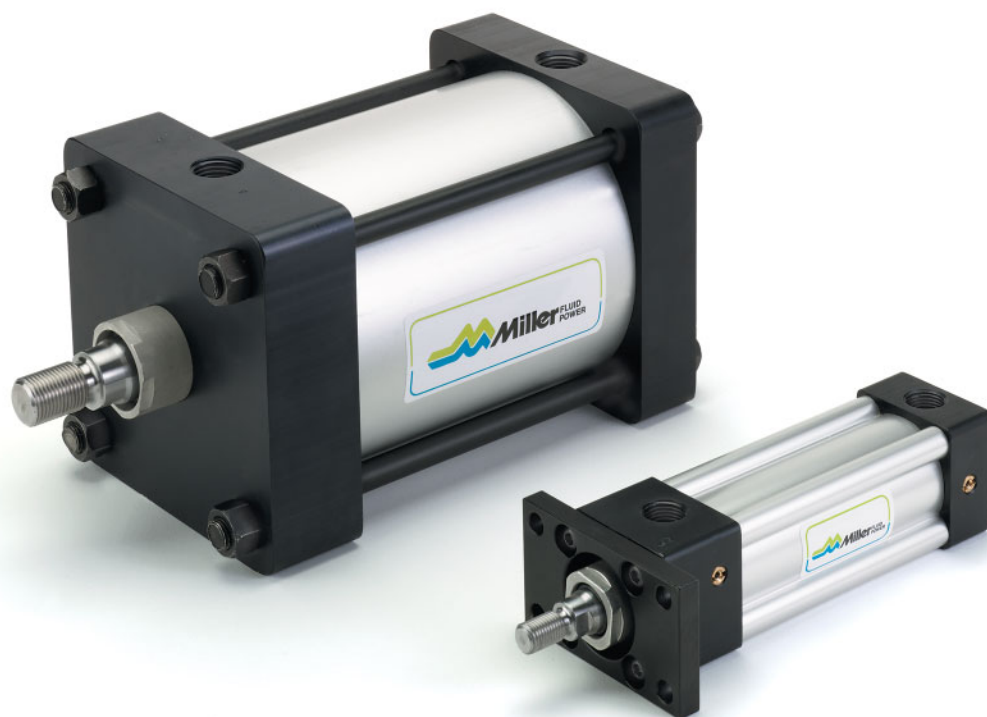


AL4 Series Air Cylinder

Catalog M0917-4

March, 2003



Up to 250 PSI
Bore Sizes 1-1/2" through 8"
NFPA Interchangeable
17 Standard Mounting Styles



AV Series Cylinders

Up to 250 PSI Permanently Lubricated



Series AV air cylinders are available in bore sizes from 1-1/2" through 14" and up to 250 PSI operating pressure. Standard NFPA dimensions and proven Miller design features.

BT & BTM Series Cylinders

Up to 250 PSI



Our BT & BTM Series air cylinders are available in bore sizes from 5/16" through 3". Operating pressures up to 250 PSI. 28 available mounting styles.

IPA Series Cylinders

10 BAR



Up to 10 BAR pressure. Bore sizes 32mm through 200 mm. Meets and approved to GM pneumatic cylinder specifications CC-001. VDMA 24562 and ISO 6431 compatible.

HV2 Series Cylinders

3000 PSI



Miller's heavy-duty cylinder line for demanding hydraulic applications. Bore sizes from 1-1/2" to 8".

Warning

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from The Company, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The product described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by The Company and its subsidiaries at any time without notice.

Offer of Sale

The items described in this document are hereby offered for sale by The Company, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by provisions stated on a separate page of this catalog in the document entitled "Offer of Sale".

Miller AL4 Series Air Cylinders

Table of Contents:

Cylinder Dimensions and Information

1-1/2" - 4" Bore Sizes

Cylinder Features	2, 3
Mounting Styles Selection	4
Standard Specifications and Mounting Styles	5
Model 50, No Mount & Models 61 and 62 Flange Mounts	6, 7
Models 51, 52, 53 Tie Rod Mounts & Model 55 Sleeve Nut Mount	8, 9
Models 71, 72, 74 and 77 Side Angle, Side Tap & Lug Mounts	10, 11
Models 84, 86 & 96 Clevis and Eye Mounts	12, 13
Models 81, 82 & 89 Trunnion Mounts	14, 15
Double Rod End	16
Style 9 Rod Ends, Split Couplers, Weld Plates and Cylinder Weights	17

5" - 8" Bore Sizes

Cylinder Features	18
Standard Specifications and Mounting Styles	19
Model 50, No Mount & Models 61 and 62 Flange Mounts	20, 21
Models 63 & 64 Head and Cap Square Mounts - 8"	22, 23
Models 51, 52, 53 Tie Rod Mounts and Model 55 Sleeve Nut Mount	24, 25
Model 71, Side Angle Mount	26, 27
Models 72 & 74 Side Lug and Side Tap Mounts	28, 29
Models 84, 86 & 96 Clevis and Eye Mounts	30, 31
Models 81, 82 & 89 Trunnion Mounts	32, 33
Double Rod End	34

Cylinder Accessories	35
Stop Tubing	36
Piston Rod Selection	37
Bumper Seal Options	38, 39
Switches	40-42
Linear Position Sensing Option	43-49
Miller Cylinder Selection Guide	50
How To Order	51
Parts List and Seal Kits	52
Disassembly and Reassembly of Cylinder & Mounting Kits	53
Model AL4T Air-Oil Tanks	55-57
Storage and Installation	58
Safety Guidelines	59
Offer Of Sale	60

Miller AL4 Series Lightweight, Non-Lube Pneumatic Cylinder.

Premium Quality and Economy in one.

Lightweight construction and solid Non-Lube design with proven reliability make the AL4 Series Cylinder the high performance, long lasting, economical choice for your air cylinder applications.

Extruded Aluminum Cylinder Body

Lightweight, unique design provides strength and eliminates areas of contamination. 5" through 8" bore have aluminum tube with steel tie rods.

Heads and Caps are precision, lightweight aluminum blocks that are anodized for maximum corrosion resistance.

Rod Seal

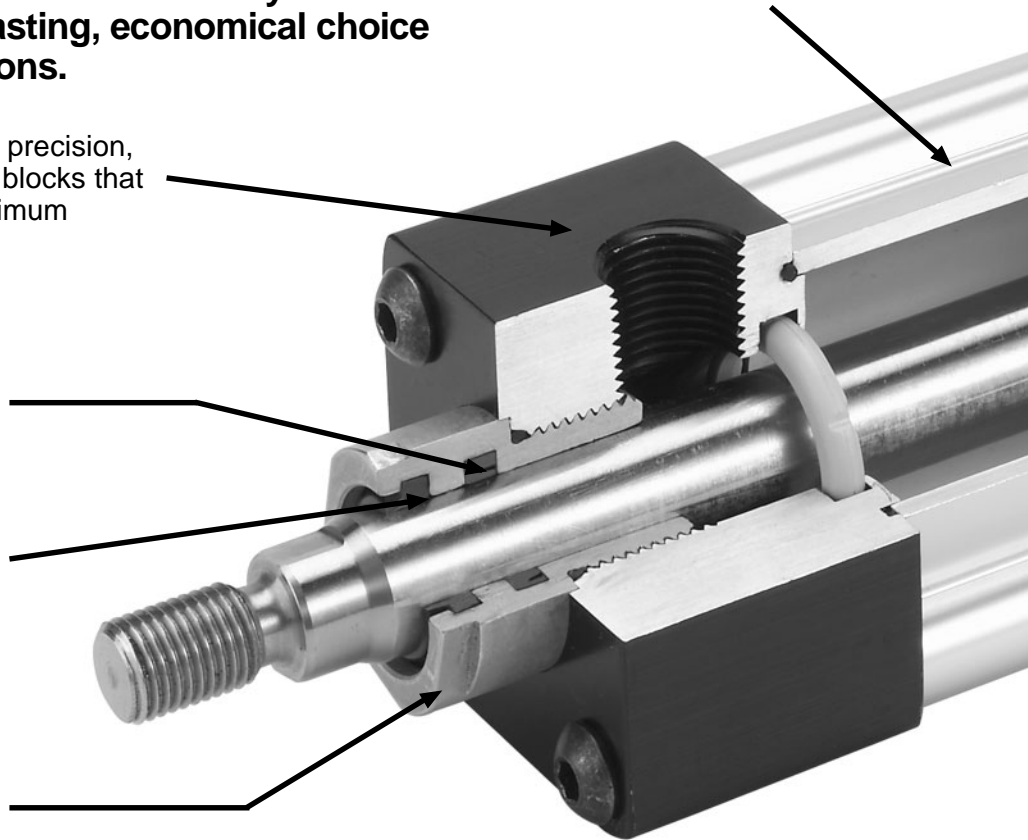
The Nitrile rod seal is pressure energized, wear compensating and resists abrasion to ensure long life.

Rod Wiper

The Urethane wiper seal wipes away dirt that may have accumulated on the rod, reducing bushing wear.

Rod Bushing

Externally removable, high-density iron, plated rod bushing protects against side loads. The outboard placement of the rod seal ensures lubrication over the full bearing length.



Check Seal Cushions*

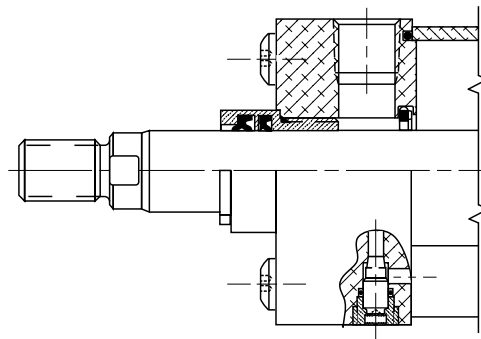
For Increased Productivity and Maximum Performance

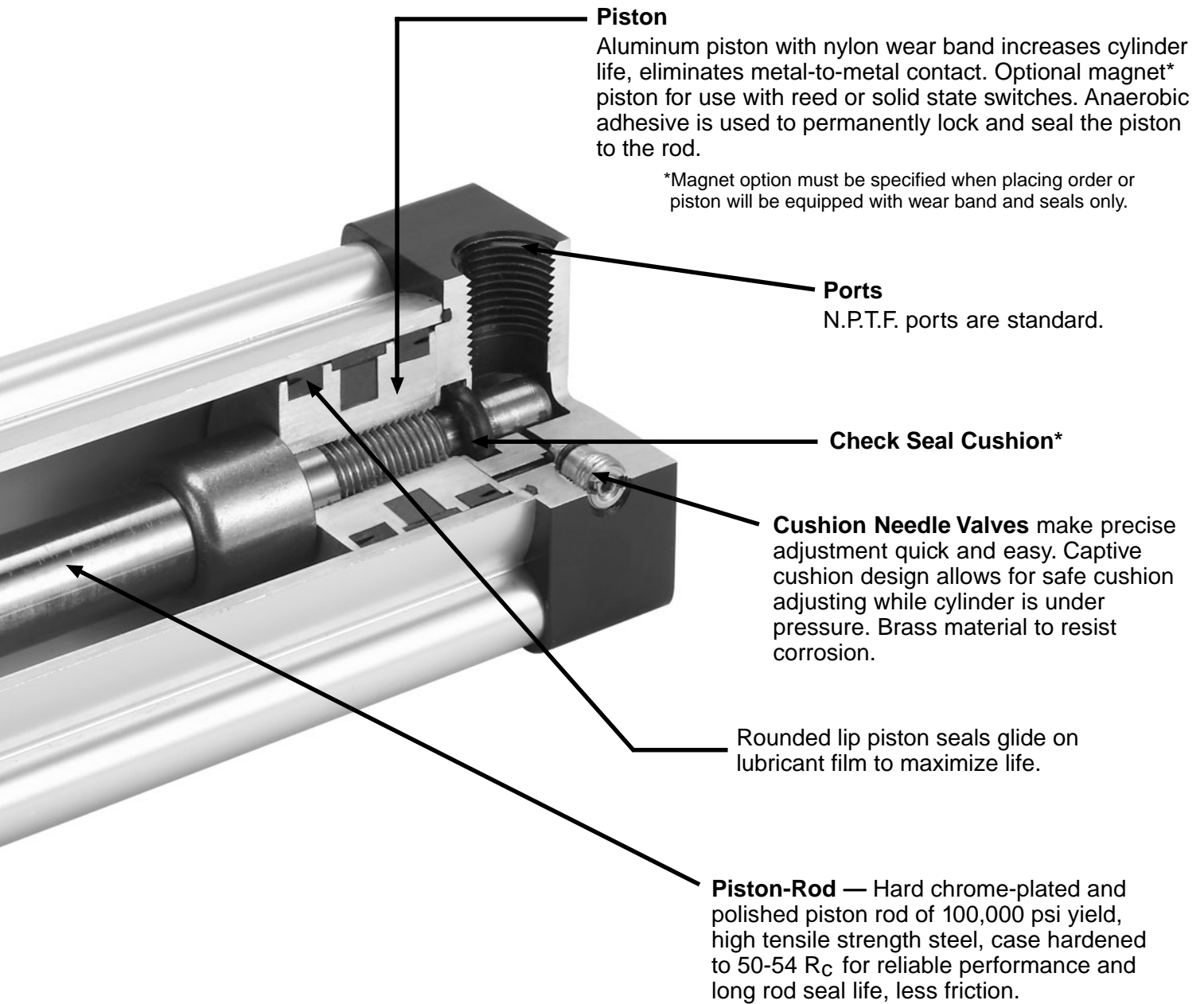
The check seal cushion is new and different from ordinary cushion designs. It combines the sealing capabilities of a lipseal for efficient capture of air for effective cushioning with check valve action for quick stroke reversal.

The design also provides "floating cushions" to assure cushion repeatability and long life. At the start of the stroke in each direction, the check valve design allows full flow to piston face with a minimum pressure drop for maximum power stroke.

Additional benefits of the new check seal cushions are increased productivity and top performance for faster cycle time, minimum wear, easy adjustment and low pressure drop.

The basic cushion design is optional and available on either the head end, cap end or both ends without change in envelope or mounting dimensions. A captive cushion adjusting needle is supplied for easy, precise adjustment on all bore sizes.





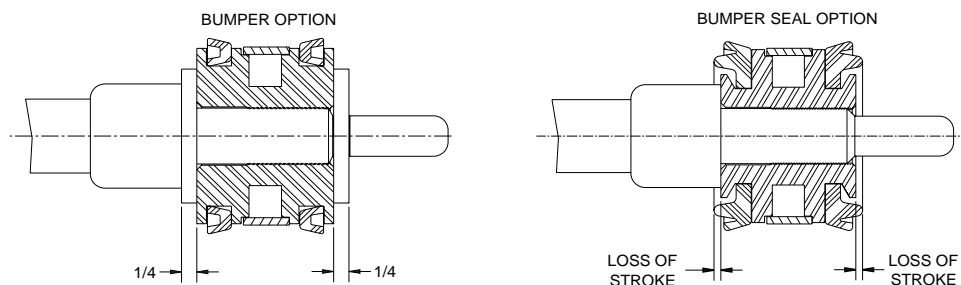
Miller Fluid Power provides the ultimate in design flexibility by offering two styles of impact dampening bumpers for the AL4 cylinder line in bore sizes ranging from 1-1/2" - 4".

Conventional bumpers can be provided on one or both sides of the piston with a 1/4" stroke loss per bumper. This style of bumper is ideal for applications subjected to high speeds where cycle time may discourage the use of cushions.

Impact dampening bumper seals can be combined with cushions to provide the ideal solution for applications that

experience high speed cycling and heavier loads. The bumper seal option combines the features of a low friction, round lip seal and impact resistant bumpers to provide smooth end of stroke deceleration. With system pressures above 80 PSI, the bumper seal option offers minimal stroke loss.

For additional information regarding the bumper seal option, refer to "Bumper Seal Options" page. For instructions on how to order these options, refer to "How To Order" page.



Miller AL4 Series Air Cylinders

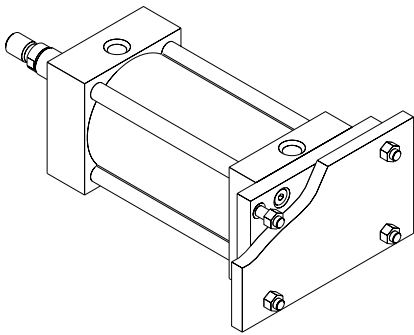
Mounting Styles That Fit Your Installation Requirement

Miller AL4 Series air cylinders operate at internal pressures up to 250 PSI, and incorporate proven Miller design characteristics to provide safe, reliable power for many heavy-duty industrial applications. Available in 17 standard mounting configurations to provide centerline, foot or pivot installations as explained below.

Centerline Mounting

The preferred cylinder installation method, centerline mounting places the mounting bolts in simple shear or simple tension so that the mounting mechanism is protected from compound forces. Centerline mounting is a rigid mounting style and this requires accurate cylinder alignment to prevent damage to the cylinder working parts.

Miller AL4 mounting configurations that provide centerline support include: tie rod mounts (51, 52, 53), and flange mounts with rectangular flanges affixed to the head or cap end of the cylinder (61 and 62).

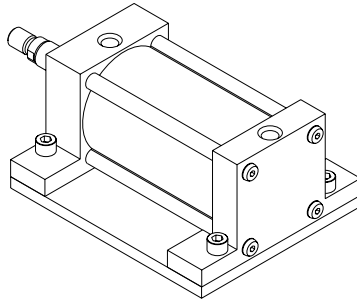


Centerline mounting is preferable since it prevents compound forces from acting on the mounting bolts (flange model shown).

Foot Mounting

Foot mounting allows the cylinder to be mounted and secured along its side, on both the head and cap end. When considering this style of mount, it should be noted that the mounting surface plane is not truly centered with the line of force plane. Therefore, the mounting bolts may be subjected to a significant amount of shear stress. Foot mounts are rigid in nature. Accurate cylinder alignment must be practiced when selecting this type of mount.

Miller AL4 Series mounting configurations that provide foot mountings are: side end angle (71), side lug (72), and side tap (74). Side tap mounting incorporates flush, tapped mounting holes on the head and cap of the cylinder providing an alternative to side lugs and foot brackets.

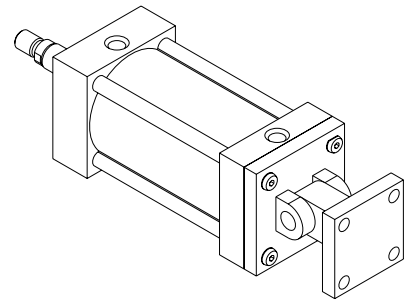


Foot mounting secures the cylinder on its side, but can subject the mounting bolts to compound stress (cylinder side lugs shown).

Pivot Mounting

Pivot mounting is used when the cylinder must pivot during piston motion. Clevis and trunnion mounts are the two methods used to allow this motion.

The clevis end design locates the pivot point at the cap end of the cylinder (84, 86, 96). Trunnion mounting allows pivoting of the cylinder via the head or cap (81, 82), or intermediate location (89). Both clevis and trunnion mount configurations allow the cylinder to pivot in one plane only.



Pivot mounting allows the cylinder to pivot during piston motion (clevis method shown).

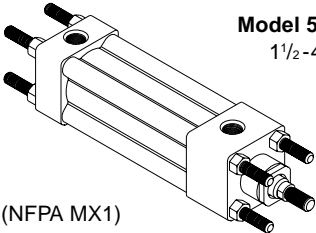
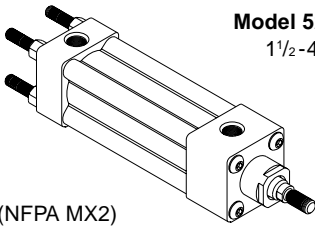
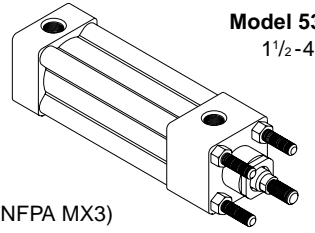
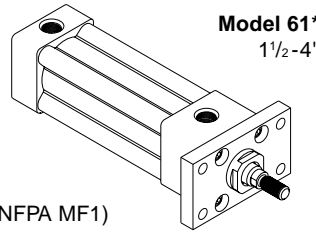
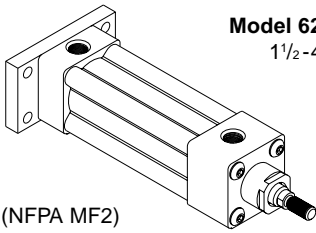
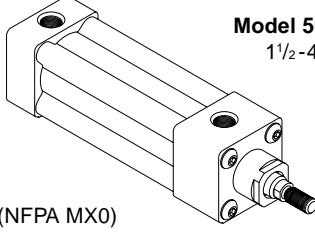
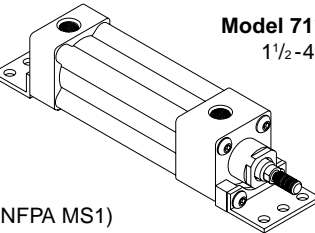
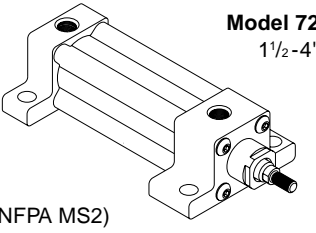
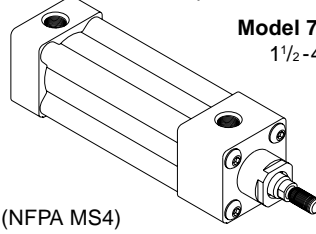
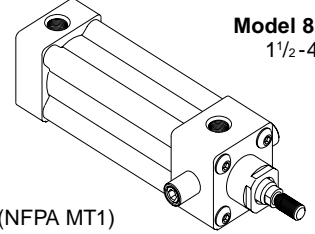
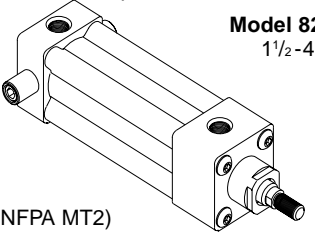
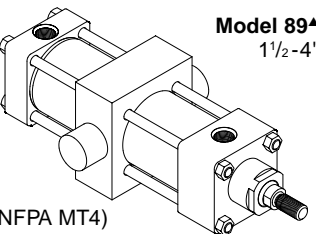
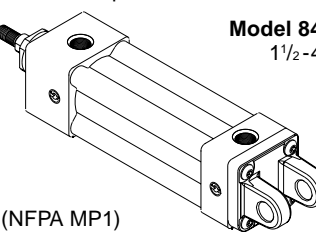
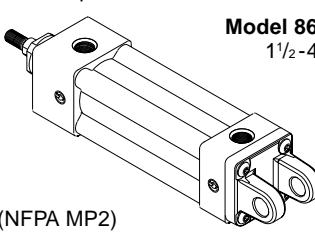
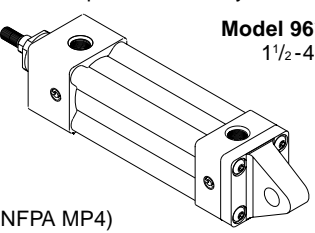
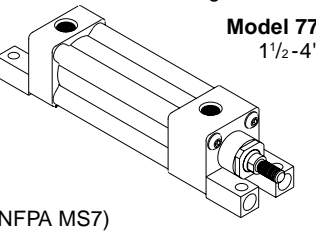
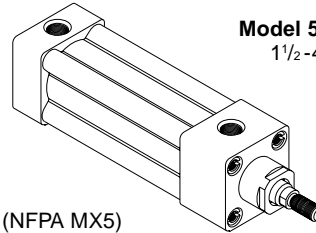
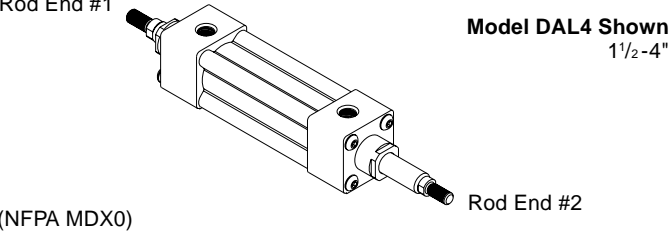
Miller AL4 Series Air Cylinders

