

CABLE CYLINDER



CABLE CYLINDER

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Introduced in 1955 as the first rodless cylinder, the Tol-O-Matic 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, Tol-O-Matic 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 Tol-O-Matic cable cylinder that can do the job for you.



CABLE CYLINDER



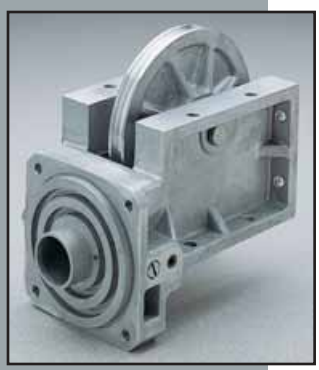
High-strength, light-weight aluminum piston pulls the cables when actuated by pneumatic or hydraulic pressure.



Light-weight 6063-T832 black anodized aluminum or steel tubing protects and houses the piston.



Patented gland seals provide a tight seal for cables to pass through with the convenience of easy installation. "Snap In/Out" Cable Seals* featured on the 1/2-, 3/4- and 1-inch bore cylinders and Encapsulated Gland Seals** featured on the 1 1/2 through 4-inch bore cylinders provide longer-lasting, trouble-free performance.



Die-cast aluminum head assemblies which house the gland seals and pulley offers hydraulic or pneumatic porting capabilities with two or three port options.

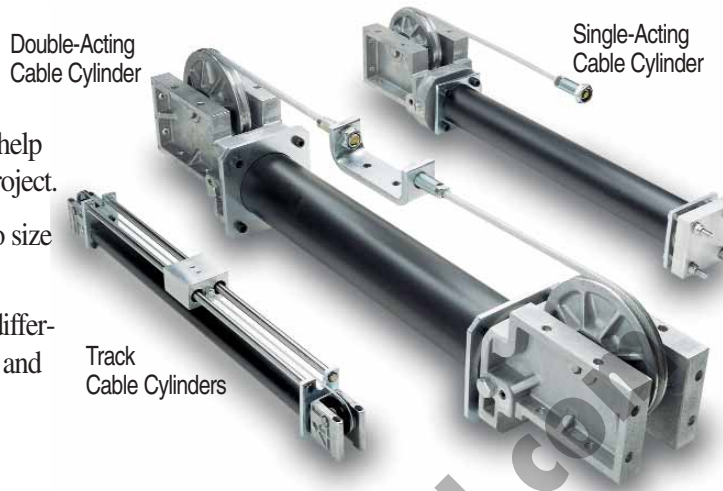


Steel clevis has cable tension adjustment points and threaded holes for load attachment.



Nylon jacketed aircraft cables transmit piston thrust to the clevis. Manufactured under Mil Spec. MIL-W-83420D, these cables provide millions of cycles of uninterrupted service.

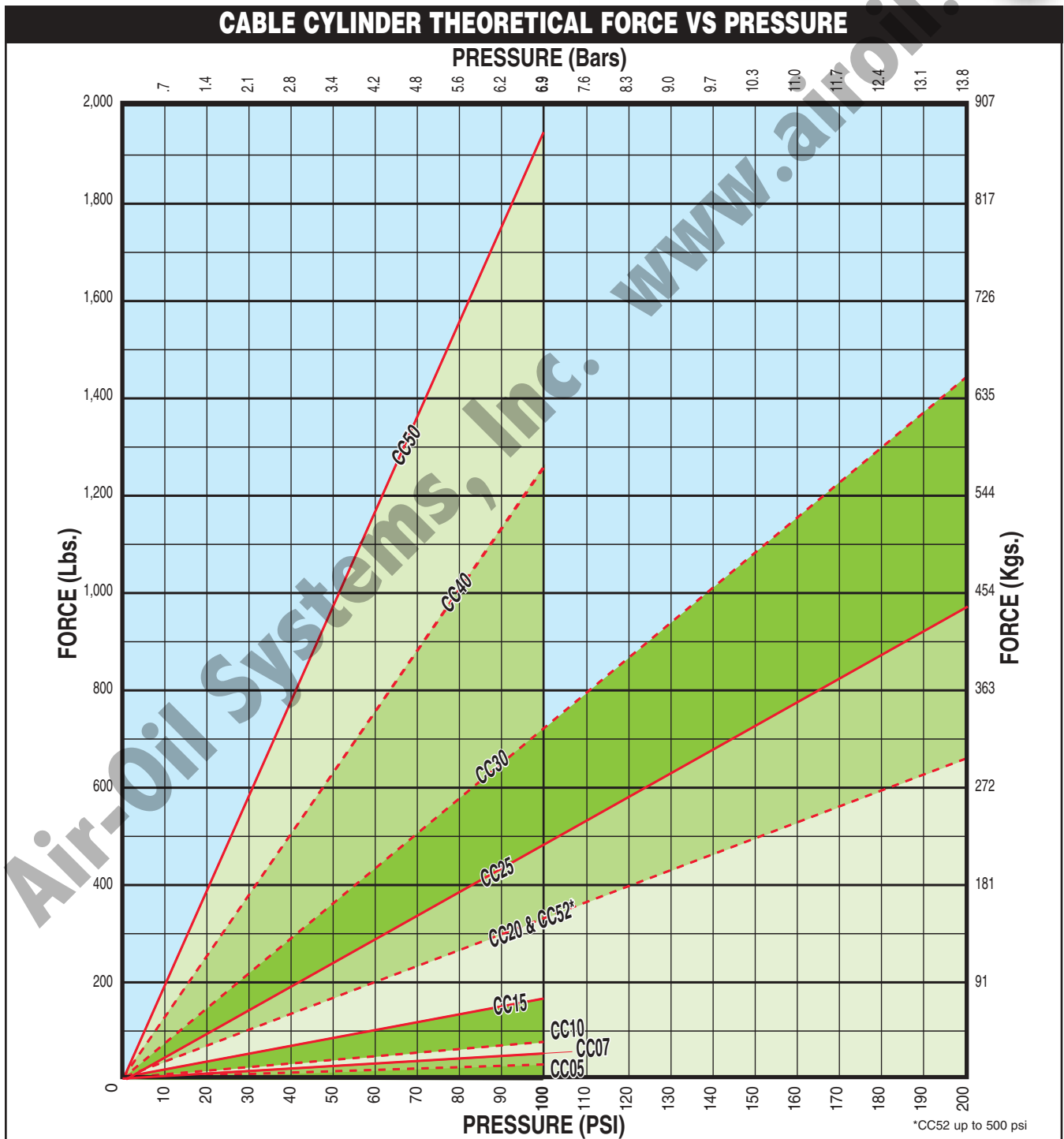
* U.S. Patent No. 4,057,257
** U.S. Patent No. 4,121,840



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

Refer to page 130 in this section to find step by step directions to size and select the best rodless cylinder for the job.

The following pages detail each of the nine bore sizes and four different types of the Cable Cylinder, giving bore size, weights, force, and available options.



DOUBLE-ACTING CABLE CYLINDERS

The Tol-O-Matic 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 with out 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	128, 197
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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	120	-	OP	OP	OP	OP	OP	OP	OP	OP	-
AUTO TENSIONER WITH TWO 1" STROKE UNITS	120	-	OP	OP	OP	OP	OP	OP	OP	OP	-
AUTO TENSIONER WITH ONE 2" STROKE UNIT	120	-	-	-	-	OP	OP	OP	OP	OP	OP
AUTO TENSIONER WITH TWO 2" STROKE UNITS	120	-	-	-	-	OP	OP	OP	OP	OP	OP
CALIPER DISC BRAKE	123	-	-	-	OP	OP	OP	OP	OP	OP	-
SWITCHES (DC REED & AC TRIAC)*	174	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	OP
3-PORTED HEADS		OP	OP	OP	OP	OP	OP	OP	OP	OP	OP

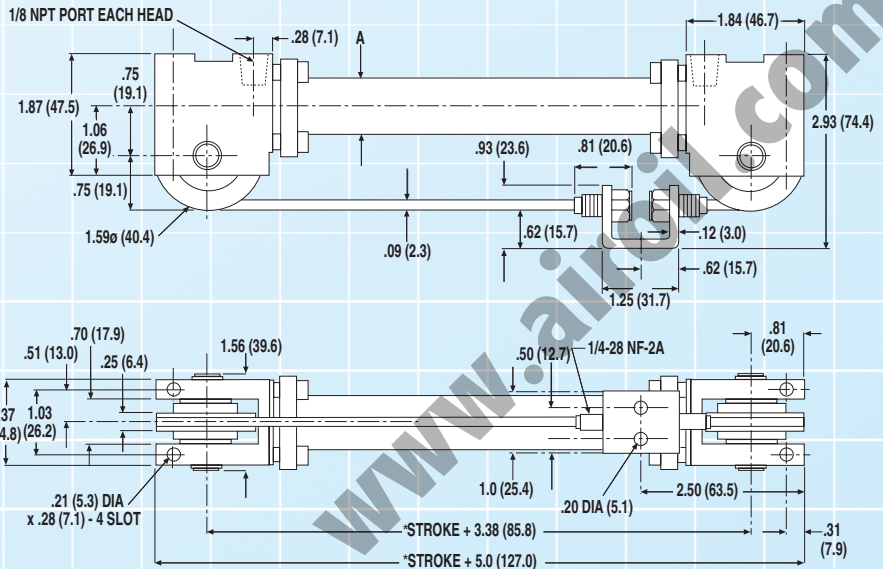
*Switches can NOT be used with steel tube option - Not Available OP Optional ST Standard

CC05, CC07, CC10



DIMENSIONAL DATA

For Assistance Call
1-800-328-2174
(Toll Free U.S. and Canada)
or
763-478-8000
Fax 763-478-8080



	CC05	CC07	CC10
A	.69 (17.4)	1.00 (25.4)	1.25 (31.8)

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

	CC05	CC07	CC10
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

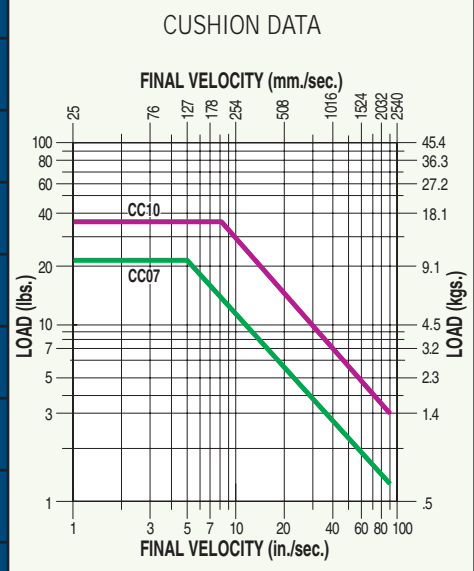
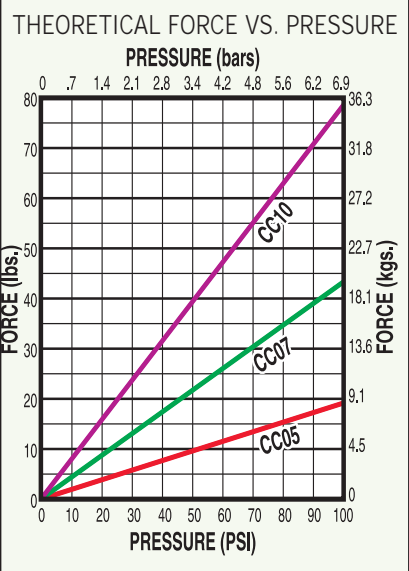
CABLE SPECIFICATIONS

	CC05	CC07	CC10
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.

