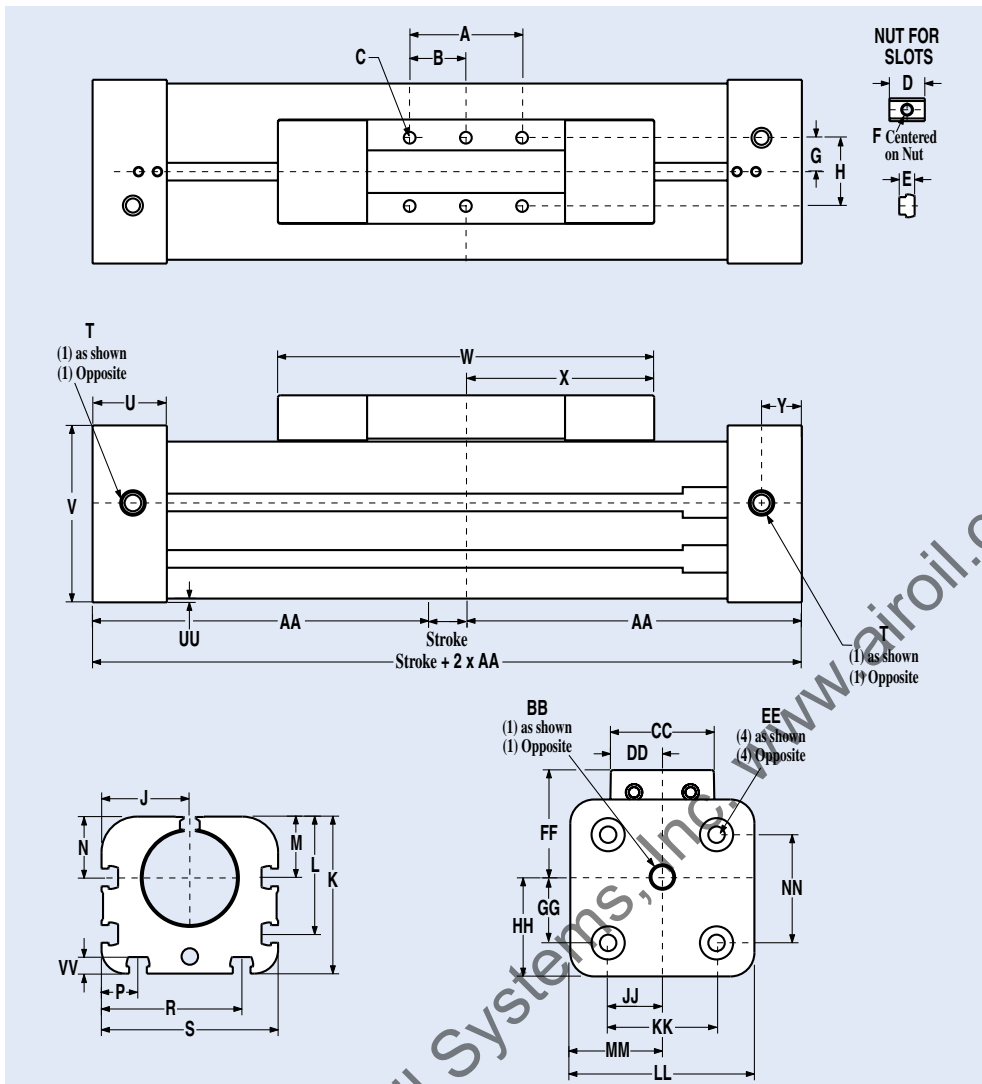
BC425 OPTIONS	Page
Auxiliary Carrier	BC4_20
Floating Mount Bracket	BC4_24
Foot Mounts	BC4_22
Long Carrier	BC4_19
Shock Absorbers	BC4_27
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Tube Supports	BC4_23

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Application Guidelines	BC4_31
Cushion Needle Adjustment	BC4_31
Ordering	BC4_25
Selection	BC4_30



# BC425 Internal Bearing Rodless Cylinder

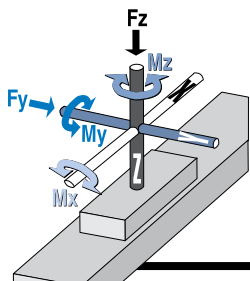
## DIMENSIONS



	25	M(MM)25
A	3.000	76.20
B	1.500	38.10
B2	-	-
C	3/8-16 x .60 DP	M10-1.5x15.2DP
D	0.94	23.88
E	0.408	10.36
F	5/16-18 UNC-2B	M8-1.25-6g Thru
G	0.909	23.09
H	1.817	46.15
J	2.341	59.46
K	4.171	105.94
L	3.106	78.89
M	1.617	41.07
N	1.630	41.40
P	0.958	24.33
R	3.708	94.18
S	4.666	118.52
T	3/8-18 NPT	3/8-19 BSP(P)T
U	1.97	50.04
V	4.700	119.38
W	9.98	253.49
X	4.990	126.75
Y	1.070	27.18
Z	-	-
AA	8.423	213.94
BB	3/8-18 NPT	3/8-19 BSP(P)T
CC	2.730	69.34
DD	1.365	34.67
EE	5/16-18 x .88 DP	M8 x 22 DP
FF	2.93	74.42
GG	1.680	42.67
HH	2.571	65.3
JJ	1.438	36.53
KK	2.875	73.03
LL	4.883	124.03
MM	2.444	62.08
NN	2.875	73.03
PP	-	-
UU	0.08	2.03
VV	0.438	11.11
	INCHES	MILLIMETERS

## SPECIFICATIONS

### BC425 BENDING MOMENTS AND LOAD

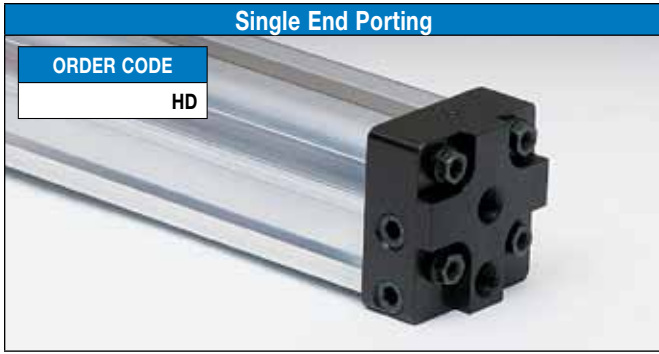


	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
25	2.50 in	1776 in-lbs	120 in-lbs	216 in-lbs	370 lbs
M(MM)25	63 mm	200.69 N-m	13.56 N-m	24.41 N-m	167.83 kg

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE
		BASE	PER UNIT OF STROKE			
25	2.50 in	22.10 lbs	0.95 lbs/in	211 in	100 PSI	20° to 140° F
M(MM)25	63 mm	10.02 kg	0.43 kg/mm	5359 mm	6.895 bar	-7° to 60° C

**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# BC4 Single End Porting - 10, 12, 15, 20, 25 Sizes

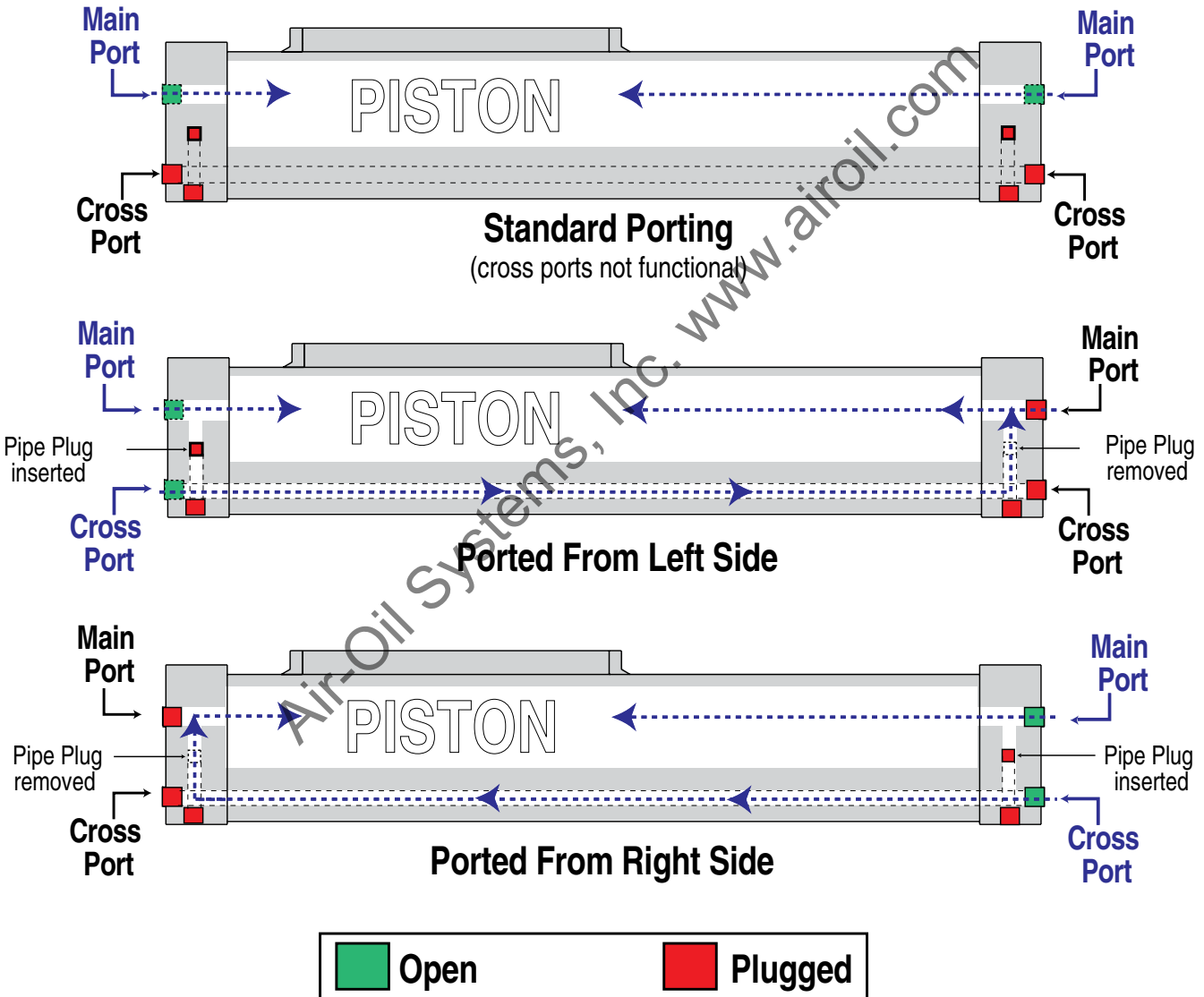



## SINGLE END PORTING ALLOWS THE GREATEST FLEXIBILITY IN AIR HOOK UP.

This option allows you to run air lines to just one end of the BC4, simplifying air hook up. The Single End Porting option for the BC410 is factory installed on the right side.

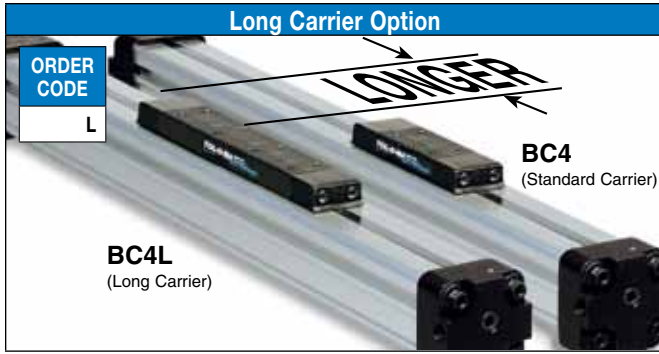
✗ Not available for 06 (5/8" bore).

## AIR FLOW DIAGRAMS



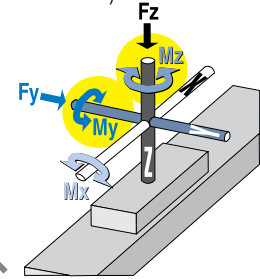
 NOTE: Standard porting may be field converted to ported from left or ported from right. For complete instructions refer to parts sheet.

# BC4 Long Carrier - 06, 10, 12, 15 Sizes



Long carrier option greatly increases the “My” and “Mz” moment load capacity. This broadens the application range for these models. Other benefits include larger mounting surface and virtual elimination of chatter for vertical cantilever loads.

⊗ Not available for 20, 25 (2" & 2.5" bore).



## PERFORMANCE

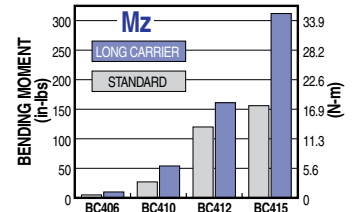
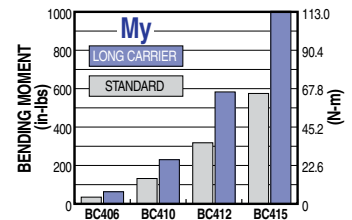
	BORE SIZE	MAXIMUM BENDING MOMENT					MAX. LOAD Fz†
		My (Standard)	My (Long)	Mx†	Mz (Standard)	Mz (Long)	
L06	0.625 in	35 in.-lbs.	<b>63 in.-lbs.</b>	3.0 in.-lbs.	5.0 in.-lbs.	<b>30 in.-lbs.</b>	30 lbs.
L10	1.00 in	132 in.-lbs.	<b>230 in.-lbs.</b>	9 in.-lbs.	27 in.-lbs.	<b>54 in.-lbs.</b>	65 lbs.
L12	1.25 in	318 in.-lbs.	<b>583 in.-lbs.</b>	36 in.-lbs.	120 in.-lbs.	<b>161 in.-lbs.</b>	115 lbs.
L15	1.50 in	575 in.-lbs.	<b>1003 in.-lbs.</b>	55 in.-lbs.	156 in.-lbs.	<b>312 in.-lbs.</b>	195 lbs.

Dimensions in inches

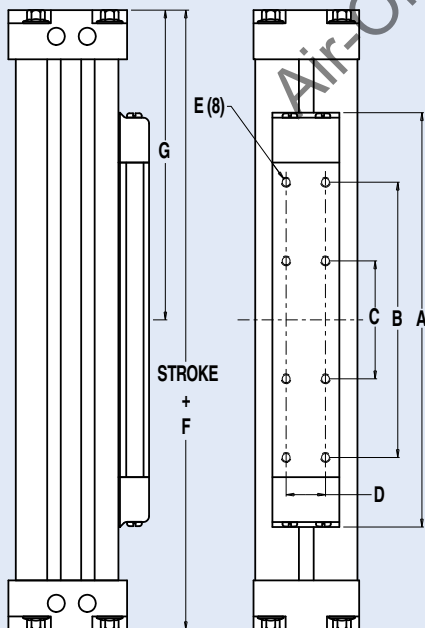
	BORE SIZE	MAXIMUM BENDING MOMENT					MAX. LOAD Fz†
		My (Standard)	My (Long)	Mx†	Mz (Standard)	Mz (Long)	
ML06	16mm	3.95 N-m	<b>7.06 N-m</b>	0.34 N-m	0.56 N-m	<b>1.12 N-m</b>	13.61 kg
M(MM)L10	25mm	14.91 N-m	<b>25.99 N-m</b>	1.02 N-m	0.33 N-m	<b>6.10 N-m</b>	29.48 kg
M(MM)L12	32mm	35.93 N-m	<b>65.83 N-m</b>	3.95 N-m	13.56 N-m	<b>18.20 N-m</b>	52.16 kg
M(MM)L15	40mm	64.97 N-m	<b>113.36 N-m</b>	6.21 N-m	17.63 N-m	<b>35.26 N-m</b>	88.45 kg

Dimensions in millimeters

†Mx Bending Moment and Fz (Maximum Load) are the same for Standard and Long Carrier BC4.



## DIMENSIONS



	BORE	A	B*	C*	D	E	F§	G
L06	0.625	6.13	3.50	1.25	0.56	#6-32 x .22 DP	8.54	4.27
L10	1.00	8.03	4.75	2.00	0.82	#10-24 x .30 DP	10.63	5.31
L12	1.25	8.53	5.00	1.75	0.75	1/4-20 x .38 DP	13.06	6.53
L15	1.50	10.53	7.00	3.00	1.00	1/4-20 x .38 DP	15.75	7.88

Dimensions in inches

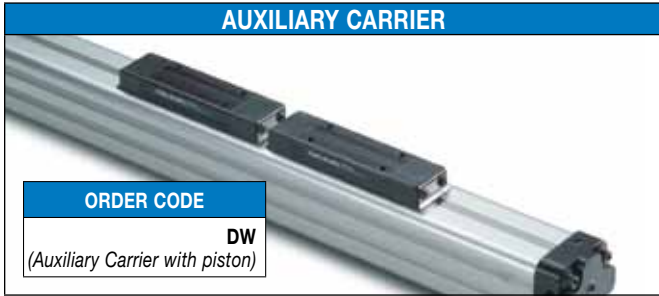
	BORE	A	B*	C*	D	E	F§	G
ML06	16	155.6	88.9	31.8	14.3	M3 x 0.5 x 6DP	217.0	108.5
M(MM)L10	25	204.0	120.7	50.8	20.9	M5 x 0.8 x 6DP	270.0	134.9
M(MM)L12	32	216.7	127.0	44.5	19.1	M6 x 1.0 x 10DP	331.7	165.8
M(MM)L15	40	267.5	177.8	76.2	25.4	M6 x 1.0 x 10DP	400.1	200.0

Dimensions in millimeters

\*Not the same as standard BC4 carrier  
§Actuator is longer than with standard BC4 carrier

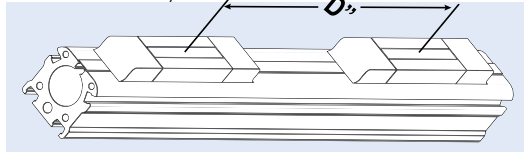
# BC4 Auxiliary Carrier - All Sizes

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR



## ORDERING INFORMATION

When ordering, determine the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart).

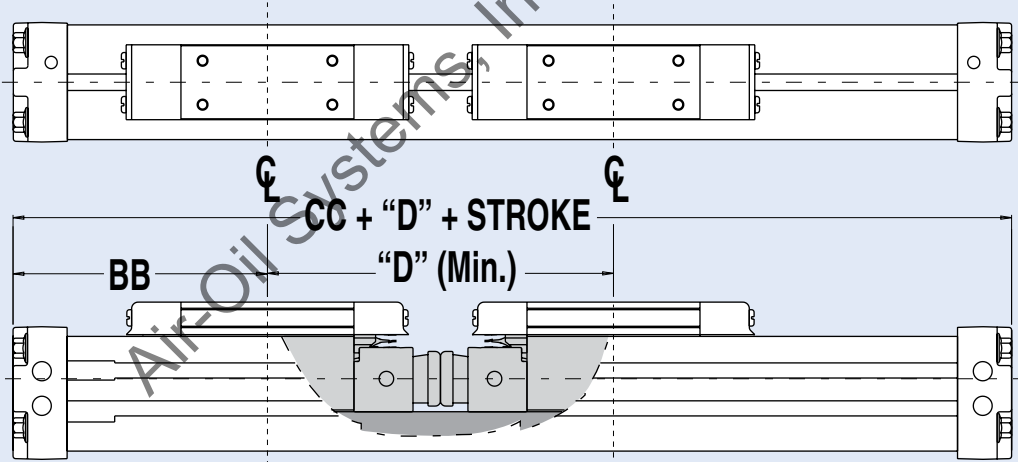


The auxiliary carrier option substantially increases load carrying and bending moments capacity over the standard single carrier models. As a general rule, the auxiliary carrier option is highly recommended in vertical applications (My) if the distance from the carrier mounting surface to the load center of gravity (CG) exceeds the overall length of the carrier. For the BC4 auxiliary carriers can only be ordered with "DW" an internal piston. (BC2 & BC3 auxiliary carriers may be ordered "DO" without a piston.)

Determine your working stroke and your "D" dimension, then enter these into your configuration string. (Example: BC415SK50.00DW15.00RT2) The configurator will calculate the overall length of the actuator.

**NOTE:** breakaway pressure will increase when using auxiliary carrier.

## DIMENSIONS

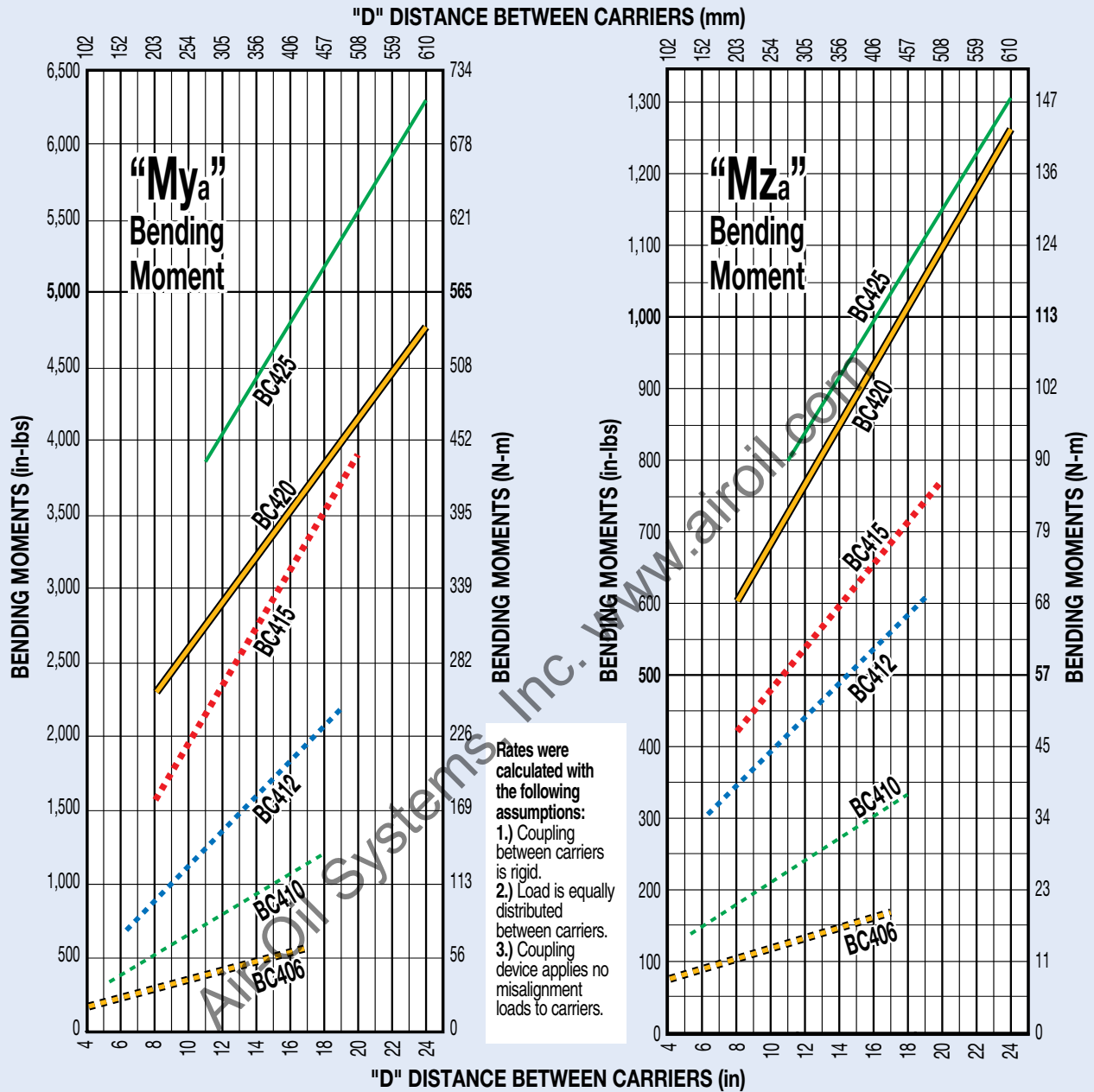


	BORE SIZE		BB		CC		"D" MINIMUM (with Piston)	
	in	mm	in	mm	in	mm	in	mm
<b>06</b>	0.625	16	3.15	79.9	6.30	159.8	4.26	108.2
<b>10</b>	1.00	25	3.94	100.2	7.88	200.4	5.30	134.6
<b>12</b>	1.25	32	4.87	123.7	9.74	247.4	6.23	158.2
<b>15</b>	1.50	40	5.88	149.4	11.81	300.0	8.00	203.2
<b>20</b>	2.00	50	6.18	157.0	12.36	314.0	8.12	206.3
<b>25</b>	2.50	63	8.42	213.9	16.85	427.9	11.04	280.4

# BC4 Auxiliary Carrier - All Sizes

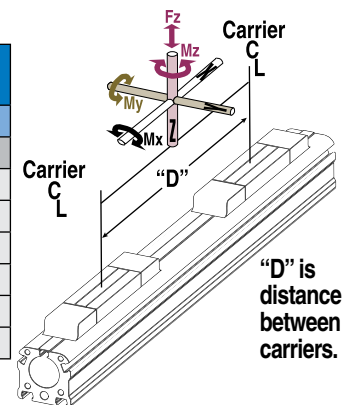
## PERFORMANCE

### BENDING MOMENTS



	BORE SIZE		"D" MINIMUM *		MAX. BENDING MOMENT		MAX. LOAD	
	in	mm	(with Piston)		Mx		Fz	
			in	mm	in-lbs	N-m	lbs	kg
<b>06</b>	0.625	16	4.26	108.2	6	0.68	60	27.0
<b>10</b>	1.00	25	5.30	134.5	18	2.03	130	59.0
<b>12</b>	1.25	32	6.23	158.2	72	8.13	230	104.0
<b>15</b>	1.50	40	8.00	203.2	110	12.43	390	176.9
<b>20</b>	2.00	50	8.12	206.3	196	22.15	540	244.9
<b>25</b>	2.50	63	11.04	280.4	240	27.12	740	335.7

\* "D" is distance between carriers

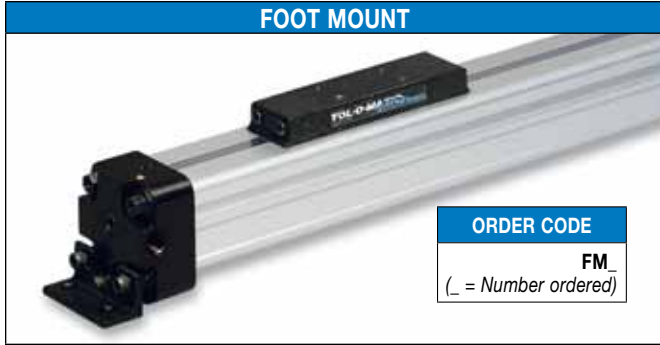


ABT  
MXP  
BCZ  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# BC4 Foot Mounts - ALL Sizes



## FOOT MOUNT



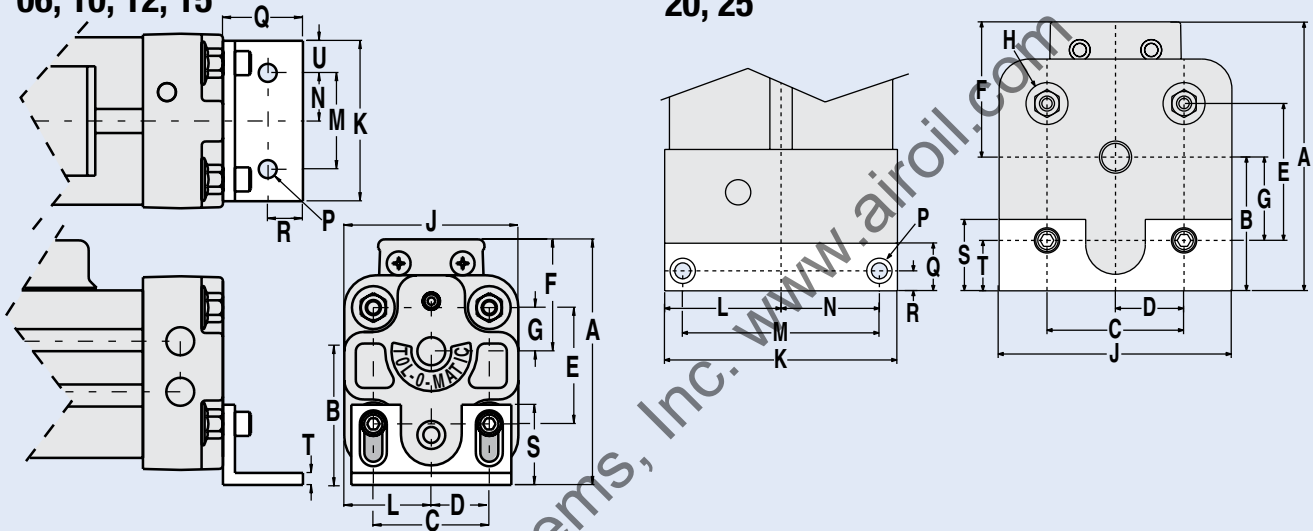
**ORDER CODE**  
**FM**  
 (\_ = Number ordered)

For mounting other than flush. Foot mounts may be specified on one or both ends of the cylinder.

## DIMENSIONS

06, 10, 12, 15

20, 25



BORE SIZE	A MIN.	A MAX.	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U
06	0.625	1.87	1.87	0.90	0.75	0.38	1.00	0.97	0.36	—	1.18	1.00	0.59	0.50	∅ .15 Thru (2)	0.70	0.30	0.38	0.06	0.25
10	1.00	2.19	2.54	0.98	1.10	0.55	1.10	1.21	0.55	10-24 ∇0.43	1.85	1.60	0.92	1.00	∅ .27 Thru (2)	1.00	0.28	0.98	0.19	0.30
12	1.25	2.93	3.20	1.46	1.62	0.81	1.62	1.47	0.61	1/4-20 ∇0.47	2.38	2.25	1.19	1.50	∅ .28 Thru (2)	1.00	0.40	1.00	0.19	0.38
15	1.50	3.38	3.83	1.64	1.81	0.91	1.81	1.74	0.68	1/4-20 ∇0.47	2.72	2.50	1.36	1.50	∅ .28 Thru (2)	1.25	0.55	1.25	0.19	0.50
20	2.00	4.62	4.62	2.54	2.25	1.13	2.25	2.08	1.52	3/8-16 ∇0.88	4.08	4.08	2.04	3.38	∅.334 ∟∅.531 ∇0.32	1.00	0.51	1.50	1.02	—
25	2.50	5.67	5.67	2.74	2.88	1.44	2.88	2.93	1.68	3/8-16 ∇0.88	4.88	4.88	2.44	4.13	∅.334 ∟∅.531 ∇0.32	1.00	0.58	1.50	1.06	—

Dimensions in inches

BORE SIZE	A MIN.	A MAX.	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U
M06	16	47.5	47.5	22.9	19.1	9.7	25.4	24.6	9.1	NA	30.0	25.4	15.0	12.7	∅ 3.8 Thru (2)	17.8	7.6	9.7	1.5	6.35
M10	25	55.6	64.5	24.9	27.9	14.0	27.9	30.8	14.0	M5 ∇10	47.0	40.6	23.4	25.4	∅ 6.9 Thru (2)	25.4	7.0	24.9	4.8	7.62
M12	32	74.3	81.3	37.1	41.1	20.6	41.1	37.3	15.5	M6 ∇12	60.5	57.1	30.2	38.1	∅ 7.1 Thru (2)	25.4	10.2	25.4	4.8	9.65
M15	40	85.9	97.3	41.7	46.0	23.1	46.0	44.2	17.3	M6 ∇12	69.1	63.5	34.5	38.1	∅ 7.1 Thru (2)	31.8	14.0	31.8	4.8	12.70
M20	50	117.3	117.3	64.5	57.2	28.6	57.2	52.9	38.6	M8 ∇22	103.6	103.6	51.8	85.7	∅8.5 ∟∅13.5 ∇8.1	25.4	13.0	38.1	25.9	—
M25	63	144.0	144.0	69.6	73.2	36.6	73.2	74.4	42.7	M8 ∇22	124.0	124.0	62.0	104.9	∅8.5 ∟∅13.5 ∇8.1	25.4	14.7	38.1	26.9	—

Dimensions in millimeters



# BC4 Tube Supports - ALL Sizes

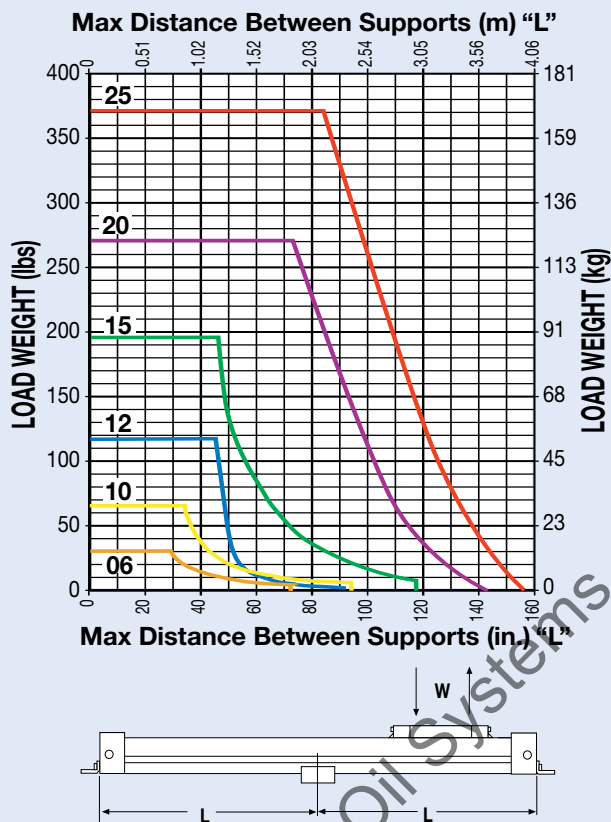


Made of anodized aluminum, BC4 tube supports are designed to attach to T-nuts inside the grooves which run the length of the cylinder tube. Refer to the tube support graph to determine the number of tube supports required.

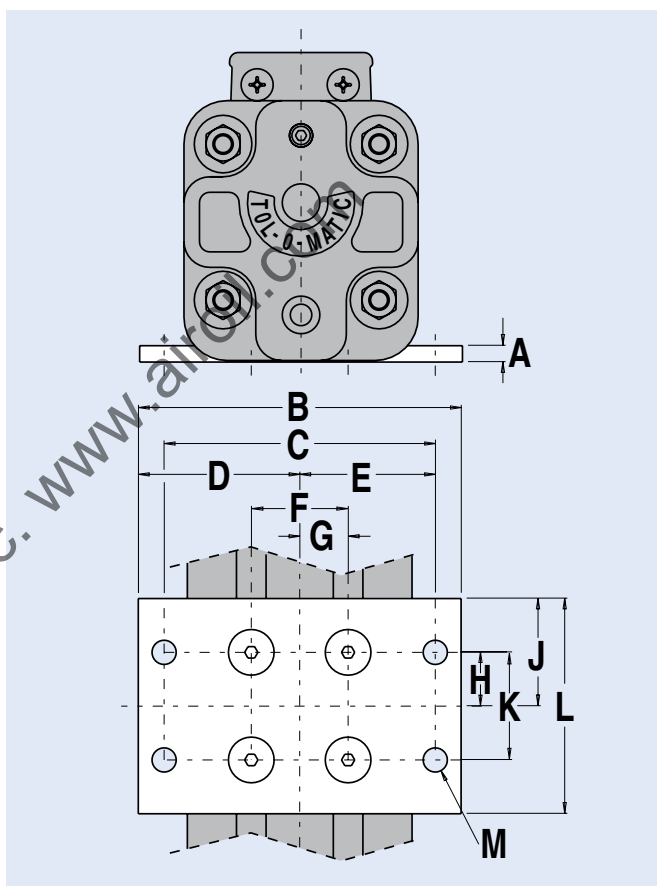
**NOTE:** Switches cannot be mounted on the same face of the actuator as tube supports.

## PERFORMANCE

### TUBE SUPPORT REQUIREMENTS



## DIMENSIONS



	BORE SIZE	A	B	C	D	E	F	G	H	J	K	L	M	
	06	0.625	0.12	1.69	1.38	0.84	0.69	0.50	0.25	0.75	1.00	1.50	2.00	Ø .15 Thru (4)
	10	1.00	0.19	2.75	2.25	1.38	1.13	1.10	0.55	0.50	0.88	1.00	1.75	Ø .23 Thru (4)
	12	1.25	0.30	3.50	2.84	1.75	1.42	0.90	0.45	0.50	1.00	1.00	2.00	Ø .28 Thru (4)
	15	1.50	0.19	3.75	3.15	1.88	1.58	1.13	0.56	0.63	1.25	1.25	2.50	Ø .28 Thru (4)
	20	2.00	0.25	6.00	5.00	3.00	2.50	2.00	1.00	0.75	1.50	1.50	3.00	Ø.344 Thru (4)
	25	2.50	0.25	6.50	5.50	3.25	2.75	2.75	1.38	0.75	1.50	1.50	3.00	Ø.344 Thru (4)

Dimensions in inches

	BORE SIZE	A	B	C	D	E	F	G	H	J	K	L	M	
	M06	16	3.2	41.7	34.9	21.4	17.5	12.7	6.4	19.1	25.4	38.1	50.8	Ø 3.9 Thru (4)
	M10	25	4.8	69.9	57.1	35.1	28.7	27.9	14.0	12.7	22.2	25.4	44.4	Ø 5.8 Thru (4)
	M12	32	7.6	88.9	72.1	44.4	38.1	22.9	11.4	12.7	25.4	25.4	50.8	Ø 7.1 Thru (4)
	M15	40	4.8	95.3	80.0	47.8	40.1	28.7	14.2	16.0	31.8	31.8	63.5	Ø 7.1 Thru (4)
	M20	50	6.4	152.4	127.0	76.2	63.5	50.8	25.4	19.1	38.1	38.1	76.2	Ø 8.7 Thru (4)
	M25	63	6.4	165.1	139.7	82.6	69.9	69.9	34.9	19.1	38.1	38.1	76.2	Ø 8.7 Thru (4)

Dimensions in millimeters

# BC4 Floating Mount Bracket - ALL Sizes



## FLOATING MOUNT BRACKET



ORDER CODE  
FL

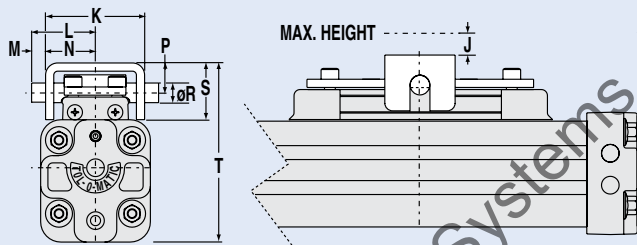
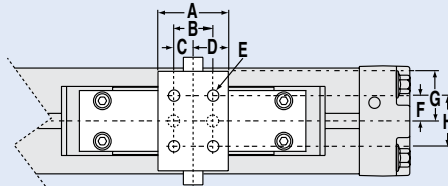
For applications where a BC4 band cylinder is moving a load that is externally guided and supported. An externally guided load, not parallel to the BC4 band cylinder may result in cylinder binding. The floating mount bracket compensates for nonparallelism between the cylinder and the external guide.

⊗ (Floating mount brackets are not to be used in conjunction with shock absorbers)

## DIMENSIONS

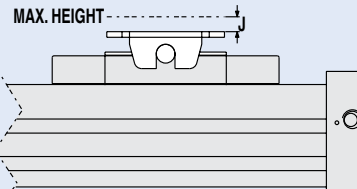
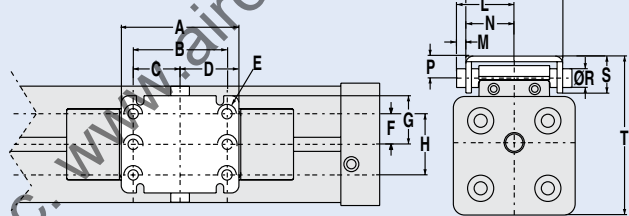
06, 10, 12, 15

**Please Note: For Dimension "E"**  
BC406 and BC410 use 2 center holes  
BC412 and BC415 use 4 corner holes



20, 25

**Please Note: For Dimension "E"**  
BC420 uses 2 center holes  
BC425 uses 4 corner holes



	BORE SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	ØR	S	T
06	0.625	0.90	0.50	0.25	0.45	Ø .17 Thru (2)	NA	0.63	NA	0.33	1.27	0.81	0.18	0.63	0.38	0.25	0.72	2.18
10	1.00	1.26	0.63	0.32	0.63	Ø .22 Thru (2)	NA	0.82	NA	0.33	1.64	1.00	0.18	0.82	0.56	0.38	1.01	3.04
12	1.25	1.50	0.75	0.37	0.75	Ø .28 Thru (4)	0.50	1.09	1.00	0.44	2.18	1.50	0.41	1.09	0.99	0.44	1.49	4.10
15	1.50	1.50	0.75	0.38	0.75	Ø .28 Thru (4)	0.63	1.24	1.25	0.52	2.48	1.63	0.39	1.24	0.99	0.44	1.56	4.62
20	2.00	3.94	3.15	1.57	1.97	Ø.344 Thru (2)	NA	1.62	NA	0.50	3.24	1.93	0.31	1.62	0.73	0.63	1.23	5.26
25	2.50	4.72	3.94	1.97	2.36	Ø.344 Thru (4)	1.39	1.78	2.77	0.57	3.54	2.36	0.59	1.77	0.75	0.63	1.32	6.28

Dimensions in inches

	BORE SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	ØR	S	T
M06	16	22.9	12.7	6.4	11.5	Ø 4.3 Thru (2)	NA	16.1	NA	8.3	32.2	20.7	4.6	16.0	9.7	6.4	18.3	55.4
M10	25	32.0	16.0	8.0	16.0	Ø 5.3 Thru (2)	NA	20.8	NA	8.3	41.7	25.4	4.6	20.8	14.2	9.7	25.7	77.2
M12	32	38.1	19.0	9.4	19.0	Ø 7.1 Thru (4)	12.7	27.7	25.4	11.2	55.4	38.1	10.4	27.7	25.1	11.2	37.8	104.1
M15	40	38.1	19.0	9.7	19.0	Ø 7.1 Thru (4)	16.0	31.5	31.8	13.2	63.0	41.4	9.9	31.5	25.1	11.2	39.6	117.3
M20	50	100.1	80.0	39.9	50.0	Ø8.7 Thru (2)	NA	41.2	NA	12.7	82.3	49.1	7.9	41.2	18.6	15.9	31.2	133.6
M25	63	119.9	100.1	50.0	59.9	Ø8.7 Thru (4)	35.2	45.1	70.4	14.4	89.9	60.0	15.0	45.0	19.1	15.9	33.5	159.5

Dimensions in millimeters

# BC4 Switches - ALL Sizes

## SWITCHES



There are 10 sensing choices: DC reed, form A (open) or form C (open or closed); AC reed (Triac, open); Hall-effect, sourcing, PNP (open); Hall-effect, sinking, NPN (open); each with either flying leads or QD (quick disconnect). Commonly used to send analog signals to PLC (programmable logic controllers), TLL, CMOS circuit or other controller device. These switches are activated by the actuator's magnet.

Switches contain reverse polarity protection. QD cables are shielded; shield should be terminated at flying lead end.

If necessary to remove factory installed switches, be sure to reinstall on the same side of actuator with scored face of switch toward internal magnet.

## SPECIFICATIONS

ORDER CODE	REED DC				REED AC		HALL-EFFECT DC			
	<b>R T</b>	<b>R M</b>	<b>B T</b>	<b>B M</b>	<b>C T</b>	<b>C M</b>	<b>T T</b>	<b>T M</b>	<b>K T</b>	<b>K M</b>
PART NUMBER	3600-9082	3600-9083	3600-9084	3600-9085	3600-9086	3600-9087	3600-9088	3600-9089	3600-9090	3600-9091
LEAD	5m	QD*	5m	QD*	5m	QD*	5m	QD*	5m	QD*
CABLE SHIELDING	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†
SWITCHING LOGIC	"A" Normally Open		"C" Normally Open or Closed		Triac Normally Open		PNP (Sourcing) Normally Open		NPN (Sinking) Normally Open	
MECHANICAL CONTACTS	Single-Pole Single-Throw		Single-Pole Double-Throw		Single-Pole Single-Throw		NO, These Are Solid State Components			
COIL DIRECT	Yes		Yes		Yes		—			
POWER LED	None		None		None		None		None	
SIGNAL LED	Red		None		None		Red		Red	
OPERATING VOLTAGE	200 Vdc max.		120 Vdc max.		120 Vac max.		5 - 25 Vdc			
OUTPUT RATING	—		—		—		25 Vdc, 200mA dc			
OPERATING TIME	0.6 msec max. (including bounce)		0.7 msec max. (including bounce)		—		< 10 micro sec.			
OPERATING TEMPERATURE	-40°F [-40°C] to 158°F [70°C]						0°F [-18°C] to 150°F [66°C]			
RELEASE TIME	1.0 msec. max.		—		—		—			
ON TRIP POINT	—		—		—		150 Gauss maximum			
OFF TRIP POINT	—		—		—		40 Gauss minimum			
**POWER RATING (WATTS)	10.0 §		3.0 §§		10.0		5.0			
VOLTAGE DROP	2.6 V typical at 100 mA		NA		—		—			
RESISTANCE	0.1 Ω Initial (Max.)		—		—		—			
CURRENT CONSUMPTION	—		—		1 Amp at 86°F [30°C]   0.5 Amp at 140°F [60°C]		200 mA at 25 Vdc			
FREQUENCY	—		—		47 - 63 Hz		—			
CABLE MIN. BEND RADIUS	STATIC	0.630" [16mm]								
	DYNAMIC	Not Recommended								

**CAUTION: DO NOT OVER TIGHTEN SWITCH HARDWARE WHEN INSTALLING!**

**\*\* WARNING:** Do not exceed power rating (Watt = Voltage X Amperage). Permanent damage to sensor will occur.

\*QD = Quick Disconnect; Male coupler is located 6" [152mm] from sensor, Female coupler to flying lead (part #2503-1025) distance is 197" [5m] also see Cable Shielding specification above

**REPLACEMENT OF QD SWITCHES MANUFACTURED BEFORE JULY 1, 1997:** It will be necessary to replace or rewire the female end coupler.



**Reed Switch Life Expectancy:** Up to 200,000,000 cycles (depending on load current, duty cycle and environmental conditions)

†Shielded from the female quick disconnect coupler to the flying leads. Shield should be terminated at flying lead end.

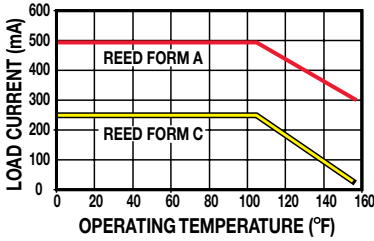
§ Maximum current 500mA (not to exceed 10VA) Refer to Temperature vs. Current graph and Voltage Derating graph

§§ Maximum current 250mA (not to exceed 3VA) Refer to Temperature vs. Current graph and Voltage Derating graph

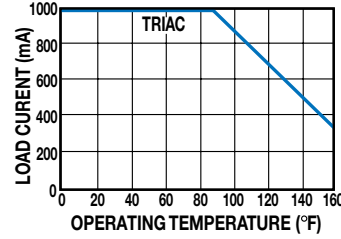
# BC4 Switches - ALL Sizes

## PERFORMANCE

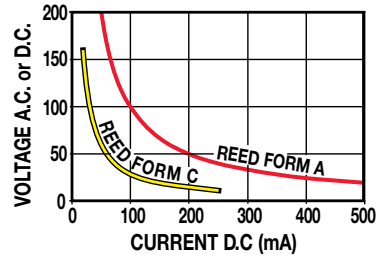
TEMP. vs CURRENT, DC REED



TEMP. vs CURRENT, AC REED

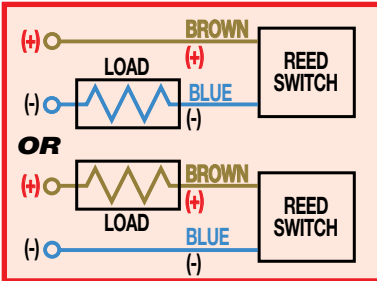


VOLTAGE DERATING, DC REED

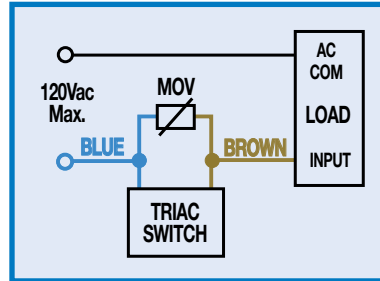


## WIRING DIAGRAMS

**R**T & **R**M DC REED, FORM A



**C**T & **C**M AC REED, TRIAC

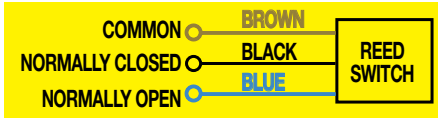


## INSTALLATION INFORMATION

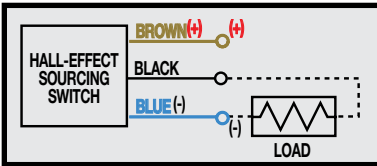


**⚠** THE NOTCHED FACE OF THE SWITCH INDICATES THE SENSING SURFACE AND MUST FACE TOWARD THE MAGNET.

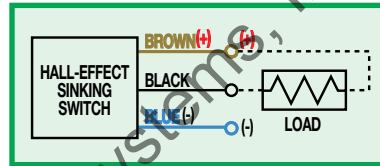
**B**T & **B**M DC REED, FORM C



**T**T & **T**M HALL-EFFECT, SOURCING, PNP

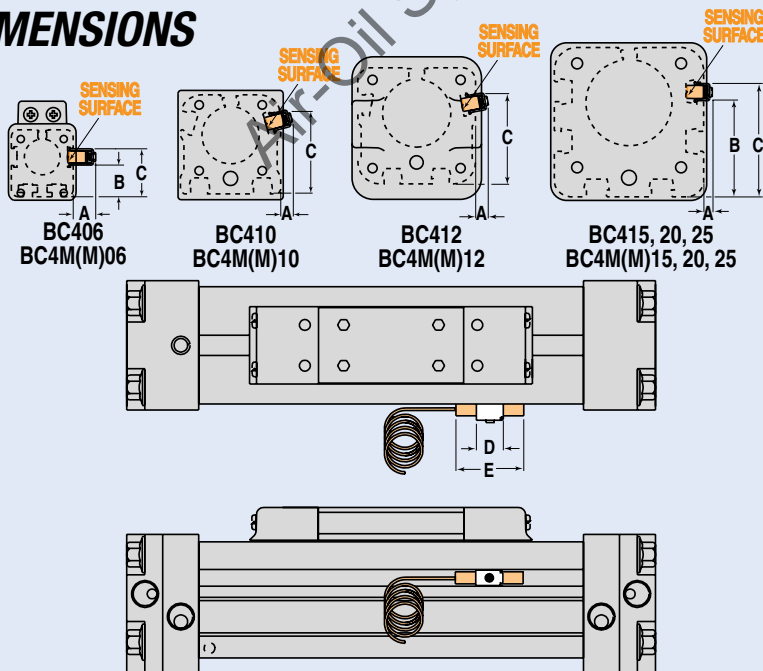


**K**T & **K**M HALL-EFFECT, SINKING, NPN



**ⓘ** Some actuators may require switch mounting on a specific side of the assembly. Call Tolomatic for details.

## DIMENSIONS



SIZE	BORE	A	B	C	D	E
06	0.625	0.39	0.55	0.84	0.50	1.25
10	1.000	0.22	-	1.47	0.50	1.25
12	1.250	0.23	-	1.66	0.50	1.25
15	1.500	0.16	-	1.98	0.50	1.25
20	2.000	0.04	1.88	2.18	0.50	1.25
25	2.500	0.04	2.41	2.70	0.50	1.25

Dimensions in inches

SIZE	BORE	A	B	C	D	E
M06	12	9.91	13.97	21.34	12.70	31.75
M10	25	5.59	-	37.34	12.70	31.75
M12	32	5.84	-	42.16	12.70	31.75
M15	40	4.06	-	50.29	12.70	31.75
M20	50	1.02	47.75	55.37	12.70	31.75
M25	63	1.02	61.21	68.58	12.70	31.75

Dimensions in millimeters

# BC4 Shock Absorbers - All Sizes



Rodless cylinders with standard internal cushion offer an effective method of decelerating loads. However, all Tolomatic rodless cylinders are capable of carrying heavier loads at higher velocities than the cylinder cushion can absorb. Optional shock absorbers can be used to increase the cylinder's life and broaden the application range for the cylinder model you have chosen.

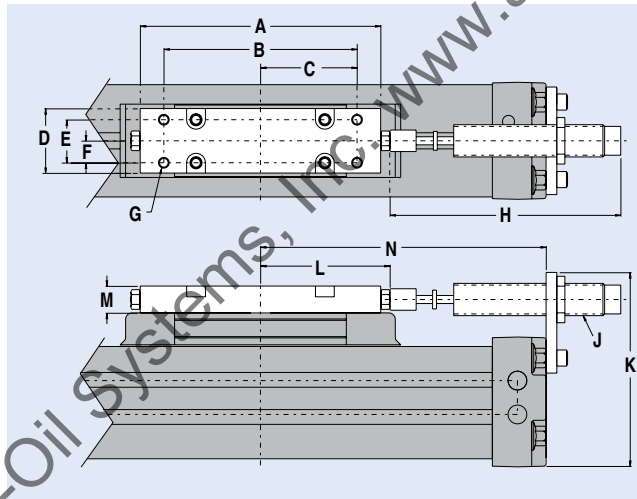
A shock stop plate must be used in conjunction with the BC4 shock to provide a stopping surface on the carrier.

Typical shock absorber life varies between 1-2 million cycles (depending on environment) appropriate preventative maintenance should be considered in high cyclic applications.

**NOTE:** When 2 shock absorbers are ordered, the unit will be assembled with NO internal cushions.

**CAUTION:** In applications which result in a load bending moment at deceleration, care should be taken to decelerate the load rather than the carrier of the band cylinder.

## DIMENSIONS



SIZE	BORE	A	B	C	D	E	F	G	H(min.)	H(max.)	J	K	L	M	N
06	0.625	3.89	2.25	1.13	0.72	0.50	0.25	#6-32 Thru (4)	2.25	2.79	3/8-32 UNF-2B	2.25	1.72	0.44	3.15
10	1.000	4.00	3.00	1.50	1.09	0.75	0.38	#10-24 Thru (4)	3.71	4.25	9/16-18 UNF-2B	3.03	2.18	0.50	3.94
12	1.250	4.00	3.18	1.58	1.31	0.75	0.37	1/4-20 Thru (4)	4.50	5.38	3/4-16 UNF THD	3.92	2.25	0.63	5.89
15	1.500	5.60	4.50	2.25	1.50	1.00	0.51	1/4-20 Thru (4)	4.50	5.38	3/4-16 UNF THD	4.50	3.02	0.63	6.65
20	2.000	6.69	5.00	2.50	2.25	1.50	0.75	5/16-18 Thru (4)	5.32	5.75	1-12 UNF THD	5.85	3.66	0.99	6.18
25	2.500	8.83	6.00	3.00	2.50	1.82	0.91	5/16-18 Thru (4)	5.32	5.75	1-12 UNF THD	6.92	4.73	1.24	8.42

Dimensions in inches

SIZE	BORE	A	B	C	D	E	F	G	H(min.)	H(max.)	J	K	L	M	N
M06	16	98.8	57.2	28.6	18.3	12.7	6.4	#6-32 Thru (4)	57.2	70.9	M8 x 1.0	57.2	43.6	11.1	79.9
M10	25	101.6	76.2	38.1	27.7	19.0	9.7	M5 x 0.8 Thru (4)	94.2	107.9	M14 x 1.5	77.0	55.4	12.7	100.1
M12	32	101.6	80.8	40.4	33.3	19.0	9.4	M6 x 1.0 Thru (4)	114.3	136.7	M20 x 1.5	99.6	57.1	16.0	149.6
M15	38	142.2	114.3	57.1	38.1	25.4	13.0	M6 x 1.0 Thru (4)	114.3	136.7	M20 x 1.5	114.3	76.7	16.0	168.9
M20	50	169.9	127.0	63.5	57.2	38.1	19.1	M8 x 1.25 Thru (4)	135.0	146.1	M25 X 1.5-6g	148.6	93.0	25.1	157.0
M25	63	224.3	152.4	76.2	63.5	46.2	23.1	M8 x 1.25 Thru (4)	135.0	146.1	M25 X 1.5-6g	175.8	120.1	31.5	213.9

Dimensions in millimeters

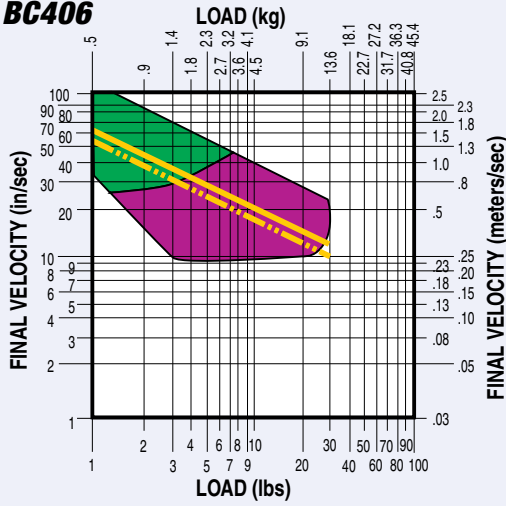
ABT  
IMXP  
BCZ  
BC3  
BC4  
LS  
MG  
PB  
ENGR

# BC4 Shock Absorbers - All Sizes

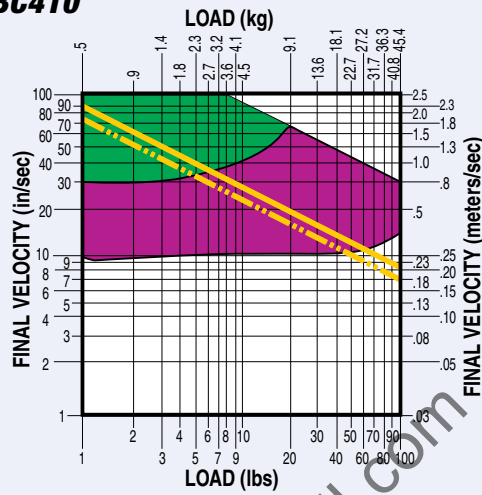
## PERFORMANCE


### VELOCITY vs LOAD

**BC406**




**BC410**

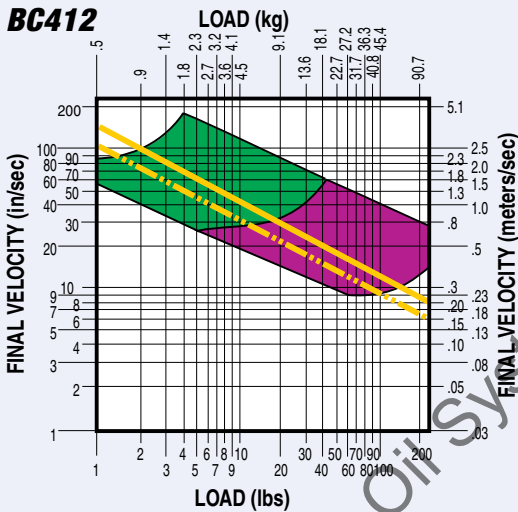


 LIGHT DUTY (Light load/High velocity)

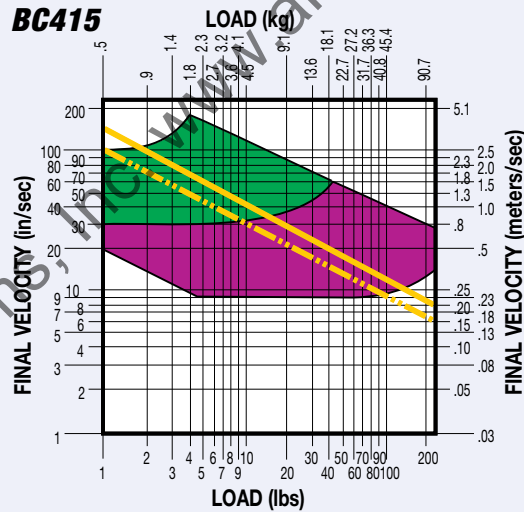
 HEAVY DUTY (Heavy load/Low velocity)

 AIR CUSHION DATA

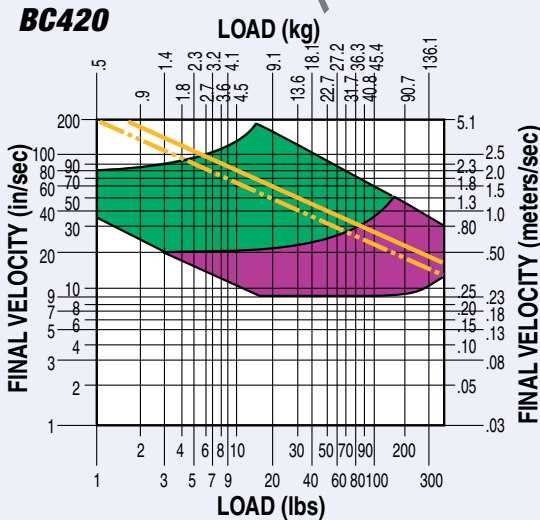
**BC412**



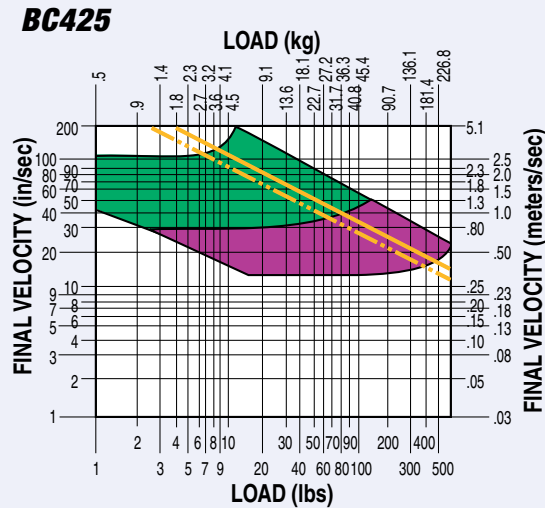
**BC415**




**BC420**



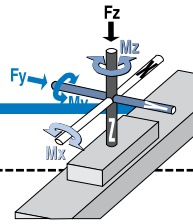
**BC425**



 NOTE: If final (or impact) velocity cannot be calculated directly, a reasonable guideline to use is 2 x average velocity.

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# Application Data Worksheet



## STROKE LENGTH \_\_\_\_\_

inch (S/K)  millimeters  
(U.S. Standard) (Metric)

## AVAILABLE AIR PRESSURE \_\_\_\_\_

PSI  bar  
(U.S. Standard) (Metric)

## REQUIRED THRUST FORCE \_\_\_\_\_

lbf  N  
(U.S. Standard) (Metric)

## LOAD \_\_\_\_\_

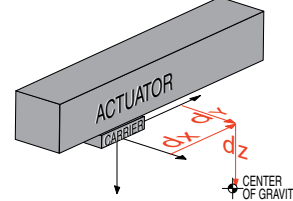
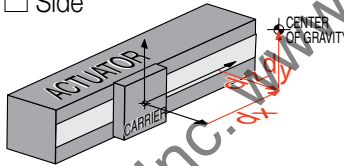
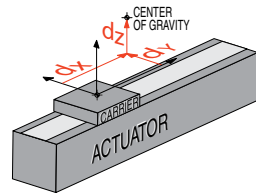
lb  kg  
(U.S. Standard) (Metric)

## LOAD CENTER OF GRAVITY DISTANCE TO CARRIER CENTER

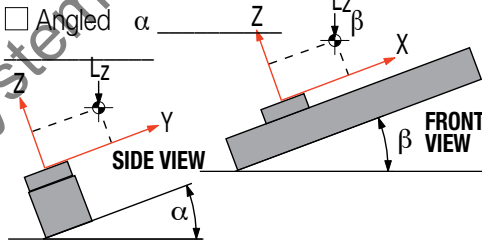
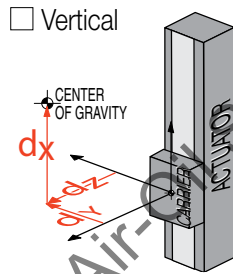
$d_x$  \_\_\_\_\_  
 $d_y$  \_\_\_\_\_  
 $d_z$  \_\_\_\_\_  
 inch  millimeters  
(U.S. Standard) (Metric)

## ORIENTATION

Horizontal  Side  Horizontal Down



Vertical



## OTHER ISSUES:

(i.e. Environment, Temperature, Contamination, etc.)

## FORCES APPLIED TO CARRIER

lbf  N  
(U.S. Standard) (Metric)

$F_z$  \_\_\_\_\_  
 $F_y$  \_\_\_\_\_

## BENDING MOMENTS APPLIED TO CARRIER

in-lbs  N-m  
(U.S. Standard) (Metric)

$M_x$  \_\_\_\_\_  
 $M_y$  \_\_\_\_\_  
 $M_z$  \_\_\_\_\_

## FINAL VELOCITY \_\_\_\_\_

in/sec  mm/sec  
(U.S. Standard) (Metric)

## MOVE TIME sec. \_\_\_\_\_

## NO. OF CYCLES \_\_\_\_\_

per minute  per hour

Contact information: \_\_\_\_\_



Fax (1-763-478-8080) or call Tolomatic (1-800-328-2174) with the above information. We will provide any assistance needed to determine the proper actuator.

# Rodless Cylinder Selection Guidelines - BC2, BC3, BC4, LS - All Sizes

## PROVIDING LOAD GUIDANCE AND SUPPORT

The process of selecting a load bearing actuator for a given application can be complex. It is highly recommended that you contact Tolomatic or a Tolomatic Distributor for assistance in selecting the best actuator for your application. The following overview of the selection guidelines are for educational purposes only.

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Band Cylinder or Linear Slide model for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs or kg)
- Orientation of load (lbs or kgs)
- Velocity of load (in/sec or mm/sec)
- Stroke length (in or mm)

HINT: Use Tolomatic sizing and selection software, download at: [tolomatic.com](http://tolomatic.com)

### 2 SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 3), the actuator will accommodate the application.

If the intersection is above the diagonal line, a larger cylinder bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 DETERMINE NATURE OF LOAD AND THE EFFECT OF BENDING MOMENTS

If the cylinder will guide and support a load located directly over the center of carrier, bending moments will not be a factor in the cylinder selection.

NOTE: The maximum load "L" must not exceed the capacity limits of the cylinder selected.

- Bending Moments

For off center or side loads, determine the distance from the center of mass of the load to the center of the carrier bracket. This measurement is needed to calculate the torque for bending moments. (Refer to Bending Moment chart for each model.)

Should the resulting maximum bending moment exceed figures indicated on the chart, external guides, auxiliary carrier/s or a larger cylinder should be considered.

- Auxiliary Carrier Bending Moments

The auxiliary carrier option (available on most models) increases load carrying capacity and bending moments. Auxiliary carriers can be ordered with or without an internal piston. (Auxiliary

carriers without a piston have no internal cushion on the cylinder end closest to the auxiliary carrier.)

IMPORTANT: When ordering, determine the working stroke, then the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart). When ordered, Tolomatic's configurator will calculate the overall length of the actuator.

NOTE: breakaway pressure will increase when using auxiliary carriers.

### 4 DETERMINE INTERNAL CUSHION CAPACITY

- Consult the Cushion Data chart for the model selected. The velocities listed on the cushion charts are final or cushion impact velocities. On applications where the internal cushions or bumpers are to be used, be sure the actual, final or impact velocity is known. If the velocity is not known, use of limit switches with valve deceleration circuits or shock absorbers should be considered. NOTE: The BC205 uses external bumpers in place of internal cushions, LS05 & LS10 do not have cushions or bumpers.

- Cross-reference the final velocity and weight of the load. If the intersection is below the diagonal lines, the internal cushions on the actuator may be used. If the point falls above the dashed diagonal line or if the velocity is not known, use deceleration circuits, external shock absorbers or select a

larger cylinder with greater cushion capacity. On high-cyclic applications, use of external stops is strongly recommended.