Standard Specifications & Mounting Styles

Standard Specifications

- N.F.P.A. Interchangeable
- Bore sizes – 1-1/2", 2", 2-1/2", 3-1/4" and 4"
- Rod Diameters – 5/8", 1", and 1-3/8"
- Rod Ends – three standard, specials to order.
- Cushions – optional at either end or both ends of stroke
- Strokes – available in any practical stroke length.
- 250 P.S.I. Air Service/Optional 250 P.S.I., Hydraulic Service (non-cushioned only).
- Standard Fluid – Filtered Air
- Standard Temperature – -10°F to +165°F
- Fluorocarbon Seals for high temperature service – -10°F to +250°F (optional)
- Single rod end or double rod end
- Mounting styles – 17 standard
- Optional noise damping bumpers
- Non-Lube

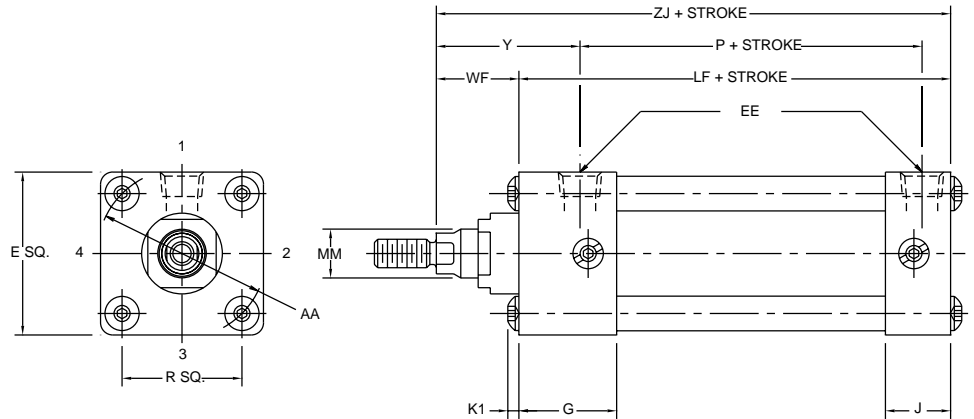
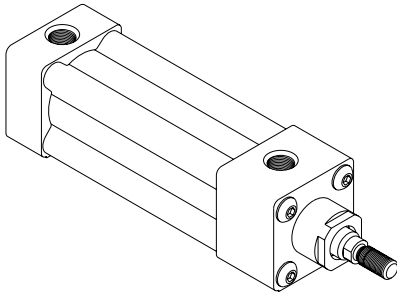
Available Mounting Styles

<p>Tie Rods Extended Both Ends</p>  <p>Model 51 1 1/2"-4"</p> <p>(NFPA MX1)</p>	<p>Tie Rods Extended Cap End</p>  <p>Model 52 1 1/2"-4"</p> <p>(NFPA MX2)</p>	<p>Tie Rods Extended Head End</p>  <p>Model 53 1 1/2"-4"</p> <p>(NFPA MX3)</p>	<p>Head Rectangular Flange</p>  <p>Model 61* 1 1/2"-4"</p> <p>(NFPA MF1)</p>
<p>Cap Rectangular Flange</p>  <p>Model 62* 1 1/2"-4"</p> <p>(NFPA MF2)</p>	<p>No Mount</p>  <p>Model 50 1 1/2"-4"</p> <p>(NFPA MX0)</p>	<p>Side End Angle</p>  <p>Model 71* 1 1/2"-4"</p> <p>(NFPA MS1)</p>	<p>Side Lug</p>  <p>Model 72 1 1/2"-4"</p> <p>(NFPA MS2)</p>
<p>Side Tap</p>  <p>Model 74 1 1/2"-4"</p> <p>(NFPA MS4)</p>	<p>Head Trunnion</p>  <p>Model 81 1 1/2"-4"</p> <p>(NFPA MT1)</p>	<p>Cap Trunnion</p>  <p>Model 82 1 1/2"-4"</p> <p>(NFPA MT2)</p>	<p>Intermediate Trunnion</p>  <p>Model 89* 1 1/2"-4"</p> <p>(NFPA MT4)</p>
<p>Cap Fixed Clevis</p>  <p>Model 84* 1 1/2"-4"</p> <p>(NFPA MP1)</p>	<p>Cap Detachable Clevis</p>  <p>Model 86* 1 1/2"-4"</p> <p>(NFPA MP2)</p>	<p>Cap Detachable Eye</p>  <p>Model 96* 1 1/2"-4"</p> <p>(NFPA MP4)</p>	<p>Side End Lug</p>  <p>Model 77 1 1/2"-4"</p> <p>(NFPA MS7)</p>
<p>Sleeve Nut</p>  <p>Model 55 1 1/2"-4"</p> <p>(NFPA MX5)</p>	<p>Rod End #1 Double Rod End Rod End #2</p>  <p>Model DAL4 Shown 1 1/2"-4"</p> <p>(NFPA MDX0)</p>		<p>▲Tie Rod Design</p> <p>*Indicates Bolt on Mounting Design 1 1/2"-4" Bores</p>

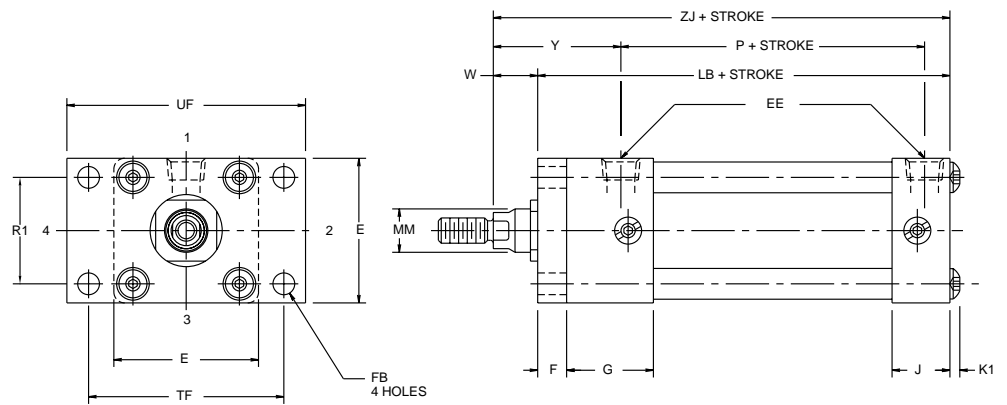
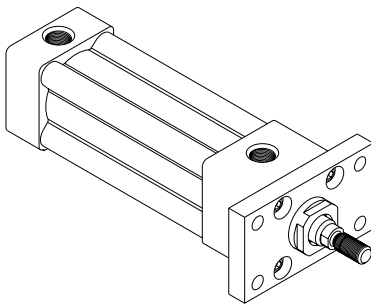
Miller AL4 Series Air Cylinders

No Mount (Basic)
Head Rectangular Flange Mount
Cap Rectangular Flange Mount
1-1/2" to 4" Bore Sizes

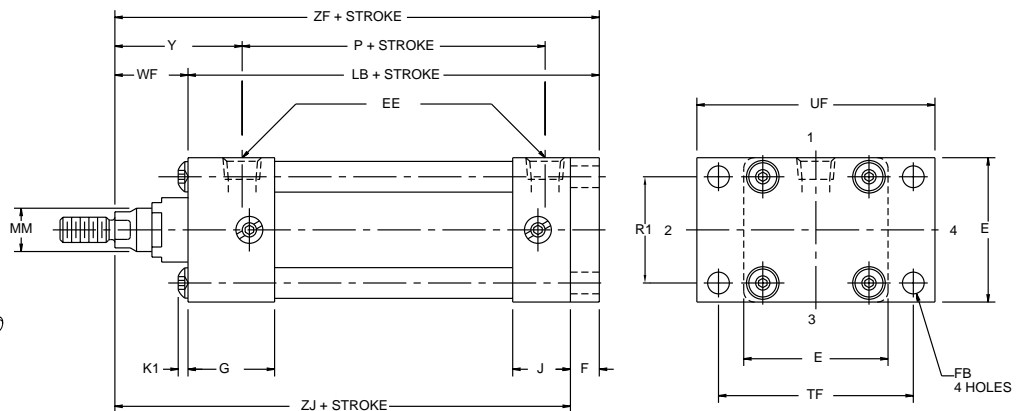
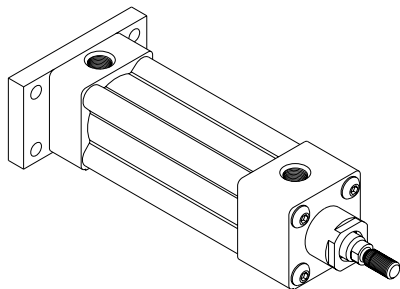
No Mount Basic Model 50 (NFPA MX0)



Head Rectangular Flange Model 61 (NFPA MF1)



Cap Rectangular Flange Model 62 (NFPA MF2)



Miller AL4 Series Air Cylinders

No Mount (Basic)
Head Rectangular Flange Mount
Cap Rectangular Flange Mount
1-1/2" to 4" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFPA Style SM)
Small Male

Thread Style 5
(NFPA Style IM)
Intermediate Male

Thread Style 4
(NFPA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

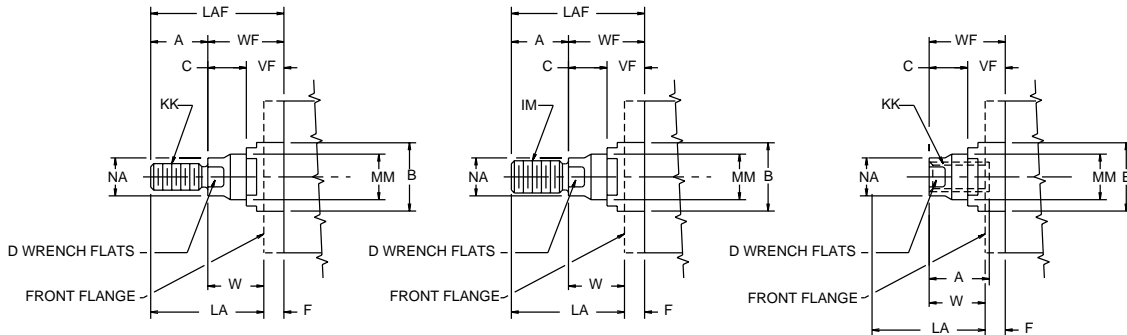


Table 1—Envelope and Mounting Dimensions

Bore	AA	E	EE (NPTF)	F	FB	G	J	K1	R	R1	TF	UF	ADD STROKE		
													LB	LF	P
1 1/2	2.02	2	3/8	3/8	5/16	17/16	15/16	1/8	1.43	1.43	23/4	33/8	4	35/8	25/16
2	2.6	2 1/2	3/8	3/8	3/8	17/16	15/16	5/32	1.84	1.84	33/8	4 1/8	4	35/8	25/16
2 1/2	3.1	3	3/8	3/8	3/8	17/16	15/16	5/32	2.19	2.19	33/8	45/8	4 1/8	33/4	23/8
3 1/4	3.9	3 3/4	1/2	5/8	7/16	111/16	13/16	3/16	2.76	2.76	4 11/16	5 1/2	47/8	4 1/4	25/8
4	4.7	4 1/2	1/2	5/8	7/16	111/16	13/16	3/16	3.32	3.32	57/16	6 1/4	47/8	4 1/4	25/8

Table 2—Rod Dimensions

Bore Size	Rod		Thread		A	+0.000 -0.002 B	C	D	LA	NA	VF	W	WF	Y	ADD STROKE	
	Dia MM	Style 5 IM	Style 2 & 4 KK	ZF											ZJ	
1 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/8	9/16	5/8	5/8	1	17/8	5	45/8	
	1*	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	7/8	1	13/8	2 1/4	5 3/8	5	
2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/8	9/16	5/8	5/8	1	17/8	5	45/8	
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	7/8	1	13/8	2 1/4	5 3/8	5	
2 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/8	9/16	5/8	5/8	1	1 15/16	5 1/8	4 3/4	
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	7/8	1	13/8	2 5/16	5 1/2	5 1/8	
3 1/4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	17/8	15/16	7/8	3/4	13/8	27/16	6 1/4	5 5/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	15/16	1	1	15/8	2 11/16	6 1/2	5 7/8	
4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	17/8	15/16	7/8	3/4	13/8	27/16	6 1/4	5 5/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	15/16	1	1	15/8	2 11/16	6 1/2	5 7/8	

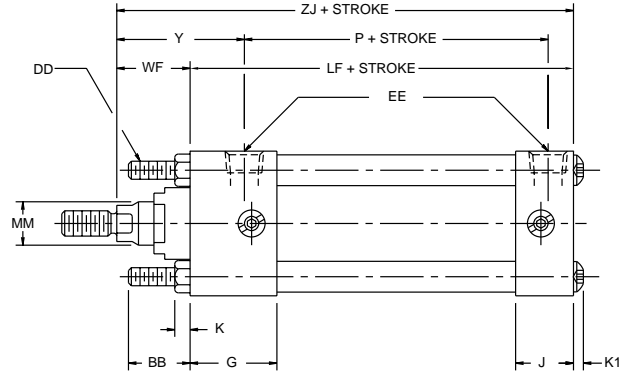
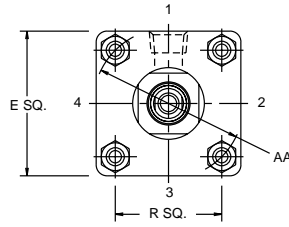
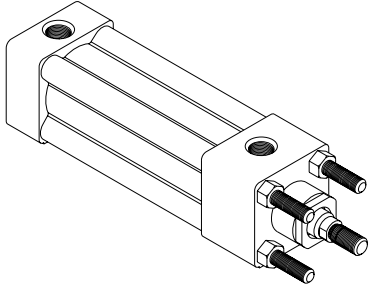
**Table 3—
Envelope
and Mounting
Dimensions**

*Cushion not available head end.

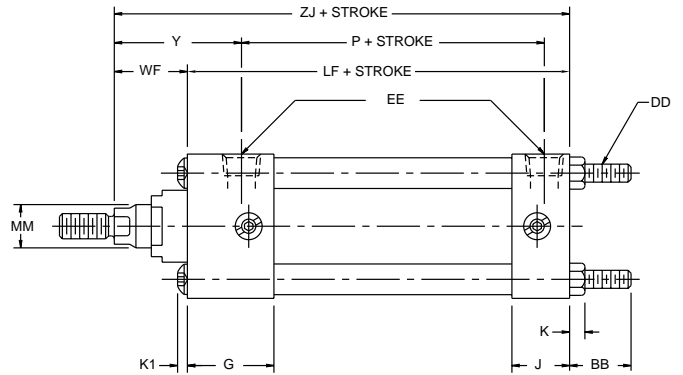
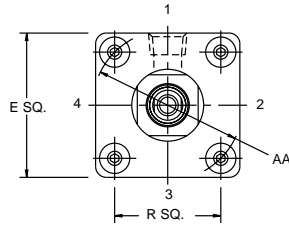
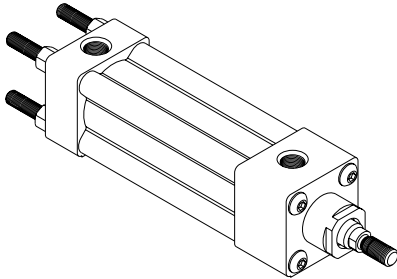
Miller AL4 Series Air Cylinders

Tie Rods Extended Head End Mount
 Tie Rods Extended Cap End Mount
 Tie Rods Extended Both Ends Mount
 Sleeve Nut Mount
 1-1/2" to 4" Bore Sizes

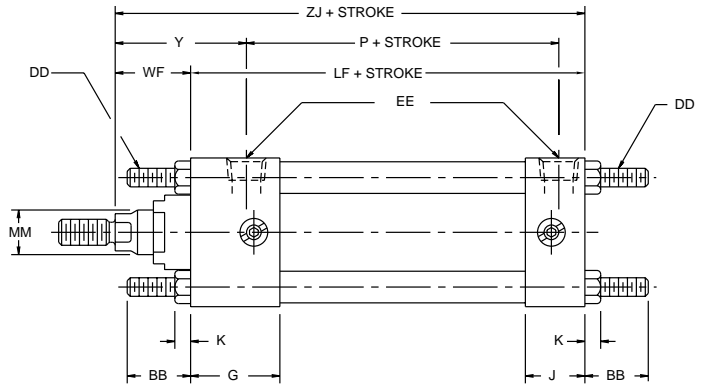
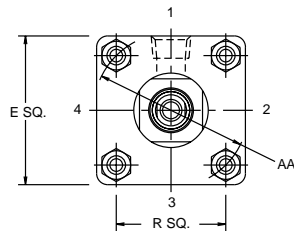
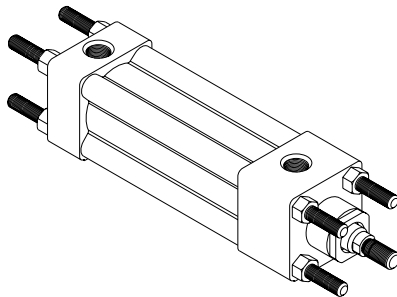
Tie Rods Extended Head End Mount Model 53 (NFPA MX3)



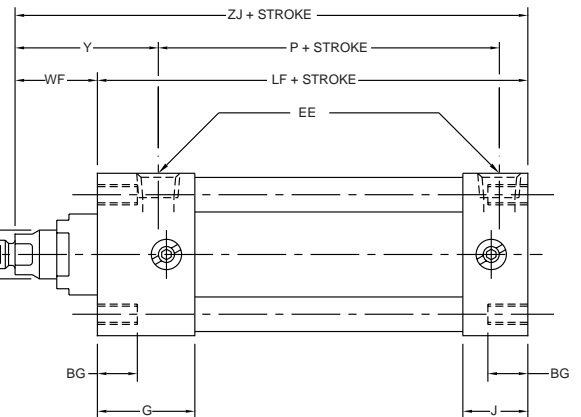
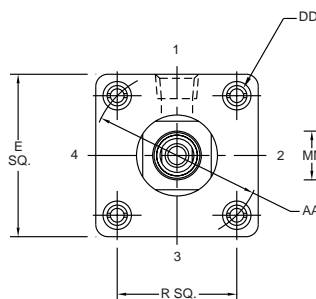
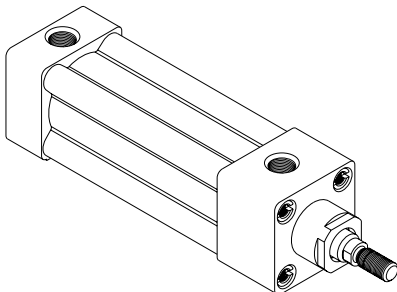
Tie Rods Extended Cap End Mount Model 52 (NFPA MX2)



Tie Rods Extended Both Ends Mount Model 51 (NFPA MX1)



Sleeve Nut Mount Model 55 (NFPA MX5)



Miller AL4 Series Air Cylinders

Tie Rods Extended Head End Mount
Tie Rods Extended Cap End Mount
Tie Rods Extended Both Ends Mount
Sleeve Nut Mount
1-1/2" to 4" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFPA Style SM)
Small Male

Thread Style 5
(NFPA Style IM)
Intermediate Male

Thread Style 4
(NFPA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

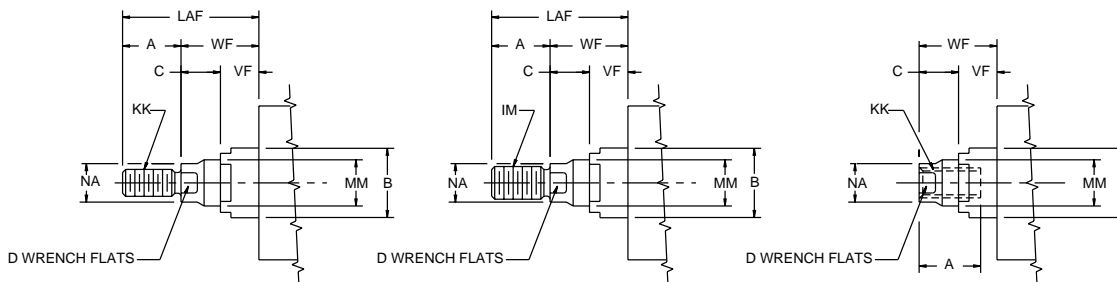


Table 1—Envelope and Mounting Dimensions

Bore	AA	BB	BG	DD	E	EE (NPTF)	G	J	K	K1	R	ADD STROKE	
												LF	P
1 1/2	2.02	1	.45	1/4-28	2	3/8	17/16	15/16	1/4	1/8	1.43	35/8	25/16
2	2.6	1 1/8	.48	5/16-24	2 1/2	3/8	17/16	15/16	5/16	5/32	1.84	35/8	25/16
2 1/2	3.1	1 1/8	.48	5/16-24	3	3/8	17/16	15/16	5/16	5/32	2.19	3 3/4	2 3/8
3 1/4	3.9	1 3/8	.50	3/8-24	3 3/4	1/2	1 11/16	1 3/16	3/8	3/16	2.76	4 1/4	2 5/8
4	4.7	1 3/8	.50	3/8-24	4 1/2	1/2	1 11/16	1 3/16	3/8	3/16	3.32	4 1/4	2 5/8

Table 2—Rod Dimensions

**Table 3—
Envelope and
Mounting Dimensions**

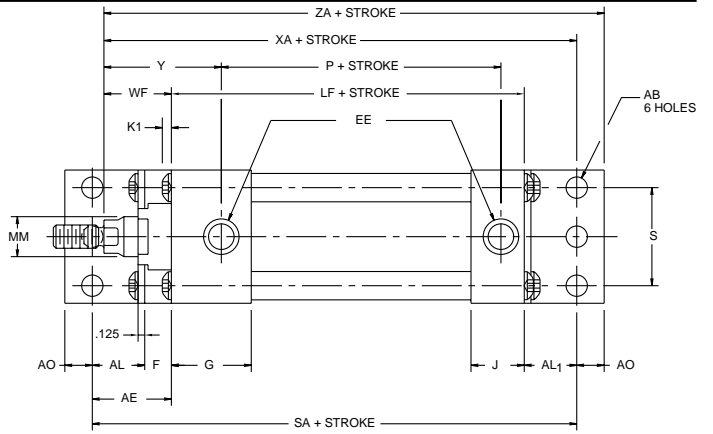
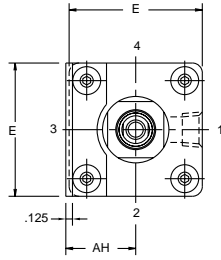
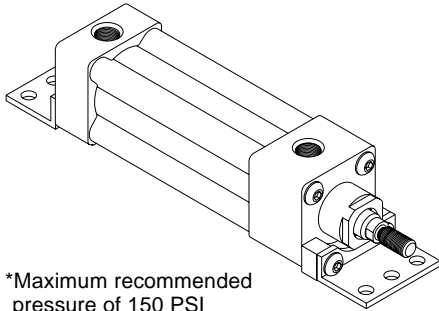
Bore Size	Rod		Thread		A	+0.000 -0.002 B	C	D	LAF	NA	VF	W	WF	Y	ZJ	ADD STROKE
	Dia MM	Style 5 IM	Style 2 & 4 KK													
1 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/4	9/16	5/8	5/8	1	17/8	45/8		
	1*	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	2 1/4	5		
2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/4	9/16	5/8	5/8	1	17/8	45/8		
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	2 1/4	5		
2 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/4	9/16	5/8	5/8	1	115/16	43/4		
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	25/16	5 1/8		
3 1/4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	27/16	55/8		
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	57/8		
4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	27/16	55/8		
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	57/8		

*Cushion not available head end.