CABLE CYLINDER

PERFORMANCE DATA

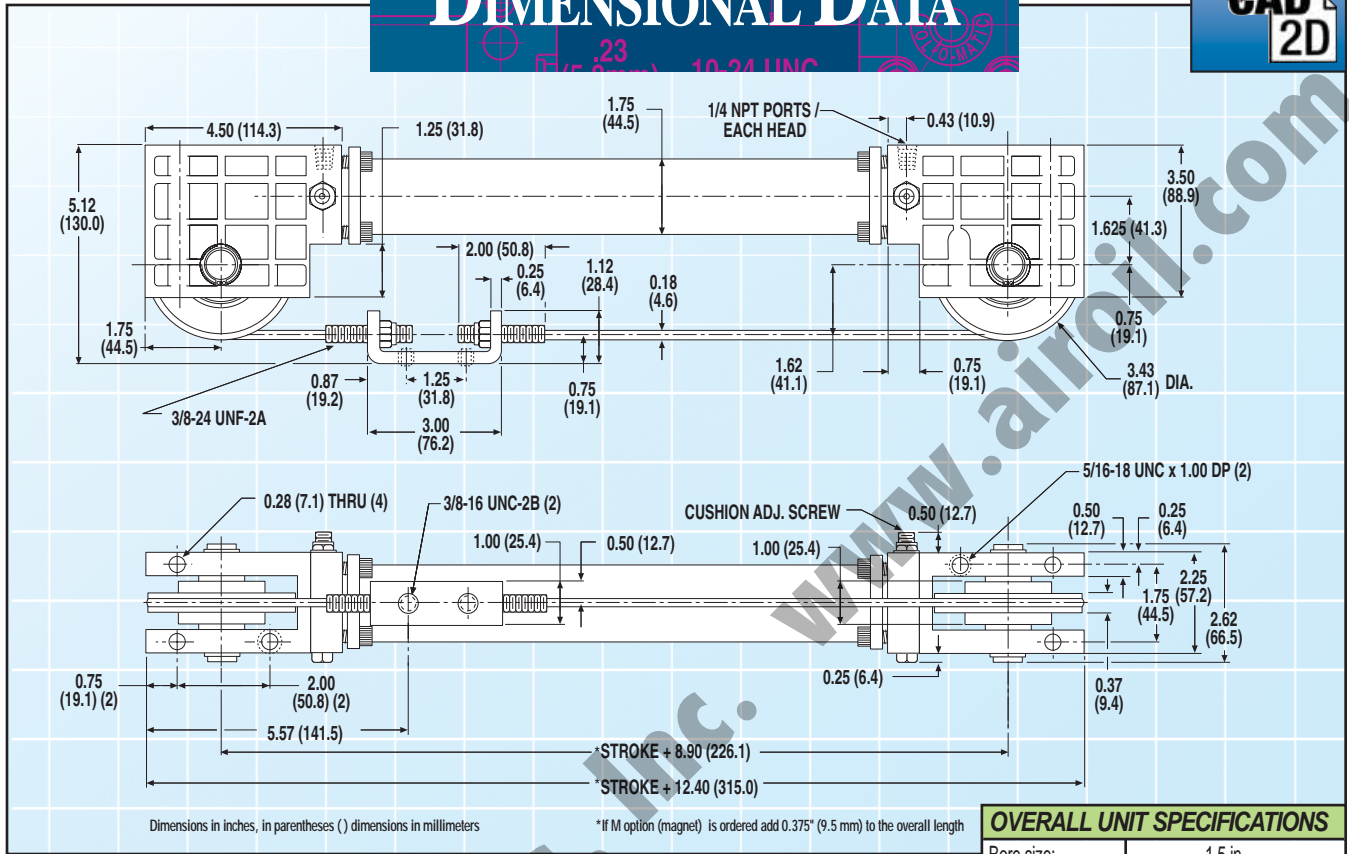


CC10
CC07
CC05

NOTE: The CC05 cylinder does not have cushions.



DIMENSIONAL DATA



OVERALL UNIT SPECIFICATIONS

Bore size:	1.5 in.	
Max. stroke	282.59 in.	7177.9 mm
Base wt.(Alum):	5.12 lbs.	2.32 kgs.
Base wt.(Steel):	5.27 lbs.	2.39 kgs.
Wt. per in. [25mm] of stroke (Alum)	.063 lbs.	.0286 kgs.
Wt. per in. [25mm] of stroke (Steel)	.181 lbs.	.0821 kgs.
Max. Pressure:	100 PSI	6.9 bars
Max. temp.:	140° F	60° C
Max. force output:	174 lbs.	78.92 kgs.

TUBING SPECIFICATIONS

Dead length *:	3.40 in.	86.4 mm
Wall thickness:	0.125 in.	3.175 mm
Material:	Alum. or Steel	
Tube support span: (Alum)	7 ft.	2.13 m
Tube support span: (Steel)	7.5 ft.	2.29 m

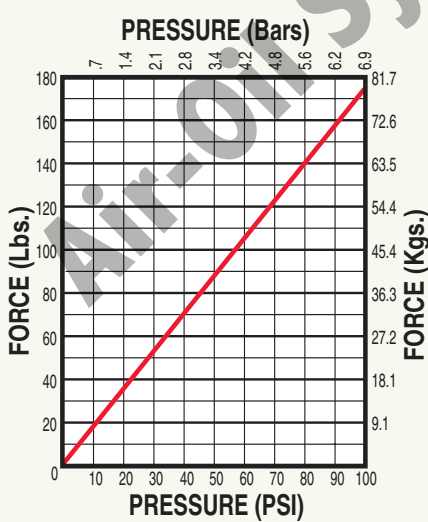
CABLE SPECIFICATIONS

Wire dia.:	0.0937 in.	2.380 mm
Nylon O.D.:	0.187 in.	4.750 mm
Strand configuration:	7 x 7	
Tensile strength:	920 lbs.	417.30 kgs.
Proof-load torque:	45 in.-lbs.	5.08 N-m
Pretensioning torque:	8 in.-lbs.	0.90 N-m

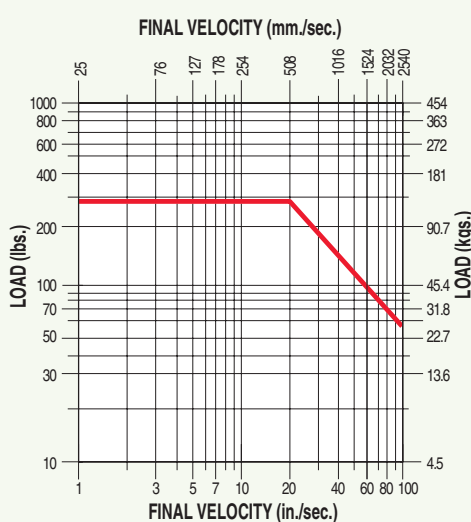
* Add to stroke length.

PERFORMANCE DATA

THEORETICAL FORCE VS. PRESSURE



CUSHION DATA

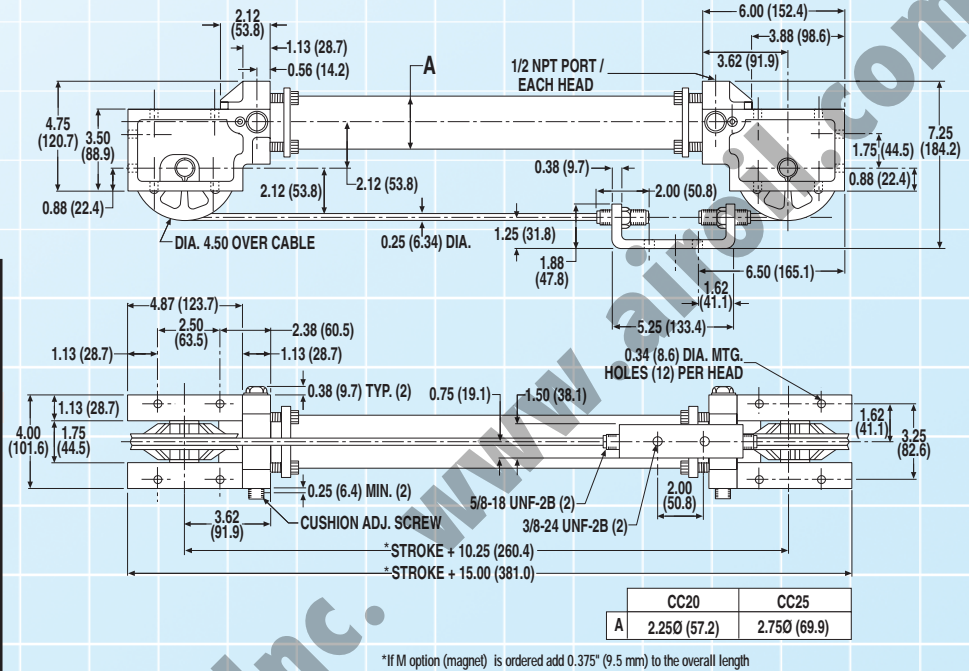


CC20, CC25

2D CAD AVAILABLE AT
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DIMENSIONAL DATA



*If M option (magnet) is ordered add 0.375" (9.5 mm) to the overall length

Dimensions in inches, in parentheses () dimensions in millimeters

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Fax 763-478-8080

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

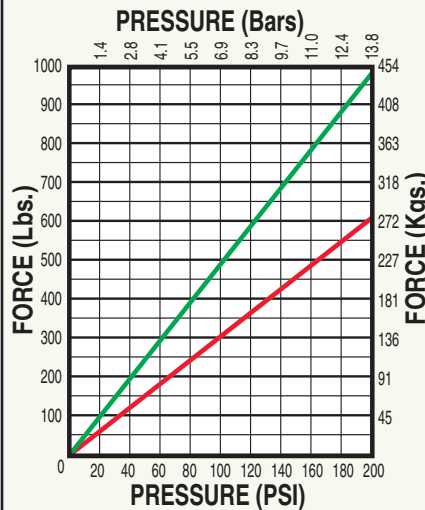
CABLE SPECIFICATIONS

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

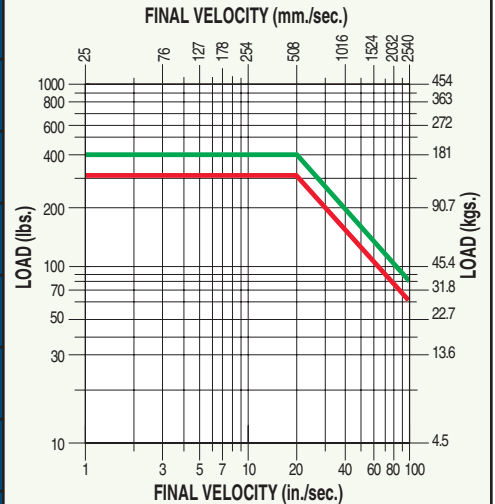
* Add to stroke length.