### 5 DETERMINE TUBE SUPPORT REQUIREMENTS

- Consult the Tube Support chart for the model selected.
- Cross reference the load weight and maximum distance between supports.

### 6 CONSIDER OPTIONS

- Switches— dc Reed, Hall-effect or ac Triac

Band Cylinders and Linear Slides each have different standard features and options. Check the options section for the actuator you have selected.

- Shock Absorbers— if needed.
- Foot Mounting Kits
- Floating Mount Bracket – use when lack of parallelism occurs between the cylinder and an external guided and supported load.
- Single End Porting (BC3, BC4)
- Long Carrier (BC4)
- Proximity Sensors (LS)
- Dual 180° Carrier (BC3)



# Application Guidelines

The following conditional statements are intended as general guidelines for use of Tolomatic actuators. Since all applications have their own specific operating requirements, consult Tolomatic, Inc. or your local Tolomatic distributor if an application is unconventional or if questions arise regarding the selection process.

## CUSHION NEEDLE ADJUSTMENT (BC2, BC3, BC4, CC, SA, DP, TC ONLY)



Adjust the cushion needles in the cylinder heads carefully to obtain a smooth, hesitation free deceleration for your particular application. If there are questions on proper adjustment, please consult Tolomatic, Inc.



## LUBRICATION GUIDELINES

All Tolomatic actuators (except Cable Cylinders) are prelubricated at the factory. To ensure maximum actuator life, the following guidelines should be followed.

### • Filtration

We recommend the use of dry, filtered air in our products. "Filtered air" means a level of 10 Micron or less. "Dry" means air should be free of appreciable amounts of moisture. Regular maintenance of installed

filters will generally keep excess moisture in check.


### • External Lubricators (optional)

The factory prelubrication of Tolomatic actuators will provide optimal performance without the use of external lubrication. However, external lubricators can further extend service life of pneumatic actuators if the supply is kept constant.

Oil lubricators, (mist or drop) should supply a minimum of 1 drop per 20 standard cubic feet per minute to the

cylinder. As a rule of thumb, double that rate if water in the system is suspected. Demanding conditions may require more lubricant.

If lubricators are used, we recommend a non-detergent, 20cP @ 140°F 10-weight lubricant. Optimum conditions for standard cylinder operation are +32° to +150°F (+0° to 65.5°C).

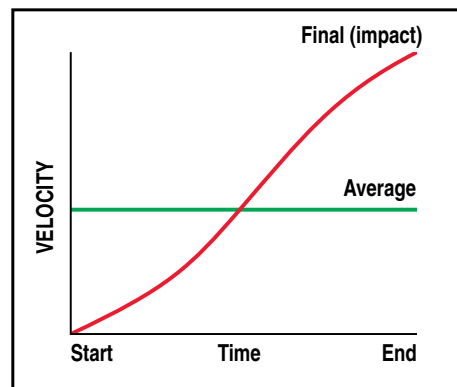
 NOTE: Use of external lubricators may wash away the factory installed lubrication. External lubricants must be maintained in a constant supply or the results will be a dry actuator prone to premature wear.

### • Sanitary Environments

Oil mist lubricators must dispense "Food Grade" lubricants to the air supply. Use fluids with ORAL LD50 toxicity ratings of 35 or higher such as Multitherm® PG-1 or equivalent. Demanding conditions can require a review of the application.

## FINAL VELOCITY CALCULATION

Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Stroking a 100-inch BC3 model in one second yields an average velocity of 100 inches per second. To properly determine the inertial forces for cushioning, it is important to know the



final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered (see diagram).

If final (or impact) velocity cannot be calculated directly, a reasonable guideline is to use 2 x average velocity.

# BC4 Ordering - ALL Sizes

## MODEL, BORE, STROKE

## OPTIONS

**BC4** **10** **SK100** **250** **DW6** **0** **TS3** **FM2** **SH2** **BM2**

### MODEL & MOUNTING

**BC4** BC4 Band Cylinder - inch (U.S. Standard)  
**BC4M** metric mounting with taper port  
**BC4MM** metric mounting with parallel port

### BORE SIZE

<b>06</b>	0.625" (16mm)
<b>10</b>	1.00" (25mm)
<b>12</b>	1.25" (32mm)
<b>15</b>	1.50" (40mm)
<b>20</b>	2.00" (50mm)
<b>25</b>	2.50" (63mm)

### STROKE LENGTH

**SK**\_\_\_ Enter desired stroke length in decimal inches

#### MAXIMUM STROKE

SIZE	BC4		BC4M(MM)	
	in	mm	in	mm
<b>06</b>	211	5,359		
<b>10</b>	210	5,334		
<b>12</b>	208	5,283		
<b>15</b>	206	5,232		
<b>20</b>	156	3,962		
<b>25</b>	211	5,359		

### AUXILIARY CARRIER (BC4\_20)

**DW** Auxiliary carrier With piston & "D" distance  
 \_\_\_ "D" Distance between carriers

⊗ Not available for 05 size

#### MINIMUM "D" DISTANCE BETWEEN CARRIERS

	with Piston	
	in	mm
<b>06</b>	4.26	108.2
<b>10</b>	5.30	134.6
<b>12</b>	6.23	158.2
<b>15</b>	8.00	203.2
<b>20</b>	8.12	206.3
<b>25</b>	11.04	280.4

📄 \*When ordering auxiliary carrier option, enter the distance required between carriers. The configurator will calculate the overall length of the actuator.

### TUBE SUPPORTS (BC4\_23)

**TS**\_ Tube Support & number required

### T-NUTS

**TN**\_ additional T-Nuts (see individual dimensional drawings for sizes)

### FOOT MOUNT (BC4\_22)

**FM**\_ Foot Mount & number required (1 or 2)

### FLOATING MOUNT (BC4\_24)

**FL** Floating Mount Bracket  
 ⊗ Not compatible with shock absorbers

### SHOCK ABSORBERS (BC4\_27)

**\*SD**\_ Shock hardware Only and number required  
**\*SH**\_ Shock, Heavy duty and number required  
**\*SL**\_ Shock, Light duty and number required

📄 \*NOTE: When shock absorbers are ordered cushion seals are removed.

### SWITCHES (BC4\_25)

TYPE		QUICK-DISCONNECT	CODE	QUANTITY	LEAD LENGTH
REED	Form A	QD	<b>RM</b>	After code enter quantity desired	5 meters
		no	<b>RT</b>		
Form C		QD	<b>BM</b>		
		no	<b>BT</b>		
HALL-EFFECT	Sinking	QD	<b>KM</b>		
		no	<b>KT</b>		
Sourcing		QD	<b>TM</b>		
		no	<b>TT</b>		
TRIAC		QD	<b>CM</b>		
		no	<b>CT</b>		

### PORTING OPTION

**HD** Single End Porting  
 ⊗ Not available for 06 size

📄 Not all codes listed are compatible with all options. Contact Tolomatic with any questions.



Use the Tolomatic Sizing Software to determine available options and accessories based on your application requirements.

# BC4 Service Parts Ordering - ALL Sizes

Inch (U.S. Standard) SIZE	06	10	12	15	20	25	30	40
<b>Auxiliary Carrier Option</b>	6906-9023	6910-9023	6912-9023	6915-9023	6920-9023	6925-9023	6930-9023	6940-9023
<b>Floating Mount Kits</b>	6906-9004	6910-9004	6912-9004	6915-9004	6920-9004	6925-9004	6930-9004	6940-9004
<b>Foot Mount Kits<sup>1</sup></b>	6906-9003	6910-9003	6912-9003	6915-9003	6920-9003	6925-9003	6930-9003	6940-9003
<b>Shock Abs. Field Retrofit Kit – Heavy Duty<sup>2</sup></b>	6906-9006	6910-9020	6912-9020	6915-9020	6920-9020	6925-9020	–	–
<b>Shock Abs. Field Retrofit Kit – Lite Duty<sup>2</sup></b>	6906-9005	6910-9005	6912-9005	6915-9005	6920-9005	6925-9005	–	–
<b>Shock Abs. Field Mount Kit (Hardware Only)<sup>3</sup></b>	6906-9024	6910-9024	6912-9024	6915-9024	6920-9024	6925-9024	–	–
<b>Shock Stop Kit<sup>4</sup></b>	6906-9019	6910-9019	6912-9019	6915-9019	6920-9019	6925-9019	–	–
<b>Shock Stop Kit (Long Carrier)<sup>4</sup></b>	6906-9029	6912-9029	6912-9029	6915-9029	–	–	–	–
<b>Single End Porting<sup>5</sup></b>	NA	6910-9018	6912-9018	6915-9018	6920-9017	6925-9017	Std.	Std.
<b>Switch (Hardware Only)</b>	2506-9999	6910-9999	6910-9999	3415-9999	3420-9999	3420-9999	3420-9999	6940-9005
<b>Tube Supports<sup>6</sup></b>	6906-9002	6910-9002	6912-9002	6915-9002	6920-9002	6925-9002	6930-9002	6940-9002
<b>Repair Kits<sup>7,8</sup></b>	RKBC406	RKBC410	RKBC412	RKBC415	RKBC420	RKBC425	RKBC430	RKBC440
<b>Seal Kits<sup>9</sup></b>	6906-9022	6910-9022	6912-9022	6915-9022	6920-9022	6925-9022	6930-9022	6940-9022

Metric SIZE	M(MM)06	M(MM)10	M(MM)12	M(MM)15	M(MM)20	M(MM)25	M(MM)30	M(MM)40
<b>Auxiliary Carrier Option</b>	7906-9023	7910-9023	7912-9023	7915-9023	7920-9023	7925-9023	7930-9023	7940-9023
<b>Floating Mount Kits</b>	7906-9004	7910-9004	7912-9008	7915-9008	7920-9004	7925-9004	7930-9005	7940-9005
<b>Foot Mount Kits<sup>1</sup></b>	7906-9003	7910-9003	7912-9004	7915-9003	7920-9003	7925-9003	7930-9003	7940-9003
<b>Shock Abs. Field Retrofit Kit – Heavy Duty<sup>2</sup></b>	7906-9006	7910-9007	7912-9006	7915-9005	7920-9020	7925-9020	–	–
<b>Shock Abs. Field Retrofit Kit – Lite Duty<sup>2</sup></b>	7906-9005	7910-9005	7912-9005	7915-9006	7920-9005	7925-9005	–	–
<b>Shock Abs. Field Mount Kit (Hardware Only)<sup>3</sup></b>	7906-9024	7910-9024	7912-9024	7915-9024	7920-9024	7925-9024	–	–
<b>Shock Stop Kit<sup>4</sup></b>	7906-9019	7910-9008	7912-9007	7915-9004	7920-9019	7925-9019	–	–
<b>Shock Stop Kit (Long Carrier)<sup>4</sup></b>	7906-9029	7910-9029	7912-9029	7915-9029	–	–	–	–
<b>Single End Porting Taper (M)<sup>5</sup></b>	NA	7910-9006	7912-9001	7915-9001	7920-9017	7925-9017	Std.	Std.
<b>Single End Porting Parallel (MM)<sup>5</sup></b>	NA	8910-9002	8912-9001	8915-9001	8920-9017	8925-9017	Std.	Std.
<b>Switch (Hardware Only)</b>	2506-9999	6910-9999	6910-9999	3415-9999	3420-9999	3420-9999	3420-9999	6940-9005
<b>Tube Supports<sup>6</sup></b>	7906-9002	7910-9002	7912-9002	7915-9002	7920-9002	7925-9002	7930-9002	7940-9002
<b>Repair Kits (Taper Port “M”)<sup>7,8</sup></b>	RKBC4M06	RKBC4M10	RKBC4M12	RKBC4M15	RKBC4M20	RKBC4M25	RKBC4M30	RKBC4M40
<b>Repair Kits (Parallel Port “MM”)<sup>7,8</sup></b>	RKBC4MM06	RKBC4MM10	RKBC4MM12	RKBC4MM15	RKBC4MM20	RKBC4MM25	RKBC4MM30	RKBC4MM40
<b>Seal Kits<sup>9</sup></b>	6906-9022	6910-9022	6912-9022	6915-9022	6920-9022	6925-9022	6930-9022	6940-9022

PART NUMBER ORDERING		CONFIG. CODE ORDERING
No Mounting Hardware or FE conn. included		Mounting Hardware & FE conn. included
PART NO.	DESCRIPTION	CODE
3600-9084	Switch Only, Reed, Form C, 5m	BT
3600-9085	Switch Only, Reed, Form C, Male Conn.	BM
3600-9082	Switch Only, Reed, Form A, 5m	RT
3600-9083	Switch Only, Reed, Form A, Male Conn.	RM
3600-9086	Switch Only, Triac, 5m	CT
3600-9087	Switch Only, Triac, Male Conn.	CM
3600-9090	Switch Only, Hall-effect, Sinking, 5m	KT
3600-9091	Switch Only, Hall-effect, Sinking, Male Conn.	KM
3600-9088	Switch Only, Hall-effect, Sourcing, 5m	TT
3600-9089	Switch Only, Hall-effect, Sourcing, Male Conn.	TM
2503-1025	Connector (Female) 5 meter lead	

NOTE: When ordered by Config. Code Female connector & all mounting hardware is included

## Switch Ordering NOTES:

To order field retrofit switch and hardware kits for all Tolomatic actuators: SW (Then the model and bore size, and type of switch required)

### Example: SWBC415RT

(Hardware and Form A Reed switch with 5 meter lead for 1.5" bore BC4 band cylinder)

⚠ Mounting hardware is required if replacing switch for any actuator manufactured before 7/1/97



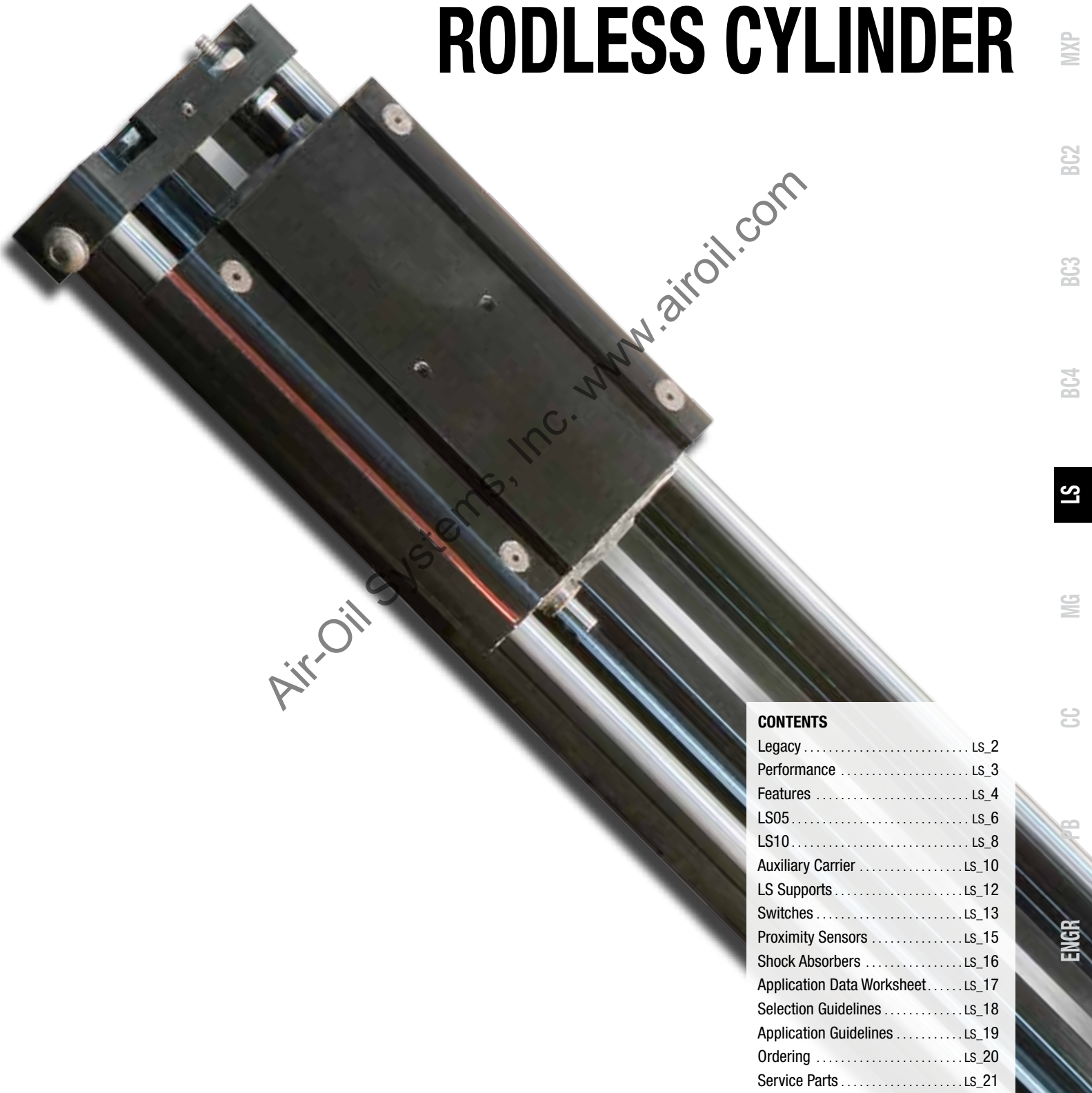
## Service Parts Ordering NOTES:

- Foot Mount Kit contains one bracket and mounting hardware.
- Shock Field Retrofit Kit contains one shock absorber, impact bolt, and mounting hardware.
- Shock Field Mount Kit contains one set of mounting hardware and impact bolt.
- Shock Stop Kit contains shock plate and screws.
- Single End Porting Kit contains replacement head and plugs.
- Contains one tube support and mounting hardware.
- Repair Kit contains End Caps, Bearing Rods, O-rings, U-cups, Wear Rings, Cushion Seals, Band Inserts, Spring Clamps, Sealing Band and Dust Band.
- When ordering repair kits, specify stroke as “SK” then indicate the desired length in decimal inches after the order code indicated above. EXAMPLE: RKBC410SK10.00
- Seal Kit contains End Caps, Bearing Rods, O-rings, U-cups, Wear Rings, Cushion Seals, Band Inserts and Spring Clamps.

NA = Not Available

Std. = Standard Feature

# LS LINEAR SLIDE RODLESS CYLINDER



Air-Oil Systems, Inc. [www.airoil.com](http://www.airoil.com)

ABT  
MXP  
BCZ  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

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 Performance ..... LS\_3  
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ABT

MXP

BC2

BC3

BC4

LS

MG

CC

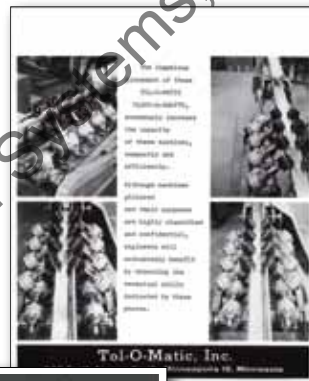
PB

ENGR

## *It started with a custom solution.*

Tolomatic's first product, the Float-A-Shaft®, marked the beginning of Tolomatic's innovative product solutions for the industrial automation market. Burton Toles, Tolomatic's founder, designed the Float-A-Shaft to greatly improve the efficiency of baler/sealing machinery used in the flour and milling industry. The unique right-angle gear box permitted quick product changeover and is still used in the packaging industry today.

On the same baler/sealer machine, customers also wanted a low-cost simple mechanism to lift and sort bags. Again, the Tolomatic solution proved to be a winner with the invention of the cable cylinder – the world's first rodless product. Thus began Tolomatic's product innovation legacy: unique and robust product solutions to solve customer problems.



## **Tolomatic Milestones**

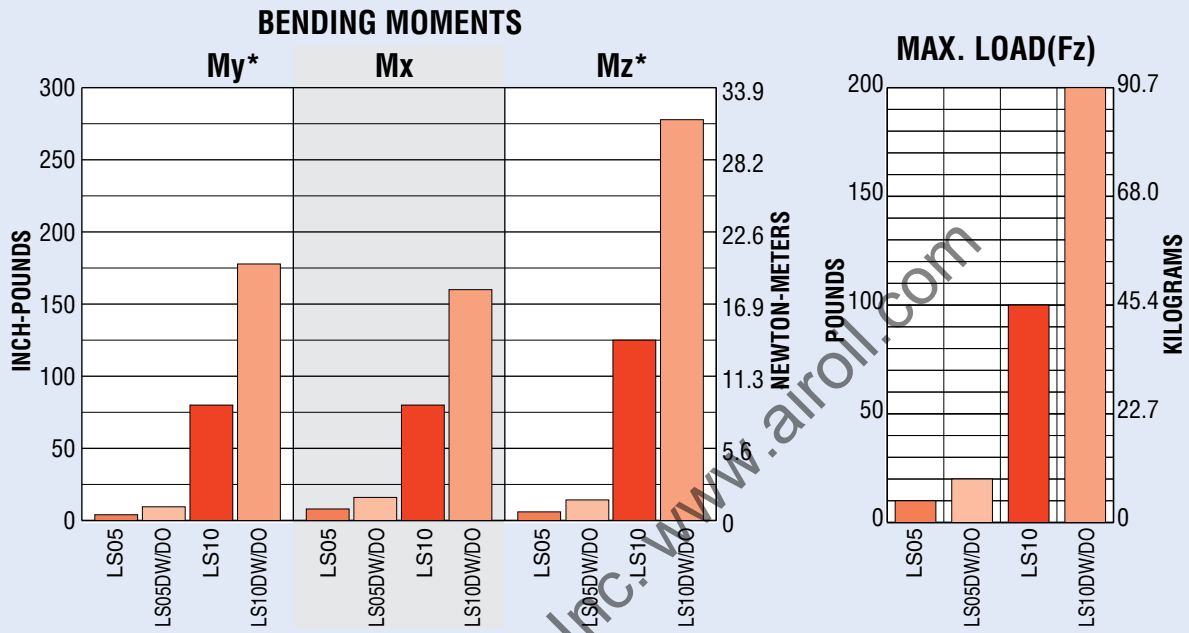
- Founded in 1954 by Burton Toles – invention of the first right-angle gearbox that floats along its shaft.
- Designed the first rodless cylinder in 1958 – the cable cylinder is still in production today!
- Introduction of the BC2 – world's best selling pneumatic rodless cylinder.
- Tolomatic holds a portfolio of patents for actuators and mechanical assemblies.
- Tolomatic becomes ISO certified in October of 1995.
- Tolomatic enters the electromechanical actuator market in 1996 with its first electric actuators.
- Top global auto producer selects Tolomatic as its sole worldwide supplier of servo actuators for robotic welding.
- Over 1,000,000 (and counting) Tolomatic actuators put in service in applications all over the world.

# LS Linear Slide Rodless Cylinder - All Sizes

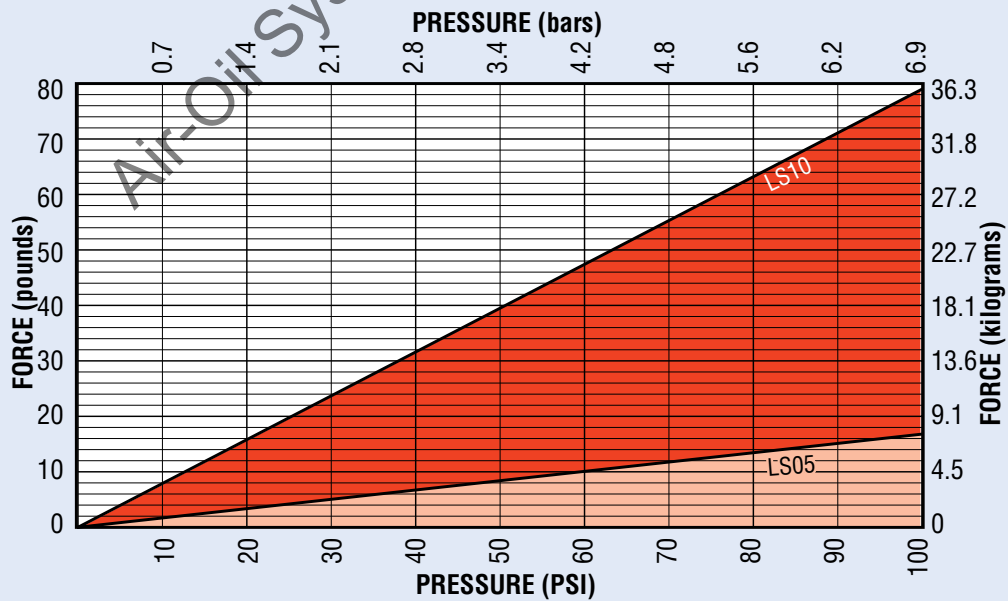
## PERFORMANCE

### MAXIMUM BENDING MOMENTS AND LOAD

#### STANDARD ACTUATOR & AUXILIARY CARRIER OPTION



### THEORETICAL FORCE vs PRESSURE



ABT  
MXP  
BCZ  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# LS - LINEAR SLIDE

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Endurance Technology features are designed for maximum durability to provide extended service life.

### STAINLESS STEEL SEALING BAND SYSTEM



- Fatigue resistant stainless steel bands are specifically made to offer longer life and will not elongate like elastomers
- Outer band keeps out contaminants for extended performance
- Inner band provides a smooth surface for less seal wear



### FORMED END CAP WIPER SEAL

- Keeps contaminants from entering the sealing area
- Protects internal components
- Reduces maintenance while increasing productivity

### LOW CARRIER HEIGHT

- Reduces overall actuator envelope
- Large mounting area for high load stability
- T-Slots for mounting flexibility

### STROKE ADJUSTMENT

- End of stroke
- Integrated into design

### 3-PORTED HEADS

- Single End Porting
- Standard feature
- Simplifies air connections

### FORMED STEEL PISTON BRACKET

- Provides maximum strength at major stress points
- Heat treated carbon steel withstands the toughest dynamic forces
- Strongest bracket design in the industry assures long life with less maintenance



# TOLOMATIC... THE RODLESS CYLINDER LEADER

## RETAINED DUST BAND

- Retained dust band keeps contaminants from entering the cylinder interior, protecting components for reduced maintenance and increased uptime

## RIGID BLACK-ANODIZED EXTRUDED ALUMINUM TUBE

- Stronger, stiffer tube retains tolerance specs when chamber is pressurized
- Keeps sealing band in place for maximized air efficiency
- Tube supports are minimized
- Solid structural support provides durability and long life performance

## STEEL GUIDE RODS

- Two precision ground steel guide rods integrated with extrusion provides positive support of load

NOTE: Boxed letters indicate ordering codes

## LOAD-BEARING CARRIER DESIGN

- Load and piston are independent - piston floats, resulting in less friction and longer seal life



- Bearings offer consistently low friction and long wear; 1/2" bore features composite bearings, 1" bore features precision linear ball bearings

## OPTIONS



### AUXILIARY CARRIER **D****W** **D****O**

- Substantially higher load capacity
- Substantially higher bending moment capacity



### SUPPORTS **M****P**

- Used for intermediate support
- Flush with bottom of actuator to retain low profile
- Drop-in, adjustable mounting locations



### T-NUTS

- Used for intermediate support, combine with Tube Supports or mount directly to surface



### SHOCK ABSORBERS **S****L** **S****H**

- Smooth deceleration
- Allows increased operating speed
- Self-compensates for load or speed changes
- Minimizes impact load to equipment
- Higher equipment productivity
- Integrated to carrier design



### SWITCHES

- Available in Proximity, Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers

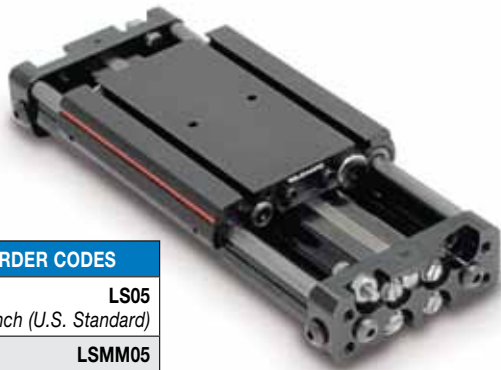
**5 DAYS**  
**BUILT-TO-ORDER**



# LS05 Linear Slide Rodless Cylinder

## PERFORMANCE

### LS05



#### ORDER CODES

**LS05**  
inch (U.S. Standard)

**LSMM05**  
(metric with parallel port)

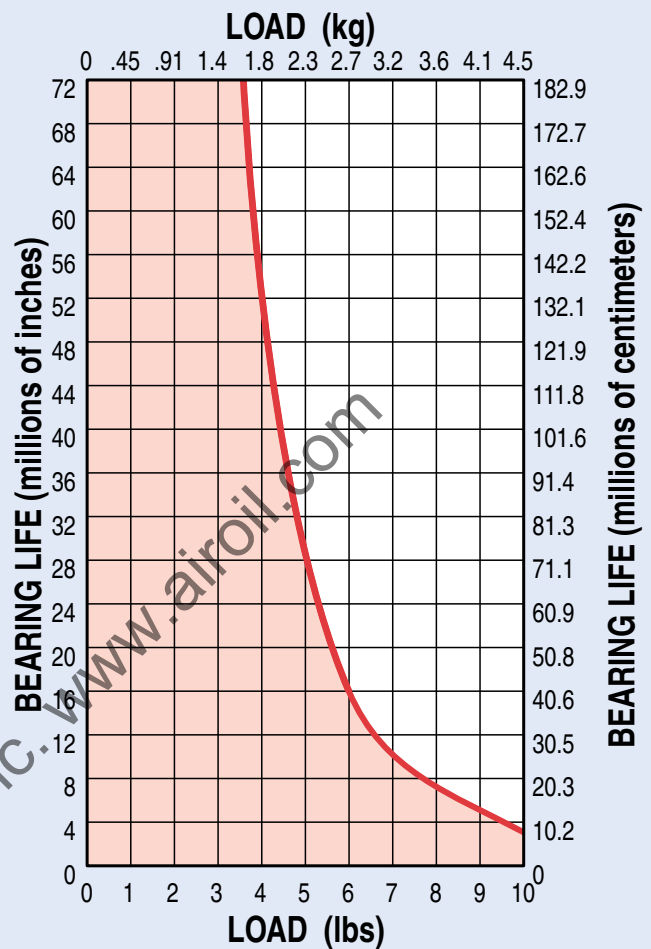
#### LS05 OPTIONS

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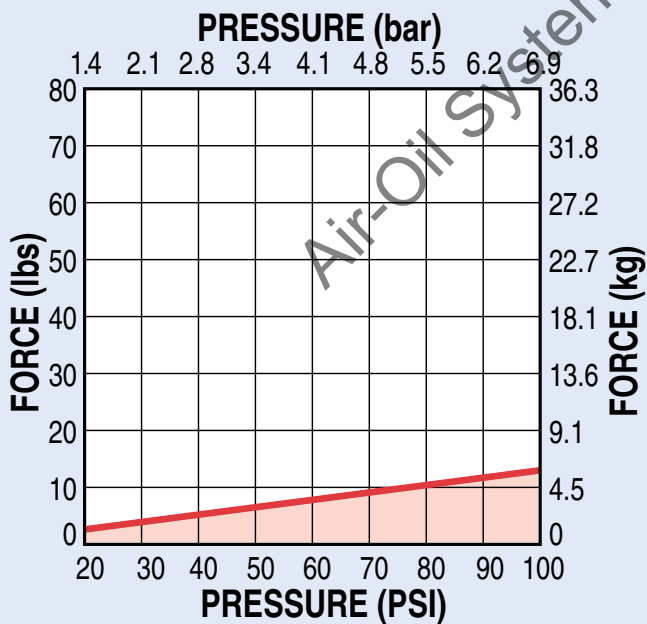
#### MORE INFORMATION

MORE INFORMATION	Page
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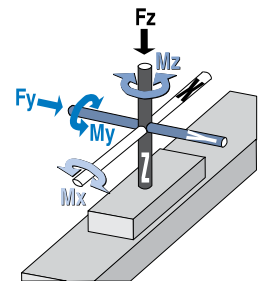
### BEARING LIFE vs LOAD



### THEORETICAL FORCE vs PRESSURE



### SPECIFICATIONS

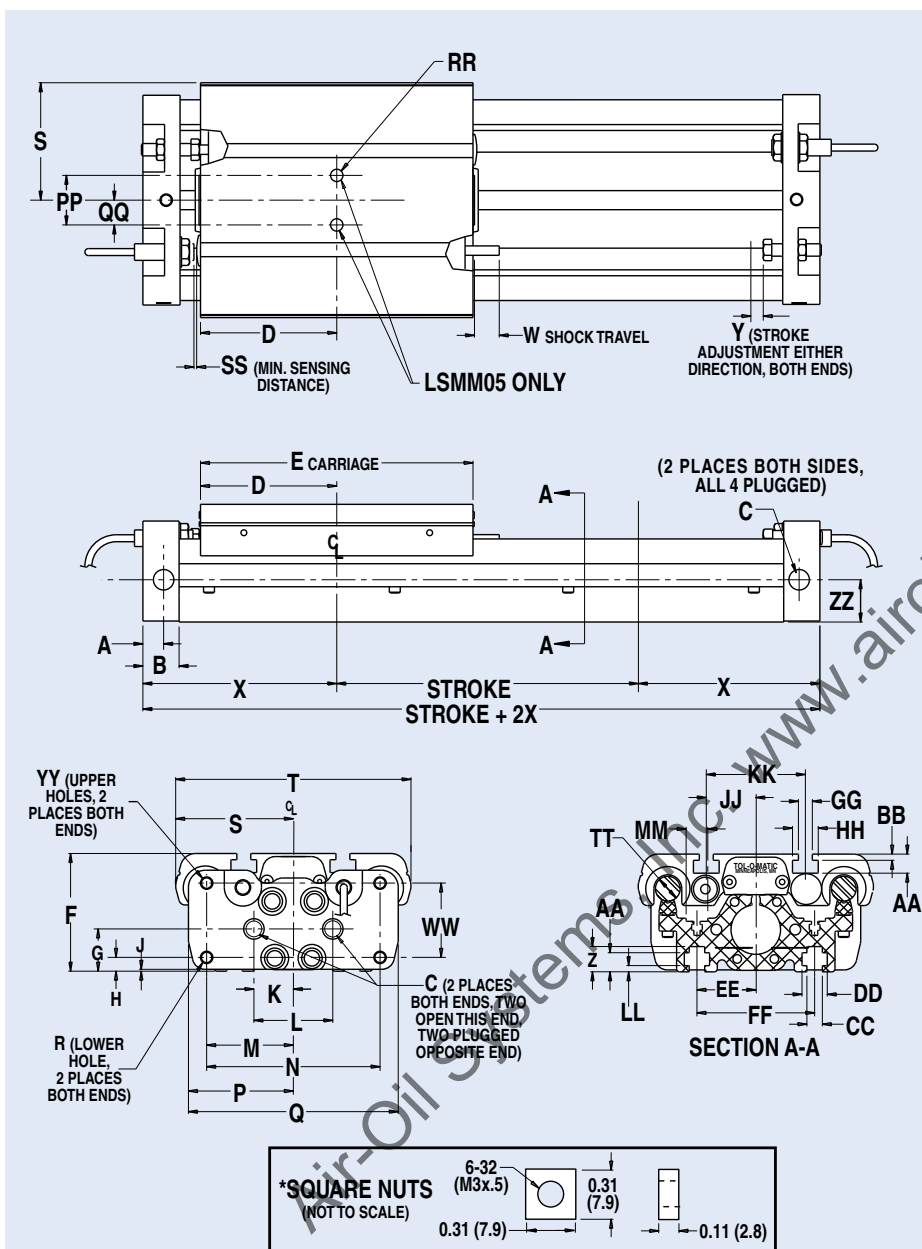


### LS05 BENDING MOMENTS AND LOAD

	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
<b>05</b>	0.50 in	4.0 in-lbs	8.0 in-lbs	6.0 in-lbs	10.0 lbs
<b>MM05</b>	12 mm	0.45 N-m	0.90 N-m	0.68 N-m	4.5 kg

# LS05 Linear Slide Rodless Cylinder

## DIMENSIONS



**\*NOTE:** Four square nuts are provided with each linear slide for base mounting. Additionally 2 square nuts are provided for 30" of stroke and 2 for every 20" of stroke thereafter.

	05	MM05
A	0.32	8.1
B	0.50	12.7
C	#10-32 PORTS	M5 x 0.8
D	1.82	46.1
E	3.63	92.2
F	1.31	33.3
G	0.43	10.8
H	0.24	6.0
J	0.02	0.5
K	0.88	22.23
L	1.75	44.45
M	1.13	28.58
N	2.25	57.15
P	1.39	35.5
Q	2.78	70.6
R	#10-24 x .38 DP	M5 x 0.8 x 10 DP
S	1.50	38.1
T	3.00	76.2
W	0.18	4.6
X	2.69	62.9
Y	0.13	3.2
Z	0.34	8.59
AA	0.19	4.88
BB	0.06	1.57
CC	0.16	3.96
DD	0.33	8.43
EE	0.81	20.62
FF	1.63	41.28
GG	0.16	3.96
HH	0.33	8.43
JJ	0.94	23.83
KK	1.88	47.63
LL	0.13	3.18
MM	0.28	7.14
PP	1.00	25.4
QQ	0.50	12.7
RR	.13 x .09 DP	3.18 x 2.4 DP
SS	0.04	1
TT	.25 Nominal	6.35 Nominal
WW	0.50	12.7
YY	#10-24 x .21 DP	M5 x 0.8 x 5 DP
ZZ	0.47	11.8
	INCHES	MILLIMETERS

## SPECIFICATIONS


	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE	END-OF-STROKE POSITIONING ACCURACY	STROKE ADJUSTMENT
		BASE	PER UNIT OF STROKE					
05	0.50 in	1.2 lbs	0.15 lbs/in	72 in	100 PSI	20° to 140° F	±0.0005 in	±0.12 in per end
MM05	12 mm	0.54 kg	0.068 kg/mm	1829 mm	6.895 bar	-7° to 60° C	0.0127 mm	±3.05 mm per end

**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

# LS10 Linear Slide Rodless Cylinder

## PERFORMANCE

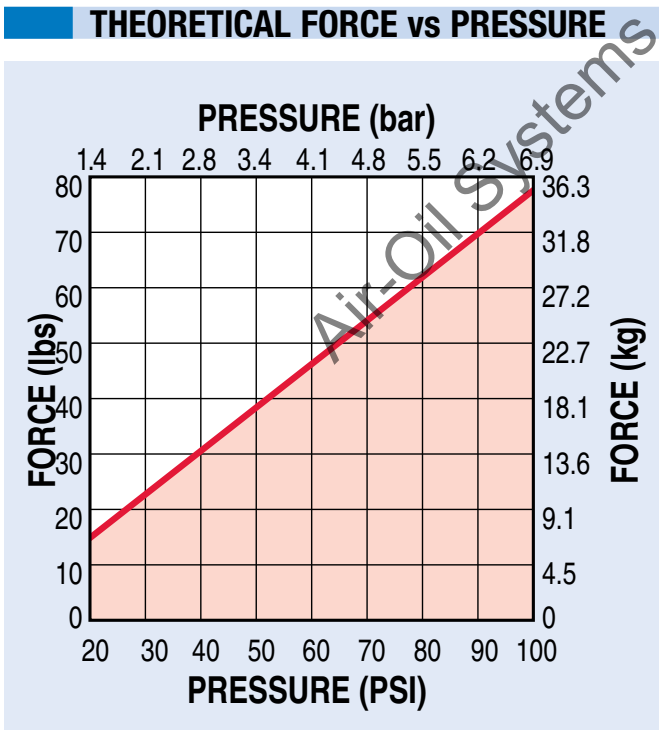
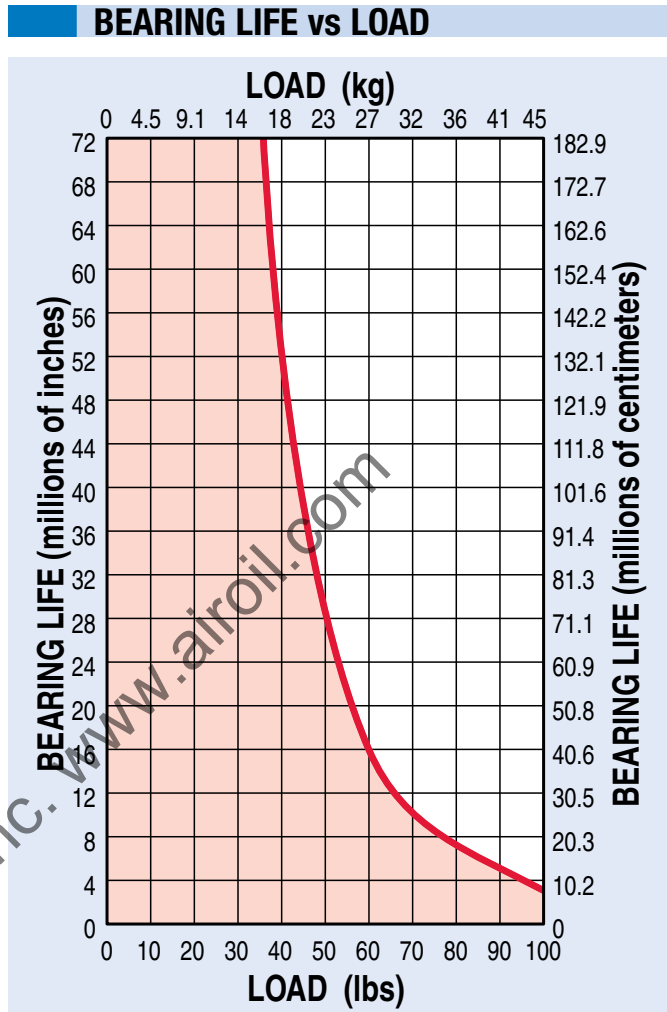
LS10



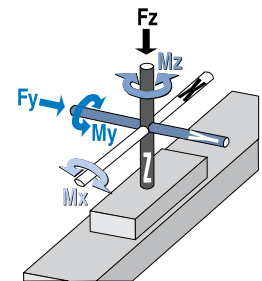
ORDER CODES	
<b>LS10</b>	inch (U.S. Standard)
<b>LSMM10</b>	(metric with parallel port)

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## SPECIFICATIONS



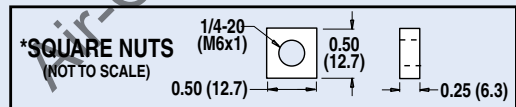
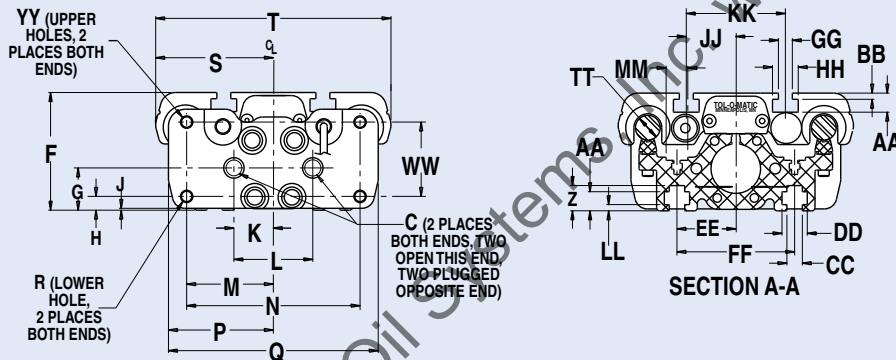
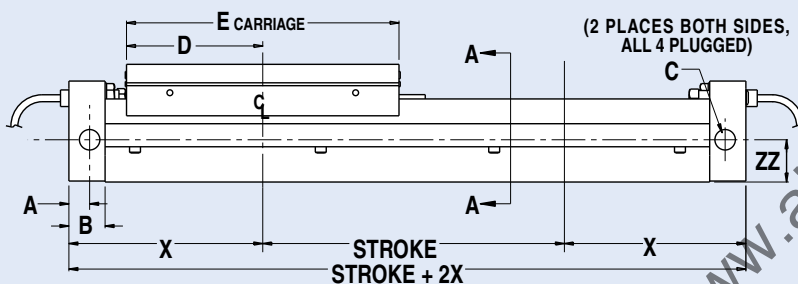
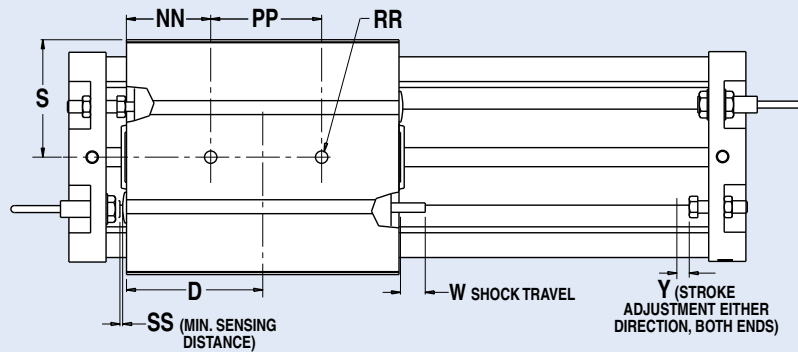
LS10 BENDING MOMENTS AND LOAD

	BORE SIZE	MAX. BENDING MOMENT			MAX. LOAD
		My	Mx	Mz	Fz
<b>10</b>	1.00 in	80 in-lbs	80 in-lbs	125 in-lbs	100 lbs
<b>MM10</b>	25 mm	9.0 N-m	9.0 N-m	14.0 N-m	45.4 kg

ABT  
 MXP  
 BC2  
 BC3  
 BC4  
 LS  
 MG  
 CC  
 PB  
 ENGR

# LS10 Linear Slide Rodless Cylinder

## DIMENSIONS



\*NOTE: Four square nuts are provided with each linear slide for base mounting. Additionally 2 square nuts are provided for 30" of stroke and 2 for every 20" of stroke thereafter.

	10	MM10
A	0.42	10.7
B	0.73	18.5
C	1/8 NPT PORT	G 1/8-28 Parallel
D	2.75	69.9
E	5.50	139.7
F	2.38	60.5
G	0.86	21.7
H	0.28	7.1
J	0.04	1.0
K	0.80	20.3
L	1.59	40.4
M	1.75	44.5
N	3.50	88.9
P	2.13	54.1
Q	4.25	107.9
R	1/4-20 x .50 DP	M6 x 1.0 x 12 DP
S	2.38	60.5
T	4.75	120.7
W	0.43	10.9
X	3.89	98.8
Y	0.25	6.4
Z	0.51	12.9
AA	0.39	9.8
BB	0.10	2.5
CC	0.31	7.9
DD	0.51	13.0
EE	1.19	30.2
FF	2.38	60.3
GG	0.28	7.1
HH	0.52	13.2
JJ	1.00	25.4
KK	2.00	50.8
LL	0.13	3.2
MM	0.44	11.1
NN	1.75	44.5
PP	2.00	50.8
RR	.25 x .20 DP	6.35 x 5.1 DP
SS	0.04	1.0
TT	.472 Nominal	12.0 Nominal
WW	1.50	38.1
YY	1/4-20 x .38 DP	M6 x 1.0 x 9 DP
	INCHES	MILLIMETERS

## SPECIFICATIONS

	BORE SIZE	WEIGHT		MAX. STROKE LENGTH*	MAX. PRESSURE	TEMPERATURE RANGE	END-OF-STROKE POSITIONING ACCURACY	STROKE ADJUSTMENT
		BASE	PER UNIT OF STROKE					
10	1.00 in	5.2 lbs	0.4 lbs/in	72 in	100 PSI	20° to 140° F	±0.0005 in	±0.25 in per end
MM10	25 mm	2.36 kg	0.181 kg/mm	1829 mm	6.895 bar	-7° to 60° C	0.0127 mm	±6.35 mm per end

**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

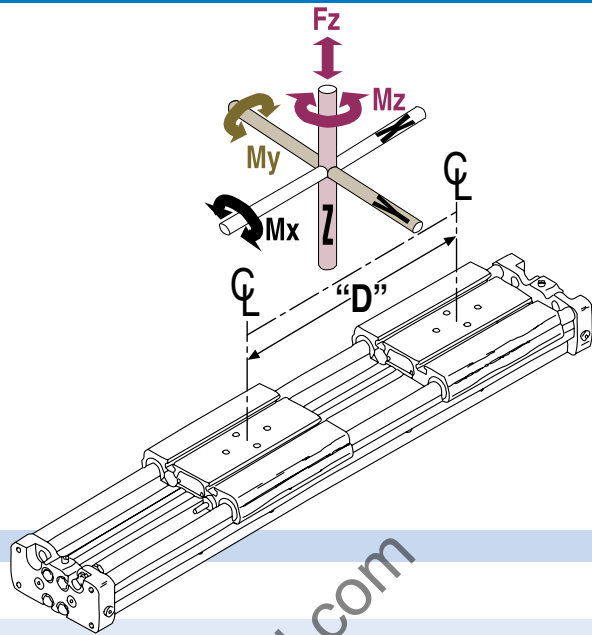
# LS Auxiliary Carrier - All Sizes

## PERFORMANCE

The auxiliary carrier option substantially increases load carrying and bending moments capacity over the standard single carrier models. As a general rule, the auxiliary carrier option is highly recommended in vertical applications ( $M_y$ ) if the distance from the carrier mounting surface to the load center of gravity (CG) exceeds the overall length of the carrier. Auxiliary carriers can be ordered with (DW) or without (DO) an internal piston. (Auxiliary carriers without a piston have no cushion on the cylinder end closest to the auxiliary carrier.)

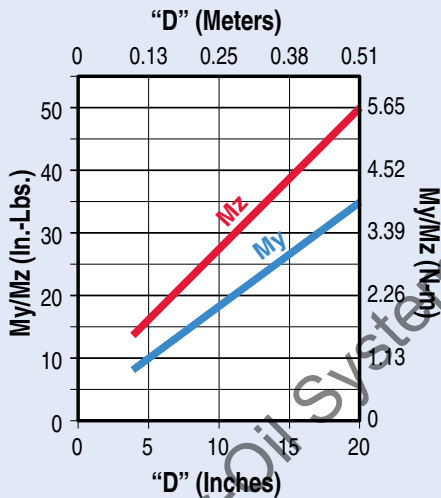


NOTE: breakaway pressure will increase when using auxiliary carrier.

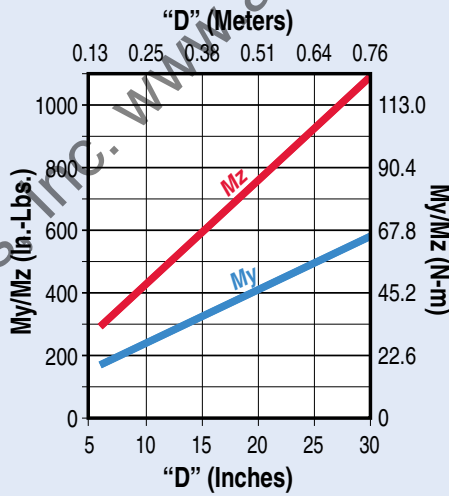


## BENDING MOMENTS

**LS05 AUXILIARY CARRIER  
LOAD vs DISTANCE**



**LS10 AUXILIARY CARRIER  
LOAD vs DISTANCE**



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.

	BORE SIZE		"D" MINIMUM *		MAX. BENDING MOMENT						MAX. LOAD	
					My**		Mx		Mz**		Fz	
	in	mm	in	mm	in-lbs	N-m	in-lbs	N-m	in-lbs	N-m	lbs	kg
<b>05</b>	0.50	12	3.63	92.2	9.51	1.07	16.00	1.81	14.27	1.61	20	9.08
<b>10</b>	1.00	25	5.75	146.1	177.80	20.09	160.00	18.08	277.80	31.30	200	90.8

\* "D" is distance between carriers

\*\* Loads calculated are at minimum "D", for substantially higher  $M_y$  and  $M_z$  loads increase "D" and refer to graph above

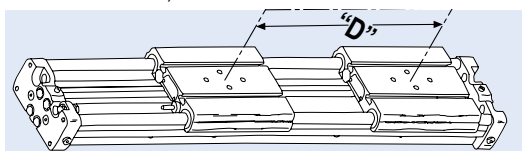
# LS Auxiliary Carrier - All Sizes

## AUXILIARY CARRIER



## ORDERING INFORMATION

When ordering, determine the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart).



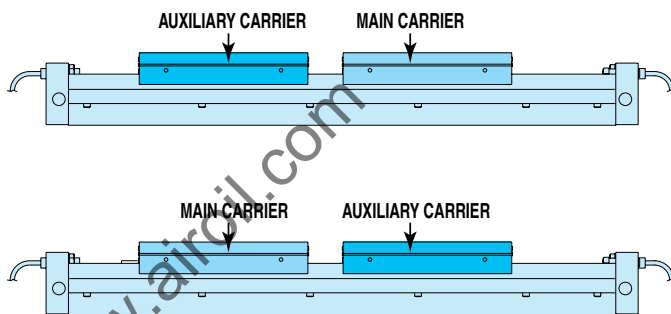
Determine your working stroke and your "D" dimension, then enter these into your configuration string. (Example: LS10SK30.00DW8.00RT2) The configurator will calculate the overall length of the actuator. Refer to page LS\_13 for complete LS ordering information.

## ASSEMBLY INFORMATION

### IMPORTANT INFORMATION REGARDING AUXILIARY CARRIER PLACEMENT

When an LS is ordered without shock absorbers, the auxiliary carrier is always placed to the left (while facing the switch mounted or open port side) of the main carrier.

When an LS is ordered with shock absorbers, the auxiliary carrier is always placed to the right (while facing the switch mounted or open port side) of the main carrier.



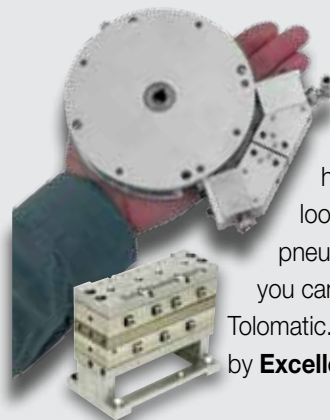
## Custom Capabilities



Tolomatic's custom model shop can create first-piece prototypes with the industry's fastest turnaround times.

### Custom Solutions are Standard Business

Hundreds of customers partner with Tolomatic to solve unique automation application challenges. We are geared to handle design requests—from our Model Shop (for fast prototypes) all the way through our ISO 9001:2000 certified manufacturing facility. Over 33% of our total business is based on products not found in our standard catalog.



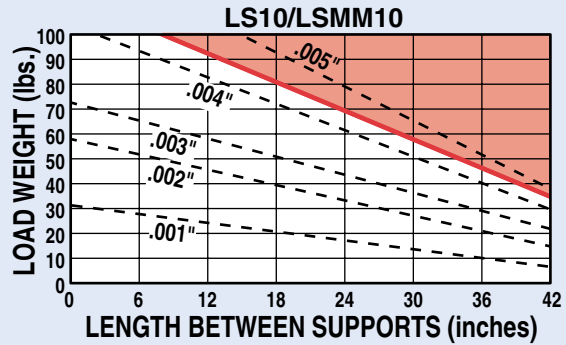
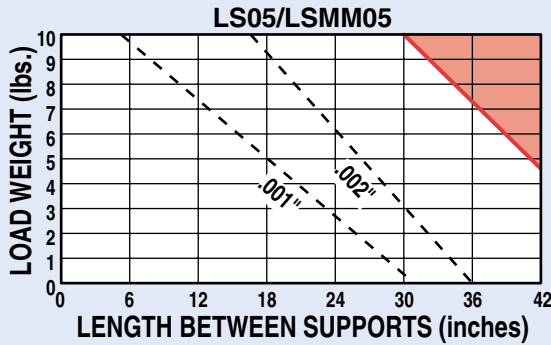
With an innovation mindset, years of solid industry experience, and fast response times, let Tolomatic help you get the job done. If you are looking for linear motion solutions—pneumatic or electromechanical—and you cannot find a catalog product, get with Tolomatic. You will experience what we mean by **Excellence in Motion**.

# LS Supports - All Sizes

## PERFORMANCE

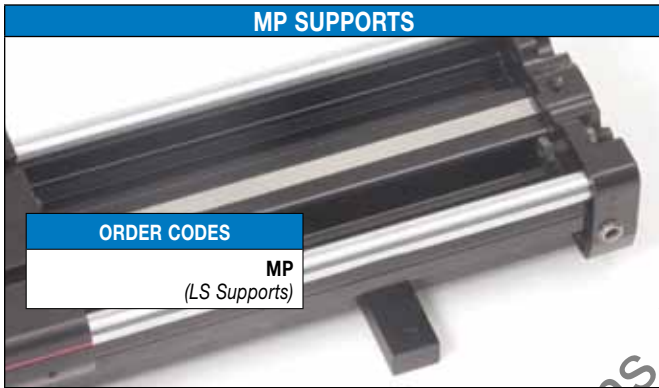


### DISTANCE BETWEEN SUPPORTS



-- Deflection Rates — Tube supports recommended above this line.

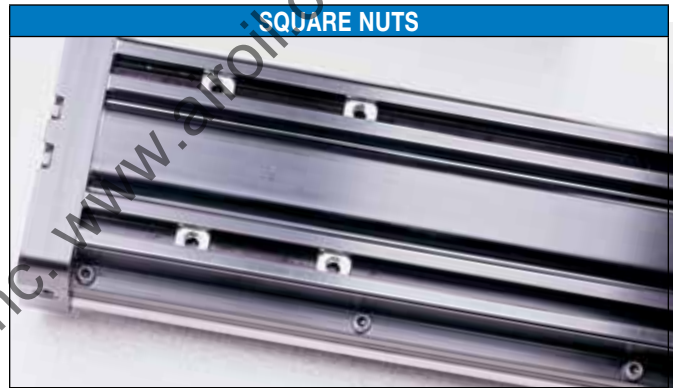
#### MP SUPPORTS



##### ORDER CODES

**MP**  
(LS Supports)

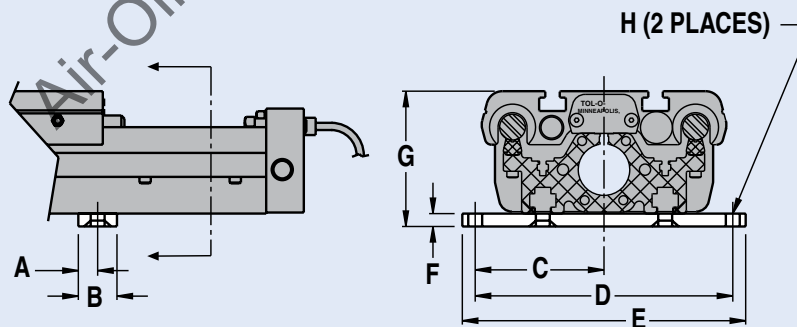
#### SQUARE NUTS



Base mounting linear slides may be accomplished by fastening directly to "T" slot nuts provided in the base of the slide (shown at right) or by using the MP mounting plates.

\*NOTE: Four square nuts are provided with each linear slide for base mounting. Additionally 2 square nuts are provided for 30" of stroke and 2 for every 20" of stroke thereafter.

## DIMENSIONS



BORE SIZE	A	B	C	D	E	F	G	H Ø	
05	0.50	0.38	0.75	1.60	3.30	3.60	0.25	1.60	0.156
10	1.00	0.38	0.75	2.50	5.00	5.50	0.25	2.63	0.270

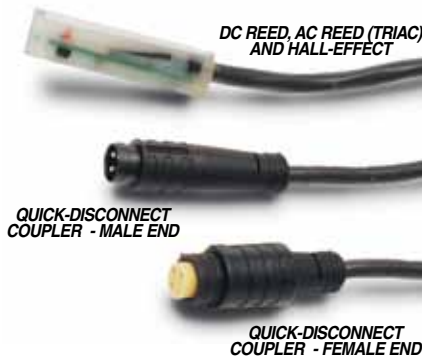
Dimensions in inches

BORE SIZE	A	B	C	D	E	F	G	H Ø	
M(MM)05	12	9.7	19.1	41.4	82.6	92.2	6.4	39.6	3.96
M(MM)10	25	9.7	19.1	63.5	127.0	139.7	6.4	66.8	6.86

Dimensions in millimeters

# LS Switches - All Sizes

## SWITCHES



There are 10 sensing choices: DC reed, form A (open) or form C (open or closed); AC reed (Triac, open); Hall-effect, sourcing, PNP (open); Hall-effect, sinking, NPN (open); each with either flying leads or QD (quick disconnect). Commonly used to send analog signals to PLC (programmable logic controllers), TLL, CMOS circuit or other controller device. These switches are activated by the actuator's magnet.

Switches contain reverse polarity protection. QD cables are shielded; shield should be terminated at flying lead end.

If necessary to remove factory installed switches, be sure to reinstall on the same side of actuator with scored face of switch toward internal magnet.

## SPECIFICATIONS

ORDER CODE	REED DC				REED AC		HALL-EFFECT DC			
	R T	R M	B T	B M	C T	C M	T T	T M	K T	K M
PART NUMBER	3600-9082	3600-9083	3600-9084	3600-9085	3600-9086	3600-9087	3600-9088	3600-9089	3600-9090	3600-9091
LEAD	5m	QD*	5m	QD*	5m	QD*	5m	QD*	5m	QD*
CABLE SHIELDING	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†
SWITCHING LOGIC	"A" Normally Open		"C" Normally Open or Closed		Triac Normally Open		PNP (Sourcing) Normally Open		NPN (Sinking) Normally Open	
MECHANICAL CONTACTS	Single-Pole Single-Throw		Single-Pole Double-Throw		Single-Pole Single-Throw		NO, These Are Solid State Components			
COIL DIRECT	Yes		Yes		Yes		—			
POWER LED	None	None		None		None	None		None	
SIGNAL LED	Red	Red		Red		Red	Red		Red	
OPERATING VOLTAGE	200 Vdc max.		120 Vdc max.		120 Vac max.		5 - 25 Vdc			
OUTPUT RATING	—		—		—		25 Vdc, 200mA dc			
OPERATING TIME	0.6 msec max. (including bounce)		0.7 msec max. (including bounce)		—		< 10 micro sec.			
OPERATING TEMPERATURE	-40°F [-40°C] to 158°F [70°C]						0°F [-18°C] to 150°F [66°C]			
RELEASE TIME	1.0 msec. max.		—		—		—			
ON TRIP POINT	—		—		—		150 Gauss maximum			
OFF TRIP POINT	—		—		—		40 Gauss minimum			
**POWER RATING (WATTS)	10.0 §		3.0 §§		10.0		5.0			
VOLTAGE DROP	2.6 V typical at 100 mA		NA		—		—			
RESISTANCE	0.1 Ω Initial (Max.)		—		—		—			
CURRENT CONSUMPTION	—		—		1 Amp at 86°F [30°C] 0.5 Amp at 140°F [60°C]		200 mA at 25 Vdc			
FREQUENCY	—		—		47 - 63 Hz		—			
CABLE MIN. BEND RADIUS	STATIC	0.630" [16mm]								
	DYNAMIC	Not Recommended								

**CAUTION: DO NOT OVER TIGHTEN SWITCH HARDWARE WHEN INSTALLING!**

**\*\* WARNING:** Do not exceed power rating (Watt = Voltage X Amperage). Permanent damage to sensor will occur.

\*QD = Quick Disconnect; Male coupler is located 6" [152mm] from sensor, Female coupler to flying lead (part #2503-1025) distance is 197" [5m] also see Cable Shielding specification above

**REPLACEMENT OF QD SWITCHES MANUFACTURED BEFORE JULY 1, 1997:** It will be necessary to replace or rewire the female end coupler.



**Reed Switch Life Expectancy:** Up to 200,000,000 cycles (depending on load current, duty cycle and environmental conditions)

†Shielded from the female quick disconnect coupler to the flying leads. Shield should be terminated at flying lead end.

§ Maximum current 500mA (not to exceed 10VA) Refer to Temperature vs. Current graph and Voltage Derating graph

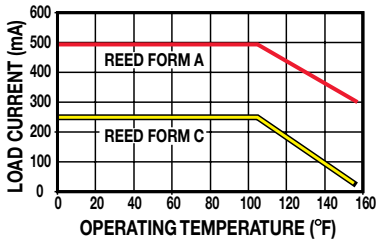
§§ Maximum current 250mA (not to exceed 3VA) Refer to Temperature vs. Current graph and Voltage Derating graph



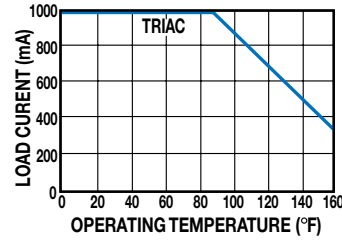
# LS Switches - All Sizes

## PERFORMANCE

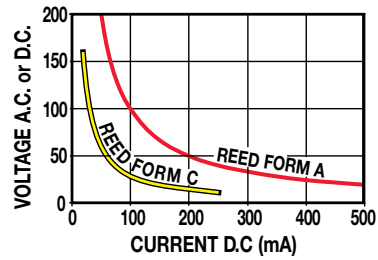
TEMP. vs CURRENT, DC REED



TEMP. vs CURRENT, AC REED

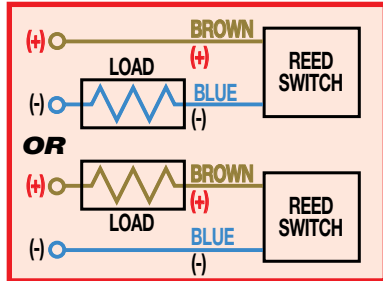


VOLTAGE DERATING, DC REED

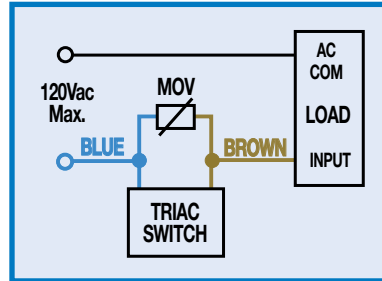


## WIRING DIAGRAMS

**R**T & **R**M DC REED, FORM A



**C**T & **C**M AC REED, TRIAC

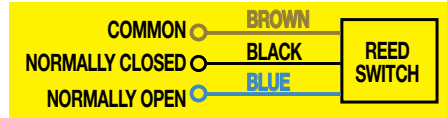


## INSTALLATION INFORMATION

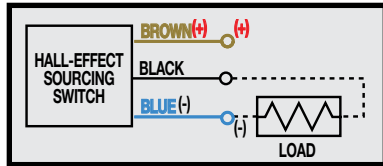


**⚠** THE NOTCHED FACE OF THE SWITCH INDICATES THE SENSING SURFACE AND MUST FACE TOWARD THE MAGNET.

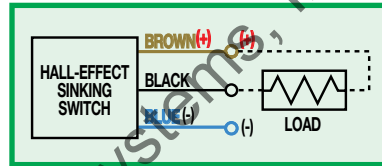
**B**T & **B**M DC REED, FORM C



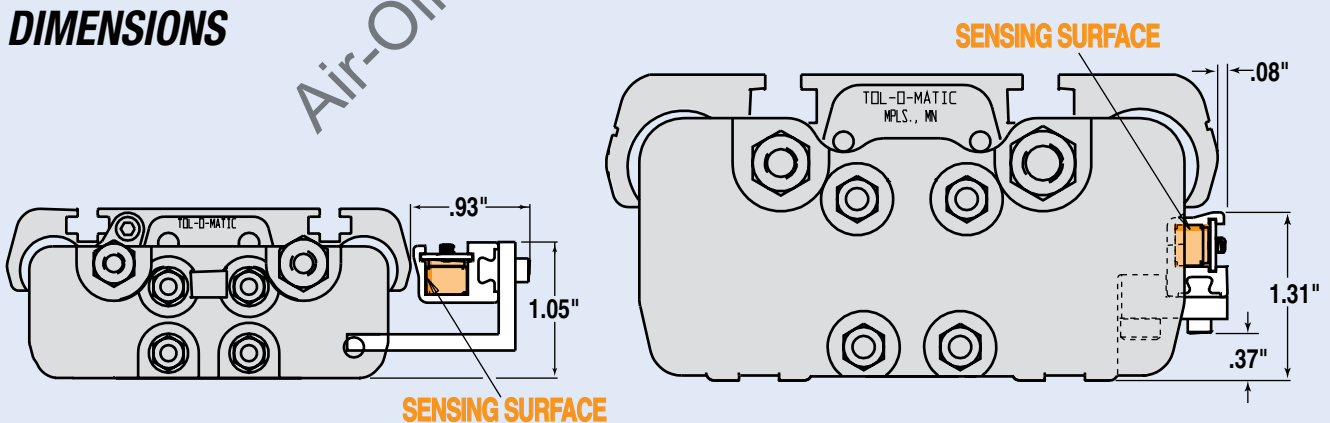
**T**T & **T**M HALL-EFFECT, SOURCING, PNP



**K**T & **K**M HALL-EFFECT, SINKING, NPN



## DIMENSIONS



# LS Proximity Sensors - All Sizes



This L.E.D. device senses end-of-stroke with one of two normally open inductive d.c. proximity sensors. NPN supplies a sinking signal; PNP supplies a sourcing signal to a device such as a programmable logic controller.