Miller AL4 Series Air Cylinders

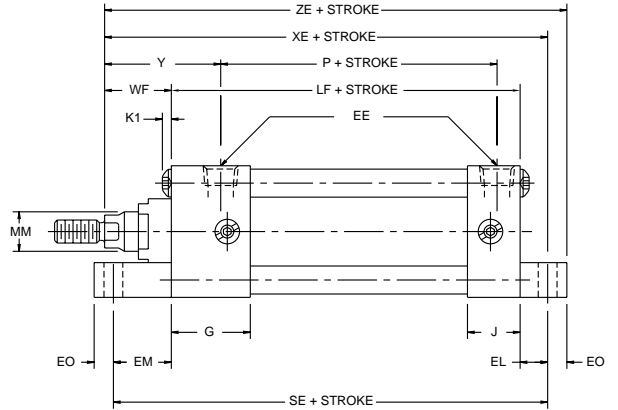
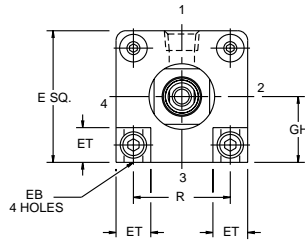
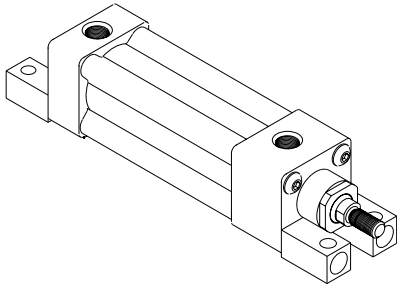
Side End Angle Mount
Side End Lug Mount
Side Lug Mount
Side Tap Mount
1-1/2" to 4" Bore Sizes

Side End Angle Mount Model 71* (NFPA MS1)

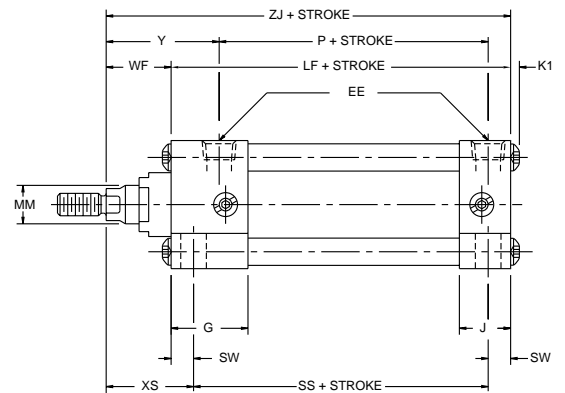
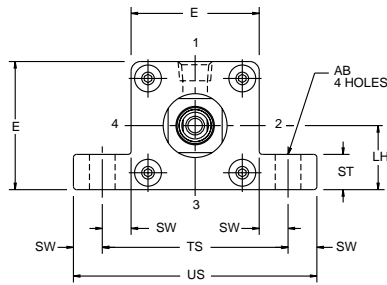
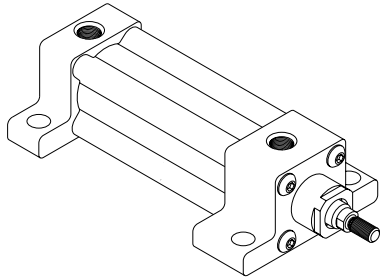


*Maximum recommended pressure of 150 PSI

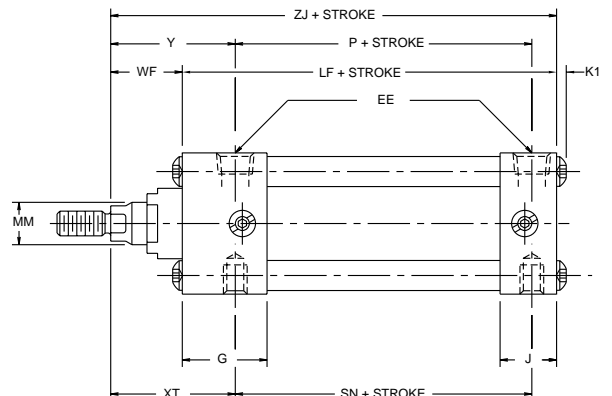
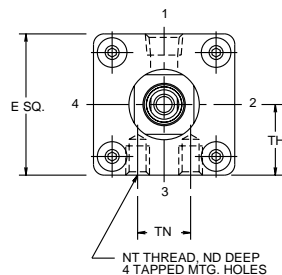
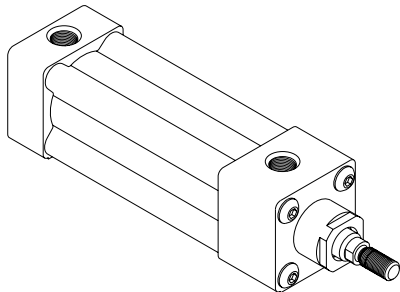
Side End Lug Mount Model 77 (NFPA MS7)



Side Lug Mount Model 72 (NFPA MS2)



Side Tap Mount* Model 74 (NFPA MS4)



*Not available in 1-1/2" bore, 1" rod.

Miller AL4 Series Air Cylinders

Side End Angle Mount
Side End Lug Mount
Side Lug Mount
Side Tap Mount
1-1/2" to 4" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFPA Style SM)
Small Male

Thread Style 5
(NFPA Style IM)
Intermediate Male

Thread Style 4
(NFPA Style SF)
Short Female

"Special Thread" Style X

Special thread, extension, rod eye, blank, etc., are also available. To order specify "Style X" and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensional sketch.

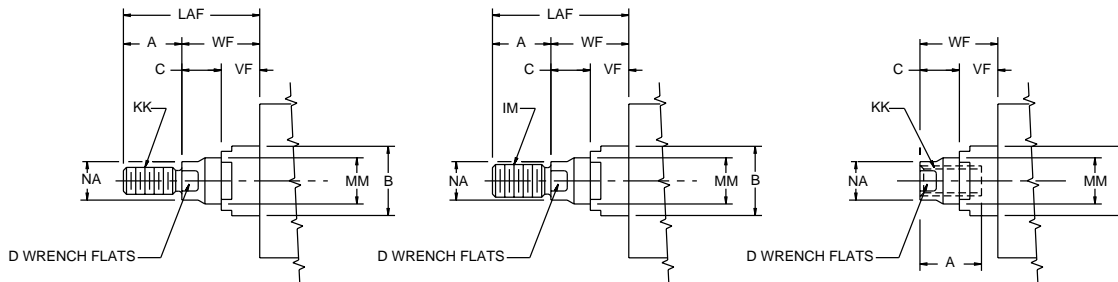


Table 1—Envelope and Mounting Dimensions

Bore	AB	AE	AH	AL	AL1	AO	E	EE (NPTF)	EB	EL	EM	EO	ET	F	G	GH ±.003	J	K1	LH ±.003	NT	S	ST	SW	TH ±.003	TN	TS	US	ADD STROKE					
																												LF	P	SA	SE	SN	SS
1 1/2	7/16	13/8	13/16	1	1	3/8	2	3/8	9/32	3/4	1 1/8	1/4	9/16	3/8	17/16	.993	15/16	1/8	.993	1/4-20	1 1/4	1/2	3/8	.993	5/8	2 3/4	3 1/2	3 5/8	2 5/16	6	5 1/2	2 1/4	2 7/8
2	7/16	13/8	17/16	1	1	3/8	2 1/2	3/8	11/32	15/16	15/16	5/16	11/16	3/8	17/16	1.243	15/16	5/32	1.243	5/16-18	1 3/4	1/2	3/8	1.243	7/8	3 1/4	4	3 5/8	2 5/16	6	5 7/8	2 1/4	2 7/8
2 1/2	7/16	13/8	15/8	1	1	3/8	3	3/8	11/32	11/16	17/16	5/16	13/16	3/8	17/16	1.493	15/16	5/32	1.493	3/8-16	2 1/4	1/2	3/8	1.493	1 1/4	3 3/4	4 1/2	3 3/4	2 3/8	6 1/8	6 1/4	2 3/8	3
3 1/4	9/16	17/8	115/16	1 1/4	1 1/4	1/2	3 3/4	1/2	13/32	7/8	1 1/2	3/8	1	5/8	1 11/16	1.868	1 3/16	3/16	1.868	1/2-13	2 3/4	3/4	1/2	1.868	1 1/2	4 3/4	5 3/4	4 1/4	2 5/8	7 3/8	6 5/8	2 5/8	3 1/4
4	9/16	—	2 1/4	1 7/8	1 1/4	1/2	4 1/2	1/2	13/32	1	1 5/8	3/8	1 3/16	—	1 11/16	2.243	1 3/16	3/16	2.243	1/2-13	3 1/2	3/4	1/2	2.243	2 1/16	5 1/2	6 1/2	4 1/4	2 5/8	7 3/8	6 7/8	2 5/8	3 1/4

Table 2—Rod Dimensions

Table 3—Envelope and Mounting Dimensions

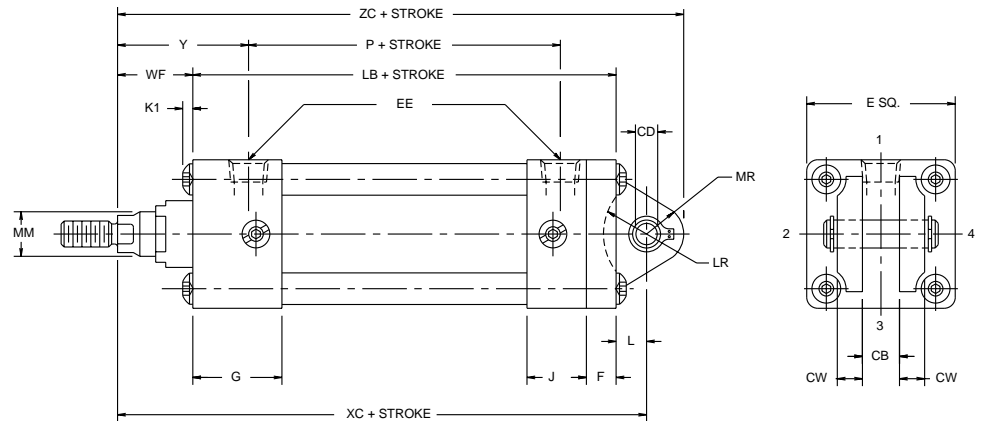
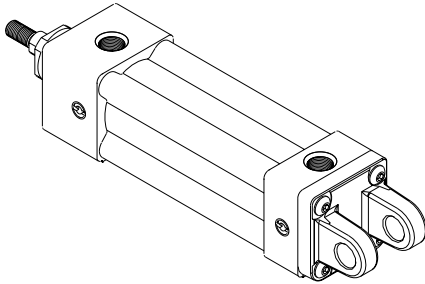
Bore Size	Rod		Thread		A	+0.000 -0.002 B	C	D	LAF	NA	VF	W	WF	Y	ND	XS	XT	ADDSTROKE				
	Dia MM	Style 5 IM	Style 2 & 4 KK	XA														XE	ZA	ZE	ZJ	
1 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/4	9/16	5/8	5/8	1	17/8	3/8	13/8	1 15/16	5 5/8	5 3/8	6	5 5/8	4 5/8	
	1*	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	1 3/8	2 1/4	—	13/4	—	6	—	6 3/8	—	5	
2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/4	9/16	5/8	5/8	1	17/8	7/16	13/8	1 15/16	5 5/8	5 9/16	6	5 7/8	4 5/8	
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	1 3/8	2 1/4	7/16	13/4	2 5/16	6	5 15/16	6 3/8	6 1/4	5	
2 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/4	9/16	5/8	5/8	1	1 15/16	5/8	13/8	1 15/16	5 3/4	5 13/16	6 1/8	6 1/8	4 3/4	
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	1 3/8	2 5/16	5/8	13/4	2 5/16	6 1/8	6 3/16	6 1/2	6 1/2	5 1/8	
3 1/4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	1 3/8	2 7/16	3/4	17/8	2 7/16	6 7/8	6 1/2	7 3/8	6 7/8	5 5/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	1 5/8	2 11/16	3/4	2 1/8	2 11/16	7 1/8	6 3/4	7 5/8	7 1/8	5 7/8	
4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	1 3/8	2 7/16	3/4	17/8	2 7/16	6 7/8	6 5/8	7 3/8	7	5 5/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	1 5/8	2 11/16	3/4	2 1/8	2 11/16	7 1/8	6 7/8	7 5/8	7 1/4	5 7/8	

*Cushion not available head end.

Miller AL4 Series Air Cylinders

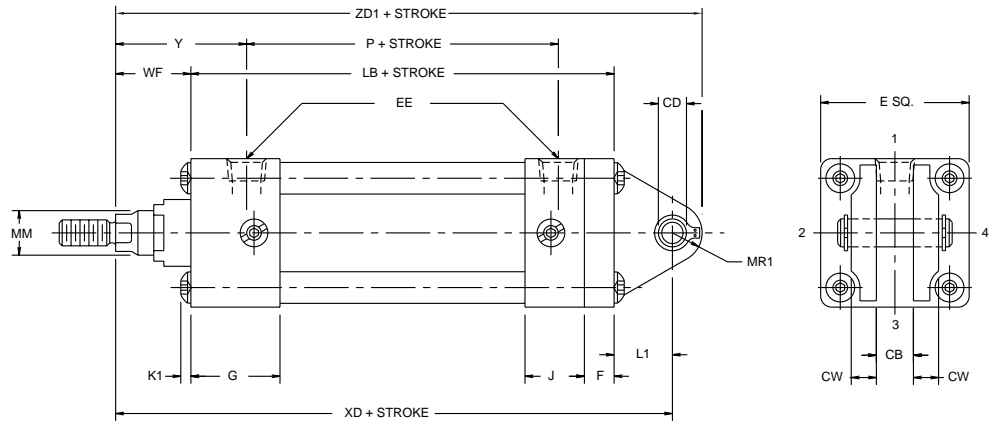
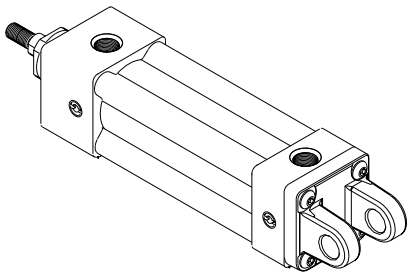
Cap Fixed Clevis Mount
Cap Detachable Clevis Mount
Cap Detachable Eye Mount
1-1/2" to 4" Bore Sizes

Cap Fixed Clevis Mount Model 84 (NFPA MP1)

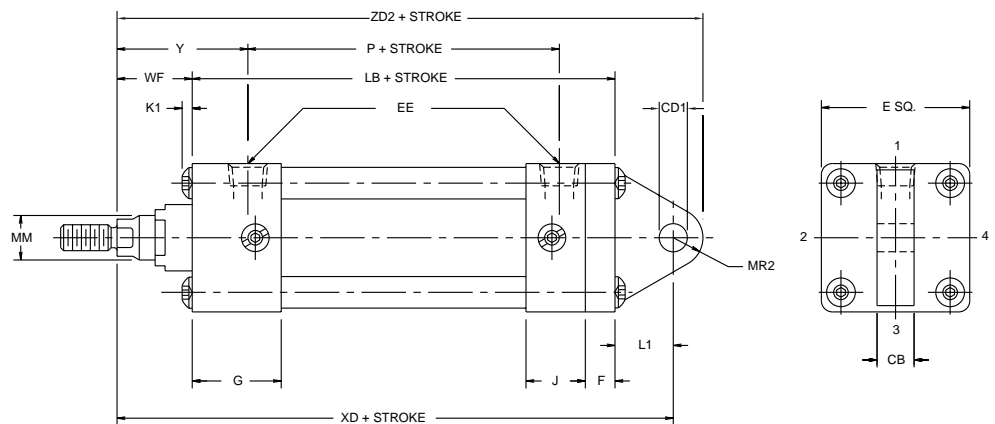
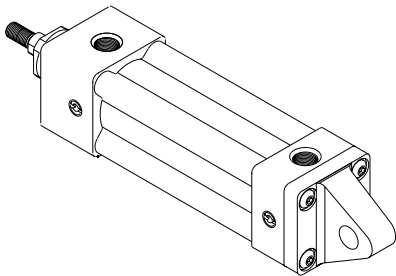


For maximum swivel angle with rear mounting plate for "84" mounting see AL4 Series cylinder accessories.

Cap Detachable Clevis Mount Model 86 (NFPA MP2)



Cap Detachable Eye Mount Model 96 (NFPA MP4)



Miller AL4 Series Air Cylinders

Cap Fixed Clevis Mount
Cap Detachable Clevis Mount
Cap Detachable Eye Mount
1-1/2" to 4" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFFA Style SM)
Small Male

Thread Style 5
(NFFA Style IM)
Intermediate Male

Thread Style 4
(NFFA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

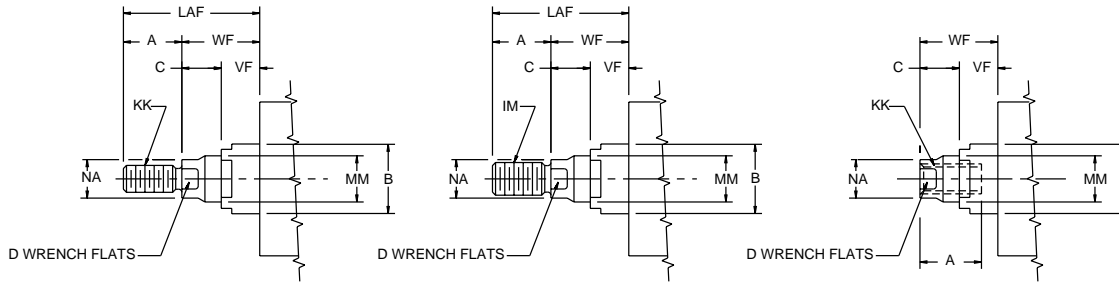


Table 1—Envelope and Mounting Dimensions

Bore	CB	+.000 CD -.002	+.002 CD, +.004	CW	E	EE (NPTF)	F	G	J	K1	L	L1	LR	MR	MR1	MR2	ADD STROKE	
																	LB	P
1 1/2	3/4	.501	.500	1/2	2	3/8	3/8	17/16	15/16	1/8	3/8	3/4	3/4	5/8	1/2	5/8	4	2 5/16
2	3/4	.501	.500	1/2	2 1/2	3/8	3/8	17/16	15/16	5/32	3/8	3/4	3/4	5/8	1/2	5/8	4	2 5/16
2 1/2	3/4	.501	.500	1/2	3	3/8	3/8	17/16	15/16	5/32	3/8	3/4	3/4	5/8	1/2	11/16	4 1/8	2 3/8
3 1/4	1 1/4	.751	.750	5/8	3 3/4	1/2	5/8	11 1/16	13 1/16	3/16	5/8	1 1/4	1	15/16	3/4	7/8	4 7/8	2 5/8
4	1 1/4	.751	.750	5/8	4 1/2	1/2	5/8	11 1/16	13 1/16	3/16	5/8	1 1/4	1	15/16	3/4	7/8	4 7/8	2 5/8

Table 2—Rod Dimensions

Bore Size	Rod		Thread		A	+.000 -.002 B	C	D	LAF	NA	VF	W	WF	Y	ADD STROKE				
	Dia MM	Style 5 IM	Style 2 & 4 KK	A											XC	XD	ZC	ZD1	ZD2
1 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/4	9/16	5/8	5/8	1	17/8	5 3/8	5 3/4	6	6 1/4	6 3/8	
	1*	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	2 1/4	5 3/4	6 1/8	6 3/8	6 5/8	6 3/4	
2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/4	9/16	5/8	5/8	1	17/8	5 3/8	5 3/4	6	6 1/4	6 3/8	
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	2 1/4	5 3/4	6 1/8	6 3/8	6 5/8	6 3/4	
2 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	13/4	9/16	5/8	5/8	1	1 15/16	5 1/2	5 7/8	6 1/8	6 3/8	6 9/16	
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	2 5/16	5 7/8	6 1/4	6 1/2	6 3/4	6 15/16	
3 1/4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	2 7/16	6 7/8	7 1/2	7 13/16	8 1/4	8 3/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	7 1/8	7 3/4	8 1/16	8 1/2	8 5/8	
4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	2 7/16	6 7/8	7 1/2	7 13/16	8 1/4	8 3/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	7 1/8	7 3/4	8 1/16	8 1/2	8 5/8	

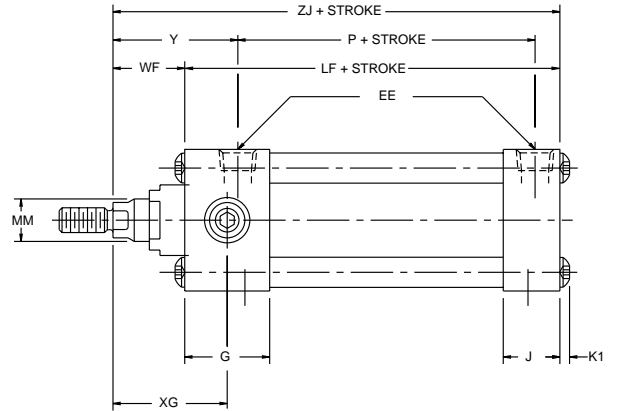
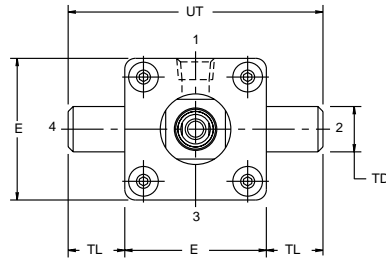
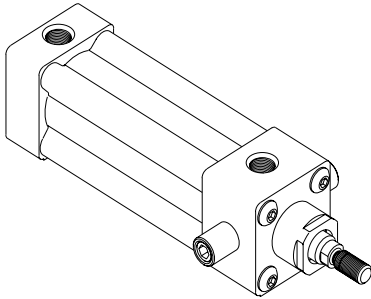
*Cushion not available head end.

Table 3—
Envelope and
Mounting Dimensions

Miller AL4 Series Air Cylinders

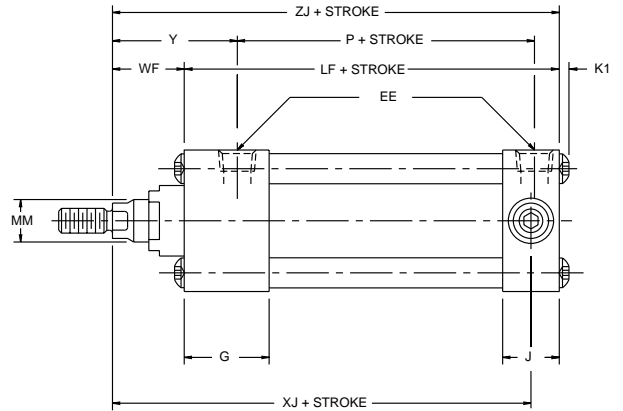
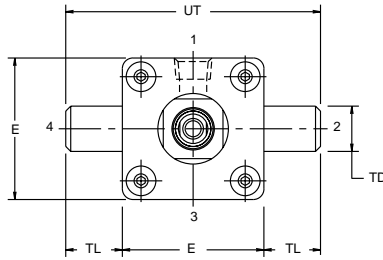
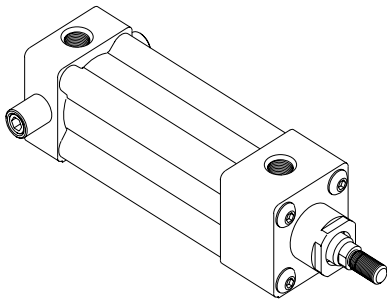
Head Trunnion Mount
Cap Trunnion Mount
Intermediate Trunnion Mount
1-1/2" to 4" Bore Sizes

Head Trunnion Mount* Model 81 (NFPA MT1)

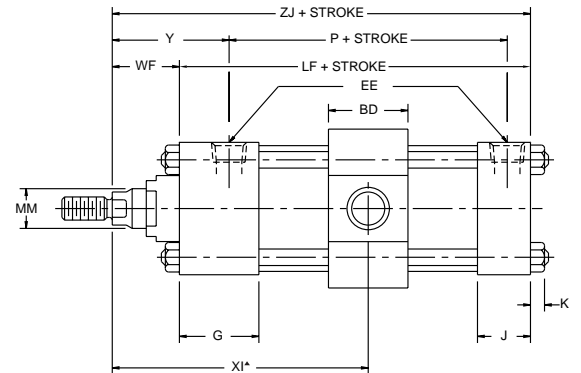
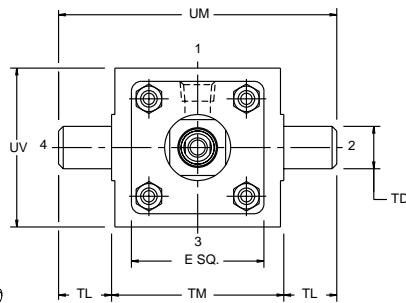
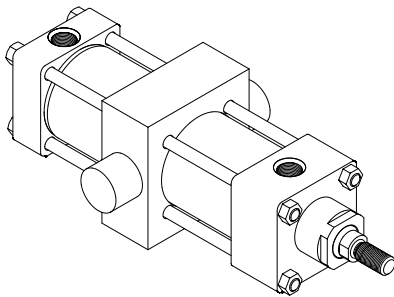


*Not available in 1-1/2" bore, 1" rod.