PERFORMANCE DATA

THEORETICAL FORCE VS. PRESSURE



CUSHION DATA



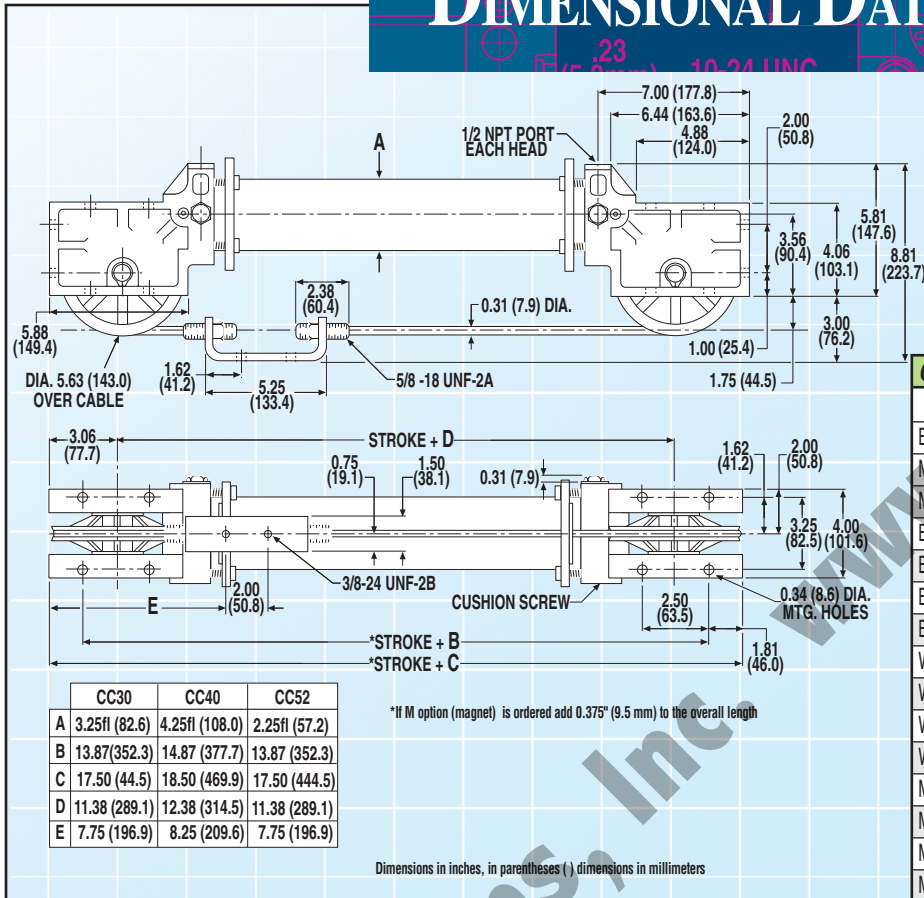
CC25
CC20

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

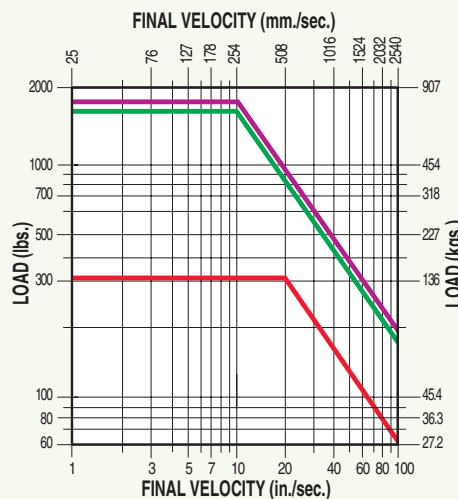
PERFORMANCE DATA

THEORETICAL FORCE VS. PRESSURE



CUSHION DATA

PLEASE SEE PAGE 197 APPLICATION GUIDELINES #2



TUBING SPECIFICATIONS

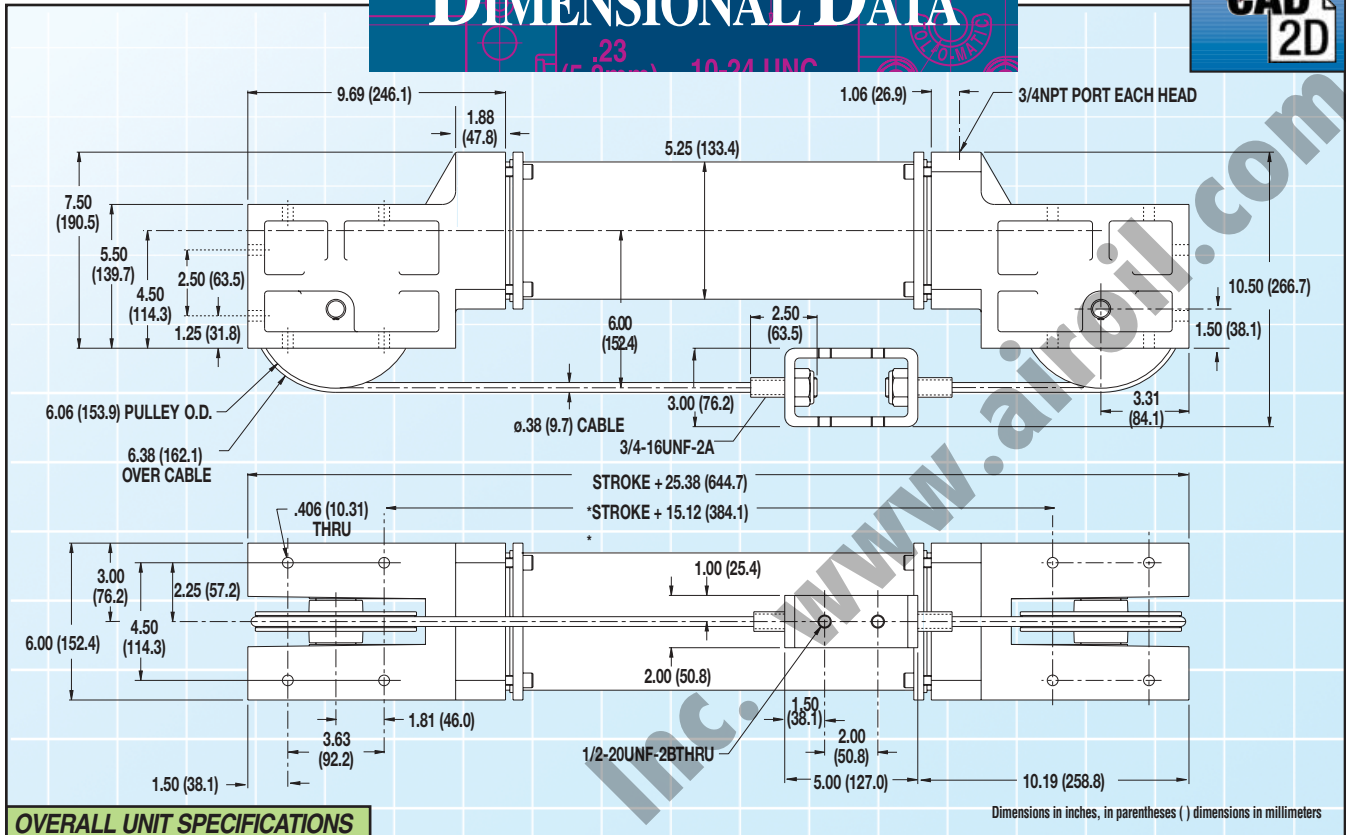
	CC30	CC40	CC52
Dead length * (in.):	3.5	4.5	3
Dead length * (mm.):	88.9	114.3	76.2
Wall thickness (in.):	0.125	0.125	0.125
Wall thickness (mm.):	3.175	3.175	3.175
Material:	Alum. or Steel	Alum. or Steel	Alum. or Steel
Tube support span (ft.) (Alum.):	8.5	9	8
Tube support span (m.) (Alum.):	2.59	2.74	2.44
Tube support span (ft.) (Steel):	10	11	8
Tube support span (m.) (Steel):	3.05	3.35	2.44

CABLE SPECIFICATIONS

	CC30	CC40	CC52
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.

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

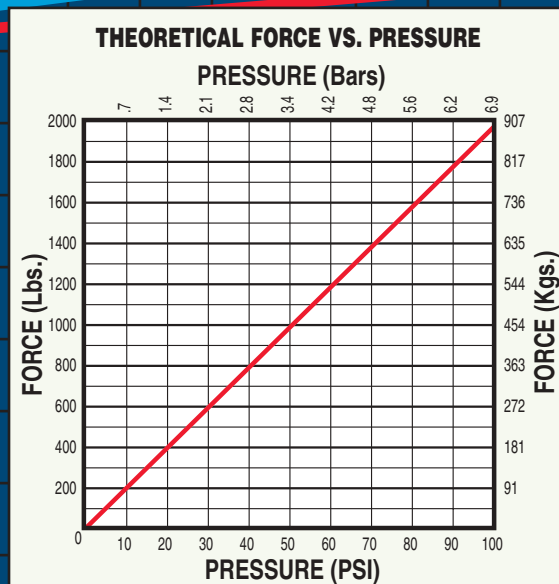
Dead length *:	6 in.	152.4 mm
Wall thickness:	0.125 in.	3.175 mm
Material:	Alum.	
Tube support span: (Alum)	13.9 ft.	4.24 m
Tube support span: (Steel)	NA	

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.

SINGLE-ACTING CABLE CYLINDERS

When a standard double-acting cable cylinder is not necessary in vertical applications, Tol-O-Matic 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. Tol-O-Matic 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 104)



SA - CABLE CYLINDER	
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FEATURES AVAILABLE FOR SINGLE-ACTING CABLE CYLINDERS

NOTE: Single-ported heads are standard on all base models.

FEATURES	PAGE #	SA07	SA10	SA15	SA50	SA20	SA25	SA30	SA40	SA52
SWITCHES (DC REED & AC TRIAC)*	174	OP	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	OP
3-PORTED HEAD		OP	OP	OP	OP	OP	OP	OP	OP	OP

*Switches can NOT be used with steel tube option - Not Available OP Optional ST Standard

SA07, SA10, SA15

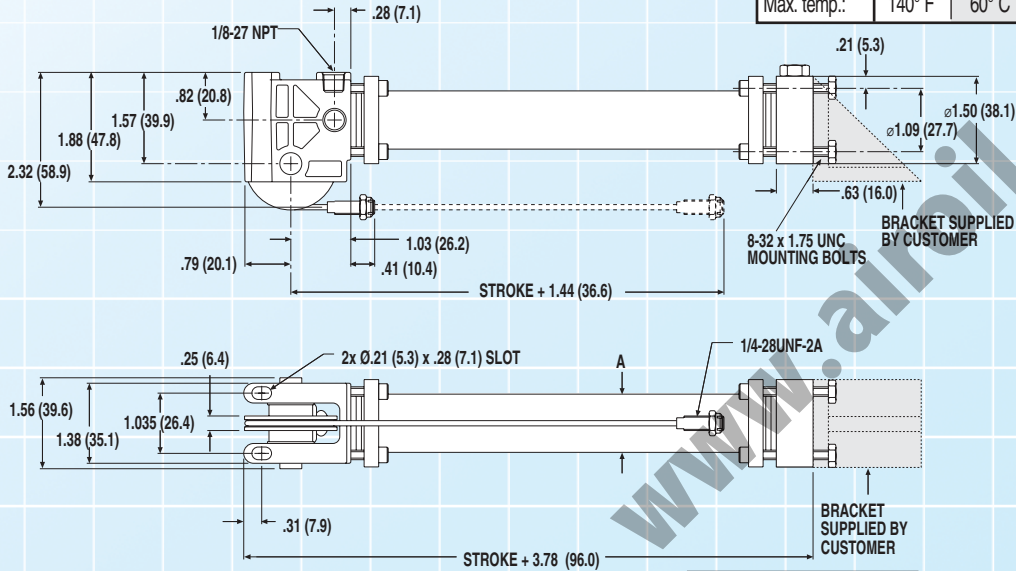
SA07, SA10

DIMENSIONAL DATA

OVERALL UNIT SPECIFICATIONS

	SA07		SA10	
Bore size:	.75 in.		1.0 in.	
Max. stroke:	139.19 in.	3535.4	283.06	7189.7
Max. pressure:	100 PSI	6.9 bars	100 PSI	6.9 bars
Max. temp.:	140° F	60° C	140° F	60° C

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WWW.TOLOMATIC.COM



Dimensions in inches, in parentheses () dimensions in millimeters

*If M option (magnet) is ordered add 1.62" (41.2 mm) to the overall length

	SA07	SA10
A	1.00Ø (25.4)	1.25Ø (31.8)

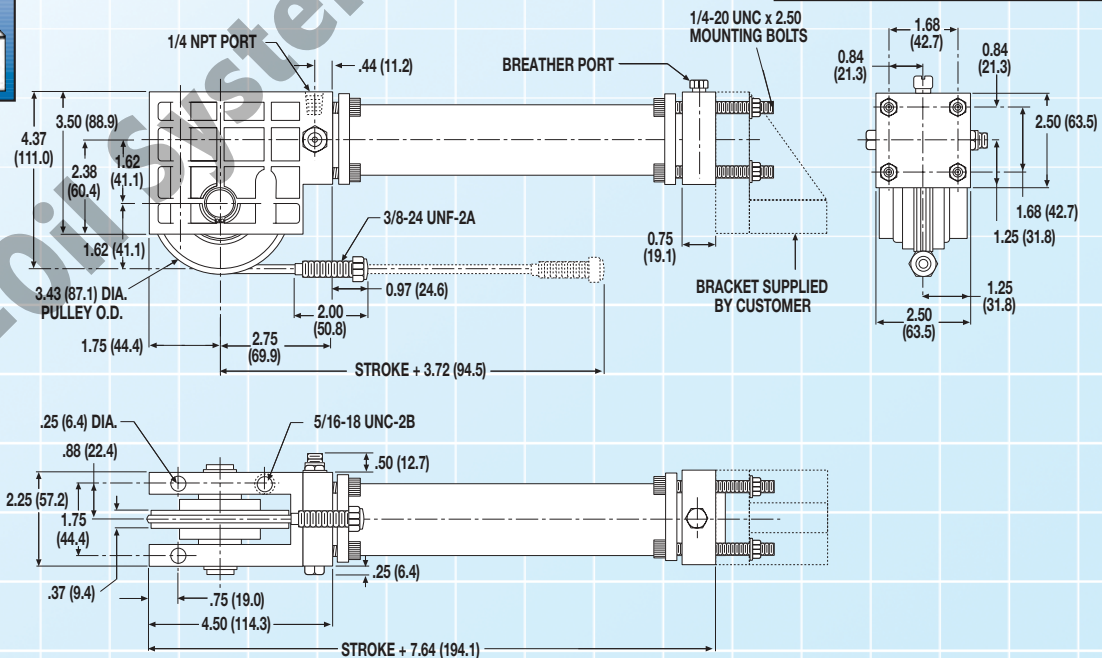
SA15

DIMENSIONAL DATA

OVERALL UNIT SPECIFICATIONS

	SA15	
Bore size:	1.5 in.	
Max. stroke:	283.24 in.	7194.2 mm
Max. pressure:	100 PSI	6.9 bars
Max. temp.:	140° F	60° C

2D CAD AVAILABLE AT
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Dimensions in inches, in parentheses () dimensions in millimeters

*If M option (magnet) is ordered add 0.375" (9.5 mm) to the overall length

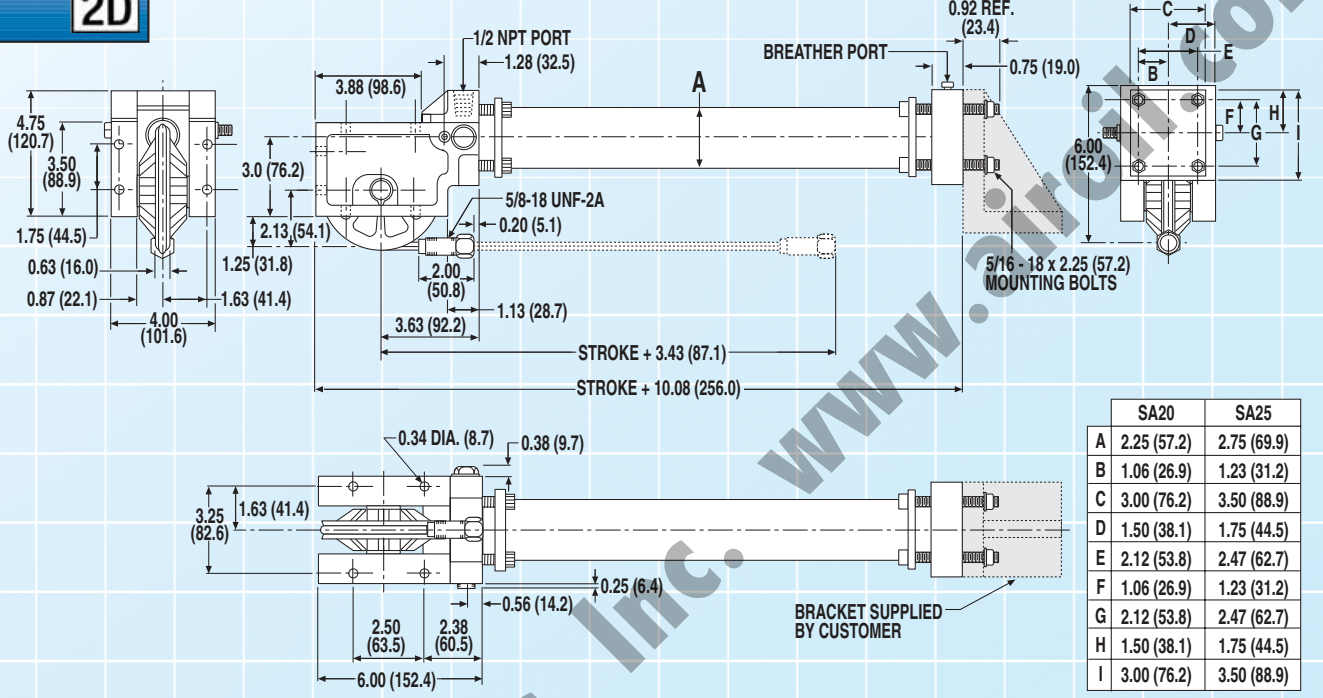
CABLE CYLINDER

SA20, SA25

SA20, SA25

DIMENSIONAL DATA

OVERALL UNIT SPECIFICATIONS		
	SA20	SA25
Bore size:	2.0 in.	2.5 in.
Max. stroke:	282.62 in. / 7178.5 mm	282.38 in. / 7172.4 mm
Max. pressure:	200 PSI / 13.8 bars	200 PSI / 13.8 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 0.375" (9.5 mm) to the overall length