Ambient Temp.: -13° to 158° F., (-25° to 70° C.)

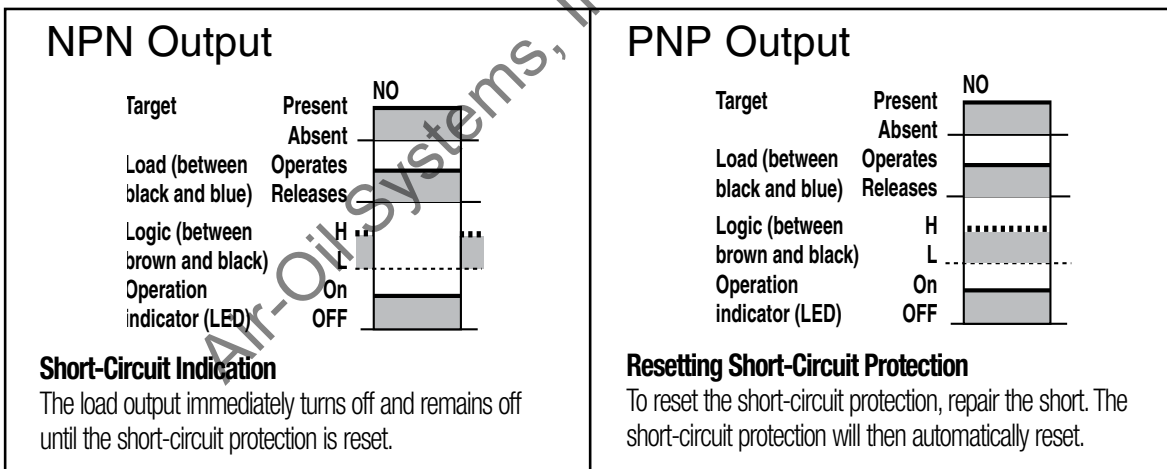
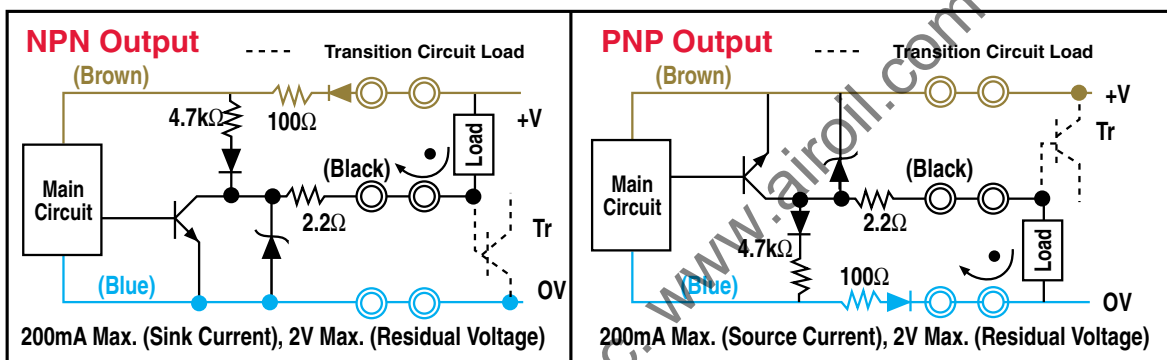
NEMA Encl. Rating: 1, 3, 4, 6, 12, 13

Lead Length: 6.56 feet (2.0m)

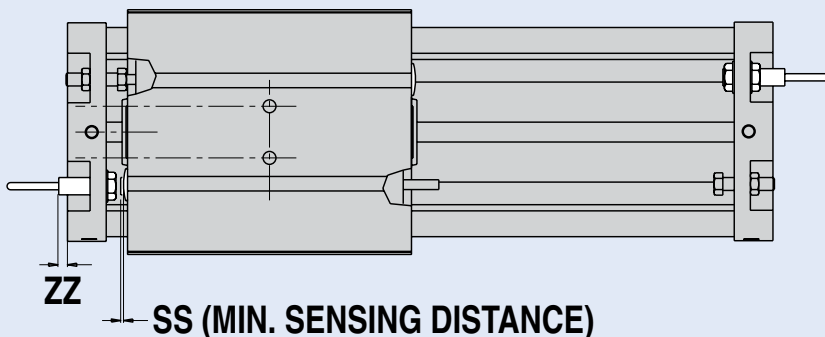
Max. Sensing Distance (LS05): .059" (1.5mm)

Max. Sensing Distance (LS10): .039" (1.0mm)

## Wiring Diagrams



## DIMENSIONS



SIZE	BORE		SS		ZZ	
	in	mm	in	mm	in	mm
05	0.50	12.7	0.04	1.02	0.46	11.68
10	1.00	25.4	0.04	1.02	0.40	10.16

# LS Shock Absorbers - All Sizes



## SHOCK ABSORBERS



**ORDER CODE**  
SH\_ or SL\_  
(\_ = Number ordered)

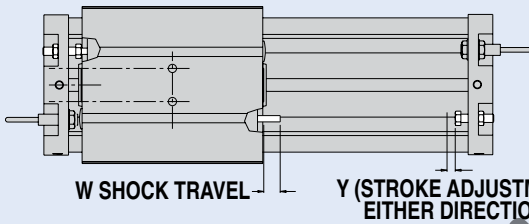
Rodless cylinders with standard internal cushion offer an effective method of decelerating loads. However, all Tolomatic rodless cylinders are capable of carrying heavier loads at higher velocities than the cylinder cushion can absorb. Optional shock absorbers can be used to increase the cylinder's life and broaden the application range for the cylinder model you have chosen.

Typical shock absorber life varies between 1-2 million cycles (depending on environment). Appropriate preventative maintenance should be considered in high cyclic applications.

**NOTE:** Actuators ordered without selecting a shock absorber MUST have external stops. The LS does NOT have internal bumpers or cushions.

**CAUTION:** In applications which result in a load bending moment at deceleration, care should be taken to decelerate the load rather than the carrier of the band cylinder.

## DIMENSIONS



SIZE	BORE	W	Y
05	0.375	0.18	0.13
10	0.625	0.43	0.25

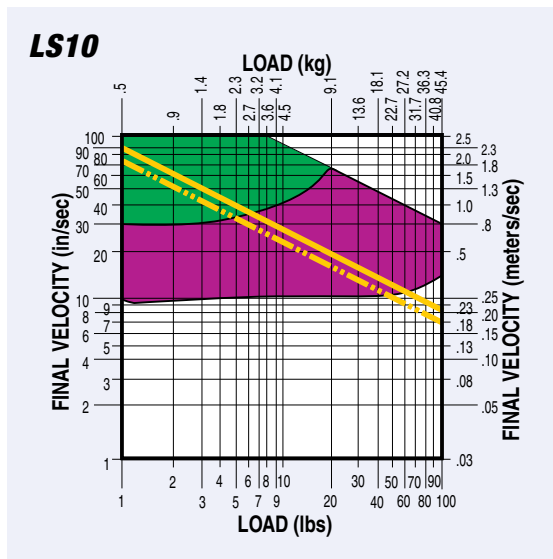
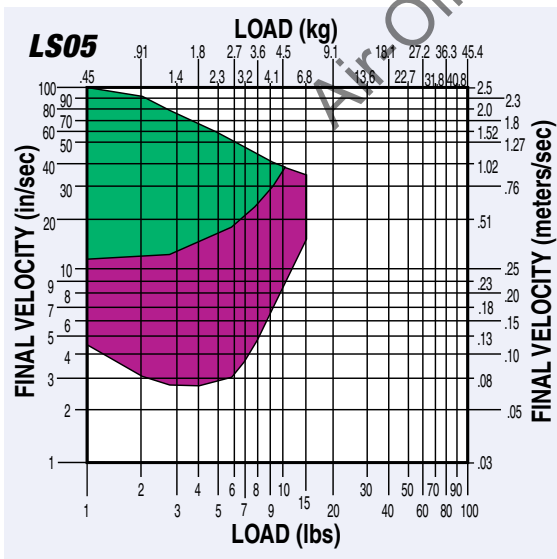
Dimensions in inches

SIZE	BORE	W	Y
MM05	12	4.6	3.2
MM10	25	10.9	6.4

Dimensions in millimeters

## PERFORMANCE

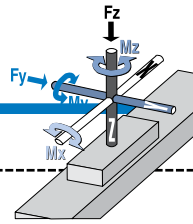
### VELOCITY vs LOAD



**LIGHT DUTY** (Light load/High velocity)

**HEAVY DUTY** (Heavy load/Low velocity)

# Application Data Worksheet



## STROKE LENGTH \_\_\_\_\_

inch (S/K)  millimeters  
(U.S. Standard) (Metric)

## AVAILABLE AIR PRESSURE \_\_\_\_\_

PSI  bar  
(U.S. Standard) (Metric)

## REQUIRED THRUST FORCE \_\_\_\_\_

lbf  N  
(U.S. Standard) (Metric)

## LOAD \_\_\_\_\_

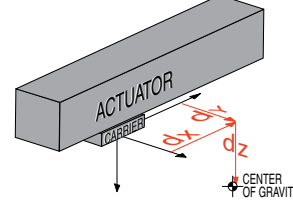
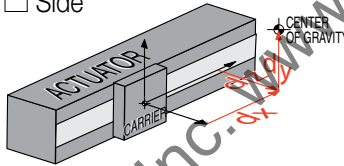
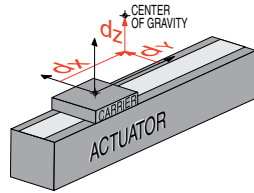
lb  kg  
(U.S. Standard) (Metric)

## LOAD CENTER OF GRAVITY DISTANCE TO CARRIER CENTER

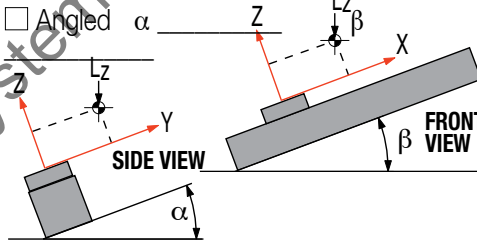
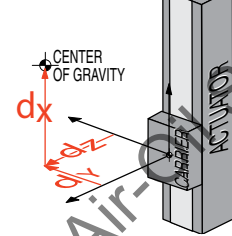
$d_x$  \_\_\_\_\_  
 $d_y$  \_\_\_\_\_  
 $d_z$  \_\_\_\_\_  
 inch  millimeters  
(U.S. Standard) (Metric)

## ORIENTATION

Horizontal  Side  Horizontal Down



Vertical



## OTHER ISSUES:

(i.e. Environment, Temperature, Contamination, etc.)

## FORCES APPLIED TO CARRIER

lbf  N  
(U.S. Standard) (Metric)

$F_z$  \_\_\_\_\_  
 $F_y$  \_\_\_\_\_

## BENDING MOMENTS APPLIED TO CARRIER

in-lbs  N-m  
(U.S. Standard) (Metric)

$M_x$  \_\_\_\_\_  
 $M_y$  \_\_\_\_\_  
 $M_z$  \_\_\_\_\_

## FINAL VELOCITY \_\_\_\_\_

in/sec  mm/sec  
(U.S. Standard) (Metric)

## MOVE TIME sec. \_\_\_\_\_

## NO. OF CYCLES \_\_\_\_\_

per minute  per hour

Contact information: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Fax (1-763-478-8080) or call Tolomatic (1-800-328-2174) with the above information. We will provide any assistance needed to determine the proper actuator.

# Rodless Cylinder Selection Guidelines - BC2, BC3, BC4, LS - All Sizes

## PROVIDING LOAD GUIDANCE AND SUPPORT

The process of selecting a load bearing actuator for a given application can be complex. It is highly recommended that you contact Tolomatic or a Tolomatic Distributor for assistance in selecting the best actuator for your application. The following overview of the selection guidelines are for educational purposes only.

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Band Cylinder or Linear Slide model for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs or kg)
- Orientation of load (lbs or kgs)
- Velocity of load (in/sec or mm/sec)
- Stroke length (in or mm)

HINT: Use Tolomatic sizing and selection software, download at: [tolomatic.com](http://tolomatic.com)

### 2 SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 3), the actuator will accommodate the application.

If the intersection is above the diagonal line, a larger cylinder bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 DETERMINE NATURE OF LOAD AND THE EFFECT OF BENDING MOMENTS

If the cylinder will guide and support a load located directly over the center of carrier, bending moments will not be a factor in the cylinder selection.

NOTE: The maximum load "L" must not exceed the capacity limits of the cylinder selected.

- Bending Moments

For off center or side loads, determine the distance from the center of mass of the load to the center of the carrier bracket. This measurement is needed to calculate the torque for bending moments. (Refer to Bending Moment chart for each model.)

Should the resulting maximum bending moment exceed figures indicated on the chart, external guides, auxiliary carrier/s or a larger cylinder should be considered.

- Auxiliary Carrier Bending Moments

The auxiliary carrier option (available on most models) increases load carrying capacity and bending moments. Auxiliary carriers can be ordered with or without an internal piston. (Auxiliary

carriers without a piston have no internal cushion on the cylinder end closest to the auxiliary carrier.)

IMPORTANT: When ordering, determine the working stroke, then the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart). When ordered, Tolomatic's configurator will calculate the overall length of the actuator.

NOTE: breakaway pressure will increase when using auxiliary carriers.

### 4 DETERMINE INTERNAL CUSHION CAPACITY

- Consult the Cushion Data chart for the model selected. The velocities listed on the cushion charts are final or cushion impact velocities. On applications where the internal cushions or bumpers are to be used, be sure the actual, final or impact velocity is known. If the velocity is not known, use of limit switches with valve deceleration circuits or shock absorbers should be considered. NOTE: The BC205 uses external bumpers in place of internal cushions, LS05 & LS10 do not have cushions or bumpers.

- Cross-reference the final velocity and weight of the load. If the intersection is below the diagonal lines, the internal cushions on the actuator may be used. If the point falls above the dashed diagonal line or if the velocity is not known, use deceleration circuits, external shock absorbers or select a

larger cylinder with greater cushion capacity. On high-cyclic applications, use of external stops is strongly recommended.

### 5 DETERMINE TUBE SUPPORT REQUIREMENTS

- Consult the Tube Support chart for the model selected.
- Cross reference the load weight and maximum distance between supports.

### 6 CONSIDER OPTIONS

- Switches— dc Reed, Hall-effect or ac Triac

Band Cylinders and Linear Slides each have different standard features and options. Check the options section for the actuator you have selected.

- Shock Absorbers— if needed.
- Foot Mounting Kits
- Floating Mount Bracket — use when lack of parallelism occurs between the cylinder and an external guided and supported load.
- Single End Porting (BC3, BC4)
- Long Carrier (BC4)
- Proximity Sensors (LS)
- Dual 180° Carrier (BC3)

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# Application Guidelines

The following conditional statements are intended as general guidelines for use of Tolomatic actuators. Since all applications have their own specific operating requirements, consult Tolomatic, Inc. or your local Tolomatic distributor if an application is unconventional or if questions arise regarding the selection process.



## LUBRICATION GUIDELINES

All Tolomatic actuators (except Cable Cylinders) are prelubricated at the factory. To ensure maximum actuator life, the following guidelines should be followed.

- **Filtration**

We recommend the use of dry, filtered air in our products. "Filtered air" means a level of 10 Micron or less. "Dry" means air should be free of appreciable amounts of moisture. Regular maintenance of installed

filters will generally keep excess moisture in check.

- **External Lubricators (optional)**

The factory prelubrication of Tolomatic actuators will provide optimal performance without the use of external lubrication. However, external lubricators can further extend service life of pneumatic actuators if the supply is kept constant.

Oil lubricators, (mist or drop) should supply a minimum of 1 drop per 20 standard cubic feet per minute to the

cylinder. As a rule of thumb, double that rate if water in the system is suspected. Demanding conditions may require more lubricant.

If lubricators are used, we recommend a non-detergent, 20cP @ 140°F 10-weight lubricant. Optimum conditions for standard cylinder operation are +32° to +150°F (+0° to 65.5°C).

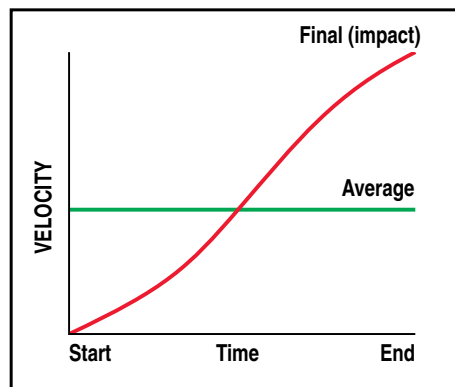
NOTE: Use of external lubricators may wash away the factory installed lubrication. External lubricants must be maintained in a constant supply or the results will be a dry actuator prone to premature wear.

- **Sanitary Environments**

Oil mist lubricators must dispense "Food Grade" lubricants to the air supply. Use fluids with ORAL LD50 toxicity ratings of 35 or higher such as Multitherm® PG-1 or equivalent. Demanding conditions can require a review of the application.

## FINAL VELOCITY CALCULATION

Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Stroking a 100-inch BC3 model in one second yields an average velocity of 100 inches per second. To properly determine the inertial forces for cushioning, it is important to know the



final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered (see diagram).

If final (or impact) velocity cannot be calculated directly, a reasonable guideline is to use 2 x average velocity.

# LS Ordering - All Sizes

**MODEL, BORE, STROKE**      **OPTIONS**

LS 10 SK 55.250 DW 6.0 MP 3 SH 2 BM 2

### MODEL & MOUNTING

**LS** LS Linear Slide - inch (U.S. Standard)  
**LSMM** metric mounting with parallel port

### BORE SIZE

**05** 0.50" (12mm)  
**10** 1.00" (25mm)

### STROKE LENGTH

**SK** \_\_\_ Enter desired stroke length in decimal inches

#### MAXIMUM STROKE

SIZE	MAXIMUM STROKE	
	LS in	LSMM mm
<b>05</b>	72	1,829
<b>10</b>	72	1,829

### AUXILIARY CARRIER (LS\_10)

**DW** Auxiliary carrier With piston & "D" distance  
**DO** Auxiliary carrier Without piston & "D" distance  
 --- "D" Distance between carriers

#### MINIMUM "D" DISTANCE BETWEEN CARRIERS

	in	mm
<b>05</b>	5.07	129
<b>10</b>	5.17	131

**\*When ordering auxiliary carrier option, enter the distance required between carriers. The configurator will calculate the overall length of the actuator.**

### SUPPORTS (LS\_12)

**MP** Support & number required

**\*NOTE:** Four square nuts are provided with each linear slide for base mounting. Additionally 2 square nuts are provided for 30" of stroke and 2 for every 20" of stroke thereafter.

### PROXIMITY SENSOR (LS\_15)

**NP** Sinking type proximity sensor (NPN)  
**PN** Sourcing type proximity sensor (PNP)

### SWITCHES (LS\_13)

(Quantity desired follows ordering code)

**RM** Reed Switch (Form A) with 5-meter lead/QD (Quick-disconnect)  
**RT** Reed Switch (Form A) with 5-m lead  
**BM** Reed Switch (Form C) with 5-meter lead/QD  
**BT** Reed Switch (Form C) with 5-m lead  
**\*KM** Hall-effect Sinking Switch with 5-meter lead/QD  
**\*KT** Hall-effect Sinking Switch w/ 5-m lead  
**\*TM** Hall-effect Sourcing Switch with 5-meter lead/QD  
**\*TT** Hall-effect Sourcing Switch with 5-meter lead  
**CM** TRIAC Switch with 5-meter lead/QD  
**CT** TRIAC Switch with 5-meter lead  
**\*MDR** Dual Magnet (Reed, Hall-effect, Triac)

**\*X** Not available for 05 size

### SHOCK ABSORBERS (LS\_16)

**SH** Shock, Heavy duty and number required  
**SL** Shock, Light duty and number required

**NOTE:** Actuators ordered without selecting a shock absorber **MUST** have external stops. The LS does **NOT** have internal bumpers or cushions.

**Not all codes listed are compatible with all options. Contact Tolomatic with any questions.**



**Use the Tolomatic Sizing Software to determine available options and accessories based on your application requirements.**

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# LS Service Parts Ordering - ALL Sizes

SIZE	Inch (U.S. Standard)		Metric	
	05	10	M(MM)05	M(MM)10
<b>Support</b> <sup>1</sup>	0605-9010	0610-9010	5605-9010	5610-9010
<b>Inductive DC Proximity Sensors - 10-24 volts NPN NO Sink</b> <sup>2</sup>	0605-1023	0610-1023	0605-1023	0610-1023
<b>Inductive DC Proximity Sensors - 10-24 volts PNP NO Source</b> <sup>2</sup>	0605-1024	0610-1024	0605-1024	0610-1024
<b>Switch Rail and Rail Hardware (specify stroke)</b> <sup>3</sup>	0605-9100SK_	0610-9100SK_	0605-9100SK_	0610-9100SK_
<b>Switch Kit - Hardware Only</b>	0605-9999	0610-9999	0605-9999	0610-9999
<b>Shock Absorbers Field Retrofit Kit - Heavy Duty</b> <sup>4,5</sup>	0605-9009	0610-9023	0605-9009	0610-9023
<b>Shock Absorbers Field Retrofit Kit - Lite Duty</b> <sup>4,5</sup>	0605-9008	0610-9022	0605-9008	0610-9022
<b>T-Nuts (Each)</b>	0605-1042	0610-1042	5605-1042	5610-1042
<b>Configured Repair Kit</b> <sup>6</sup>	RKLS05SK_	RKLS10SK_	RKLSMM05SK_	RKLSMM10SK_
<b>Configured Repair Kit (Manufactured before May 1, 1998)</b> <sup>6</sup>	RKLS05SK_	0610-9033SK_	RKLSMM05SK_	0610-9033SK_

PART NUMBER ORDERING		CONFIG. CODE ORDERING
No Mounting Hardware or FE conn. included		Mounting Hardware & FE conn. included
PART NO.	DESCRIPTION	CODE
3600-9084	Switch Only, Reed, Form C, 5m	BT
3600-9085	Switch Only, Reed, Form C, Male Conn.	BM
3600-9082	Switch Only, Reed, Form A, 5m	RT
3600-9083	Switch Only, Reed, Form A, Male Conn.	RM
3600-9086	Switch Only, Triac, 5m	CT
3600-9087	Switch Only, Triac, Male Conn.	CM
3600-9090	Switch Only, Hall-effect, Sinking, 5m	KT
3600-9091	Switch Only, Hall-effect, Sinking, Male Conn.	KM
3600-9088	Switch Only, Hall-effect, Sourcing, 5m	TT
3600-9089	Switch Only, Hall-effect, Sourcing, Male Conn.	TM
2503-1025	Connector (Female) 5 meter lead	


NOTE: When ordered by Config. Code Female connector & all mounting hardware is included


### Switch Ordering NOTES:

To order field retrofit switch and hardware kits for all Tolomatic actuators: SW (Then the model and bore size, and type of switch required)

#### Example: SWLS10RT

(Hardware and Form A Reed switch with 5 meter lead for 1.0" bore LS linear slide)

 Replacing an existing switch on an actuator manufactured AFTER 7-1-1997  
**Order using PART NUMBER in table above**

 Replacing an existing switch on an actuator manufactured BEFORE 7-1-1997  
**Order using CONFIGURATOR CODE in table above**  
**Also order SWITCH RAIL and RAIL HARDWARE**  
If replacing a quick-disconnect switch on an actuator manufactured BEFORE 7-1-1997 it will also be necessary to replace or require the female-end coupler with the in-line splice (see page 175)

 Adding a switch to an actuator manufactured without switches  
**Order using CONFIGURATOR CODE in table above**  
**Also order SWITCH RAIL and RAIL HARDWARE**



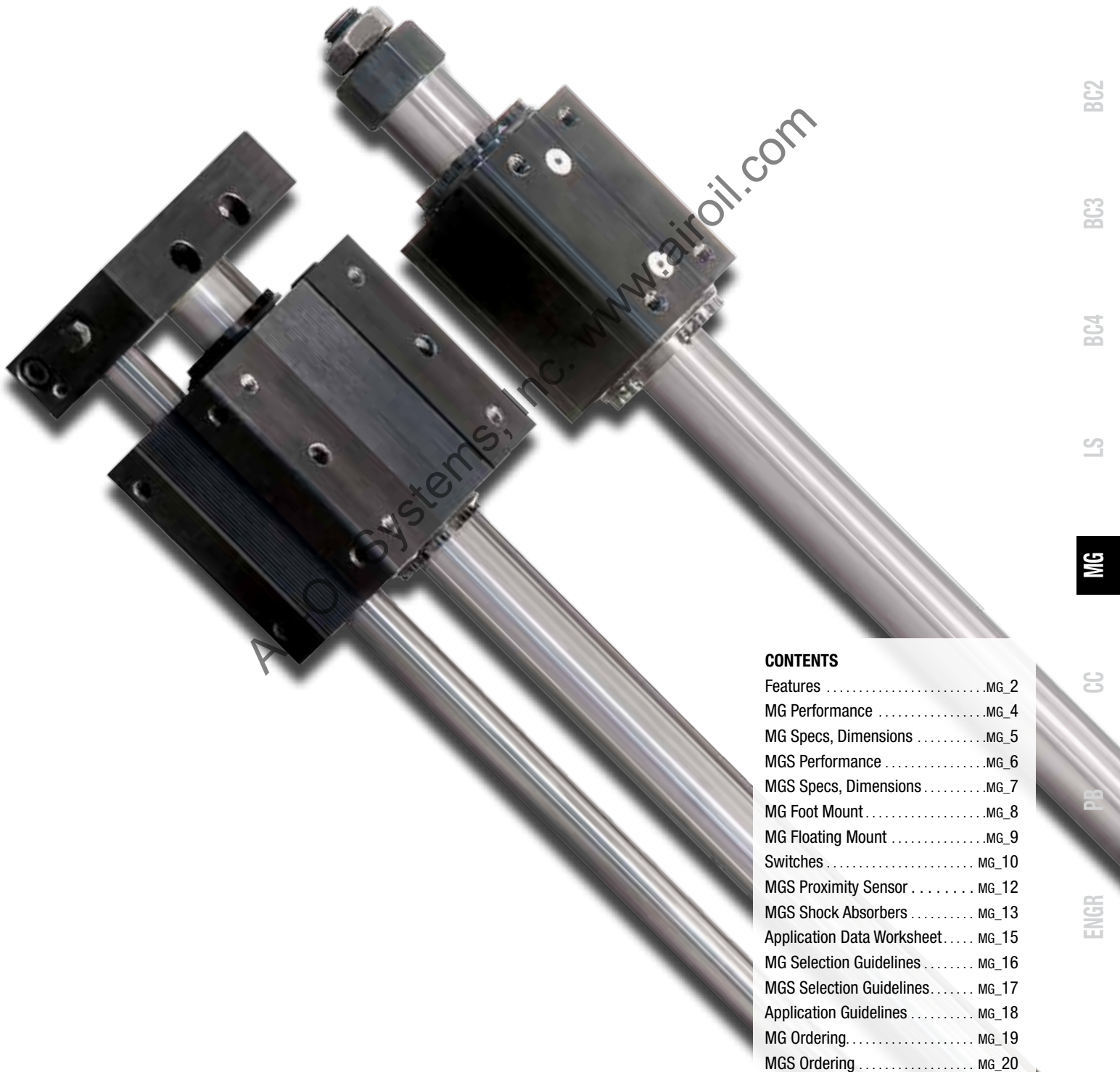
### Service Parts Ordering NOTES:

- Support Kit contains one bracket and two screws
- Proximity sensors for the LS05 have 5mm thread size; LS10 have 8mm thread size
- When replacing an existing switch on an actuator manufactured BEFORE 7-1-1997 switch rail and hardware must be ordered stroke length is required. Order switch using Configurator Code in table at left.
- Shock absorber kit includes one shock and mounting hardware
- NOTE: Actuators ordered without selecting a shock absorber MUST have external stops. The LS does NOT have internal bumpers or cushions.
- Repair Kit for LS contains external dust band, internal seal band, wipers, end caps and internal soft seals. Stroke length must be included after number or code.

NA = Not Available



# MG & MGS MAGNETICALLY COUPLED RODLESS CYLINDER/SLIDE



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ABT  
MXP  
BCZ  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# MAG COUPLED CYLINDER

**ENDURANCE TECHNOLOGY**<sup>SM</sup>

Endurance Technology features are designed for maximum durability to provide extended service life.

With magnetically coupled cylinders there is no mechanical connection of the carrier to the piston. The fully enclosed actuator body prevents contaminants from entering or escaping the actuator body. The perfect choice for applications where there are environmental concerns. Features internal polyurethane bumpers for dampened end-of-travel impact, anodized aluminum heads and actuator block, and a field-repairable design to practically eliminate maintenance downtime.

Air or oil actuated to 100 PSIG. With no mechanical piston connection, the actuator block can be easily rotated for increased mounting flexibility.

## MGS MAG SLIDE

### BEARING CHOICE

- Precision linear ball bearing or
- Sintered bronze

### FIELD REPAIRABLE DESIGN

- Unique in the industry
- Durable and reliable

### ENGINEERED ELASTOMER WIPER

- No leak construction
- Durable, long lasting material

### ANODIZED ALUMINUM CARRIER

- Durable and corrosion resistant
- Precision milled

## MGC MAG CYLINDER

### ANODIZED ALUMINUM HEADS

- Durable and corrosion resistant

# TOLOMATIC... THE RODLESS CYLINDER LEADER

## • DECELERATION •

- Built-in shock absorber mounting
- External bumpers standard
- End of stroke adjustment



## • MULTIPLE-PORTED HEAD • BLOCKS

- Flexible air connection to suit your application

## • HARDENED STEEL SHAFTS •

- Corrosion resistant, durable and stable support system

## • STAINLESS STEEL TUBING •

- Precision milled interior on these long lasting, corrosion resistant tubes

## • MAGNETIC FORCE • CONNECTS PISTON • TO CARRIER

- Rare earth magnets create positive connection between piston and carrier
- 3 coupling strengths
- Decouples at known force (useful in a variety of applications)
- Wear bearing for long life



## OPTIONS - CYLINDER



### FLOATING MOUNT BRACKET **F L**

- Compensates for non-parallelism between cylinder and independently guided load
- Makes installation easier, increases actuator block bearing life



### FOOT MOUNT **F M**

- Best mounting choice in most applications
- Made from plated stamped steel



### SWITCHES

- Available in Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers



### CORROSION RESISTANT

- Stainless steel components with seals for use in harsh environments

## OPTIONS - SLIDE



### SHOCK ABSORBERS **S L S H**

- Smoother deceleration
- Self-compensates for load changes
- Reduces need for equipment maintenance



### PROXIMITY SENSOR

- L.E.D. device senses end-of-stroke with one of two normally open inductive dc proximity sensors.



### SWITCHES

- Available in Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers

## • PNEUMATICALLY OR • HYDRAULICALLY POWERED

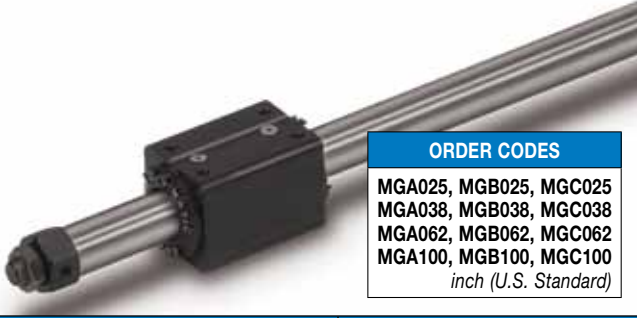
- No leak construction
- Up to 100 PSI



# MG Magnetically Coupled Cylinder - All Sizes

## PERFORMANCE

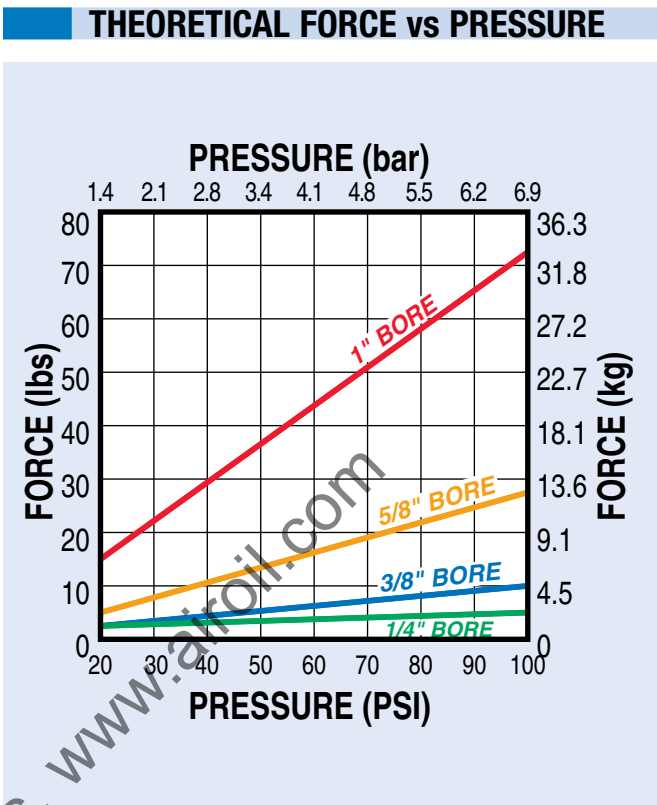
MGA, MGB, MGC



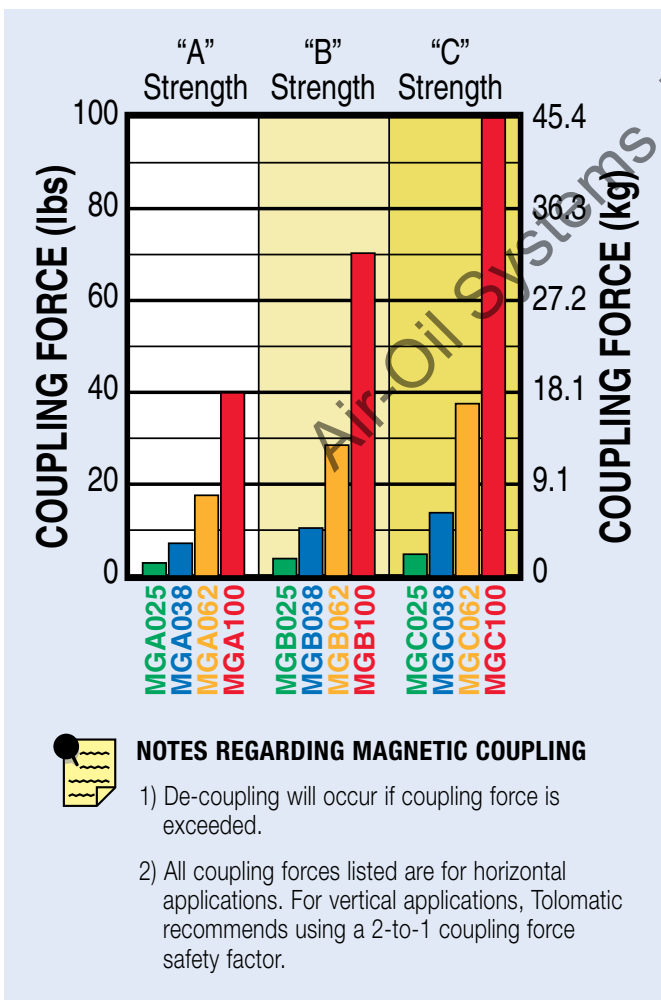
ORDER CODES

MGA025, MGB025, MGC025  
MGA038, MGB038, MGC038  
MGA062, MGB062, MGC062  
MGA100, MGB100, MGC100  
*inch (U.S. Standard)*

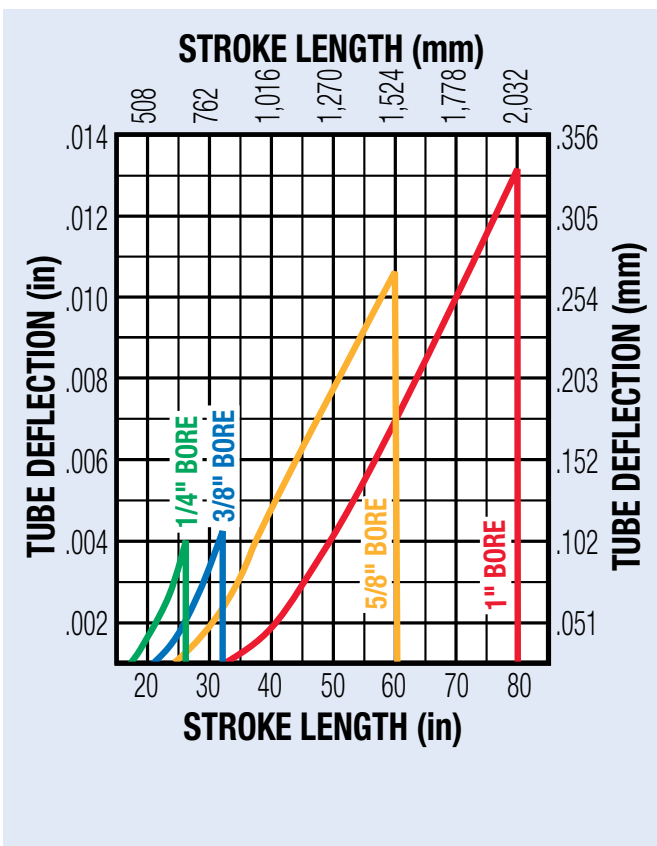
MG OPTIONS	Page
Floating Mount Bracket	MG_9
Foot Mounts	MG_8
Switches	MG_10
MORE INFORMATION	Page
Application Guidelines	MG_18
Ordering	MG_19
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MAGNETIC COUPLING STRENGTH



TUBE DEFLECTION

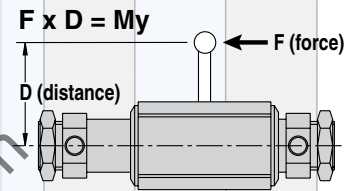


# MG Magnetically Coupled Cylinder - All Sizes

## SPECIFICATIONS

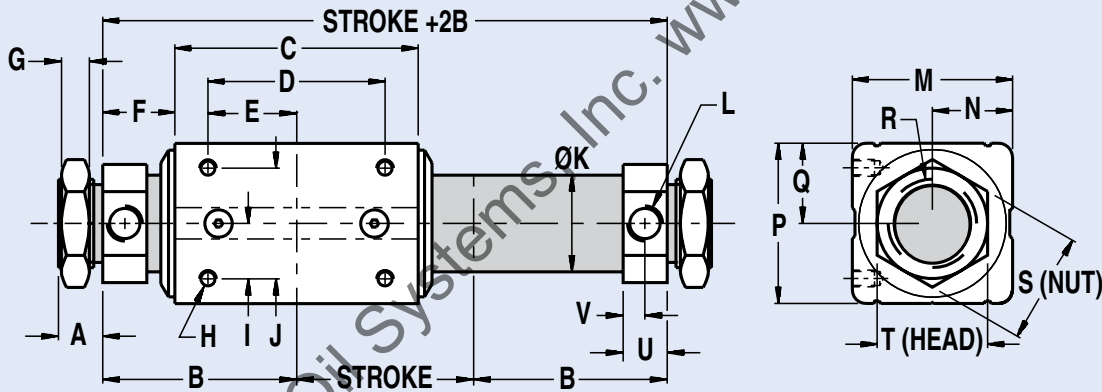
### MGA, MGB, MGC BENDING MOMENT, WEIGHT, ETC.

MAGNET CODE	SIZE	BORE SIZE		BASE WEIGHT		WEIGHT/UNIT		MAX. STROKE		MAX. BENDING MOMENT My		MAX. PRESSURE		TEMPERATURE RANGE	
		in	mm	lbs	kg	lbs/in	kg/mm	in	mm	in-lbs	N-m	PSI	bar	°F	°C
A	025	0.250	6.4	0.12	0.05	0.01	0.00018	26.00	660.4	3.00	0.339	100	6.895	20° to 140°	-7° to 60°
B				0.12	0.05										
C				0.13	0.06										
A	038	0.375	9.5	0.20	0.09	0.01	0.00018	32.00	812.8	4.00	0.452	100	6.895	20° to 140°	-7° to 60°
B				0.21	0.10										
C				0.24	0.11										
A	062	0.625	16	0.49	0.22	0.02	0.00036	60.00	1524.0	9.00	1.017	100	6.895	20° to 140°	-7° to 60°
B				0.51	0.23										
C				0.57	0.26										
A	100	1.000	25	1.52	0.69	0.04	0.00071	80.00	2032.0	35.00	3.954	100	6.895	20° to 140°	-7° to 60°
B				1.55	0.70										
C				1.79	0.81										



**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

## DIMENSIONS



	BORE	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	U	V
025	0.250	0.47	0.23	#5-40UNC x .18	0.20	0.39	Ø.31	#10-32	0.67	0.34	0.67	0.34	3/8-24UNF	0.56	0.56	0.41	0.21
038	0.375	0.50	0.23	#5-40UNC x .18	0.31	0.63	Ø.44	#10-32	0.98	0.49	0.98	0.49	3/8-24UNF	0.56	0.56	0.41	0.21
062	0.625	0.67	0.23	#8-32UNC x .24	0.37	0.75	Ø.69	#10-32	1.38	0.69	1.38	0.69	3/8-24UNF	0.56	0.75	0.44	0.22
100	1.000	0.81	0.32	#10-32UNC x .25	0.62	1.25	Ø1.09	1/8 NPT	1.81	0.91	1.81	0.91	1-12UNF	1.25	1.25	0.50	0.25

Dimensions in inches

	BORE	A	B	B*	C	C*	D	E
025	0.250	0.38	1.25	1.32	1.56	1.70	1.00	0.50
038	0.375	0.38	1.25	1.35	1.50	1.70	1.12	0.56
062	0.625	0.38	1.62	1.75	1.92	2.19	1.50	0.75
100	1.000	0.50	2.19	2.40	2.75	3.17	2.00	1.00

Dimensions in inches

\*For "C strength" configurations only.

	BORE	A	B	B*	C	C*	D	E
025	6.4	9.7	31.8	33.5	39.6	43.2	25.4	12.7
038	9.5	9.7	31.8	34.3	38.1	43.2	28.4	14.2
062	16	9.7	41.1	44.5	48.8	55.6	38.1	19.1
100	25	12.7	55.6	61.0	69.9	80.5	50.8	25.4

Dimensions in millimeters

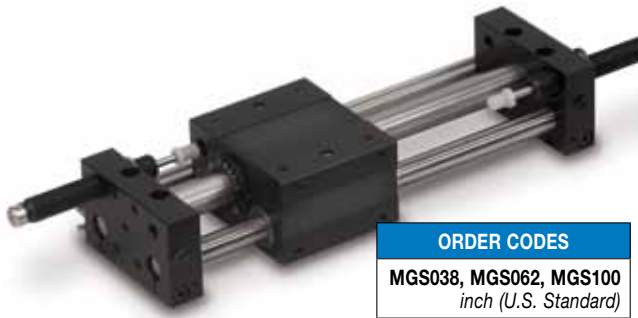
	BORE	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	U	V
025	6.4	11.9	5.8	#5-40UNC x .18	5.1	9.9	7.9	#10-32	17.0	8.6	17.0	8.6	3/8-24UNF	14.2	14.2	10.4	5.3
038	9.5	12.7	5.8	#5-40UNC x .18	7.9	16.0	11.2	#10-32	24.9	12.4	24.9	12.4	3/8-24UNF	14.2	14.2	10.4	5.3
062	16	17.0	5.8	#8-32UNC x .24	9.4	19.1	17.5	#10-32	35.1	17.5	35.1	17.5	3/8-24UNF	14.2	19.1	11.2	5.6
100	25	20.6	8.1	#10-32UNC x .25	15.7	31.8	27.7	1/8 NPT	46.0	23.1	46.0	23.1	1-12UNF	31.8	31.8	12.7	6.4

Dimensions in millimeters

# MGS Magnetically Coupled Slide - All Sizes

## PERFORMANCE

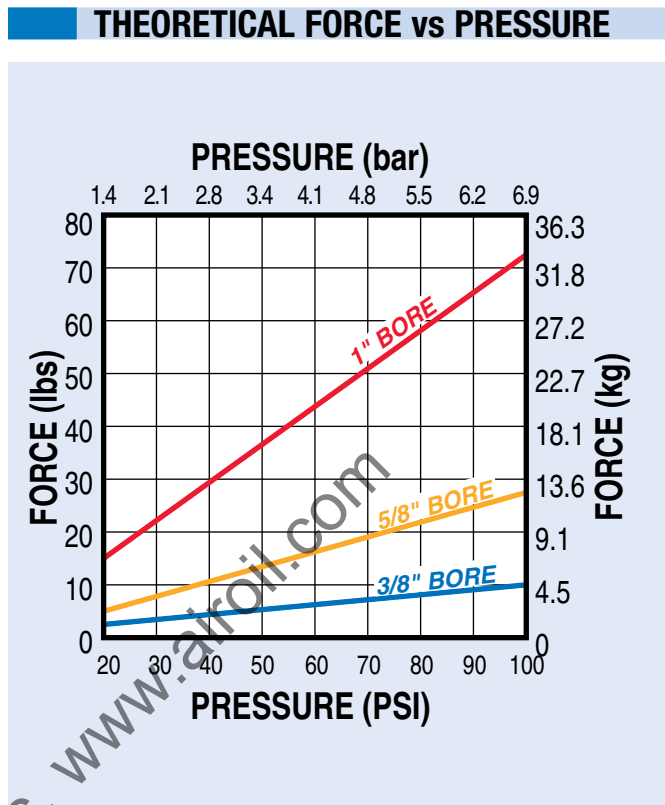
**MGS**



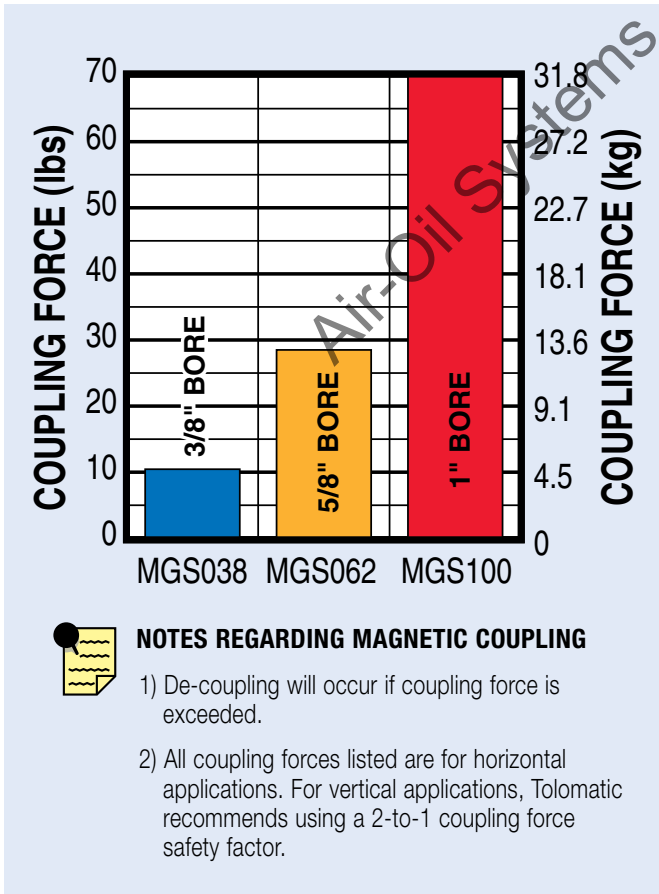
**ORDER CODES**

MGS038, MGS062, MGS100  
*inch (U.S. Standard)*

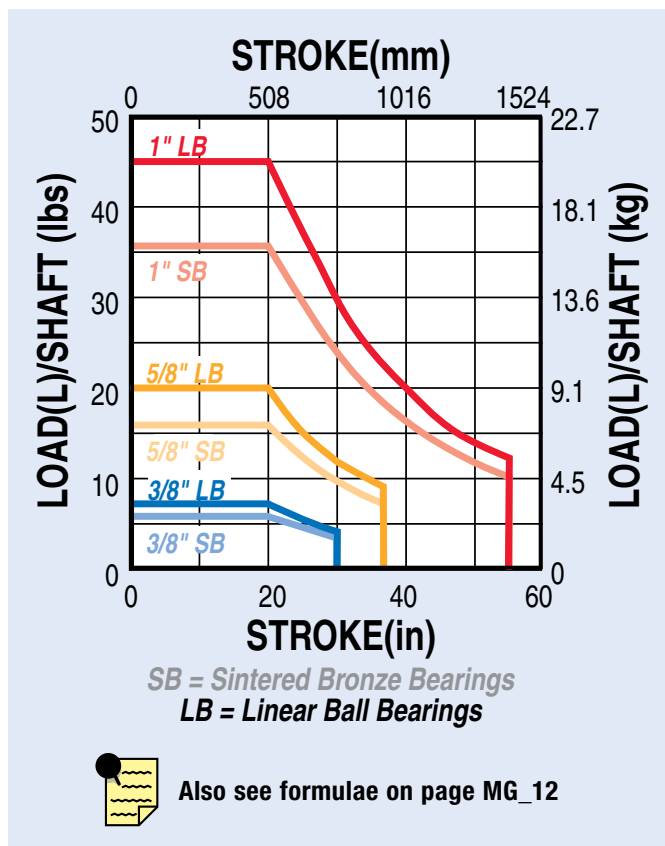
MGS OPTIONS	Page
Proximity Sensor	MG_12
Shock Absorber	MG_13
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**MAGNETIC COUPLING STRENGTH**



**LOAD vs STROKE**



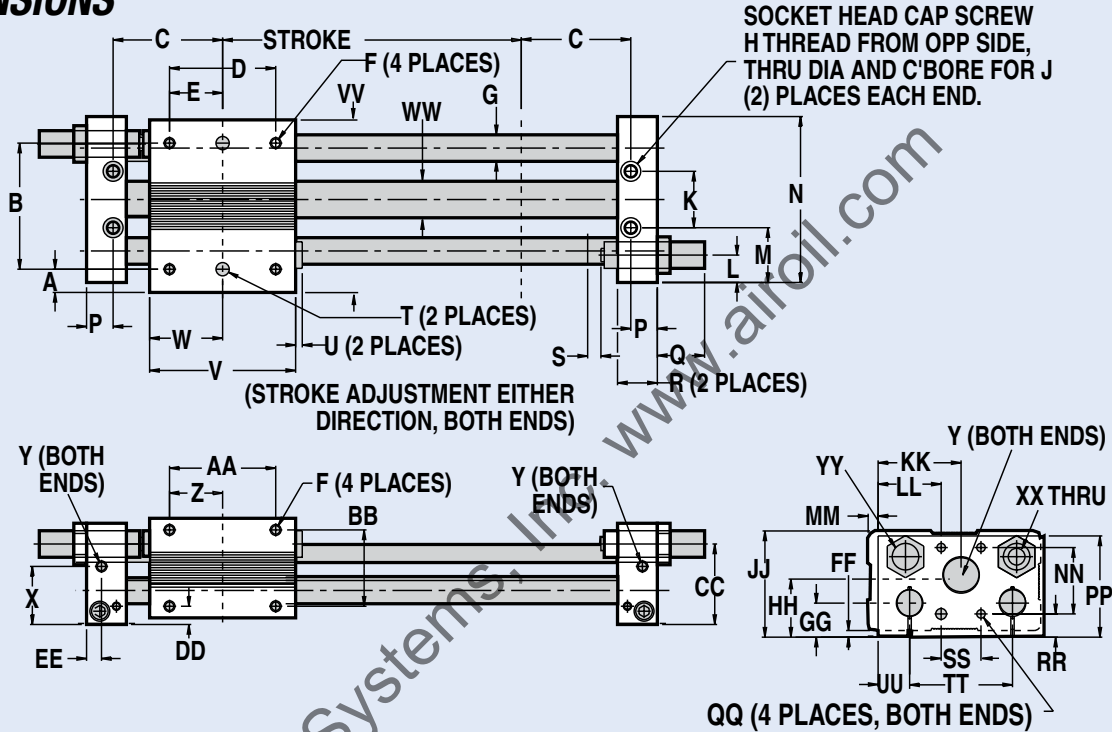
# MGS Magnetically Coupled Slide - All Sizes

## SPECIFICATIONS

SIZE	BORE SIZE		BASE WEIGHT		WEIGHT/UNIT		MAX. STROKE		MAX. PRESSURE		TEMPERATURE RANGE	
	in	mm	lbs	kg	lbs/in	kg/mm	in	mm	PSI	bar	°F	°C
038	0.375	9.5	1.24	0.56	0.004	0.000071	30.00	762.0	100	6.895	20° to 140°	-7° to 60°
062	0.625	16	3.14	1.42	0.130	0.002322	37.00	939.8				
100	1.000	25	4.89	2.22	0.180	0.003214	55.00	1397.0				

**\*For longer strokes, alternate materials, mounting and/or fasteners – consult Tolomatic**

## DIMENSIONS



MODEL	BORE	A	B*	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W
MGS038	0.375	0.30	1.875	1.66	1.19	0.59	10-24 x .38 DP	0.38	1/4-20 x .50 DP	#8	0.75	0.45	0.81	2.38	0.41	1.26 max.	0.63	0.25	2495/2500 x .20 DP	0.13	2.00	1.00
MGS062	0.625	0.44	2.375	2.06	2.00	1.00	10-24 x .38 DP	0.50	1/4-20 x .50 DP	#10	1.06	0.52	1.03	3.12	0.50	1.14 max.	0.75	0.25	2495/2500 x .20 DP	0.13	2.75	1.38
MGS100	1.000	0.42	3.250	2.28	2.50	1.25	10-24 x .38 DP	0.63	1/4-20 x .50 DP	#10	1.63	0.63	1.22	4.06	0.53	1.14 max.	0.75	0.25	2495/2500 x .20 DP	0.13	3.25	1.63

MODEL	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	QQ	RR	SS	TT	UU	VV	WW	XX	YY
MGS038	1.03	#10-32 Port	0.81	1.63	1.06	1.34	0.44	0.19	0.25	0.66	1.08	1.69	1.19	0.81	0.16	0.75	1.62	8-32 x .31 DP	0.56	0.75	1.44	0.47	2.47	0.44	M8-1	3/8-32 Thru, 0.500x.31DP
MGS062	1.09	#10-32 Port	1.00	2.00	1.44	1.52	0.34	0.28	0.13	0.64	1.08	2.00	1.56	1.19	0.19	1.25	1.91	10-24 x .38 DP	0.44	0.75	1.94	0.59	3.25	0.69	M8-1	1/2-20 Thru, 0.625x.33DP
MGS100	1.31	1/8-27 Port	1.00	2.00	1.69	1.75	0.34	0.28	0.13	0.81	1.31	2.34	2.08	1.47	0.09	1.13	2.22	10-24 x .38 DP	0.75	1.13	2.63	0.72	4.09	1.09	M8-1	9/16-18 Thru, 0.688x.31DP

\*Tolerance between dowel pins is ±.001"

Above dimensions in inches

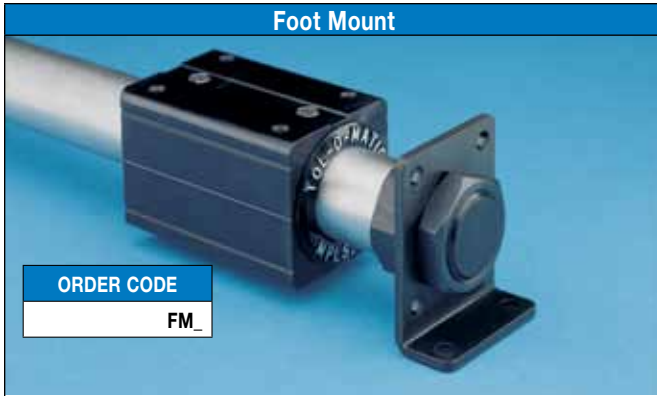
MODEL	BORE	A	B*	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W
MGS038	9.5	7.6	47.6	42.2	30.2	15.0	10-24 x .38 DP	9.7	1/4-20 x .50 DP	#8	19.1	11.4	20.6	60.5	10.4	32.0 max.	16.0	6.4	2495/2500 x .20 DP	3.3	50.8	25.4
MGS062	15.9	11.2	60.3	52.3	50.8	25.4	10-24 x .38 DP	12.7	1/4-20 x .50 DP	#10	26.9	13.2	26.2	79.2	12.7	29.0 max.	19.1	6.4	2495/2500 x .20 DP	3.3	69.9	35.1
MGS100	25.4	10.7	82.6	57.9	63.5	31.8	10-24 x .38 DP	16.0	1/4-20 x .50 DP	#10	41.4	16.0	31.0	103.1	13.5	29.0 max.	19.1	6.4	2495/2500 x .20 DP	3.3	82.6	41.4

MODEL	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	QQ	RR	SS	TT	UU	VV	WW	XX	YY
MGS038	26.2	#10-32 Port	20.6	41.4	26.9	34.0	11.2	4.8	6.4	16.8	27.4	42.9	30.2	20.6	4.1	19.1	41.1	8-32 x .31 DP	14.2	19.1	36.6	11.9	62.7	11.2	M8-1	3/8-32 Thru, 0.500x.31DP
MGS062	27.7	#10-32 Port	25.4	50.8	36.6	38.6	8.6	7.1	3.3	16.3	27.4	50.8	39.6	30.2	4.8	31.8	48.5	10-24 x .38 DP	11.2	19.1	49.3	15.0	82.6	17.5	M8-1	1/2-20 Thru, 0.625x.33DP
MGS100	33.3	1/8-27 Port	25.4	50.8	42.9	44.5	8.6	7.1	3.3	20.6	33.3	59.4	52.8	37.3	2.3	28.7	56.4	10-24 x .38 DP	19.1	28.7	66.8	18.3	103.9	27.7	M8-1	9/16-18 Thru, 0.688x.31DP

\*Tolerance between dowel pins is ±.025mm

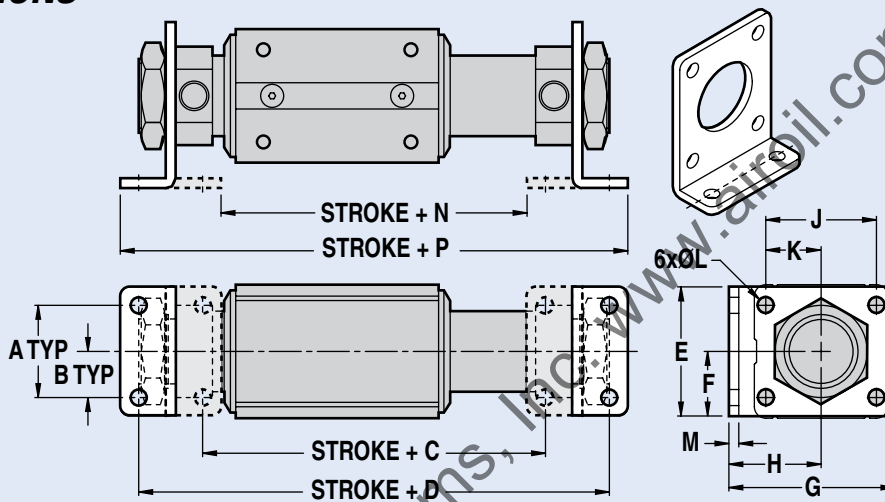
Above dimensions in millimeters

# MG Foot Mount - All Sizes



Foot mounts are an excellent mounting alternative. Made from plated stamped steel, foot mounts are attached to cylinder heads as shown in the dimension drawing, below. Foot mounts may be ordered for one or both ends of the cylinder. Foot mounts can then be attached to almost any surface at a 90° angle to provide solid support without affecting stroke.

## DIMENSIONS



	BORE	A	B	C	C*	D	D*	E	F	G	H	J	K	L	M	N	N*	P	P*
025	0.250	1.13	0.56	2.06	2.20	3.06	3.20	1.50	0.75	1.16	0.72	0.50	0.25	Ø.17	0.06	1.49	1.89	3.36	3.23
038	0.375	1.13	0.56	2.06	2.26	3.06	3.26	1.50	0.75	1.16	0.72	0.50	0.25	Ø.17	0.06	1.49	1.95	3.36	3.29
062	0.625	1.13	0.56	2.80	3.07	3.80	4.07	1.50	0.75	1.16	0.72	0.50	0.25	Ø.17	0.06	2.50	2.77	4.12	4.39
100	1.000	1.25	0.63	3.65	4.07	5.38	5.80	1.75	0.88	2.25	1.25	1.50	0.75	Ø.22	0.13	3.15	3.58	5.88	6.31

Dimensions in inches

\*For "C strength" configurations only.

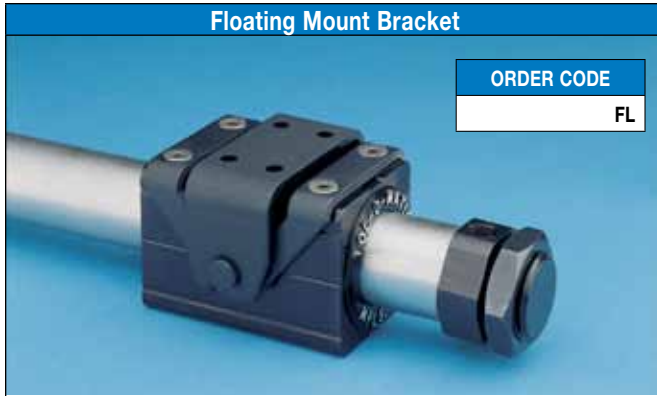
	BORE	A	B	C	C*	D	D*	E	F	G	H	J	K	L	M	N	N*	P	P*
025	6.4	28.7	14.2	52.3	55.9	77.7	81.3	38.1	19.1	29.5	18.3	12.7	6.4	4.3	1.5	37.8	48.0	85.3	82.0
038	9.5	28.7	14.2	52.3	57.4	77.7	82.8	38.1	19.1	29.5	18.3	12.7	6.4	4.3	1.5	37.8	49.5	85.3	83.6
062	16	28.7	14.2	71.1	78.0	96.5	103.4	38.1	19.1	29.5	18.3	12.7	6.4	4.3	1.5	63.5	70.4	104.6	111.5
100	25	31.8	16.0	92.7	103.4	136.7	147.3	44.5	22.4	57.2	31.8	38.1	19.1	5.6	3.3	80.0	90.9	149.4	160.3

Dimensions in millimeters

SIZE	BORE SIZE		WEIGHT	
	in	mm	lbs	kg
025	0.250	6.4	0.07	0.032
038	0.375	9.5	0.07	0.032
062	0.625	16	0.17	0.077
100	1.000	25	0.28	0.127



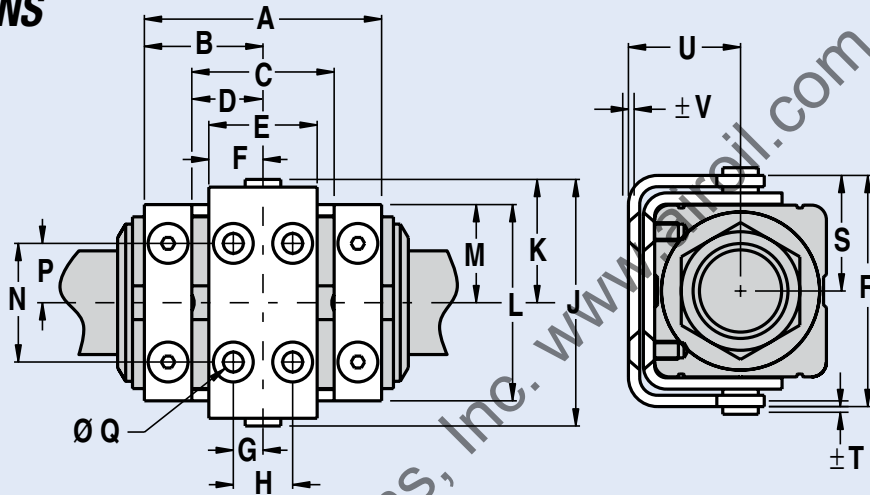
# MG Floating Mount Bracket - All Sizes



The integral floating mount bracket is available for applications in which a load is externally guided and supported and there is a need to compensate for non-parallelism between the cylinder and the independently-guided load.

Loads which are not parallel to the cylinder may result in the cylinder binding if the floating mount bracket is not used. Also, use of the floating mount is highly recommended to provide easier set-up of guide/support system and to help increase actuator block bearing life.

## DIMENSIONS



	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V
<b>025</b>	0.250	1.34	0.67	0.66	0.33	0.63	0.31	0.16	0.31	1.26	0.63	0.87	0.43	0.37	0.18	Ø.14	1.14	0.57	0.04	0.53	0.08
<b>038</b>	0.375	1.47	0.73	0.78	0.39	0.69	0.34	0.16	0.31	1.57	0.78	1.18	0.59	0.63	0.31	Ø.14	1.45	0.72	0.04	0.69	0.08
<b>062</b>	0.625	1.88	0.94	1.12	0.56	0.79	0.39	0.19	0.38	2.09	1.05	1.64	0.82	0.75	0.38	Ø.19	1.99	0.99	0.04	0.93	0.08
<b>100</b>	1.000	2.50	1.25	1.50	0.75	1.14	0.57	0.31	0.62	2.60	1.30	2.07	1.03	1.25	0.63	Ø.248	2.44	1.22	0.06	1.20	0.08

Dimensions in inches

	BORE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V
<b>025</b>	6.4	34.0	17.0	16.8	8.4	16.0	7.9	4.1	7.9	32.0	16.0	22.1	10.9	9.4	4.6	3.6	29.0	14.5	1.0	13.5	2.0
<b>038</b>	9.5	37.3	18.5	19.8	9.9	17.5	8.6	4.1	7.9	39.9	19.8	30.0	15.0	16.0	7.9	3.6	36.8	18.3	1.0	17.5	2.0
<b>062</b>	15.9	47.8	23.9	28.4	14.2	20.1	9.9	4.8	9.7	53.1	26.7	41.7	20.8	19.1	9.7	4.8	50.5	25.1	1.0	23.6	2.0
<b>100</b>	25.4	63.5	31.8	38.1	19.1	29.0	14.5	7.9	15.7	66.0	33.0	52.6	26.2	31.8	16.0	6.3	62.0	31.0	1.5	30.5	2.0

Dimensions in millimeters

SIZE	BORE SIZE		WEIGHT	
	in	mm	lbs	kg
<b>025</b>	0.250	6.4	0.06	0.027
<b>038</b>	0.375	9.5	0.08	0.036
<b>062</b>	0.625	16	0.18	0.082
<b>100</b>	1.000	25	0.33	0.150

# MG & MGS Switches - All Sizes

## SWITCHES



There are 10 sensing choices: DC reed, form A (open) or form C (open or closed); AC reed (Triac, open); Hall-effect, sourcing, PNP (open); Hall-effect, sinking, NPN (open); each with either flying leads or QD (quick disconnect). Commonly used to send analog signals to PLC (programmable logic controllers), TLL, CMOS circuit or other controller device. These switches are activated by the actuator's magnet.

Switches contain reverse polarity protection. QD cables are shielded; shield should be terminated at flying lead end.

If necessary to remove factory installed switches, be sure to reinstall on the same of side of actuator with scored face of switch toward internal magnet.