Cap Trunnion Mount Model 82 (NFPA MT2)



Intermediate Trunnion Mount Model 89 (NFPA MT4)



▲ Dimension "XI" to be specified by customer.

Miller AL4 Series Air Cylinders

Head Trunnion Mount
Cap Trunnion Mount
Intermediate Trunnion Mount
1-1/2" to 4" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFFA Style SM)
Small Male

Thread Style 5
(NFFA Style IM)
Intermediate Male

Thread Style 4
(NFFA Style SF)
Short Female

"Special Thread" Style X

Special thread, extension, rod eye, blank, etc., are also available. To order specify "Style X" and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

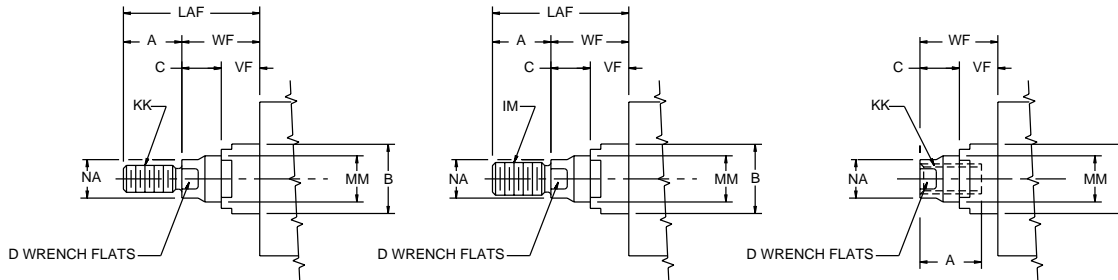


Table 1—Envelope and Mounting Dimensions

Bore	BD	E	EE (NPTF)	G	J	K	K1	+0.000 TD -0.001	TL	TM	UM	UT	UV	ADD STROKE		Style MT4 Minimum Stroke
														LF	P	
1 1/2	1 1/4	2	3/8	17/16	15/16	1/4	1/8	1.000	1	2 1/2	4 1/2	4	2 1/2	3 5/8	2 5/16	0
2	1 1/2	2 1/2	3/8	17/16	15/16	5/16	5/32	1.000	1	3	5	4 1/2	3	3 5/8	2 5/16	1/4
2 1/2	1 1/2	3	3/8	17/16	15/16	5/16	5/32	1.000	1	3 1/2	5 1/2	5	3 1/2	3 3/4	2 3/8	1/8
3 1/4	2	3 3/4	1/2	1 11/16	1 3/16	3/8	3/16	1.000	1	4 1/2	6 1/2	5 3/4	4 1/4	4 1/4	2 5/8	5/8
4	2	4 1/2	1/2	1 11/16	1 3/16	3/8	3/16	1.000	1	5 1/4	7 1/4	6 1/2	5	4 1/4	2 5/8	5/8

Table 2—Rod Dimensions

Bore Size	Rod		Thread		A	+0.000 -0.002 B	C	D	LAF	NA	VF	W	WF	Y	XG	▲ Min. XI	ADD STROKE	
	Dia MM	Style 5 IM	Style 2 & 4 KK	XJ													ZJ	
1 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/4	9/16	5/8	5/8	1	17/8	13/4	3 1/8	4 1/8	4 5/8	
	1*	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	2 1/4	—	3 1/2	4 1/2	5	
2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/4	9/16	5/8	5/8	1	17/8	13/4	3 1/4	4 1/8	4 5/8	
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	2 1/4	2 1/8	3 5/8	4 1/2	5	
2 1/2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/4	9/16	5/8	5/8	1	1 15/16	13/4	3 1/4	4 1/4	4 3/4	
	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	1	13/8	2 5/16	2 1/8	3 5/8	4 5/8	5 1/8	
3 1/4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	2 7/16	2 1/4	4 1/8	5	5 5/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	2 1/2	4 3/8	5 1/4	5 7/8	
4	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	2 7/16	2 1/4	4 1/8	5	5 5/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	2 1/2	4 3/8	5 1/4	5 7/8	

*Cushion not available head end.

▲ Dimension "XI" to be specified by customer.

**Table 3—
Envelope and
Mounting Dimensions**

Miller AL4 Series Air Cylinders

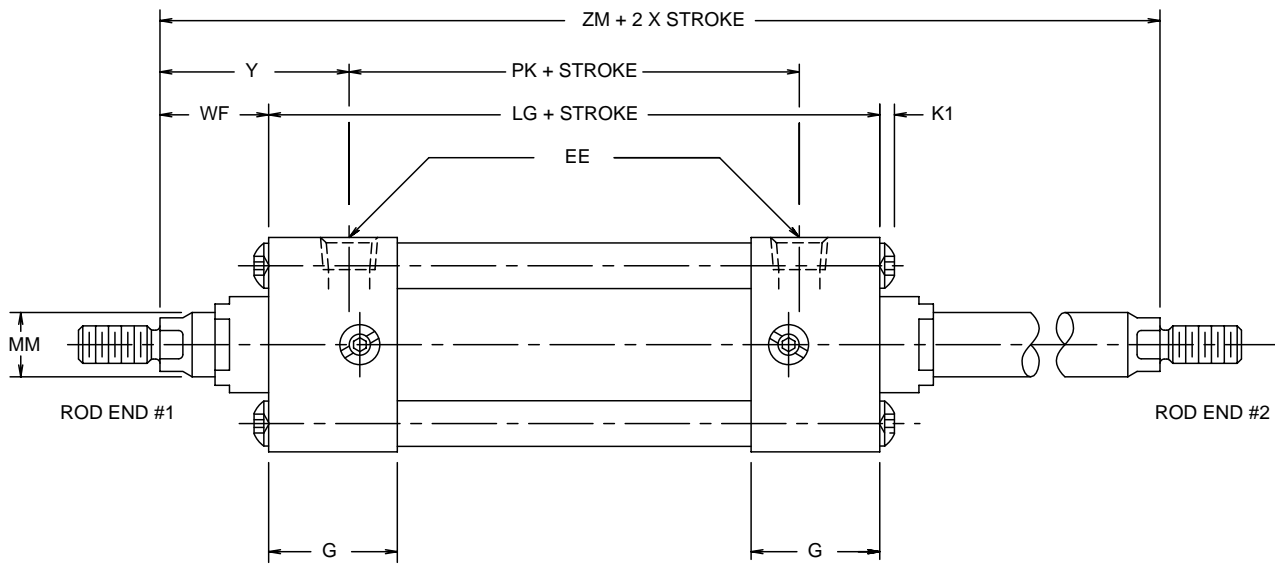
Double Rod Models
1-1/2" to 4" Bore Sizes

How to Use Double Rod Cylinder Dimension Drawings

To determine dimensions for a double rod cylinder, first refer to the desired single rod mounting style cylinder shown on preceding pages of this catalog. After selecting necessary dimensions from that drawing, return to this page and supplement the single rod dimensions with those shown on the drawing and dimension table below. Note that double rod cylinders have a head (Dim. G) at both ends and that dimension LG replaces LF and PK replaces P,

etc. The double rod dimensions differ from, or are in addition to those for single rod cylinders shown on preceding pages and provide the information needed to completely dimension a double rod cylinder.

On a double rod cylinder where the two rod ends are different, be sure to clearly state which rod end is to be assembled at which end.



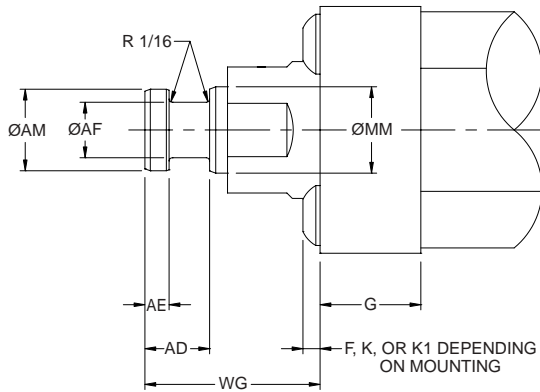
All dimensions are in inches and apply to standard rod sizes only. For alternate rod sizes, determine all envelope dimensions (within LD dim.) as described above and then use appropriate rod end dimensions for proper rod size from single rod cylinder.

Bore	Rod Dia.	ADD STROKE								Add 2x Stroke
	MM	LG	PK	SAK	XAK	SSK	SNK	SEK	XEK	ZM
1 1/2	5/8	4 1/8	2 3/8	6 1/8	6 1/8	3 3/8	2 1/4	6 3/8	6 1/4	6 1/8
2	5/8	4 1/8	2 3/8	6 1/8	6 1/8	3 3/8	2 1/4	6 3/4	6 7/16	6 1/8
2 1/2	5/8	4 1/4	2 3/8	6 1/4	6 1/4	3 1/2	2 3/8	7 1/8	6 11/16	6 1/4
3 1/4	1	4 3/4	2 5/8	7 1/4	7 3/8	3 3/4	2 5/8	7 3/4	7 5/8	7 1/2
4	1	4 3/4	2 5/8	7 1/4	7 3/8	3 3/4	2 5/8	8	7 3/4	7 1/2
REPLACES DIMENSION		LF	P	SA	XA	SS	SN	SE	XE	-
ON SINGLE ROD MOUNTING STYLES		ALL MTG STYLES		71		72	74	77		ALL MTG STYLES

Miller AL4 Series Air Cylinders

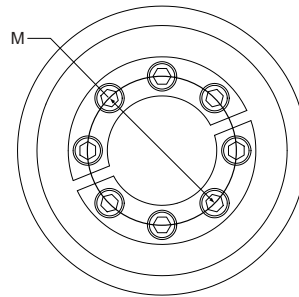
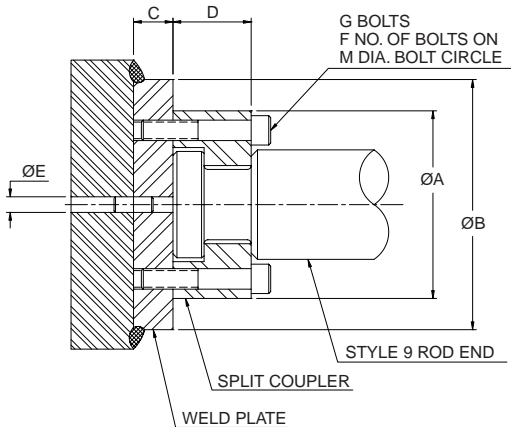
Style 9 Rod Ends
Split Couplers & Weld Plates
Cylinder Weight Chart

Style 9 Rod End For Flange Coupling



MM Rod Dia.	AD	AE	AF	AM	WG
5/8	5/8	1/4	3/8	0.57	1 3/4
1	15/16	3/8	11/16	0.95	2 3/8
1 3/8	1 1/16	3/8	7/8	1.32	2 3/4
1 3/4	1 5/16	1/2	1 1/8	1.70	3 1/8

Split Flange Coupler & Weld Plate



⚠ WARNING: Piston rod separation from the machine member can result in severe personal injury or even death to nearby personnel. The cylinder user must make sure the weld holding the weld plate to the machine is of sufficient quality and size to hold the intended load. The cylinder user must also make sure the bolts holding split coupler to the weld plate are of sufficient strength to hold the intended load and installed in such a way that they will not become loose during the machine's operation.

Part Numbers and Dimensions

Rod Dia.	A	B	C	D	E	F	G	M	Split Coupler Part Number	Weld Plate Part Number
5/8	1 1/2	2	1/2	9/16	1/4	4	#10-24 x .94 LG	1.125	147234 0062	148174 0062
1	2	2 1/2	1/2	7/8	1/4	6	1/4-20 x 1.25 LG	1.500	147234 0100	148174 0100
1 3/8	2 1/2	3	5/8	1	1/4	6	5/16-18 x 1.50 LG	2.000	147234 0138	148174 0138
1 3/4	3	4	5/8	1 1/4	1/4	8	5/16-18 x 1.75 LG	2.375	147234 0175	148174 0175

Cylinder Weights—AL4, AL4H Cylinders

No Mount Single Rod				No Mount Double Rod	
Bore In.	Rod In.	Base Lbs.	Per Inch Lbs.	Base Lbs.	Per Inch Lbs.
1.50	.625	1.73	.20	2.16	.28
2.00	.625	2.40	.21	3.05	.30
2.00	1.00	2.99	.35	4.34	.58
2.50	.625	3.25	.23	3.96	.31
2.50	1.00	4.06	.37	5.74	.60
3.25	1.00	6.45	.42	7.65	.64
3.25	1.375	7.93	.62	11.46	1.05
4.00	1.00	8.80	.49	10.32	.71
4.00	1.375	10.29	.69	14.37	1.12
5.00	1.00	13.20	.61	15.84	.84
5.00	1.375	14.72	.81	18.89	1.24
6.00	1.375	20.50	.87	25.65	1.30
6.00	1.75	22.61	1.13	30.41	1.82
8.00	1.375	35.50	1.25	41.15	1.68
8.00	1.75	37.63	1.51	45.90	2.20

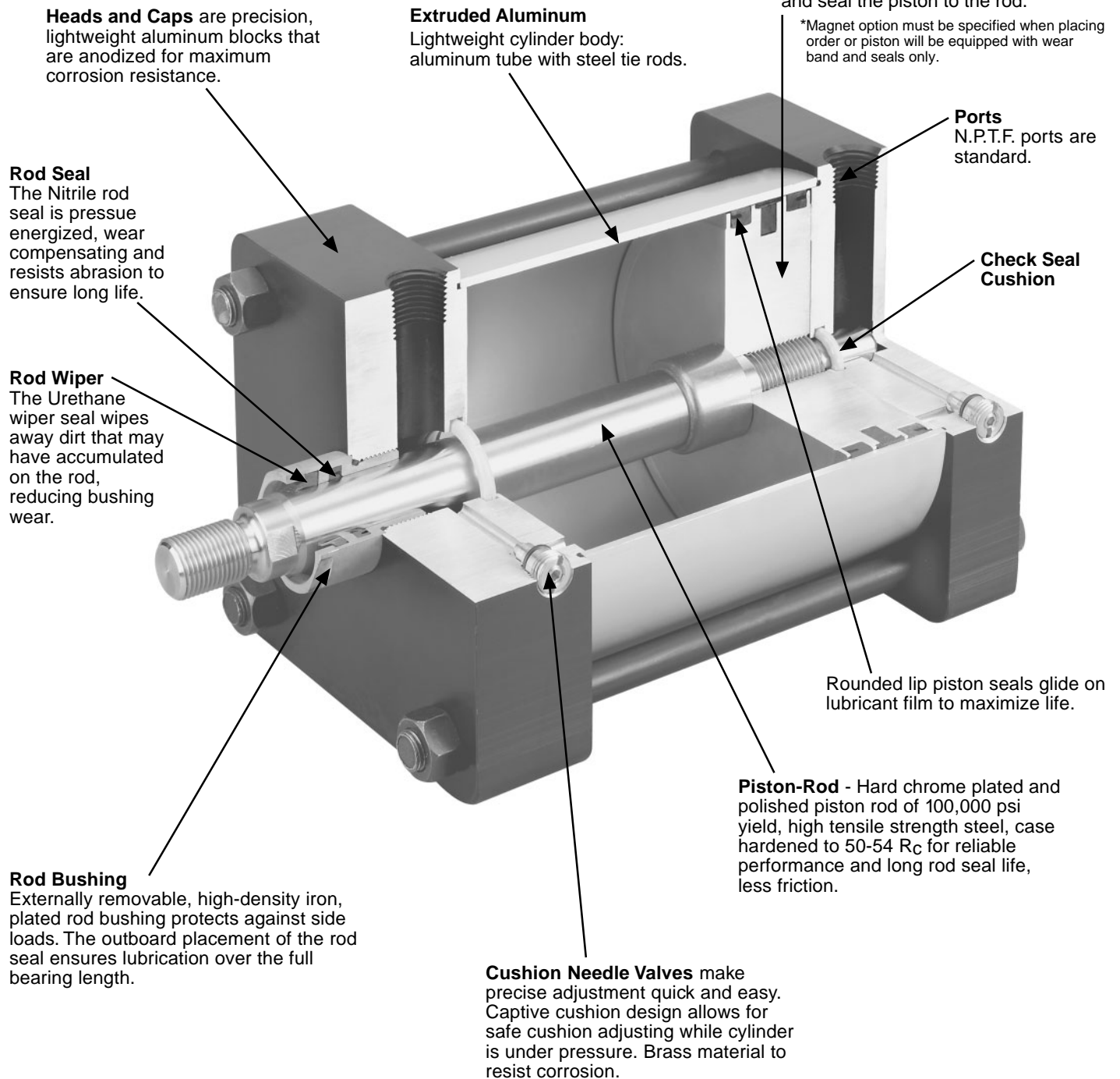
Mounting Weight Adders by Model Number

Bore In.	61, 62	81, 82	84	71, 77	89	96	72	86
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1.50	.51	.50	.15	.36	1.70	.23	.15	.20
2.00	.76	.50	.26	.65	2.38	.32	.15	.29
2.50	1.13	.50	.38	1.05	3.00	.42	.15	.41
3.25	2.76	.50	.98	1.38	5.35	1.26	.35	1.06
4.00	4.05	.50	1.35	2.20	6.75	1.62	.35	1.49
5.00	6.46	.50	1.20	4.29	8.77	N/A	.57	2.41
6.00	10.74	1.22	2.91	5.88	15.52	N/A	.69	11.38
8.00	N/A	1.22	2.91	7.84	25.01	N/A	.67	17.31

Miller AL4 Series - 5" through 8" Bore Lightweight, Non-Lube Pneumatic Cylinder.

Premium Quality and Economy in one.

Lightweight construction and solid Non-Lube design with proven reliability make the AL4 Series Cylinder the high performance, long lasting, economical choice for your air cylinder applications.



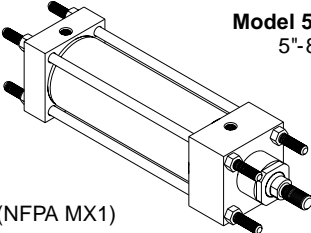
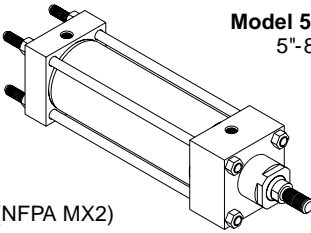
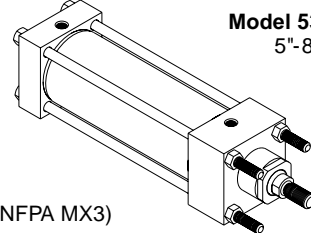
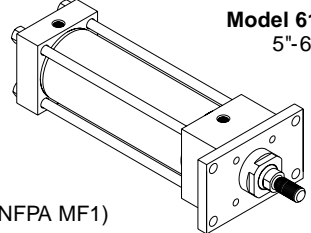
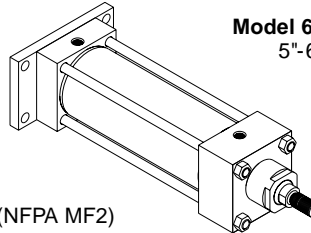
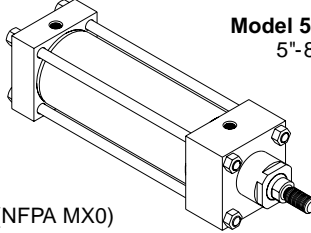
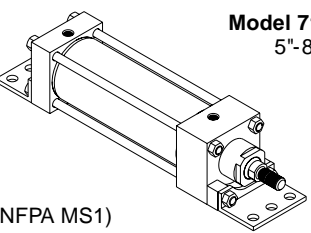
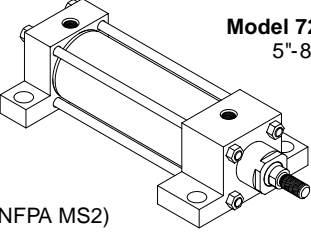
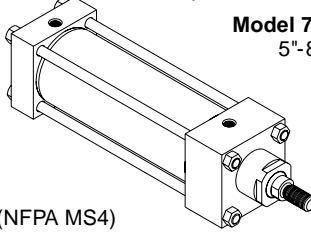
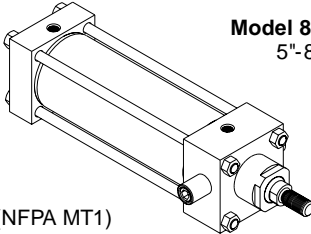
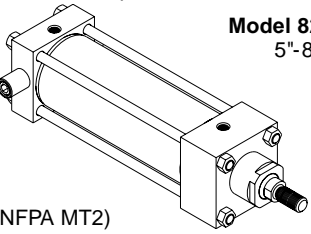
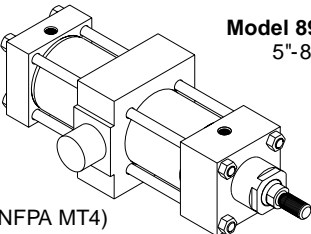
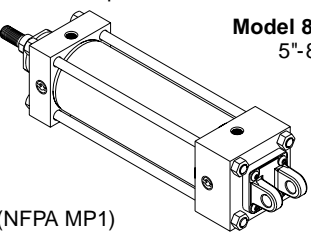
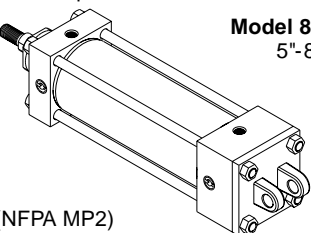
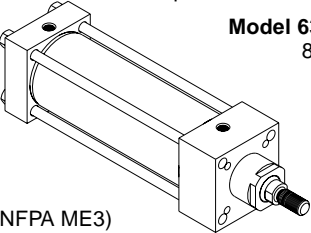
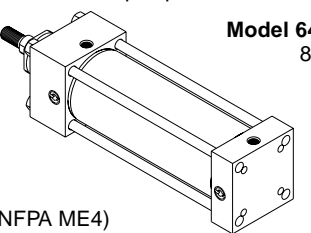
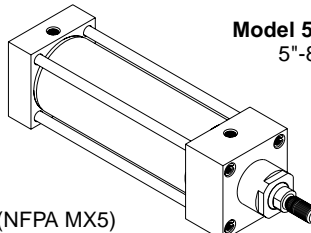
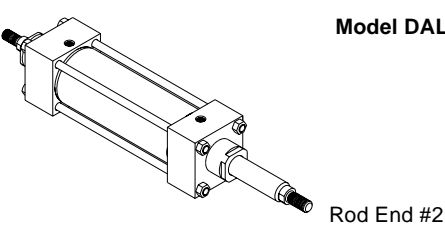
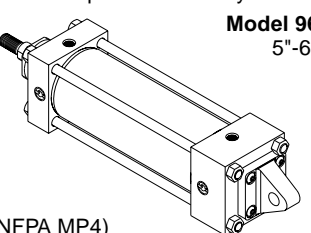
Miller AL4 Series Air Cylinders