CABLE CYLINDER

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 (Toll Free U.S. and Canada)
 or
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 Fax 763-478-8080

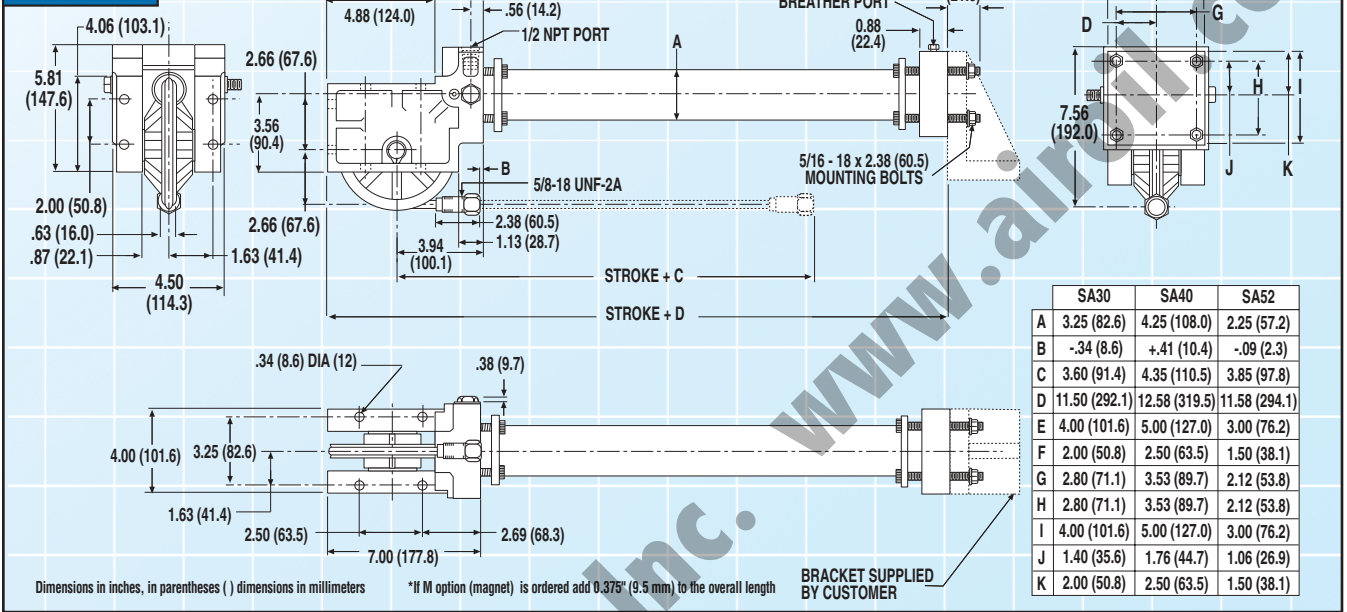
SA30, SA40, SA52, SA50

SA30, SA40,
SA52

DIMENSIONAL DATA

OVERALL UNIT SPECIFICATIONS

	SA30	SA40	SA52
Bore size:	3.0 in.	4.0 in.	2.0 in.
Max. stroke	282.12" 7165mm	280.87" 7134mm	281.87" 7159mm
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

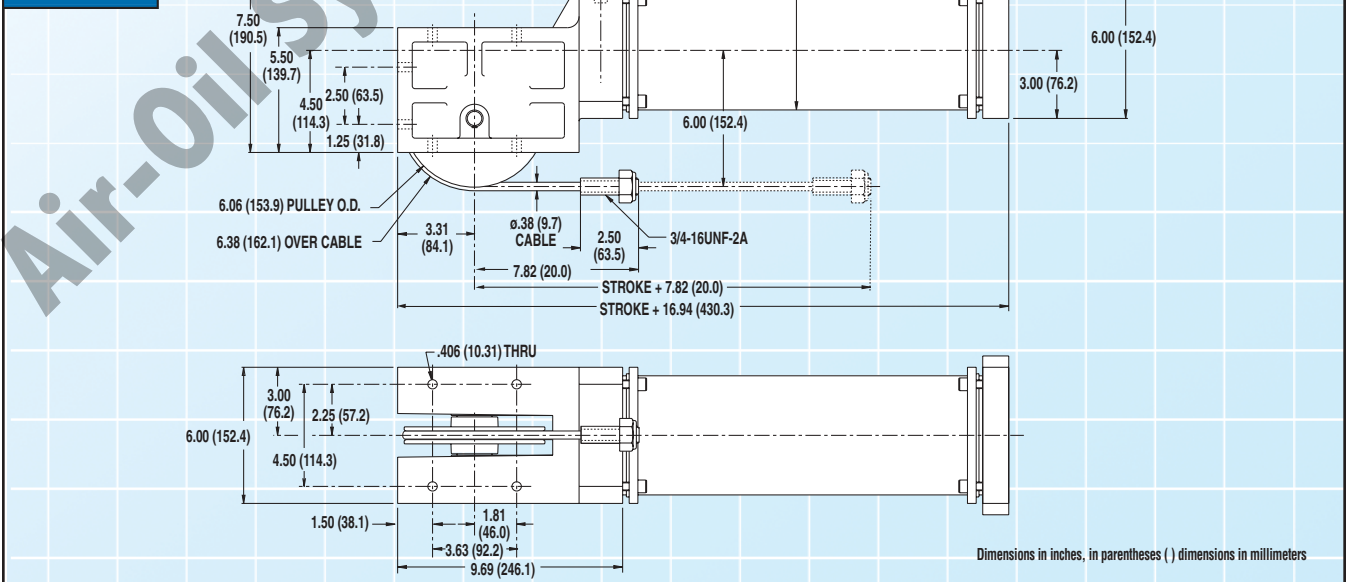


SA50

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



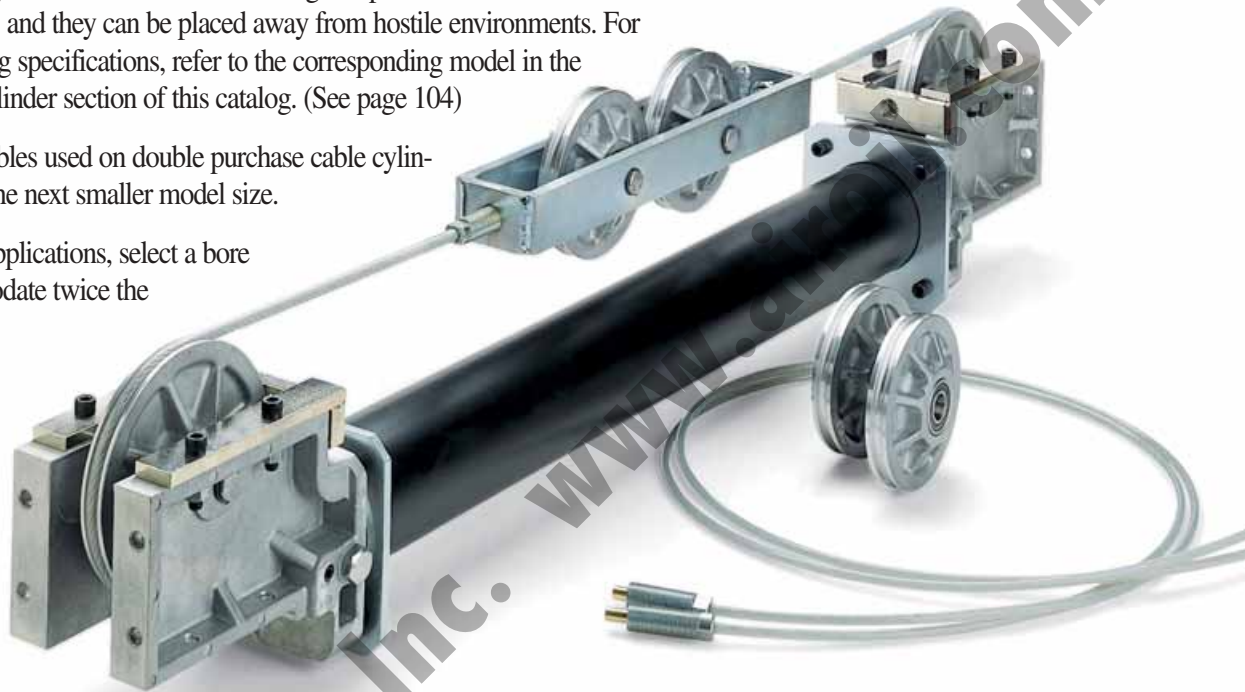
CABLE CYLINDER

DOUBLE PURCHASE CABLE CYLINDERS

The Tol-O-Matic 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 104)

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	128, 197
CUSHION NEEDLE ADJ.	197
LUBRICATION GUIDELINES	129
ORDERING	126
SELECTION	130
SELECTION (HN, HM)	132

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	120	OP	OP	OP	OP	OP	OP
AUTO TENSIONER WITH TWO 1" STROKE UNITS	120	OP	OP	OP	OP	OP	OP
AUTO TENSIONER WITH ONE 2" STROKE UNIT	120	-	OP	OP	OP	OP	OP
AUTO TENSIONER WITH TWO 2" STROKE UNITS	120	-	OP	OP	OP	OP	OP
CALIPER DISC BRAKE	123	OP	OP	OP	OP	OP	OP
SWITCHES (DC REED & AC TRIAC)*	174	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

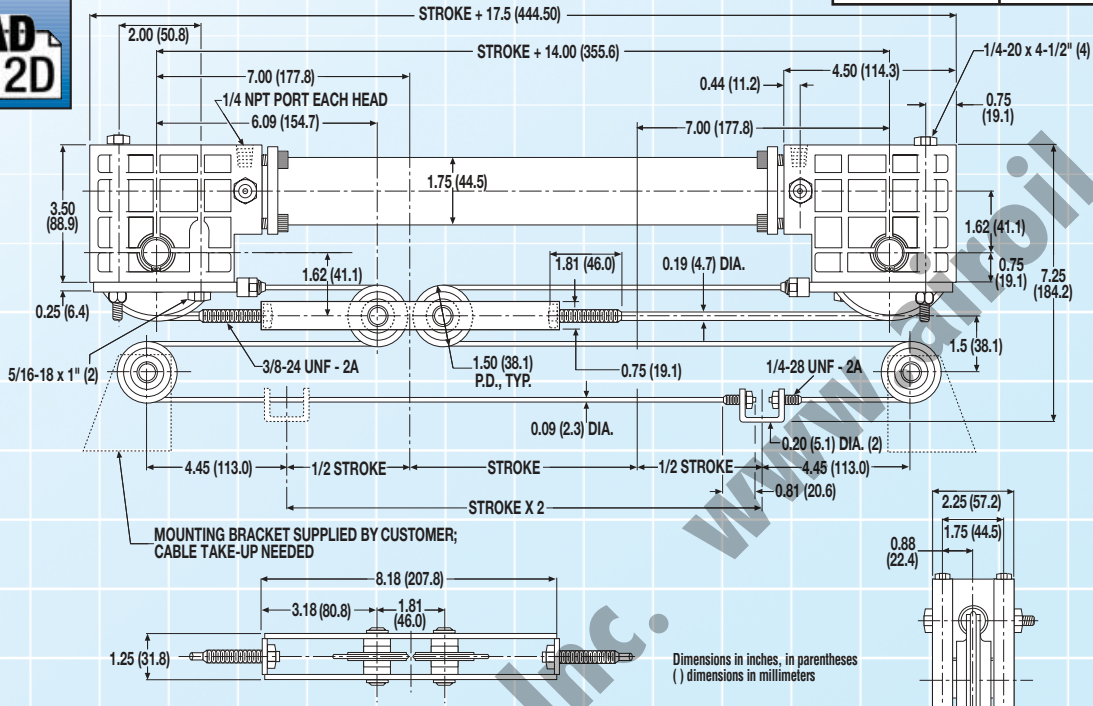
*Switches can NOT be used with steel tube option – Not Available OP Optional ST Standard