## SPECIFICATIONS

ORDER CODE	REED DC				REED AC		HALL-EFFECT DC			
	RT	RM	BT	BM	CT	CM	TT	TM	KT	KM
PART NUMBER	3600-9082	3600-9083	3600-9084	3600-9085	3600-9086	3600-9087	3600-9088	3600-9089	3600-9090	3600-9091
LEAD	5m	QD*	5m	QD*	5m	QD*	5m	QD*	5m	QD*
CABLE SHIELDING	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†
SWITCHING LOGIC	"A" Normally Open		"C" Normally Open or Closed		Triac Normally Open		PNP (Sourcing) Normally Open		NPN (Sinking) Normally Open	
MECHANICAL CONTACTS	Single-Pole Single-Throw		Single-Pole Double-Throw		Single-Pole Single-Throw		NO, These Are Solid State Components			
COIL DIRECT	Yes		Yes		Yes		—			
POWER LED	None		None		None		None		None	
SIGNAL LED	Red		None		None		Red		Red	
OPERATING VOLTAGE	200 Vdc max.		120 Vdc max.		120 Vac max.		5 - 25 Vdc			
OUTPUT RATING	—		—		—		25 Vdc, 200mA dc			
OPERATING TIME	0.6 msec max. (including bounce)		0.7 msec max. (including bounce)		—		< 10 micro sec.			
OPERATING TEMPERATURE	-40°F [-40°C] to 158°F [70°C]						0°F [-18°C] to 150°F [66°C]			
RELEASE TIME	1.0 msec. max.		—		—		—			
ON TRIP POINT	—		—		—		150 Gauss maximum			
OFF TRIP POINT	—		—		—		40 Gauss minimum			
**POWER RATING (WATTS)	10.0 §		3.0 §§		10.0		5.0			
VOLTAGE DROP	2.6 V typical at 100 mA		NA		—		—			
RESISTANCE	0.1 Ω Initial (Max.)		—		—		—			
CURRENT CONSUMPTION	—		—		1 Amp at 86°F [30°C]   0.5 Amp at 140°F [60°C]		200 mA at 25 Vdc			
FREQUENCY	—		—		47 - 63 Hz		—			
CABLE MIN. BEND RADIUS	STATIC		0.630" [16mm]							
	DYNAMIC		Not Recommended							

**CAUTION: DO NOT OVER TIGHTEN SWITCH HARDWARE WHEN INSTALLING!**

**\*\* WARNING:** Do not exceed power rating (Watt = Voltage X Amperage). Permanent damage to sensor will occur.

\*QD = Quick Disconnect; Male coupler is located 6" [152mm] from sensor, Female coupler to flying lead (part #2503-1025) distance is 197" [5m] also see Cable Shielding specification above

**REPLACEMENT OF QD SWITCHES MANUFACTURED BEFORE JULY 1, 1997:** It will be necessary to replace or rewire the female end coupler.



**Reed Switch Life Expectancy:** Up to 200,000,000 cycles (depending on load current, duty cycle and environmental conditions)

†Shielded from the female quick disconnect coupler to the flying leads. Shield should be terminated at flying lead end.

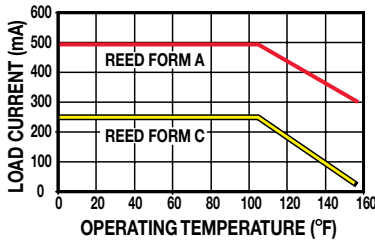
§ Maximum current 500mA (not to exceed 10VA) Refer to Temperature vs. Current graph and Voltage Derating graph

§§ Maximum current 250mA (not to exceed 3VA) Refer to Temperature vs. Current graph and Voltage Derating graph

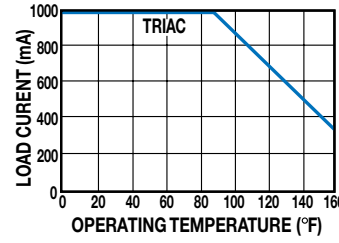
# MG & MGS Switches - All Sizes

## PERFORMANCE

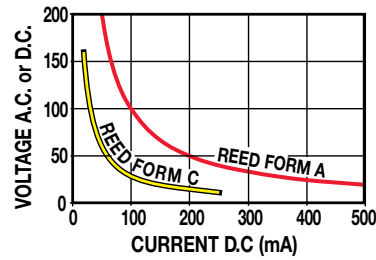
TEMP. vs CURRENT, DC REED



TEMP. vs CURRENT, AC REED

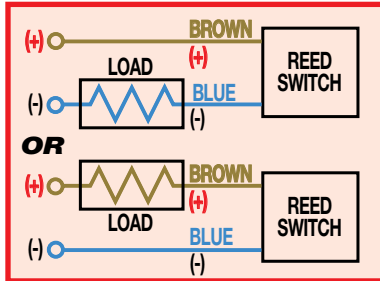


VOLTAGE DERATING, DC REED

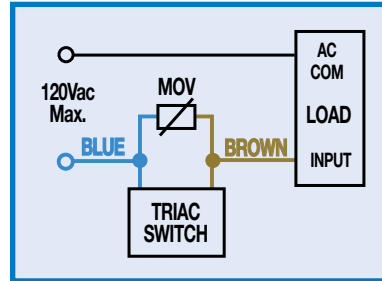


## WIRING DIAGRAMS

**R**T & **R**M DC REED, FORM A



**C**T & **C**M AC REED, TRIAC

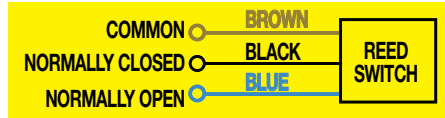


## INSTALLATION INFORMATION

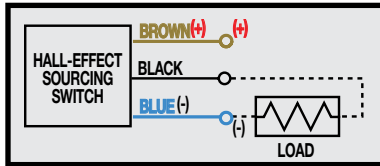


**!** THE NOTCHED FACE OF THE SWITCH INDICATES THE SENSING SURFACE AND MUST FACE TOWARD THE MAGNET.

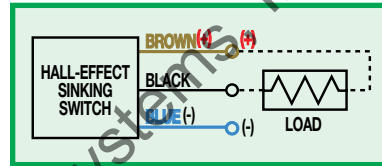
**B**T & **B**M DC REED, FORM C



**T**T & **T**M HALL-EFFECT, SOURCING, PNP

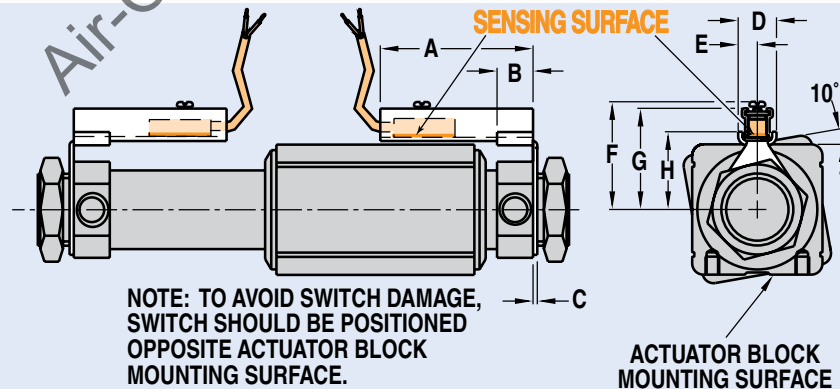


**K**T & **K**M HALL-EFFECT, SINKING, NPN



## MG Magnetically Coupled Cylinder

### DIMENSIONS



	BORE	A	B	C	D	E	F	G	H
<b>025</b>	0.250	1.23	0.40	0.06	0.53	0.27	0.91	0.88	0.51
<b>038</b>	0.375	1.23	0.40	0.06	0.53	0.27	1.07	1.04	0.67
<b>062</b>	0.625	1.60	0.45	0.06	0.53	0.27	1.27	1.24	0.87
<b>100</b>	1.000	2.12	0.50	0.06	0.53	0.27	1.48	1.45	1.08

Dimensions in inches

	BORE	A	B	C	D	E	F	G	H
<b>025</b>	6.4	31.24	10.16	1.52	13.46	6.86	23.16	22.35	12.95
<b>038</b>	9.5	31.24	10.16	1.52	13.46	6.86	27.18	26.42	17.02
<b>062</b>	15.9	40.64	11.43	1.52	13.46	6.86	32.26	31.50	22.10
<b>100</b>	25.4	53.85	12.70	1.52	13.46	6.86	37.59	36.83	27.43

Dimensions in millimeters

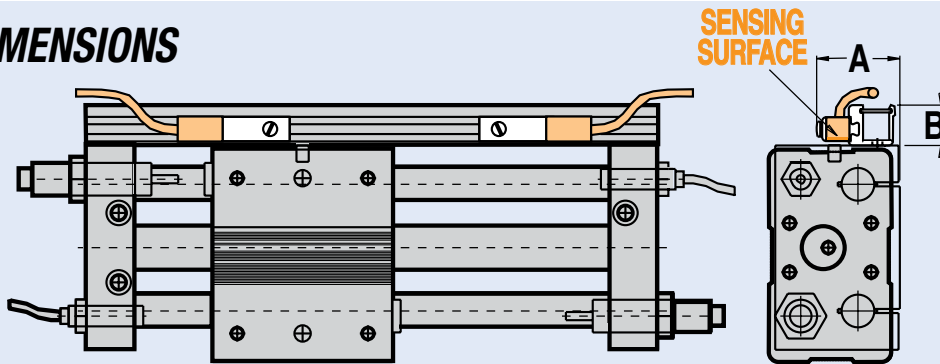
ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# MGS Switches - All Sizes



## MGS Magnetically Coupled Slide

### DIMENSIONS



	BORE	A	B
038	0.375	1.24	0.47
062	0.625	1.16	0.47
100	1.000	1.47	0.47

Dimensions in inches

	BORE	A	B
038	9.5	31.50	11.94
062	15.9	29.46	11.94
100	25.4	37.34	11.94

Dimensions in millimeters

## MGS Proximity Sensor



This L.E.D. device senses end-of-stroke with one of two normally open inductive d.c. proximity sensors. NPN supplies a sinking signal, PNP supplies a sourcing signal to a device such as a programmable logic controller.

Ambient Temp.: -13° to 158° F., (-25° to 70° C.)

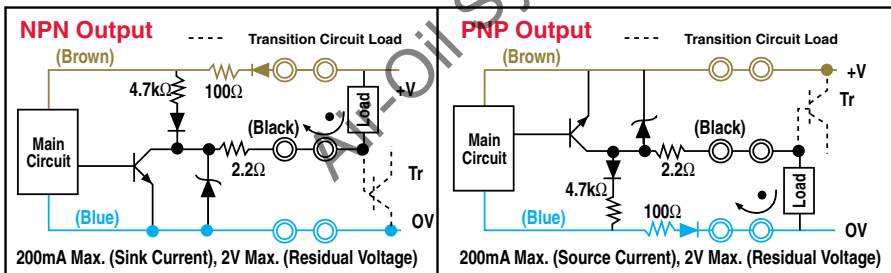
NEMA Encl. Rating: 1, 3, 4, 6, 12, 13

Lead Length: 6.56 feet (2.0m)

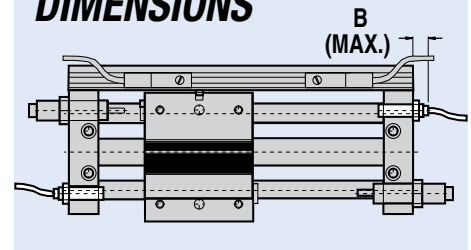
Max. Sensing Distance (LS05): .059" (1.5mm)

Max. Sensing Distance (LS10): .039" (1.0mm)

### Wiring Diagrams

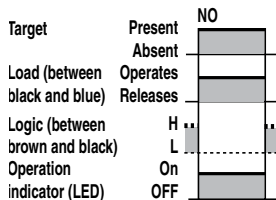


### DIMENSIONS



SIZE	BORE		B		WEIGHT	
	in	mm	in	mm	lbs	kg
038	0.375	9.5	0.63	16.0	0.24	0.109
062	0.625	16	0.52	13.2	0.24	0.109
100	1.000	25	0.52	13.2	0.25	0.113

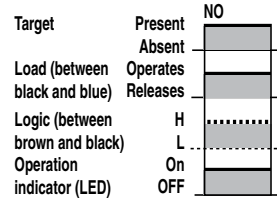
#### NPN Output



#### Short-Circuit Indication

The load output immediately turns off and remains off until the short-circuit protection is reset.

#### PNP Output

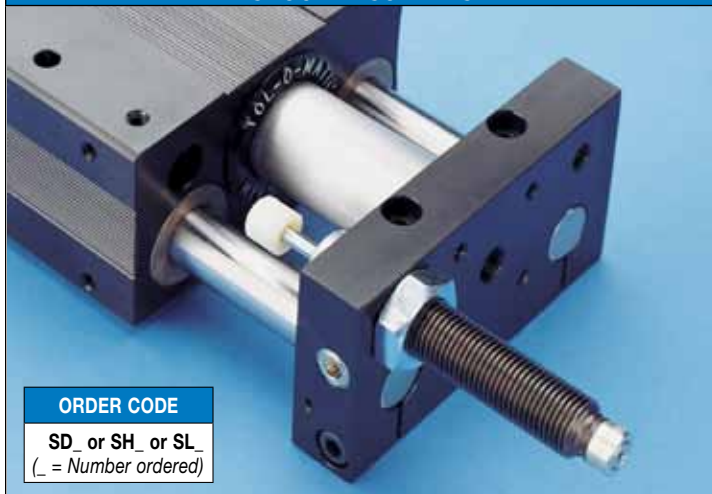


#### Resetting Short-Circuit Protection

To reset the short-circuit protection, repair the short. The short-circuit protection will then automatically reset.

# MGS Shock Absorbers - All Sizes

## SHOCK ABSORBERS



### ORDER CODE

SD\_ or SH\_ or SL\_  
 (\_ = Number ordered)

Magnetically coupled slides with standard internal bumpers offer an effective method of decelerating loads. However, magnetically coupled slides are capable of carrying heavier loads at higher velocities than the internal bumpers can absorb. Optional shock absorbers can be used to increase the unit's life and broaden the application range for the magnetically coupled slide you have chosen.

Typical shock absorber life varies between 1-2 million cycles (depending on environment). Appropriate preventative maintenance should be considered in high cyclic applications.

**⚠ CAUTION:** In applications which result in a load bending moment at deceleration, care should be taken to decelerate the load rather than the carrier of the magnetically coupled slide.

ABT

IMXP

BCZ

BC3

BC4

LS

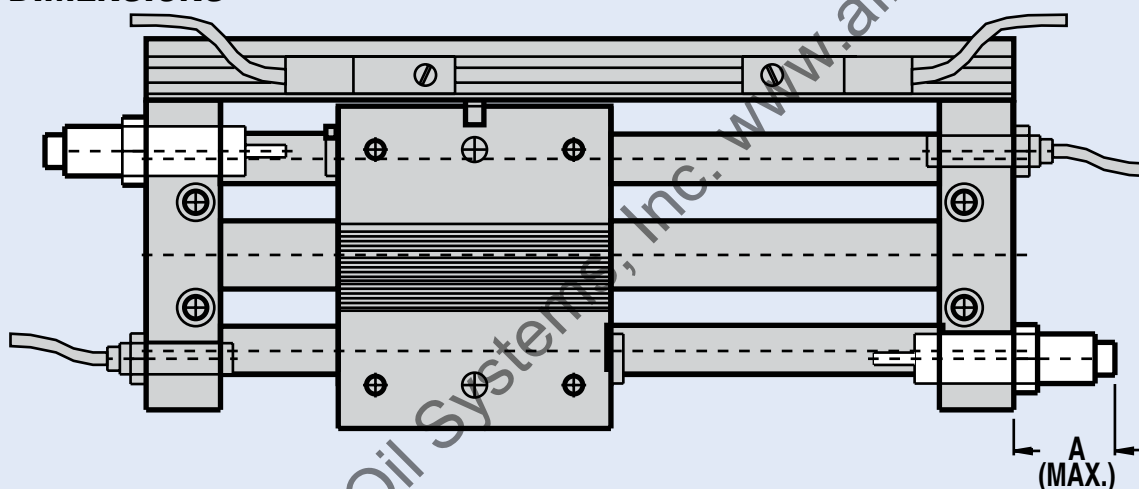
MG

CC

PB

ENGR

## DIMENSIONS



SIZE	BORE		A		WEIGHT	
	in	mm	in	mm	lbs	kg
038	0.375	9.5	0.94	23.9	0.01	0.005
062	0.625	16	2.48	63.0	0.02	0.009
100	1.000	25	2.63	66.8	0.04	0.018

# MGS Shock Absorbers - All Sizes

## PERFORMANCE

### VELOCITY vs LOAD

ABT

MXP

BC2

BC3

BC4

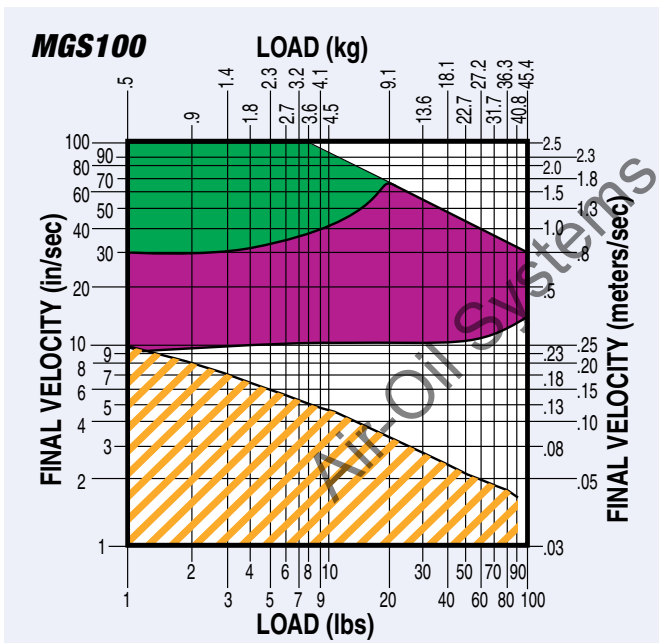
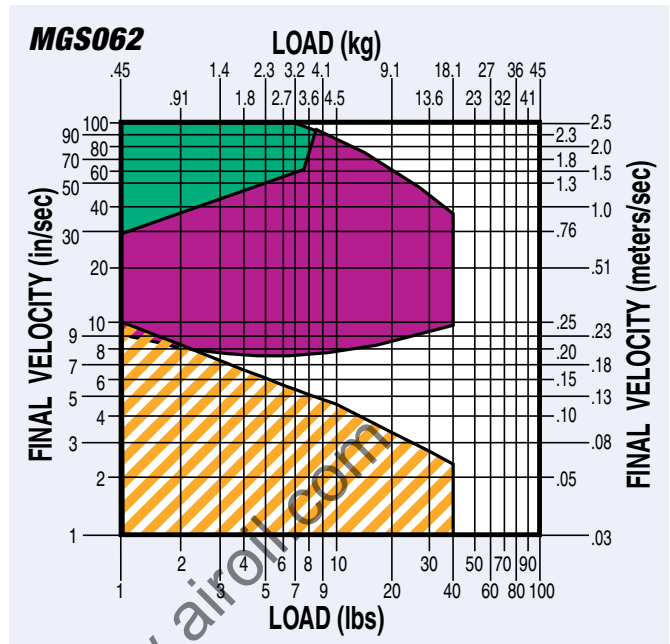
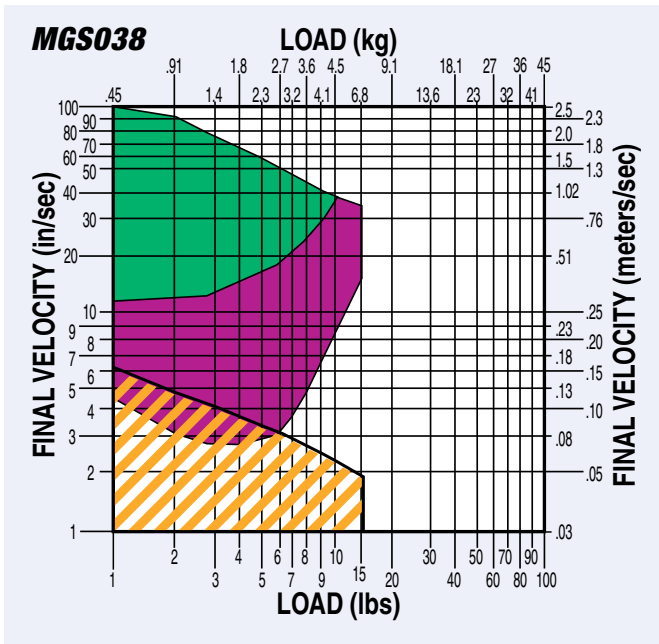
LS

MG

CC

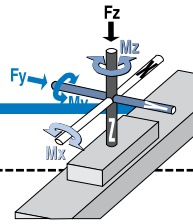
PB

ENGR



**NOTE:** If final (or impact) velocity cannot be calculated directly, a reasonable guideline to use is 2 x average velocity.

# Application Data Worksheet



## STROKE LENGTH \_\_\_\_\_

inch (S I K)  millimeters  
(U.S. Standard) (Metric)

## AVAILABLE AIR PRESSURE \_\_\_\_\_

PSI  bar  
(U.S. Standard) (Metric)

## REQUIRED THRUST FORCE \_\_\_\_\_

lbf  N  
(U.S. Standard) (Metric)

## LOAD \_\_\_\_\_

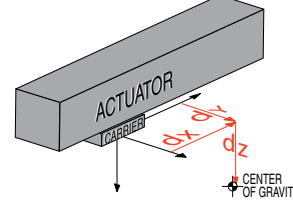
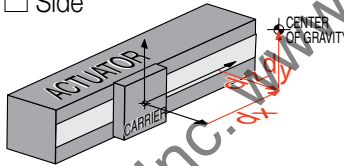
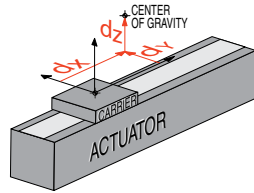
lb  kg  
(U.S. Standard) (Metric)

## LOAD CENTER OF GRAVITY DISTANCE TO CARRIER CENTER

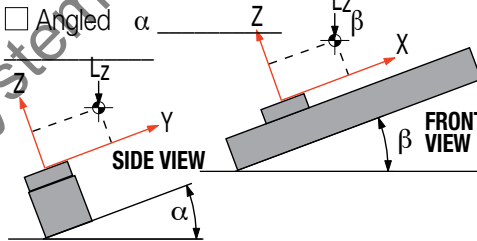
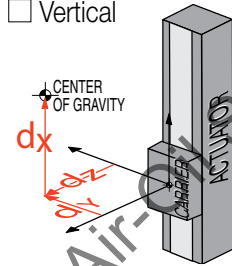
$d_x$  \_\_\_\_\_  
 $d_y$  \_\_\_\_\_  
 $d_z$  \_\_\_\_\_  
 inch  millimeters  
(U.S. Standard) (Metric)

## ORIENTATION

Horizontal  Side  Horizontal Down



Vertical



## OTHER ISSUES:

(i.e. Environment, Temperature, Contamination, etc.)

## FORCES APPLIED TO CARRIER

lbf  N  
(U.S. Standard) (Metric)

$F_z$  \_\_\_\_\_  
 $F_y$  \_\_\_\_\_

## BENDING MOMENTS APPLIED TO CARRIER

in-lbs  N-m  
(U.S. Standard) (Metric)

$M_x$  \_\_\_\_\_  
 $M_y$  \_\_\_\_\_  
 $M_z$  \_\_\_\_\_

## FINAL VELOCITY \_\_\_\_\_

in/sec  mm/sec  
(U.S. Standard) (Metric)

## MOVE TIME sec. \_\_\_\_\_

## NO. OF CYCLES \_\_\_\_\_

per minute  per hour

Contact information: \_\_\_\_\_



Fax (1-763-478-8080) or call Tolomatic (1-800-328-2174) with the above information. We will provide any assistance needed to determine the proper actuator.

# MG: Mag Coupled Cylinder Selection Guidelines - All Sizes

## EXTERNAL LOAD GUIDANCE AND SUPPORT

The process of selecting a magnetically coupled cylinder for a given application can be complex. **It is highly recommended that you contact Tolomatic or a Tolomatic Distributor for assistance in selecting the best actuator for your application. The following overview of the selection guidelines are for educational purposes only.**

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Magnetically Coupled Cylinder model for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs. or kgs.)
- Orientation of load (lbs. or kgs.)
- Velocity of load (in./sec. or mm/sec.)
- Stroke length (in. or mm)

### 2 SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 3), the actuator will accommodate the application. If the intersection is above the diagonal line, a larger cylinder bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 DETERMINE COUPLING FORCE REQUIREMENTS

Use the following formula:

$$F = .013 \times \text{Weight} \times \text{Velocity}^2$$

Calculated value must be less than the Magnetic Coupling Strength values. (page MG\_04)

### 4 DETERMINE INTERNAL CUSHION CAPACITY

- Consult the Cushion Data chart for the model selected. The velocities listed on the cushion charts are final or cushion impact velocities. On applications where the internal cushions or bumpers are to be used, be sure the actual, final or impact velocity is known. If the velocity is not known, use of limit switches with valve deceleration circuits or shock absorbers should be considered.

Cross-reference the final velocity and weight of the load. If the intersection is below the diagonal lines, the internal cushions on the actuator may be used. If the point falls above the dashed diagonal line or if the velocity is not known, use deceleration circuits, external shock absorbers or select a larger cylinder with greater cushion capacity. On high-cyclic applications, use of external stops is strongly recommended.

NOTE: Magnetically coupled cylinders do not have internal cushions. Heavier loads require external stops or shock absorbers.

Air-Oil Systems, Inc. www.airoil.com



# MGS: Mag Coupled Slide Selection Guidelines - All Sizes

## PROVIDING LOAD GUIDANCE AND SUPPORT

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Magnetically Coupled Slide for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs. or kgs.)
- Orientation of load (lbs. or kgs.)
- Velocity of load (in./sec. or mm/sec.)
- Stroke length (in. or mm)

### 2 SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 3), the actuator will accommodate the application. If the intersection is above the

diagonal line, a larger cylinder bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 KEEP UNDER MAXIMUM STROKE LENGTH

There are specific maximum stroke lengths for each model.  
MGS038: 30.00"  
MGS062: 37.00"  
MGS100: 55.00"

### 4 DETERMINE NATURE OF LOAD AND THE EFFECT OF BENDING MOMENTS

If the actuator will guide and support a load located directly over the center of carrier, bending moments will not be a factor in the actuator selection. Magnetically Coupled Slides perform best that way. See the Bending Moments Formulae below if your application requires the load to be away from center of the carrier.

### 5 DETERMINE THE BEARING ROD LOAD CAPACITY

Determine whether the Load Weight and Stroke Length will be within the load capacity for the bearing rods.

Cross reference the load weight and stroke on the Load Weight vs. Stroke chart for the selected bore size. (Page MG\_6) If the intersection falls below the curve, the cylinder will accommodate the application requirements. If the intersection falls outside the curve, consult the chart of a larger bore size that will accommodate the required load weight and stroke for your application.

The weight on the bearing rods causes them to bend or deflect slightly over their length. This deflection is increased for longer rods and/or higher weights on the bearing block. For proper operation, rod deflection must not exceed .30".

### 6 DETERMINE COUPLING FORCE REQUIRED

- Consult the Mag Coupling Strength chart (page MG\_6). If the load value is less than the coupling force for the chosen actuator, it may be used for the application. If the load value is greater than the coupling force for the chosen actuator, select a larger actuator.

### 7 DETERMINE INTERNAL BUMPER CAPACITY

- Consult the Cushion Data chart (Bumper Data for Magnetically Coupled Slides page MG\_14) for the model selected. The velocities listed on the cushion charts are final or cushion impact velocities. On applications where internal bumpers are to be used, be sure the actual, final or impact velocity is known. If the velocity is not known, use of limit switches with valve deceleration circuits or shock absorbers should be considered.

## BENDING MOMENTS

### Loading Equation Data

MODEL	BORE SIZE	A (in.)	D (in.)	F (lbs.)	G (lbs.)
MGS038	3/8"	1.44	1.13	14.00	11.00
MGS062	5/8"	1.94	1.50	40.00	32.00
MGS100	1"	2.62	2.00	90.00	72.00

(See MGS Load vs Stroke graph on page MG\_6)

### Loading Equation Key

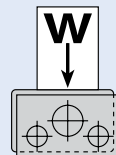
- A** = Distance between shaft centers
- B** = Distance from load center to center of nearest shaft (in.); determined by application

- L** = Load per shaft (lbs.)
- W** = Payload weight (lbs.)
- D** = Axial distance between center of bearings (in.)

- F** = Max. bearing sliding load (linear bearings) (lbs.)
- G** = Max. bearing sliding load (sintered bronze bearings) (lbs.)

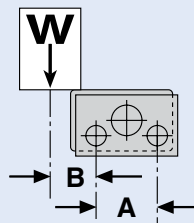
#### "L" MOMENT

$$L = \frac{W}{2}$$



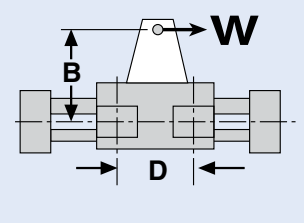
#### "Mx" MOMENT

$$L = \frac{WB}{A}$$



#### "My" / "Mz" MOMENT

$$F \text{ or } G = 2L = \frac{WB}{D}$$



L should be below curve for the corresponding slide on the "Load vs. Stroke" chart (for sintered bronze or linear bearings - Mag Coupled Slides).

# Application Guidelines

The following conditional statements are intended as general guidelines for use of Tolomatic actuators. Since all applications have their own specific operating requirements, consult Tolomatic, Inc. or your local Tolomatic distributor if an application is unconventional or if questions arise regarding the selection process.



## LUBRICATION GUIDELINES

All Tolomatic actuators (except Cable Cylinders) are prelubricated at the factory. To ensure maximum actuator life, the following guidelines should be followed.

### • Filtration

We recommend the use of dry, filtered air in our products. "Filtered air" means a level of 10 Micron or less. "Dry" means air should be free of appreciable amounts of moisture. Regular maintenance of installed

filters will generally keep excess moisture in check.

### • External Lubricators (optional)

The factory prelubrication of Tolomatic actuators will provide optimal performance without the use of external lubrication. However, external lubricators can further extend service life of pneumatic actuators if the supply is kept constant.

Oil lubricators, (mist or drop) should supply a minimum of 1 drop per 20 standard cubic feet per minute to the

cylinder. As a rule of thumb, double that rate if water in the system is suspected. Demanding conditions may require more lubricant.

If lubricators are used, we recommend a non-detergent, 20cP @ 140°F 10-weight lubricant. Optimum conditions for standard cylinder operation are +32° to +150°F (+0° to 65.5°C).

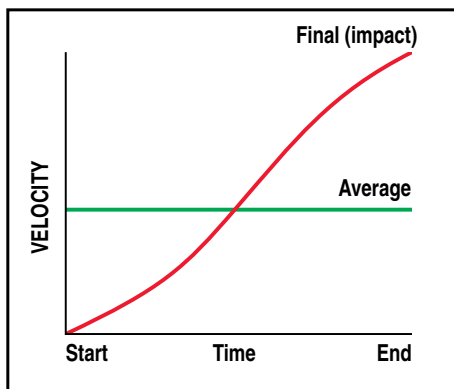
NOTE: Use of external lubricators may wash away the factory installed lubrication. External lubricants must be maintained in a constant supply or the results will be a dry actuator prone to premature wear.

### • Sanitary Environments

Oil mist lubricators must dispense "Food Grade" lubricants to the air supply. Use fluids with ORAL LD50 toxicity ratings of 35 or higher such as Multitherm® PG-1 or equivalent. Demanding conditions can require a review of the application.

## FINAL VELOCITY CALCULATION

Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Stroking a 100-inch BC3 model in one second yields an average velocity of 100 inches per second. To properly determine the inertial forces for cushioning, it is important to know the



final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered (see diagram).

If final (or impact) velocity cannot be calculated directly, a reasonable guideline is to use 2 x average velocity.

# MG Ordering - ALL Sizes

**MODEL, BORE, STROKE**      **OPTIONS**

**MGC 062 SK58-250 FM2 FL BM2**

**MODEL & MAG COUPLING**

**MGA** Low coupling strength mag coupled cylinder

**MGB** Medium coupling strength mag coupled cylinder

**MGC** High coupling strength mag coupled cylinder

**STROKE LENGTH**

SK \_\_\_ Enter desired stroke length in decimal inches

SIZE	MAXIMUM STROKE	
	in	mm
025	26.00	660.4
038	32.00	812.8
062	60.00	1,524.0
100	80.00	2,032.0

**SWITCHES (MG\_10)**

TYPE		QUICK-DISCONNECT	CODE	QUANTITY	LEAD LENGTH
REED	Form A	QD	RM	After code enter quantity desired	5 meters
		no	RT		
Form C		QD	BM		
		no	BT		
HALLEFFECT	Sinking	QD	KM		
		no	KT		
Sourcing		QD	TM		
		no	TT		
TRIAC		QD	CM		
		no	CT		

**BORE SIZE**

025 0.25" (6.4mm)

038 0.375" (9.5mm)

062 0.625" (16mm)

100 1.00" (25mm)

**FOOT MOUNT (MG\_8)**

FM\_ Foot Mount & number required (1 or 2)

**FLOATING MOUNT (MG\_9)**

FL Floating Mount Bracket

# MG Service Parts Ordering - ALL Sizes

PART NUMBER ORDERING		CONFIG. CODE ORDERING
No Mounting Hardware or FE conn. included		Mounting Hardware & FE conn. included
PART NO.	DESCRIPTION	CODE
3600-9084	Switch Only, Reed, Form C, 5m	BT
3600-9085	Switch Only, Reed, Form C, Male Conn.	BM
3600-9082	Switch Only, Reed, Form A, 5m	RT
3600-9083	Switch Only, Reed, Form A, Male Conn.	RM
3600-9086	Switch Only, Triac, 5m	CT
3600-9087	Switch Only, Triac, Male Conn.	CM
3600-9090	Switch Only, Hall-effect, Sinking, 5m	KT
3600-9091	Switch Only, Hall-effect, Sinking, Male Conn.	KM
3600-9088	Switch Only, Hall-effect, Sourcing, 5m	TT
3600-9089	Switch Only, Hall-effect, Sourcing, Male Conn.	TM
2503-1025	Connector (Female) 5 meter lead	

NOTE: When ordered by Config. Code Female connector & all mounting hardware is included



**Switch Ordering NOTES:**

To order field retrofit switch and hardware kits for all Tolomatic actuators: SW (Then the model and bore size, and type of switch required)

**Example: SWMGC062RT**

(Hardware and Form A Reed switch with 5 meter lead for 0.625" bore Mag coupled cylinder)



Mounting hardware is required if replacing switch for any actuator manufactured before 7/1/97

SIZE	025	038	062	100
<b>Floating Mount Kit</b>	2402-9005	2403-9005	2406-9005	2410-9005
<b>Foot Mount Kit<sup>1</sup></b>	2402-9011	2402-9011	2402-9011	2410-9011
<b>Switch Hardware</b>	2402-9999	2402-9999	2402-9999	2402-9999



**Service Parts Ordering NOTES:**

1 Foot Mount Kit contains two (2) brackets.

\_ = numeric entry required

# MGS Ordering - ALL Sizes

**MODEL, BORE, STROKE**      **OPTIONS**  
**MGS 062 SK28.250 SL2 BM2**

MODEL	
<b>MGS</b>	Mag coupled slide

BORE SIZE	
<b>038</b>	0.375" (9.5mm)
<b>062</b>	0.625" (16mm)
<b>100</b>	1.00" (25mm)

STROKE LENGTH		
<b>SK</b> __	Enter desired stroke length in decimal inches	
<b>MAXIMUM STROKE</b>		
<b>MG</b>		
<b>SIZE</b>	in	mm
<b>038</b>	30.00	762.0
<b>062</b>	37.00	939.8
<b>100</b>	55.00	1,397.0

PROXIMITY SENSOR (MG_12)	
<b>NP</b> _	Sinking type proximity sensor (NPN)
<b>PN</b> _	Sourcing type proximity sensor (PNP)

SHOCK ABSORBERS (MG_13)	
<b>SL</b> _	Light duty shock absorber
<b>SH</b> _	Heavy duty shock absorber

SWITCHES (MG_10)					
TYPE		QUICK-DISCONNECT	CODE	QUANTITY	LEAD LENGTH
REED	Form A	QD	<b>RM</b>	After code enter quantity desired	5 meters
		no	<b>RT</b>		
Form C		QD	<b>BM</b>		
		no	<b>BT</b>		
HALL EFFECT	Sinking	QD	<b>KM</b>		
		no	<b>KT</b>		
Sourcing		QD	<b>TM</b>		
		no	<b>TT</b>		
TRIAC		QD	<b>CM</b>		
		no	<b>CT</b>		

# MGS Service Parts Ordering - ALL Sizes

PART NUMBER ORDERING		CONFIG. CODE ORDERING
No Mounting Hardware or FE conn. included		Mounting Hardware & FE conn. included
PART NO.	DESCRIPTION	CODE
3600-9084	Switch Only, Reed, Form C, 5m	BT
3600-9085	Switch Only, Reed, Form C, Male Conn.	BM
3600-9082	Switch Only, Reed, Form A, 5m	RT
3600-9083	Switch Only, Reed, Form A, Male Conn.	RM
3600-9086	Switch Only, Triac, 5m	CT
3600-9087	Switch Only, Triac, Male Conn.	CM
3600-9090	Switch Only, Hall-effect, Sinking, 5m	KT
3600-9091	Switch Only, Hall-effect, Sinking, Male Conn.	KM
3600-9088	Switch Only, Hall-effect, Sourcing, 5m	TT
3600-9089	Switch Only, Hall-effect, Sourcing, Male Conn.	TM
2503-1025	Connector (Female) 5 meter lead	

NOTE: When ordered by Config. Code Female connector & all mounting hardware is included

SIZE	038	062	100
<b>Shock Absorbers Light Duty</b>	2403-1062	2406-1063	0910-1479
<b>Shock Absorbers Heavy Duty</b>	0605-1006	2406-1062	0910-1480
<b>NPN Sinking Proximity Sensor</b>	2410-1048	2410-1048	2410-1048
<b>PNP Sourcing Proximity Sensor</b>	2410-1053	2410-1053	2410-1053
<b>Switch Rail</b>	2403-8888	2406-8888	2410-8888
<b>Magnet</b>	2410-9020	2410-9020	2410-9020

## Switch Ordering NOTES:

To order field retrofit switch and hardware kits for all Tolomatic actuators: SW (Then the model and bore size, and type of switch required)

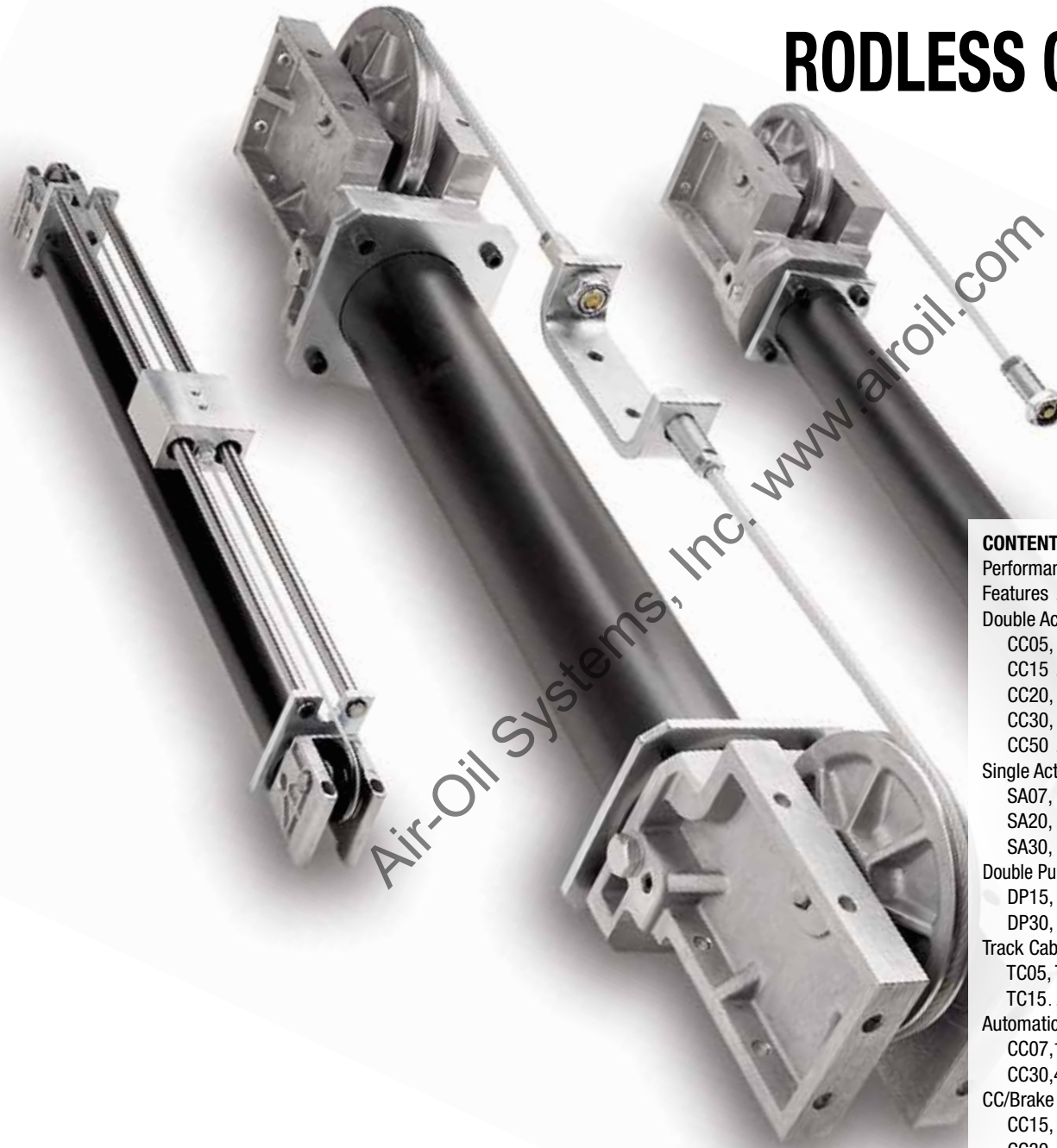
**Example: SWMGS062RT**

(Hardware and Form A Reed switch with 5 meter lead for 0.625" bore Mag coupled slide)

⚠ Mounting hardware is required if replacing switch for any actuator manufactured before 7/1/97

# CC CABLE CYLINDER

## RODLESS CYLINDER



Air-Oil Systems, Inc. [www.airoil.com](http://www.airoil.com)

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ABT  
MXP  
BCZ  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

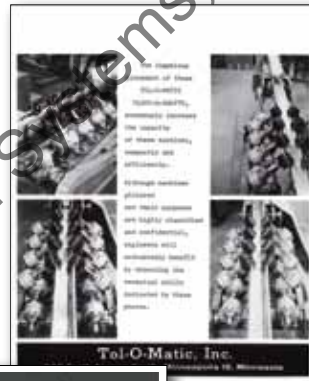
ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR



### *It started with a custom solution.*

Tolomatic's first product, the Float-A-Shaft®, marked the beginning of Tolomatic's innovative product solutions for the industrial automation market. Burton Toles, Tolomatic's founder, designed the Float-A-Shaft to greatly improve the efficiency of baler/sealing machinery used in the flour and milling industry. The unique right-angle gear box permitted quick product changeover and is still used in the packaging industry today.

On the same baler/sealer machine, customers also wanted a low-cost simple mechanism to lift and sort bags. Again, the Tolomatic solution proved to be a winner with the invention of the cable cylinder – the world's first rodless product. Thus began Tolomatic's product innovation legacy: unique and robust product solutions to solve customer problems.

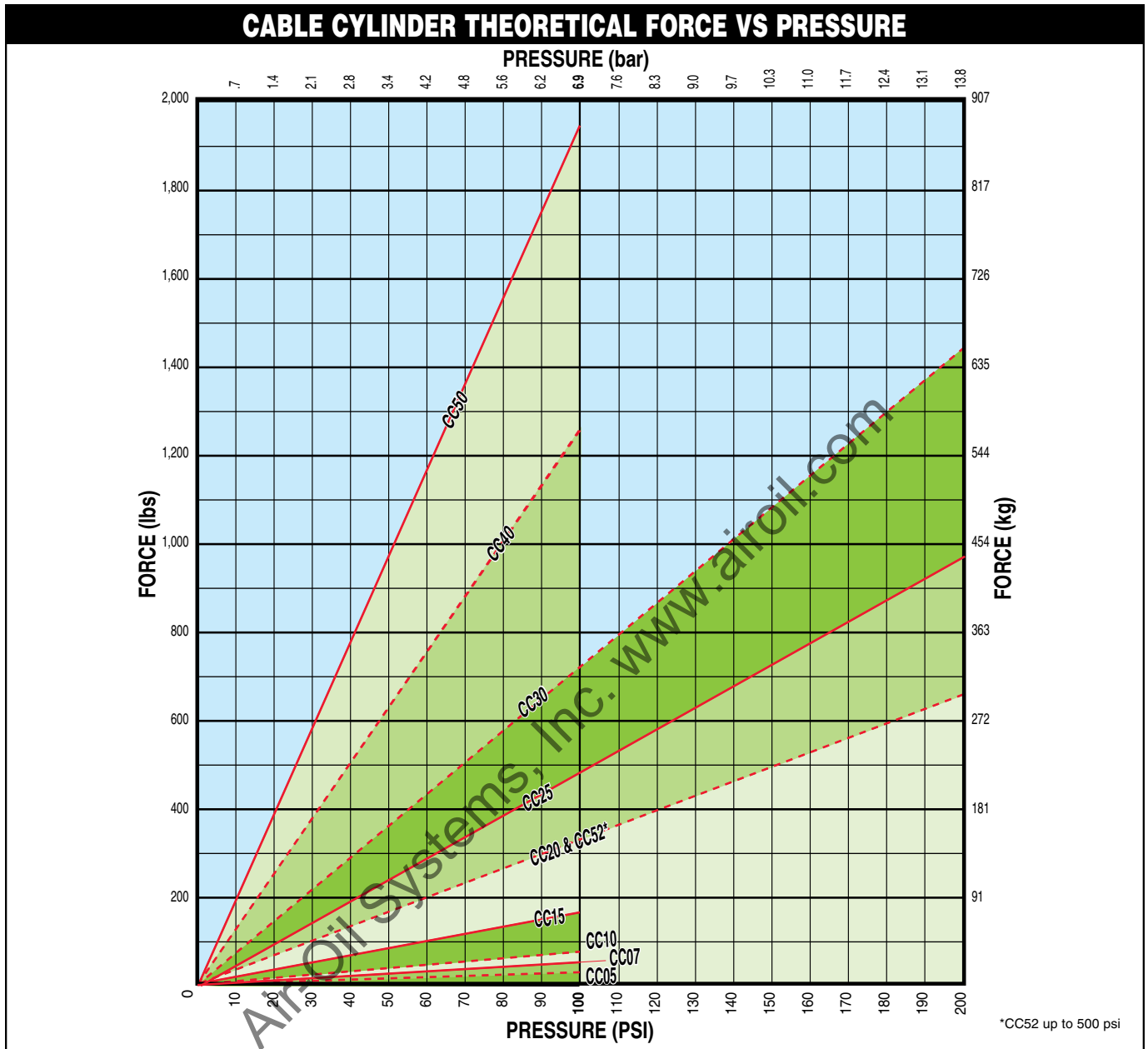


### **Tolomatic Milestones**

- Founded in 1954 by Burton Toles – invention of the first right-angle gearbox that floats along its shaft.
- Designed the first rodless cylinder in 1958 – the cable cylinder is still in production today!
- Introduction of the BC2 – world's best selling pneumatic rodless cylinder.
- Tolomatic holds a portfolio of patents for actuators and mechanical assemblies.
- Tolomatic becomes ISO certified in October of 1995.
- Tolomatic enters the electromechanical actuator market in 1996 with its first electric actuators.
- Top global auto producer selects Tolomatic as its sole worldwide supplier of servo actuators for robotic welding.
- Over 1,000,000 (and counting) Tolomatic actuators put in service in applications all over the world.

# CC Cable Cylinder

## PERFORMANCE



Introduced in 1955 as the first rodless cylinder, the Tolomatic cable cylinder provides reliable linear motion with space and cost-savings features. Its simple yet efficient design solves a wide variety of application requirements. Unlike rod cylinders, the cable cylinder's stroke is contained within the cylinder itself. That can

be a big advantage when space limitations are a consideration. The cable cylinder also allows equal force to be applied in both directions. Cables (fastened to both ends of the piston) pass through gland seals at the ends of the cylinder tube, go around pulleys and are then joined by a load bracket or clevis. The cables can

be cut different lengths, threaded through a machine or wrapped around a drum to fill a wide variety of rotary and/or linear motion requirements. First in the industry to offer an automatic tensioning cylinder and combine it with a caliper disc brake for static holding, Tolomatic also offers reed switch

options on most cylinder models. Available in double-acting, single-acting, double purchase and track cylinder models with 11 bore sizes ranging from 1/2-inch to 5 inches and stroke lengths ranging from a few inches to 60 feet, there is a Tolomatic cable cylinder that can do the job for you.

# CABLE CYLINDER

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Endurance Technology features are designed for maximum durability to provide extended service life.

### HIGH STRENGTH TUBE

- High-strength, lightweight 6063-T832 black anodized aluminum or steel
- Creates chamber for pneumatic or hydraulic pressure and protects piston



### STEEL CLEVIS

- High strength material resists deformation
- Cable adjustment points
- Threaded holes for load attachment

DOUBLE ACTING CABLE CYLINDER

### PORTING CHOICES

- Choose from 2 or 3 port heads

### ALUMINUM PISTON

- High-strength, lightweight aluminum
- Pulls the cables when actuated by pneumatic or hydraulic pressure



### DIE CAST HEAD ASSEMBLY

- High-strength, lightweight anodized aluminum
- Protects piston and creates chamber for pneumatic or hydraulic pressure

### LOCATE REMOTELY

- Cylinder can be located away from work area. Useful in harsh environments and if space/weight are limited

### UNIQUE GLAND SEALS

- Tight seal for cables to pass through
- Easy installation
- Snap In/Out cable seals or encapsulated gland seals depending on bore size



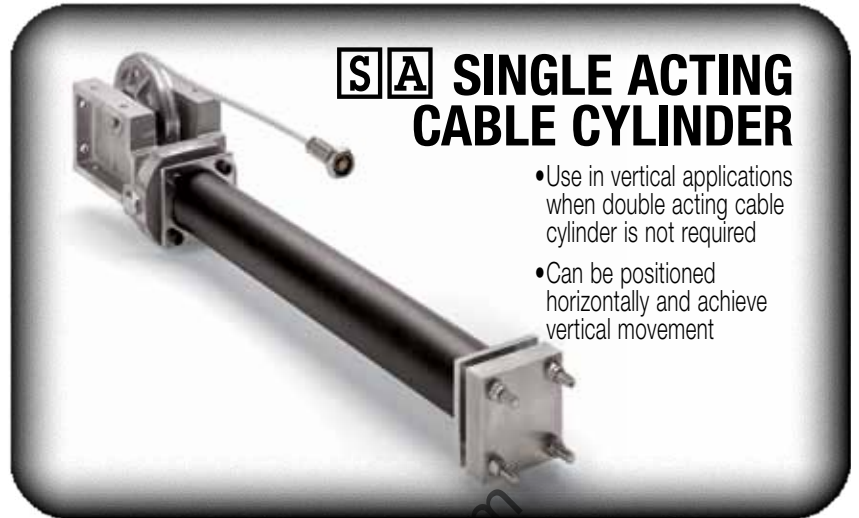


# TOLOMATIC... THE RODLESS CYLINDER LEADER



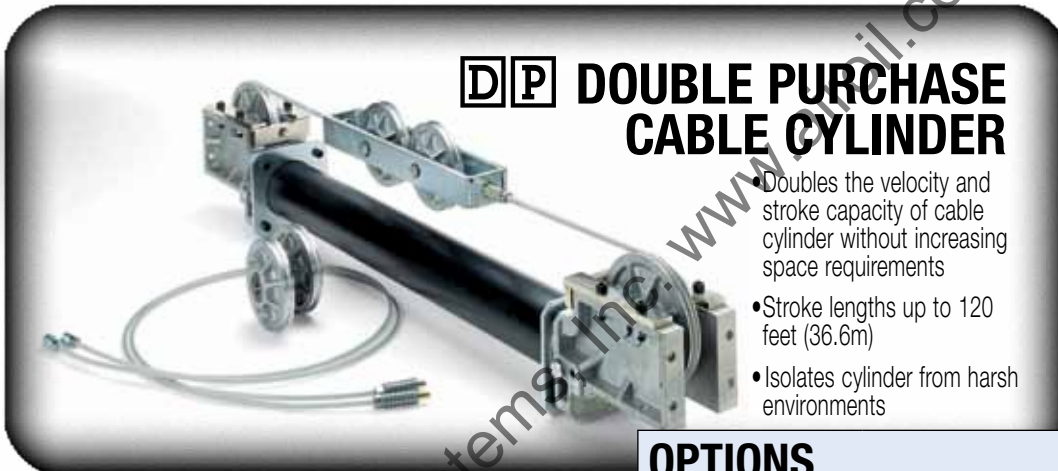
## MIL SPEC CABLES

- Field proven to provide millions of cycles of uninterrupted service
- Nylon jacketed aircraft cables manufactured under Mil Spec. MIL-W-83420D



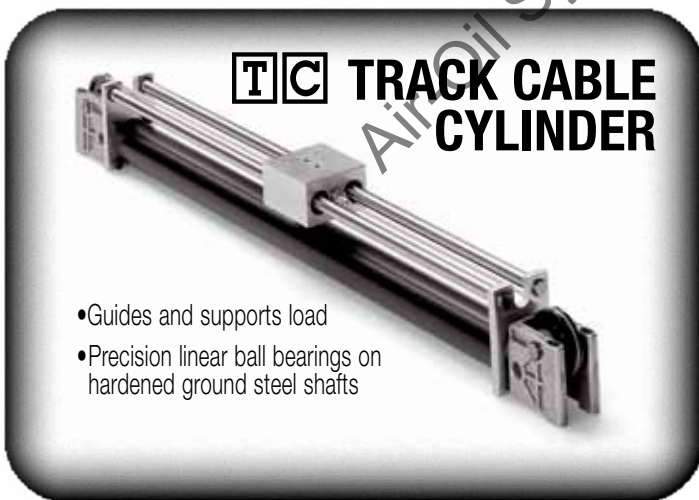
## SA SINGLE ACTING CABLE CYLINDER

- Use in vertical applications when double acting cable cylinder is not required
- Can be positioned horizontally and achieve vertical movement



## DP DOUBLE PURCHASE CABLE CYLINDER

- Doubles the velocity and stroke capacity of cable cylinder without increasing space requirements
- Stroke lengths up to 120 feet (36.6m)
- Isolates cylinder from harsh environments



## TC TRACK CABLE CYLINDER

- Guides and supports load
- Precision linear ball bearings on hardened ground steel shafts

## OPTIONS



### AUTO TENSIONER

- Maintains proper cable tension
- Maximizes service life of both cable and seals



### CALIPER DISC BRAKE **HM HN**

- Best mounting choice in most applications



### STEEL TUBE

- For extra strength & use in harsh environments



### 3 PORTED HEAD

- For convenient air connection



### SWITCHES

- Available in Reed and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers



### SEALS OF VITON® MATERIAL **V**

- Long lasting seal option
- High temperature applications



### EXTRA CABLE **XA XB**

- To remotely locate cable cylinder

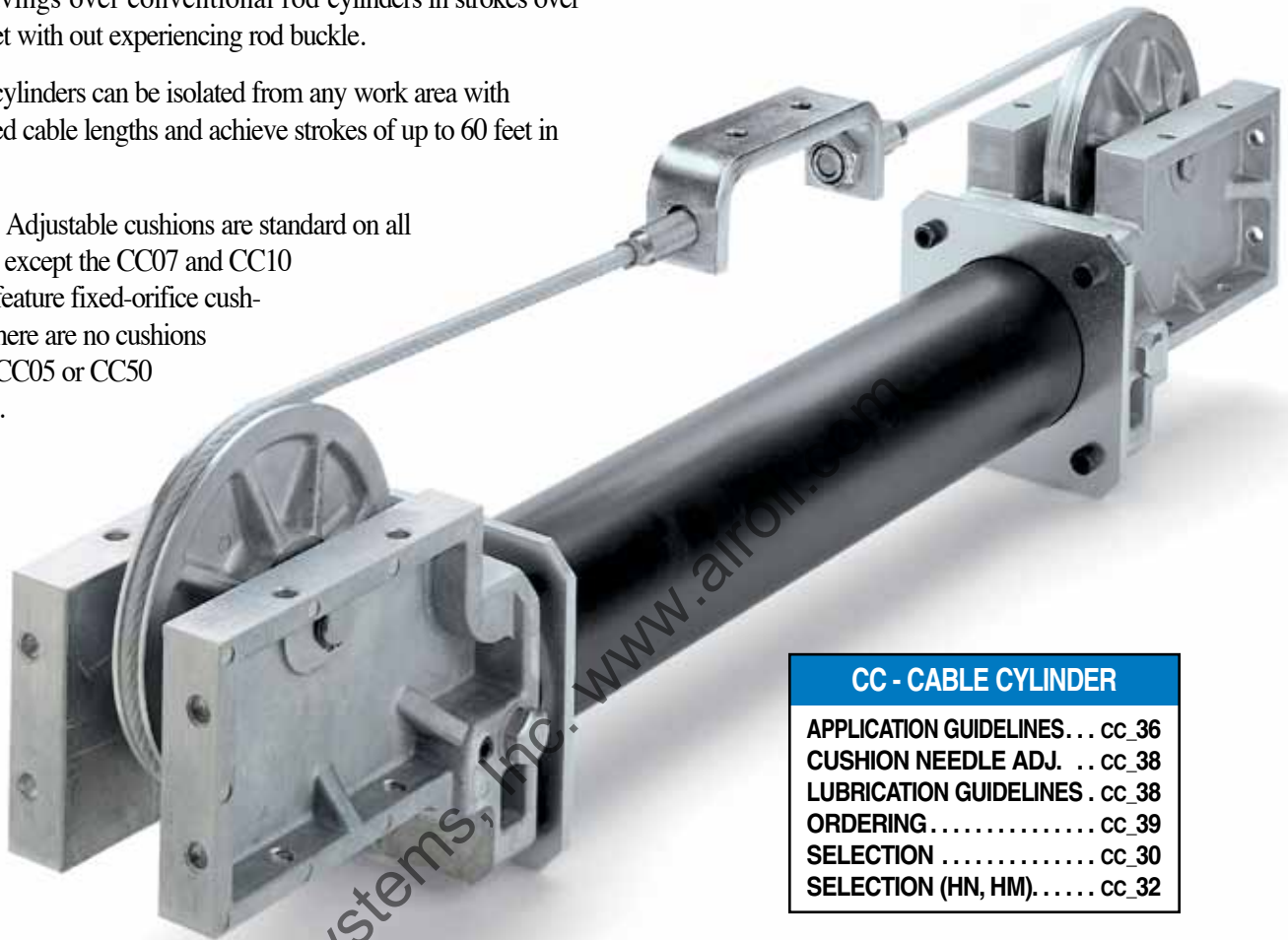
**5 DAYS**  
BUILT-TO-ORDER

# CC Double Acting Cable Cylinder - All Sizes

The Tolomatic double-acting cable cylinder is a versatile space saver, available in all 9 bore sizes. Enjoy cost savings over conventional rod cylinders in strokes over four feet without experiencing rod buckle.

These cylinders can be isolated from any work area with extended cable lengths and achieve strokes of up to 60 feet in length.

NOTE: Adjustable cushions are standard on all models except the CC07 and CC10 which feature fixed-orifice cushions. There are no cushions on the CC05 or CC50 models.



CC - CABLE CYLINDER	
APPLICATION GUIDELINES . . .	cc 36
CUSHION NEEDLE ADJ. . .	cc 38
LUBRICATION GUIDELINES .	cc 38
ORDERING . . . . .	cc 39
SELECTION . . . . .	cc 30
SELECTION (HN, HM). . . . .	cc 32

## FEATURES AVAILABLE FOR DOUBLE-ACTING CABLE CYLINDERS

NOTE: Single-Ported Heads are standard on all base models.

FEATURES	PAGE #	CC05	CC07	CC10	CC15	CC20	CC25	CC30	CC40	CC52	CC50
AUTO TENSIONER WITH ONE 1" STROKE UNIT	cc 22	-	OP	OP	OP	OP	OP	OP	OP	OP	-
AUTO TENSIONER WITH TWO 1" STROKE UNITS	cc 22	-	OP	OP	OP	OP	OP	OP	OP	OP	-
AUTO TENSIONER WITH ONE 2" STROKE UNIT	cc 22	-	-	-	-	OP	OP	OP	OP	OP	OP
AUTO TENSIONER WITH TWO 2" STROKE UNITS	cc 22	-	-	-	-	OP	OP	OP	OP	OP	OP
CALIPER DISC BRAKE	cc 25	-	-	-	OP	OP	OP	OP	OP	OP	-
SWITCHES (DC REED & AC TRIAC)*	cc 28	OP	OP	OP	OP	OP	OP	OP	OP	OP	OP
ALUMINUM TUBE		ST	ST	ST	ST	ST	ST	ST	ST	ST	ST
STEEL TUBE		-	-	OP	OP	OP	OP	OP	OP	OP	-
SEALS OF VITON® MATERIAL		-	OP	OP	OP	OP	OP	OP	OP	OP	-
3-PORTED HEADS		OP	OP	OP	OP	OP	OP	OP	OP	OP	OP

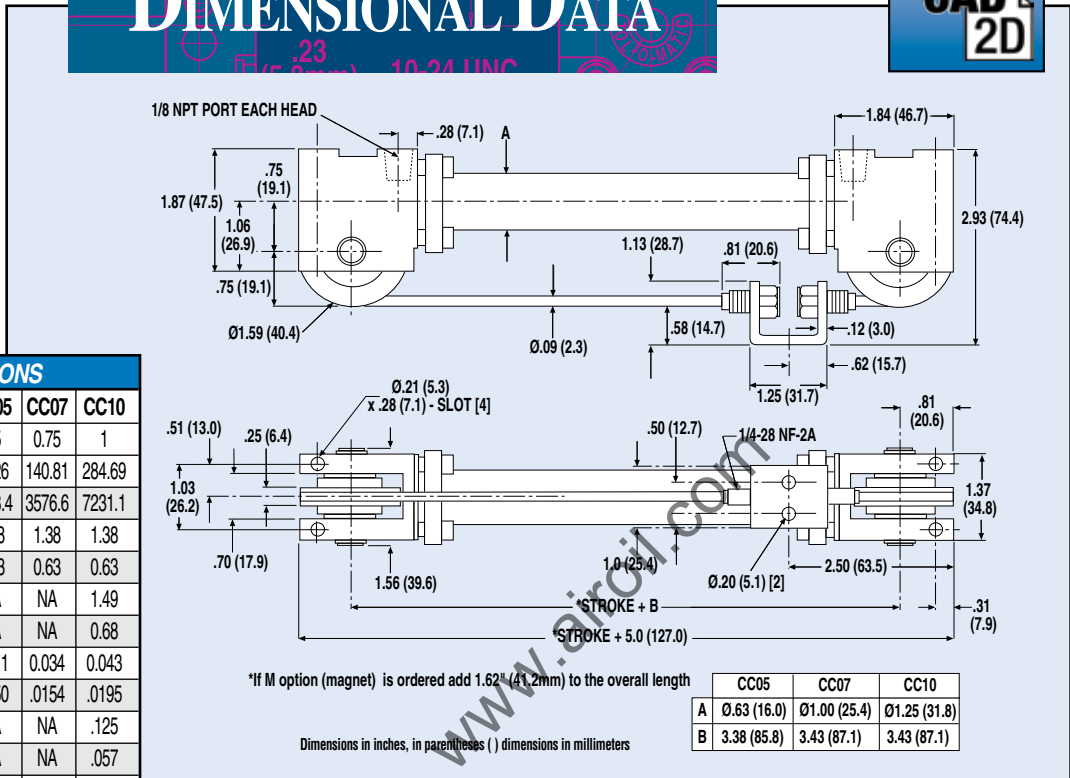
\*Switches can NOT be used with steel tube option

- Not Available    OP Optional    ST Standard

# Double Acting Cable Cylinder - CC05, CC07, CC10



## DIMENSIONAL DATA



### OVERALL UNIT SPECIFICATIONS

	CC05	CC07	CC10
Bore size (in.):	0.5	0.75	1
Max. stroke (in.):	67.26	140.81	284.69
Max. stroke (mm):	1708.4	3576.6	7231.1
Base wt. (lbs.) (Alum):	1.38	1.38	1.38
Base wt. (kgs.) (Alum):	0.63	0.63	0.63
Base wt. (lbs.) (Steel):	NA	NA	1.49
Base wt. (kgs.) (Steel):	NA	NA	0.68
Wt. per in. of strk. (lbs.) (Alum):	0.011	0.034	0.043
Wt. per in. [25mm] of strk. (kgs.) (Alum):	.0050	.0154	.0195
Wt. per in. of strk. (lbs.) (Steel):	NA	NA	.125
Wt. per in. [25mm] of strk. (kgs.) (Steel):	NA	NA	.057
Max. pressure (PSI):	100	100	100
Max. pressure (bars):	6.9	6.9	6.9
Max. temp. (°F):	140	140	140
Max. temp. (°C):	60	60	60
Max. force output (lbs.):	19.4	43.5	77.9
Max. force output (kgs.):	8.80	19.73	35.33

### TUBING SPECIFICATIONS

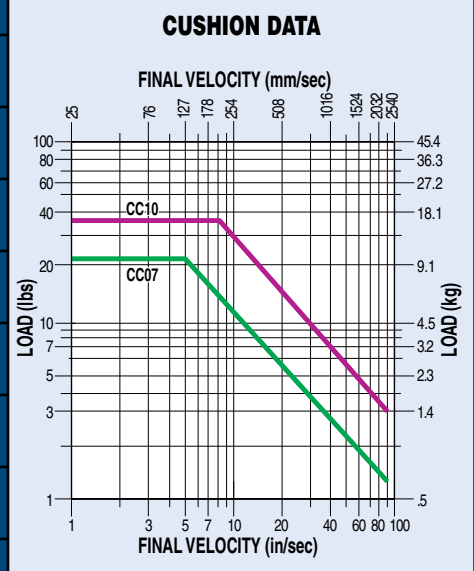
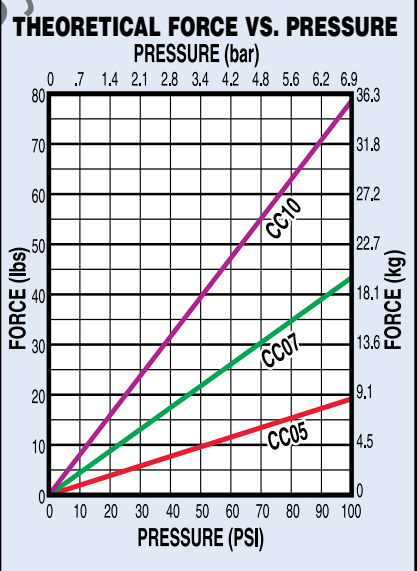
Dead length * (in.):	1.11	1.18	1.31
Dead length * (mm):	28.2	30.0	33.3
Wall thickness (in.):	0.0937	0.125	0.125
Wall thickness (mm):	2.380	3.175	3.175
Material:	Alum.	Alum.	Alum. or Steel
Tube support span (ft.) (Alum.):	5	5	6
Tube support span (m.) (Alum.):	1.52	1.52	1.83
Tube support span (ft.) (Steel):	NA	NA	6.5
Tube support span (m.) (Steel):	NA	NA	1.98

### CABLE SPECIFICATIONS

Wire dia. (in.):	0.0468	0.0468	0.0468
Wire dia. (mm):	1.189	1.189	1.189
Nylon O.D. (in.):	0.0937	0.0937	0.0937
Nylon O.D. (mm):	2.380	2.380	2.380
Strand configuration:	7 x 7	7 x 7	7 x 7
Tensile strength (lbs.):	270	270	270
Tensile strength (kgs.):	122.47	122.47	122.47
Proof-load torque (in.-lbs.):	15	15	15
Proof-load torque (N-m):	1.69	1.69	1.69
Pretensioning torque (in.-lbs.):	2.5	2.5	2.5
Pretensioning torque (N-m):	0.28	0.28	0.28

\* Add to stroke length.