Standard Specifications and Mounting Styles

Standard Specifications

- N.F.P.A. Interchangeable
- Bore sizes – 5", 6" and 8"
- Rod Diameters – 1", 1-3/8", and 1-3/4"
- Rod Ends – three standard, specials to order.
- Cushions – optional at either end or both ends of stroke.
- Strokes – available in any practical stroke length.
- 250 P.S.I. Air Service
- 250 P.S.I. Hydraulic Service (non-cushioned only)
- Standard Fluid – Filtered Air
- Standard Temperature – -10°F to +165°F
- Fluorocarbon Seals for high temperature service – -10°F to +250°F (optional)
- Single rod end or double rod end
- Mounting styles – 17 standard
- Non-Lube Service

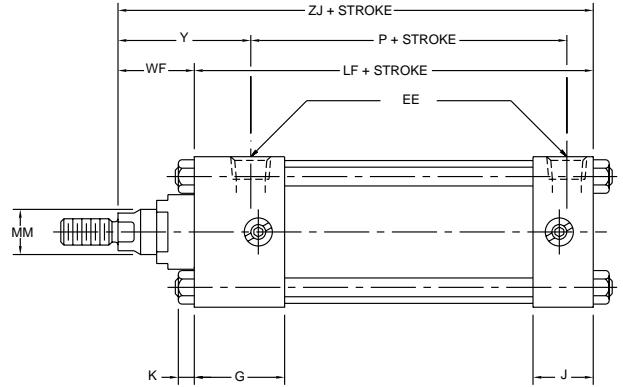
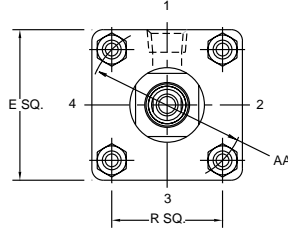
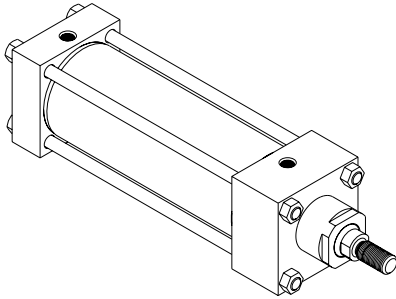
Available Mounting Styles

<p>Tie Rods Extended Both Ends</p>  <p>Model 51 5"-8"</p> <p>(NFPA MX1)</p>	<p>Tie Rods Extended Cap End</p>  <p>Model 52 5"-8"</p> <p>(NFPA MX2)</p>	<p>Tie Rods Extended Head End</p>  <p>Model 53 5"-8"</p> <p>(NFPA MX3)</p>	<p>Head Rectangular Flange</p>  <p>Model 61 5"-6"</p> <p>(NFPA MF1)</p>
<p>Cap Rectangular Flange</p>  <p>Model 62 5"-6"</p> <p>(NFPA MF2)</p>	<p>No Mount</p>  <p>Model 50 5"-8"</p> <p>(NFPA MX0)</p>	<p>Side End Angle</p>  <p>Model 71 5"-8"</p> <p>(NFPA MS1)</p>	<p>Side Lug</p>  <p>Model 72 5"-8"</p> <p>(NFPA MS2)</p>
<p>Side Tap</p>  <p>Model 74 5"-8"</p> <p>(NFPA MS4)</p>	<p>Head Trunnion</p>  <p>Model 81 5"-8"</p> <p>(NFPA MT1)</p>	<p>Cap Trunnion</p>  <p>Model 82 5"-8"</p> <p>(NFPA MT2)</p>	<p>Intermediate Trunnion</p>  <p>Model 89 5"-8"</p> <p>(NFPA MT4)</p>
<p>Cap Fixed Clevis</p>  <p>Model 84 5"-8"</p> <p>(NFPA MP1)</p>	<p>Cap Detachable Clevis</p>  <p>Model 86 5"-8"</p> <p>(NFPA MP2)</p>	<p>Head Square</p>  <p>Model 63 8"</p> <p>(NFPA ME3)</p>	<p>Cap Square</p>  <p>Model 64 8"</p> <p>(NFPA ME4)</p>
<p>Sleeve Nut</p>  <p>Model 55 5"-8"</p> <p>(NFPA MX5)</p>	<p>Double Rod End</p>  <p>Model DAL4 Shown 5"-8"</p> <p>Rod End #1 Rod End #2</p> <p>(NFPA MDX0)</p>		<p>Cap Detachable Eye</p>  <p>Model 96 5"-6"</p> <p>(NFPA MP4)</p>

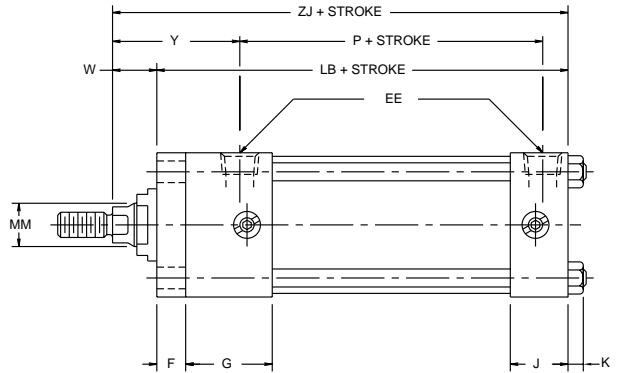
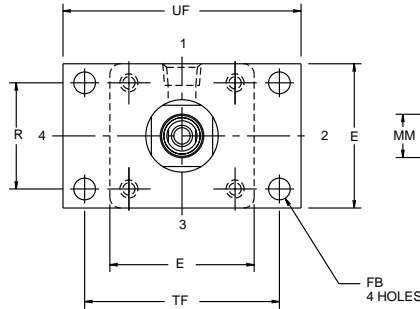
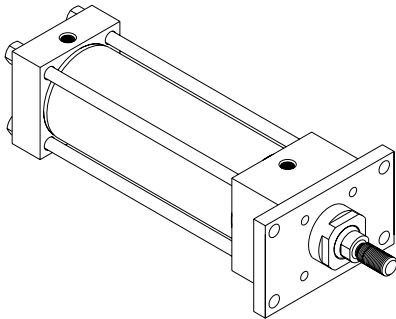
Miller AL4 Series Air Cylinders

No Mount (Basic)
Head Rectangular Flange Mount
Cap Rectangular Flange Mount
5" to 8" Bore Sizes

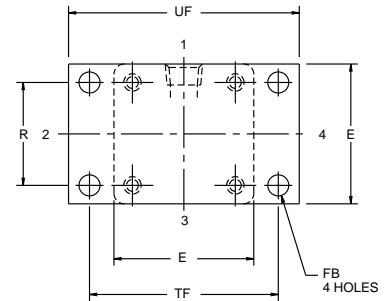
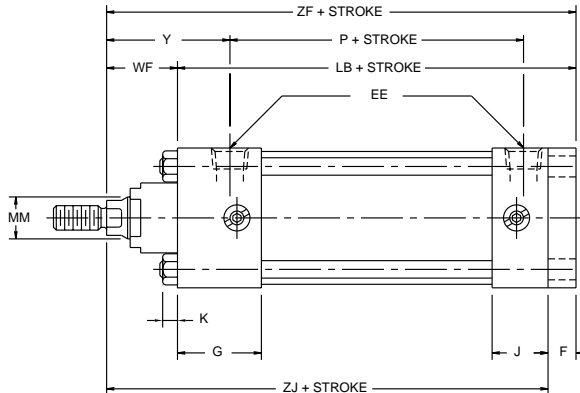
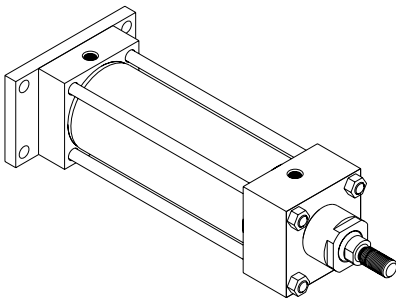
No Mount Basic Model 50 (NFPA MX0)



Head Rectangular Flange Mount (5" and 6" bore sizes) Model 61 (NFPA MF1)



Cap Rectangular Flange Mount (5" and 6" bore sizes) Model 62 (NFPA MF2)



Miller AL4 Series Air Cylinders

No Mount (Basic)
Head Rectangular Flange Mount
Cap Rectangular Flange Mount
5" to 8" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFFA Style SM)
Small Male

Thread Style 5
(NFFA Style IM)
Intermediate Male

Thread Style 4
(NFFA Style SF)
Short Female

"Special Thread" Style X

Special thread, extension, rod eye, blank, etc., are also available. To order specify "Style X" and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

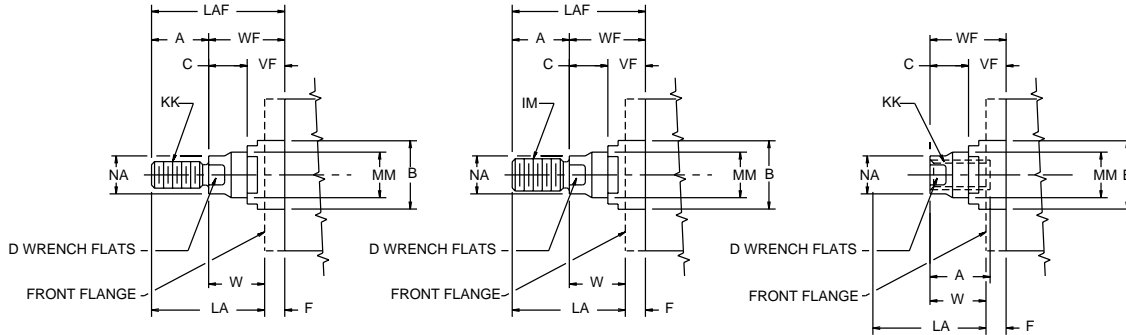


Table 1—Envelope and Mounting Dimensions

Bore	AA	E	EE (NPTF)	F	FB	G	J	K	R	TF	UF	ADD STROKE		
												LB	LF	P
5	5.8	5 1/2	1/2	5/8	9/16	1.66	1.22	7/16	4.10	6 5/8	7 5/8	5 1/8	4 1/2	2 7/8
6	6.9	6 1/2	3/4	3/4	9/16	1.91	1.41	7/16	4.88	7 5/8	8 5/8	5 3/4	5	3 1/8
8	9.1	8 1/2	3/4	3/4	—	1.81	1.44	9/16	—	—	—	5 7/8	5 1/8	3 1/4

Table 2—Rod Dimensions

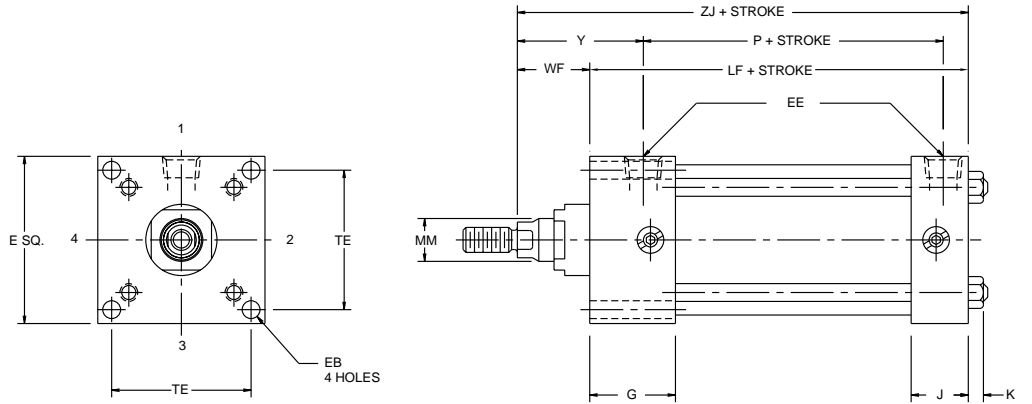
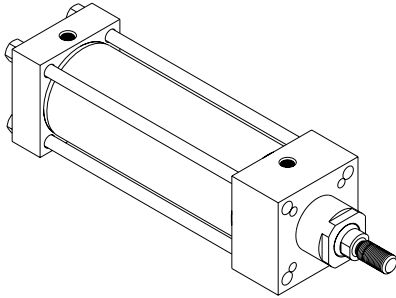
Bore Size	Rod		Thread		A	+0.000 -0.002 B	C	D	LA	NA	VF	W	WF	Y	ADD STROKE	
	Dia MM	Style 5 IM	Style 2 & 4 KK	ZF											ZJ	
5	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	7/8	3/4	1 3/8	2 7/16	6 1/2	5 7/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	15/16	1	1	1 5/8	2 11/16	6 3/4	6 1/8	
6	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	15/16	1	7/8	1 5/8	2 13/16	7 3/8	6 5/8	
	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	1 1/8	1 1/8	1 7/8	3 1/16	7 5/8	6 7/8	
8	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	15/16	1	7/8	1 5/8	2 3/4	—	6 3/4	
	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	1 1/8	1 1/8	1 7/8	3	—	7	

Table 3—Envelope and Mounting Dimensions

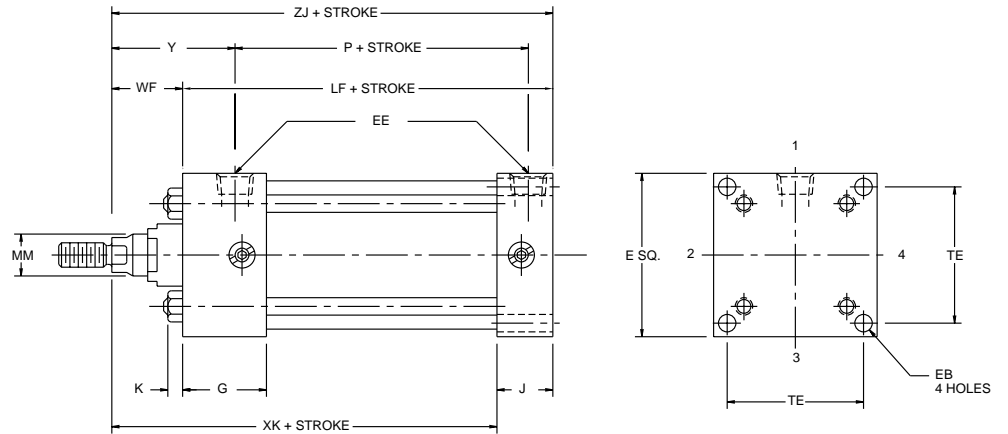
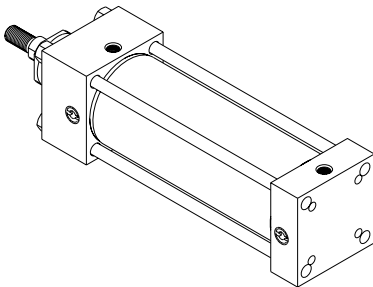
Miller AL4 Series Air Cylinders

Head Square Mount
Cap Square Mount
8" Bore Size

Head Square Mount Model 63 (NFPA ME3)



Cap Square Mount Model 64 (NFPA ME4)



Miller AL4 Series Air Cylinders

Head Square Mount
Cap Square Mount
8" Bore Size

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFPA Style SM)
Small Male

Thread Style 5
(NFPA Style IM)
Intermediate Male

Thread Style 4
(NFPA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

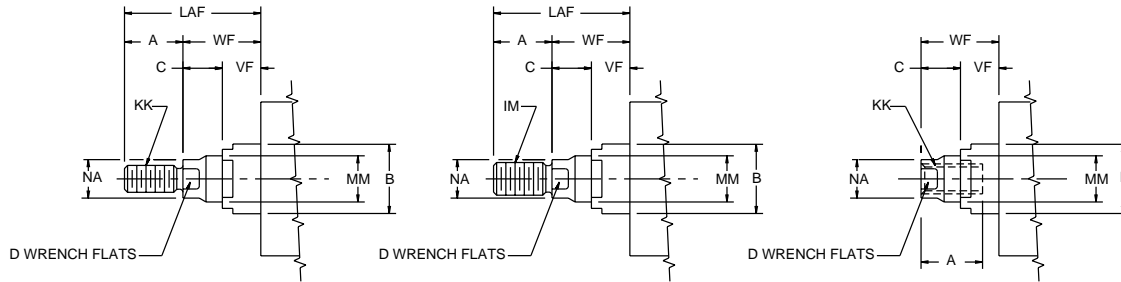


Table 1—Envelope and Mounting Dimensions

Bore	E	EB	EE (NPTF)	G	J	K	TE	ADD STROKE	
								LF	P
8	8 ¹ / ₂	1 ¹ / ₁₆	3/4	1.81	1.44	9/16	7.57	5 ¹ / ₈	3 ¹ / ₄

Table 2—Rod Dimensions

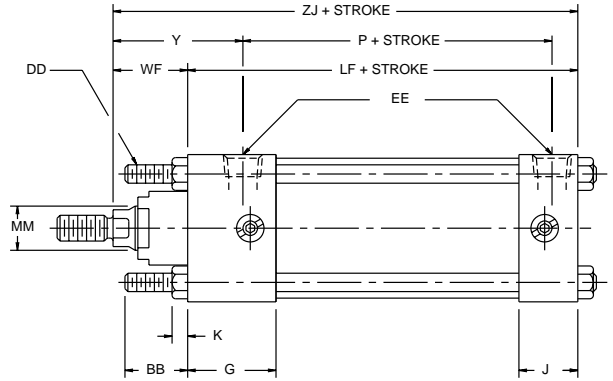
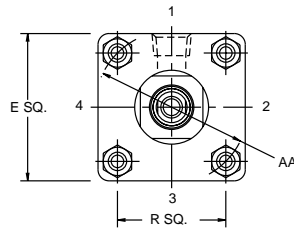
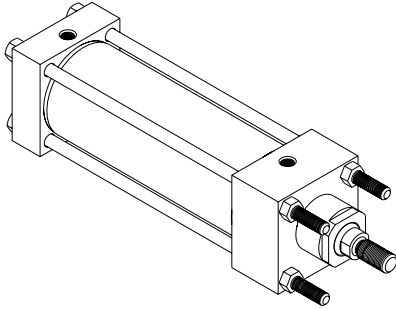
Bore Size	Rod	Thread		A	+0.000 -0.002 B	C	D	LAF	NA	VF	W	WF	Y	ADD STROKE	
	Dia MM	Style 5 IM	Style 2 & 4 KK											XK	ZJ
8	1 ³ / ₈	1 ¹ / ₄ -12	1-14	1 ⁵ / ₈	1.999	5/8	1 ¹ / ₈	3 ¹ / ₄	1 ⁵ / ₁₆	1	7/8	1 ⁵ / ₈	2 ³ / ₄	5 ⁵ / ₁₆	6 ³ / ₄
	1 ³ / ₄	1 ¹ / ₂ -12	1 ¹ / ₄ -12	2	2.374	3/4	1 ¹ / ₂	3 ⁷ / ₈	1 ¹¹ / ₁₆	1 ¹ / ₈	1 ¹ / ₈	1 ⁷ / ₈	3	5 ⁹ / ₁₆	7

**Table 3—
Envelope
and Mounting
Dimensions**

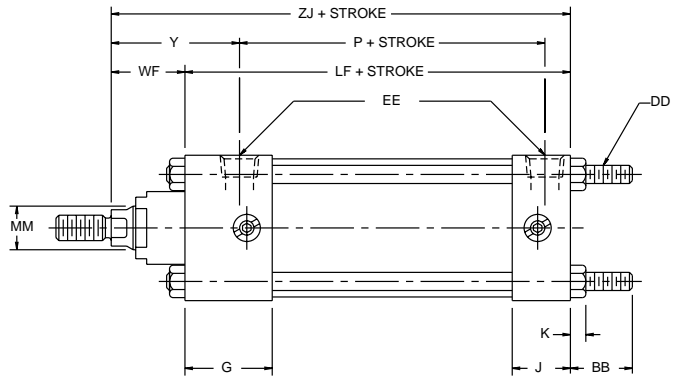
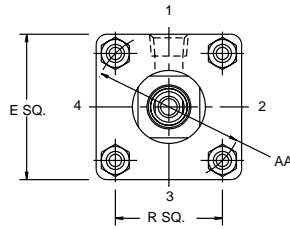
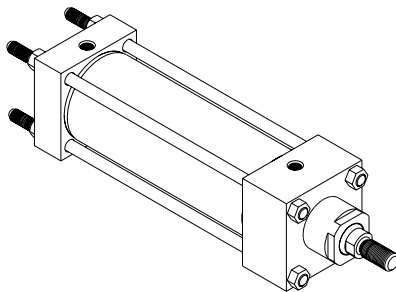
Miller AL4 Series Air Cylinders

Tie Rods Extended Head End Mount
Tie Rods Extended Cap End Mount
Tie Rods Extended Both Ends Mount
Sleeve Nut Mount
5" to 8" Bore Sizes

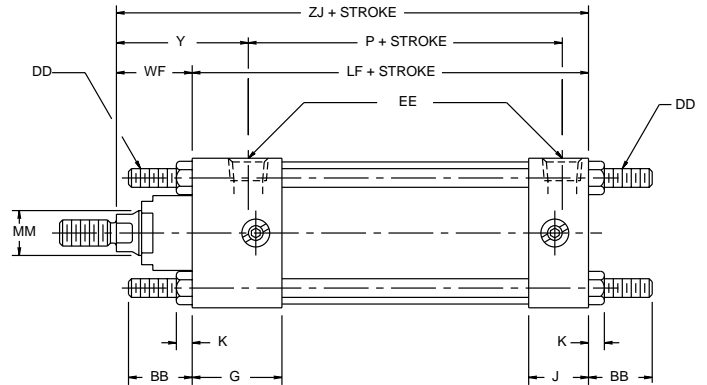
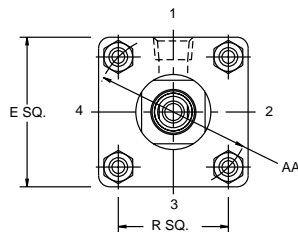
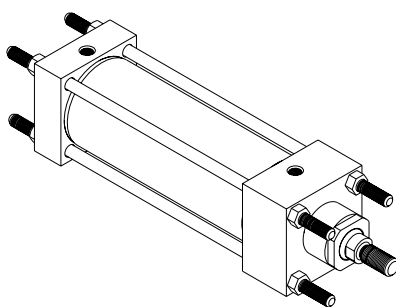
Tie Rods Extended Head End Mount Model 53 (NFPA MX3)



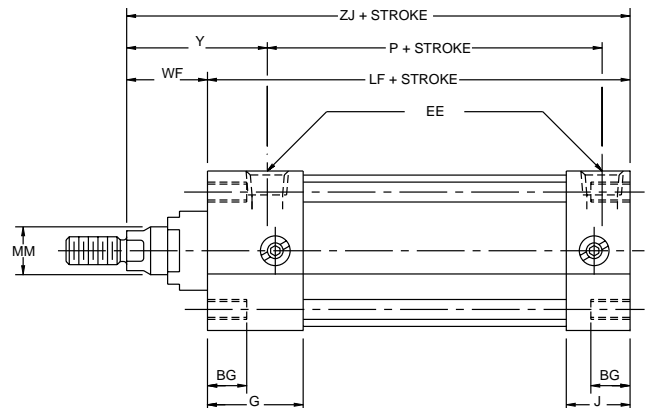
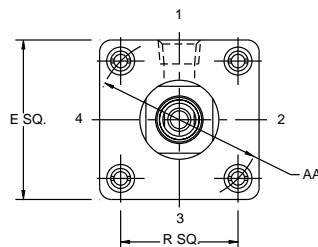
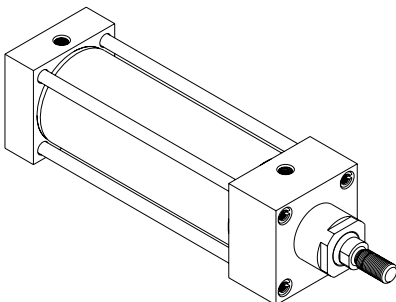
Tie Rods Extended Cap End Mount Model 52 (NFPA MX2)



Tie Rods Extended Both Ends Mount Model 51 (NFPA MX1)



Sleeve Nut Mount Model 55 (NFPA MX5)