DP15, DP20, DP25

DP15

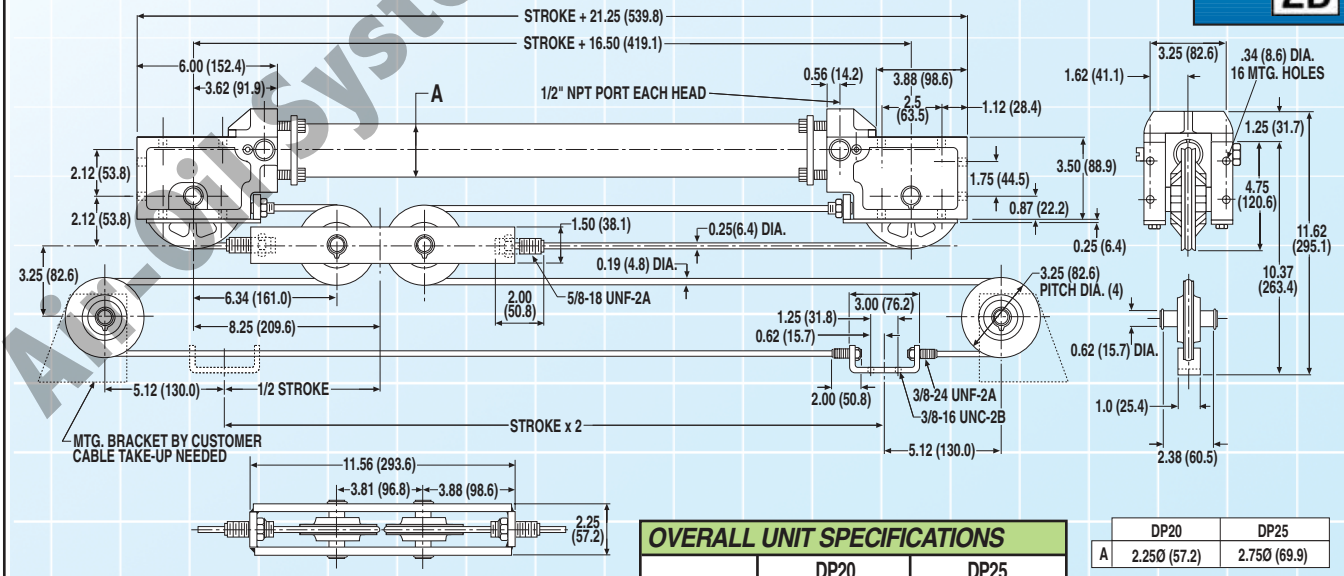
DIMENSIONAL DATA

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

DIMENSIONAL DATA



OVERALL UNIT SPECIFICATIONS				
	DP20		DP25	
Bore size:	2.0 in.		2.5 in.	
Max. stroke:	228.75"	5810mm	252.75"	6419mm
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	2.25Ø (57.2)	2.75Ø (69.9)

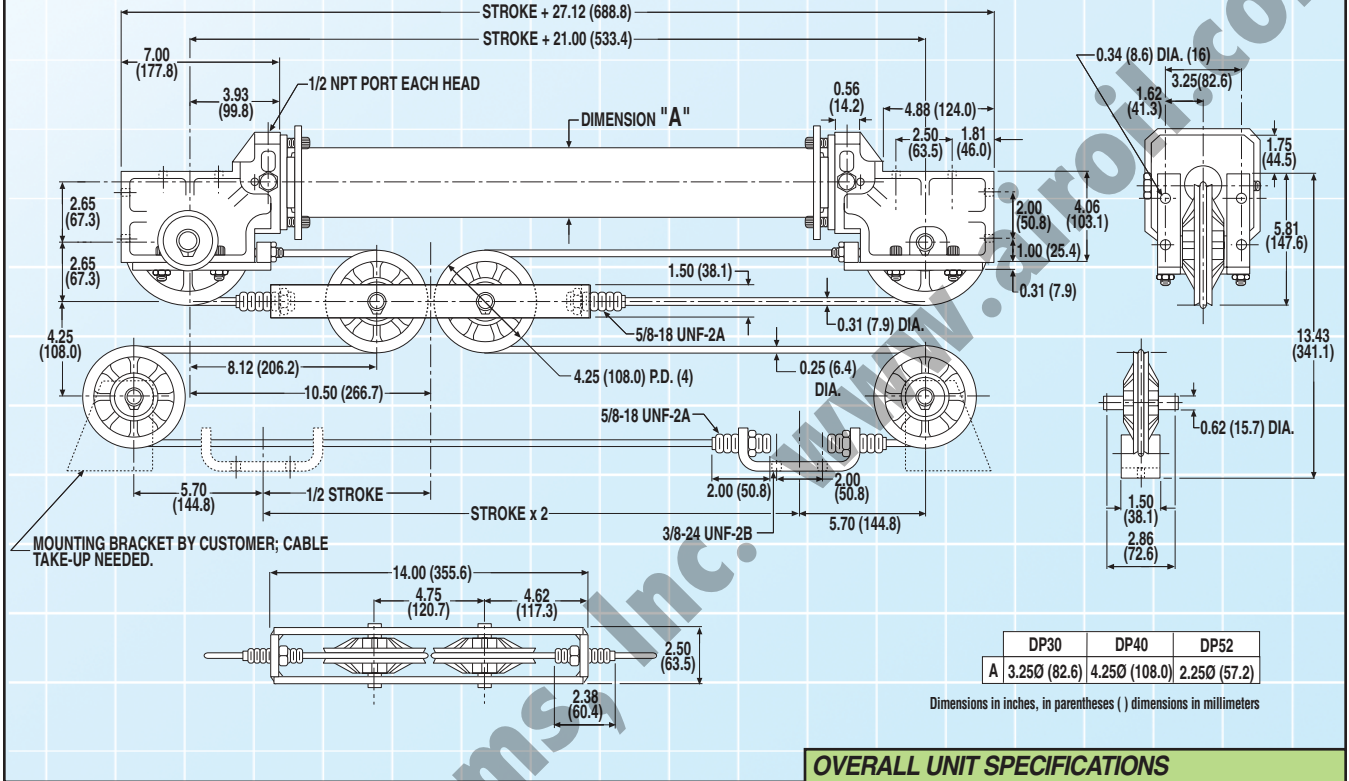
CABLE CYLINDER

DP30, DP40, DP52

DP30, DP40,
DP52

DIMENSIONAL DATA

2D CAD AVAILABLE AT
WWW.TOLOMATIC.COM



OVERALL UNIT SPECIFICATIONS

	DP30	DP40	DP52
Bore size:	3.0 in.	4.0 in.	2.0 in.
Max. stroke	248.88" 6321mm	248.88" 6321mm	272.88" 6931mm
Max. pressure:	200 PSI 13.8 bar	100 PSI 13.8 bar	500 PSI 34.5 bar
Max. temp.:	140° F 60° C	140° F 60° C	140° F 60° C

CABLE CYLINDER

Air-Oil Systems Inc.

For Assistance Call
1-800-328-2174
(Toll Free U.S. and Canada)
or
763-478-8000
Fax 763-478-8080

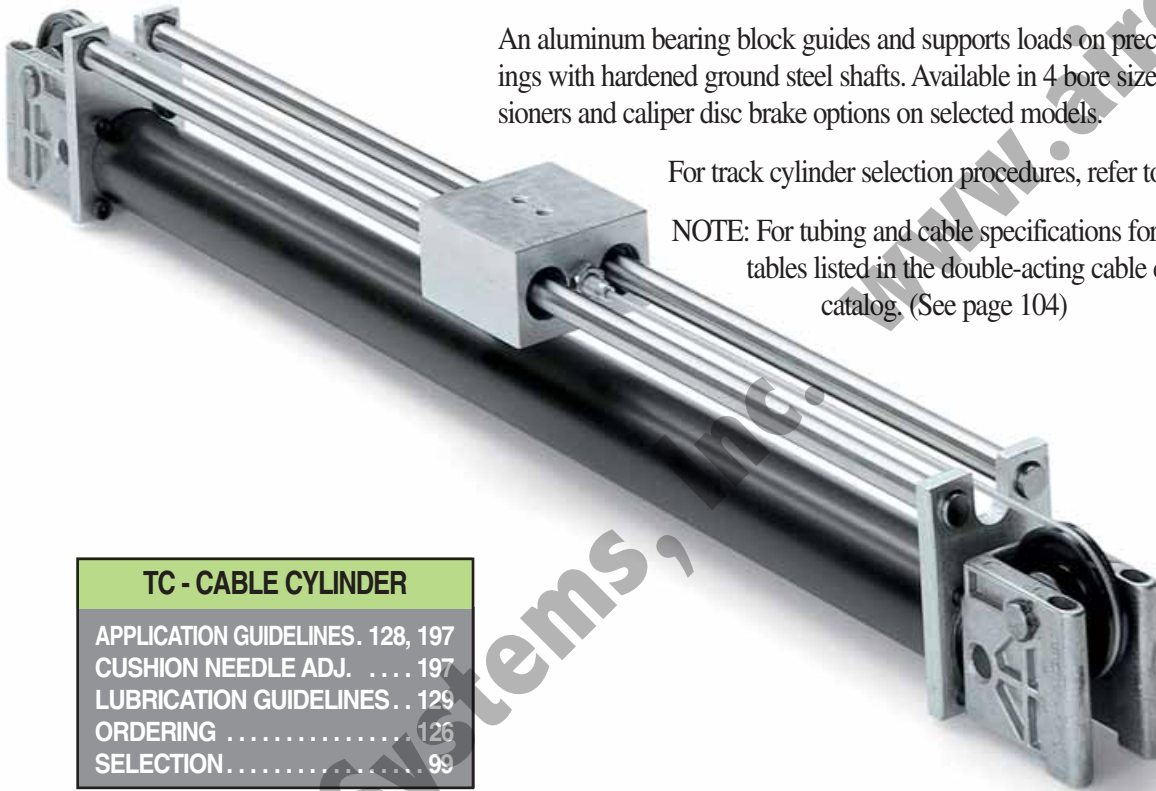
TRACK CABLE CYLINDERS

Tol-O-Matic 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 99.

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 104)



TC - CABLE CYLINDER

APPLICATION GUIDELINES	128, 197
CUSHION NEEDLE ADJ.	197
LUBRICATION GUIDELINES	129
ORDERING	126
SELECTION	99

FEATURES AVAILABLE FOR TRACK CABLE CYLINDERS

NOTE: Single-ported heads are standard on all base models.