## PERFORMANCE DATA



- CC10
- CC07
- CC05

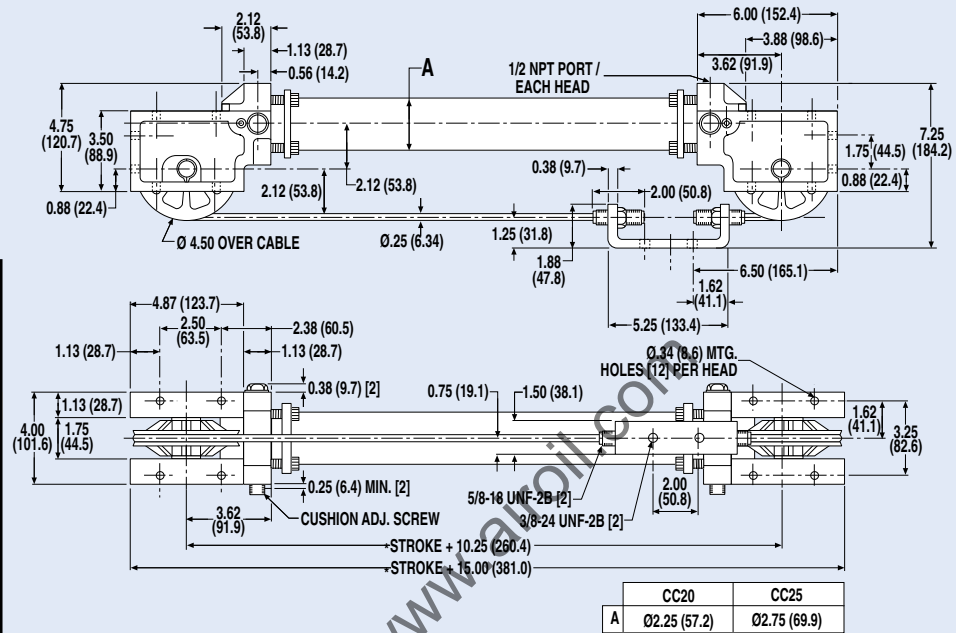
NOTE: The CC05 cylinder does not have cushions.



# Double Acting Cable Cylinder - CC20, CC25



## DIMENSIONAL DATA



OVERALL UNIT SPECIFICATIONS		
	CC20	CC25
Bore size (in.):	2	2.5
Max. stroke (in.):	283.00	283.00
Max. stroke (mm):	7188.2	7188.2
Base wt. (lbs.) (Alum.):	12.44	12.9
Base wt. (kgs.) (Alum.):	5.64	5.85
Base wt. (lbs.) (Steel):	12.9	13.48
Base wt. (kgs.) (Steel):	5.85	6.11
Wt. per in. of strk. (lbs.) (Alum.):	0.083	0.103
Wt. per in. [25mm] of strk. (kgs.) (Alum.):	.0376	.0467
Wt. per in. of strk. (lbs.) (Steel):	0.236	0.292
Wt. per in. [25mm] of strk. (kgs.) (Steel):	.1070	.1324
Max. PSI:	200	200
Max. pressure (bars):	13.8	13.8
Max. temp. (°F):	140	140
Max. temp. (°C):	60	60
Max. force output (lbs.):	618.5	971.9
Max. force output (kgs.):	280.55	440.84

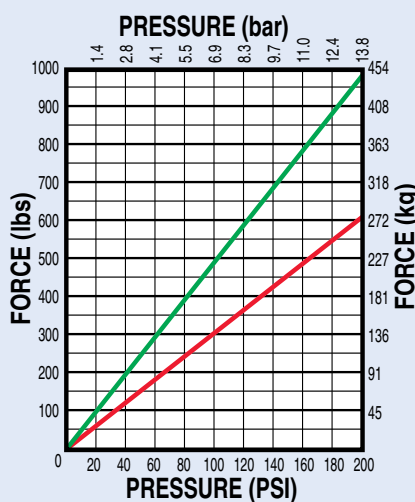
TUBING SPECIFICATIONS		
Dead length * (in.):	3	3
Dead length * (mm.):	76.2	76.2
Wall thickness (in.):	0.125	0.125
Wall thickness (mm.):	3.175	3.175
Material:	Alum. or Steel	Alum. or Steel
Tube support span (ft.) (Alum.):	7.5	8
Tube support span (m.) (Alum.):	2.29	2.44
Tube support span (ft.) (Steel):	8	9
Tube support span (m.) (Steel):	2.44	2.74

CABLE SPECIFICATIONS		
Wire dia. (in.):	0.125	0.125
Wire dia. (mm.):	3.175	3.175
Nylon O.D. (in.):	0.25	0.25
Nylon O.D. (mm.):	6.350	6.350
Strand configuration:	7 x 19	7 x 19
Tensile strength (lbs.):	2000	2000
Tensile strength (kgs.):	907.18	907.18
Proof-load torque (in.-lbs.):	115	115
Proof-load torque (N-m):	12.99	12.99
Pretensioning torque (in.-lbs.):	46	73
Pretensioning torque (N-m):	5.20	8.25

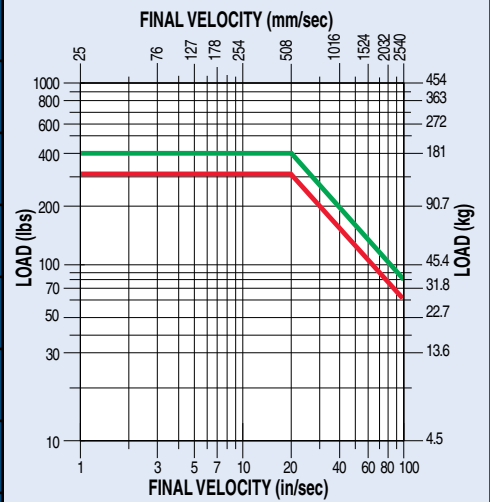
\* Add to stroke length.

## PERFORMANCE DATA

THEORETICAL FORCE VS. PRESSURE



CUSHION DATA

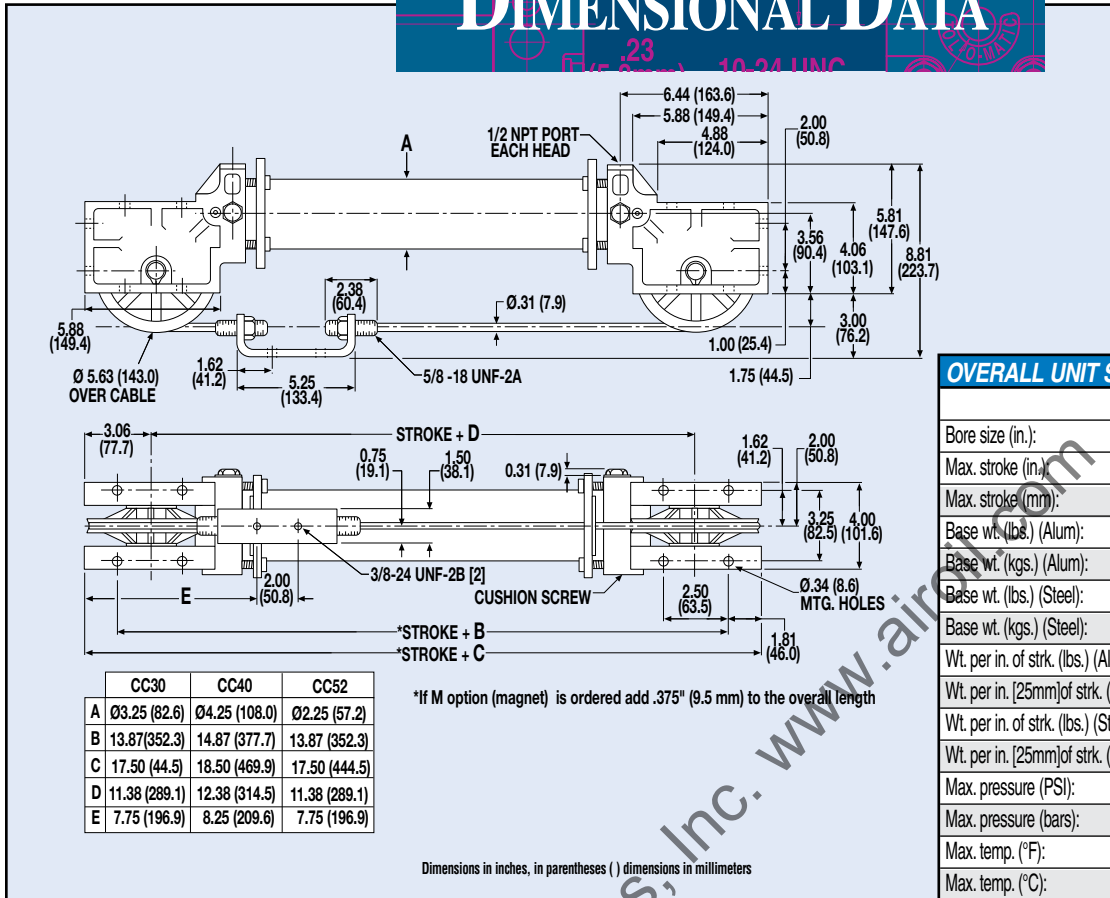


CC25  
CC20

# Double Acting Cable Cylinder - CC30, CC40, CC52



## DIMENSIONAL DATA

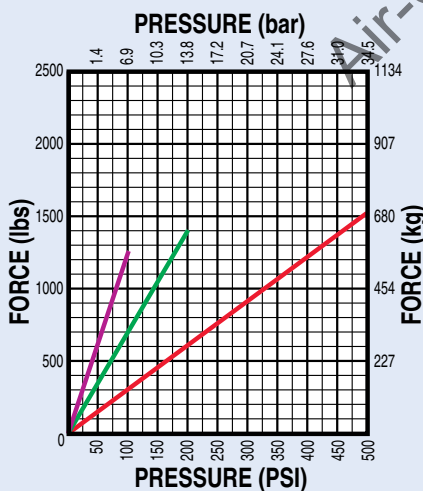


### OVERALL UNIT SPECIFICATIONS

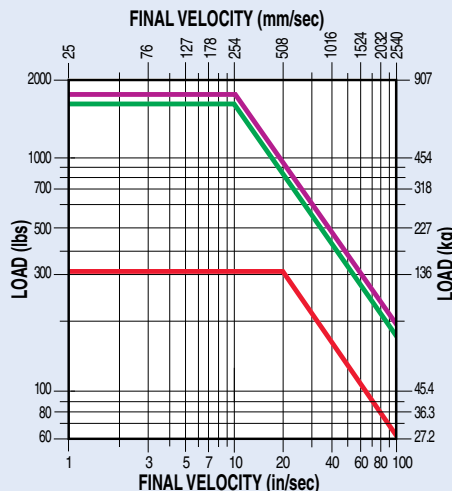
	CC30	CC40	CC52
Bore size (in.):	3	4	2
Max. stroke (in.):	282.50	281.50	282.50
Max. stroke (mm):	7175.5	7150.1	7175.5
Base wt. (lbs.) (Alum):	18.69	20.75	12.44
Base wt. (kgs.) (Alum):	8.48	9.41	5.64
Base wt. (lbs.) (Steel):	19.45	22.09	12.9
Base wt. (kgs.) (Steel):	8.82	10.02	5.85
Wt. per in. of strk. (lbs.) (Alum):	0.12	0.159	0.081
Wt. per in. [25mm] of strk. (kgs.) (Alum):	.0544	0.0721	.0367
Wt. per in. of strk. (lbs.) (Steel):	0.334	0.459	0.236
Wt. per in. [25mm] of strk. (kgs.) (Steel):	.1515	.2082	.1070
Max. pressure (PSI):	200	100	500
Max. pressure (bars):	13.8	6.9	34.5
Max. temp. (°F):	140	140	140
Max. temp. (°C):	60	60	60
Max. force output (lbs.):	1398.4	1248.9	1532.4
Max. force output (kgs.):	634	567	695

## PERFORMANCE DATA

### THEORETICAL FORCE VS. PRESSURE



### CUSHION DATA



### TUBING SPECIFICATIONS

Dead length * (in.):	3.5	4.5	3
Dead length * (mm.):	88.9	114.3	76.2
Wall thickness (in.):	0.125	0.125	0.125
Wall thickness (mm.):	3.175	3.175	3.175
Material:	Alum. or Steel	Alum. or Steel	Alum. or Steel
Tube support span (ft.) (Alum.):	8.5	9	8
Tube support span (m.) (Alum.):	2.59	2.74	2.44
Tube support span (ft.) (Steel):	10	11	8
Tube support span (m.) (Steel):	3.05	3.35	2.44

### CABLE SPECIFICATIONS

Wire dia. (in.):	0.187	0.187	0.187
Wire dia. (mm.):	4.750	4.750	4.750
Nylon O.D. (in.):	0.312	0.312	0.312
Nylon O.D. (mm.):	7.925	7.925	7.925
Strand configuration:	7 x 19	7 x 19	7 x 19
Tensile strength (lbs.):	4200	4200	4200
Tensile strength (kgs.):	1905	1905	1905
Proof-load torque (in.-lbs.):	15	15	15
Proof-load torque (N-m):	210	210	210
Pretensioning torque (in.-lbs.):	105	187.5	115
Pretensioning torque (N-m):	11.86	21.19	12.99

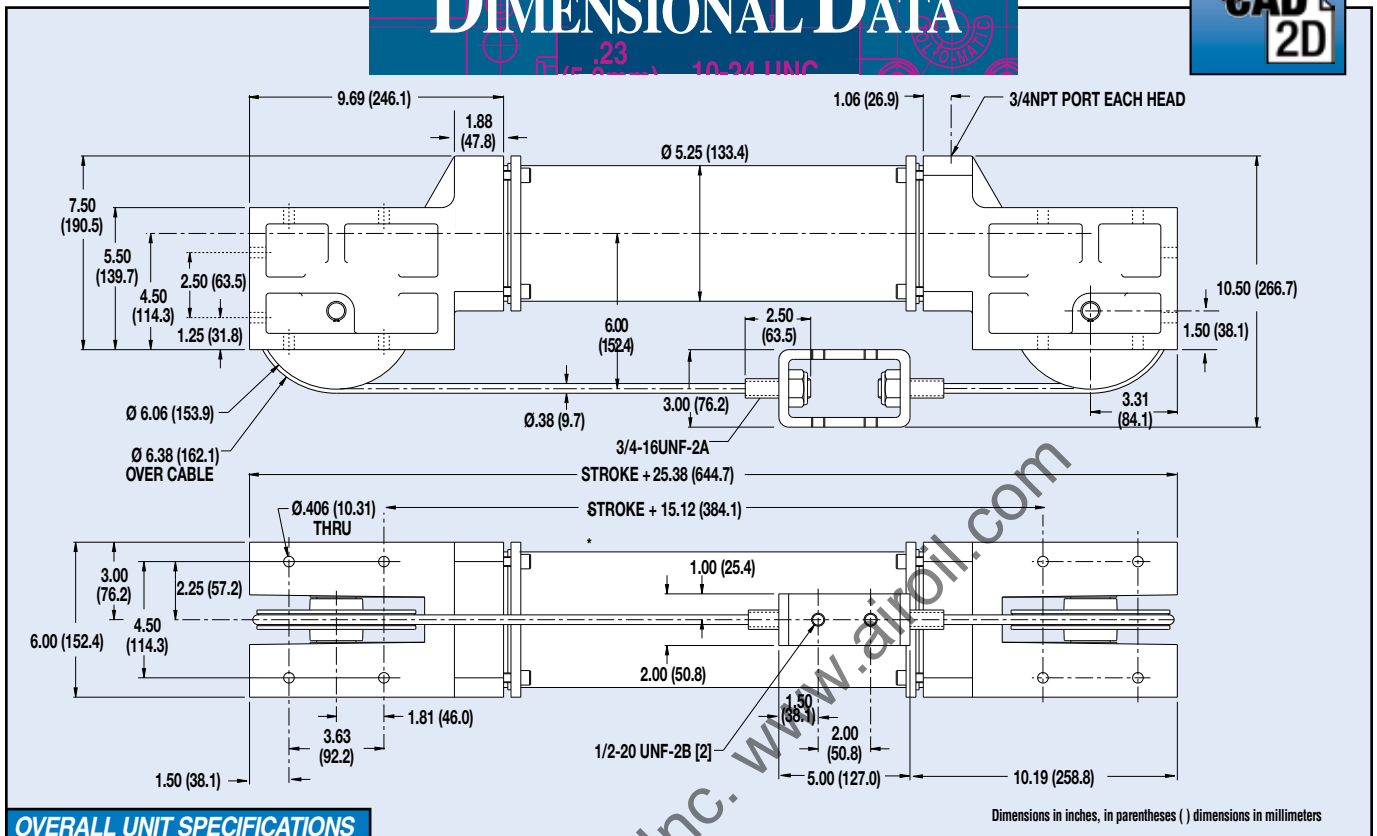
\* Add to stroke length.

# Double Acting Cable Cylinder - CC50

2D CAD AVAILABLE AT  
WWW.TOLOMATIC.COM



## DIMENSIONAL DATA



### OVERALL UNIT SPECIFICATIONS

Bore size:	5.0 in.	
Max. stroke:	136.00 in.	3454.4 mm
Base wt. (Alum):	30.75 lbs.	13.95 kgs.
Base wt. (Steel):	NA	
Wt. per in. [25mm] of stroke (Alum)	0.202 lbs.	0.0916 kgs.
Wt. per in. [25mm] of stroke (Steel)	NA	
Max. Pressure:	100 PSI	6.9 bars
Max. temp.:	140° F	60° C
Max. force output:	1919 lbs.	870.44 kgs.

### TUBING SPECIFICATIONS

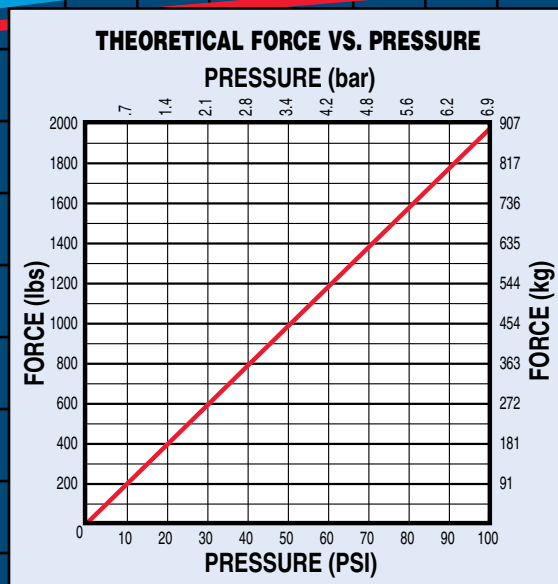
Dead length *:	6 in.	152.4 mm
Wall thickness:	0.125 in.	3.175 mm
Material:	Alum.	
Tube support span: (Alum)	13.9 ft.	4.24 m
Tube support span: (Steel)	NA	

### CABLE SPECIFICATIONS

Wire dia.:	0.25 in.	6.350 mm
Nylon O.D.:	0.375 in.	9.525 mm
Strand configuration:	7 x 19	
Tensile strength:	7000 lbs.	3175.13 kgs.
Proof-load torque:	325 in.-lbs.	36.72 N-m
Pretensioning torque:	180 in.-lbs.	20.34 N-m

\* Add to stroke length.

## PERFORMANCE DATA



CC50

NOTE: The CC50 cylinder has no cushions.

# SA Single Acting Cable Cylinder - All Sizes

When a standard double-acting cable cylinder is not necessary in vertical applications, Tolomatic single-acting cable cylinders provide a cost savings advantage. Ideal for vertical lifting applications, these cylinders may be positioned horizontally and still achieve a vertical movement. Tolomatic single-acting cylinders are available in 8 bore sizes ranging from 3/4-inch to 5 inches with optional reed switches.

NOTE: For performance, tubing and cable specifications, refer to the corresponding model in the double-acting cable cylinder section of this catalog. (See page cc\_6)



SA - CABLE CYLINDER	
APPLICATION GUIDELINES . . .	cc_36
CUSHION NEEDLE ADJ. . .	cc_38
ORDERING . . . . .	cc_39
SELECTION . . . . .	cc_30

## FEATURES AVAILABLE FOR SINGLE-ACTING CABLE CYLINDERS

NOTE: Single-ported heads are standard on all base models.

FEATURES	PAGE #	SA07	SA10	SA15	SA20	SA25	SA30	SA40	SA50	SA52
SWITCHES (DC REED & AC TRIAC)*	cc_28	OP	OP	OP	OP	OP	OP	OP	-	OP
ALUMINUM TUBE		ST	ST	ST	ST	ST	ST	ST	ST	ST
STEEL TUBE		-	OP	OP	OP	OP	OP	OP	-	OP
SEALS OF VITON® MATERIAL		OP	OP	OP	OP	OP	OP	OP	-	OP
3-PORTED HEAD		OP	OP	OP	OP	OP	OP	OP	-	OP

\*Switches can NOT be used with steel tube option

- Not Available    OP Optional    ST Standard

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR



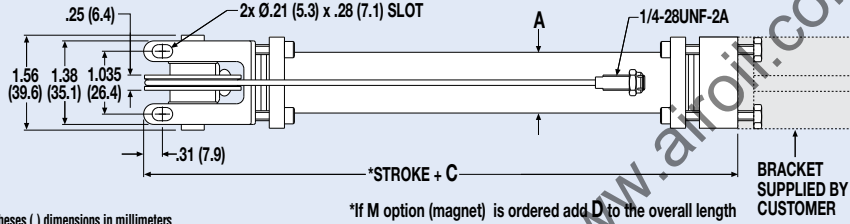
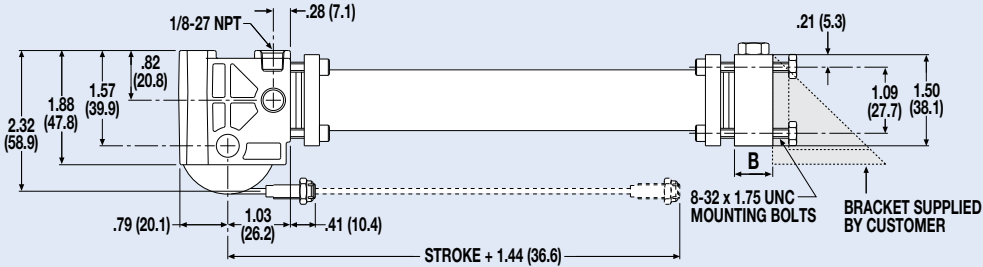
# Single Acting Cable Cylinder - SA07, SA10, SA15

SA07, SA10

## DIMENSIONAL DATA

### OVERALL UNIT SPECIFICATIONS

	SA07	SA10
Bore size:	.75 in.	1.0 in.
Max. stroke:	140.81 in. 3576.5 mm	284.69 7231.1 mm
Max. pressure:	100 PSI 6.9 bars	100 PSI 6.9 bars
Max. temp.:	140° F 60° C	140° F 60° C



Dimensions in inches, in parentheses ( ) dimensions in millimeters

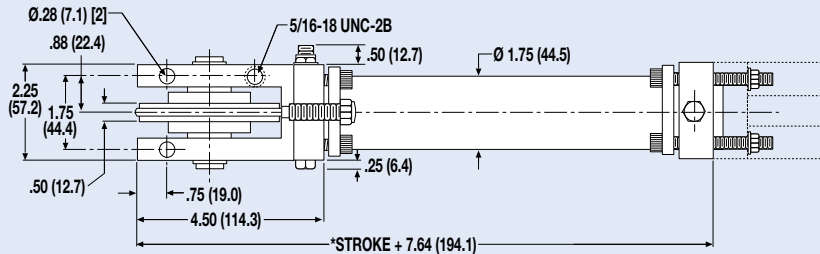
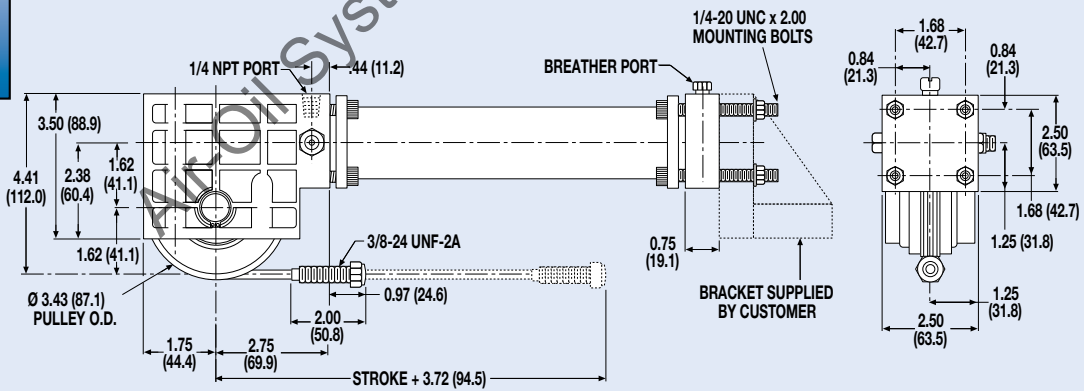
\*If M option (magnet) is ordered add D to the overall length

SA15

## DIMENSIONAL DATA

### OVERALL UNIT SPECIFICATIONS

	SA15
Bore size:	1.5 in.
Max. stroke:	283.61 in. 7203.6 mm
Max. pressure:	100 PSI 6.9 bars
Max. temp.:	140° F 60° C



Dimensions in inches, in parentheses ( ) dimensions in millimeters

\*If M option (magnet) is ordered add .375" (9.5 mm) to the overall length

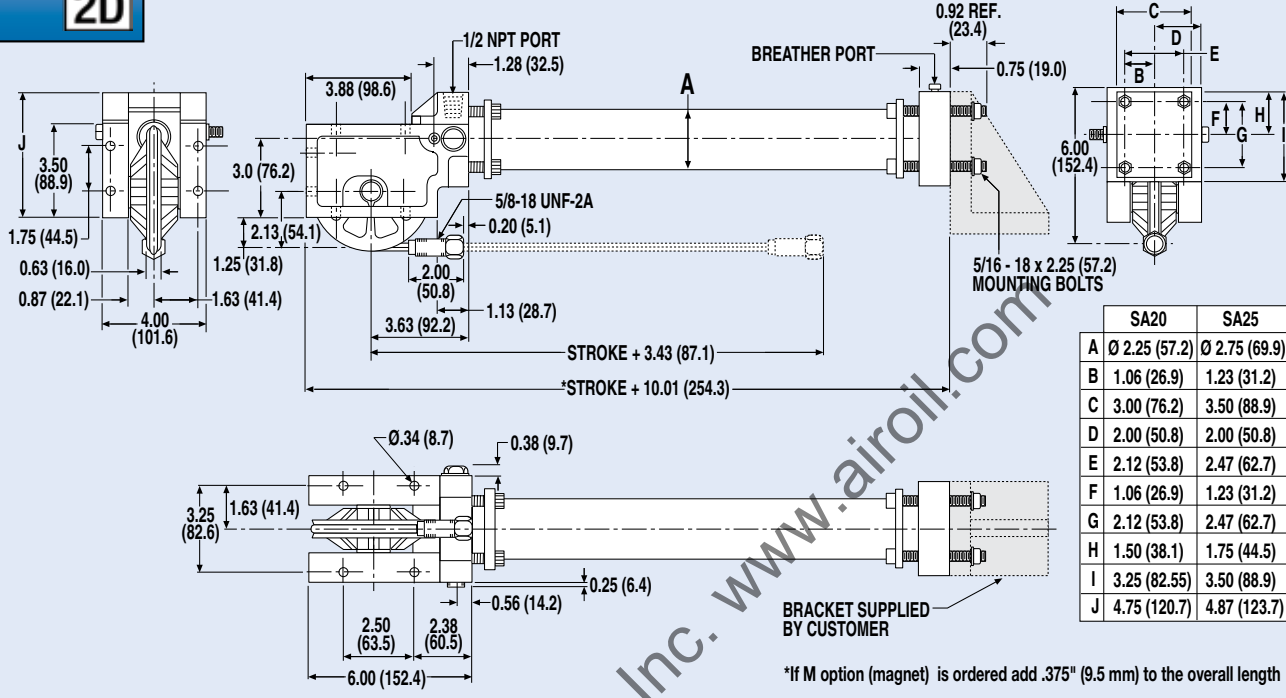
# Single Acting Cable Cylinder - SA20, SA25

SA20, SA25

## DIMENSIONAL DATA

### OVERALL UNIT SPECIFICATIONS

	SA20	SA25
Bore size:	2.0 in.	2.5 in.
Max. stroke	282.75 in. 7181.8 mm	282.75 in. 7181.8 mm
Max. pressure:	200 PSI 13.8 bars	200 PSI 13.8 bars
Max. temp.:	140° F 60° C	140° F 60° C



	SA20	SA25
A	Ø 2.25 (57.2)	Ø 2.75 (69.9)
B	1.06 (26.9)	1.23 (31.2)
C	3.00 (76.2)	3.50 (88.9)
D	2.00 (50.8)	2.00 (50.8)
E	2.12 (53.8)	2.47 (62.7)
F	1.06 (26.9)	1.23 (31.2)
G	2.12 (53.8)	2.47 (62.7)
H	1.50 (38.1)	1.75 (44.5)
I	3.25 (82.55)	3.50 (88.9)
J	4.75 (120.7)	4.87 (123.7)

Dimensions in inches, in parentheses ( ) dimensions in millimeters

\*If M option (magnet) is ordered add .375" (9.5 mm) to the overall length

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 BC2  
 BC3  
 BC4  
 LS  
 MG  
 CC  
 PB  
 ENGR

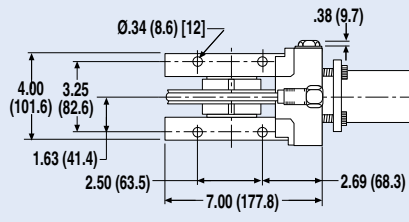
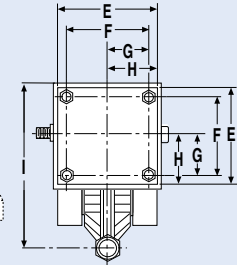
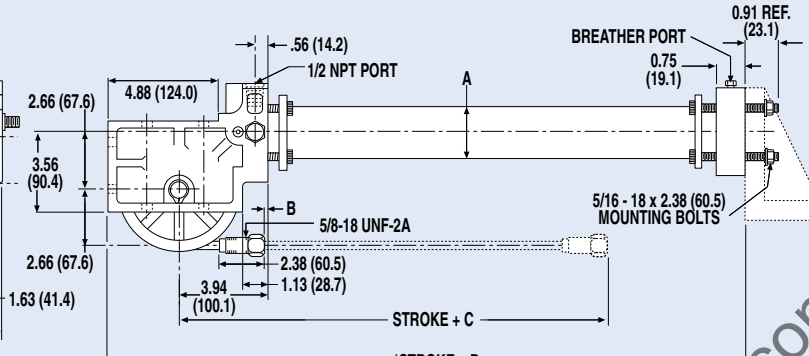
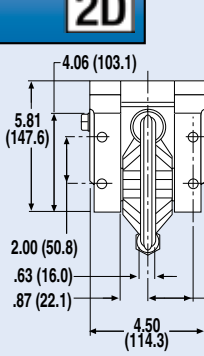
# Single Acting Cable Cylinder - SA30, SA40, SA52, SA50

SA30, SA40,  
SA52

## DIMENSIONAL DATA

### OVERALL UNIT SPECIFICATIONS

	SA30	SA40	SA52
Bore size:	3.0 in.	4.0 in.	2.0 in.
Max. stroke	282.25" 7169mm	281.25" 7143mm	282.25" 7169mm
Max. pressure:	200 PSI 13.8 bars	100 PSI 13.8 bars	500 PSI 34.5 bars
Max. temp.:	140° F 60° C	140° F 60° C	140° F 60° C



	SA30	SA40	SA52
A	Ø3.25 (82.6)	Ø4.25 (108.0)	Ø2.25 (57.2)
B	-.13 (3.3)	+.63 (16.0)	-.16 (4.1)
C	3.69 (93.7)	4.25 (108.0)	3.72 (94.5)
D	11.50 (292.1)	12.55 (318.8)	11.50 (292.1)
E	4.00 (101.6)	5.00 (127.0)	3.00 (76.2)
F	2.80 (71.1)	3.53 (89.7)	2.12 (53.8)
G	1.40 (35.6)	1.77 (45.0)	1.06 (26.9)
H	2.00 (50.8)	2.50 (63.5)	1.50 (38.1)
I	7.31 (185.7)	7.81 (198.4)	6.81 (76.2)

\*If M option (magnet) is ordered add .375" (9.5 mm) to the overall length

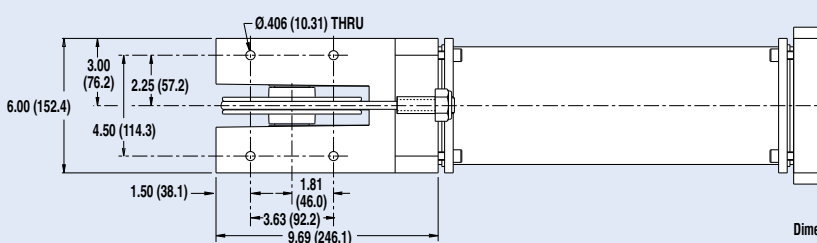
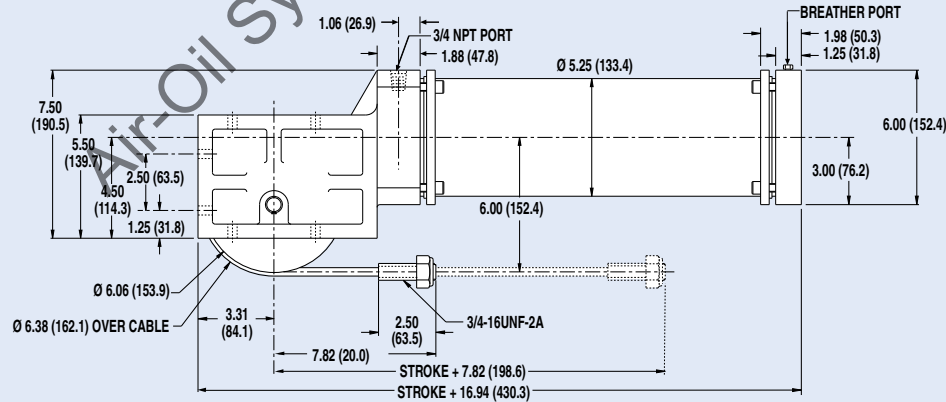
Dimensions in inches, in parentheses ( ) dimensions in millimeters

SA50

## DIMENSIONAL DATA

### OVERALL UNIT SPECIFICATIONS

	SA50
Bore size:	5.0 in.
Max. stroke	136.00 in. 3454.4 mm
Max. pressure:	100 PSI 6.9 bars
Max. temp.:	140° F 60° C



Dimensions in inches, in parentheses ( ) dimensions in millimeters

# Double Purchase Cable Cylinder - All Sizes

The Tolomatic double purchase cable cylinder doubles the velocity and stroke capacity of double-acting cylinders without increasing space requirements. Available in 5 bore sizes, these cylinders can extend stroke lengths up to 120 feet with considerable cost-saving advantages and they can be placed away from hostile environments. For performance and tubing specifications, refer to the corresponding model in the double-acting cable cylinder section of this catalog. (See page cc\_6)

NOTE: Pulleys and cables used on double purchase cable cylinders are always from the next smaller model size.

For double purchase applications, select a bore size that will accommodate twice the load force.



## DP - CABLE CYLINDER

APPLICATION GUIDELINES...	cc_36
CUSHION NEEDLE ADJ. . .	cc_38
LUBRICATION GUIDELINES .	cc_38
ORDERING .....	cc_39
SELECTION .....	cc_30
SELECTION (HN, HM).....	cc_32

## FEATURES AVAILABLE FOR DOUBLE PURCHASE CABLE CYLINDERS

NOTE: Single-ported heads are standard on all base models.

FEATURES	PAGE	DP15	DP20	DP25	DP30	DP40	DP52
AUTO TENSIONER WITH ONE 1" STROKE UNIT	cc_22	OP	OP	OP	OP	OP	OP
AUTO TENSIONER WITH TWO 1" STROKE UNITS	cc_22	OP	OP	OP	OP	OP	OP
AUTO TENSIONER WITH ONE 2" STROKE UNIT	cc_22	-	OP	OP	OP	OP	OP
AUTO TENSIONER WITH TWO 2" STROKE UNITS	cc_22	-	OP	OP	OP	OP	OP
CALIPER DISC BRAKE	cc_25	OP	OP	OP	OP	OP	OP
SWITCHES (DC REED & AC TRIAC)*	cc_28	OP	OP	OP	OP	OP	OP
ALUMINUM TUBE		ST	ST	ST	ST	ST	ST
STEEL TUBE		OP	OP	OP	OP	OP	OP
SEALS OF VITON® MATERIAL		OP	OP	OP	OP	OP	OP
3-PORTED HEADS		OP	OP	OP	OP	OP	OP

\*Switches can NOT be used with steel tube option

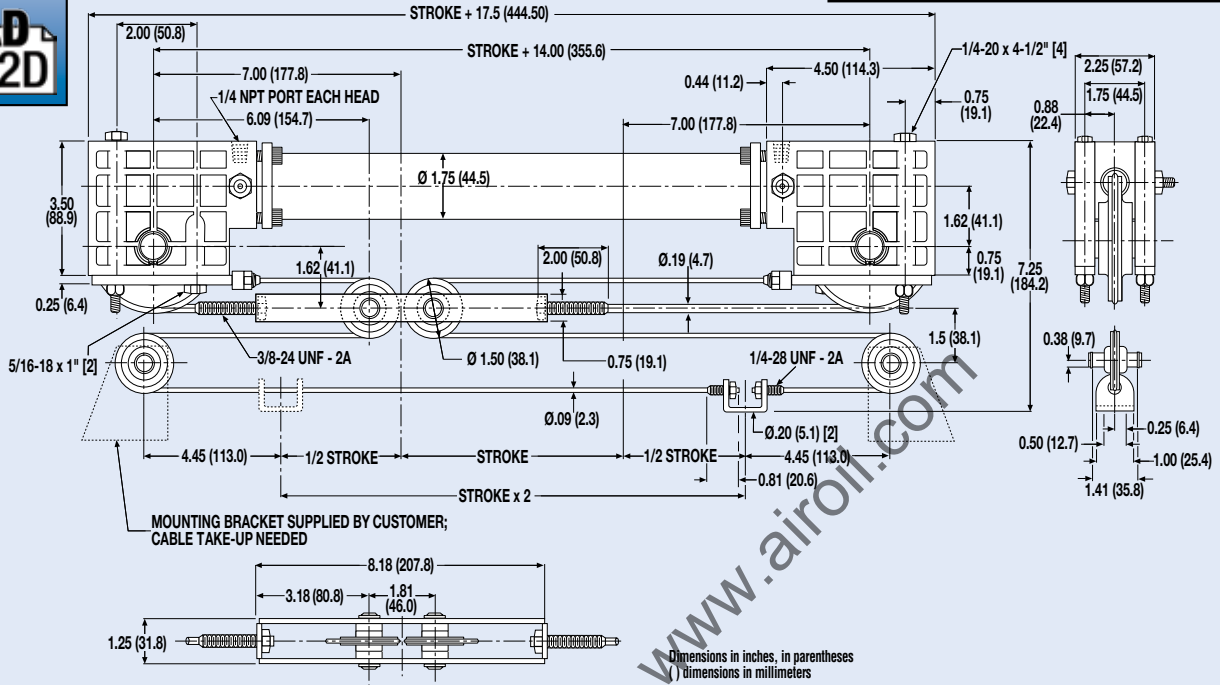
- Not Available OP Optional ST Standard

# Double Purchase Cable Cylinder - DP15, DP20, DP25

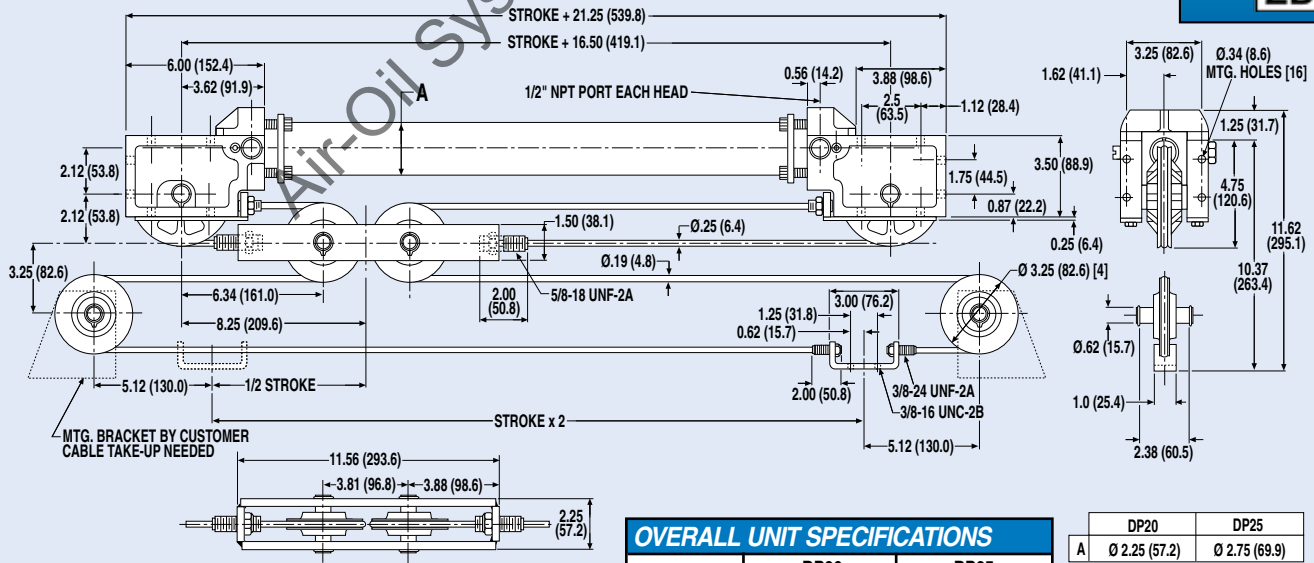
DP15



OVERALL UNIT SPECIFICATIONS		
Bore size:	1.5 in.	
Max. stroke:	229.50 in	5829.3 mm
Max. pressure:	100 PSI	6.9 bars
Max. temp.:	140° F	60° C



DP20, DP25



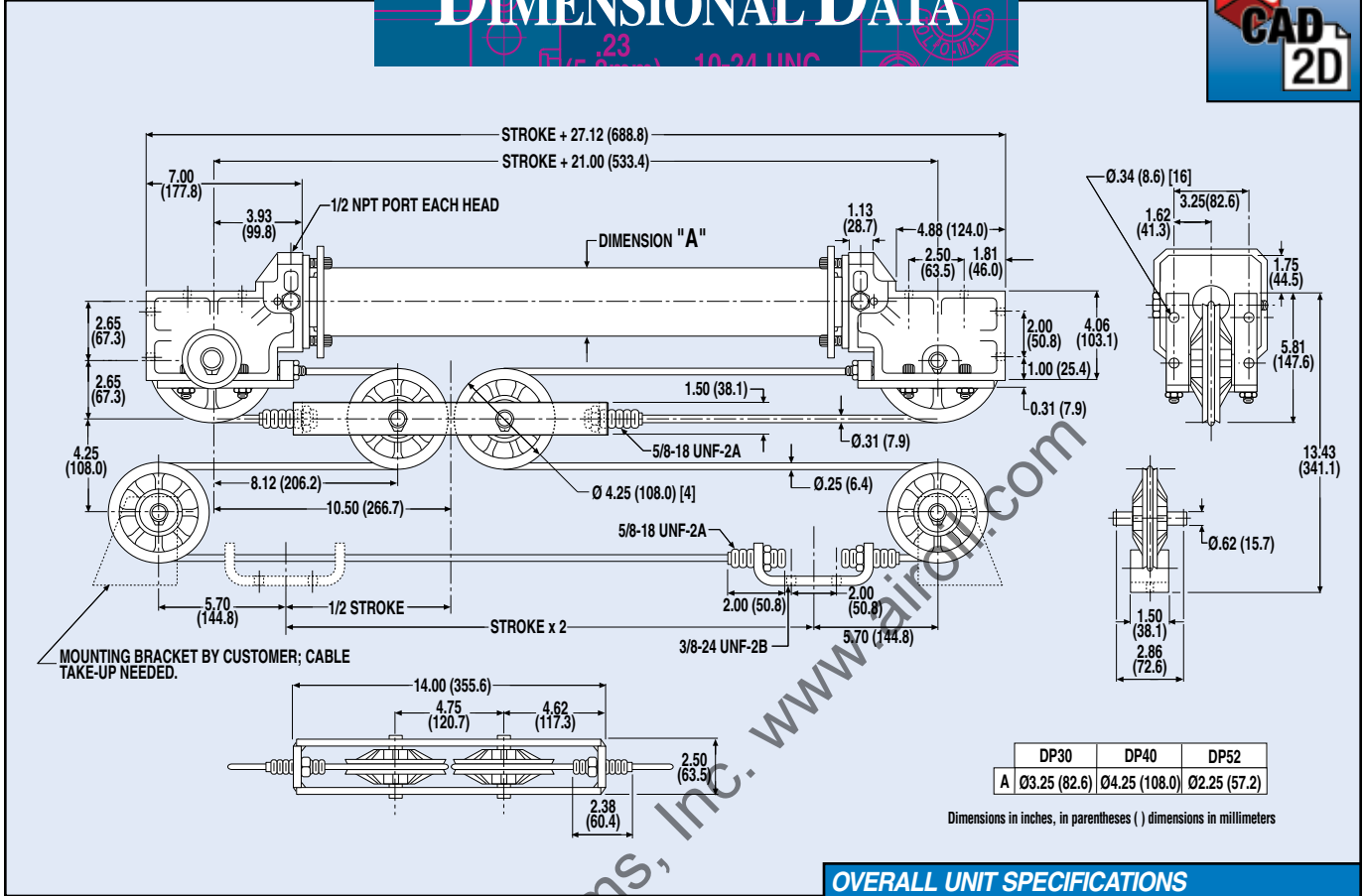
OVERALL UNIT SPECIFICATIONS				
	DP20		DP25	
Bore size:	2.0 in.		2.5 in.	
Max. stroke:	276.75"	7029mm	276.75"	7029mm
Max. pressure:	200 PSI	13.8 bars	200 PSI	13.8 bars
Max. temp.:	140° F	60° C	140° F	60° C

	DP20	DP25
A	Ø 2.25 (57.2)	Ø 2.75 (69.9)

# Double Purchase Cable Cylinder - DP30, DP40, DP55

DP30, DP40,  
DP52

## DIMENSIONAL DATA



	DP30	DP40	DP52
A	Ø3.25 (82.6)	Ø4.25 (108.0)	Ø2.25 (57.2)

Dimensions in inches, in parentheses ( ) dimensions in millimeters

### OVERALL UNIT SPECIFICATIONS

	DP30	DP40	DP52
Bore size:	3.0 in.	4.0 in.	2.0 in.
Max. stroke	272.88" 6931mm	272.88" 6931mm	272.88" 6931mm
Max. pressure:	200 PSI 13.8 bar	100 PSI 6.9 bar	500 PSI 34.5 bar
Max. temp.:	140° F 60° C	140° F 60° C	140° F 60° C

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763-478-8000  
Fax 763-478-8080

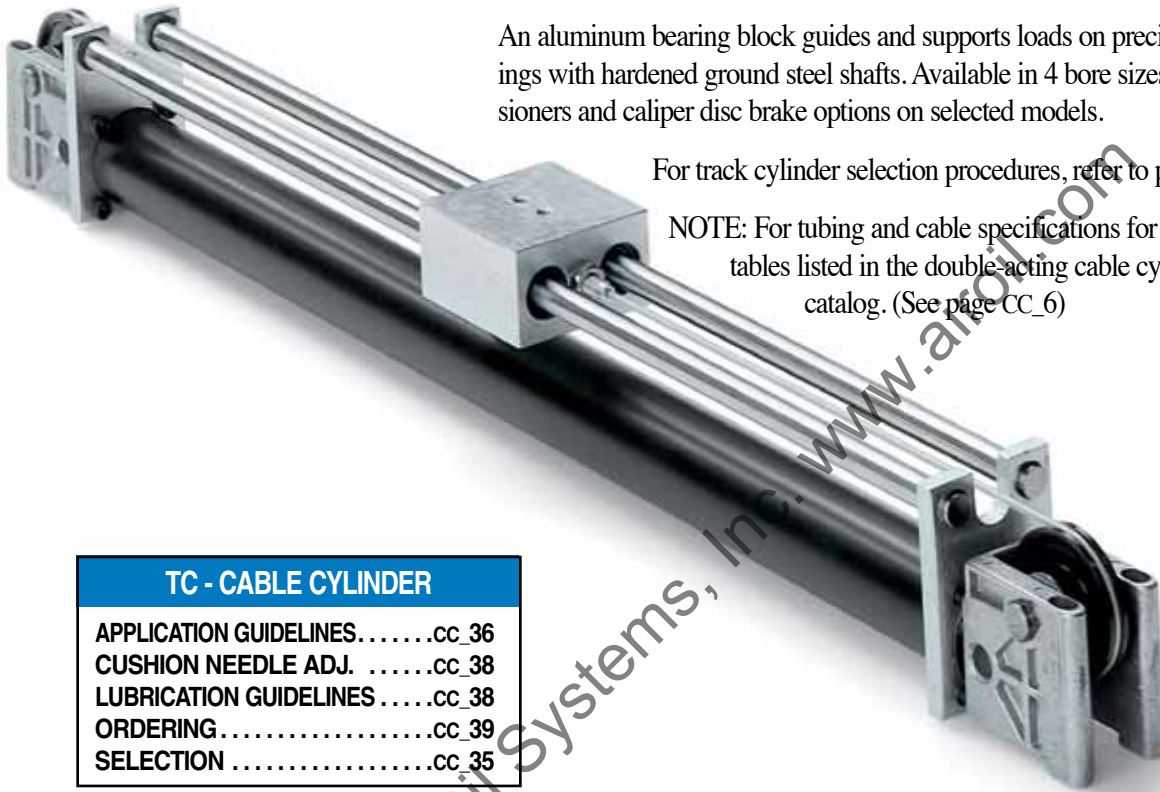
# TC Track Cable Cylinder - All Sizes

Tolomatic track cable cylinders provide a pre-packaged, pre-engineered guide and support system for greater bearing surface and larger load capacities.

An aluminum bearing block guides and supports loads on precision linear ball bearings with hardened ground steel shafts. Available in 4 bore sizes with automatic tensioners and caliper disc brake options on selected models.

For track cylinder selection procedures, refer to page CC\_35.

NOTE: For tubing and cable specifications for each model, refer to tables listed in the double-acting cable cylinder section of this catalog. (See page CC\_6)



TC - CABLE CYLINDER	
APPLICATION GUIDELINES . . . . .	cc_36
CUSHION NEEDLE ADJ. . . . .	cc_38
LUBRICATION GUIDELINES . . . . .	cc_38
ORDERING . . . . .	cc_39
SELECTION . . . . .	cc_35

## FEATURES AVAILABLE FOR TRACK CABLE CYLINDERS

NOTE: Single-ported heads are standard on all base models.

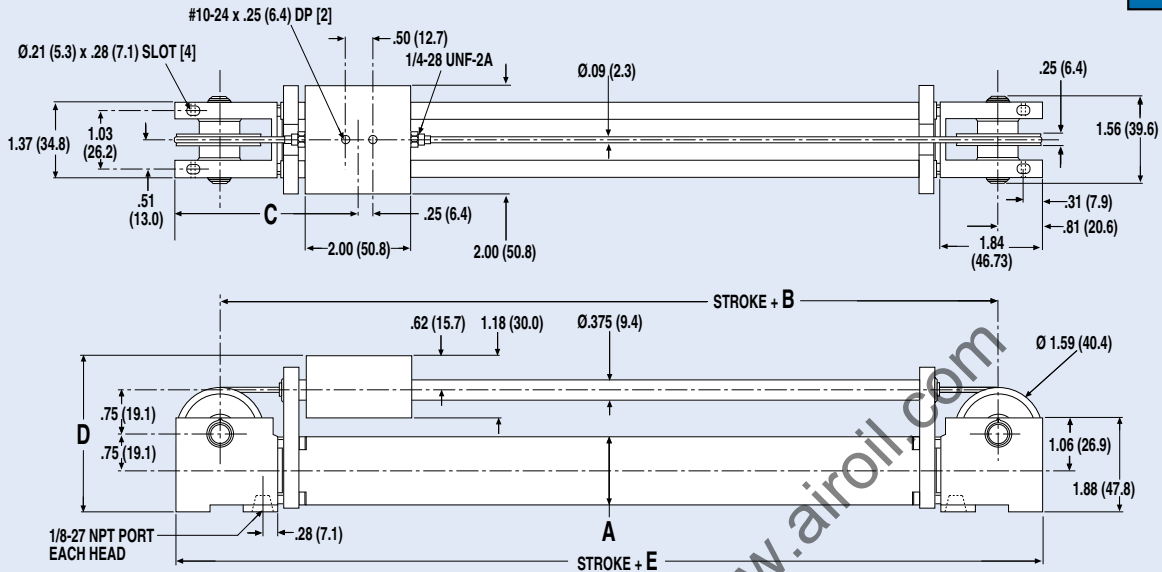
FEATURES	PAGE	TC05	TC07	TC10	TC15
AUTO TENSIONER WITH ONE 1" STROKE UNIT	cc_22	-	OP	OP	OP
AUTO TENSIONER WITH TWO 1" STROKE UNITS	cc_22	-	OP	OP	OP
CALIPER DISC BRAKE	cc_25	-	-	-	OP
SWITCHES (DC REED & AC TRIAC)*	cc_28	OP	OP	OP	OP
ALUMINUM TUBE		ST	ST	ST	ST
STEEL TUBE		-	-	OP	OP
SEALS OF VITON® MATERIAL		-	OP	OP	OP
3-PORTED HEADS		OP	OP	OP	OP

\*Switches can NOT be used with steel tube option

- Not Available OP Optional ST Standard

# TC Track Cable Cylinder - TC05, TC07, TC10

## DIMENSIONAL DATA



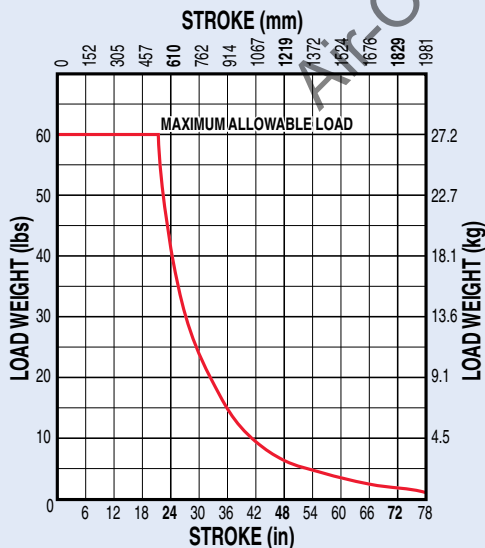
Dimensions in inches, in parentheses ( ) dimensions in millimeters

	TC05	TC07	TC10
<b>A</b>	0.625	1.000	1.250
<b>mm</b>	15.88	25.40	31.75
<b>B</b>	5.260	5.326	5.322
<b>mm</b>	133.60	135.28	135.18
<b>C</b>	3.44	3.46	3.48
<b>mm</b>	87.4	87.9	88.4
<b>D</b>	2.93	2.96	2.93
<b>mm</b>	74.4	75.2	74.4
<b>E</b>	6.870	6.936	6.932
<b>mm</b>	174.50	176.17	176.07

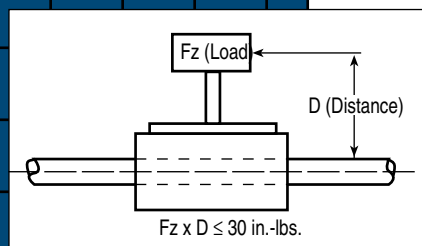
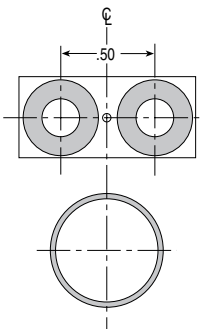
## PERFORMANCE DATA

### LOAD WEIGHT vs STROKE TC05, TC07, TC10 (3/8-inch dia. rods at .30-inch deflection)

NOTE: Rod deflection must not exceed .30 inches



CENTER OF GRAVITY OF LOAD TO BE WITHIN THIS AREA



### OVERALL UNIT SPECIFICATIONS

	TC05	TC07	TC10
Bore size (in.):	.5	.75	1
Max. stroke (in.):	67.00	78.00	78.00
Max. stroke (mm):	1701.8	1981.2	1981.2
Max. pressure (PSI):	100	100	100
Max. pressure (bars):	6.9	6.9	6.9
Max. temp. (°F):	140	140	140
Max. temp. (°C):	60	60	60

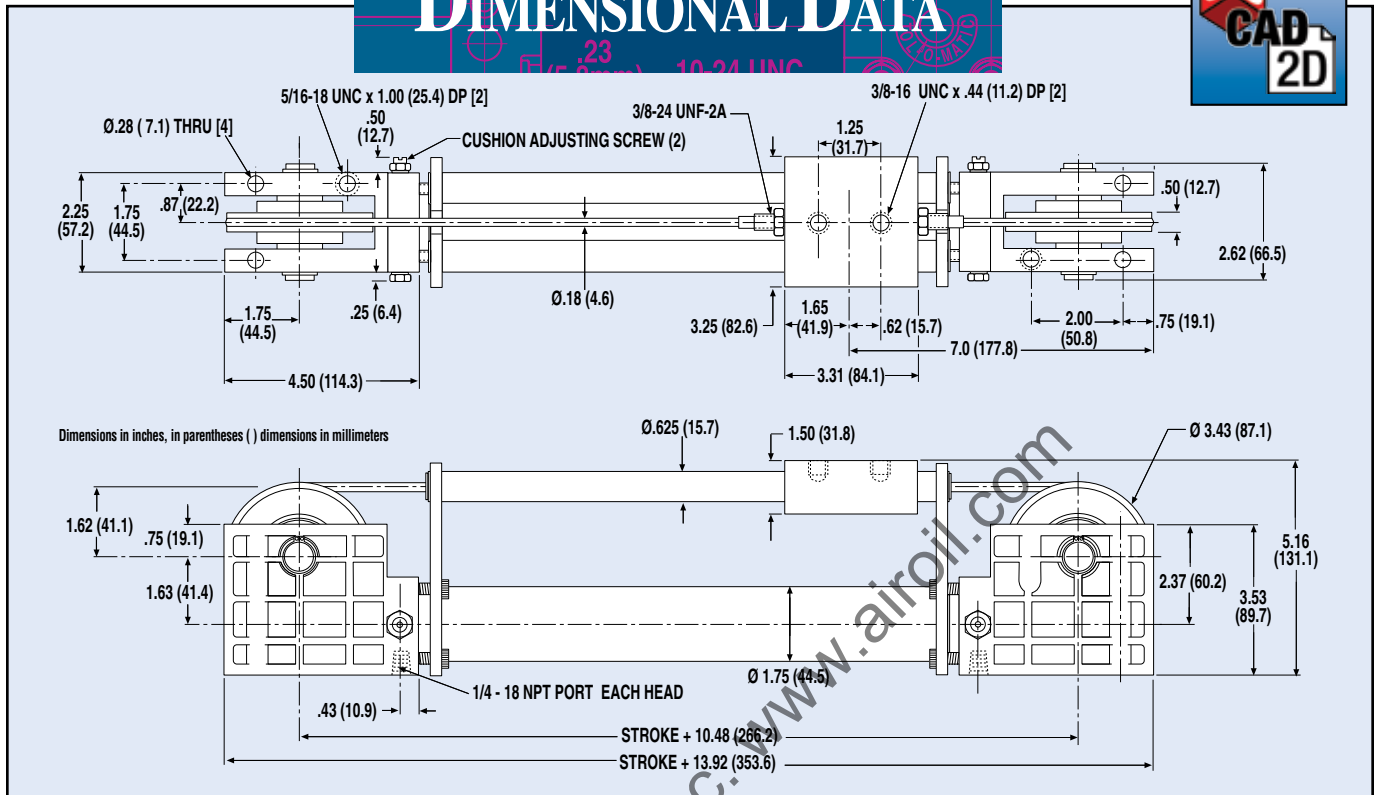
NOTE: Moderate bending moments are acceptable, so long as the moment load does not exceed 30 inch-pounds for the 1/2-, 3/4- and 1-inch bore cylinders.

The diagrams at left, illustrate how this is calculated.



# TC Track Cable Cylinder - TC15

## DIMENSIONAL DATA

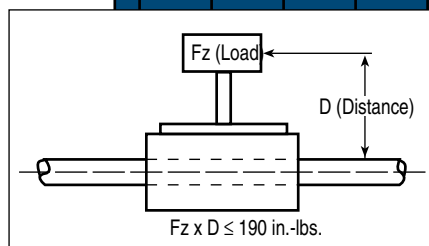
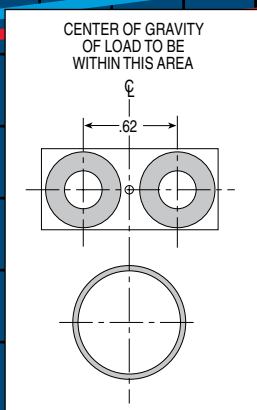


## PERFORMANCE DATA

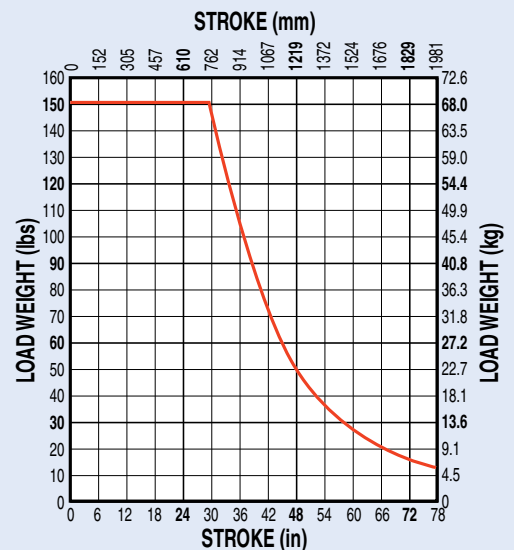
OVERALL UNIT SPECIFICATIONS		
Bore size:	1.5 in.	
Max. stroke	78.00	1981.2
Max. PSI:	100 PSI	6.9 bars
Max. temp.	140° F	60° C

NOTE: Moderate bending moments are acceptable, so long as the moment load does not exceed 190 inch-pounds.

The diagrams at right, illustrate how this is calculated.



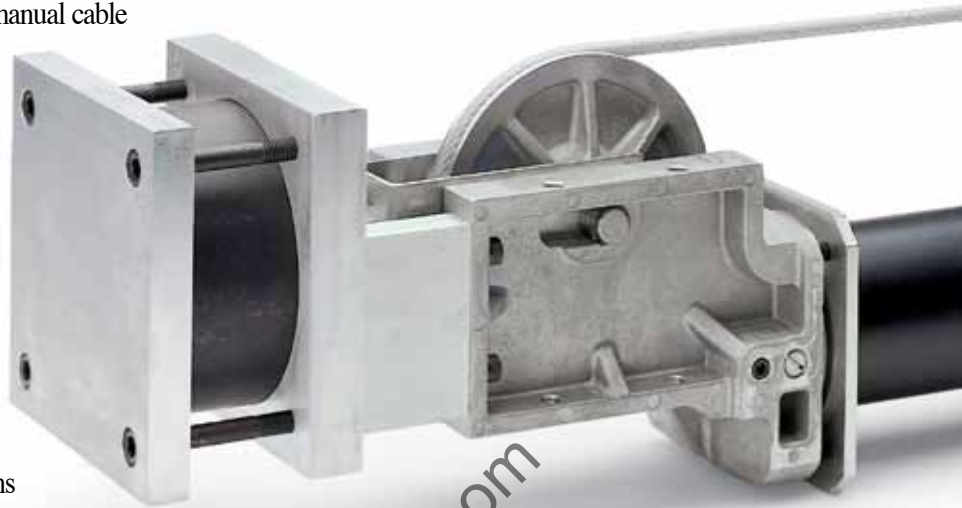
**LOAD WEIGHT vs STROKE TC15**  
 (5/8-inch dia. rods at .30-inch deflection)  
 NOTE: Rod deflection must not exceed .30 inches



# CC Automatic Tensioner - All Sizes

Automatic tensioners are required when a cylinder's stroke length is beyond the maximum stroke length for full manual cable adjustment for that bore size. The AT unit keeps the cable rigid and ensures maximum service life of both the cable and gland seals. AT units are also recommended for vertical lifting or severe, high-cyclic applications.

The standard automatic tensioner unit has a 1-inch stroke, providing 2 inches of cable take-up. A 2-inch stroke AT unit may be installed on a cylinder, providing 4 inches of cable take-up. Refer to the tables below for tensioner stroke options on available bore sizes.



## MAXIMUM STROKE LENGTHS FOR CYLINDERS WITH AUTO TENSIONERS

NOTE: A cable cylinder should be completely proof-loaded and pretensioned with either the

Torque Method or the Field Method in order for the auto tensioner to achieve the maximum stroke lengths shown in the table below. (For

more information on proof-loading and pretensioning, please see page CC\_36)

STROKE OPTIONS	STROKE LENGTHS IN INCHES BASED ON CYLINDER'S MAXIMUM OPERATING PRESSURE									
	CC05	CC07	CC10	CC15	CC20	CC25	CC30	CC40	CC50	CC52
Auto Tensioner with one 1" stroke unit	NA	134.4	134.4	361.2	260.4	159.6	243.6	134.4	NA	266.8
Auto Tensioner with two 1" stroke units	NA	252.0	252.0	579.6	369.6	266.8	344.4	193.2	NA	327.6
Auto Tensioner with one 2" stroke unit	NA	NA	NA	NA	369.6	266.8	344.4	193.2	468.0	327.6
Auto Tensioner with two 2" stroke units	NA	NA	NA	NA	524.4	322.8	487.2	277.2	714.0	472.8

Above Dimensions in inches

STROKE OPTIONS	STROKE LENGTHS IN METERS BASED ON CYLINDER'S MAXIMUM OPERATING PRESSURE									
	CC05	CC07	CC10	CC15	CC20	CC25	CC30	CC40	CC50	CC52
Auto Tensioner with one 1" stroke unit	NA	3.41	3.41	9.17	6.61	4.05	6.19	3.41	NA	6.78
Auto Tensioner with two 1" stroke units	NA	6.40	6.40	14.72	9.39	6.78	8.75	4.91	NA	8.32
Auto Tensioner with one 2" stroke unit	NA	NA	NA	NA	9.39	6.78	8.75	4.91	11.89	8.32
Auto Tensioner with two 2" stroke units	NA	NA	NA	NA	13.32	8.20	12.37	7.04	18.14	12.01

Above Dimensions in METERS

NOTE: Tube couplers are required on cable cylinders with strokes over 280 inches (7.11m).