Miller AL4 Series Air Cylinders

Tie Rods Extended Head End Mount
Tie Rods Extended Cap End Mount
Tie Rods Extended Both Ends Mount
Sleeve Nut Mount
5" to 8" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFPA Style SM)
Small Male

Thread Style 5
(NFPA Style IM)
Intermediate Male

Thread Style 4
(NFPA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

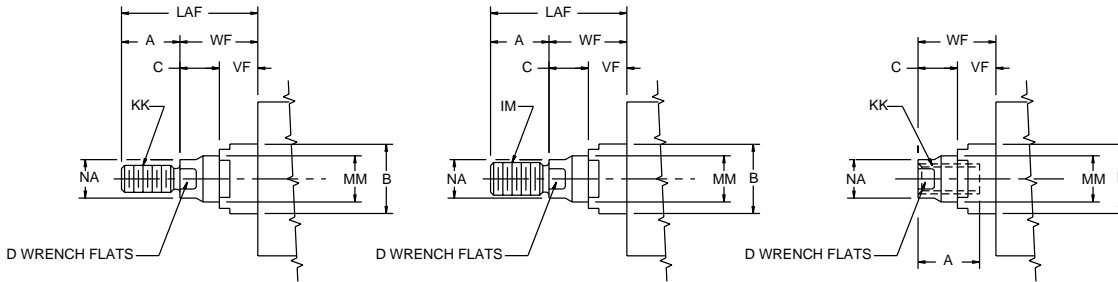


Table 1—Envelope and Mounting Dimensions

Bore	AA	BB	BG	DD	E	EE (NPTF)	G	J	K	R	ADD STROKE	
											LF	P
5	5.8	113/16	.50	1/2-20	5 1/2	1/2	1.66	1.22	7/16	4.10	4 1/2	27/8
6	6.9	113/16	.50	1/2-20	6 1/2	3/4	1.91	1.41	7/16	4.88	5	3 1/8
8	9.1	25/16	.62	5/8-18	8 1/2	3/4	1.81	1.44	9/16	6.44	5 1/8	3 1/4

Table 2—Rod Dimensions

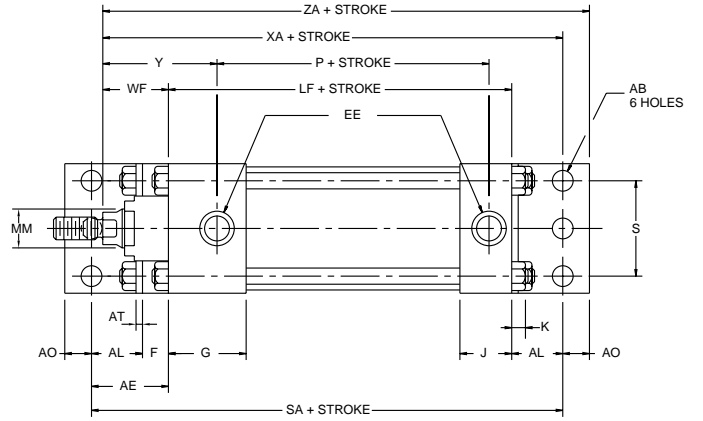
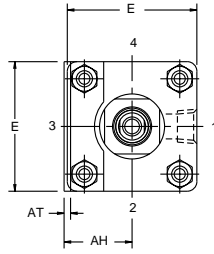
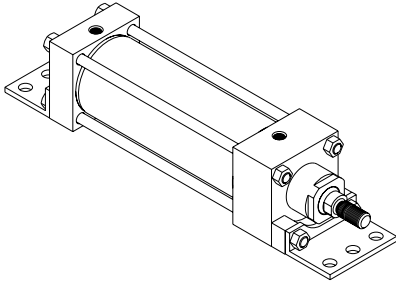
Bore Size	Rod Dia MM	Thread		A	+.000 -.002 B	C	D	LAF	NA	VF	W	WF	Y	ADD STROKE
		Style 5 IM	Style 2 & 4 KK											ZJ
5	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	27/16	57/8
	13/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	6 1/8
6	13/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	7/8	15/8	2 13/16	6 5/8
	13/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 11/16	1 1/8	1 1/8	17/8	3 1/16	6 7/8
8	13/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	7/8	15/8	2 3/4	6 3/4
	13/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 11/16	1 1/8	1 1/8	17/8	3	7

Table 3—
Envelope
and Mounting
Dimensions

Miller AL4 Series Air Cylinders

Side End Angle Mount
5" to 8" Bore Sizes

Side End Angle Mount
Model 71*
(NFPA MS1)



*Maximum recommended pressure of 150 PSI

Miller AL4 Series Air Cylinders

Side End Angle Mount
5" to 8" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFFA Style SM)
Small Male

Thread Style 5
(NFFA Style IM)
Intermediate Male

Thread Style 4
(NFFA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

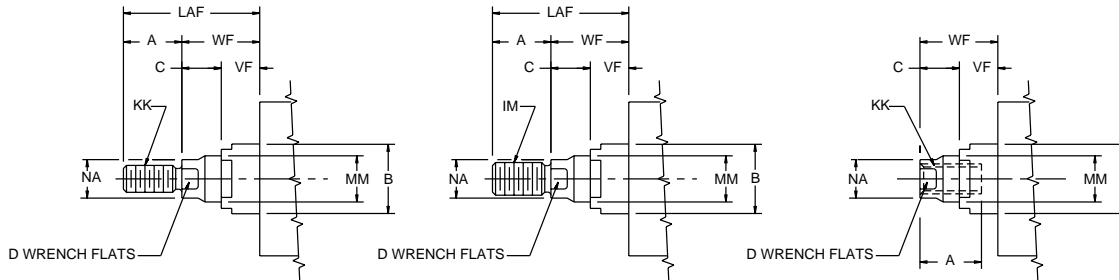


Table 1—Envelope and Mounting Dimensions

Bore	AB	AE	AH	AL	AO	AT	E	EE (NPTF)	F	G	J	K	R	S	ADD STROKE		
															LF	P	SA
5	11/16	2	2 3/4	1 3/8	5/8	3/16	5 1/2	1/2	5/8	1.66	1.22	7/16	4.10	4 1/4	4 1/2	27/8	7 7/8
6	13/16	2 1/8	3 1/4	1 3/8	5/8	3/16	6 1/2	3/4	3/4	1.91	1.41	7/16	4.88	5 1/4	5	3 1/8	8 1/2
8	13/16	1 13/16	4 1/4	1 13/16	1 1/16	1/4	8 1/2	3/4	—	1.81	1.44	9/16	6.44	7 1/8	5 1/8	3 1/4	8 3/4

Table 2—Rod Dimensions

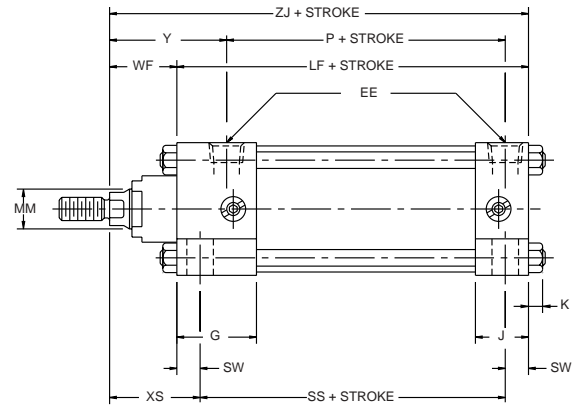
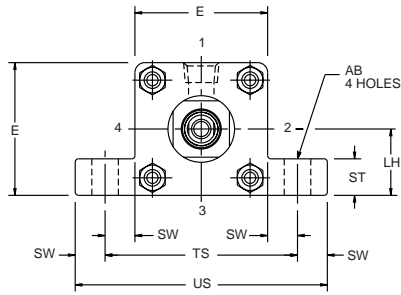
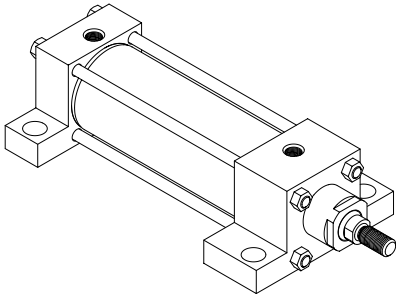
Bore Size	Rod Dia MM	Thread		A	+0.000 -0.002 B	C	D	LAF	NA	VF	W	WF	Y	ADD STROKE	
		Style 5 IM	Style 2 & 4 KK											XA	ZA
5	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	27/16	7 1/4	7 7/8
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	1 5/16	1	1	15/8	2 11/16	7 1/2	8 1/8
6	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	1 5/16	1	7/8	5/8	2 13/16	8	8 5/8
	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 11/16	1 1/8	1 1/8	17/8	3 1/16	8 1/4	8 7/8
8	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	1 5/16	1	7/8	15/8	2 3/4	8 9/16	9 1/4
	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 11/16	1 1/8	1 1/8	17/8	3	8 13/16	9 1/2

Table 3—Envelope and Mounting Dimensions

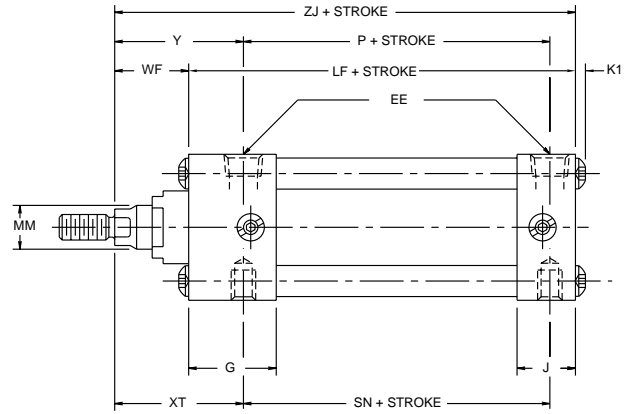
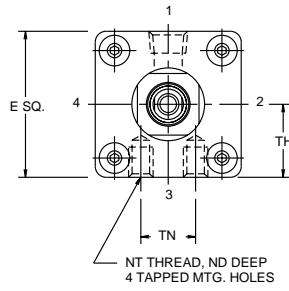
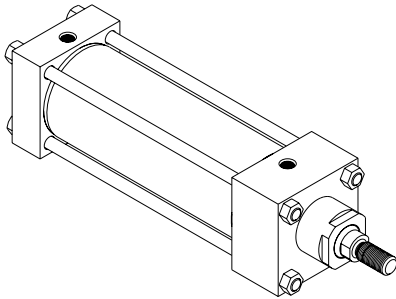
Miller AL4 Series Air Cylinders

Side Lug Mount
Side Tap Mount
5" to 8" Bore Sizes

Side Lug Mount Model 72 (NFPA MS2)



Side Tap Mount Model 74 (NFPA MS4)



Miller AL4 Series Air Cylinders

Side Lug Mount
Side Tap Mount
5" to 8" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFPA Style SM)
Small Male

Thread Style 5
(NFPA Style IM)
Intermediate Male

Thread Style 4
(NFPA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

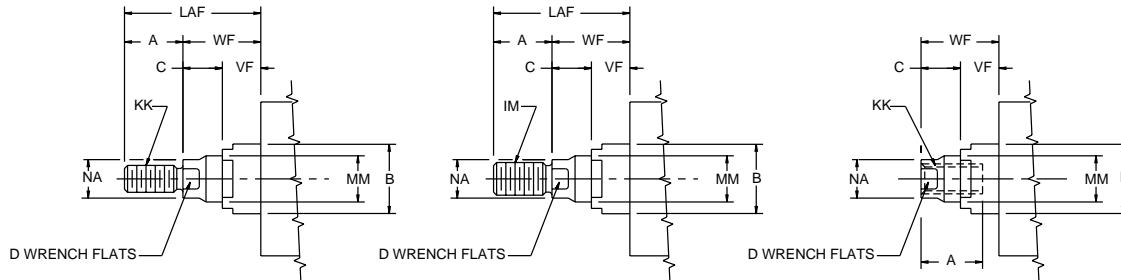


Table 1—Envelope and Mounting Dimensions

Bore	AB	E	EE (NPTF)	G	J	K	LH ±.003	NT	ST	SW	TH ±.003	TN	TS	US	ADD STROKE			
															LF	P	SN	SS
5	13/16	5 1/2	1/2	1.66	1.22	7/16	2.743	5/8-11	1	11/16	2.743	2 11/16	6 7/8	8 1/4	4 1/2	2 7/8	2 7/8	3 1/8
6	13/16	6 1/2	3/4	1.91	1.41	7/16	3.243	3/4-10	1	11/16	3.243	3 1/4	7 7/8	9 1/4	5	3 1/8	3 1/8	3 5/8
8	13/16	8 1/2	3/4	1.81	1.44	9/16	4.243	3/4-10	1	11/16	4.243	4 1/2	9 7/8	11 1/4	5 1/8	3 1/4	3 1/4	3 3/4

Table 2—Rod Dimensions

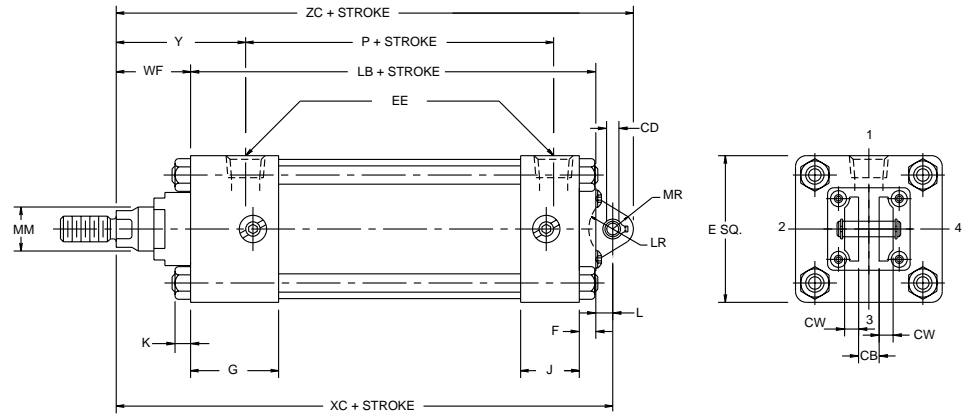
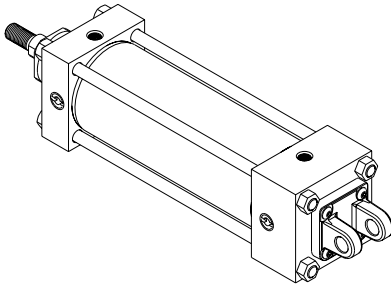
Bore Size	Rod Dia MM	Thread		A	+.000 -.002 B	C	D	LAF	NA	VF	W	WF	Y	ND	XS	XT	ZJ	ADD STROKE
		Style 5 IM	Style 2 & 4 KK															
5	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	2 7/16	15/16	2 1/16	2 7/16	5 7/8	
	13/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	15/16	2 5/16	2 11/16	6 1/8	
6	13/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	7/8	15/8	2 13/16	1 1/8	2 5/16	2 13/16	6 5/8	
	13/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 1/16	1 1/8	1 1/8	1 7/8	3 1/16	1 1/8	2 9/16	3 1/16	6 7/8	
8	13/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	7/8	15/8	2 3/4	1 1/8	2 5/16	2 13/16	6 3/4	
	13/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 1/16	1 1/8	1 1/8	1 7/8	3	1 1/8	2 9/16	3 1/16	7	

**Table 3—
Envelope and
Mounting Dimensions**

Miller AL4 Series Air Cylinders

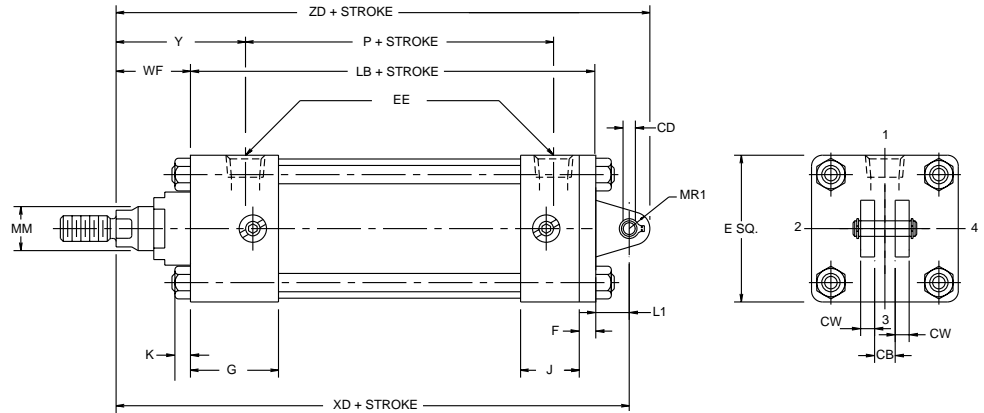
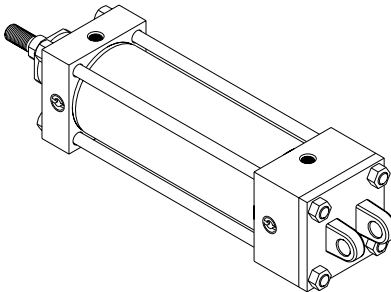
Cap Fixed Clevis Mount
Cap Detachable Clevis Mount
Cap Detachable Eye Mount
5" to 8" Bore Sizes

Cap Fixed Clevis Model 84 (NFPA MP1)

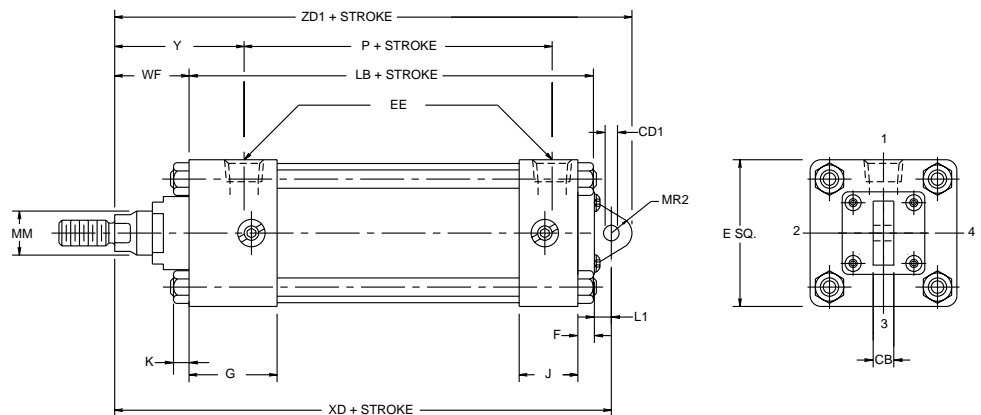
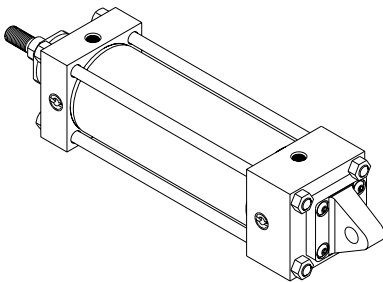


For maximum swivel angle with rear mounting plate for Model 84 mounting see Series AL4 cylinder accessories.

Cap Detachable Clevis Model 86 (NFPA MP2)



Cap Detachable Eye Mount (5" and 6" bore sizes) Model 96 (NFPA MP4)



Miller AL4 Series Air Cylinders

Cap Fixed Clevis Mount
Cap Detachable Clevis Mount
Cap Detachable Eye Mount
5" to 8" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFPA Style SM)
Small Male

Thread Style 5
(NFPA Style IM)
Intermediate Male

Thread Style 4
(NFPA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

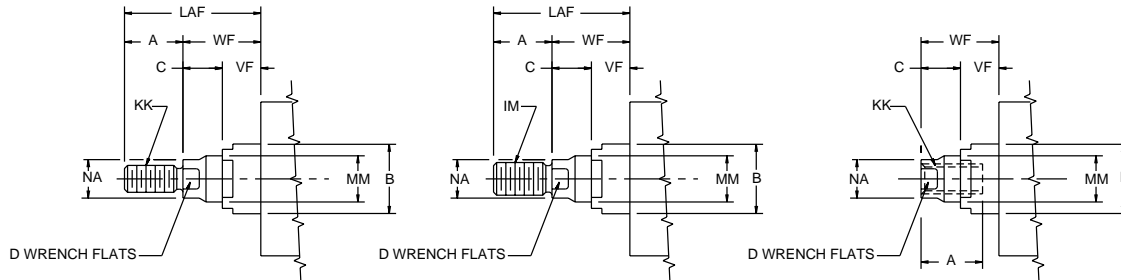


Table 1—Envelope and Mounting Dimensions

Bore	CB	+.000 CD▲ -.002	+.002 CD1▲ +.004	CW	E	EE (NPTF)	F	G	J	K	L	L1	LR	MR	MR1	MR2	ADD STROKE	
																	LB	P
5	1 1/4	.751	.750	5/8	5 1/2	1/2	5/8	1.66	1.22	7/16	5/8	1 1/4	1	15/16	3/4	7/8	5 1/8	27/8
6	1 1/2	1.001	1.00	3/4	6 1/2	3/4	3/4	1.91	1.41	7/16	3/4	1 1/2	1 1/4	11/8	1	1 1/8	5 3/4	3 1/8
8	1 1/2	1.001	—	3/4	8 1/2	3/4	3/4	1.81	1.44	9/16	3/4	1 1/2	1 1/4	11/8	1	—	5 7/8	3 1/4

▲Dimension CD is pin diameter.