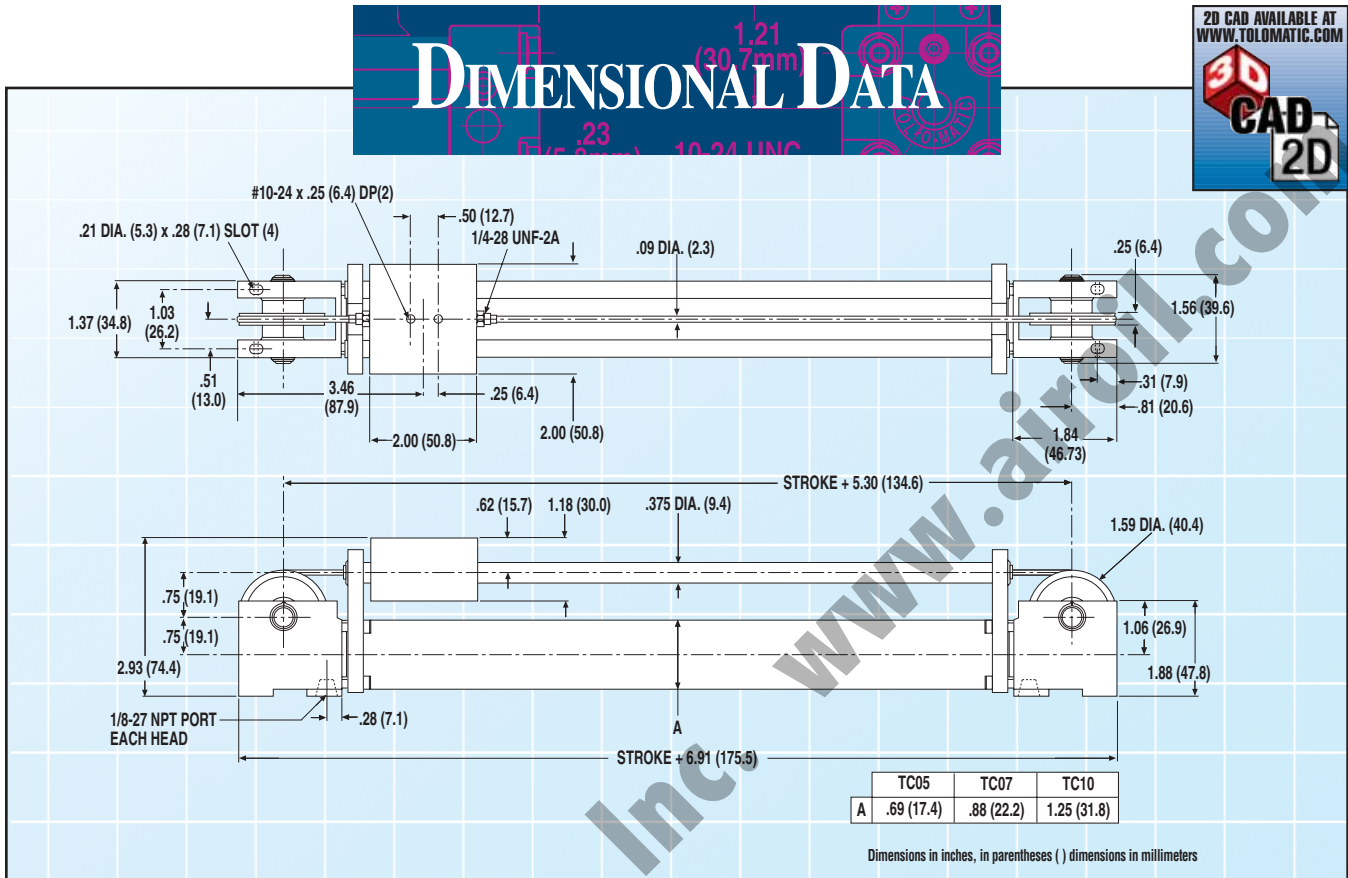
FEATURES	PAGE	TC05	TC07	TC10	TC15
AUTO TENSIONER WITH ONE 1" STROKE UNIT	120	-	OP	OP	OP
AUTO TENSIONER WITH TWO 1" STROKE UNITS	120	-	OP	OP	OP
CALIPER DISC BRAKE	123	-	-	-	OP
SWITCHES (DC REED & AC TRIAC)*	174	OP	OP	OP	OP
ALUMINUM TUBE		ST	ST	ST	ST
STEEL TUBE		-	-	OP	OP
SEALS OF VITON® MATERIAL		-	OP	OP	OP
3-PORTED HEADS		-	OP	OP	OP

*Switches can NOT be used with steel tube option - Not Available OP Optional ST Standard

TC05, TC07, TC10

DIMENSIONAL DATA

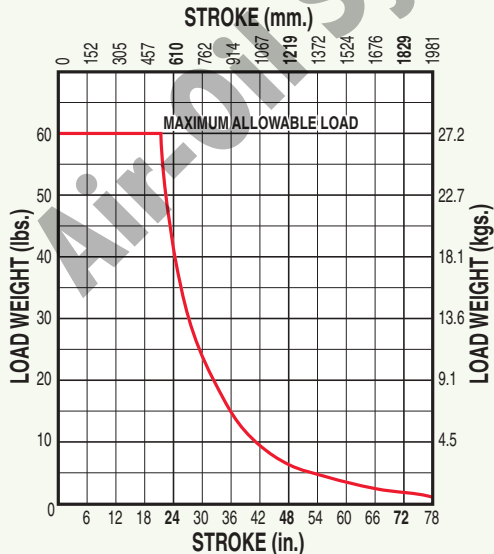
2D CAD AVAILABLE AT
WWW.TOLOMATIC.COM



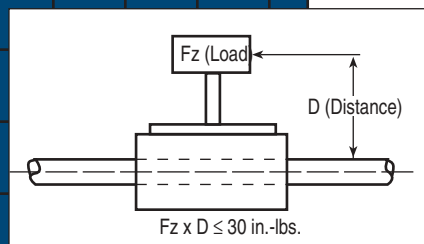
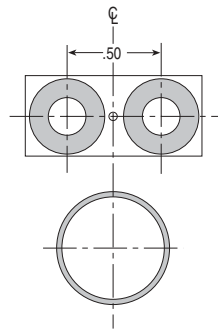
PERFORMANCE DATA

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



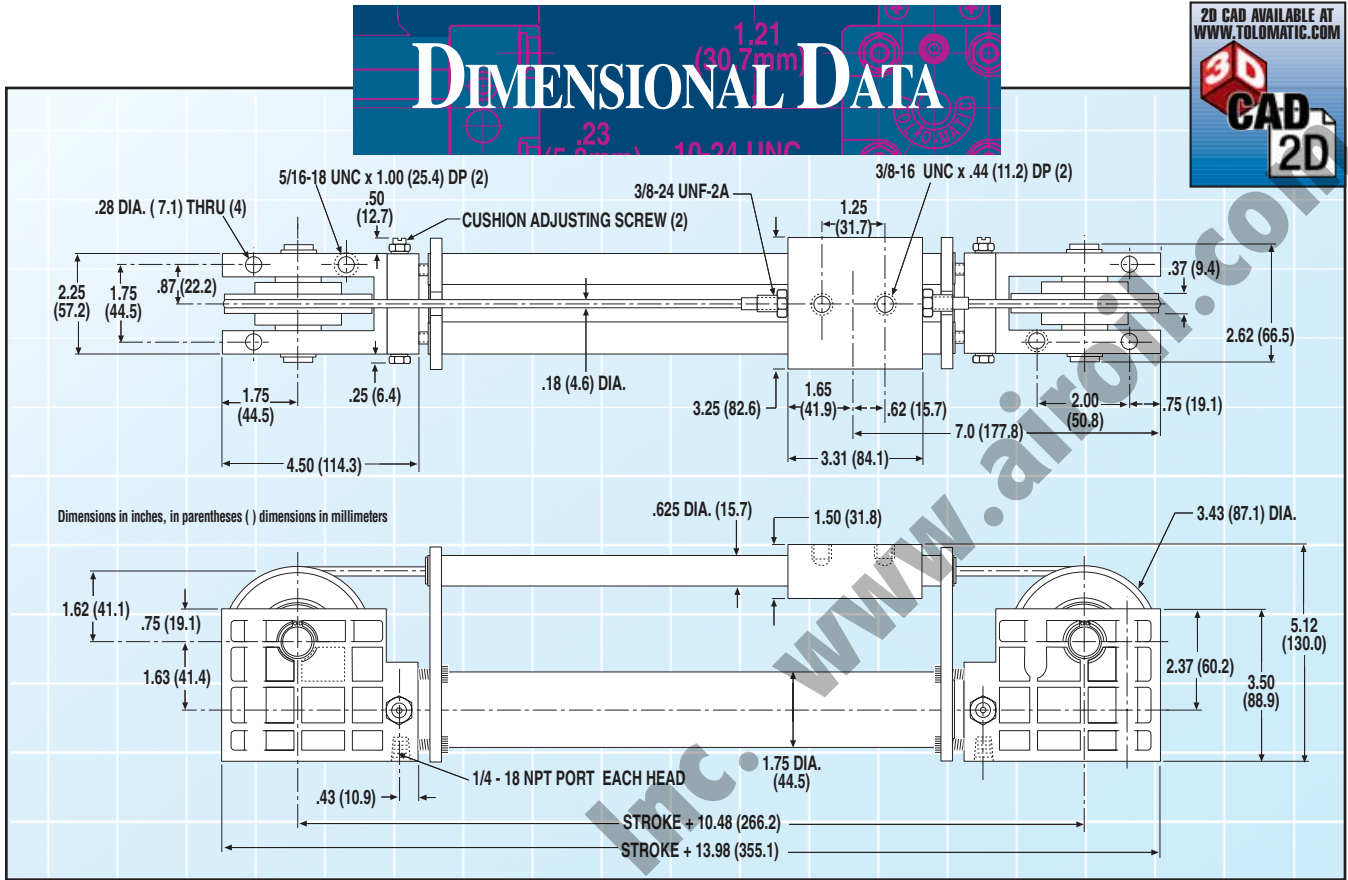
OVERALL UNIT SPECIFICATIONS

	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.

DIMENSIONAL DATA



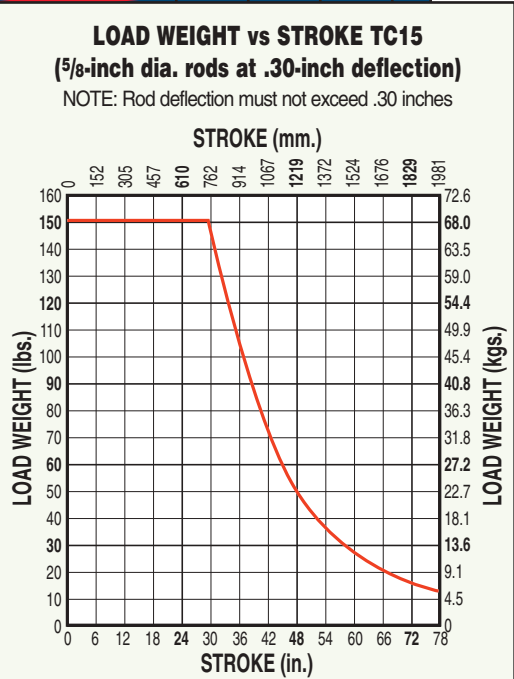
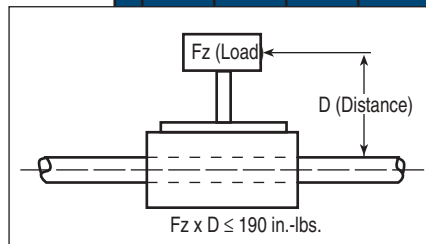
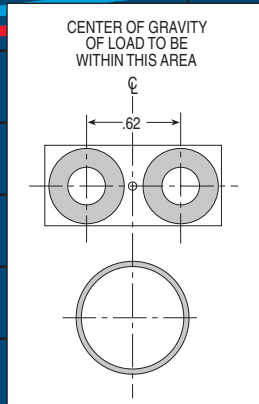
CABLE CYLINDER

PERFORMANCE DATA

OVERALL UNIT SPECIFICATIONS		
Bore size (in.):	1.5 in.	
Max. stroke	78.00	1981.2
Max. PSI:	100 PSI	6.9 bars
Max. temp. (°F)	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.



AUTOMATIC TENSIONERS

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 (102mm) 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 128.)

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.

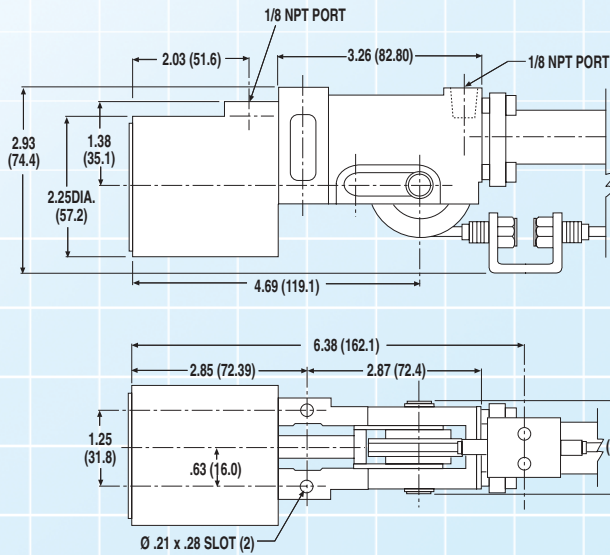
AUTO TENSIONER PRESSURE SETTINGS FOR MODEL % OF LOAD PRESSURE

CC07	22%
CC10	40%
CC15	86%
CC20	32%
CC25	51%
CC30	54%
CC40	96%
CC50	75%
CC52	24%

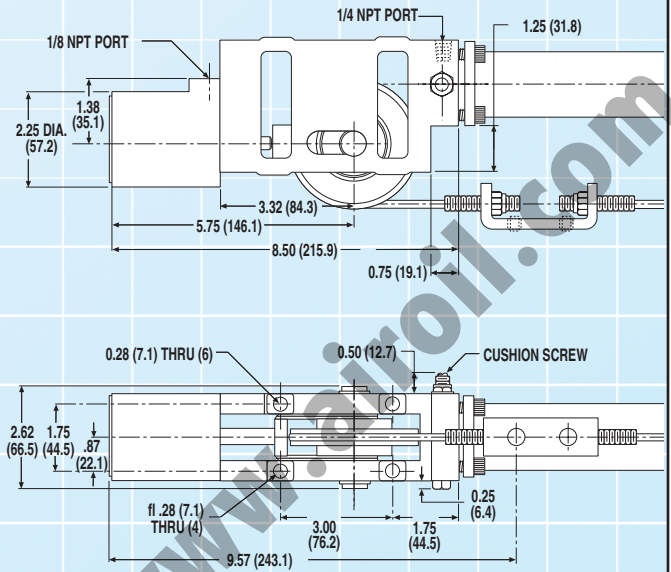
DIMENSIONAL DATA



AT FOR CC07, CC10

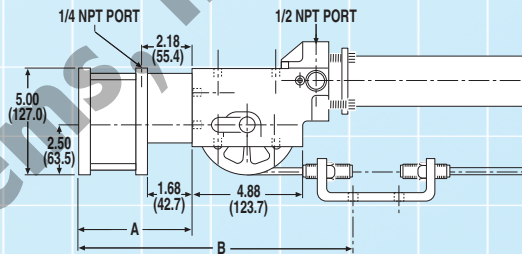


AT FOR CC15



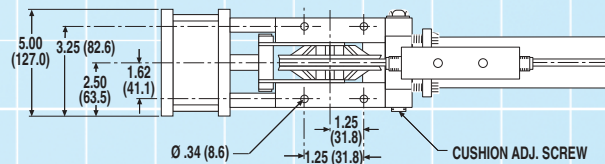
Dimensions in inches, in parentheses () dimensions in millimeters