Maximum stroke lengths in the above table can be extended by using the percentage of the pressure differential between the cylinder's actual operating pressure and the maximum operating pressure.

Example: If the cylinder selected is a CC15 (1 1/2-inch bore) with one 1-inch stroke AT unit:

Actual PSI: 80  
Max. PSI: 100  
Differential: 20%

20% x 361.2 in. (maximum stroke) = 72.24 in.  
72.24 in. + 361.2 in. = 433.44 in. (36.12 feet)

All AT units should be plumbed with a separate, regulated non-fluctuating pressure source which is a set percentage of the actual cylinder operating pressure. These are listed in the table at the right.

NOTE: When using an AT unit in an application where the cylinder is loaded in only one direction, it is recommended to have the AT unit located so the load direction of travel is away from the AT

unit. On vertical applications, the AT unit should be located on the bottom.

### AUTO TENSIONER PRESSURE SETTINGS FOR MODEL % OF LOAD PRESSURE

CC07	22%
CC10	40%
CC15	86%
CC20	32%
CC25	51%
CC30	54%
CC40	96%
CC50	75%
CC52	24%

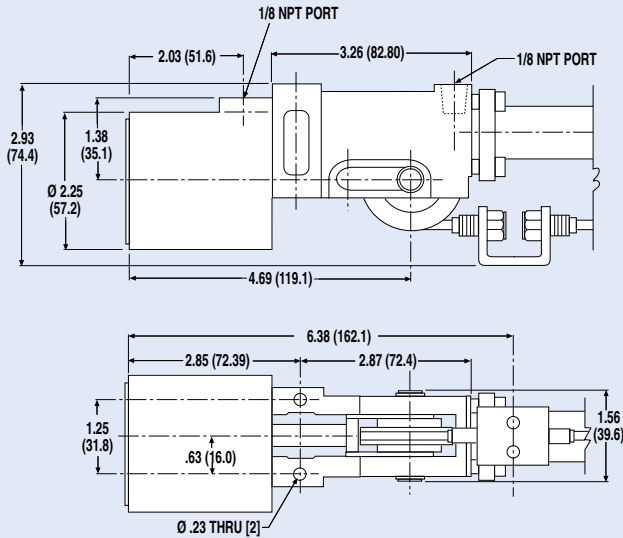
# CC Automatic Tensioner - CC07, CC10, CC15, CC20, CC25

2D CAD AVAILABLE AT  
WWW.TOLOMATIC.COM

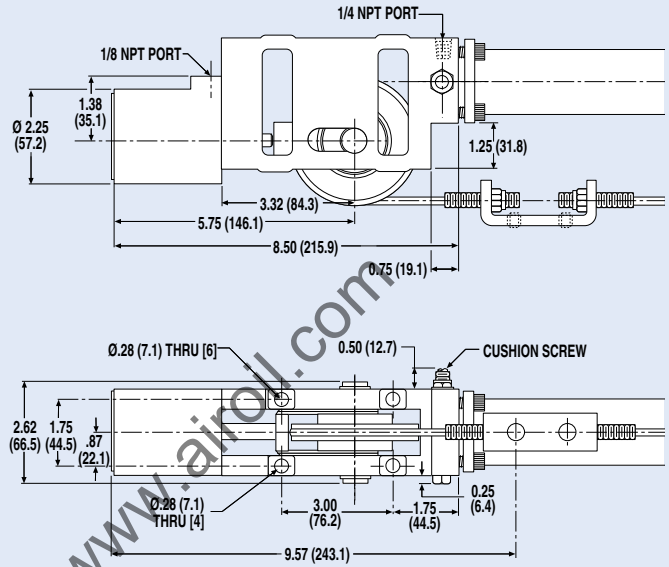


## DIMENSIONAL DATA

### AT FOR CC07, CC10

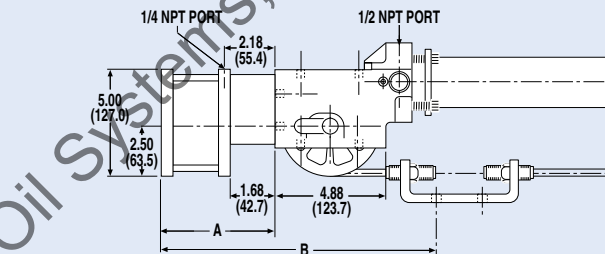


### AT FOR CC15



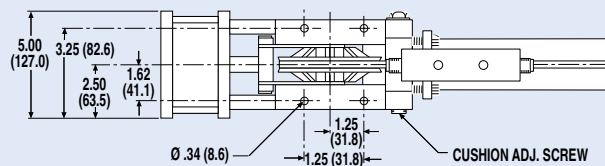
Dimensions in inches, in parentheses ( ) dimensions in millimeters

### AT FOR CC20, CC25



MODEL	A	B
1" Stroke Tensioner	5.66"	12.16"
2" Stroke Tensioner	6.66"	13.16"

MODEL	A	B
1" Stroke Tensioner	143.8mm	308.9mm
2" Stroke Tensioner	169.2mm	334.3mm



SPACE AND WEIGHT REQUIREMENTS		
MODEL	DEAD LENGTH (in)*	WEIGHT (lbs)
CC07	8.87	1.06
CC10	8.87	1.06
CC15	16.41	2.76
CC20	20.66	8.41
CC25	20.66	8.41

SPACE AND WEIGHT REQUIREMENTS		
MODEL	DEAD LENGTH (mm)*	WEIGHT (kg)
CC07	225	0.48
CC10	225	0.48
CC15	417	1.25
CC20	525	3.81
CC25	525	3.81

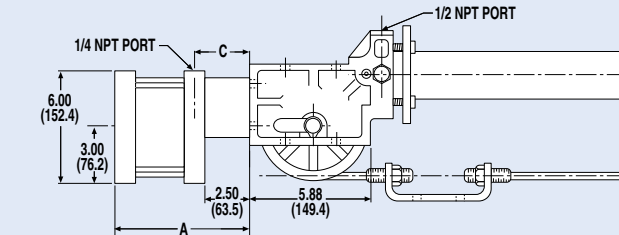
\*Add dead length to stroke length to determine overall cylinder length

# CC Automatic Tensioner - CC30, CC40, CC52, CC50

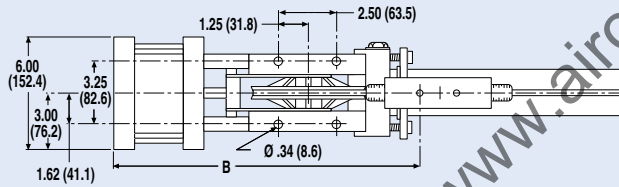
## DIMENSIONAL DATA



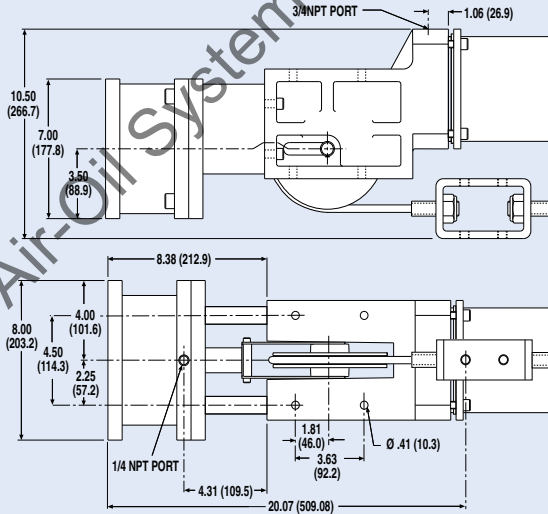
### AT FOR CC30, CC40, CC52



MODEL	A	B	C	MODEL	A	B	C
1" Stroke Tensioner	6.38"	14.12"	3.01"	1" Stroke Tensioner	162.1mm	358.6mm	76.5mm
2" Stroke Tensioner	7.38"	15.12"	3.50"	2" Stroke Tensioner	187.5mm	384.0mm	88.9mm



### AT FOR CC50



Dimensions in inches, in parentheses ( ) dimensions in millimeters

#### SPACE AND WEIGHT REQUIREMENTS

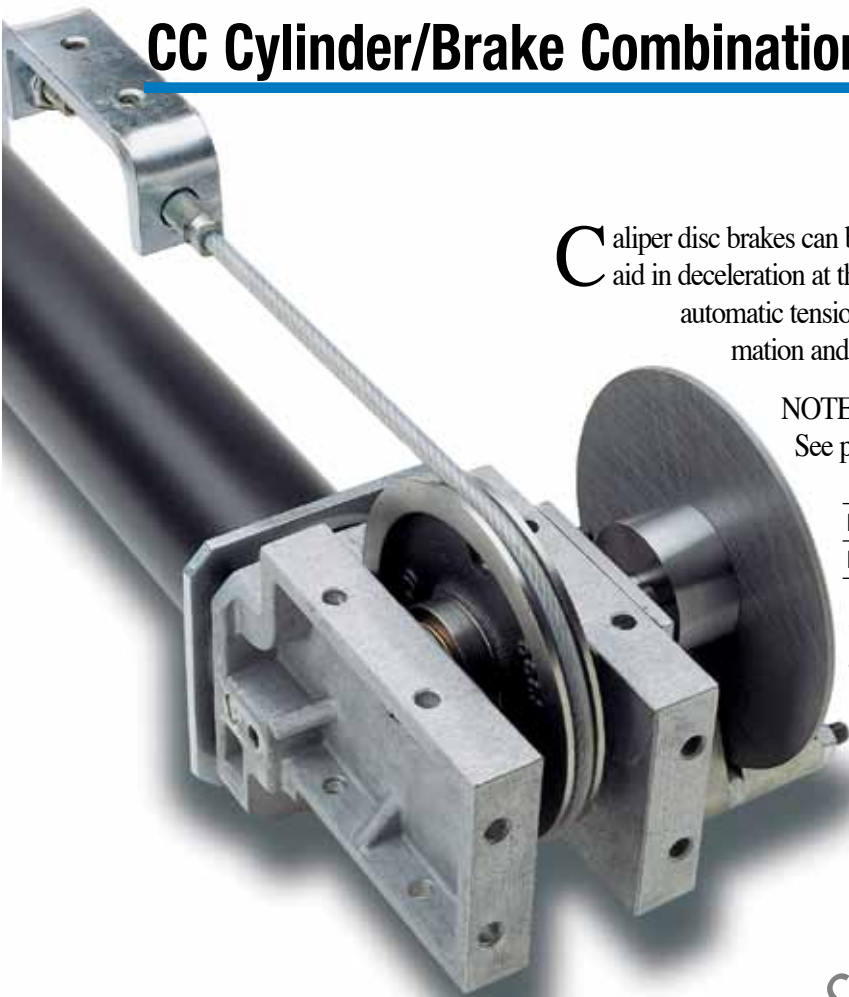
MODEL	DEAD LENGTH (in)*	WEIGHT (lbs)
CC30	23.88	14.36
CC40	24.88	14.36
CC52	23.88	14.36
CC50	33.75	23.68

#### SPACE AND WEIGHT REQUIREMENTS

MODEL	DEAD LENGTH (mm)*	WEIGHT (kg)
CC30	607	6.51
CC40	632	6.51
CC52	607	6.51
CC50	857	10.74

\*Add dead length to stroke length to determine overall cylinder length

# CC Cylinder/Brake Combinations - All Sizes



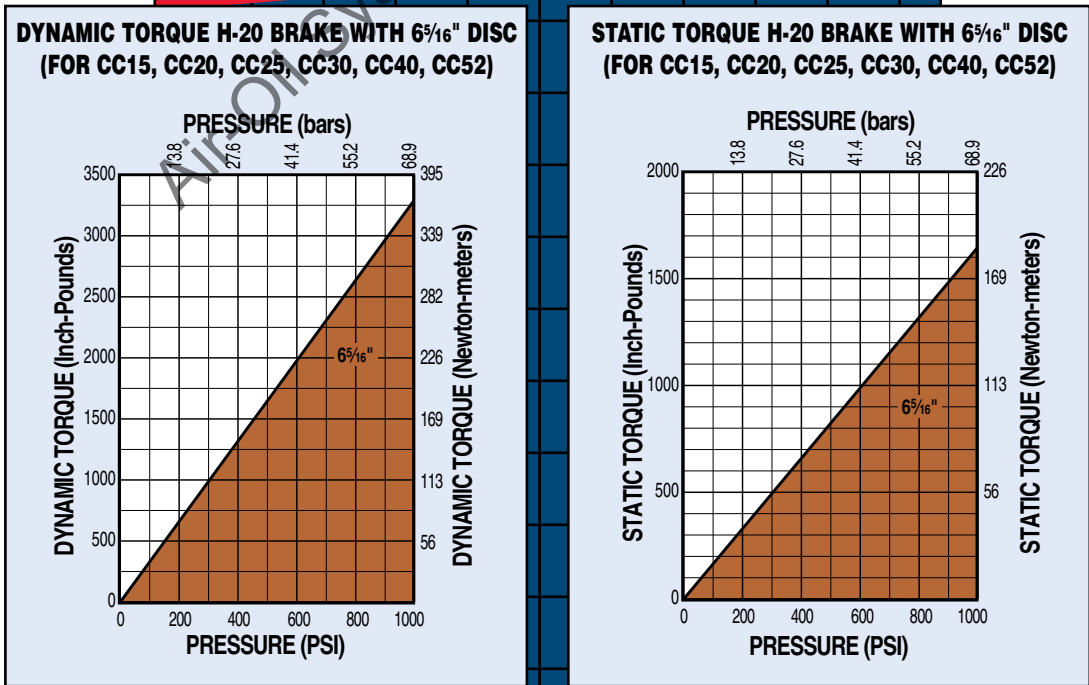
Caliper disc brakes can be used to add holding force in horizontal applications and aid in deceleration at the end of stroke. Caliper disc brakes must be used with an automatic tensioner to function properly. See page CC\_32 for selection information and braking formulae.

NOTE: Tolomatic's H20DARC is used on all available models.  
See part numbers below:

	CC15	CC20	CC25	CC30	CC40	CC52
Brake Number	0728-0010	0728-0010	0728-0010	0728-0010	0728-0010	0728-0010
Disc & Hub No.	0801-0008	0801-0010	0801-0010	0801-0010	0801-0010	0801-0010

See catalog 9900-4009 for detailed information on brakes and discs.

## PERFORMANCE DATA

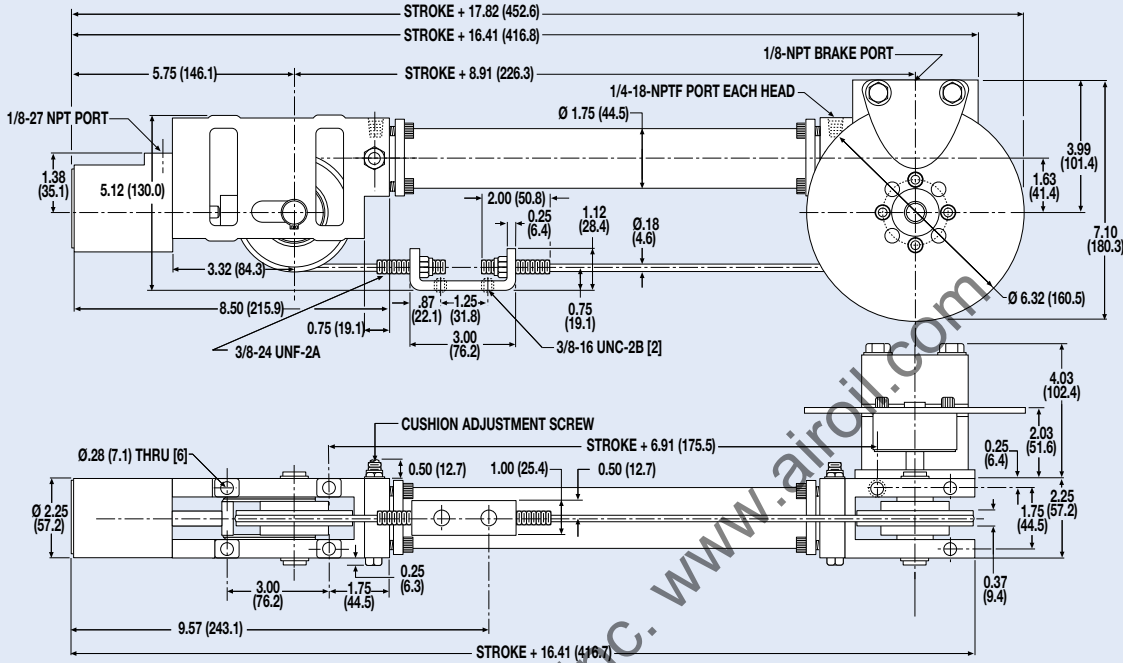


# CC Cylinder/Brake Combinations - CC15, CC20, CC25

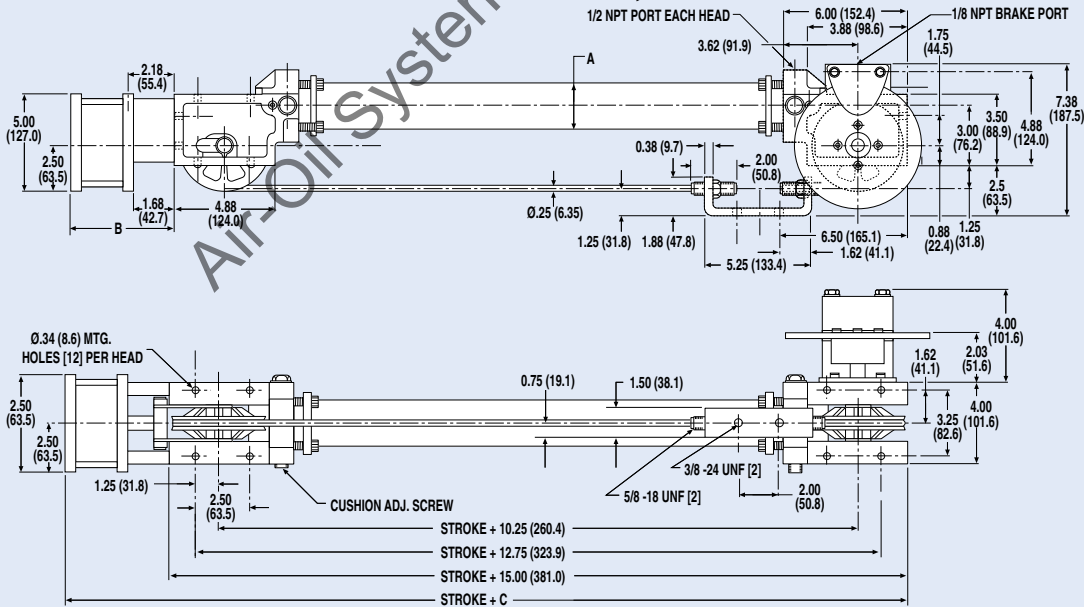
## DIMENSIONAL DATA



### CYLINDER/ BRAKE COMBINATION FOR CC15



### CYLINDER/ BRAKE COMBINATION FOR CC20, CC25



MODEL	A	B	C
CC20 w/ 1" Stroke Tensioner	Ø 2.25"	5.66"	20.66"
CC20 w/ 2" Stroke Tensioner	Ø 2.25"	6.66"	22.15"
CC25 w/ 1" Stroke Tensioner	Ø 2.75"	5.66"	20.66"
CC25 w/ 2" Stroke Tensioner	Ø 2.75"	6.66"	22.15"

MODEL	A	B	C
CC20 w/ 1" Stroke Tensioner	Ø 57.2mm	143.8mm	524.7mm
CC20 w/ 2" Stroke Tensioner	Ø 57.2mm	169.2mm	561.6mm
CC25 w/ 1" Stroke Tensioner	Ø 69.9mm	143.8mm	524.7mm
CC25 w/ 2" Stroke Tensioner	Ø 69.9mm	169.2mm	561.6mm

Dimensions in inches, in parentheses ( ) dimensions in millimeters

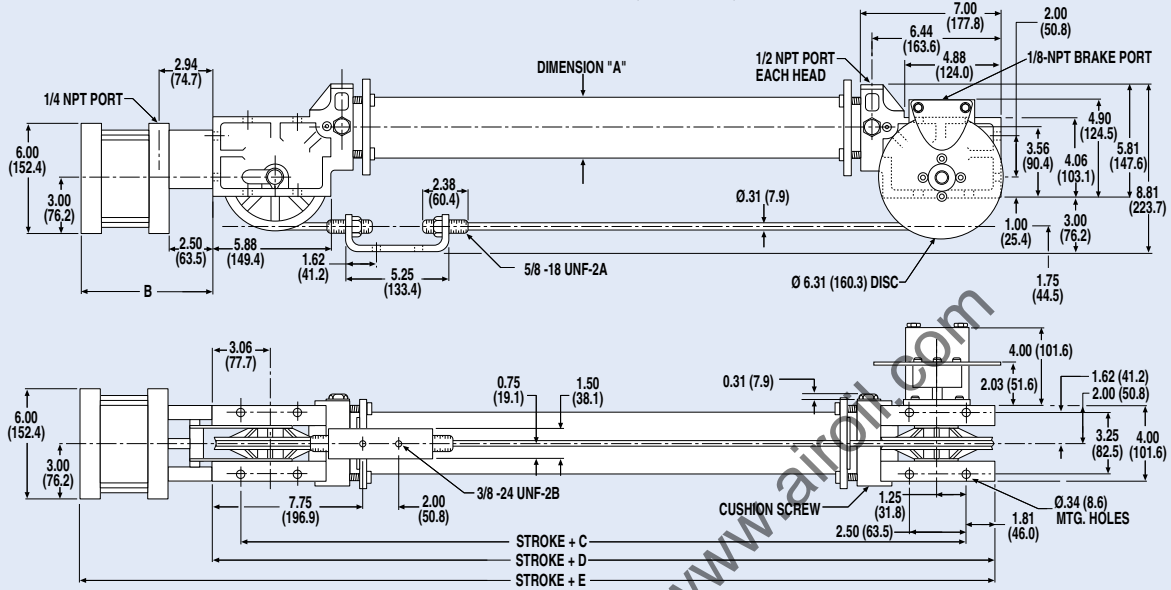
# CC Cylinder/Brake Combinations - CC30, CC40, CC52

## DIMENSIONAL DATA 1.21 (30.7mm) 2.23 (56.9mm) 10-24 UNC



ABT  
 MXP  
 BCL  
 BC3  
 BC4  
 LS  
 MG  
 PB  
 ENGR

### CYLINDER/ BRAKE COMBINATION FOR CC30, CC40, CC52



MODEL	A	B	C	D	E
CC30 w/ 1" Stroke Tensioner	Ø 3.25"	6.38"	13.87"	17.50"	23.89"
CC30 w/ 2" Stroke Tensioner	Ø 3.25"	7.38"	13.87"	17.50"	24.89"
CC40 w/ 1" Stroke Tensioner	Ø 4.25"	6.38"	14.07"	18.50"	24.89"
CC40 w/ 2" Stroke Tensioner	Ø 4.25"	7.38"	14.07"	18.50"	25.89"
CC52 w/ 1" Stroke Tensioner	Ø 2.25"	6.38"	13.87"	17.50"	23.89"
CC52 w/ 2" Stroke Tensioner	Ø 2.25"	7.38"	13.87"	17.50"	24.09"

MODEL	A	B	C	D	E
CC30 w/ 1" Stroke Tensioner	Ø 82.6mm	162.1mm	352.3mm	444.5mm	609.1mm
CC30 w/ 2" Stroke Tensioner	Ø 82.6mm	187.5mm	352.3mm	444.5mm	634.5mm
CC40 w/ 1" Stroke Tensioner	Ø 108.0mm	162.1mm	357.4mm	469.9mm	609.1mm
CC40 w/ 2" Stroke Tensioner	Ø 108.0mm	187.5mm	357.4mm	469.9mm	634.5mm
CC52 w/ 1" Stroke Tensioner	Ø 57.2mm	162.1mm	352.3mm	444.5mm	609.1mm
CC52 w/ 2" Stroke Tensioner	Ø 57.2mm	187.5mm	352.3mm	444.5mm	634.5mm

Dimensions in inches, in parentheses ( ) dimensions in millimeters

Air-Oil Systems, Inc. www.airoil.com

For Assistance Call  
 1-800-328-2174  
 (Toll Free U.S. and Canada)  
 or  
 763-478-8000  
 Fax 763-478-8080

# CC, SA, DP, TC Switches - All Sizes

## SWITCHES



There are 10 sensing choices: DC reed, form A (open) or form C (open or closed); AC reed (Triac, open); Hall-effect, sourcing, PNP (open); Hall-effect, sinking, NPN (open); each with either flying leads or QD (quick disconnect). Commonly used to send analog signals to PLC (programmable logic controllers), TLL, CMOS circuit or other controller device. These switches are activated by the actuator's magnet.

Switches contain reverse polarity protection. QD cables are shielded; shield should be terminated at flying lead end.

If necessary to remove factory installed switches, be sure to reinstall on the same of side of actuator with scored face of switch toward internal magnet.

## SPECIFICATIONS

ORDER CODE	REED DC				REED AC	
	RT	RM	BT	BM	CT	CM
PART NUMBER	3600-9082	3600-9083	3600-9084	3600-9085	3600-9086	3600-9087
LEAD	5m	QD*	5m	QD*	5m	QD*
CABLE SHIELDING	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†
SWITCHING LOGIC	"A" Normally Open		"C" Normally Open or Closed		Triac Normally Open	
MECHANICAL CONTACTS	Single-Pole Single-Throw		Single-Pole Double-Throw		Single-Pole Single-Throw	
COIL DIRECT	Yes		Yes		Yes	
POWER LED	None		None		None	
SIGNAL LED	Red		None		None	
OPERATING VOLTAGE	200 Vdc max.		120 Vdc max.		120 Vac max.	
OUTPUT RATING	—		—		—	
OPERATING TIME	0.6 msec max. (including bounce)		0.7 msec max. (including bounce)		—	
OPERATING TEMPERATURE	-40°F [-40°C] to 158°F [70°C]					
RELEASE TIME	1.0 msec. max.		—		—	
ON TRIP POINT	—		—		—	
OFF TRIP POINT	—		—		—	
**POWER RATING (WATTS)	10.0 §		3.0 §§		10.0	
VOLTAGE DROP	2.6 V typical at 100 mA		NA		—	
RESISTANCE	0.1 Ω Initial (Max.)		—		—	
CURRENT CONSUMPTION	—		—		1 Amp at 86°F [30°C]	0.5 Amp at 140°F [60°C]
FREQUENCY	—		—		47 - 63 Hz	
CABLE MIN. BEND RADIUS	STATIC	0.630" [16mm]				
	DYNAMIC	Not Recommended				

**CAUTION: DO NOT OVER TIGHTEN SWITCH HARDWARE WHEN INSTALLING!**

**\*\* WARNING:** Do not exceed power rating (Watt = Voltage X Amperage). Permanent damage to sensor will occur.

\*QD = Quick Disconnect; Male coupler is located 6" [152mm] from sensor, Female coupler to flying lead (part #2503-1025) distance is 197" [5m] also see Cable Shielding specification above

**REPLACEMENT OF QD SWITCHES MANUFACTURED BEFORE JULY 1, 1997:** It will be necessary to replace or rewire the female end coupler.



**Reed Switch Life Expectancy:** Up to 200,000,000 cycles (depending on load current, duty cycle and environmental conditions)

†Shielded from the female quick disconnect coupler to the flying leads. Shield should be terminated at flying lead end.

§ Maximum current 500mA (not to exceed 10VA) Refer to Temperature vs. Current graph and Voltage Derating graph

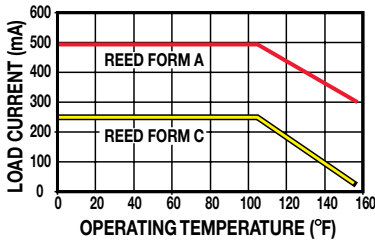
§§ Maximum current 250mA (not to exceed 3VA) Refer to Temperature vs. Current graph and Voltage Derating graph



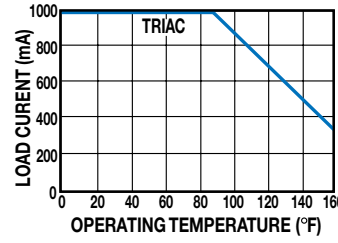
# CC, SA, DP, TC Switches - All Sizes

## PERFORMANCE

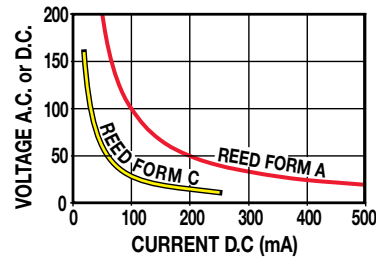
TEMP. vs CURRENT, DC REED



TEMP. vs CURRENT, AC REED

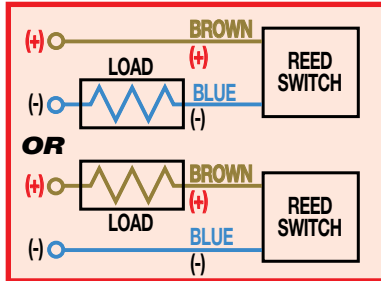


VOLTAGE DERATING, DC REED

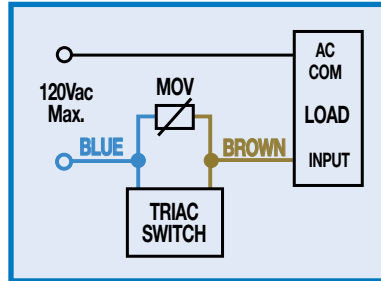


## WIRING DIAGRAMS

**R**T & **R**M DC REED, FORM A



**C**T & **C**M AC REED, TRIAC

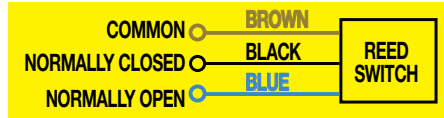


## INSTALLATION INFORMATION

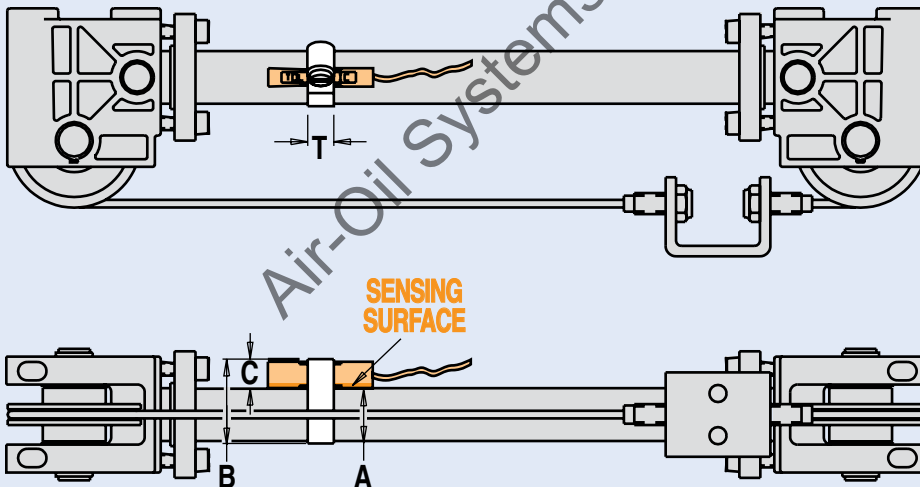


**!** THE NOTCHED FACE OF THE SWITCH INDICATES THE SENSING SURFACE AND MUST FACE TOWARD THE MAGNET.

**B**T & **B**M DC REED, FORM C



## DIMENSIONS



NOTE: HALL-EFFECT SWITCHES ARE NOT AVAILABLE FOR CABLE CYLINDERS  
SWITCHES ARE NOT AVAILABLE FOR CABLE CYLINDERS WITH STEEL TUBE  
DEAD LENGTH WILL INCREASE ON MOST MODELS, SEE BELOW

MODEL	BORE	A*	B	C	T
CCM05	0.50	0.81	1.09	0.35	0.31
CCM07	0.75	0.81	1.09	0.35	0.31
CCM10	1.00	1.12	1.65	0.35	0.31
CCM15	1.50	1.56	2.15	0.35	0.31
CCM20	2.00	2.08	2.65	0.35	0.31
CCM52	2.00	2.08	2.65	0.35	0.31
CCM25	2.50	2.75	3.15	0.35	0.31
CCM30	3.00	3.25	3.65	0.35	0.31
CCM40	4.00	4.25	4.65	0.35	0.56
CCM50	5.00	5.25	5.65	0.35	0.56

Above dimensions in inches  
\*Inside Dimension ±.06"

MODEL	BORE	A*	B	C	T
CCM05	0.50"	20.57	27.69	8.76	7.87
CCM07	0.75"	20.57	27.69	8.76	7.87
CCM10	1.00"	28.45	41.91	8.76	7.87
CCM15	1.50"	39.62	54.61	8.76	7.87
CCM20	2.00"	52.83	67.31	8.76	7.87
CCM52	2.00"	52.83	67.31	8.76	7.87
CCM25	2.50"	69.85	80.01	8.76	7.87
CCM30	3.00"	82.55	92.71	8.76	7.87
CCM40	4.00"	107.95	118.11	8.76	14.22
CCM50	5.00"	133.35	143.51	8.76	14.22

Above dimensions in millimeters  
\*Inside Dimension ±1.5mm

MODEL	CCM05	CCM07 SAM07	CCM10 SAM10	CCM15 SAM15	CCM20 SAM20	CCM52 SAM52	CCM25 SAM25	CCM30 SAM30	CCM40 SAM40	CCM50
BORE	0.50"	0.75"	1.00"	1.50"	2.00"	2.00"	2.50"	3.00"	4.00"	5.00"

SPACE REQUIREMENTS -  
ADD DEAD LENGTH  
TO STROKE LENGTH

IN.	1.62	1.62	1.62	0.375	0.375	0.375	0.375	0.375	0.375	0
MM	41.2	41.2	41.2	9.5	9.5	9.5	9.5	9.5	9.5	0

# CC: Cable Cylinder Selection Guidelines - All Sizes

## EXTERNAL LOAD GUIDANCE AND SUPPORT

The process of selecting a cable cylinder for a given application can be complex. It is highly recommended that you contact Tolomatic or a Tolomatic Distributor for assistance in selecting the best actuator for your application. The following overview of the selection guidelines are for educational purposes only.

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Cable Cylinder for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs. or kgs.)
- Orientation of load (lbs. or kgs.)
- Velocity of load (in./sec. or mm/sec.)
- Stroke length (in. or mm)

### 2 SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 3), the actuator will accommodate the application. If the intersection is above the

diagonal line, a larger cylinder bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 DETERMINE INTERNAL CUSHION CAPACITY

- Consult the Cushion Data chart for the model selected. The velocities listed on the cushion charts are final or cushion impact velocities. On applications where the internal cushions or bumpers are to be used, be sure the actual, final or impact velocity is known. If the velocity is not known, use of limit switches with valve deceleration circuits or shock absorbers should be considered. Cross-reference the final velocity and weight of the load. If the intersection is below the diagonal lines, the internal cushions on the actuator may be used. If the point falls above the dashed diagonal line or if the velocity is not known, use deceleration circuits, external shock absorbers or select a larger cylinder with greater cushion capacity. On high-cyclic applications, use of external stops is strongly recommended.

NOTE: The 1/2-inch and 5-inch cable cylinders and all sizes of magnetically coupled cylinders do not have internal cushions.

The 1/2-inch cable cylinder can handle only very light inertial loads (5 pounds or less). Heavier loads require external stops or shock absorbers.

### 4 DETERMINE THE MAXIMUM STROKE LENGTHS FOR FULL MANUAL CABLE ADJUSTMENT (CC ONLY)

Once you have selected the proper bore size for your application and determined the cylinder's cushion capacity, you need to determine the physical stroke length limitation of the cylinder. Refer to the table below to find the bore size selected and its maximum stroke length.

NOTE: Maximum recommended stroke length for full manual cable adjustment is the maximum stroke length at which the cables can be properly proof-loaded, pretensioned and maintained at the required tension by manually adjusting the clevis terminal lock nuts. Maximum stroke length is based on the cylinder's maximum pressure rating.

If the stroke length for your application falls within the maximum stroke length for full manual cable adjustment, your model selection is complete. (Refer to graph on page cc\_31.)

IMPORTANT NOTE: Once a cylinder is installed in an application, but before putting it into service, the cables must be proof-loaded and pretensioned for proper operation. Refer to Application Guidelines on page cc\_36 for proof-loading and pretensioning methods.

If your stroke length is beyond the maximum stroke lengths shown, you have two options available.

1. Increase the maximum stroke length of the selected cylinder size by the percentage of the

pressure differential between the cylinder's actual operating pressure and the cylinder's maximum rated operating pressure.

Example: If the cylinder selected is a CC15 (1½ - inch bore):

Actual PSI:	80
Max. PSI:	100
Differential:	20%
20% x 126 in. (maximum stroke) = 25.2 in.	
25.2 + 126 = 151.2 in. (12.6 feet)	

2. If your required stroke length is still more than the increased stroke length determined from option "1.", an automatic tensioner (AT) or multiple tensioners may be required.

For maximum stroke lengths when using auto tensioners, refer to the chart on page cc\_22.

NOTE: When using auto tensioners, the cylinder's cables must be proof-loaded and pretensioned before pressure is applied to the AT unit. Refer to Application Guidelines on page cc\_36 for proper proof-loading and pretensioning methods.

Auto tensioners are strongly recommended for vertical lifting applications and severe, high-cyclic applications even when the cylinder's stroke is within the maximum stroke length at full manual cable adjustment.

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# CC: Cable Cylinder Selection Example

The procedure for selection of cable cylinder and magnetically coupled cylinder are very similar. For illustrative purposes, charts for the CC10 model are used in this example.

## 1. COMPILE APPLICATION REQUIREMENTS

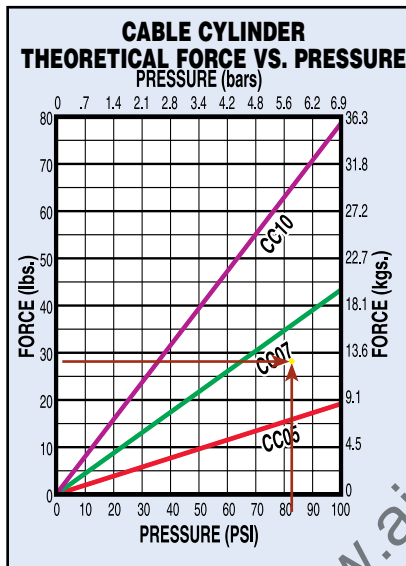
- Available pressure 80 psi
- Weight of load 30 lbs.
- Orientation of load horiz.
- Final velocity\* of load 10" per sec
- Stroke length 68"

\*2x average velocity, see page 197

## 2. SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force and

the available operating pressure. In this example a CC07 would accommodate this load at the available PSI.



## 3. DETERMINE COUPLING FORCE REQUIREMENTS (MG ONLY)

Since we are selecting a cable cylinder we can skip this step.

## 4. DETERMINE INTERNAL CUSHION CAPACITY (CC ONLY)

- Consult the Cushion Data Chart for the model selected.

In this example the calculated value for the final velocity and the load intersect at the line for the internal cushions capacity. Thus the CC10 will work for this application.

## 5. DETERMINE THE MAXIMUM STROKE LENGTHS FOR FULL MANUAL CABLE ADJUSTMENT (CC ONLY)

- Consult the chart below left.

In our example we are using 80 PSI, the chart indicates a maximum of 100 PSI, so we can calculate the maximum stroke length with manual adjustment:

$$1.20 \times 20.4" = 24.48"$$

Our stroke length is 68" so it will require the automatic tensioner option.

## 6. CONSIDER OPTIONS

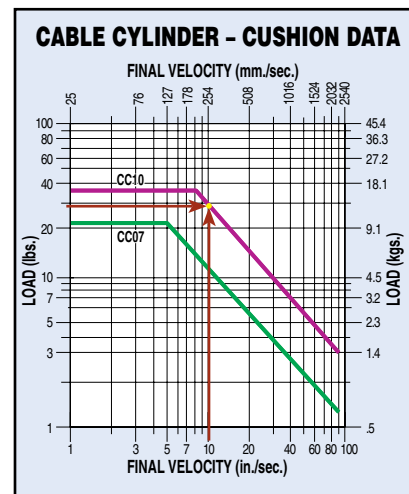
This application will use Form C dc Reed switches to signal other units in this automated system.

The final configured string will appear as follows:

**CCM10SK68.000HIBM2**

### CABLE CYLINDER MAXIMUM STROKE LENGTHS FOR FULL MANUAL CABLE ADJUSTMENT

MODEL	BORE IN.	MAXIMUM PRESSURE		MAXIMUM STROKE	
		PSI	BARS	IN.	MM
CC05	0.5	100	6.89	20.4	518.2
CC07	0.75	100	6.89	20.4	518.2
CC10	1.0	100	6.89	20.4	518.2
CC15	1.5	100	6.89	126.0	3200.4
CC20	2.0	200	13.79	159.6	4053.8
CC25	2.5	200	13.79	100.8	2560.3
CC30	3.0	200	13.79	151.2	3840.5
CC40	4.0	200	13.79	84.0	2133.6
CC50	5.0	100	6.89	222.0	5638.8
CC52	2.0	500	34.47	134.4	3413.8



For Assistance Call  
1-800-328-2174  
(Toll Free U.S. and Canada)  
or  
763-478-8000  
Fax: 763-478-8080

# CC: Caliper Disc Brake for Cable Cylinder Selection Guidelines

ADT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR



## DETERMINE THE LOAD CONFIGURATION AND THE HOLDING CAPACITY OF THE BRAKE

The following steps will help determine the adequate stopping time and distance for the cable cylinder

equipped with a caliper disc brake under various conditions and loads.

1. Select the bore size of the cable cylinder based on load to be moved. Determine load pressure. Set regulator at 25% above load pressure ( $P_c$ ).

2. Calculate the unbalanced cylinder force ( $F_c$ ) **only** if pressure is applied when braking. If pressure is removed prior to braking, go on to 3.

$$F_c = P_c \times A_c$$

3. Calculate the tangential braking force required. This is ( $F_{tr}$ ) when pressure is removed prior to braking, or ( $F_{ta}$ ) when pressure is still applied when braking. Refer to illustrations in Figure 1.

Carefully note conditions:

$$F_{tr} = W \left[ \left( \frac{a}{g} - \sin \vartheta \right) - (f \cos \vartheta) \right], \text{ Horizontal or Load rising}$$

$$F_{tr} = W \left[ \left( \frac{a}{g} + \sin \vartheta \right) - (f \cos \vartheta) \right], \text{ Load falling}$$

$$F_{ta} = F_c + W \left( \frac{a}{g} - f \right), \text{ Horizontal loads}$$

$$= F_c + W \left[ \left( \frac{a}{g} - \sin \vartheta \right) - (f \cos \vartheta) \right], \text{ Incline load rising}$$

$$= F_c + W \left( \frac{a}{g} - 1 \right), \text{ Vertical load rising}$$

In the above expressions (a) can be calculated from:

$$a = \frac{V^2}{2S} \text{ or } \frac{V}{T}, \text{ In./Sec.}^2$$

4. Calculate the tension required in brake side cable at the time of braking.

$$L_{tr} = \frac{F_{tr}}{0.369}, \text{ lbs.}; \text{ Pressure removed while braking}$$

$$L_{ta} = \frac{F_{ta}}{0.369}, \text{ lbs.}; \text{ Pressure applied while braking}$$

### NOMENCLATURE

a = Deceleration, in/sec <sup>2</sup>	V = Velocity of load, in/sec.
g = Deceleration due to gravity = 386.4 in/sec <sup>2</sup>	W = Weight of load, lbs.
f* = Coefficient of friction of sliding load	W <sub>e</sub> = Equivalent Load, lbs.
f <sub>c</sub> = Coefficient of friction between cable and sheave	W <sub>e</sub> = W (Sin $\vartheta$ + f cos $\vartheta$ )
F <sub>c</sub> = Unbalanced cylinder force, lbs.	$\vartheta$ = Angle of inclination ( $\vartheta = 0^\circ$ for horizontal) ( $\vartheta = 90^\circ$ for vertical)
F <sub>ta</sub> = Tangential braking force required with pressure still applied when braking, lbs.	R <sub>s</sub> = Root radius of sheave groove, inches
F <sub>tr</sub> = Tangential braking force required with pressure removed prior to braking, lbs.	P <sub>c</sub> = Load Pressure, PSI
L <sub>tr</sub> = Tension in cable of brake side half while braking with pressure removed, lbs.	A <sub>c</sub> = Area of cable cylinder bore, in <sup>2</sup>
L <sub>ta</sub> = Tension in cable of brake side half while braking with pressure applied, lbs.	P <sub>t</sub> = Load Pressure, PSI
L <sub>trm</sub> = Maximum tension in cable with pressure removed while braking, lbs.	A <sub>t</sub> = Area of tensioner cylinder, in <sup>2</sup>
L <sub>tam</sub> = Maximum tension in cable with pressure applied while braking, lbs.	P <sub>ba</sub> = Brake pressure setting. Pressure applied while braking, PSI
S = Stopping distance, inches	P <sub>br</sub> = Brake pressure setting. Pressure removed while braking, PSI
T = Stopping time, seconds	

\*Customer must precisely determine coefficient of friction (f), if this value is used.

# CC: Caliper Disc Brake for Cable Cylinder Selection Guidelines

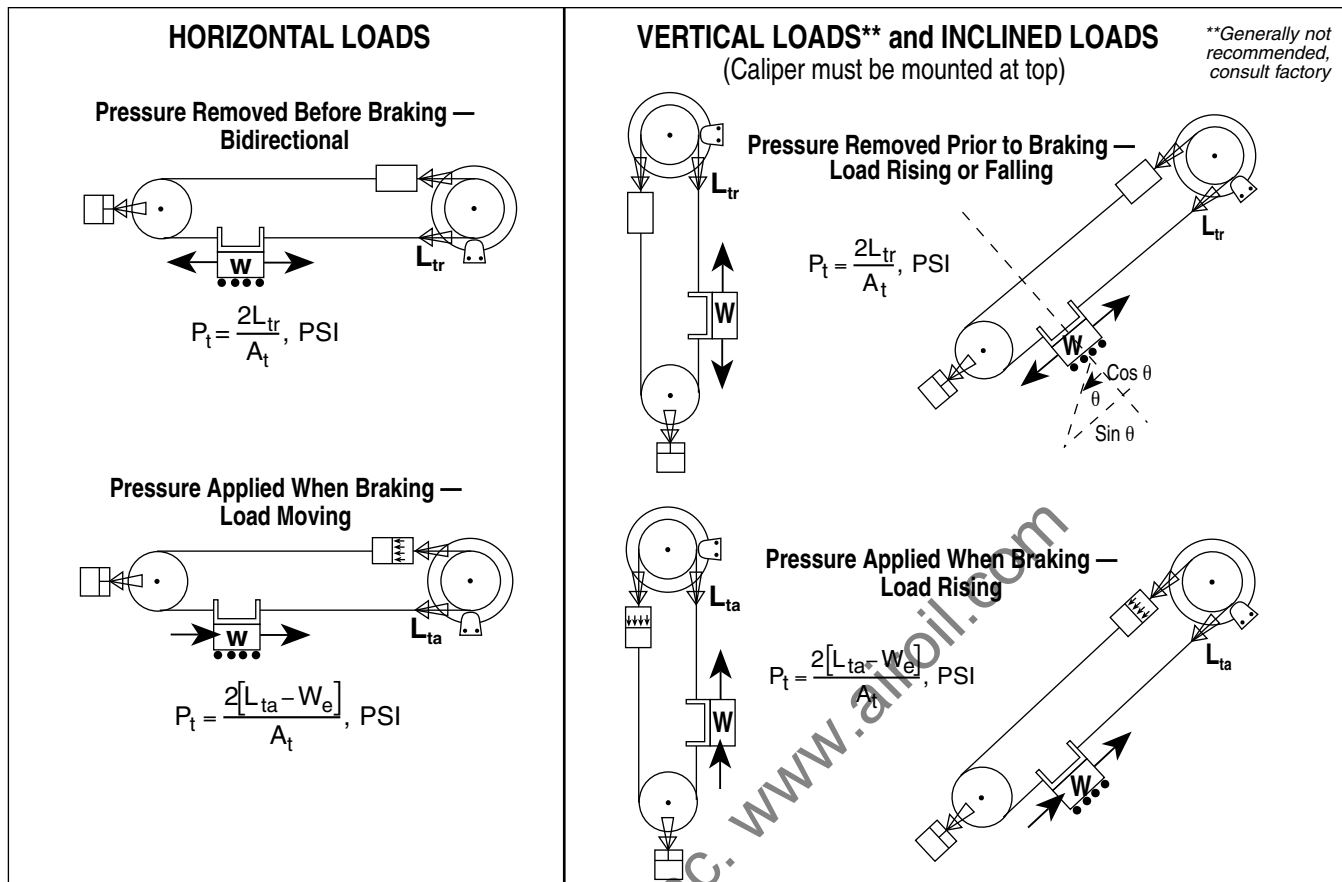


Figure 1

5. Calculate tensioner pressure setting, ( $P_t$ ) based on type of load configuration. See Figure 1 and Table 1

6. Calculate maximum tension in the cable with **pressure removed** prior to braking ( $L_{trm}$ ) or with **pressure applied** when braking ( $L_{tam}$ ).

### Horizontal Loads:

$L_{trm} = L_{tr} + W_e$ , lbs.; Pressure removed prior to braking bidirectional

$L_{tam} = L_{ta}$ , lbs.; Pressure applied when braking and load moving toward caliper

$L_{tam} = L_{ta} + 2W_e$ , lbs.; Pressure applied when braking and load moving away from caliper.

### Vertical or Inclined Loads:

$L_{trm} = L_{tr} + W_e$ , lbs.; Pressure removed prior to braking and load rising or falling

$L_{tam} = L_{ta}$ , lbs.; Pressure still applied when braking and load rising

7. Carefully check that ( $L_{trm}$ ) or ( $L_{tam}$ ) does not exceed 60% of the cable tensile strength\*. If they exceed the 60% figure, either stopping time or stopping distance has to be increased. Repeat steps 1-7.

8. Calculate the brake operating pressure. See Table 1

$P_{br} = .113 [L_{tr} R_s]$ , PSI; Pressure removed prior to braking

$P_{ba} = .113 [L_{ta} R_s]$ , PSI; Pressure still applied when braking

9. If pressure is removed prior to braking, check to see if brake can hold the load if application is either vertical or inclined.

The brake can hold the load if:

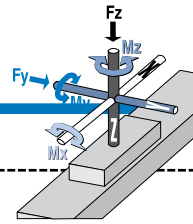
$$.369 L_{tr} \geq W_e$$

\*Refer to Cable Specifications in the double-acting cable cylinder section of this catalog for cable tensile strengths.

Table 1

	$A_t$ ; in <sup>2</sup>	$R_s$ ; in.	$A_c$ ; in <sup>2</sup>
CC07	2.30		
CC10	2.30		
CC15	2.30	1.531	1.767
CC20	11.96	2.00	3.142
CC25	11.96	2.00	4.909
CC30	16.20	2.50	7.069
CC40	16.20	2.50	12.566
CC52	16.20	2.50	3.142
CC50	27.05		

# Application Data Worksheet



ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

**STROKE LENGTH** \_\_\_\_\_

inch (S K)  millimeters  
(U.S. Standard) (Metric)

**AVAILABLE AIR PRESSURE** \_\_\_\_\_

PSI  bar  
(U.S. Standard) (Metric)

**REQUIRED THRUST FORCE** \_\_\_\_\_

lbf  N  
(U.S. Standard) (Metric)

**LOAD** \_\_\_\_\_

lb  kg  
(U.S. Standard) (Metric)

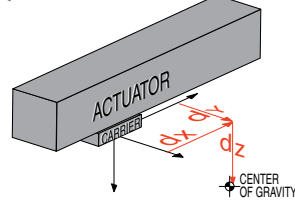
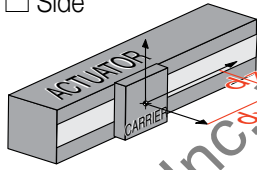
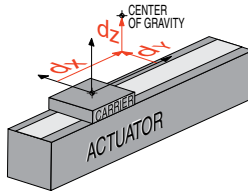
**LOAD CENTER OF GRAVITY DISTANCE TO CARRIER CENTER**

inch  millimeters  
(U.S. Standard) (Metric)

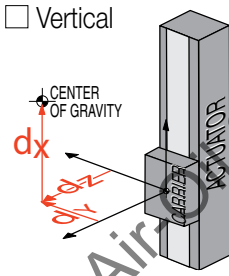
$d_x$  \_\_\_\_\_  
 $d_y$  \_\_\_\_\_  
 $d_z$  \_\_\_\_\_

**ORIENTATION**

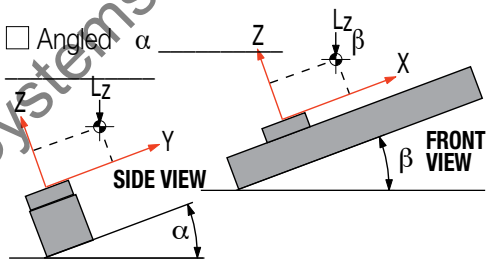
Horizontal  Side  Horizontal Down



Vertical



Angled  $\alpha$



**FORCES APPLIED TO CARRIER**

lbf  N  
(U.S. Standard) (Metric)

$F_z$  \_\_\_\_\_  
 $F_y$  \_\_\_\_\_

**BENDING MOMENTS APPLIED TO CARRIER**

in-lbs  N-m  
(U.S. Standard) (Metric)

$M_x$  \_\_\_\_\_  
 $M_y$  \_\_\_\_\_  
 $M_z$  \_\_\_\_\_

**FINAL VELOCITY** \_\_\_\_\_

in/sec  mm/sec  
(U.S. Standard) (Metric)

**MOVE TIME** sec. \_\_\_\_\_

**NO. OF CYCLES** \_\_\_\_\_

per minute  per hour

**OTHER ISSUES:**

(i.e. Environment,  
Temperature,  
Contamination, etc.)

Contact information: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



Fax (1-763-478-8080) or call Tolomatic (1-800-328-2174) with the above information. We will provide any assistance needed to determine the proper actuator.

# TC: Track Cable Cylinder Selection Guidelines - All Sizes

## PROVIDING LOAD GUIDANCE AND SUPPORT

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Track Cable Cylinder for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs. or kgs.)
- Orientation of load (lbs. or kgs.)
- Velocity of load (in./sec. or mm/sec.)
- Stroke length (in. or mm)

### 2 SELECT CYLINDER SIZE

- Consult the Theoretical Force vs. Pressure charts.
- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 3), the actuator will accommodate the application. If the intersection is above the

diagonal line, a larger cylinder bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 KEEP UNDER MAXIMUM STROKE LENGTH

There are specific maximum stroke lengths for each model.  
 TC05: 67.00"  
 TC07: 78.00"  
 TC10: 78.00"  
 TC15: 78.00"

### 4 DETERMINE NATURE OF LOAD AND THE EFFECT OF BENDING MOMENTS

If the actuator will guide and support a load located directly over the center of carrier, bending moments will not be a factor in the actuator selection. Track Cable Cylinders perform best that way. See the Bending Moments Formulae below if your application requires the load to be away from center of the carrier.

### 5 DETERMINE THE BEARING ROD LOAD CAPACITY

Determine whether the Load Weight and Stroke Length will be within the load capacity for the bearing rods.

Cross reference the load weight and stroke on the Load Weight vs. Stroke chart for the selected bore size. (Page cc\_20, cc\_21) If the intersection falls within the curve, the cylinder will accommodate the application requirements. If the intersection falls outside the curve, consult the chart of a larger bore size that will accommodate the required load weight and stroke for your application.

The weight on the bearing rods causes them to bend or deflect slightly over their length. This deflection is increased for longer rods and/or higher weights on the bearing block. For proper operation, rod deflection must not exceed .30 of an inch.

### 6 DETERMINE INTERNAL CUSHION CAPACITY

- Consult the Cushion Data chart (Cushion Data for Track Cable Cylinders page cc\_7 to cc\_11) for the model selected. The velocities listed on the cushion charts are final or cushion impact velocities. On applications where internal cushions are to be used, be sure the actual, final or impact velocity is known. If the velocity is not known, use of limit switches with valve deceleration circuits or shock absorbers should be considered.

## BENDING MOMENTS

### Loading Equation Data

MODEL	BORE SIZE	A (in.)	D (in.)	F (lbs.)	G (lbs.)
TC05	1/2"	1.09	1.0	14.00	-
TC07	3/4"	1.09	1.0	14.00	-
TC10	1"	1.09	1.0	14.00	-
TC15	1-1/2"	1.68	2.31	90.00	-

(See MGS Load vs Stroke graph on page MG\_6)

### Loading Equation Key

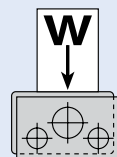
- A** = Distance between shaft centers.
- B** = Distance from load center to center of nearest shaft (in.); determined by application.

- L** = Load per shaft (lbs.).
- W** = Payload weight (lbs.).
- D** = Axial distance between center of bearings (in.).

- F** = Max. bearing sliding load (linear bearings) (lbs.).
- G** = Max. bearing sliding load (sintered bronze bearings) (lbs.).

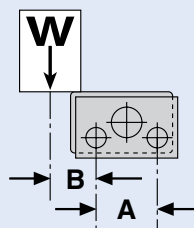
#### "L" MOMENT

$$L = \frac{W}{2}$$



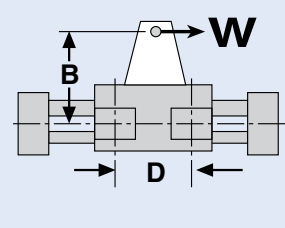
#### "Mx" MOMENT

$$L = \frac{WB}{A}$$



#### "My" / "Mz" MOMENT

$$F \text{ or } G = 2L = \frac{WB}{D}$$

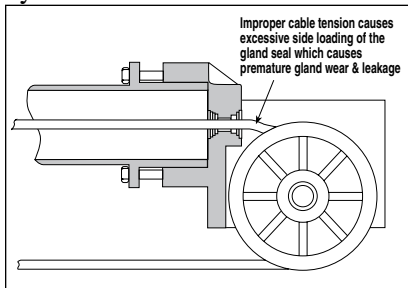


L should be below curve for the corresponding slide on the "Load vs. Stroke" chart (for sintered bronze or linear bearings - Mag Coupled Slides).

# CC Cable Cylinder Application Guidelines - All Sizes

## 1. PROOF-LOADING AND PRETENSIONING CABLES

Once installed, but before putting in service, the cables on the cylinder should be proof-loaded and pretensioned to ensure that they are rigid for the maximum service life of the cylinder.



Proof-loading and pretensioning involve removing the two types of stretch in the cable by adjusting the clevis terminal lock nuts.

- *Proof-loading* – When cables are manufactured, individual wires and strands are laid in position but left slightly loose. When subjected to proof-loading the wires align themselves, tighten and constructional stretch in the cable is eliminated.
- *Pretensioning* – Elastic stretch in cable is inherent in the wire itself. It is removed when subjected to pretensioning.

There are two ways to proof-load and pretension a cylinder's cables — The Torque Method or The Field Method. These two methods are explained at right. Either method may be used.

All cables should be checked periodically from a preventative maintenance standpoint. When installing new cable assemblies proof-load and pretension using these same methods.

## THE TORQUE METHOD

1. Tighten the clevis terminal lock nuts equally with a torque wrench to the values listed under Proof-loading torque in the Proof-loading, Pretensioning table below.
2. Let tightened nuts sit for 30 seconds.
3. Loosen the lock nuts to remove tension (but tight enough to eliminate any slack).
4. Re-torque clevis terminal lock nuts equally with a torque wrench to the total pretensioning figures listed in the table below.

PROOF-LOADING AND PRETENSIONING TORQUE OF CABLES								
CC Model	Proof-loading Torque		Pretensioning Torque		Starting Torque of Nuts on Terminals		Total Pretensioning Torque	
CC05	15 in.-lbs.	1.69 N-m	2.5 in.-lbs.	0.28 N-m	10 in.-lbs.	1.13 N-m	12.5 in.-lbs.	1.41 N-m
CC07	15 in.-lbs.	1.69 N-m	2.5 in.-lbs.	0.28 N-m	10 in.-lbs.	1.13 N-m	12.5 in.-lbs.	1.41 N-m
CC10	15 in.-lbs.	1.69 N-m	2.5 in.-lbs.	0.28 N-m	10 in.-lbs.	1.13 N-m	12.5 in.-lbs.	1.41 N-m
CC15	45 in.-lbs.	5.08 N-m	8.0 in.-lbs.	0.90 N-m	20 in.-lbs.	2.26 N-m	28.8 in.-lbs.	3.25 N-m
CC20	115 in.-lbs.	12.99 N-m	46.0 in.-lbs.	5.20 N-m	25 in.-lbs.	2.82 N-m	71.0 in.-lbs.	8.02 N-m
CC25	115 in.-lbs.	12.99 N-m	73.0 in.-lbs.	8.25 N-m	25 in.-lbs.	2.82 N-m	98.0 in.-lbs.	11.07 N-m
CC30	210 in.-lbs.	23.73 N-m	105.0 in.-lbs.	11.86 N-m	25 in.-lbs.	2.82 N-m	130.0 in.-lbs.	14.69 N-m
CC40	210 in.-lbs.	23.73 N-m	187.5 in.-lbs.	21.19 N-m	25 in.-lbs.	2.82 N-m	212.5 in.-lbs.	24.01 N-m
CC50	325 in.-lbs.	36.72 N-m	180.0 in.-lbs.	20.34 N-m	30 in.-lbs.	3.39 N-m	210.0 in.-lbs.	23.73 N-m
CC52	210 in.-lbs.	23.73 N-m	115.0 in.-lbs.	12.99 N-m	25 in.-lbs.	2.82 N-m	140.0 in.-lbs.	15.82 N-m

## THE FIELD METHOD

The Field Method simplifies Proof-loading and Pretensioning the cable cylinder by combining the two processes.

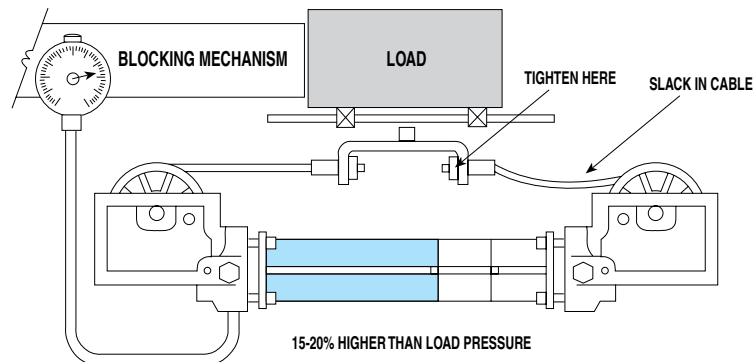
1. Block the load some distance from the end of stroke to keep the piston from bottoming.

2. Apply a pressure that is 15% to 20% higher than the actual load pressure.

NOTE: Load pressure is defined as the pressure required to move the load. When the load is stopped externally, before the piston bottoms, the relief valve

or regulator setting becomes the load pressure.

3. Upon pressurizing, one cable will become tight while the other will become slack. Manually adjust out the slack with a wrench on the clevis terminal lock nut.
4. Release the pressure, block the load on the other side and repeat steps 1 through 3. When these steps are done, turn down the regulator pressure to the normal operating pressure and remove the block.

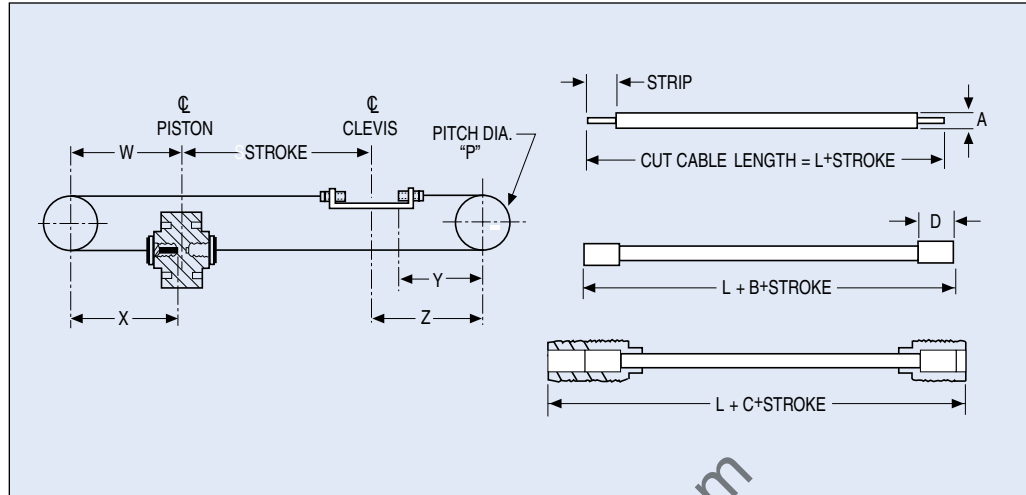




# CC Cable Cylinder Application Guidelines - All Sizes

## 2. DETERMINING SPECIAL CABLE LENGTHS

When an application requires a specialized cable length, use the dimensional table and illustrations to determine the proper cable length.



MODEL	P		W		X		Y		Z		STRIP		A		B		C		D		L(std) + Stroke	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
CC05	1.500	38.1	1.687	42.8	1.350	34.3	1.406	35.7	1.687	42.8	0.328	8.3	0.093	2.4	0.234	5.9	0.375	9.5	0.437	11.1	4.68	118.9
CC07	1.500	38.1	1.687	42.8	1.350	34.3	1.406	35.7	1.687	42.8	0.328	8.3	0.093	2.4	0.234	5.9	0.375	9.5	0.437	11.1	4.68	118.9
CC10	1.500	38.1	1.687	42.8	1.350	34.3	1.406	35.7	1.687	42.8	0.328	8.3	0.093	2.4	0.234	5.9	0.375	9.5	0.437	11.1	4.68	118.9
CC15	3.250	82.6	4.452	113.1	4.325	109.9	3.725	94.6	4.452	113.1	0.468	11.9	0.187	4.7	0.343	8.7	0.420	10.7	0.828	21.0	12.50	317.5
CC20	4.250	108.0	5.125	130.2	4.688	119.1	3.426	87.0	5.125	130.2	0.620	15.7	0.250	6.4	0.641	16.3	0.540	13.7	1.060	26.9	14.25	362.0
CC25	4.250	108.0	5.125	130.2	4.688	119.1	3.426	87.0	5.125	130.2	0.620	15.7	0.250	6.4	0.641	16.3	0.540	13.7	1.060	26.9	14.25	362.0
CC30	5.312	134.9	5.687	144.4	5.000	127.0	3.601	91.5	5.687	144.4	0.844	21.4	0.312	7.9	0.500	12.7	0.195	5.0	1.100	27.9	17.00	431.8
CC40	5.312	134.9	6.187	157.1	5.000	127.0	4.315	109.6	6.187	157.1	0.844	21.4	0.312	7.9	0.500	12.7	0.195	5.0	1.100	27.9	17.50	444.5
CC50	6.000	152.4	9.370	238.0	8.630	219.2	7.820	198.6	9.370	238.0	1.180	30.0	0.375	9.5	1.000	25.4	0.500	12.7	1.930	49.0	24.55	623.6
CC52	5.312	134.9	5.702	144.8	5.000	127.0	3.850	97.8	5.702	144.8	0.844	21.4	0.312	7.9	0.500	12.7	0.195	5.0	1.100	27.9	17.00	431.8

## 3. LUBRICATION GUIDELINES

All Tolomatic cable cylinders require internal lubrication unless specified. To ensure maximum cylinder life, the following guidelines should be followed.

### • Filtration

We recommend the use of dry, filtered air in our products. "Filtered air" means a level of 10 Micron or less. "Dry" means air should be free of appreciable amounts of moisture. Regular maintenance of installed filters will generally keep excess moisture in check.

### • External Lubricators

External lubrication should be utilized for maximum service life of pneumatic cable cylinders.