Table 2—Rod Dimensions

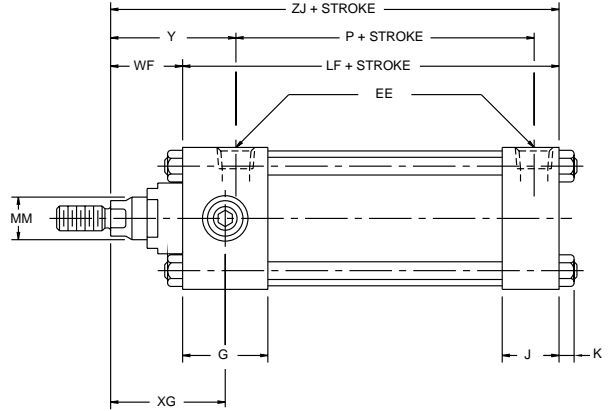
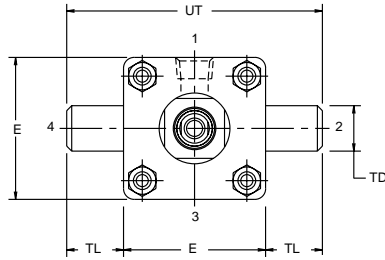
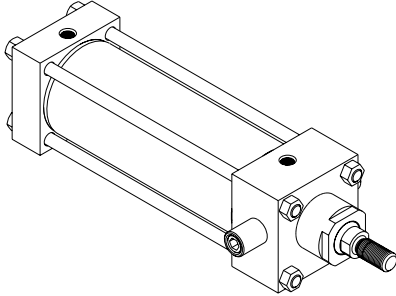
Bore Size	Rod Dia MM	Thread		A	+.000 -.002 B	C	D	LAF	NA	VF	W	WF	Y	ADD STROKE				
		Style 5 IM	Style 2 & 4 KK											XC	XD	ZC	ZD	ZD1
5	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	1 3/8	27/16	7 1/8	7 3/4	8 1/16	8 1/2	8 5/8
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	1 5/8	2 11/16	7 3/8	8	8 5/16	8 3/4	—
6	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	7/8	1 5/8	2 13/16	8 1/8	8 7/8	9 1/4	9 7/8	10
	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 1/16	1 1/8	1 1/8	1 7/8	3 1/16	8 3/8	9 1/8	9 1/2	10 1/8	—
8	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	7/8	1 5/8	2 3/4	8 1/4	9	9 3/8	10	—
	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 1/16	1 1/8	1 1/8	1 7/8	3	8 1/2	9 1/4	9 5/8	10 1/4	—

**Table 3—
Envelope and
Mounting Dimensions**

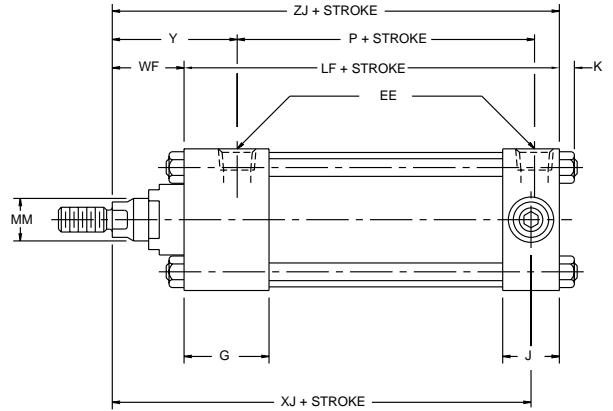
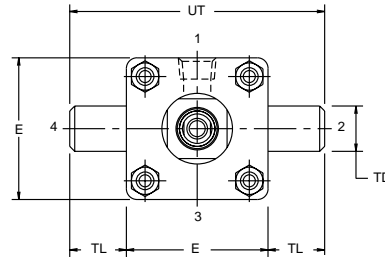
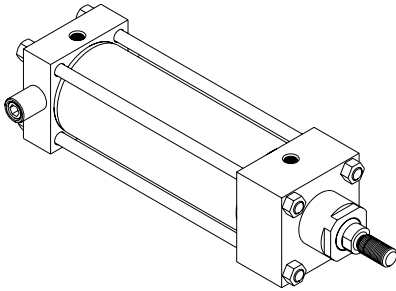
Miller AL4 Series Air Cylinders

Head Trunnion Mount
Cap Trunnion Mount
Intermediate Trunnion Mount
5" to 8" Bore Sizes

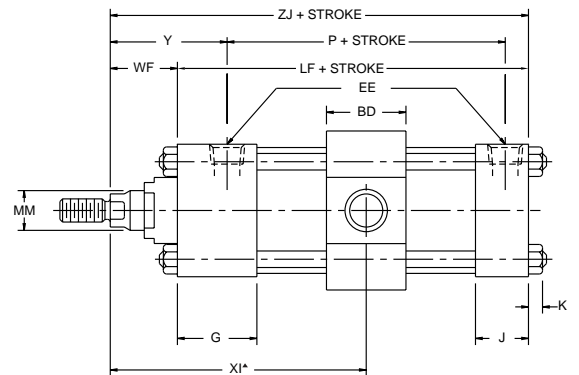
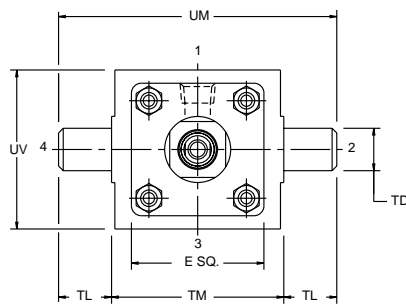
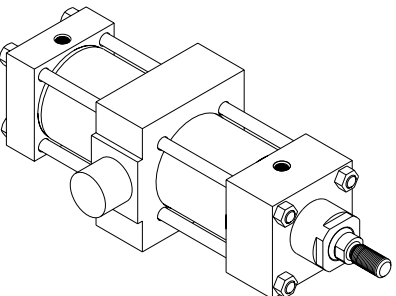
Head Trunnion Mount Model 81 (NFPA MT1)



Cap Trunnion Mount Model 82 (NFPA MT2)



Intermediate Trunnion Mount Model 89 (NFPA MT4)



▲Dimension "XI" to be specified by customer.

Miller AL4 Series Air Cylinders

Head Trunnion Mount
Cap Trunnion Mount
Intermediate Trunnion Mount
5" to 8" Bore Sizes

Rod End Dimensions—Basic Cylinder

Thread Style 2
(NFPA Style SM)
Small Male

Thread Style 5
(NFPA Style IM)
Intermediate Male

Thread Style 4
(NFPA Style SF)
Short Female

**“Special Thread”
Style X**

Special thread, extension, rod eye, blank, etc., are also available. To order specify “Style X” and give desired dimensions for KK, A and W or WF. If otherwise special, furnish dimensioned sketch.

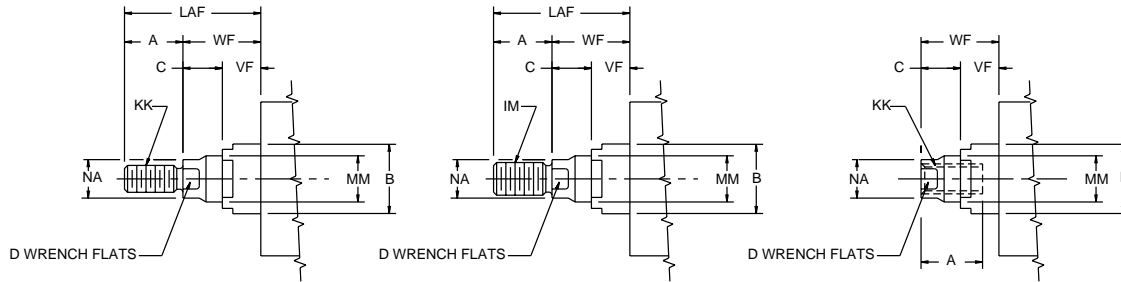


Table 1—Envelope and Mounting Dimensions

Bore	BD	E	EE (NPTF)	G	J	K	+.000 TD -.001	TL	TM	UM	UT	UV	ADD STROKE		Model 89 Minimum Stroke
													LF	P	
5	2	5 1/2	1/2	1.66	1.22	7/16	1.000	1	6 1/4	8 1/4	7 1/2	6	4 1/2	2 7/8	3/8
6	2 1/2	6 1/2	3/4	1.91	1.41	7/16	1.375	1 3/8	7 5/8	10 3/8	9 1/4	7	5	3 1/8	7/8
8	2 1/2	8 1/2	3/4	1.81	1.44	9/16	1.375	1 3/8	9 3/4	12 1/2	11 1/4	9 1/2	5 1/8	3 1/4	5/8

Table 2—Rod Dimensions

Bore Size	Rod		Thread		A	+.000 -.002 B	C	D	LAF	NA	VF	W	WF	Y	XG	▲ Min. XI	ADD STROKE	
	Dia MM	Style 5 IM	Style 2 & 4 KK	XJ													ZJ	
5	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/2	15/16	7/8	3/4	13/8	27/16	2 1/4	4 1/16	5 1/4	5 7/8	
	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	1	15/8	2 11/16	2 1/2	4 5/16	5 1/2	6 1/8	
6	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	7/8	15/8	2 13/16	2 5/8	4 13/16	5 7/8	6 5/8	
	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 11/16	1 1/8	1 1/8	1 7/8	3 1/16	2 7/8	5 1/16	6 1/8	6 7/8	
8	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	3 1/4	15/16	1	7/8	15/8	2 3/4	2 5/8	4 3/4	6	6 3/4	
	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 7/8	1 11/16	1 1/8	1 1/8	1 7/8	3	2 7/8	5	6 1/4	7	

**Table 3—
Envelope and
Mounting Dimensions**

▲Dimension “XI” to be specified by customer.

Miller AL4 Series Air Cylinders

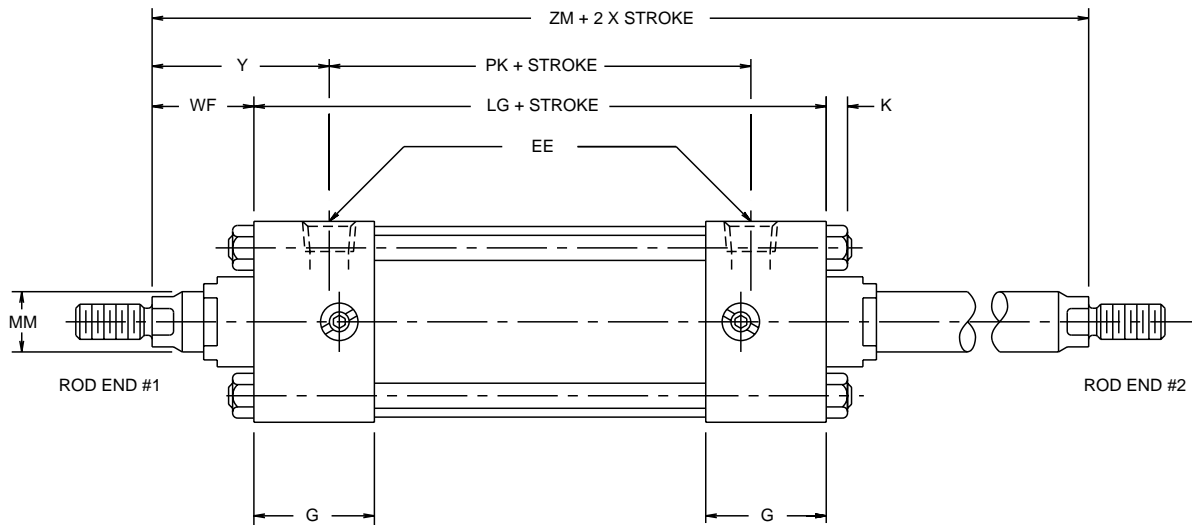
Double Rod Models
5" to 8" Bore Sizes

How to Use Double Rod Cylinder Dimension Drawings

To determine dimensions for a double rod cylinder, first refer to the desired single rod mounting style cylinder shown on preceding pages of this catalog. After selecting necessary dimensions from that drawing, return to this page and supplement the single rod dimensions with those shown on the drawing and dimension table below. Note that double rod cylinders have a head (Dim. G) at both ends and that dimension LG replaces LF and PK replaces P,

etc. The double rod dimensions differ from, or are in addition to those for single rod cylinders shown on preceding pages and provide the information needed to completely dimension a double rod cylinder.

On a double rod cylinder where the two rod ends are different, be sure to clearly state which rod end is to be assembled at which end.



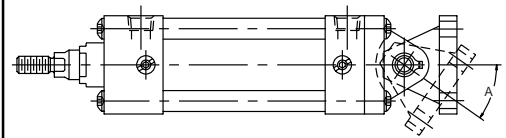
Bore	Rod Dia.	ADD STROKE						Add 2X Stroke
	MM	LG	PK	SAK	XAK	SSK	SNK	ZM
5	1	4 ^{15/16}	2 ^{13/16}	7 ^{11/16}	7 ^{11/16}	3 ^{9/16}	2 ^{13/16}	7 ^{11/16}
6	1 ^{3/8}	5 ^{1/2}	3 ^{1/8}	8 ^{1/4}	8 ^{1/2}	4 ^{1/8}	3 ^{1/8}	8 ^{3/4}
8	1 ^{3/8}	5 ^{1/2}	3 ^{1/4}	9 ^{1/8}	8 ^{15/16}	4 ^{1/8}	3 ^{1/8}	8 ^{3/4}
REPLACES DIMENSION		LF	P	SA	XA	SS	SN	—
ON SINGLE ROD MOUNTING STYLES		ALL MTG STYLES		71		72	74	ALL MTG STYLES

All dimensions are in inches and apply to standard rod sizes only. For alternate rod sizes, determine all envelope dimensions (within LD dim.) as described above and then use appropriate rod end dimensions for proper rod size from single rod cylinder.

Miller AL4 Series Air Cylinders

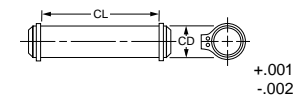
Cylinder Accessories

Rod end accessories can be selected by cylinder rod end thread size from Table A & B below. Mating parts for rod end accessories are listed just to the right of the rod eye or clevis selected. Eye brackets and clevis brackets for models 84 and 96 cylinder mounts are selected by bore size from Table C.



Bore	1 1/2	2	2 1/2	3 1/4	4	5	6	8
Angle A	52	43	29	50	49	45	42	42

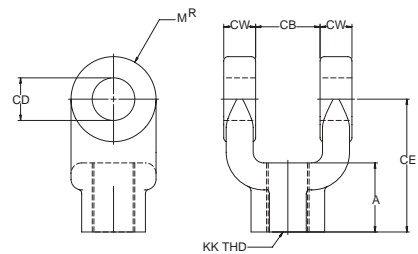
Rod End Thread Size	TABLE A			TABLE B			TABLE C		
	Rod Clevis	Mating Parts		Rod Eye	Mating Parts		Bore Size	Mounting Plate	
		Eye Bracket	Pivot Pin		Clevis Bracket	Pivot Pin		For Model 84 Cylinder	For Model 96 Cylinder
7/16-20	057-RC001-44-20	057-EB001-50	057-PP006-50	057-RE001-44-20	170-MB86A-150-50	057-PP006-50	1 1/2	057-EB001-50	170-MB86A-150-50
							2	057-EB001-50	170-MB86A-150-50
3/4-16	057-RC001-75-16	057-EB001-75	057-PP006-75	057-RE001-75-16	170-MB86A-250-75	057-PP006-75	2 1/2	057-EB001-50	170-MB86A-150-50
							3 1/4	057-EB001-75	170-MB86A-250-75
1-14	057-RC001-100-14	057-EB001-100	057-PP006-100	057-RE001-100-14	170-MB86A-325-100	057-PP006-100	4	057-EB001-75	170-MB86A-250-75
							5	057-EB001-75	—
							6	057-EB001-100	—
1 1/4-12	057-RC001-125-12	057-EB001-138	057-PP006-138	057-RE001-125-12	170-MB86A-400-138	057-PP006-138	6	057-EB001-100	—
							8	057-EB001-100	—



Pivot Pin

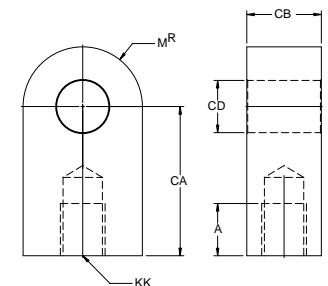
Symbol	057-PP016-50	057-PP016-75	057-PP016-100	057-PP016-138
CD	1/2	3/4	1	1 3/8
CL	1 1/8	2 5/8	3 1/8	4 1/4
Shear Cap. Lbs.	8600	19300	34300	65000

Note: Pivot Pin must be ordered separately for single lug pivot mounting.



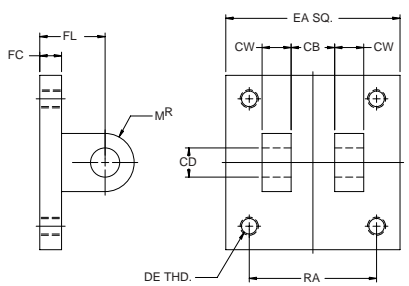
Rod Clevis

Symbol	057-RC001-44-20	057-RC001-75-16	057-RC001-100-14	057-RC001-125-12
A	3/4	1 1/8	1 3/8	2
CB	3/4	1 1/4	1 1/2	2
CD	1/2	3/4	1	1 3/8
CE	1 1/2	2 3/8	3 1/8	4 1/8
CW	1/2	5/8	3/4	1
M	1/2	3/4	1	1 3/8
KK	7/16-20	3/4-16	1-14	1 1/4-12
Load Capacity Lbs.	4250	11200	19500	33500



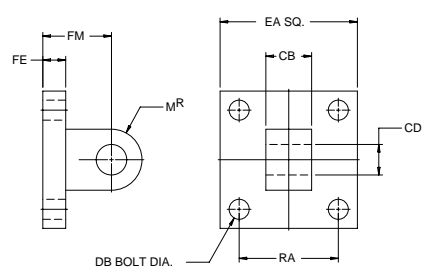
Rod Eye

Symbol	057-RE001-44-20	057-RE001-75-16	057-RE001-100-14	057-RE001-125-12
A	3/4	1 1/8	1 5/8	2
CA	1 1/2	2 1/16	2 13/16	3 7/16
CB	3/4	1 1/4	1 1/2	2
CD	1/2	3/4	1	1 3/8
M	1/2	3/4	1	1 3/8
KK	7/16-20	3/4-16	1-14	1 1/4-12
Load Capacity Lbs.	5000	12100	21700	33500



Clevis Bracket

Symbol	170-MB86A-150-50	170-MB86A-250-75	170-MB86A-325-100	170-MB86A-400-138
CB	3/4	1 1/4	1 1/2	2
CD	1/2	3/4	1	1 3/8
CW	1/2	5/8	3/4	1
DE	3/8-24	1/2-20	5/8-18	5/8-18
EA	2 1/2	3 1/2	4 1/2	5
FC	3/8	5/8	3/4	7/8
FL	1 1/8	1 7/8	2 1/4	3
M	1/2	3/4	1	1 3/8
RA	1.63	2.55	3.25	3.82
Load Capacity Lbs.	5000	11000	17000	30000



Eye Bracket

Symbol	057-EB001-50	057-EB001-75	057-EB001-100	057-EB001-138
CB	3/4	1 1/4	1 1/2	2
CD	1/2	3/4	1	1 3/8
DB	3/8	1/2	5/8	5/8
EA	2 1/2	3 1/2	4 1/2	5
FE	3/8	5/8	3/4	7/8
FM	1 1/8	1 7/8	2 1/4	3
M	1/2	3/4	1	1 3/8
RA	1.63	2.55	3.25	3.82
Load Capacity Lbs.	3600	11000	17000	21000

Miller AL4 Series Air Cylinders

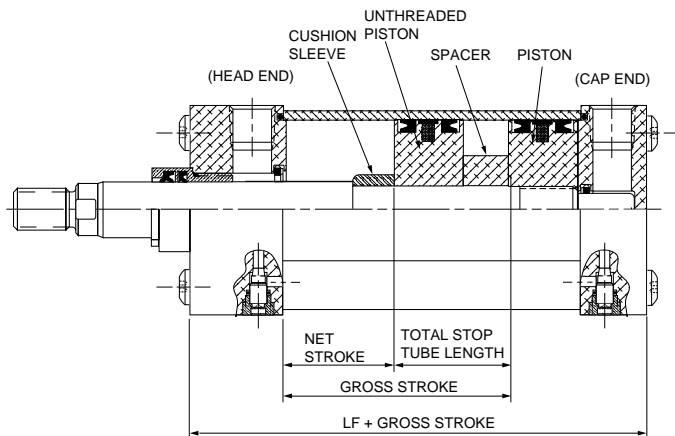
Stop Tubing
Mounting Classes

Stop Tubing

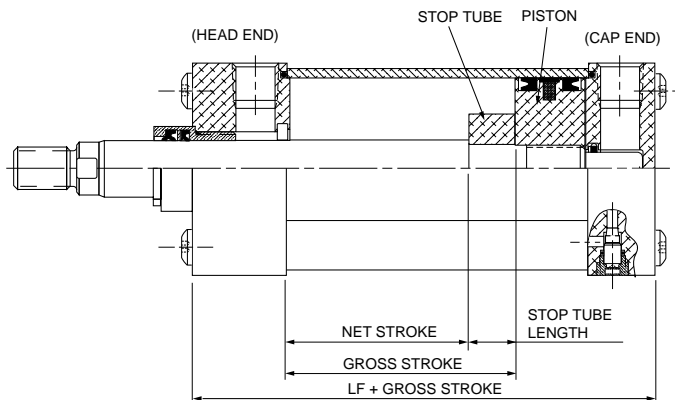
Long stroke cylinders, fixed or pivot mounted, tend to jackknife or buckle on push load applications, resulting in high bearing loading at the rod bushing or piston. Use of a stop tube to lengthen the distance between the bushing and piston when cylinder rod is fully extended is recommended to reduce these bearing loads. The drawing below shows stop tube construction for fluid power cylinders. Refer to chart on next page to determine stop tube length.

When specifying cylinders with long stroke and stop tube, be sure to call out the net stroke and the length of the stop tube. Machine design can be continued without delay by laying in a cylinder equivalent in length to the **NET STROKE PLUS STOP TUBE LENGTH**, which is referred to as **GROSS STROKE**.

Refer to the next page to determine stop tube length.



Double piston design is supplied on air cylinders with cushion head end or both ends.



This design is supplied on cushioned cap or non-cushioned cylinders.

Cushion Selection

Cushions are required when cylinder piston rod speed exceeds 4" per second.

Mounting Classes

Standard mountings for fluid power cylinders fall into three basic groups. The groups can be summarized as follows:

Group 1 – Straight Line Force Transfer with fixed mounts which absorb force on cylinder centerline.

Group 2 – Pivot Force Transfer. Pivot mountings permit a cylinder to change its alignment in one plane.

Group 3 – Straight Line Force Transfer with fixed mounts which do not absorb force on cylinder centerline.

Because a cylinder's mounting directly affects the maximum pressure at which the cylinder can be used, the charts below should be helpful in the selection of the proper mounting combination for your application. Stroke length, piston rod connection to load, extra piston rod length over standard, etc. should be considered for thrust loads. Alloy steel mounting bolts are recommended for all mounting styles, and thrust keys are recommended for Group 3.

HEAVY-DUTY SERVICE

For Thrust Loads _____
For Tension Loads _____

MEDIUM-DUTY SERVICE

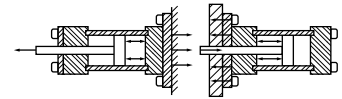
For Thrust Loads _____
For Tension Loads _____

LIGHT-DUTY SERVICE

For Thrust Loads _____
For Tension Loads _____

GROUP 1

FIXED MOUNTS which absorb force on cylinder centerline.



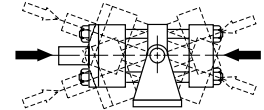
Mtg. Model 52
Mtg. Model 53

Mtg. Model 62, 64
Mtg. Model 61, 63

Mtg. Model 62, 64
Mtg. Model 61, 63

GROUP 2

PIVOT MOUNTS which absorb force on cylinder centerline.



Mtg. Models 89, 81
Mtg. Models 84, 86, 89, 81, 82

HEAVY-DUTY SERVICE

For Thrust Loads _____
For Tension Loads _____

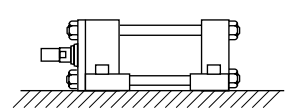
MEDIUM-DUTY SERVICE

For Thrust Loads _____
For Tension Loads _____

Mtg. Models 84, 86, 96
Mtg. Models 84, 86, 96

GROUP 3

FIXED MOUNTS which do not absorb force on the centerline.



HEAVY-DUTY SERVICE

For Thrust Loads _____
For Tension Loads _____

Mtg. Model 72
Mtg. Model 72

MEDIUM-DUTY SERVICE

For Thrust Loads _____
For Tension Loads _____

Mtg. Model 74
Mtg. Model 74

LIGHT-DUTY SERVICE

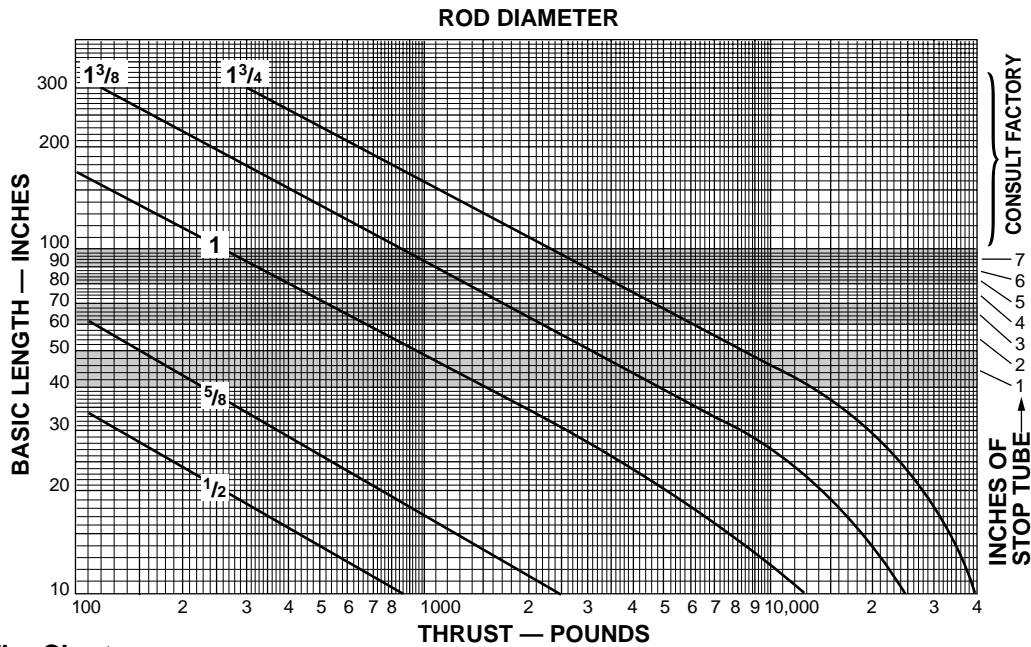
For Thrust Loads _____
For Tension Loads _____

Mtg. Model 71*
Mtg. Model 71*

*Mounting model 71 recommended for maximum pressure of 150 p.s.i.