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 (KGS.)
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

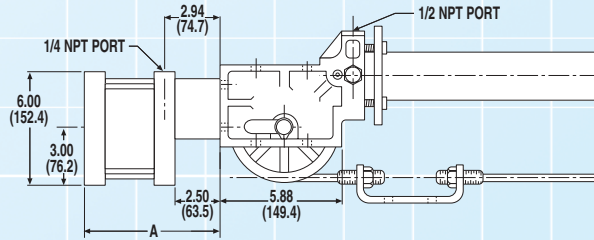
AUTOMATIC TENSIONERS

DIMENSIONAL DATA

2D CAD AVAILABLE AT
WWW.TOLOMATIC.COM

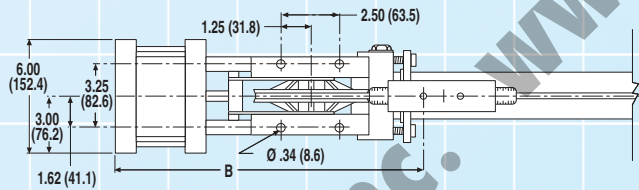


AT FOR CC30, CC40, CC52

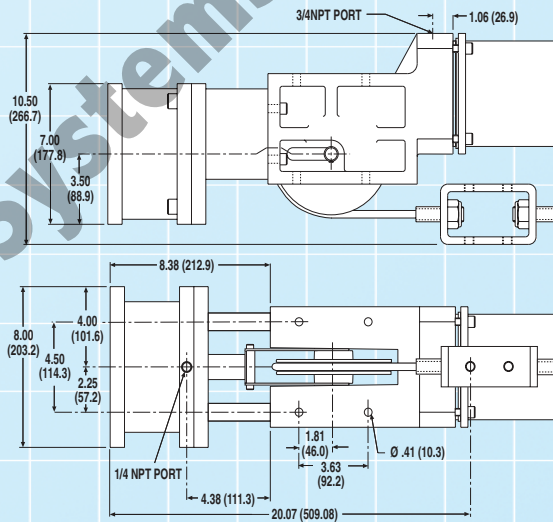


MODEL	A	B
1" Stroke Tensioner	6.38"	14.12"
2" Stroke Tensioner	7.38"	15.12"

MODEL	A	B
1" Stroke Tensioner	162.1mm	358.6mm
2" Stroke Tensioner	187.5mm	384.0mm



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 (KGS.)
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

CYLINDER/BRAKE COMBINATIONS



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 132 for selection information and braking formulae.

NOTE: Tol-O-Matic's H20DARC is used on all available models. See part numbers below:

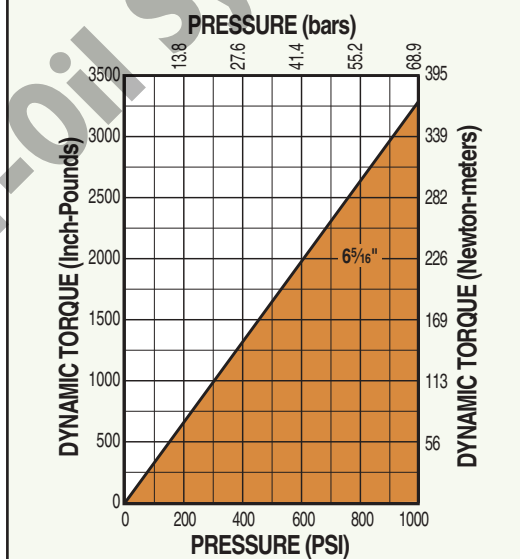
	CC15	CC20	CC25	CC30	CC40	CC52
Brake Number	0728-0010	0728-0010	0728-0010	0728-0010	0728-0010	0728-0010
Disc & Hub No.	0801-0008	0801-0010	0801-0010	0801-0010	0801-0010	0801-0010

See catalog 9900-4009 for detailed information on brakes and discs.

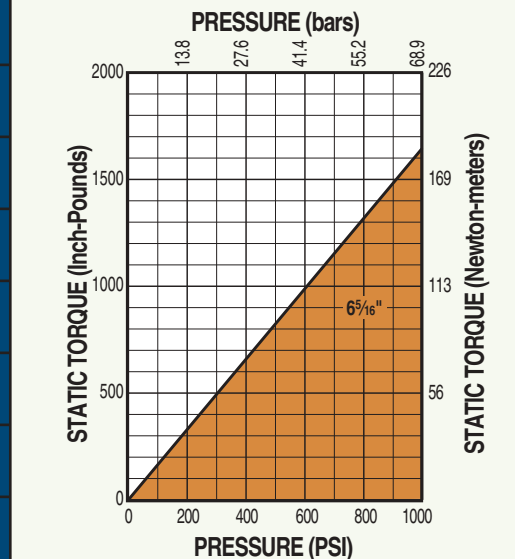
CABLE CYLINDER

PERFORMANCE DATA

**DYNAMIC TORQUE H-20 BRAKE WITH 6⁵/₁₆" DISC
(FOR CC15, CC20, CC25, CC30, CC40, CC52)**



**STATIC TORQUE H-20 BRAKE WITH 6⁵/₁₆" DISC
(FOR CC15, CC20, CC25, CC30, CC40, CC52)**



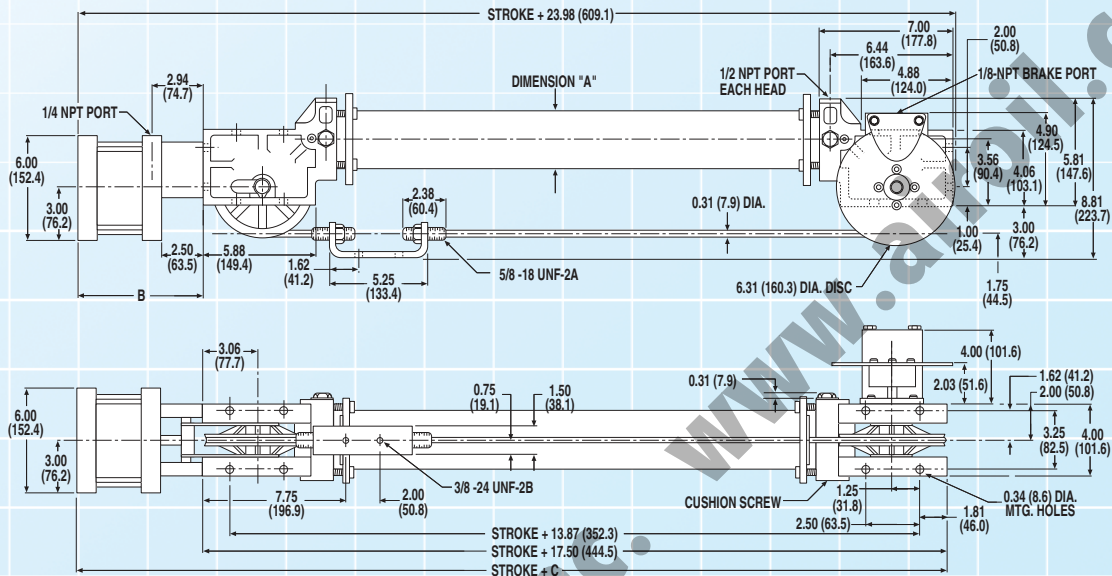
CC30, CC40, CC52

DIMENSIONAL DATA

2D CAD AVAILABLE AT
WWW.TOLOMATIC.COM



CYLINDER/ BRAKE COMBINATION FOR CC30, CC40, CC52



MODEL	A	B	C
CC30 w/ 1" Stroke Tensioner	3.25"	6.38"	23.98"
CC30 w/ 2" Stroke Tensioner	3.25"	7.38"	24.98"
CC40 w/ 1" Stroke Tensioner	4.25"	6.38"	23.98"
CC40 w/ 2" Stroke Tensioner	4.25"	7.38"	24.98"
CC52 w/ 1" Stroke Tensioner	2.25"	6.38"	23.98"
CC52 w/ 2" Stroke Tensioner	2.25"	7.38"	24.98"

MODEL	A	B	C
CC30 w/ 1" Stroke Tensioner	82.6mm	162.1mm	609.1mm
CC30 w/ 2" Stroke Tensioner	82.6mm	187.5mm	634.5mm
CC40 w/ 1" Stroke Tensioner	108.0mm	162.1mm	609.1mm
CC40 w/ 2" Stroke Tensioner	108.0mm	187.5mm	634.5mm
CC52 w/ 1" Stroke Tensioner	57.2mm	162.1mm	609.1mm
CC52 w/ 2" Stroke Tensioner	57.2mm	187.5mm	634.5mm

Dimensions in inches, in parentheses () dimensions in millimeters

Air-Oil Systems, Inc.

CABLE CYLINDER

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 - ORDERING

CONFIGURATOR EXAMPLE

MODEL, SEALS, TUBING, BORE, AND STROKE

1.	2.	3.	4.	5.	6.
CC	V		M	15	SK125.250

ACCESSORIES AND OPTIONS

7.	7.	8.	9.	9.
END #1 HJ	END #2 HG	RT2	XA	XB

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 179)

Increase does not apply to TC Models.

5. BORE SIZE

Enter:

- | | |
|-----------------------------|------------------------------------|
| 05 for .5-inch bore | 25 for 2.50-inch bore |
| 07 for .75-inch bore | 30 for 3-inch bore |
| 10 for 1-inch bore | 40 for 4-inch bore |
| 15 for 1.5-inch bore | 50 for 5-inch bore |
| 20 for 2-inch bore | 52 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.

CC/SA/DP/TC FIELD RETROFIT

CABLE CYLINDER REPLACEMENT KITS

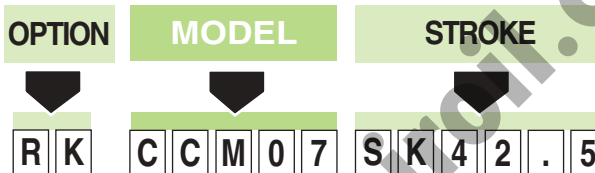
Find the appropriate part number for the specific model and specify that part number with your stroke length when ordering.

CABLE ASSEMBLIES¹ AND REPAIR KITS²

MODEL	CABLE ASSEMBLY	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	CASAM25	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: RKCCM07SK25



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)

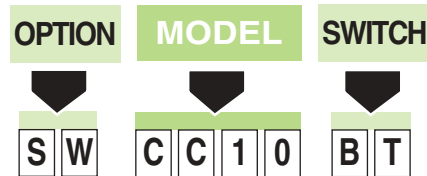
¹ Cable Assemblies contain: one Cable Assembly (specify stroke).

² Repair Kits contain: two Cable Assemblies (specify stroke) and all wearable seals required to rebuild the cylinder.

SWITCH KITS³

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.

³ 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 126.

- Adding switch to an actuator that has not had a switch in the past:
Order via configurator code on page 126.

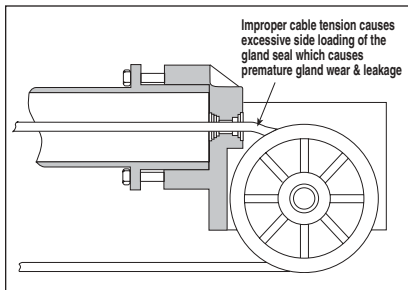
3600-9082	Switch, Reed, Form A, 5m Wire
3600-9083	Switch, Reed, Form A, Male Connector
3600-9084	Switch, Reed, Form C, 5m Wire
3600-9085	Switch, Reed, Form C, Male Connector
3600-9086	Switch, Triac, 5m Wire
3600-9087	Switch, Triac, Male Connector
2503-1025	Connector, Female, 5m

(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 175.)

CC APPLICATION GUIDELINES

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

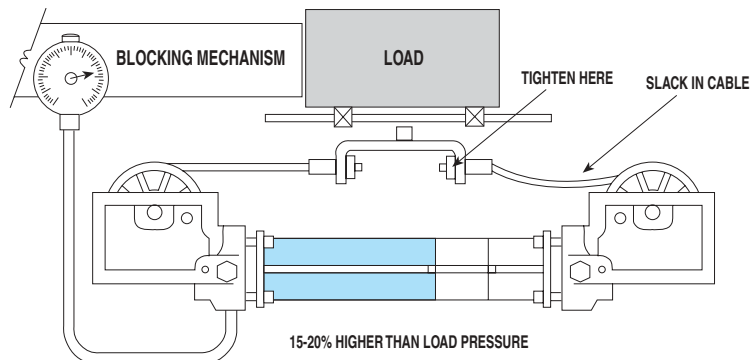
The Field Method simplifies Proof-loading and Pretensioning the cable cylinder by combining the two processes.