Lubrication *must be maintained* in a constant supply or the results will be a dry cylinder prone to premature wear.

Oil lubricators, (mist or drop) should supply a minimum of 1 drop per 20 standard cubic feet per minute to the cylinder. As a rule of thumb, double that rate if water in the system is suspected. Demanding conditions may require more lubricant.

We recommend a **non-detergent, 20cP @ 140°F** 10-weight lubricant. Optimum conditions for standard cylinder operation are **+32° to +125°F (+0° to 51.6°C)**.

### • Sanitary environments

Oil mist lubricators must dispense "Food Grade" lubricants to the air supply. Use fluids with **ORAL LD50 toxicity ratings of 35 or higher** such as **Multitherm® PG-1 or equivalent**. Demanding conditions can require a review of the application.

# Application Guidelines

The following conditional statements are intended as general guidelines for use of Tolomatic actuators. Since all applications have their own specific operating requirements, consult Tolomatic, Inc. or your local Tolomatic distributor if an application is unconventional or if questions arise regarding the selection process.

## CUSHION NEEDLE ADJUSTMENT (BC2, BC3, BC4, CC, SA, DP, TC ONLY)



Adjust the cushion needles in the cylinder heads carefully to obtain a smooth, hesitation free deceleration for your particular application. If there are questions on proper adjustment, please consult Tolomatic, Inc.



## LUBRICATION GUIDELINES

All Tolomatic actuators (except Cable Cylinders) are prelubricated at the factory. To ensure maximum actuator life, the following guidelines should be followed.

### • Filtration

We recommend the use of dry, filtered air in our products. "Filtered air" means a level of 10 Micron or less. "Dry" means air should be free of appreciable amounts of moisture. Regular maintenance of installed

filters will generally keep excess moisture in check.

### • External Lubricators (optional)

The factory prelubrication of Tolomatic actuators will provide optimal performance without the use of external lubrication. However, external lubricators can further extend service life of pneumatic actuators if the supply is kept constant.

Oil lubricators, (mist or drop) should supply a minimum of 1 drop per 20 standard cubic feet per minute to the

cylinder. As a rule of thumb, double that rate if water in the system is suspected. Demanding conditions may require more lubricant.

If lubricators are used, we recommend a non-detergent, 20cP @ 140°F 10-weight lubricant. Optimum conditions for standard cylinder operation are +32° to +150°F (+0° to 65.5°C).

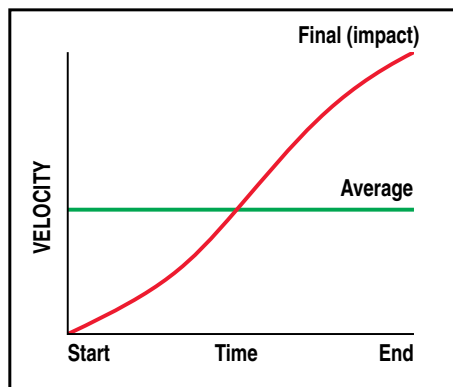
NOTE: Use of external lubricators may wash away the factory installed lubrication. External lubricants must be maintained in a constant supply or the results will be a dry actuator prone to premature wear.

### • Sanitary Environments

Oil mist lubricators must dispense "Food Grade" lubricants to the air supply. Use fluids with ORAL LD50 toxicity ratings of 35 or higher such as Multitherm® PG-1 or equivalent. Demanding conditions can require a review of the application.

## FINAL VELOCITY CALCULATION

Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Stroking a 100-inch BC3 model in one second yields an average velocity of 100 inches per second. To properly determine the inertial forces for cushioning, it is important to know the



final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered (see diagram).

If final (or impact) velocity cannot be calculated directly, a reasonable guideline is to use 2 x average velocity.

# Cable Cylinder Ordering - CC, SA, DP, TC - All Sizes

## CONFIGURATOR EXAMPLE

MODEL, SEALS, TUBING, BORE, AND STROKE						ACCESSORIES AND OPTIONS																							
1.	2.	3.	4.	5.	6.	END #1	7.	END #2	7.	8.	9.	9.																	
C	C	V		M	15	S	K	1	2	5	.	2	5	0	END #1	H	J	END #2	H	G	R	T	2	X	A	.	X	B	.

The above example describes a double-acting cable cylinder with seals of Viton® material, a standard aluminum tube, magnet, 1.5-inch bore, and a stroke of 125.25 inches. Options are a 3-ported head with auto tensioner on right end, a 3-ported head on the left end and two Form A (normally open) reed switches.

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 configured order. For the above example, the order string as it is typed would appear as follows: **CCVM15SK125.25HJHGRT2XA.XB.**

### 1. CYLINDER MODEL

Enter:

- CC** for double-acting cable cylinder
- SA** for single-acting cable cylinder
- DP** for double purchase cable cylinder
- TC** for track cable cylinder

### 2. SEALS OF VITON® MATERIAL

Enter:

- V** if VITON® seals are desired, or leave blank

### 3. TUBING

Enter:

- Blank** for standard aluminum tube
- S** for steel tube

Note: Steel tubing is not available on CC05, CC07 or CC50 models.

Switches cannot be used with steel tubing.

### 4. SWITCH MAGNET

Enter:

- M** if switch magnet is required, or leave blank

Note: Magnet will increase dead length. (See page cc\_29)

Increase does not apply to TC Models.

### 5. BORE SIZE

Enter:

- |                             |                                    |
|-----------------------------|------------------------------------|
| <b>05</b> for .5-inch bore  | <b>25</b> for 2.50-inch bore       |
| <b>07</b> for .75-inch bore | <b>30</b> for 3-inch bore          |
| <b>10</b> for 1-inch bore   | <b>40</b> for 4-inch bore          |
| <b>15</b> for 1.5-inch bore | <b>50</b> for 5-inch bore          |
| <b>20</b> for 2-inch bore   | <b>52</b> for 2-inch bore (500PSI) |

### 6. STROKE LENGTH

Enter:

**SK** then required stroke length in inches:

**Example:** **SK125.25** for 125.250-inch stroke

Note: Strokes over 284 inches require Tube Couplers, please consult factory for lead times. (max. stroke varies by model and bore size, see *dimensions page for specification*)

### 7. HEAD OPTIONS

Single-ported heads are standard on all cylinders.

Enter head options for “END #1” (right end) and/or “END #2” (left end) of the cylinder:

- HG\*+** for 3-ported head
- HI** for 1-inch auto tensioner assembly
- HJ+** for 1-inch auto tensioner assembly with 3-ported head
- HK** for 2-inch auto tensioner assembly
- HL+** for 2-inch auto tensioner assembly with 3-ported head
- HM\*\*** for caliper disc brake assembly
- HN\*\*+** for caliper disc brake assembly with 3-ported head

\* Only head option available for single-acting cylinders.

\*\* Auto tensioner assembly required on one end of the cylinder.

+ Cushions are removed on all 3-ported heads.

### 8. SWITCH TYPE

NOTE: “M” must be selected in (4.) before selecting a switch type. Enter:

- BT** for Form C Reed Switch 5-meter lead
- BM** for Form C Reed Switch 5-meter lead Quick-disconnect
- RT** for Form A Reed Switch 5-meter lead
- RM** for Form A Reed Switch 5-meter lead Quick-disconnect
- CT** for AC Triac Reed Switch 5-meter lead
- CM** for AC Triac Reed Switch 5-meter lead Quick-disconnect

Then enter:

**The number of Switches required.**

### 9. EXTRA CABLE

Enter:

- XA** for extra cable beyond standard in inches
- XB** for extra cable beyond standard in inches

# Service Parts Ordering - CC, SA, DP, TC - All Sizes

## CABLE CYLINDER REPLACEMENT KITS

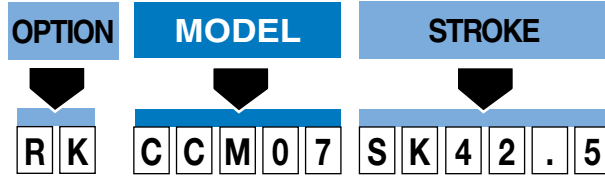
Find the appropriate part number for the specific model and specify that part number with your stroke length when ordering.

### CABLE ASSEMBLIES<sup>1</sup> AND REPAIR KITS<sup>2</sup>

MODEL	CABLE ASSY.	REPAIR KITS
CC05	CACC05	RKCC05
TC05	CATC05	RKTC05
CCM05	CACCM05	RKCCM05
TCM05	CATCM05	RKTCM05
CC07	CACC07	RKCC07
SA07	CASA07	RKSA07
TC07	CATC07	RKTC07
CCM07	CACCM07	RKCCM07
SAM07	CASAM07	RKSAM07
TCM07	CATCM07	RKTCM07
CC10	CACC10	RKCC10
SA10	CASA10	RKSA10
TC10	CATC10	RKTC10
CCM10	CACCM10	RKCCM10
SAM10	CASAM10	RKSAM10
TCM10	CATCM15	RKTCM10
CC15	CACC15	RKCC15
DP15	CADP15	RKDP15
SA15	CASA15	RKSA15
TC15	CATC15	RKTC15
CCM15	CACCM15	RKCCM15
DPM15	CADPM15	RKDPM15
SAM15	CASAM15	RKSAM15
TCM15	CATCM15	RKTCM15
CC20	CACC20	RKCC20
DP20	CADP20	RKDP20
SA20	CASA20	RKSA20
CCM20	CACCM20	RKCCM20
DPM20	CADPM20	RKDPM20
SAM20	CASAM20	RKSAM20
CC25	CACC25	RKCC25
DP25	CADP25	RKDP25
SA25	CASA25	RKSA25
CCM25	CACCM25	RKCCM25
DPM25	CADPM25	RKDPM25
SAM25	CASAM52	RKSAM25
CC52	CACC52	RKCC52
DP52	CADP52	RKDP52
SA52	CASA52	RKSA52
CCM52	CACCM52	RKCCM52
DPM52	CADPM52	RKDPM52
SAM52	CASAM52	RKSAM52
CC30	CACC30	RKCC30
DP30	CADP30	RKDP30
SA30	CASA30	RKSA30
CCM30	CACCM30	RKCCM30
DPM30	CADPM30	RKDPM30
SAM30	CASAM30	RKSAM30
CC40	CACC40	RKCC40
DP40	CADP40	RKDP40
SA40	CASA40	RKSA40
CCM40	CACCM40	RKCCM40
DPM40	CADPM40	RKDPM40
SAM40	CASAM40	RKSAM40
CC50(ALL)	CACC50	RKCC50
SA50(ALL)	CASA50	RKSA50

### REPAIR KIT ORDERING

Example: RKCCMO7SK25



Where **RK** is the Repair Kit code, **CCM** is the Cable Cylinder Code, **07** is the .75" bore and **SK 42.5** indicates a stroke length of 42.5 inches.

Cable Assemblies and Repair Kits for cable cylinder with Viton Seals: Modify Repair Kit Part number to include a "V" after the model style and before the bore size.

(ex. CACCV10SK\_ or RKTCVM15SK\_)

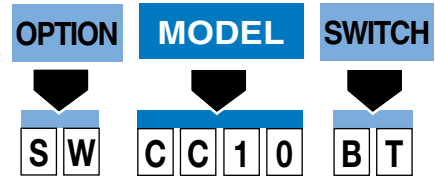
<sup>1</sup> Cable Assemblies contain: one Cable Assembly (specify stroke).

<sup>2</sup> Repair Kits contain: two Cable Assemblies (specify stroke) and all wearable seals required to rebuild the cylinder.

### SWITCH KITS

To order retrofit switch and hardware kits:

Enter: **SW** then the model and bore size, and type of switch needed.



Example: SWCCM10BT

Where **SW** is the Switch Kit code, **CCM** is the Cable Cylinder code, **10** is the 1" bore, and **BT** is the switch code for a Form C Reed Switch.

<sup>3</sup> Switch Kits contain: one reed switch and mounting hardware.

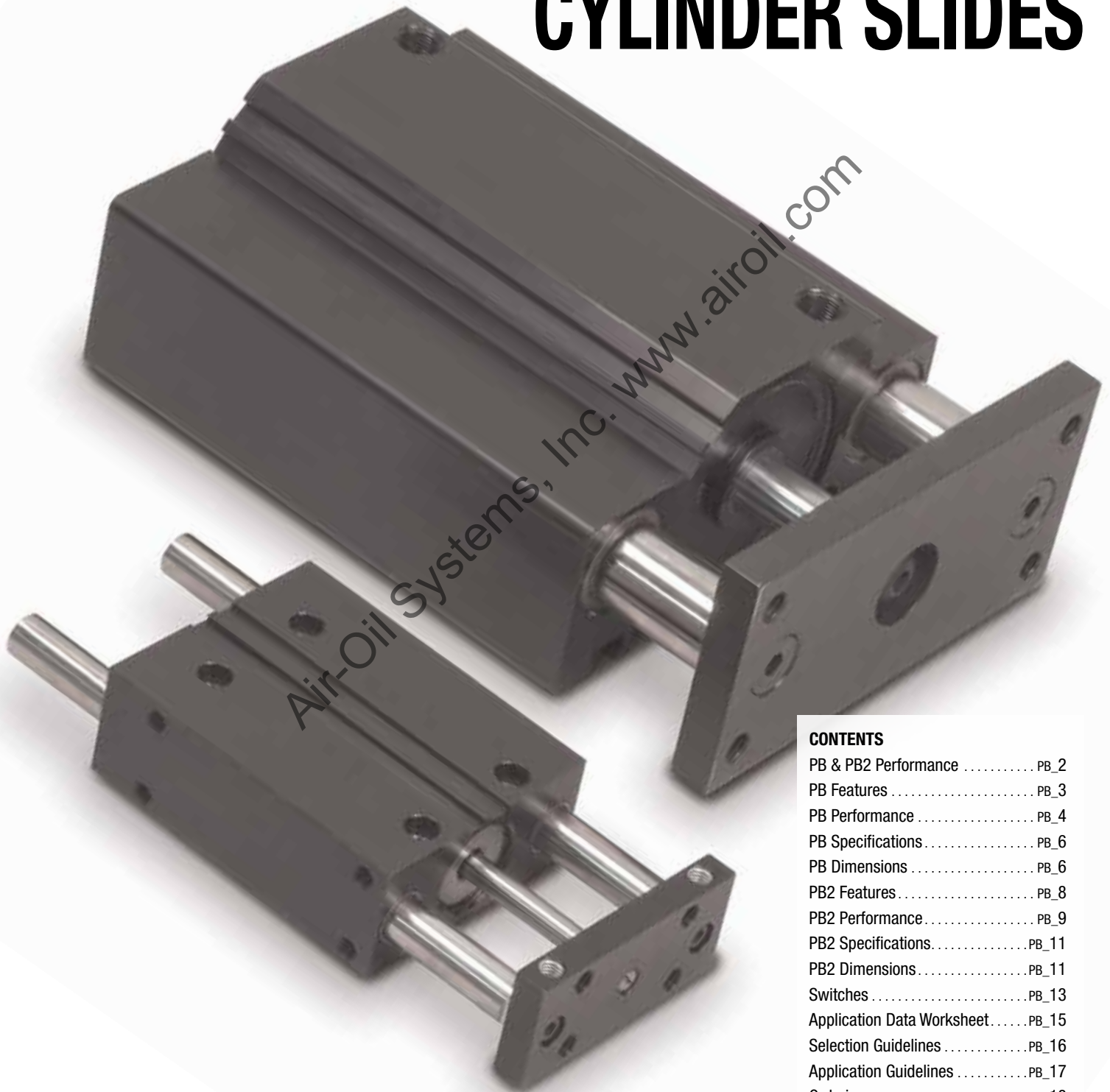
### Field Retrofit Switches

- Replacing an existing switch on actuator manufactured AFTER 7/1/97:  
**Order from part numbers on table below.**
- Replacing an existing switch on actuator manufactured BEFORE 7/1/97:  
**Order via configurator code on page CC\_39.**
- Adding switch to an actuator that has not had a switch in the past:  
**Order via configurator code on page CC\_39.**

3600-9082	Switch, Reed, Form A, 5m Wire
3600-9083	Switch, Reed, Form A, Male Connector
3600-9084	Switch, Reed, Form C, 5m Wire
3600-9085	Switch, Reed, Form C, Male Connector
3600-9086	Switch, Triac, 5m Wire
3600-9087	Switch, Triac, Male Connector
2503-1025	Connector, Female, 5m

(NOTE: If replacing a quick-disconnect switch manufactured before 7-1-97 it will also be necessary to replace or rewire the female-end coupler with the in-line splice. See page CC\_28.)

# PB, PB2 ROD CYLINDER SLIDES



## CONTENTS

PB & PB2 Performance .....	PB_2
PB Features .....	PB_3
PB Performance .....	PB_4
PB Specifications .....	PB_6
PB Dimensions .....	PB_6
PB2 Features .....	PB_8
PB2 Performance .....	PB_9
PB2 Specifications .....	PB_11
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Switches .....	PB_13
Application Data Worksheet .....	PB_15
Selection Guidelines .....	PB_16
Application Guidelines .....	PB_17
Ordering .....	PB_18
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ABT

MXP

BCZ

BC3

BC4

LS

MG

CC

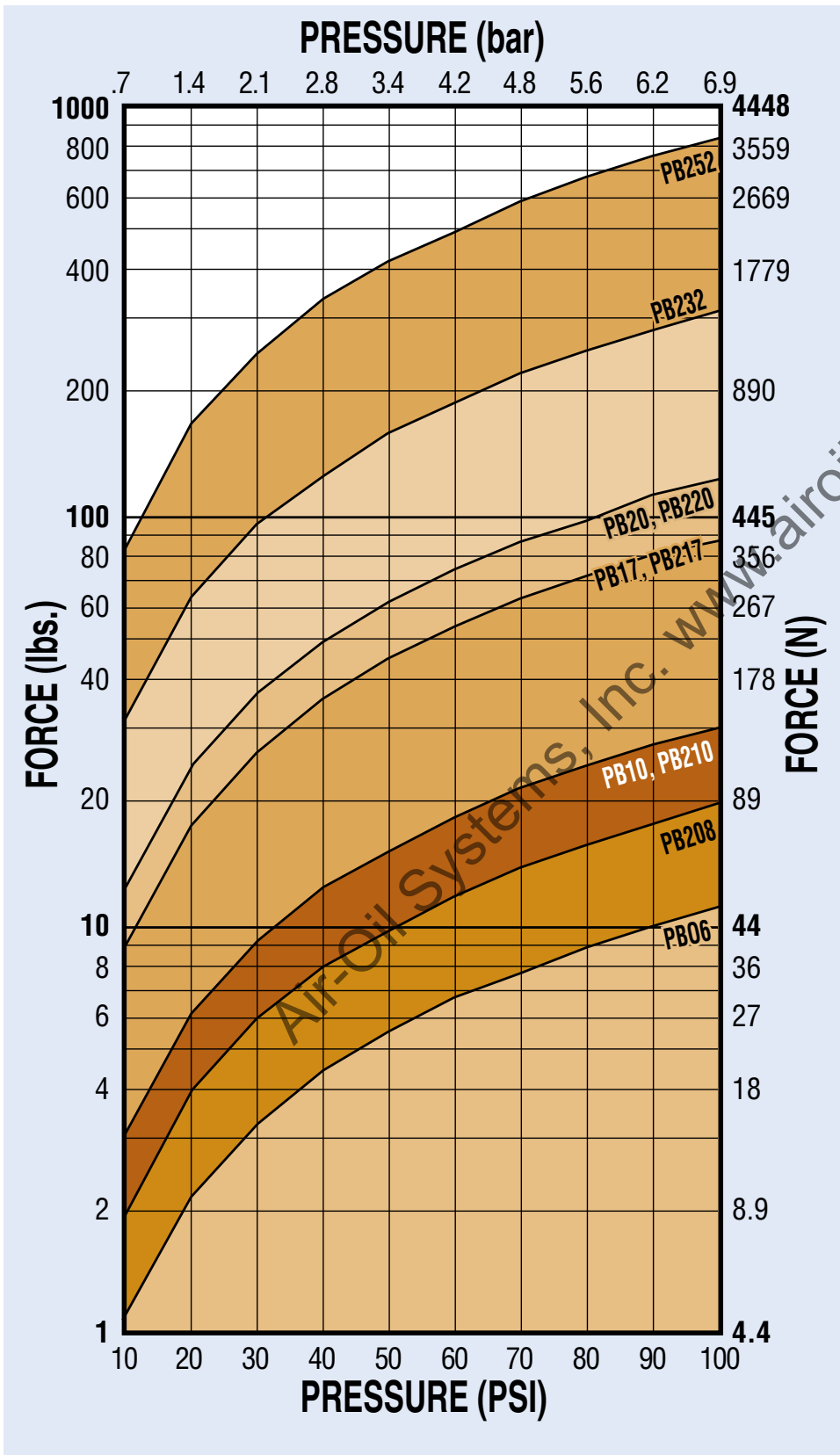
**PB**

ENGR

# PB & PB2 Rod Cylinder Slides - All Sizes

## PERFORMANCE

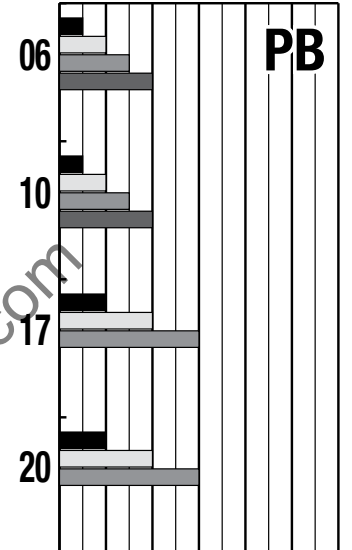
### THEORETICAL FORCE vs PRESSURE



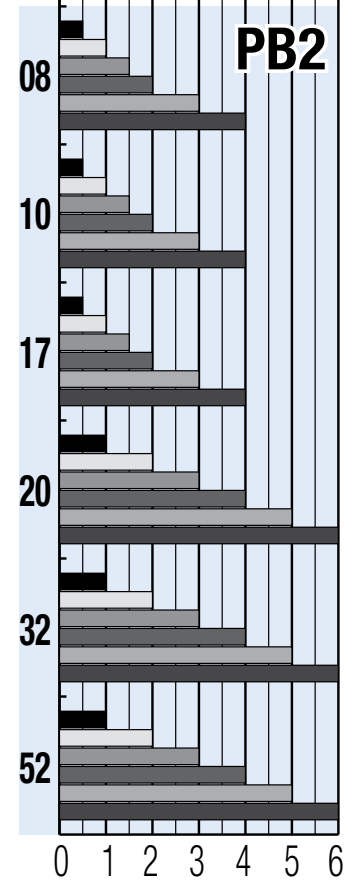
### AVAILABLE STROKE LENGTHS

#### STROKE (mm)

0 25 51 76 102 127 152



#### STROKE (in)



#### STROKE (in)

# PB POWER-BLOCK

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Endurance Technology features are designed for maximum durability to provide extended service life.

### DURABLE BEARING

#### COMPOSITE BEARINGS

- Thin profile allows use of oversize guide rods
- Best choice for impact use or high contaminant environments



### DOVETAIL SLOTS

- For easy switch mounting

### INTERNAL BUMPER

- Made of urethane composite to prolong cylinder life and reduce noise



### NICKEL-PLATED SHAFTS

- Shafts up to 0.625" diameter

### DURABLE DESIGN

- Tough, lightweight extruded aluminum in a low profile package

### MOUNTING FLEXIBILITY

- Threaded holes for base or side mounting



### PLATED STEEL TOOLING PLATE

- Threaded bolt thru holes for tooling plate mounting

## OPTIONS



### STOP COLLAR / BUMPER KIT

- Includes 2 stop collars and 1/4" thick polyurethane external bumpers to help absorb impact shock



### DUAL TOOLING PLATE

- Added flexibility for many applications



### SWITCHES

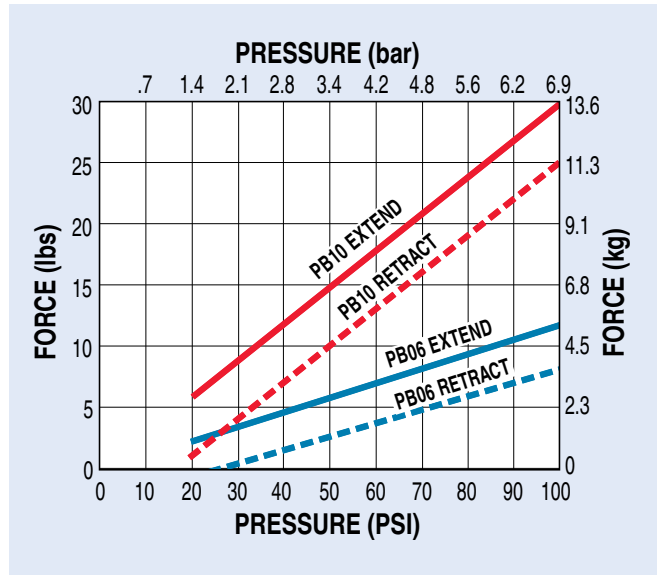
- Available in Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers



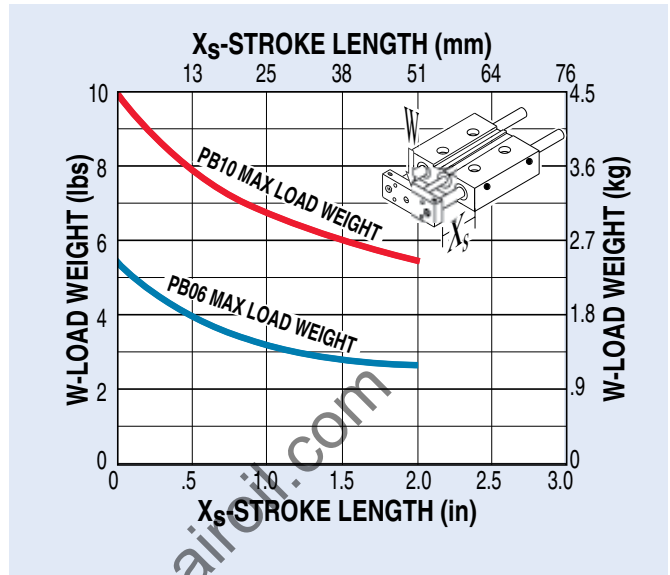
# PB Power-Block Rod Cylinder Slide - 06, 10 Sizes

## PERFORMANCE

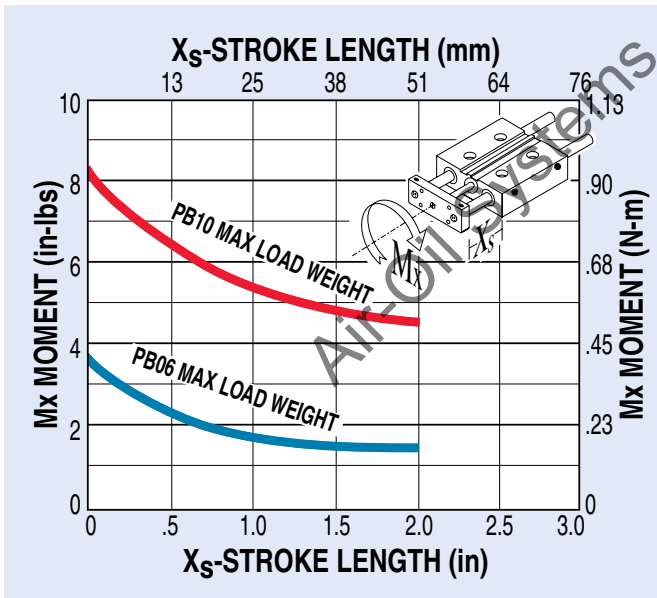
### THEORETICAL FORCE vs PRESSURE



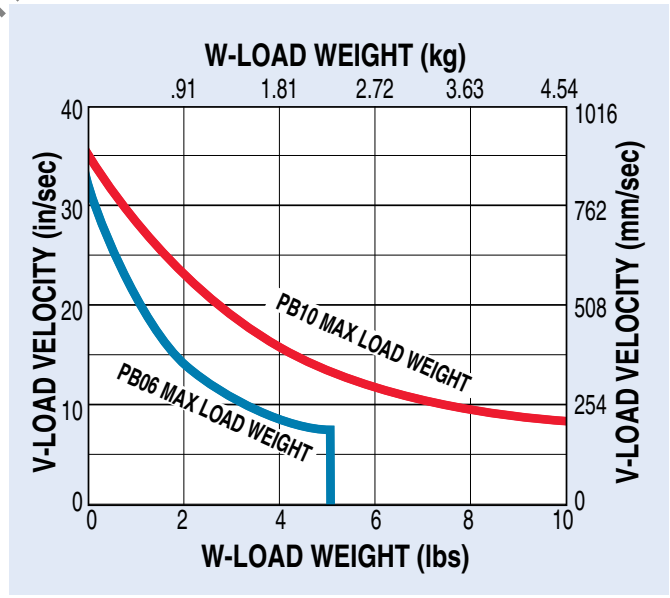
### MAX. LOAD WEIGHT vs STROKE LENGTH



### BENDING MOMENTS



### LOAD WEIGHT vs VELOCITY (USING INTERNAL BUMPERS)



#### FORCE VS. PRESSURE

Force vs Pressure performance data applies to models with composite bearings.

#### MAX. LOAD WEIGHT vs STROKE LENGTH

Do not exceed Max. Load curve. Max. Load for composite bearings is based on 200 million linear inches of travel.

#### BENDING MOMENTS

Max. Moment for composite bearings is based on 200 million linear inches of travel.

#### LOAD VS VELOCITY

Do not exceed Max. Load curve. Max. Load for Power-Block is based on 200 million linear inches of travel.

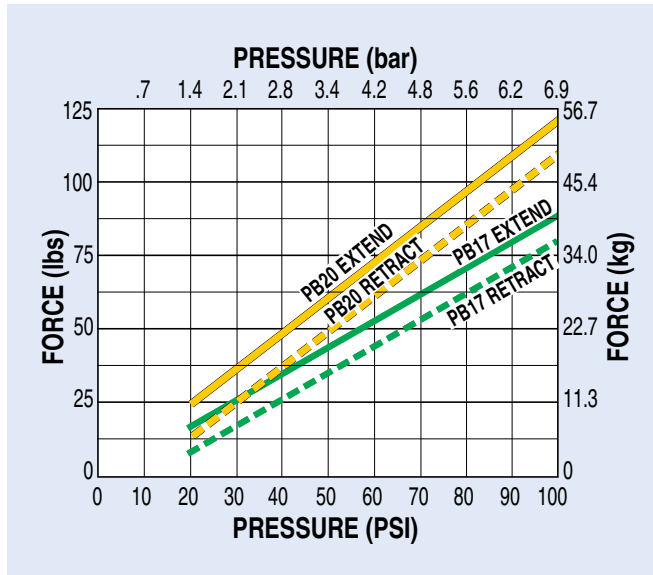
ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR



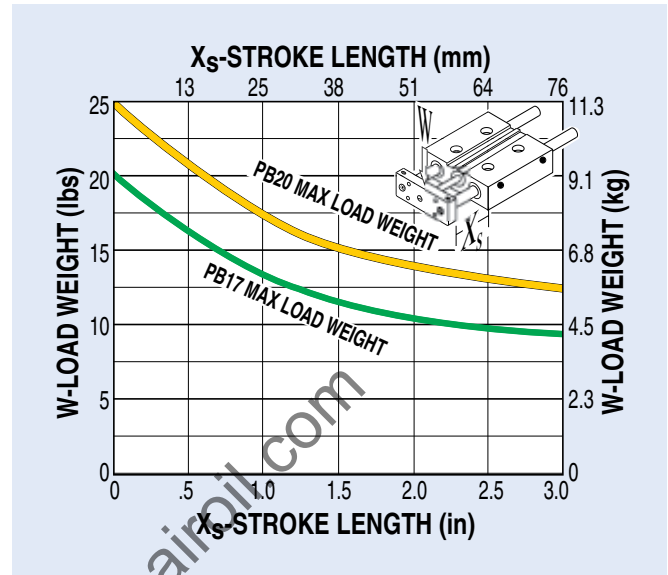
# PB Power-Block Rod Cylinder Slide - 17, 20 Sizes

## PERFORMANCE

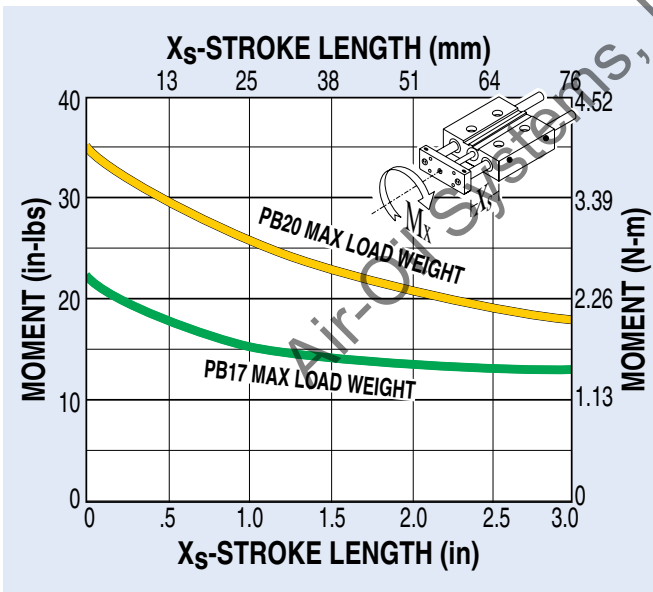
### THEORETICAL FORCE vs PRESSURE



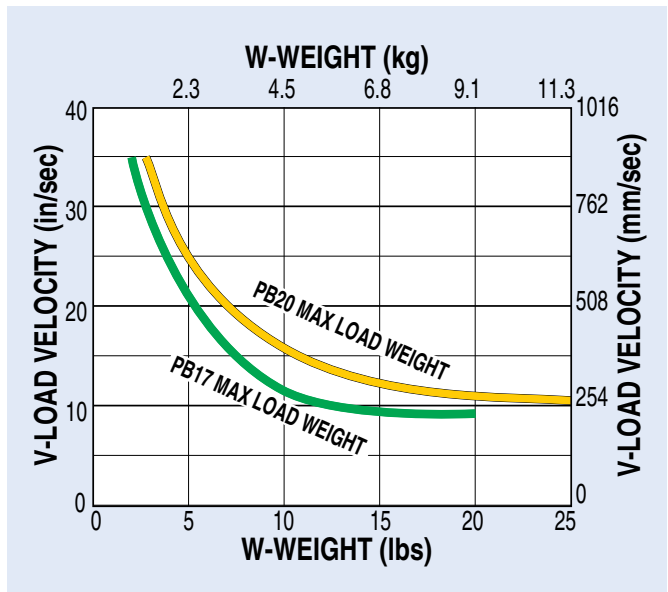
### MAX. LOAD WEIGHT vs STROKE LENGTH



### BENDING MOMENTS



### LOAD WEIGHT vs VELOCITY (USING INTERNAL BUMPERS)



#### FORCE VS. PRESSURE

Force vs Pressure performance data applies to models with composite bearings.

#### MAX. LOAD WEIGHT vs STROKE LENGTH

Do not exceed Max. Load curve. Max. Load for composite bearings is based on 200 million linear inches of travel.

#### BENDING MOMENTS

Max. Moment for composite bearings is based on 200 million linear inches of travel.

#### LOAD VS VELOCITY


Do not exceed Max. Load curve. Max. Load for Power-Block is based on 200 million linear inches of travel.

# PB Power-Block Rod Cylinder Slide - All Sizes

## SPECIFICATIONS

	BORE SIZE		WEIGHT				STROKE LENGTH		MAX. PRESSURE		TEMPERATURE RANGE	
			BASE		PER UNIT OF STROKE							
	in	mm	lbs	kg	lbs	kg	in	mm	PSI	bar	°F	°C
<b>06</b>	0.375	9.5	0.26	0.1	0.18	0.08	0.5, 1.0, 1.5, 2.0	13, 25, 38, 51	100	6.895	20 to 140	-7 to 60
<b>10</b>	0.625	16.0	0.53	0.2	0.30	0.14						
<b>17</b>	1.062	27.0	1.08	0.5	0.57	0.26	1.0, 2.0, 3.0	25, 51, 76				
<b>20</b>	1.250	31.8	1.56	0.7	0.88	0.40						

**PB**



**ORDER CODES**

**PB06, PB10, PB17, PB20**  
inch (U.S. Standard)

PB OPTIONS	Page
Stop Collar/Bumper	PB_6
Dual Tooling Plate	PB_6
Switches	PB_13
MORE INFORMATION	Page
Application Guidelines	PB_17
Ordering	PB_18
Selection	PB_16

## OPTIONS



### STOP COLLAR / BUMPER KIT

- Includes 2 stop collars and 1/4" thick polyurethane external bumpers to help absorb impact shock



### DUAL TOOLING PLATE

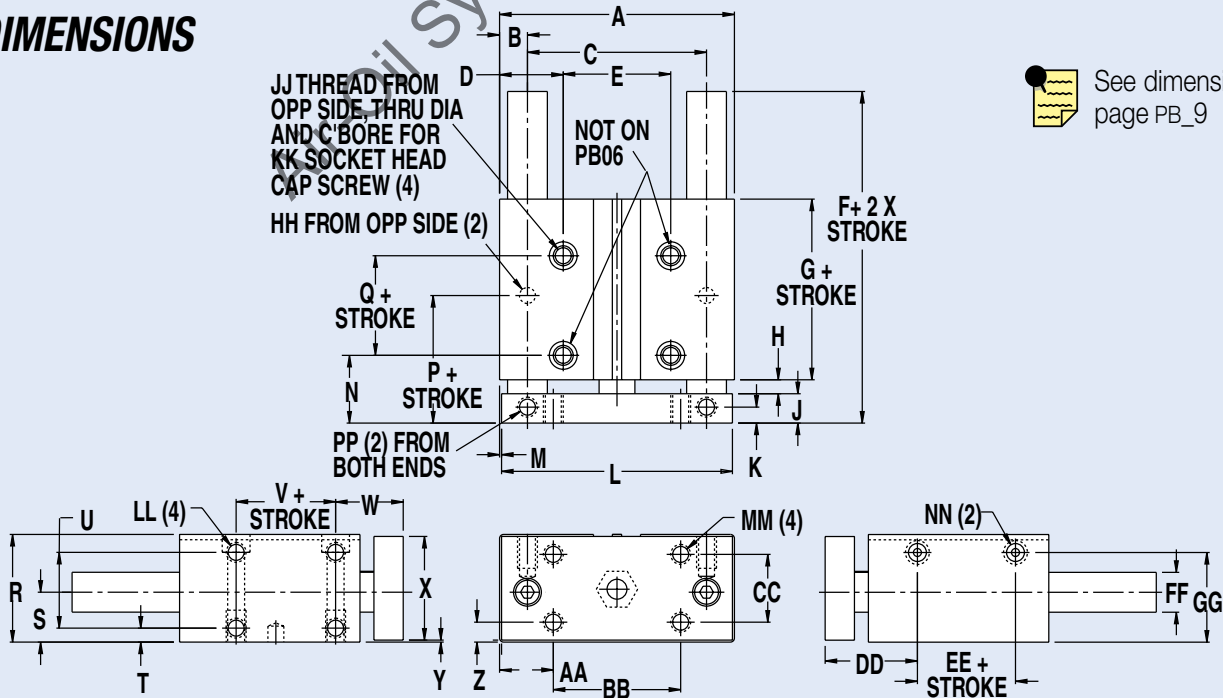
- Added flexibility for many applications



### SWITCHES

- Available in Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers

## DIMENSIONS



See dimensions page PB\_9

# PB Power-Block Rod Cylinder Slide - All Sizes



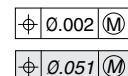
## DIMENSIONS



See drawing page PB\_8

	PB06		PB10		PB17		PB20	
	in	mm	in	mm	in	mm	in	mm
<b>BORE</b>	0.375	9.5	0.625	16.0	1.013	27.0	1.25	31.8
<b>A</b>	1.688	42.9	2.250	57.2	3.125	79.4	3.688	93.7
<b>B</b>	0.219	5.6	0.297	7.5	0.375	9.5	0.438	11.1
<b>C</b>	1.250	31.8	1.656	42.1	2.375	60.3	2.813	71.5
<b>D</b>	0.500	12.7	0.656	16.7	0.844	21.4	1.000	25.4
<b>E</b>	0.688	17.5	0.938	23.8	1.438	36.5	1.688	42.9
<b>F</b>	2.370	60.2	2.853	72.5	3.070	78.0	3.198	81.2
<b>G</b>	1.375	34.9	1.672	42.5	1.781	45.2	1.833	46.6
<b>H</b>	0.156	4.0	0.219	5.6	0.188	4.8	0.219	5.6
<b>J</b>	0.273	6.9	0.335	8.5	0.460	11.7	0.460	11.7
<b>K</b>	0.125	3.2	0.156	4.0	0.250	6.4	0.250	6.4
<b>L</b>	1.625	41.3	2.188	55.6	3.063	77.8	3.625	92.1
<b>M</b>	0.031	0.8	0.031	0.8	0.031	0.8	0.031	0.8
<b>N</b>	0.688	17.5	0.875	22.2	1.063	27.0	1.063	27.0
<b>P</b>	0.688	17.5	1.063	27.0	0.656	16.7	1.000	25.4
<b>Q</b>	0.500	12.7	0.625	15.9	0.563	14.3	0.563	14.3
<b>R</b>	0.891	22.6	1.063	27.0	1.484	37.7	1.688	42.9
<b>S</b>	0.406	10.3	0.500	12.7	0.609	15.5	0.781	19.8
<b>T</b>	0.125	3.2	0.141	3.6	0.156	4.0	0.219	5.6
<b>U</b>	0.594	15.1	0.750	19.1	1.125	28.6	1.188	30.2
<b>V</b>	0.500	12.7	0.625	15.9	0.563	14.3	0.563	14.3
<b>W</b>	0.688	17.5	0.875	22.2	1.063	27.0	1.063	27.0
<b>X</b>	0.828	21.0	1.000	25.4	1.422	36.1	1.623	41.2
<b>Y</b>	0.031	0.8	0.031	0.8	0.031	0.8	0.031	0.8
<b>Z</b>	0.156	4.0	0.188	4.8	0.219	5.6	0.313	8.0
<b>AA</b>	0.469	11.9	0.500	12.7	0.688	17.5	0.844	21.4
<b>BB</b>	0.750	19.1	1.250	31.8	1.750	44.5	2.000	50.8
<b>CC</b>	0.563	14.3	0.688	17.5	1.000	25.4	1.063	27.0
<b>DD</b>	0.913	23.2	1.281	32.5	1.429	36.3	1.449	36.8
<b>EE</b>	0.466	11.8	0.450	11.4	0.500	12.7	0.540	13.7
<b>FF</b>	0.250	6.4	0.375	9.5	0.500	12.7	0.625	15.9
<b>GG</b>	0.734	18.6	0.875	22.2	1.203	30.6	1.406	35.7
<b>HH*</b>	.1875/.1865 X .22 DP	4.8/4.7 x 5.6 DP	.1875/.1865 X .22 DP	4.8/4.7 x 5.6 DP	.2500/.2490 X .25 DP	6.4/6.3 x 6.4 DP	2500/.2490 X .25 DP	6.4/6.3 x 6.4 DP
<b>JJ</b>	6-32 X .38" (9.5) DP		8-32 X .38" (9.5) DP		1/4-20 X .25" (6.4) DP		5/16-18UNC X .50 (12.7)" DP	
<b>KK</b>	#4		#6		#10		1/4	
<b>LL</b>	6-32 X .25" (6.4) DP		8-32 X .38" (9.5) DP		10-24 X .44" (11.2) DP		5/16-18 X .50" (12.7) DP	
<b>MM</b>	6-32 THRU		8-32 THRU		10-24 THRU		5/16-18 THRU	
<b>NN</b>	10-32 UNF		10-32 UNF		1/8-27 NPT		1/8-27 NPT	
<b>PP</b>	6-32UNC X .22" (5.6) DP		8-32UNC X .28" (7.1) DP		10-24UNC X .34" (8.6) DP		5/16-18UNC X .38" (9.7) DP	

\*Dowel Pins



ABT

IXP

BCZ

BC3

BC4

LS

MG

CC

PB

ENGR

# PB2 POWER-BLOCK 2

## ENDURANCE TECHNOLOGY<sup>SM</sup>

Endurance Technology features are designed for maximum durability to provide extended service life.

### HIGH PRESSURE CAPABLE

- Designed for pressures up to 150 PSI (10.3 bar) with a 10,000,000 cycle rating

### INTERNAL BUMPERS

- Made of urethane composite to prolong cylinder life and reduce noise



### PISTON MAGNET

- Piston magnet is a standard feature allowing sensor mounting whenever required

### LARGE SHAFTS

- Shafts up to 1.25" diameter

### DURABLE DESIGN

- Tough, lightweight extruded aluminum in a low profile package

### DURABLE BEARING OPTIONS

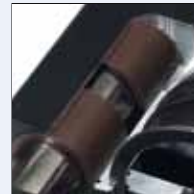
#### LINEAR BALL BEARINGS

- Low friction, long life
- Best tooling plate accuracy



#### COMPOSITE BEARINGS

- Thin profile allows use of oversize guide rods
- Best choice for impact use or high contaminant environments



### PLATED STEEL TOOLING PLATE

- Threaded bolt thru holes for tooling plate mounting

### MOUNTING FLEXIBILITY

- T-slots and threaded holes for base mounting



## OPTIONS

### SWITCHES

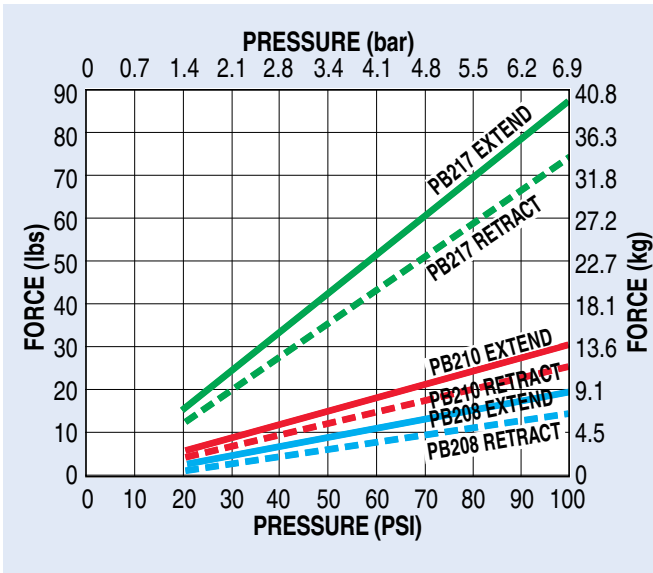
- Available in Reed, Hall-effect and Triac
- 15ft. cable with flying leads; available with quick-disconnect couplers

**5 DAYS**  
BUILT-TO-ORDER

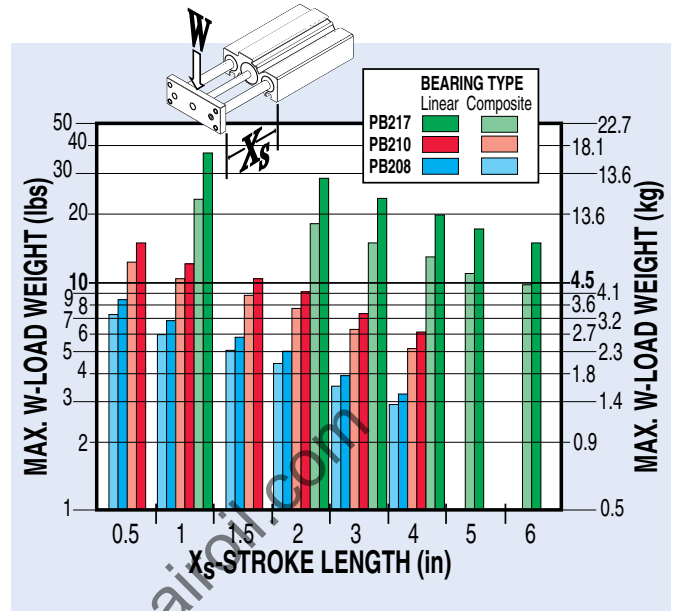
# PB2 Power-Block2 Rod Cylinder Slide - 08, 10, 17 Sizes

## PERFORMANCE

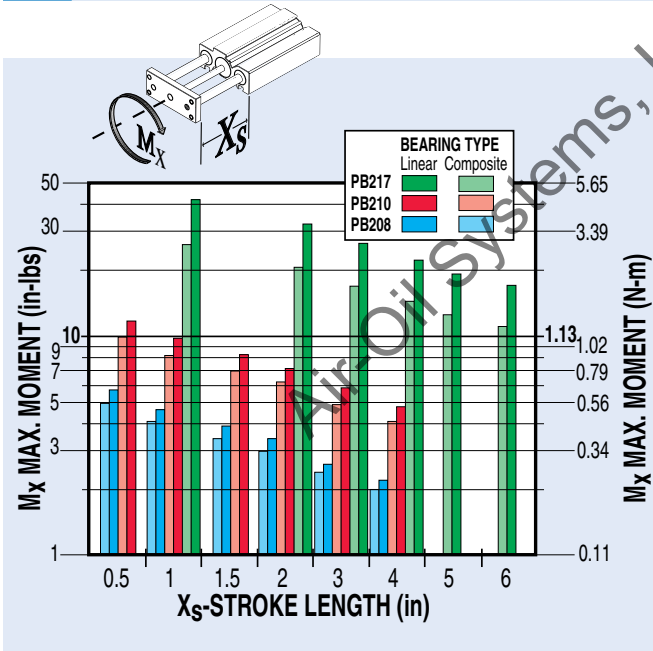
### THEORETICAL FORCE vs PRESSURE



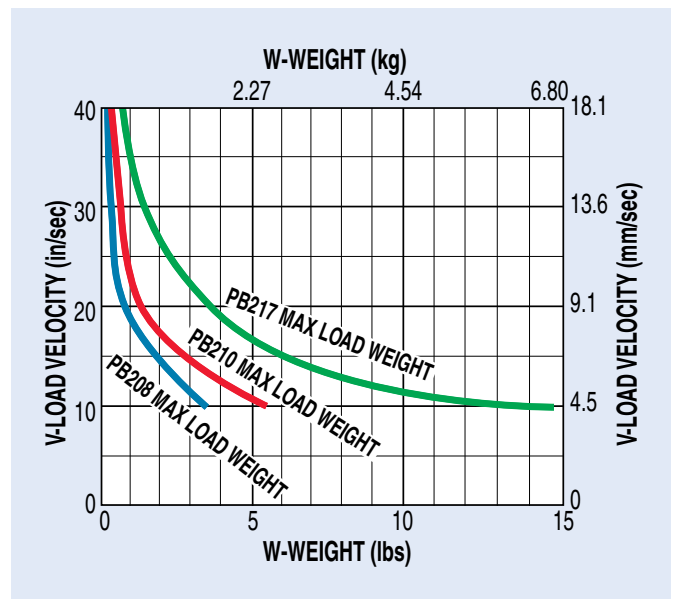
### MAX. LOAD WEIGHT vs STROKE LENGTH



### BENDING MOMENTS



### LOAD WEIGHT vs VELOCITY (USING INTERNAL BUMPERS)



#### FORCE VS. PRESSURE

Force vs Pressure performance data applies to models with composite bearings.

#### MAX. LOAD WEIGHT vs STROKE LENGTH

Do not exceed Max. Load curve. Max. Load for composite bearings is based on 200 million linear inches of travel.

#### BENDING MOMENTS

Max. Moment for composite bearings is based on 200 million linear inches of travel.

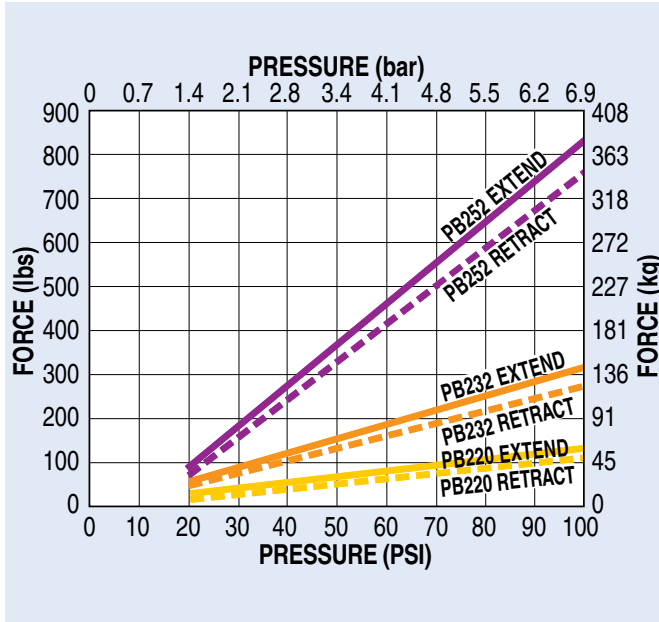
#### LOAD VS VELOCITY

Do not exceed Max. Load curve. Max. Load for Power-Block is based on 200 million linear inches of travel.

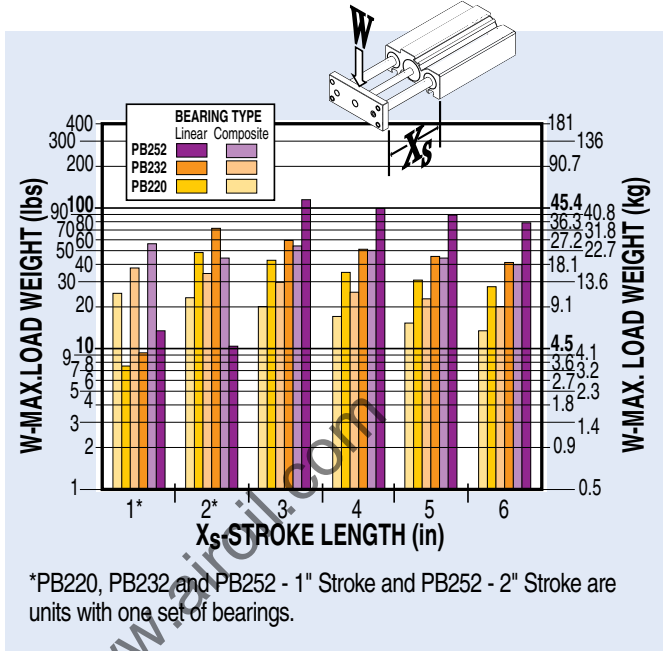
# PB2 Power-Block2 Rod Cylinder Slide - 20, 32, 52 Sizes

## PERFORMANCE

### THEORETICAL FORCE vs PRESSURE

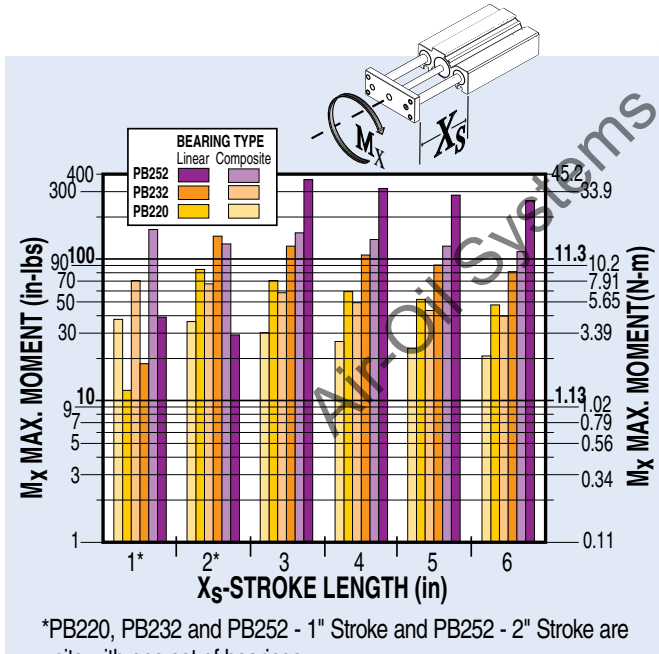


### MAX. LOAD WEIGHT vs STROKE LENGTH



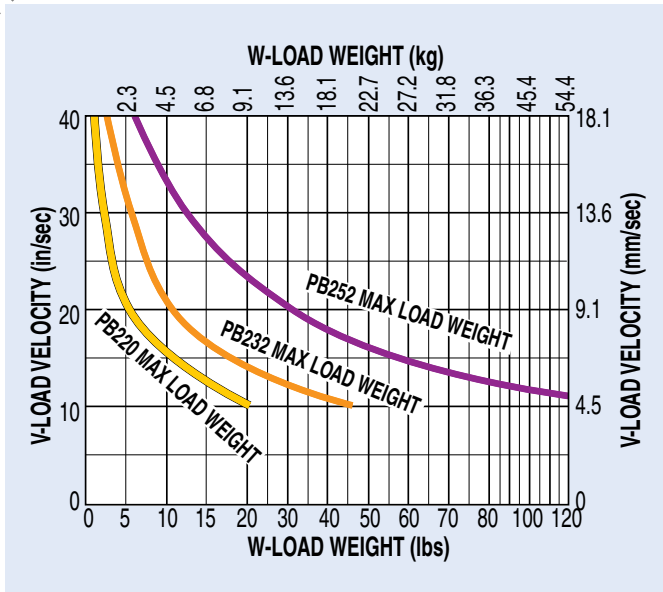
\*PB220, PB232 and PB252 - 1" Stroke and PB252 - 2" Stroke are units with one set of bearings.

### BENDING MOMENTS



\*PB220, PB232 and PB252 - 1" Stroke and PB252 - 2" Stroke are units with one set of bearings.

### LOAD WEIGHT vs VELOCITY (USING INTERNAL BUMPERS)



### FORCE VS. PRESSURE

Force vs Pressure performance data applies to models with composite bearings.

### MAX. LOAD WEIGHT vs STROKE LENGTH

Do not exceed Max. Load curve. Max. Load for composite bearings is based on 200 million linear inches of travel.

### BENDING MOMENTS

Max. Moment for composite bearings is based on 200 million linear inches of travel.

### LOAD VS VELOCITY

Do not exceed Max. Load curve. Max. Load for Power-Block is based on 200 million linear inches of travel.

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB

# PB2 Power-Block2 Rod Cylinder Slide - All Sizes

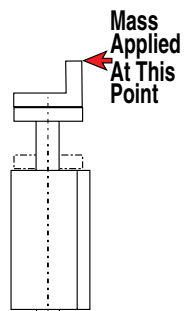
## SPECIFICATIONS

LB = Linear Bearing      CB = Composite Bearing

SIZE	08		10		17		20		32		52			
	LB	CB	LB	CB	LB	CB	LB	CB	LB	CB	LB	CB		
BORE SIZE	in	0.50	0.63	1.06	1.25	2.00	3.25							
	mm	12.7	15.9	27.0	31.8	50.8	82.6							
STROKE & WEIGHT	0.5" (13mm)	lbs	0.62	0.65	0.86	0.90	NA							
		kg	0.28	0.29	0.39	0.41								
	1.0" (25mm)	lbs	0.70	0.75	0.97	1.03	1.97	2.32	2.79	3.32	4.85	5.59	10.92	11.74
		kg	0.32	0.34	0.44	0.47	0.89	1.05	1.27	1.51	2.20	2.54	4.95	5.33
	1.5" (38mm)	lbs	0.78	0.85	1.08	1.17	NA							
		kg	0.35	0.39	0.49	0.53								
	2.0" (51mm)	lbs	0.86	0.95	1.19	1.30	2.38	2.88	3.87	4.36	6.43	6.95	12.57	13.63
		kg	0.39	0.43	0.54	0.59	1.08	1.31	1.76	1.98	2.92	3.15	5.70	6.18
	3.0" (76mm)	lbs	1.03	1.16	1.42	1.57	2.80	3.43	4.49	5.14	5.48	8.03	15.71	16.57
		kg	0.47	0.53	0.64	0.71	1.27	1.56	2.04	2.33	2.49	3.64	7.13	7.52
	4.0" (102mm)	lbs	1.20	1.35	1.64	1.84	3.21	3.40	5.11	5.92	8.20	9.12	17.36	18.46
		kg	0.54	0.61	0.74	0.83	1.46	1.54	2.32	2.69	3.72	4.14	7.87	8.37
	5.0" (127mm)	lbs	NA				3.63	4.54	5.72	6.71	9.08	10.20	19.00	20.36
		kg					1.65	2.06	2.59	3.04	4.12	4.63	8.62	9.24
6.0" (152mm)	lbs	NA				4.04	5.09	6.34	7.49	9.97	11.28	20.64	22.25	
	kg					1.83	2.31	2.88	3.40	4.52	5.12	9.36	10.09	
STROKE LENGTH	in	0.5, 1.0, 1.5, 2.0, 3.0, 4.0					1.0, 2.0, 3.0, 4.0, 5.0, 6.0							
	mm	13, 25, 38, 51, 76, 102					25, 51, 76, 102, 127, 152							
MAX. PRESSURE	PSI	100												
	bar	6.895												
TEMP. RANGE	°F	20 to 140												
	°C	-7 to 60												

## IMPACT LOADING

(Composite Bearings ONLY)



$$KE = \frac{1}{2} \frac{W}{g} v^2$$

KE = Energy

w = Weight in Lbs.

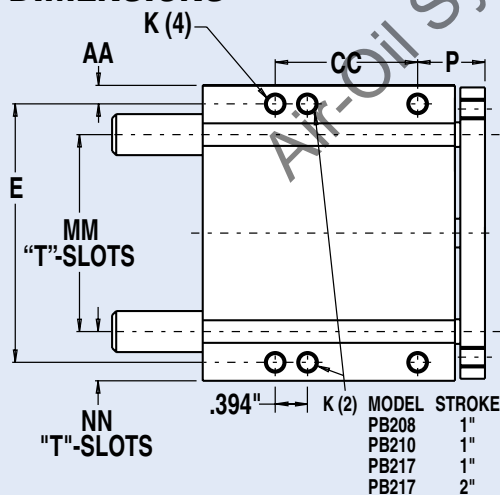
g = 32.2 Ft./sec.<sup>2</sup>  
(gravitational constant)

v = Ft./sec. (velocity)

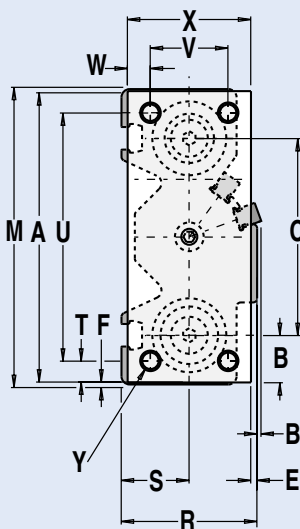
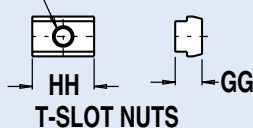
In applications such as conveyor stops impact loading may be a factor. The table below gives the maximum KE energy for each of the PB2 models. Use the above equation to determine the KE for your application. Your result should not exceed the maximum KE for the PB2 model you select.

	BORE SIZE		MAX. "KE"	
	in	mm	in-lbs	N-m
<b>08</b>	0.500	12.7	1.08	0.12
<b>10</b>	0.625	15.9	5.64	0.64
<b>17</b>	1.063	27.0	17.88	2.02
<b>20</b>	1.250	31.8	40.80	4.61
<b>32</b>	2.000	50.8	129.60	14.64
<b>52</b>	3.250	82.6	285.60	32.27

## DIMENSIONS



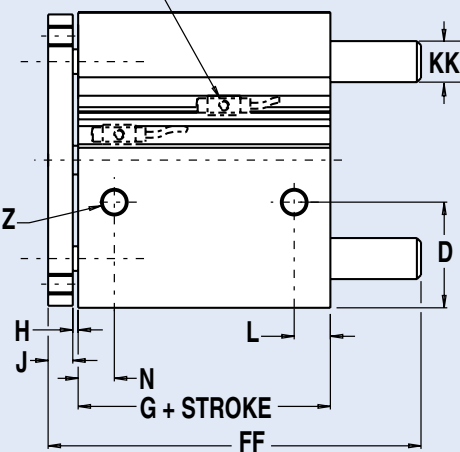
JJ TAPPED HOLE THRU  
CENTERED ON HH



OPTIONAL SWITCH



See dimensions  
page PB\_12



# PB2 Power-Block2 Rod Cylinder Slide - All Sizes

## DIMENSIONS



See drawing page PB\_11

Size	08		10		17		20		32		52				
Bore	0.500 (12.7)		0.625 (15.9)		1.125 (27.0)		1.250 (31.8)		2.000 (50.8)		3.250 (82.6)				
A	2.190	55.6	2.380	60.5	3.380	85.9	4.440	112.8	5.440	138.2	7.280	184.9			
B	0.33	8.4	0.39	9.9	0.55	14.0	0.72	18.3	0.81	20.6	0.89	22.6			
C	1.53	38.9	1.59	40.5	2.28	57.9	3.00	76.2	3.81	96.9	5.50	139.7			
D	1.120	28.4	1.220	31.0	1.200	30.5	1.610	40.9	1.670	42.4	2.110	53.6			
E	1.969	50.0	2.126	54.0	2.992	76.0	3.937	100.0	4.882	124.0	6.535	166.0			
F	0.031	0.8	0.031	0.8	0.047	1.2	0.031	0.8	0.031	0.8	0.047	1.2			
G	1.738	44.1	1.795	45.6	1.881	47.8	1.834	46.6	2.297	58.3	2.693	68.4			
H	0.063	1.6	0.063	1.6	0.063	1.6	0.082	2.1	0.063	1.6	0.063	1.6			
J	0.38	9.7	0.38	9.7	0.38	9.7	0.38	9.7	0.50	12.7	0.63	16.0			
K	#8-32x.34DP (4)		#10-24x.38DP (4)		1/4-20x.44 DP (4)		5/16-18 x .44 DP (4)		3/8-16 x .56 DP (4)		1/2-13 x .75 DP (4)				
L	0.60	15.2	0.55	14.0	0.52	13.2	0.53	13.5	0.58	14.7	0.69	17.5			
M	2.25	57.2	2.44	62.0	3.47	88.1	4.50	114.3	5.50	139.7	7.37	187.2			
N	0.47	11.9	0.50	12.7	0.52	13.2	0.53	13.5	0.58	14.7	0.69	17.5			
P	0.87	22.0	0.91	23.0	0.95	24.0	1.02	26.0	1.14	29.0	1.54	39.0			
R	1.11	28.2	1.33	33.8	1.72	43.7	2.06	52.3	2.48	63.0	3.77	95.8			
S	0.52	13.2	0.67	17.0	0.83	21.1	1.03	26.2	1.23	31.2	1.89	48.0			
T	0.15	3.8	0.16	4.1	0.31	7.9	0.33	8.4	0.36	9.1	0.49	12.4			
U	1.890	48.01	2.047	51.99	2.756	70.00	3.780	96.01	4.724	119.99	6.299	159.99			
V	0.551	14.00	0.630	16.00	1.024	26.01	1.181	30.00	1.575	40.01	2.362	59.99			
W	0.16	4.1	0.19	4.8	0.24	6.1	0.35	8.9	0.37	9.4	0.57	14.5			
X	0.88	22.4	1.00	25.4	1.50	38.1	1.88	47.8	2.38	60.5	3.50	88.9			
Y	#8-32 Thru (4)		#10-24 Thru (4)		1/4-20 Thru (4)		5/16-18 Thru (4)		3/8-16 Thru (4)		1/2-13 Thru (4)				
Z	10-32UNF (2)		10-32UNF (2)		1/8 NPT (2)		1/8-27 NPT (2)		1/4-18 NPT (2)		3/8-18 NPT (2)				
AA	0.14	3.6	0.16	4.1	0.24	6.1	0.28	7.1	0.31	7.9	0.42	10.7			
BB	0.05	1.3	0.08	2.0	0.18	4.6	0.06	1.5	-	-	-	-			
CC - STROKE LENGTH	0.5	0.591	15.01	0.669	16.99	NA						1.378	35.00	1.575	40.01
	1.0	1.378	35.00	1.457	37.01	1.575	40.01	1.181	30.00	1.378	35.00	1.575	40.01		
	1.5	1.772	45.01	1.850	46.99	NA						1.378	35.00	1.575	40.01
	2.0	2.165	54.99	2.244	57.00	2.362	59.99	2.165	54.99	2.362	59.99	2.559	65.00		
	3.0	3.150	80.01	3.228	81.99	3.346	84.99	3.150	80.01	3.346	84.99	3.543	89.99		
	4.0	4.134	105.00	4.213	107.01	4.331	110.01	4.134	105.00	4.331	110.01	4.528	115.01		
	5.0	NA			5.315	135.00	5.118	130.00	5.315	135.00	5.512	140.00	6.299	159.99	
6.0	NA			6.299	159.99	6.102	154.99	6.299	159.99	6.496	165.00	6.496	165.00		
EE	0.08	2.0	0.17	4.3	0.08	2.0	0.09	2.3	0.03	0.8	0.12	3.0			
FF - Linear Bearing / Stroke Length	0.5	2.67	67.8	2.86	72.6	NA						4.43	112.5	4.94	125.5
	1.0	3.17	80.5	3.36	85.3	4.14	105.2	3.17	80.5	3.43	87.1	4.19	106.4		
	1.5	3.67	93.2	3.86	98.0	NA						4.43	112.5	4.94	125.5
	2.0	4.17	105.9	4.36	110.7	5.14	130.6	5.67	144.0	6.06	153.9	5.19	131.8		
	3.0	5.17	131.3	5.36	136.1	6.14	156.0	6.67	169.4	7.06	179.3	6.44	163.4		
	4.0	6.17	156.7	6.36	161.5	7.14	181.4	7.67	194.8	8.06	204.7	7.44	189.8		
	5.0	NA			8.14	206.8	8.67	220.2	9.06	230.1	10.44	265.2	11.44	290.6	
6.0	NA			9.14	232.2	9.67	245.6	10.06	255.5	11.44	290.6	11.44	290.6		
FF - Composite Bearing / Stroke Length	0.5	2.67	67.8	2.86	72.6	NA						4.43	112.5	4.94	125.5
	1.0	3.17	80.5	3.36	85.3	4.14	105.2	3.92	99.6	4.43	112.5	4.94	125.5		
	1.5	3.67	93.2	3.86	98.0	NA						4.43	112.5	4.94	125.5
	2.0	4.17	105.9	4.36	110.7	5.14	130.6	5.67	144.0	6.06	153.9	5.94	150.9		
	3.0	5.17	131.3	5.36	136.1	6.14	156.0	6.67	169.4	7.06	179.3	6.44	163.4		
	4.0	6.17	156.7	6.36	161.5	7.14	181.4	7.67	194.8	8.06	204.7	7.44	189.8		
	5.0	NA			8.14	206.8	8.67	220.2	9.06	230.1	10.44	265.2	11.44	290.6	
6.0	NA			9.14	232.2	9.67	245.6	10.06	255.5	11.44	290.6	11.44	290.6		
GG	0.22	5.6	0.22	5.6	0.25	6.4	0.25	6.4	0.41	10.4	0.41	10.4			
HH	0.66	16.8	0.66	16.8	0.75	19.1	0.75	19.1	0.94	23.9	0.94	23.9			
JJ	10-24		10-24		1/4-20		1/4-20		5/16-18		5/16-18				
KK - Shaft Ø	LB	0.250	6.35	0.375	9.53	0.500	12.70	0.625	15.88	0.750	19.05	1.000	25.40		
	CB	0.375	9.53	0.500	12.70	0.750	19.05	0.875	22.23	1.000	25.40	1.250	31.75		
MM	0.781	19.8	1.438	36.5	2.125	54.0	3.000	76.2	3.625	92.1	5.188	131.8			
NN	0.73	18.5	0.50	12.7	0.67	17.0	0.75	19.1	0.94	23.9	1.09	27.7			

LB = Linear Bearing

CB = Composite Bearing

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR



# PB & PB2 Switches - All Sizes

## SWITCHES



There are 10 sensing choices: DC reed, form A (open) or form C (open or closed); AC reed (Triac, open); Hall-effect, sourcing, PNP (open); Hall-effect, sinking, NPN (open); each with either flying leads or QD (quick disconnect). Commonly used to send analog signals to PLC (programmable logic controllers), TLL, CMOS circuit or other controller device. These switches are activated by the actuator's magnet.