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.

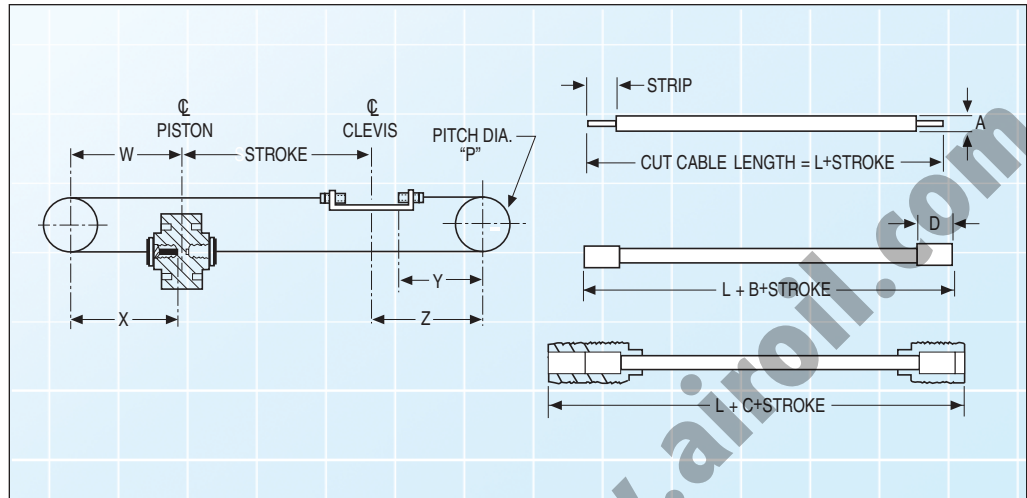
3. Upon pressurizing, one cable will become tight while the other will become slack. Manually adjust out the slack with a wrench on the clevis terminal lock nut.
4. Release the pressure, block the load on the other side and repeat steps 1 through 3. When these steps are done, turn down the regulator pressure to the normal operating pressure and remove the block.



CC APPLICATION GUIDELINES

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 Tol-O-Matic 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 is **+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.

CABLE CYLINDER / MAGNETICALLY COUPLED CYLINDER SELECTION PROCEDURE:

1. COMPILE APPLICATION REQUIREMENTS

To determine the appropriate Cable Cylinder or Mag 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 (MG ONLY)

Use the following formula:

$$F = .013 \times \text{Weight} \times \text{Velocity}^2$$

Calculated value must be less than the Magnetic Coupling Strength values. (MG see page 91, MGS page 95)

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: 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.

5. 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 at full manual cable adjustment, your model selection is complete. (Refer to graph on page 131.)

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 128 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 120.

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 128 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.

SELECTION CC, MG

SELECTION EXAMPLE: CC

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

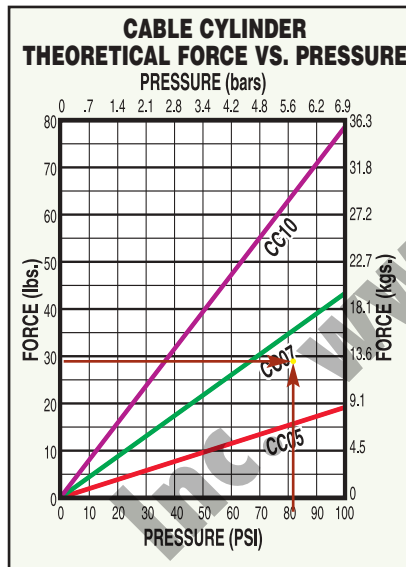
- Available pressure 80 psi
- Weight of load 30 lbs.
- Orientation of load horiz.
- Final velocity* of load 10" per sec
- Stroke length 68"

*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

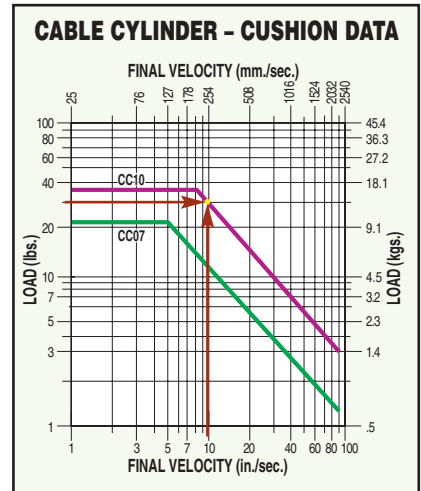
This application will use Form C dc Reed switches to signal other units in this automated system.

The final configured string will appear as follows:

CCM10SK68.000HBM2

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

SELECTION CC/HN, HM

CALIPER DISC BRAKE OPTION FOR CABLE CYLINDER SELECTION PROCEDURE:



SELECTION - CC/HN, HM

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 condi-

tions 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 prior to braking. If pressure is not applied prior to braking, go on to 3.
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:

$$F_C = W \left[\frac{a}{g} - f^* \right], \text{ Horizontal loads}$$

$$F(\text{lbs.}) = W \left[\left(\frac{a}{g} - \sin \vartheta \right) - (f \cos \vartheta) \right], \text{ Incline load rising}$$

$$F(\text{lbs.}) = W \left[\left(\frac{a}{g} + \sin \vartheta \right) - (f \cos \vartheta) \right], \text{ Incline load falling}$$

$$F(\text{lbs.}) = W \left(\frac{a}{g} - 1 \right), \text{ Vertical load rising}$$

$$F(\text{lbs.}) = W \left(\frac{a}{g} + 1 \right), \text{ Vertical load falling}$$

$$F_{ta} = F_C + W \left(\frac{a}{g} - f \right), \text{ Horizontal loads}$$

$$= F_C + W \left[\left(\frac{a}{g} - \sin \vartheta \right) - (f \cos \vartheta) \right], \text{ Incline load rising}$$

$$= F_C + W \left(\frac{a}{g} - 1 \right), \text{ Vertical load rising}$$

In the above expressions (a) can be calculated from:

$$a = \frac{V^2}{2S} \text{ or } \ln, \text{ In./Sec.}^2$$

4. Calculate the tension required in brake side cable at the time of braking.

$$L_{tr} = \frac{F_{tr}}{0.369}, \text{ lbs. Pressure removed while braking}$$

$$L_{ta} = \frac{F_{ta}}{0.369}, \text{ lbs. Pressure applied while braking}$$

NOMENCLATURE

a = Deceleration, in/sec ²	W = Weight of load, lbs.
g = Deceleration due to gravity = 386.4 in/sec ²	W _e = Load equivalent
f* = Coefficient of friction of sliding load	W _e = (W) (f), lbs. — Horizontal loads
f _c = Coefficient of friction between cable and sheave	W _e = W, lbs. — Vertical loads
F _C = Unbalanced cylinder force, lbs.	W _e = W (Sin ϑ + f cos ϑ), lbs. — Inclined loads
F _{ta} = Tangential braking force required with pressure still applied when braking, lbs.	ϑ = Angle of inclination
F _{tr} = Tangential braking force required with pressure removed prior to braking, lbs.	R _s = Root radius of sheave groove, inches
L _{tr} = Tension in cable of brake side half while braking with pressure removed, lbs.	P _C = Pressure regulator or relief valve setting, PSI
L _{ta} = Tension in cable of brake side half while braking with pressure applied, lbs.	A _C = Area of cable cylinder bore, in ²
L _{tm} = Maximum tension in cable with pressure removed while braking, lbs.	P _t = Pressure setting of tensioner, PSI
L _{tam} = Maximum tension in cable with pressure applied while braking, lbs.	A _t = Area of tensioner cylinder, in ²
S = Stopping distance, inches	P _{ba} = Brake pressure setting. Pressure applied while braking, PSI
T = Stopping time, seconds	P _{br} = Brake pressure setting. Pressure removed while braking, PSI
V = Velocity of load, in/sec.	

*Customer must precisely determine coefficient of friction (f), if this value is used.

SELECTION CC/HN, HM

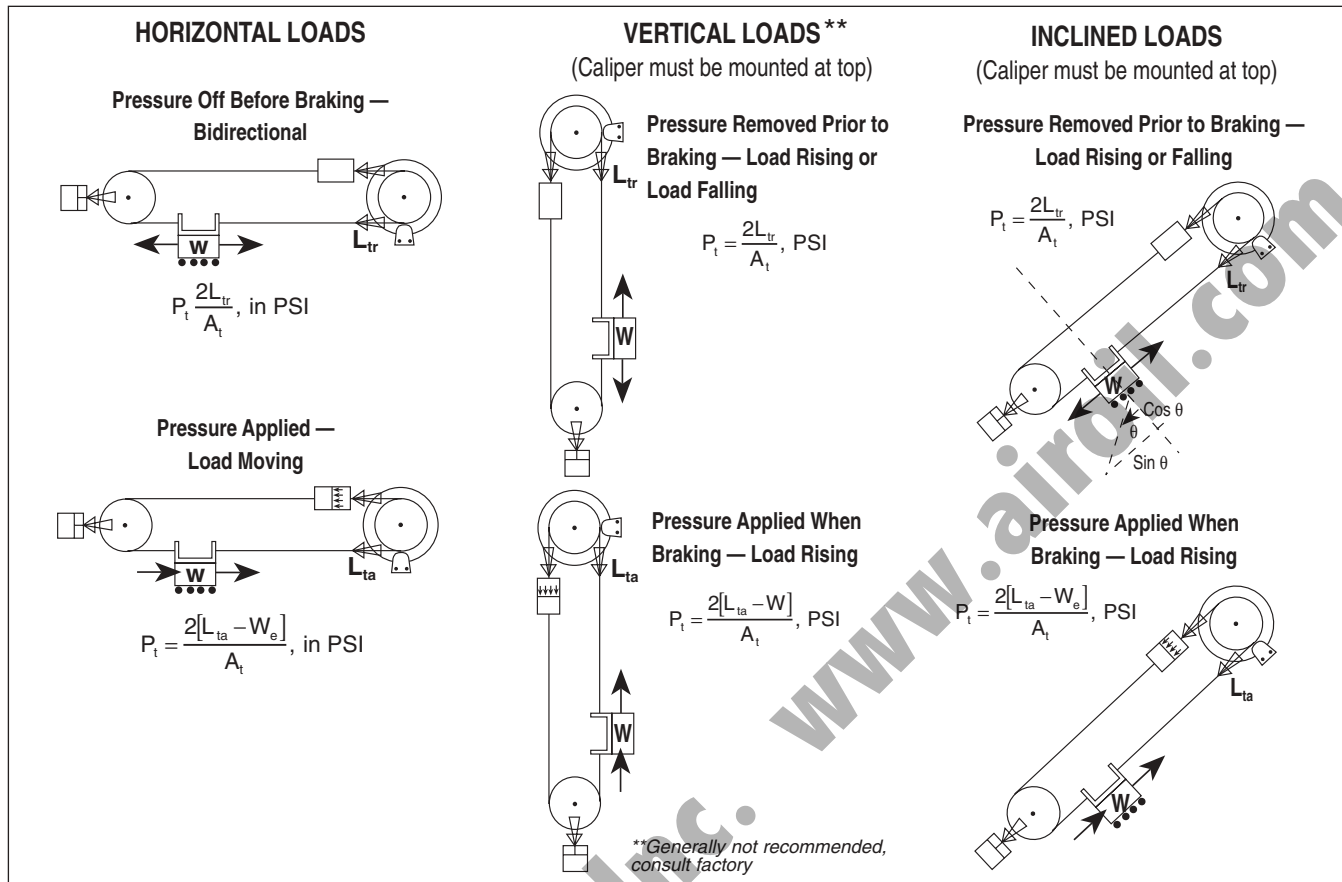


Figure 1.

5. Calculate tensioner pressure setting (Figure 1.) based on type of load configuration where:

- $A_t = 2.36 \text{ in}^2$ for CC15
- $A_t = 11.96 \text{ in}^2$ for CC20, CC25
- $A_t = 16.20 \text{ in}^2$ for CC30, CC40, CC52

6. Calculate maximum tension in the cable with **pressure removed** while braking (L_{trm}) or maximum tension in cable with **pressure applied** when braking (L_{tam}).

Horizontal Loads:

- $L_{trm} = L_r + W_e$, 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 Loads:

- $L_{trm} = L_r + W$, lbs. — Pressure removed prior to braking rising or falling
- $L_{tam} = L_{ta}$, lbs. — Pressure still applied when braking and load rising

Inclined Loads:

- $L_{trm} = L_r + W_e$, 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.

- $P_{br} = .113[L_{tr}], \text{ PSI}$ — Pressure removed when braking
- $P_{ba} = .113[L_{ta}], \text{ PSI}$ — Pressure still applied when braking

Where:

R_s (in inches) for various models

TC15	.531
CC20	2.0
CC25	2.0
CC30	2.5
CC40	2.5
CC52	2.5

9. If pressure is removed prior to braking, check to see if brake can hold the load if application is either vertical or incline.

- The brake can hold the load if:
- $.369 L_r \geq W$, Vertical load
- $.369 L_r \geq W_e$, Inclined load

*Refer to Cable Specifications in the double-acting cable cylinder section of this catalog for cable tensile strengths.

SELECTION - CC/HN, HM