Switches contain reverse polarity protection. QD cables are shielded; shield should be terminated at flying lead end.

If necessary to remove factory installed switches, be sure to reinstall on the same side of actuator with scored face of switch toward internal magnet.

## SPECIFICATIONS

ORDER CODE	REED DC				REED AC		HALL-EFFECT DC			
	<b>R T</b>	<b>R M</b>	<b>B T</b>	<b>B M</b>	<b>C T</b>	<b>C M</b>	<b>T T</b>	<b>T M</b>	<b>K T</b>	<b>K M</b>
PART NUMBER	3600-9082	3600-9083	3600-9084	3600-9085	3600-9086	3600-9087	3600-9088	3600-9089	3600-9090	3600-9091
LEAD	5m	QD*	5m	QD*	5m	QD*	5m	QD*	5m	QD*
CABLE SHIELDING	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†	Unshielded	Shielded†
SWITCHING LOGIC	"A" Normally Open		"C" Normally Open or Closed		Triac Normally Open		PNP (Sourcing) Normally Open		NPN (Sinking) Normally Open	
MECHANICAL CONTACTS	Single-Pole Single-Throw		Single-Pole Double-Throw		Single-Pole Single-Throw		NO, These Are Solid State Components			
COIL DIRECT	Yes		Yes		Yes		—			
POWER LED	None		None		None		None		None	
SIGNAL LED	Red		None		None		Red		Red	
OPERATING VOLTAGE	200 Vdc max.		120 Vdc max.		120 Vac max.		5 - 25 Vdc			
OUTPUT RATING	—		—		—		25 Vdc, 200mA dc			
OPERATING TIME	0.6 msec max. (including bounce)		0.7 msec max. (including bounce)		—		< 10 micro sec.			
OPERATING TEMPERATURE	-40°F [-40°C] to 158°F [70°C]						0°F [-18°C] to 150°F [66°C]			
RELEASE TIME	1.0 msec. max.		—		—		—			
ON TRIP POINT	—		—		—		150 Gauss maximum			
OFF TRIP POINT	—		—		—		40 Gauss minimum			
**POWER RATING (WATTS)	10.0 §		3.0 §§		10.0		5.0			
VOLTAGE DROP	2.6 V typical at 100 mA		NA		—		—			
RESISTANCE	0.1 Ω Initial (Max.)		—		—		—			
CURRENT CONSUMPTION	—		—		1 Amp at 86°F [30°C]   0.5 Amp at 140°F [60°C]		200 mA at 25 Vdc			
FREQUENCY	—		—		47 - 63 Hz		—			
CABLE MIN. BEND RADIUS	STATIC	0.630" [16mm]								
	DYNAMIC	Not Recommended								

**CAUTION: DO NOT OVER TIGHTEN SWITCH HARDWARE WHEN INSTALLING!**

**\*\* WARNING:** Do not exceed power rating (Watt = Voltage X Amperage). Permanent damage to sensor will occur.

\*QD = Quick Disconnect; Male coupler is located 6" [152mm] from sensor, Female coupler to flying lead (part #2503-1025) distance is 197" [5m] also see Cable Shielding specification above

**REPLACEMENT OF QD SWITCHES MANUFACTURED BEFORE JULY 1, 1997:** It will be necessary to replace or rewire the female end coupler.



**Reed Switch Life Expectancy:** Up to 200,000,000 cycles (depending on load current, duty cycle and environmental conditions)

†Shielded from the female quick disconnect coupler to the flying leads. Shield should be terminated at flying lead end.

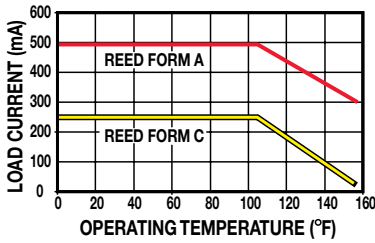
§ Maximum current 500mA (not to exceed 10VA) Refer to Temperature vs. Current graph and Voltage Derating graph

§§ Maximum current 250mA (not to exceed 3VA) Refer to Temperature vs. Current graph and Voltage Derating graph

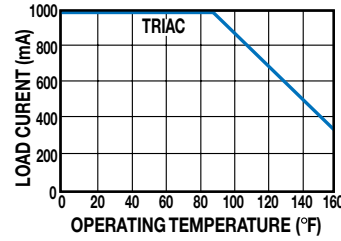
# PB & PB2 Switches - All Sizes

## PERFORMANCE

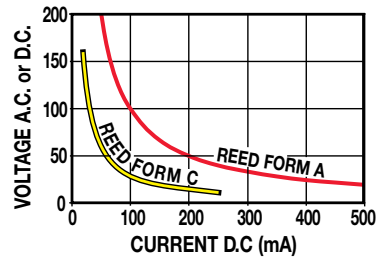
TEMP. vs CURRENT, DC REED



TEMP. vs CURRENT, AC REED

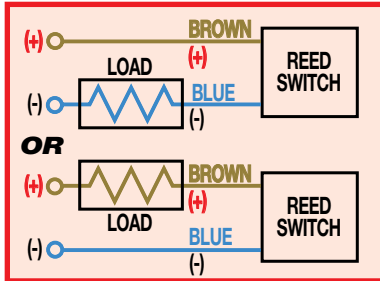


VOLTAGE DERATING, DC REED

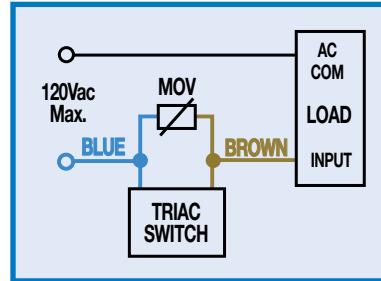


## WIRING DIAGRAMS

**R**T & **R**M DC REED, FORM A



**C**T & **C**M AC REED, TRIAC

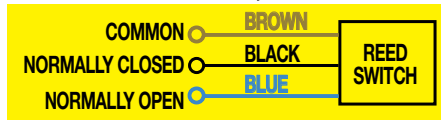


## INSTALLATION INFORMATION

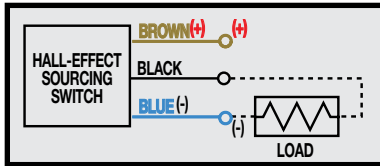


**⚠** THE NOTCHED FACE OF THE SWITCH INDICATES THE SENSING SURFACE AND MUST FACE TOWARD THE MAGNET.

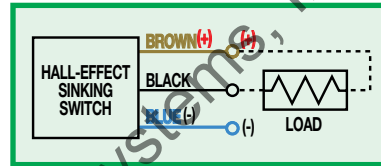
**B**T & **B**M DC REED, FORM C



**T**T & **T**M HALL-EFFECT, SOURCING, PNP



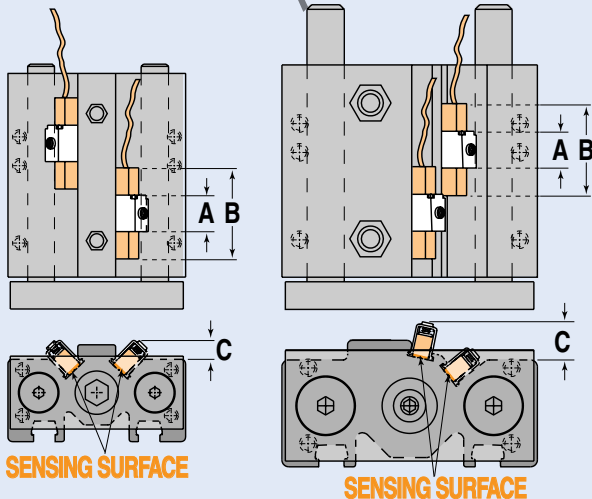
**K**T & **K**M HALL-EFFECT, SINKING, NPN



## DIMENSIONS

PB208, PB210

PB217, PB220  
PB232, PB252



MODEL	BORE	A	B	C
PB208	0.500	0.50	1.25	0.25
PB210	0.625	0.50	1.25	0.26
PB217	1.063	0.50	1.25	0.52
PB220	1.250	0.50	1.25	0.48
PB232	2.000	0.50	1.25	0.64
PB252	3.000	0.50	1.25	0.85

Dimensions in inches

MODEL	BORE	A	B	C
PB208	12.70	12.70	31.75	6.35
PB210	15.88	12.70	31.75	6.60
PB217	27.00	12.70	31.75	13.21
PB220	31.75	12.70	31.75	12.19
PB232	50.80	12.70	31.75	16.26
PB252	76.20	12.70	31.75	21.59

Dimensions in millimeters

# Application Data Worksheet



## STROKE LENGTH \_\_\_\_\_

inch (S I K)  millimeters  
(U.S. Standard) (Metric)

## AVAILABLE AIR PRESSURE \_\_\_\_\_

PSI  bar  
(U.S. Standard) (Metric)

## REQUIRED THRUST FORCE \_\_\_\_\_

lbf  N  
(U.S. Standard) (Metric)

## LOAD \_\_\_\_\_

lb  kg  
(U.S. Standard) (Metric)

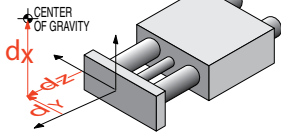
## LOAD CENTER OF GRAVITY DISTANCE TO TOOLING PLATE CENTER

inch  millimeters  
(U.S. Standard) (Metric)

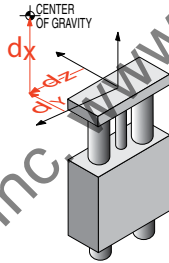
$d_x$  \_\_\_\_\_  
 $d_y$  \_\_\_\_\_  
 $d_z$  \_\_\_\_\_

## ORIENTATION

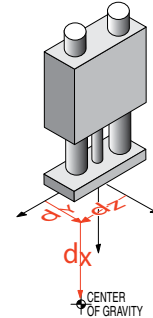
Horizontal



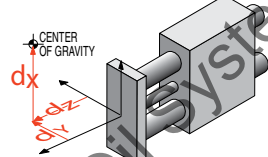
Vertical



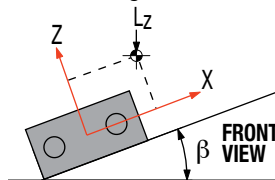
Vertical Down



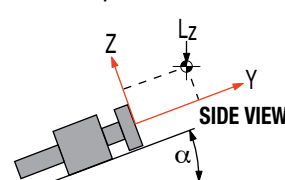
Horizontal Side



Angled  $\alpha$  \_\_\_\_\_



$\beta$  \_\_\_\_\_



## OTHER ISSUES:

(i.e. Environment,  
Temperature,  
Contamination, etc.)

Contact information: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Fax (1-763-478-8080) or call Tolomatic (1-800-328-2174) with the above information. We will provide any assistance needed to determine the proper actuator.

ABT

MXP

BCZ

BC3

BC4

LS

MG

CC

PB

ENGR

# Rod Cylinder Slide Selection Guidelines - PB & PB2 - All Sizes

## PROVIDING LOAD GUIDANCE AND SUPPORT

The process of selecting a load bearing actuator for a given application can be complex. **It is highly recommended that you contact Tolomatic or a Tolomatic Distributor for assistance in selecting the best actuator for your application.** The following overview of the selection guidelines are for educational purposes only.

### 1 COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Tolomatic rod cylinder slide for an application, compile the following information:

- Available pressure (PSI)
- Weight of load (lbs. or kgs.)
- Orientation of load (lbs. or kgs.)
- Velocity of load (in./sec. or mm/sec.)
- Stroke length (in. or mm)

Use the Application Data Worksheet on page PB\_15

### 2 SELECT ROD CYLINDER SLIDE SIZE

- Consult the Theoretical Force vs. Pressure graphs

NOTE: Graphs for PB are on pages PB\_4 to 5 and PB2 are on pages PB\_9 to 10.

- Cross-reference the load force (or load weight if force is not known) and the available operating pressure. If the intersection falls below the diagonal line, and if moments do not exceed maximum values listed for that model (see Step 4) the Tolomatic rod cylinder slide will accommodate the application. If the intersection is above the diagonal line, a

larger rod cylinder slide bore size should be considered.

NOTE: Additional force may be required to obtain the necessary acceleration for vertical or horizontal loads.

### 3 DETERMINE EFFECT OF LOAD VS. EXTENDED LENGTH

- Consult the Max. Load Weight vs Stroke Length Chart for the Tolomatic rod cylinder slides.
- Cross-reference the load weight and the extended length. If the intersection falls below the maximum load line, and if moments do not exceed maximum values listed for that model (see Step 4), the rod cylinder slide will accommodate the application. If the intersection is above the diagonal line, a larger rod cylinder slide bore size should be considered.

### 4 DETERMINE NATURE OF LOAD AND THE EFFECT OF BENDING MOMENTS

If the rod cylinder slide will guide and support a load located directly on center of the tooling plate, bending moments will not be a factor in the rod cylinder slide selection.

NOTE: the maximum load weight "W" must not exceed the capacity limits of the rod cylinder slide selected.

- Bending Moments

For off center or side loads, determine the distance from the center of mass of the load to the center of the tooling plate. This measurement is needed to calculate the torque for bending moments.

Should the resulting maximum bending moment exceed figures indicated on the chart, a larger rod cylinder slide should be considered.

### 5 DETERMINE INTERNAL BUMPER CAPACITY [POWER-BLOCK2 ONLY]

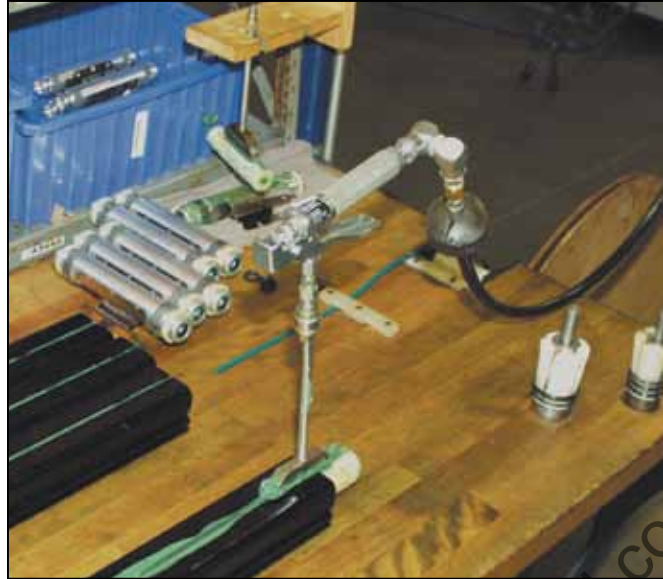
- Consult the Load vs Velocity Data Chart for the Power-Block model selected. The velocities listed on the charts are final or bumper impact velocities.
- Cross-reference the final velocity and weight of the load. If the intersection is below the diagonal lines, the internal bumpers on the Power-Block2 may be used. If the point falls above the dashed diagonal line or if the velocity is not known, select a larger rod cylinder slide. On high-cyclic applications, use of external stops is strongly recommended.

### 6 CONSIDER OPTIONS

- Switches— dc Reed, Hall-effect, or ac Triac - (All Models)
- Bumpers and Stop Collars - (Power-Block)
- Dual Tooling Plate (Power-Block)

# Application Guidelines

The following conditional statements are intended as general guidelines for use of Tolomatic actuators. Since all applications have their own specific operating requirements, consult Tolomatic, Inc. or your local Tolomatic distributor if an application is unconventional or if questions arise regarding the selection process.



## LUBRICATION GUIDELINES

All Tolomatic actuators (except Cable Cylinders) are prelubricated at the factory. To ensure maximum actuator life, the following guidelines should be followed.

- **Filtration**

We recommend the use of dry, filtered air in our products. "Filtered air" means a level of 10 Micron or less. "Dry" means air should be free of appreciable amounts of moisture. Regular maintenance of installed

filters will generally keep excess moisture in check.


- **External Lubricators (optional)**

The factory prelubrication of Tolomatic actuators will provide optimal performance without the use of external lubrication. However, external lubricators can further extend service life of pneumatic actuators if the supply is kept constant.

Oil lubricators, (mist or drop) should supply a minimum of 1 drop per 20 standard cubic feet per minute to the

cylinder. As a rule of thumb, double that rate if water in the system is suspected. Demanding conditions may require more lubricant.

If lubricators are used, we recommend a non-detergent, 20cP @ 140°F 10-weight lubricant. Optimum conditions for standard cylinder operation are +32° to +150°F (+0° to 65.5°C).

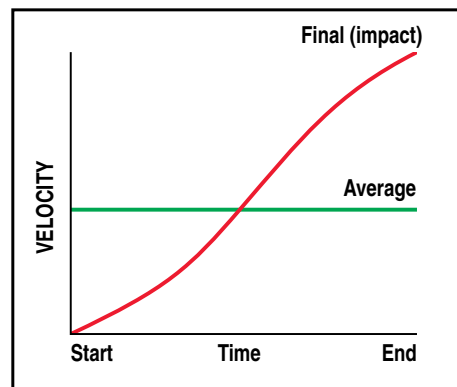
 NOTE: Use of external lubricators may wash away the factory installed lubrication. External lubricants must be maintained in a constant supply or the results will be a dry actuator prone to premature wear.

- **Sanitary Environments**

Oil mist lubricators must dispense "Food Grade" lubricants to the air supply. Use fluids with ORAL LD50 toxicity ratings of 35 or higher such as Multitherm® PG-1 or equivalent. Demanding conditions can require a review of the application.

## FINAL VELOCITY CALCULATION

Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Stroking a 100-inch BC3 model in one second yields an average velocity of 100 inches per second. To properly determine the inertial forces for cushioning, it is important to know the



final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered (see diagram).

If final (or impact) velocity cannot be calculated directly, a reasonable guideline is to use 2 x average velocity.

# PB & PB2 Ordering - All Sizes

**MODEL, BORE, STROKE, BEARING**      **OPTIONS**

**P B** **2 0** **S K** **3 0** **D P** **B P** **B M** **2**

**MODEL & MOUNTING**

**PB** Power Block Rod  
Cylinder Slide-  
inch (U.S. Standard)

**PB2** Power Block2 Rod  
Cylinder Slide-  
inch (U.S. Standard)

**PB BORE SIZE**

**06** 0.38" (10mm)  
**10** 0.63" (16mm)  
**17** 1.13" (27mm)  
**20** 1.25" (32mm)

**PB2 BORE SIZE**

**08** 0.50" (13mm)  
**10** 0.63" (16mm)  
**17** 1.13" (27mm)  
**20** 1.25" (32mm)  
**32** 2.00" (51mm)  
**52** 3.25" (83mm)

**STROKE LENGTH**

**SK**\_\_ Enter desired stroke length from the code number in the table below

STROKE LENGTH	ORDER CODE									
	PB				PB2					
	06	10	17	20	08	10	17	20	32	52
<b>0.5" (13mm)</b>	05	05			05	05				
<b>1.0" (25mm)</b>	10	10	10	10	10	10	10	10	10	10
<b>1.5" (38mm)</b>	15	15			15	15				
<b>2.0" (51mm)</b>	20	20	20	20	20	20	20	20	20	20
<b>3.0" (76mm)</b>			30	30	30	30	30	30	30	30
<b>4.0" (102mm)</b>					40	40	40	40	40	40
<b>5.0" (127mm)</b>							50	50	50	50
<b>6.0" (152mm)</b>							60	60	60	60

**BEARING TYPE**

PB	PB2
Composite Bearings - NO Entry Required	<b>LB</b> Linear Bearings <b>CB</b> Composite Bearings

**SWITCHES (PB\_13)**

*(Quantity desired follows ordering code)*

**RM**\_ Reed Switch (Form A) with 5-meter lead/QD (Quick-disconnect)

**RT**\_ Reed Switch (Form A) with 5-m lead

**BM**\_ Reed Switch (Form C) with 5-meter lead/QD

**BT**\_ Reed Switch (Form C) with 5-m lead

**\*KM**\_ Hall-effect Sinking Switch with 5-meter lead/QD

**\*KT**\_ Hall-effect Sinking Switch w/ 5-m lead

**\*TM**\_ Hall-effect Sourcing Switch with 5-meter lead/QD

**\*TT**\_ Hall-effect Sourcing Switch with 5-meter lead

**CM**\_ TRIAC Switch with 5-meter lead/QD

**CT**\_ TRIAC Switch with 5-meter lead

**\*MDR** Dual Magnet (Reed, Hall-effect, Triac)

\*⊗ Not available for 05 size

**STOP COLLARS/BUMPERS (PB ONLY)**

**BP** For Bumpers/Stop Collars

**DUAL TOOLING PLATE (PB ONLY)**

**DP** For Dual Tooling Plate

**T-NUTS (PB2 ONLY)**

**TN**\_ For T-Nuts, indicate number required

 **Not all codes listed are compatible with all options. Contact Tolomatic with any questions.**



**Use the Tolomatic Sizing Software to determine available options and accessories based on your application requirements.**

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

# PB & PB2 Service Parts Ordering - ALL Sizes

PB: Power-Block Rod Cylinder Slide SIZE	Inch (U.S. Standard)			
	06	10	17	20
Switch Hardware Kit	2506-9999	2506-9999	2506-9999	2506-9999
Reed Switch Magnet <sup>1</sup>	2506-9003	2510-9003	2517-9003	2520-9003
Hall-effect Switch Magnet <sup>1</sup>	2506-9004	2510-9004	2517-9004	2520-9004
BP: Stop Collar / Bumper Kit <sup>2</sup>	2506-9002	2510-9002	2517-9002	2520-9002

PB2: Power-Block2 Rod Cylinder Slide SIZE	Inch (U.S. Standard)					
	08	10	17	20	32	52
Switch Hardware Kit	2506-9999	2506-9999	2506-9999	2506-9999	2506-9999	2506-9999
TN: T-Nuts	3410-1013	3410-1013	3415-1013	3415-1013	3420-1013	3420-1013

PART NUMBER ORDERING		CONFIG. CODE ORDERING
No Mounting Hardware or FE conn. included		Mounting Hardware & FE conn. included
PART NO.	DESCRIPTION	CODE
3600-9084	Switch Only, Reed, Form C, 5m	BT
3600-9085	Switch Only, Reed, Form C, Male Conn.	BM
3600-9082	Switch Only, Reed, Form A, 5m	RT
3600-9083	Switch Only, Reed, Form A, Male Conn.	RM
3600-9086	Switch Only, Triac, 5m	CT
3600-9087	Switch Only, Triac, Male Conn.	CM
3600-9090	Switch Only, Hall-effect, Sinking, 5m	KT
3600-9091	Switch Only, Hall-effect, Sinking, Male Conn.	KM
3600-9088	Switch Only, Hall-effect, Sourcing, 5m	TT
3600-9089	Switch Only, Hall-effect, Sourcing, Male Conn.	TM
2503-1025	Connector (Female) 5 meter lead	

NOTE: When ordered by Config. Code Female connector & all mounting hardware is included

## Switch Ordering NOTES:

To order field retrofit switch and hardware kits for all Tolomatic actuators: SW (Then the model and bore size, and type of switch required)

### Example: SWPB10RT

(Hardware and Form A Reed switch with 5 meter lead for 0.625" bore PB Rod Cylinder Slide)

 Replacing an existing switch on an actuator manufactured AFTER 7-1-1997

**Order using PART NUMBER in table above**

 Replacing an existing switch on an actuator manufactured BEFORE 7-1-1997

**Order using CONFIGURATOR CODE in table above**

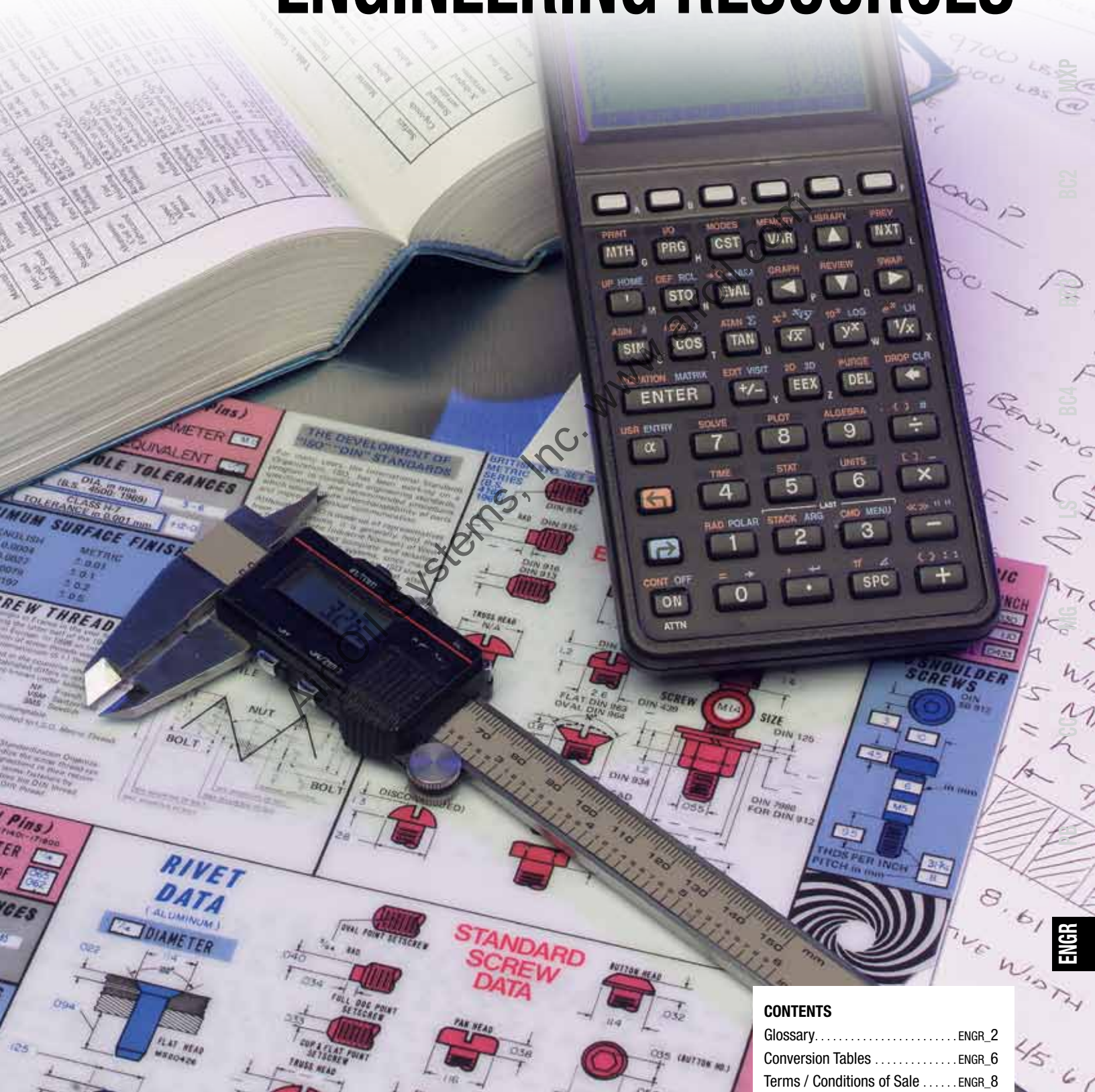
If replacing a quick-disconnect switch on an actuator manufactured BEFORE 7-1-1997 it will also be necessary to replace or require the female-end coupler with the in-line splice (see page PB\_13)



## Service Parts Ordering NOTES:

- 1 One Each
- 2 Kit includes: 2 (two) stop collars and 2 (two) 1/4" thick polyurethane external bumpers to help absorb impact shock

# ENGINEERING RESOURCES



**CONTENTS**

- Glossary ..... ENGR\_2
- Conversion Tables ..... ENGR\_6
- Terms / Conditions of Sale ..... ENGR\_8



# Glossary

- A**
- ACCELERATION**  
The change in velocity as a function of time. Acceleration usually refers to increasing velocity, and deceleration to decreasing velocity.
- ACCURACY**  
A measure of the difference between expected position and actual position.
- ACTUATOR**  
A mechanism for moving or controlling something indirectly instead of by hand.
- ADJUSTABLE SHOCK ABSORBERS**  
Used on BC2 and BC3 band cylinders to decelerate heavy loads at high velocities. Tolomatic offers light and heavy duty shock absorbers. The sizing and selection software will automatically choose the correct either light duty or heavy duty as required. When shock absorbers are used on the cylinder internal cushions are not operational. Note: Shock absorber is most effective when stopping load at its center of gravity.
- AMBIENT TEMPERATURE**  
The temperature of the cooling medium, usually air, immediately surrounding the motor or another device.
- ANODIZING**  
Protective treatment for aluminum that involves subjecting the metal to electrolytic action in a chemical bath, to create a protective film of aluminum oxide with a very smooth finish. The process is similar to that of hardcoating, but the latter involves the use of a different, more complex chemical bath and results in a thicker, rougher, extremely brittle coating of aluminum oxide.
- AUXILIARY CARRIER**  
An option for band cylinders or linear slides that increases the load capacity of the cylinder as well as increasing the capacity
- of bending moment about the Y axis. Note: internal cushion will not work when auxiliary carrier ordered without piston, it will be necessary to add external shock absorbers.
- AVERAGE VELOCITY**  
Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Cycling a 100 inch BC3 model in one direction in one second yields an average velocity of 100 inches per second. To properly determine the inertia forces for cushioning, it is important to know the final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered. If final velocity cannot be calculated directly, a reasonable guideline is to use 2X average velocity.
- AXIAL LOADING**  
A load with a force directed along an axis, such as a shaft.
- B**
- BALL BEARING**  
A bearing where the journal turns upon loose, hardened steel balls that roll easily in a race.
- BAND CYLINDER**  
A name for a rodless cylinder using Tolomatic's unique band retention system. Band cylinders feature a central slot. A band-type cylinder uses a bracket directly mounted to the cylinder piston to transmit force. The bracket passes between two bands which then seal the cylinder. The inner sealing band creates a tight metal to metal seal with the internal diameter of the cylinder bore. An outer dust band keeps dust and grit away from the sealing band. Elastomer strips provide a positive, non-magnetic lock. Tolomatic models include: BC2, BC3, BC4
- BAR**  
The SI Metric unit of pressure equal to one million Dynes per square centimeter. The bar is used to measure both pneumatic and hydraulic pressure. One Bar is equal to 14.5038 pounds per square inch. It is also nearly equivalent to one atmosphere of pressure.
- BASE MOUNT**  
Base mounting linear slides may be accomplished by fastening directly to "T" slot nuts provided in the base of the slide or by using the base mounting.
- BC2 BAND CYLINDER**  
The second generation of the original band cylinder, introduced in 1986.
- BC3 BAND CYLINDER**  
This band cylinder, introduced in 1995, incorporates a ball bearing system in the carrier for high performance.
- BC4 BAND CYLINDER**  
Introduced in 1996, the BC4 is an economical choice for supported loads.
- BENDING MOMENT**  
Equivalent torque produced by a force displaced by a known distance from the carriage.
- BREAKAWAY**  
The minimum amount of force or pressure required to cause the initial movement of a given device such as a cable cylinder piston, a brake piston, or a rotary actuator through a full stroke.
- BRITISH THERMAL UNIT (BTU)**  
The amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.
- BUNA-N**  
A widely used copolymer (artificial rubber) used for making seals. Buna-N seals should never be used with automotive brake fluid.
- C**
- CABLE**  
A wire rope made of twisted strands of material. In the case of cable cylinders, cables are made of strands of galvanized steel which are twisted together in bundles of seven strands each. These bundles, in turn, are twisted around each other. The resulting cable is coated with an extruded nylon covering.
- CABLE ASSEMBLY**  
A sub-assembly consisting of the cable ferrules, terminals and gland seals.
- CABLE CYLINDER**  
A rodless cylinder using cables to transmit force from a piston.
- CABLE CYLINDER REPAIR KIT**  
A sub-assembly consisting of two cable assemblies and the internal seals (two piston seals, two cushion seals and two tube-sealing O-rings) required to keep a cable cylinder operational.
- CALIPER DISC BRAKE**  
A form of brake, used to retard, stop or hold action. The brake is called a "caliper" because it is mounted over a rotating disc to which it applies a friction member (puck) to slow, stop or hold the disc.
- CARRIER**  
Attached to band cylinder or linear slide with bearing system the carrier supports and moves the load. Tolomatic options include: Auxiliary carrier, Dual 180 carrier (BC3 only), Long Carrier (BC4 only).
- CENTER OF GRAVITY (Center of Mass)**  
The point at which the entire weight of a body may be considered as concentrated so that if supported at this point the body would remain in equilibrium in any position.
- CLEVIS**  
The name given to the U-shaped cable connecting bracket on a Tolomatic cable cylinder.

# Glossary

## COEFFICIENT OF FRICTION

The measurement of friction of one object sliding across another. Symbolized by the Greek letter Mu ( $\mu$ ) it is defined as the tangent of the angle of repose of a static body. The coefficient is expressed in decimal values (clean iron on clean iron is 1.0, while metal on solid rubber may range from 1.0 up to 4.0). When objects are wet, the coefficient of friction decreases.

## CONFIGURATOR

Name given to the software that uses the configuration string to give instructions to the factory with correct specifications to create your built-to-order actuator.

## CONFIGURATOR STRING

A series of code letters and numbers that Tolomatic uses to create built-to-order actuators.

## CONSTRAINT

Guided and supported in a particular direction, through the use of an external guidance and bearing system.

## CUSHION

A means of slowing down a cylinder piston at the end of its stroke by using an exhaust port with an orifice small enough to restrict the velocity at which the pressure fluid is exhausted.

## CUSTOM PRODUCTS

These products don't resemble any of the products seen in the Tolomatic catalogs. Tell us your performance requirements, we can build a custom product for you.

## CYCLE

- 1) A sequence of operations that is repeated regularly.
- 2) The time it takes for one such sequence to occur.

## CYCLE RATE

The total number of times a complete motion is made from start and return to start in a specific period of time.

## D

### DEAD LENGTH

Dead length is the part of the band cylinder or linear slide required for mounting and mechanisms. The overall length of a band cylinder or linear slide is the stroke length plus the dead length.

### DECELERATION

The opposite of acceleration. Deceleration means diminished velocity or slowing down.

### DEFLECTION

A measurement of the amount of bend under the weight of a load, such as that to which a load-supporting rod or cable is subject.

### DIE-CAST

A metal-forming process similar to injection-molding for plastic. In Die-Casting, molten metal (usually aluminum) is injected into a mold under pressure.

### DOUBLE-ACTING CABLE CYLINDER

Cable cylinder that applies equal force in two directions.

### DOUBLE-PURCHASE CABLE CYLINDER

Cable cylinder that uses additional cable and pulleys to double the velocity and stroke of cable cylinders.

### DUAL 180 CARRIER

Option for the BC3 that gives greater bending moments without using a larger actuator.

### DUAL MAGNET

Option for BC2 with two magnets, one on each side of the carrier.

### DUST BAND

Part of Tolomatic's unique band retention system, the external band.

## E

### EXTERNAL CUSHIONS

Shock absorbers of some sort used to decelerate the load on a rodless cylinder in cases

where the load is too heavy to make use of the cylinder's internal cushions.

### EXTERNAL STOPS

Stops used on the outside of a vane-type rotary actuator to limit the rotation of the unit short of the unit's full cycle.

## F

### FINAL VELOCITY

Velocity calculations for all rodless cylinders need to differentiate between final velocity and average velocity. For example: Cycling a 100 inch BC3 model in one direction in one second yields an average velocity of 100 inches per second. To properly determine the inertia forces for cushioning, it is important to know the final (or impact) velocity. Rodless cylinders accelerate and decelerate at each end of the stroke. Therefore this acceleration must be considered. If final velocity cannot be calculated directly, a reasonable guideline is to use 2X average velocity.

### FLOATING MOUNT (BAND CYLINDERS, MAGNETICALLY COUPLED CYLINDERS)

An option for use in applications where the load is not guided and supported by the Tolomatic actuator, or when compensating for nonparallelism.

### FOOT MOUNT

A mounting plate that attaches a cylinder head to mount the cylinder to a flat surface at a 90° angle.

### FORCE

An agency or influence that if applied to a free body results chiefly in an acceleration of the body and sometimes in elastic deformation and other effects.

### 4 PORTED HEAD

The BC2 features standard 3 ported heads but can be ordered with an additional 4th port in the underside of the head for additional mounting

flexibility.

### FRICTION

Resistance to relative motion between two bodies in contact, such as steel sliding on steel.

## H

### HALL-EFFECT D.C. SWITCH

A magnetically-controlled transistor switch controlling DC power. It has no moving parts and theoretically unlimited contact life.

### HEAD

A metal component mounted at each end of a rodless pneumatic cylinder. With a cable cylinder, the head has a pulley, ports, mounting holes and provides sealing. On a Band Cylinder, the head provides tube sealing, fluid ports and mounting holes.

### HUB

A means of attaching a sprocket, pulley or disc to a shaft.

## I

### INCH-POUND

A unit of measure of torque. It is derived from a given force in pounds acting at a given radius in inches (pounds multiplied by inches = inch-pounds). An inch-pound is 1/12th of a foot-pound. Inch-pounds may be converted to the SI Metric equivalent of Newton-meters by multiplying them by 0.1129848. Newton-meters may be converted to inch-pounds by multiplying them by 8.850748.

### INERTIA

A measure of an object's resistance to a change in velocity. The larger an object's inertia, the larger the torque required to accelerate or decelerate it. Inertia is a function of an object's mass and shape.

## K

### KEY

A demountable machine part,

# Glossary

which, when assembled into a keyseat, provides a positive means for transmitting torque between two other machine parts.

## KEYWAY

An axially-located groove in the length of a shaft along which a key may be located.

## KINETIC ENERGY

The ability to do work based on motion. It is found by multiplying half the mass by the square of the velocity.

## L

### LIMIT SWITCH

A switch that is actuated by some part or motion of a machine or equipment to alter the electrical circuit associated with it.

### LINEAR SLIDE

A rodless cylinder using the same unique band retention system as the band cylinder. The Linear Slide uses a wider extrusion with steel shafts and bearings for additional load support. Tolomatic model: LS

### LOAD

A mass or weight supported by the carrier (rodless cylinders) or tooling plate (rod cylinder slides).

### LONG CARRIER

An option available for the BC4 the long carrier increases the My and Mz moment load capacity. It also gives a larger mounting surface and virtually eliminates chatter for vertical cantilever loads.

## M

### MAGNETICALLY COUPLED ACTUATOR

Rodless cylinder and slides featuring a magnetic couple between the piston and moving carrier.

### MAGNETIC COUPLING FORCE

The force created between the piston magnets and the moving carrier (measured in pounds).

## MODIFIED STANDARD PRODUCTS

Tolomatic can easily accommodate your special needs. Our standard products are often customized with extra mounting holes, different materials and other requests. This can often be done within our normal 5 day production time. We welcome modifications as well as completely new custom products.

## N

### NEEDLE BEARING

A type of roller bearing where the journal turns on small-diameter, hardened needle-like rollers which roll easily in a metal race.

## O

### O-RING

A ring of synthetic rubber with a circular cross-section, used as a gasket or seal.

## P

### PARALLEL PORT

Metric versions of the BC2, BC3, BC4 and LS have the choice of parallel port and taper port.

### PISTON

A sliding component moved by fluid pressure. It usually consists of a short, solid metal cylinder within a cylindrical vessel in which it moves back and forth.

### PORT

In pneumatic units, the area to make connection to air lines that supply power to the actuator. In electrical units: a connecting unit between a data link and a device.

### POUNDS PER SQUARE INCH OR PSI

A measurement of pressure in the U.S. customary system. By way of comparison, the weight of the atmosphere (one atmosphere) is 14.7 pounds per square inch, at sea level. It is used to express pressure in both pneumatic and

hydraulic-powered systems. In the SI Metric system, pressure is measured in Bars. To convert PSI to Bars, take the PSI figure and multiply it by 0.0689476.

## PRESSURE

The force or thrust exerted over a surface divided by its area. In the U.S. customary system, pressure is expressed as Pounds per Square Inch (PSI). In the SI Metric system, it is expressed in Bars.

## PROXIMITY SENSOR

An LED-equipped device for sensing end-of-stroke on cylinder slides. Proximity sensors supply either a sourcing signal or a sinking signal to a device such as a programmable logic controller.

## PULLEY

A sheave or small wheel with a grooved rim used with a cable cylinder to change the direction and point of application of the pulling force generated by the cylinder's piston.

## Q

### QUAD RING

A sealing ring of synthetic rubber which has 4 sealing lobes and is capable of sealing in two directions.

## R

### REED SWITCH

Tolomatic's Form A Reed Switch is an LED-equipped 0.5 ampere switch consisting of ferromagnetic blades brought into contact when a magnet passes nearby. Reed switches are used for signalling position only.

### RELATIVE HUMIDITY

A ratio that indicates the amount of water vapor in the air. It is usually expressed as a percentage. At any temperature, it is the amount of water vapor in the air, divided by the amount that would be present at saturation.

### RMS (ROOT MEAN SQUARE)

An industry-accepted standard

for measuring the smoothness of a surface finish. Under a microscope, all surface finishes have peaks and valleys. The more peaks and valleys, the rougher the finish and the higher the RMS value. The smaller the RMS number, the smoother the finish.

## ROCKWELL

Industry-accepted standard for definition of hardness.

## ROD CYLINDER

A cylinder using a rod attached to its piston to transmit force. Tolomatic models include: RCS and PB2.

## RODLESS CYLINDER

An actuator that contains the stroke within the cylinder itself. Tolomatic models include: BC2, BC3, BC4, LS, MG, MGS, CC, SA, DP, and TC.

## ROLLER BEARING

An anti-friction device consisting of a journal which rests on free-rolling, hardened cylinders in a race.

## S

### SCHEMATIC

A diagram of a circuit in which symbols illustrate circuit components.

### SEAL

An object used to retain air pressure, water, hydraulic fluid or oil in a vessel. In the Tolomatic product line, seals are made of an elastomer, which is any of a variety of synthetic rubber compounds.

### SEALING BAND

The stainless steel strap which is part of Tolomatic's unique band retention system, the internal band.

### SHIELDING

The practice of confining the electrical field around a conductor to the primary insulation of the cable by putting a conducting layer over and/or under the cable insulation. (External shielding is a conducting layer on the outside of the cable insulation.)

# Glossary

Strand or internal shielding is a conducting layer over the wire insulation.)

## SHOCK ABSORBERS

A self contained hydraulic device commonly used on rodless cylinders, rodless slides and rod cylinder slides to decelerate heavy loads at high velocities.

## SIGNAL

The event, phenomenon, or electrical quantity that conveys information from one point to another.

## SINGLE-ACTING CABLE CYLINDER

Cable cylinder that applies force in one direction and uses gravity (generally) to return to home position.

## SINGLE END PORTING

Single end porting simplifies air hook up, allows running air lines to just one end of the actuator. Unless otherwise specified single end porting is factory installed on the right side of the actuator. Available for the BC3 and BC4.

## SNAP-IN SEAL®

A unique method of installing seals in cable cylinder heads without using tools. It includes a plastic washer, which, when pulled into a cable cylinder head cable port, snaps into a groove and holds the seal arrangement in place.

## SOLID STATE DEVICES

Electronic components that control electron flow through solid materials (e.g., transistors, diodes, or integrated circuits).

## STROKE LENGTH

Stroke length is the distance that the carrier and its load will move on the band cylinder or linear slide.

## SURGE

A transient variation in the current or potential at a point in the circuit.

## SWITCH MAGNETS

Located on the carrier or

piston magnets are needed for switches to sense position of carrier. On the BC3 and BC4 the switch magnet is a standard feature, attached to the piston. On the BC2 and LS the switch magnet is only included if switch is ordered. Magnets are easily inserted into carrier for field retrofitting.

## SWITCH MAGNETS (DUAL)

The BC2 optionally can have dual switch magnets, one on each side of the carrier.

## SWITCHES

For signaling position Tolomatic has 5 different switches available. These switches are available with a 5 meter lead, or with a quick-disconnect connector and 5 meter lead.

## SYSTEM

A collection of units combined to work as a larger integrated unit having the capabilities of all of the separate units.

## T

### T-NUTS

For intermediate support tube support brackets can be mounted to the BC2, BC3, and BC4 models. For the BC3 and BC4 the T-Nuts, that are needed for the brackets, must also be ordered.

### TAPER PORT

Metric versions of the BC2, BC3, BC4 and LS have the choice of parallel port and taper port.

### TENSILE STRENGTH

The greatest longitudinal stress a substance can bear without permanent deformation.

### TERMINAL

A threaded device attached to the end of a cable cylinder assembly for convenience in making connections and adjustments. One terminal is attached to the piston, while the other is attached to the bracket (clevis).

### TOLERANCE

A specified allowance for error

from a desired or measured quantity.

## TORQUE

A force that produces rotation. A turning or twisting force. (From the Latin torquere - to twist. Also the root word for torture.)

## TRACK CABLE CYLINDER

A cable cylinder with hardened ground shafts and a guided carrier within linear bearings, giving the cylinder the ability to guide and support moderate work loads.

## TRIAC AC REED SWITCH

These switches are designed for signaling end-of-stroke position to devices such as programmable controllers. They can be used to operate ac relays and solenoids if a protection circuit is used and if current and voltage limits are observed.

## TUBE DEFLECTION

Due to the nature of loads and aluminum extrusions tube deflection will occur if cylinder (linear slide) is supported only on the ends without tube supports at recommended intervals along length of cylinder.

## TUBE SUPPORTS

Optional accessory for band cylinders and linear slides (base mount) to prevent tube deflection.

## U

### U-CUP

A synthetic rubber component with lips along its inner and outer circumferences giving a cross-section the appearance of the letter "U". When under pressure, the lips flare out, providing a tight seal in one direction and minimal drag from the non-pressurized side.

### UNITS

U.S. customary: A system of weights and measures based on the pound and inches. Metric: A decimal system of weights and measures based on the kilogram and meter.

## V

### VALUE

A number that represents a computed or assigned quantity; or, a number contained in a data table or data file word.

### VITON®

A DuPont Chemical Co. trademark for a fluorocarbon rubber used in high temperature applications. At Tolomatic, Viton® is used for seals in high temperature situations and for brakes designed to be operated with non-flammable hydraulic fluids such as phosphate-ester.

### VOLT

Unit of electromotive force. It is the difference of potential required to make a current of one ampere flow through a resistance of one ohm.

### VOLTAGE

The term most often used in place of electromotive force, potential, potential difference, or voltage drop. It describes the electric pressure that exists between two points and is capable of producing a flow or current when a closed circuit is connected between the two points.

### VOLTAGE RATING

The maximum voltage at which a given device may be safely maintained during continuous use in a normal manner. It is also called working voltage.

## W

### WATT

A unit of power or a rate of doing work. The power dissipated by a one ohm resistor with one ampere of current is one watt.

# Conversion Tables

To convert from A to B, multiply by entry in table

LENGTH	B						
	in	ft	yd	mm	cm	m	
A	in	1	0.0833	0.028	25.4	2.54	0.0254
	ft	12	1	0.333	304.8	30.48	0.3048
	yd	36	3	1	914.4	91.44	0.914
	mm	0.03937	0.00328	0.000109	1	0.1	0.001
	cm	0.3937	0.03281	0.00109	10	1	0.01
	m	39.37	3.281	1.09	1000	100	1

MASS	B					
	gm	kg	slug	lb(m)	oz(m)	
A	gm	1	0.001	$6.852 \times 10^{-5}$	$2.205 \times 10^{-3}$	0.03527
	kg	1000	1	$6.852 \times 10^{-2}$	2.205	35.274
	slug	14590	14.59	1	32.2	514.72
	lb(m)	453.6	0.45359	0.0311	1	16
	oz(m)	28.35	0.02835	$1.94 \times 10^{-3}$	0.0625	1

PRESSURE	B						
	atm	bar	millibar	lbs/sqr ft (PSF)	lbs/sqr in (PSI)	N/sqr m (NSM)	N/sqr mm (NSMM)
A	atm	1	1.01325	1013.25	2,116.22	14.6454	101,325
	bar	0.986923	1	1000	2088.54	14.5037	100,000
	millibar	0.000987	0.001	1	2.08854	0.014504	100
	PSF	0.000473	0.000479	0.478803	1	0.006944	47.88
	PSI	0.068046	0.068948	68.94757	143.99999	1	6,894.757
	NSM	0.00001	0.00001	0.01	0.020885	0.000145	1
	NSMM	98,692	10	10,000	20885.43	145.0377	1,000,000

FORCE	B						
	lb(f)	N	dyne	oz(f)	kg(f)	gm(f)	
A	lb(f)	1	4.4482	$4.448 \times 10^5$	16	0.45359	453.6
	N	0.22481	1	100	3.5967	0.10197	---
	dyne	$2.248 \times 10^{-6}$	0.00001	1	$3.59 \times 10^{-5}$	---	980.6
	oz(f)	0.0625	0.27801	$2.78 \times 10^4$	1	0.02835	28.35
	kg(f)	2.205	9.80665	---	35.274	1	1000
	gm(f)	$2.205 \times 10^{-3}$	---	$1.02 \times 10^{-3}$	0.03527	0.001	1

POWER	B						
	Watts	KW	hp (US customary)	hp (Metric)	ft-lb/s	in-lb/s	
A	Watts	1	$1 \times 10^{-3}$	$1.34 \times 10^{-3}$	$1.36 \times 10^{-3}$	0.74	8.88
	kw	1000	1	1.34	1.36	738	8880
	hp (US customary)	746	0.746	1	1.01	550	6600
	hp (Metric)	736	0.736	0.986	1	543	6516
	ft-lb/s	1.35	$1.36 \times 10^{-3}$	$1.82 \times 10^{-3}$	$1.84 \times 10^{-3}$	1	12
	in-lb/s	0.113	$1.13 \times 10^{-4}$	$1.52 \times 10^{-4}$	$1.53 \times 10^{-4}$	$8.3 \times 10^{-2}$	1

ABBREVIATED TERMS
atm = atmosphere (STD)
C = Celsius
cm = centimeter
F = Fahrenheit
ft = foot
g = gravity
gm = gram
gm(f) = gram force
hp = horse power
in = inch
kg = kilogram
kg(f) = kilogram force
kw = Kilowatt
lb(f) = pound force
lb(m) = pound mass
min = minute
mm = millimeter
m = meter
N = Newton
oz(f) = ounce force
oz(m) = ounce mass
rad = radians
rpm = revs per minute
rps = revs per second
s = seconds
sqr = square

# Conversion Tables

To convert from A to B, multiply by entry in table

TORQUE		B							
		dyne-cm	gm-cm	oz-in	kg-cm	lb-in	N-m	lb/ft	kg/m
A	dyne-cm	1	$1.019 \times 10^{-2}$	$1.416 \times 10^{-5}$	$1.0197 \times 10^{-6}$	$8.850 \times 10^{-7}$	$10^{-7}$	$7.375 \times 10^{-6}$	$1.019 \times 10^{-6}$
	gm-cm	980.665	1	$1.388 \times 10^{-2}$	.001	$8.679 \times 10^{-4}$	$9.806 \times 10^{-5}$	$7.233 \times 10^{-5}$	10 <sup>-5</sup>
	oz-in	$7.061 \times 10^4$	72.007	1	$7.200 \times 10^{-2}$	$6.25 \times 10^{-2}$	$7.061 \times 10^{-3}$	$5.208 \times 10^{-3}$	$7.200 \times 10^{-4}$
	kg-cm	$9.806 \times 10^5$	1000	13.877	1	0.8679	$9.806 \times 10^{-2}$	$7.233 \times 10^{-2}$	0.001
	lb-in	$1.129 \times 10^6$	$1.152 \times 10^3$	16	1.152	1	0.112	$8.333 \times 10^{-2}$	$1.152 \times 10^{-2}$
	N-m	$10^7$	$1.019 \times 10^4$	141.612	10.197	8.85	1	0.737	0.102
	lb-ft	$1.355 \times 10^7$	$1.382 \times 10^4$	192	13.825	12	1.355	1	0.138
	kg-m	$9.806 \times 10^7$	105	$1.388 \times 10^3$	100	86.796	9.806	7.233	1

INERTIA (ROTARY)		NOTE: Mass inertia = $\frac{\text{wt. inertia}}{g}$									
		B									
		gm-cm <sup>2</sup>	oz-in <sup>2</sup>	gm-cm-s <sup>2</sup>	kg-cm <sup>2</sup>	lb-in <sup>2</sup>	oz-in-s <sup>2</sup>	lb-ft <sup>2</sup>	kg-cm-s <sup>2</sup>	lb-in-s <sup>2</sup>	lb-ft-s <sup>2</sup> or slug-ft-s <sup>2</sup>
A	gm-cm <sup>2</sup>	1	$5.46 \times 10^{-2}$	$1.01 \times 10^{-3}$	38,992	$3.417 \times 10^{-4}$	$1.41 \times 10^{-5}$	$2.37 \times 10^{-6}$	$1.01 \times 10^{-4}$	$8.85 \times 10^{-7}$	$7.37 \times 10^{-4}$
	oz-in <sup>2</sup>	182.9	1	0.186	0.182	0.0625	$2.59 \times 10^{-2}$	$4.34 \times 10^{-4}$	$1.86 \times 10^{-4}$	$1.61 \times 10^{-4}$	$1.34 \times 10^{-5}$
	gm-cm-s <sup>2</sup>	980.6	5.36	1	0.9806	0.335	$1.38 \times 10^{-2}$	$2.32 \times 10^{-3}$	38,992	$8.67 \times 10^{-4}$	$7.23 \times 10^{-5}$
	kg-cm <sup>2</sup>	1,000	5.46	1.019	1	0.3417	$1.41 \times 10^{-2}$	$2.37 \times 10^{-3}$	$1.019 \times 10^{-3}$	$8.85 \times 10^{-4}$	$7.37 \times 10^{-5}$
	lb-in <sup>2</sup>	$2.92 \times 10^3$	16	2.984	2.925	1	$4.14 \times 10^{-2}$	$6.94 \times 10^{-3}$	$2.96 \times 10^{-3}$	$2.59 \times 10^{-3}$	$2.15 \times 10^{-4}$
	oz-in-s <sup>2</sup>	$7.06 \times 10^4$	386.08	72	70.615	24.13	1	0.1675	$7.20 \times 10^{-2}$	$6.25 \times 10^{-2}$	$5.20 \times 10^{-3}$
	lb-ft <sup>2</sup>	$4.21 \times 10^5$	2,304	429.71	421.4	144	5.967	1	0.4297	0.3729	$3.10 \times 10^{-2}$
	kg-cm-s <sup>2</sup>	$9.8 \times 10^5$	$5.36 \times 10^3$	1,000	980.66	335.1	13.887	2.327	1	0.8679	$7.23 \times 10^{-2}$
	lb-in-s <sup>2</sup>	$1.129 \times 10^4$	$6.177 \times 10^3$	$1.152 \times 10^3$	$1.129 \times 10^3$	386.08	16	2.681	1.152	1	$8.33 \times 10^{-2}$
lb-ft-s <sup>2</sup>	$1.355 \times 10^7$	$7.41 \times 10^4$	$1.38 \times 10^4$	$1.35 \times 10^4$	$4.63 \times 10^3$	192	32.17	13.825	12	1	

ANGULAR VELOCITY		B			
		deg/s	rad/s	rpm	rps
A	deg/s	1	$1.75 \times 10^{-2}$	0.167	$2.78 \times 10^{-3}$
	rad/s	57.3	1	9.55	0.159
	rpm	6	0.105	1	$1.67 \times 10^{-2}$
	rps	360	6.28	60	1

## TEMPERATURE

$$^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32$$

$$^{\circ}\text{C} = .555 \times (^{\circ}\text{F} - 32)$$

LINEAR VELOCITY		B					
		in/min	ft/min	in/sec	ft/sec	mm/sec	m/sec
A	in/min	1	0.0833	0.0167	$1.39 \times 10^{-3}$	0.42	$4.2 \times 10^{-4}$
	ft/min	12	1	0.2	0.0167	5.08	$5.08 \times 10^{-3}$
	in/sec	60	5	1	0.083	25.4	0.0254
	ft/sec	720	60	12	1	304.8	0.3048
	cm/sec	23.62	1.97	0.3937	0.0328	10	0.01
	m/sec	2362.2	196.9	39.37	3.281	1000	1

## GRAVITY

(Acceleration Constant)

$$g = 386 \text{ in/sec}^2 = 32.2 \text{ ft/sec}^2 = 9.8 \text{ m/sec}^2$$

# Terms / Conditions of Sale

**1. ORDER ACCEPTANCE.** All orders or services are subject to acceptance in Minnesota by the written approval of an authorized official of Tolomatic, Inc. Any such order shall be subject to these Terms and Conditions of Sale, and acceptance shall be conditioned on Purchaser's assent to such conditions. Purchaser's assent shall be deemed given unless Purchaser shall expressly notify Tolomatic, Inc. in writing to the contrary within five (5) days after receipt of acknowledgment to confirmation of an order.

**2. CANCELLATION AND CHANGES.** No order accepted by Tolomatic, Inc. may be modified in any manner by Purchaser unless agreed to in writing, by an authorized official of Tolomatic, Inc. Order cancellations, including reductions to order quantities, and changes shall be governed by the following:

- a. Any standard product order scheduled for shipment within five (5) working days of purchaser's request to cancel or modify will be shipped as previously acknowledged and purchaser agrees to accept shipment and payment responsibility, in full, at the price agreed upon.
- b. "Customer Special" orders scheduled for shipment within twenty (20) working days of purchaser's request to cancel or modify will be shipped as previously acknowledged and purchaser agrees to accept shipment and payment responsibility, in full, at the price agreed upon.
- c. All work in connection with "Customer Special" orders, not covered under Paragraph b, will be stopped immediately upon notification, and purchaser agrees to reimburse Tolomatic, Inc. for all work-in-process and any materials or supplies used, or for which commitments have been made by Tolomatic, Inc. in connection therewith.

**3. QUOTATIONS AND PRICES.** Written quotations automatically expire 30 calendar days from the date issued unless terminated sooner by written notice. (Verbal quotations expire, unless accepted in writing, the same day.)

All published prices and discounts are subject to change without notice. In the event of a net price change, the price of product(s) on order will be the price in effect on the date of order acknowledgment.

Any addition to an outstanding order will be accepted at prices in effect when the addition is made.

**4. MINIMUM BILLING.** Orders amounting to less than \$35.00 net will be billed at \$35.00

**5. TAXES.** Any Manufacturer's Tax, Retailers Occupation Tax, Use Tax, Sales Tax, Excise Tax, Duty, Customer, Inspection or Testing Fee, or any other tax, fee or charge of any nature whatsoever, imposed by any government authority, on or measured by any transactions between Tolomatic, Inc. and Purchaser shall be paid by the Purchaser in addition to the prices quoted or involved. In the event Tolomatic, Inc. shall be required to pay any such tax, fee or charge, Purchaser shall reimburse therefore.

**6. TERMS OF PAYMENT.** Net invoice amount is due within 30 days from date of invoice subject to credit approval. A 2% per month service charge shall apply to all invoices not paid within 30 days. All clerical errors are subject to correction. Any invoice in not paid within 60 days will subject that account to an immediate shipping hold.

**7. F.O.B. POINT.** All sales are F.O.B. Tolomatic, Inc.'s facility in Hamel, Minnesota, unless quoted otherwise.

**8. DELIVERY.** Delivery of product(s) by Tolomatic, Inc. to a carrier shall constitute delivery to Purchaser, and regardless of freight payment, title and all risk or loss or damage in transit shall pass to Purchaser at that time.

Should shipment be held beyond scheduled date, upon request of Purchaser, product will be billed and Purchaser agrees to accept any charges for warehousing, trucking and other expenses as may be incident to such delay.

Great care is taken by Tolomatic, Inc. in crating its product. Tolomatic, Inc. cannot be held responsible for breakage after having received "In Good Order" receipts from the transporting carrier. All claims for loss and damage must be made by Purchaser to the carrier within 14 days from receipt of goods. Tolomatic, Inc. will assist insofar as practical in securing satisfactory adjustment of such claims wherever possible.

Claims for shortages or other errors must be made, in writing, within ten (10) days to Tolomatic, Inc. and any additional expense of the method or route of shipment specified by Purchaser shall be borne by the Purchaser.

**9. SHIPPING SCHEDULES.** All quoted shipping schedules are approximate and will depend upon prompt receipt from Purchaser of confirming copy of Purchase Order. Dimensional drawings and specifications submitted by Tolomatic, Inc. to Purchaser for approval must be returned to Tolomatic, Inc. within 10 working days, with approval granted, and any exceptions noted, in order to avoid delay in manufacturing schedules.

Orders which include penalty clauses for failure to meet shipping schedules will not be acceptable, except in those cases specifically approved in writing by the General Manager of Tolomatic, Inc.

Tolomatic, Inc. shall not be liable for damage as a result of any delay due to any cause beyond Tolomatic, Inc.'s reasonable control, including, without limitation, an Act of Nature; act of Purchaser; embargo, or other government act, regulation or request; fire; accident; strike; slow down; war; riot; flood; delay in transportation; and inability to obtain necessary labor, materials or manufacturing facilities. In the event of any such delay, the date of delivery shall be extended for a period equal to the time loss by reason of the delay. The acceptance of the product when delivered shall constitute a waiver of all claims for damages caused by any such delays.

**10. RETURN OF PRODUCT.** No product may be returned without first obtaining a Return Goods Authorization form and confirming memorandum from Tolomatic, Inc. Product, if accepted for credit, shall be subject to a minimum service charge of 35% of the invoice price and all transportation charges shall be prepaid by the Purchaser; however, assembled products classified as "special," such as Cable Cylinders and other products which have been modified or built as "Customer Specials," are not returnable to Tolomatic, Inc.

**11. WARRANTY.** Tolomatic, Inc., WARRANTS PRODUCT MANUFACTURED BY IT TO BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF

ONE YEAR FROM DATE OF SHIPMENT BY Tolomatic, Inc. IF WITHIN SUCH PERIOD ANY SUCH PRODUCT SHALL BE PROVED TO Tolomatic, Inc.'s SATISFACTION TO BE SO DEFECTIVE, SUCH PRODUCT SHALL EITHER BE REPAIRED OR REPLACED AT Tolomatic, Inc.'s OPTION.

THIS WARRANTY SHALL NOT APPLY:

- a. TO PRODUCT NOT MANUFACTURED BY Tolomatic, Inc. WITH RESPECT TO PRODUCT NOT MANUFACTURED BY Tolomatic, Inc. THE WARRANTY OBLIGATIONS OF Tolomatic, Inc. SHALL IN ALL RESPECTS CONFORM AND BE LIMITED TO THE WARRANTY ACTUALLY EXTENDED TO Tolomatic, Inc. BY ITS SUPPLIER.
- b. TO PRODUCT WHICH SHALL HAVE BEEN REPAIRED OR ALTERED BY PARTIES OTHER THAN Tolomatic, Inc. SO AS, IN Tolomatic, Inc.'s JUDGMENT, TO AFFECT THE SAME ADVERSELY, OR
- c. TO PRODUCT WHICH SHALL HAVE BEEN SUBJECT TO NEGLIGENCE, ACCIDENT, OR DAMAGE BY CIRCUMSTANCES BEYOND THE CONTROL OF Tolomatic, Inc. OR TO IMPROPER OPERATION MAINTENANCE OR STORAGE, OR TO OTHER THAN NORMAL USE AND SERVICE.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES WHATSOEVER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, Tolomatic, Inc. SHALL NOT BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES WHATSOEVER WITH RESPECT TO PRODUCT MANUFACTURED OR SUPPLIED BY Tolomatic, Inc. OR SERVICE RENDERED BY IT.

**12. CONSEQUENTIAL DAMAGE.** Tolomatic, Inc. shall not, under any circumstances, be liable for consequential damages.

**13. SERVICE CHARGES.** Should the Purchaser request the service of any erector, demonstrator or service man (except as specifically provided for and included in the price of the product) such service will be rendered at the rate outlined in the schedule of field service charges in effect at the date of request.

ABT  
MXP  
BC2  
BC3  
BC4  
LS  
MG  
CC  
PB  
ENGR

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