Miller AL4 Series Air Cylinders

Piston Rod Selection Chart and Data



How To Use The Chart

The selection of a piston rod for thrust (push) conditions requires the following steps:

- Determine the type of cylinder mounting style and rod end connection to be used. Then consult the chart below and find the "stroke factor" that corresponds to the conditions used.
- Using this stroke factor, determine the "basic length" from the equation:

$$\text{Basic Length} = \frac{\text{Actual Stroke}}{\text{Stroke Factor}}$$

The graph is prepared for standard rod extensions beyond the face of the bushing retainer. For rod extensions greater than standard, add the increase to the stroke in arriving at the "basic length."

- Find the load imposed for the thrust application by multiplying the full bore area of the cylinder by the system pressure.
- Enter the graph along the values of "basic length" and "thrust" as found above and note the point of intersection:

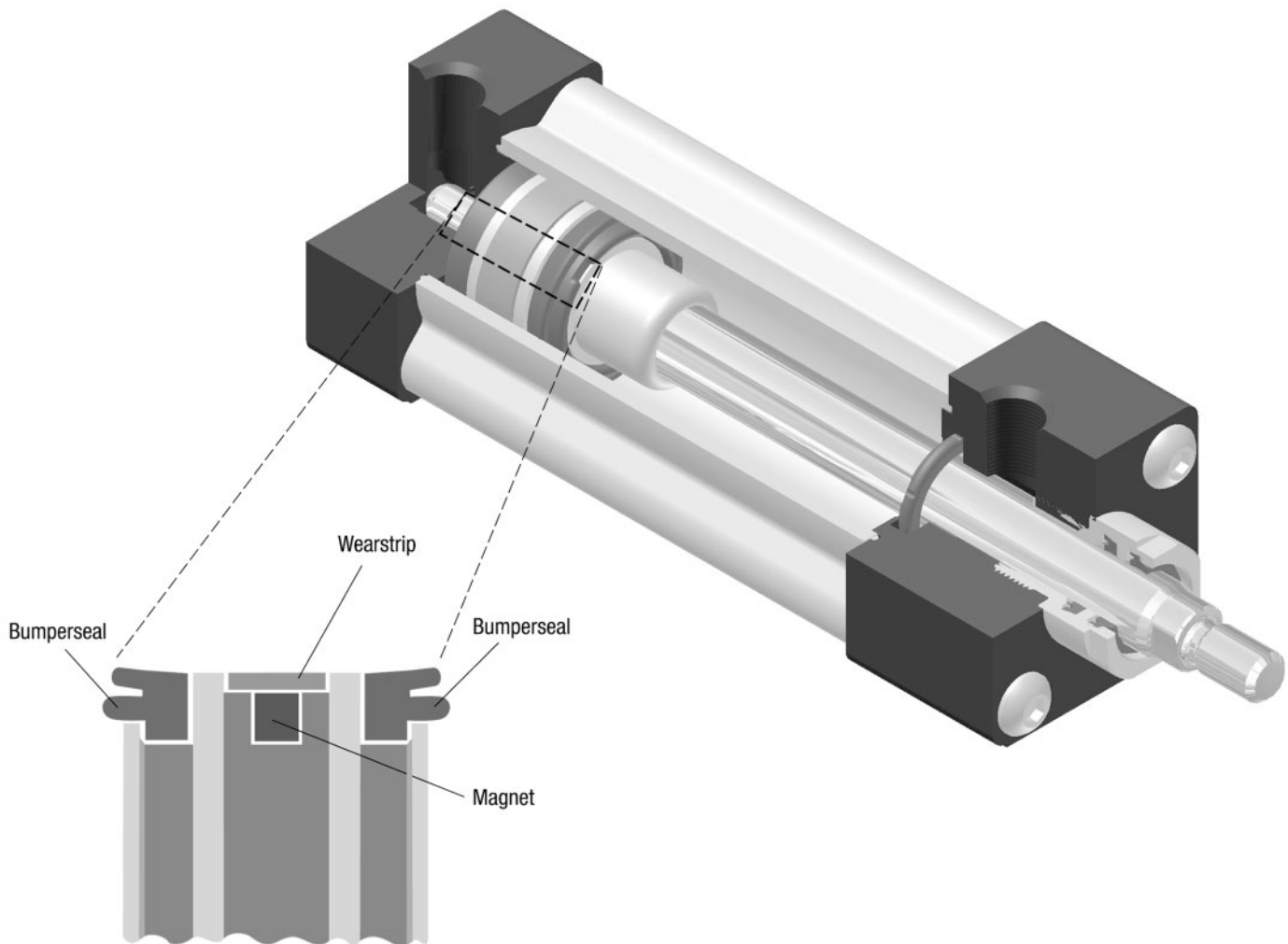
- The correct piston rod size is read from the diagonally curved line labeled "Rod Diameter" next *above* the point of intersection.
- The required length of stop tube is read from the right of the graph by following the shaded band in which the point of intersection lies.
- If required length of stop tube is in the region labeled "consult factory," submit the following information for an individual analysis.
 - Cylinder mounting style.
 - Rod end connection and method of guiding load.
 - Bore, required stroke, length of rod extension (Dim. "LA") if greater than standard, and series of cylinder used.
 - Mounting position of cylinder. (Note: if at an angle or vertical, specify direction of piston rod.)
 - Operating pressure of cylinder if limited to less than standard pressure for cylinder selected.

Recommended Mounting Styles for Maximum Stroke and Thrust Loads	Rod End Connection	Case	Stroke Factor
Groups 1 or 3 Long stroke cylinders for thrust loads should be mounted using a heavy-duty mounting style at one end, firmly fixed and aligned to take the principal force. Additional mounting should be specified at the opposite end, which should be used for alignment and support. An intermediate support may also be desirable for long stroke cylinders mounted horizontally.	FIXED AND RIGIDLY GUIDED	I	.50
	PIVOTED AND RIGIDLY GUIDED	II	.70
	SUPPORTED BUT NOT RIGIDLY GUIDED	III	2.00
Group 2 Model 81 - Trunnion on Head	PIVOTED AND RIGIDLY GUIDED	IV	1.00
Model 89 - Intermediate Trunnion	PIVOTED AND RIGIDLY GUIDED	V	1.50
Model 82 - Trunnion on Cap or Model 84 - Clevis on Cap	PIVOTED AND RIGIDLY GUIDED	VI	2.00

Bumper Seal Piston Option

Impact dampening Bumper Seals are now optional on all Miller AL4 air cylinders from 1-1/2" to 4" bore. The Bumper Seal piston combines the features of low-friction, round lipseals and impact-dampening bumpers to provide reduced noise and smoother end-of-stroke

deceleration. At pressures greater than 80 psi, the compressible Buna Nitrile Bumper Seal has a minimal effect on stroke loss. When specified, Bumper Seals will be supplied on both ends of the piston, eliminating the need to specify head end or cap end only.



Specifying the Bumper Seal piston feature on Miller AL4 cylinders provides many benefits, such as:

Advantage	Benefit
Reduced noise upon piston impact	Quieter operating environment
Minimal loss of stroke (or added piston thickness)	Space-efficient design for applying cylinders in tight spaces
Smoother end-of-stroke deceleration when used in combination with cushions	Efficient cushioning increases cylinder and machine life
Rounded sealing lip is rated for non-lube service	Long seal life without the need for external lubrication

Miller AL4 Series Air Cylinders

Bumper Seal Option

Summary of Accelerometer Test Results

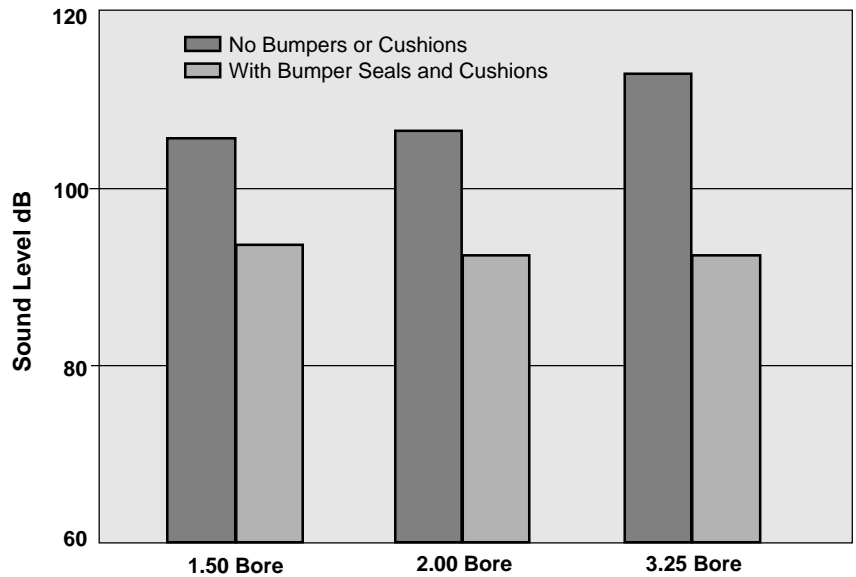
Bore Size	Piston Type	Cushioning Efficiency (Maximum G's of deceleration force created)	Cushioning Time (Ms)
1.50"	Standard Piston	13.4	22
	Bumper Seal Piston	5.1	22
2.00"	Standard Piston	12.6	33
	Bumper Seal Piston	7.8	26
2.50"	Standard Piston	12.2	36
	Bumper Seal Piston	5.2	24

Bumper Seals Reduce Noise

The special profile of the Bumper Seal prevents the piston from banging into the end cap at the end of stroke. Independent testing shows that the Bumper Seal, when combined with cushions, will absorb the final piston inertia and reduce the stroke noise by as much as 20 dB. The Sound Level Comparison graph illustrates the noise-reducing effects of the Bumper Seal piston when combined with cushions.

Impact noise was recorded at a distance of 3 feet from the front of the cylinder, inside a semi-anechoic chamber. Cylinders were operating at 95 psi.

Sound Level Comparison



Bumper Seals Have Minimum Effect on Stroke Length

The accompanying chart depicts typical amounts of overall stroke loss incurred at various system pressures. The amount of stroke loss may vary slightly due to design tolerances of seal size, variance in seal durometer, and compression set associated with cylinder wear.

To determine the total stroke loss at either end of the cylinder, divide the values by two.

Pressure (psi)	Typical Overall Stroke Loss by Bore Size (in.)				
	1.50	2.00	2.50	3.25	4.00
0	.16"	.13"	.19"	.22"	.22"
20	.12"	.11"	.12"	.18"	.18"
40	.10"	.08"	.09"	.12"	.12"
60	.08"	.07"	.07"	.09"	.09"
80	.06"	.05"	.05"	.06"	.06"
100	.05"	.03"	.02"	.04"	.04"

Miller AL4 Series Air Cylinders

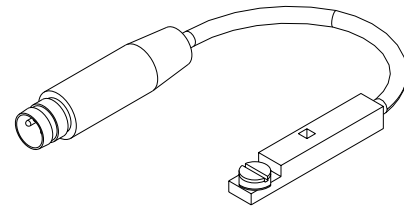
Solid State Switch Specifications

Switch Part Numbers

PNP	Wiring	NPN	Wiring
P8S-GPFLX	3m flying leads	P8S-GNFLX	3m flying leads
P8S-GPFTX	10m flying leads	P8S-GNFTX	10m flying leads
P8S-GPSHX	.2m lead with 8mm connector	P8S-GNSHX	.2m lead with 8mm connector
P8S-GPMHX	.2m lead with 12mm connector	P8S-GNMHX	.2m lead with 12mm connector
P8S-GPSCX	1m lead with 8mm connector	P8S-GNSCX	1m lead with 8mm connector

SOLID STATE SWITCH SPECIFICATIONS

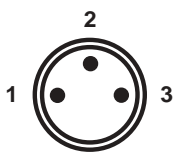
Type Electronic
 Output Function Normally Open
 Switching Output PNP/NPN
 Operating Voltage 10 - 30VDC
 Continuous Current 200 mA max.*
 Response Sensivity 2.8 mT min.
 Switching Frequency 5 KHz
 Power Consumption 10 mA max.
 Voltage Drop 2 VDC max.
 Ripple 10% of Operating Voltage
 Hysteresis 1.5 mm max.
 Repeatability 0.1 mm max.
 EMC EN 60 947-5-2
 Short-circuit Protection Yes
 Power-up Pulse Suppression Yes
 Reverse Polarity Protection Yes
 Enclosure Rating IP 67
 Shock and Vibration Stress 30g, 11 ms, 10 to 55 Hz, 1 mm
 Operating Temperature Range -25°C to +75°C (-13°F to 167°F)
 Housing Material PA 12, Black
 Connector Cable PVC
 Connector PUR cable w/8 or 12 mm conn.



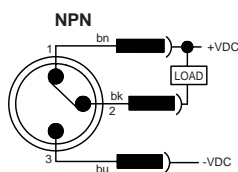
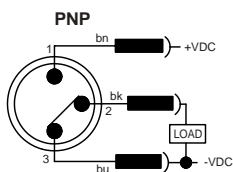
*M12 connector rated for 100 mA maximum continuous current.

SOLID STATE SWITCH - WIRING CONNECTION

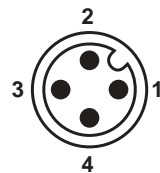
Flying Lead or 8 mm Connector (shown)



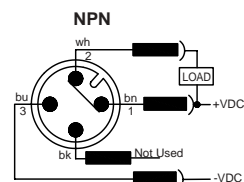
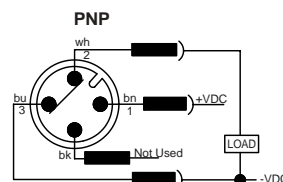
Pin	Wire	Function
1	Brown	Operating Voltage
2	Black	Output signal
3	Blue	0V



12 mm Connector



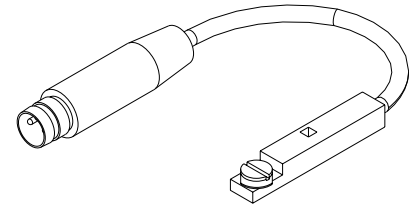
Wire Color	PIN	Function
bn brown	1	Operating Voltage
bk black	4	Not used
wh white	2	Output Signal
bu blue	3	0V



Miller AL4 Series Air Cylinders

Switch Part Numbers

REED	Wiring
P8S-GRFLX	3m flying leads
P8S-GRFTX	10m flying leads
P8S-GRSHX	.2m lead with 8mm connector
P8S-GRMHX	.2m lead with 12mm connector
P8S-GRSCX	1m lead with 8mm connector



REED SWITCH SPECIFICATIONS

Type	Reed
Output Function	Normally Open
Operating Voltage	10 - 120 VAC*
.....	10 - 30 VDC
Continuous Current	100 mA max.
Response Sensivity	2.5 mT min.
Switching Frequency	400 Hz
Voltage Drop	3 V max.
Ripple	10% of Operating Voltage
Hysteresis	1.5 mm max.
Repeatability	0.2 mm max.
EMC	EN 60 947-5-2
Reverse Polarity Protection	Yes
Enclosure Rating	IP 67
Shock and Vibration Stress	30g, 11 ms, 10 to 55 Hz, 1 mm
Operating Temperature Range	-25°C to +75°C (-13°F to 167°F)
Housing Material	PA 12, Black
Connector Cable	PVC
Connector	PUR cable w/8 or 12 mm conn.

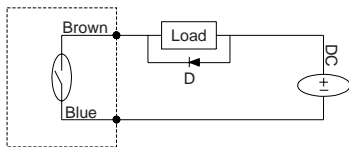
*8mm connector version operating voltage is 10-75 VAC.

REED SWITCH - WIRING CONNECTION			
Flying Lead or 8 mm Connector			
	Pin	Wire	Function
	1	Brown	Operating Voltage
	2	Black	Output signal
3	Blue	Not used	
12 mm Connector			
	Pin	Wire	Function
	1	Brown	Operating Voltage
	2	White	Output signal
	3	Blue	Not used
4	Black	Not used	

Circuit for Switching Contact Protection (Inductive Loads)

(Required for proper operation 24V DC)

Put Diode parallel to loads following polarity as shown below.



D: Diode: select a Diode with the breakdown voltage and current rating according to the load.

Typical Example—100 Volt, 1 Amp Diode

CR: Relay coil (under 0.5W coil rating)

(Recommended for longer life 125 VAC)

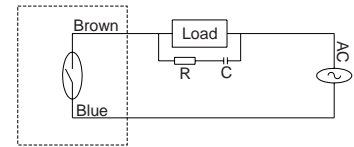
Put a resistor and capacitor in parallel with the load. Select the resistor and capacitor according to the load.

Typical Example:

CR: Relay coil (under 2W coil rating)

R: Resistor 1 K Ω - 5 K Ω , 1/4 W

C: Capacitor 0.1 μ F, 600 V



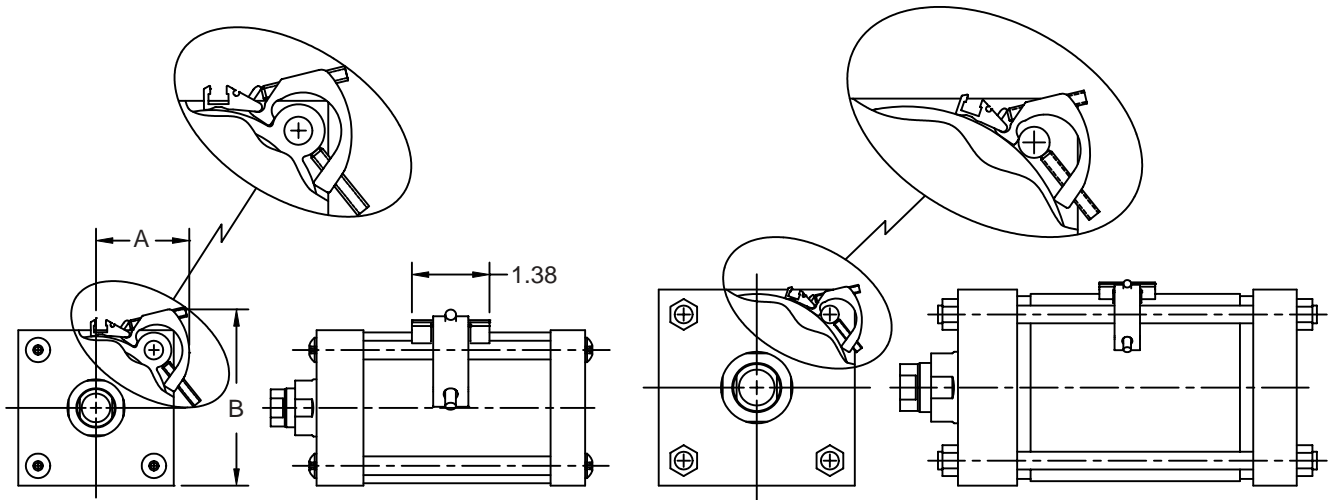
⚠ Caution

- Use an ampmeter to test reed switch current. Testing devices such as incandescent light bulbs may subject the reed switch to high in-rush loads.
- **NOTE:** When checking an unpowered reed switch for continuity with a digital ohmmeter the resistance reading will change from infinity to a very large resistance (2 M ohm) when the switch is activated. This is due to the presence of a diode in the reed switch.
- Anti-magnetic shielding is recommended for reed switches exposed to high external RF or magnetic fields.
- The magnetic field strength of the piston magnet is designed to operate with our switches. Other manufacturers' switches or sensors may not operate correctly in conjunction with these magnets.
- Use relay coils for reed switch contact protection.
- The operation of some 120 VAC PLC's (especially some older Allen-Bradley PLC's) can overload the reed switch. The switch may fail to release after the piston magnet has passed. This problem may be corrected by the placement of a 700 to 1K OHM resistor between the switch and the PLC input terminal. Consult the manufacturer of the PLC for appropriate circuit.
- Switches with long wire leads (greater than 15 feet) can cause capacitance build-up and sticking will result. Attach a resistor in series with the reed switch (the resistor should be installed as close as possible to the switch). The resistor should be selected such that R (ohms) >E/0.3.

Miller AL4 Series Air Cylinders

Switches

Switch Clamp Assembly Dimensions



Bore Size	Dimension		Piston Travel @ Midstroke (in.), Switch ON, ±.01
	'A'	'B'	
1½	1.43	2.40	0.35
2	1.68	2.90	0.35
2½	1.92	3.33	0.40
3¼	2.29	4.04	0.40
4	2.70	4.77	0.43
5	2.88	5.52	0.57
6	3.23	6.38	0.55
8	4.02	8.19	0.51

Clamp Assembly and Switch Part Numbers

Clamp Assembly Part Number: P8S-TMA0X

Solid State Switch (see following pages)

Part Number: P8S - G _ _ _ _ X

Reed Switch (see following pages)

Part Number: P8S - G R _ _ _ _ X

M8 Cordset with Female Quick Connect (see below)

Part Number: 086620 _ _ _ _ _

M12 Cordset with Female Quick Connect (see below)

Part Number: 912648 _ _ _ _ _

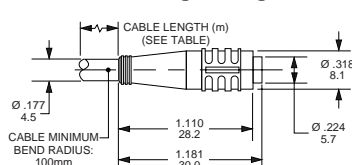
Cordsets – M8 & M12

A female connector is available for all switches with the male quick connect option. The M8 male plug will accept a snap-on or threaded connector. The M12 will accept straight or right angle threaded connector. Cordset part numbers are listed below.

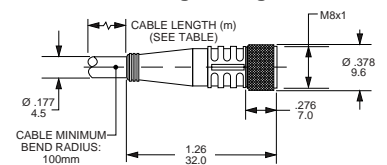
Specifications

- Connector: Polyvinylchloride (PVC) body material, PVC contact carrier, Spacing to VDE 0110 Group C, (250VAC / 300VDC).
- Contacts: Gold Plated Copper Tin (CuSn), stamped from stock.
- Coupling Method: Threaded nut: Chrome plated brass.
- Cord Construction: PVC non-wicking, non-hygroscopic, 250VAC / 300VDC. Cable end is stripped.
- Conductors: Extra high flex stranding with PVC insulation
- Temperature: -13°F to 158°F (-25°C to 70°C)
- Protection: NEMA 1, 3, 4, 6P and IEC 1P67
- Cable Length: 6.56 ft (2m) or 16.4 ft (5m)

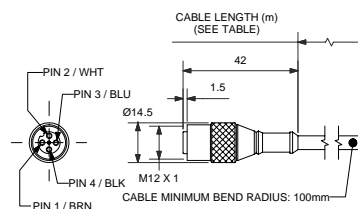
M8 Snap-On Straight Plug



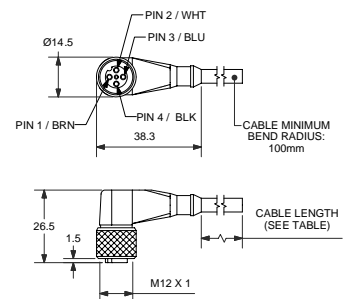
M8 Threaded Straight Plug



M12 Straight Plug



M12 Right Angle Plug



Cable Length	M8 Snap-On	M8 Threaded	M12 Straight	M12 Right Angle
2 meters	086620S002	086620T002	9126487202	9126487302
5 meters	086620S005	086620T005	9126487205	9126487305

Linear Position Sensor Option for AL4 Series Cylinder



Non-Contact Sensing

Analog or Digital Outputs

Bore Sizes 2" - 8"

Available in Eleven Mounting Styles

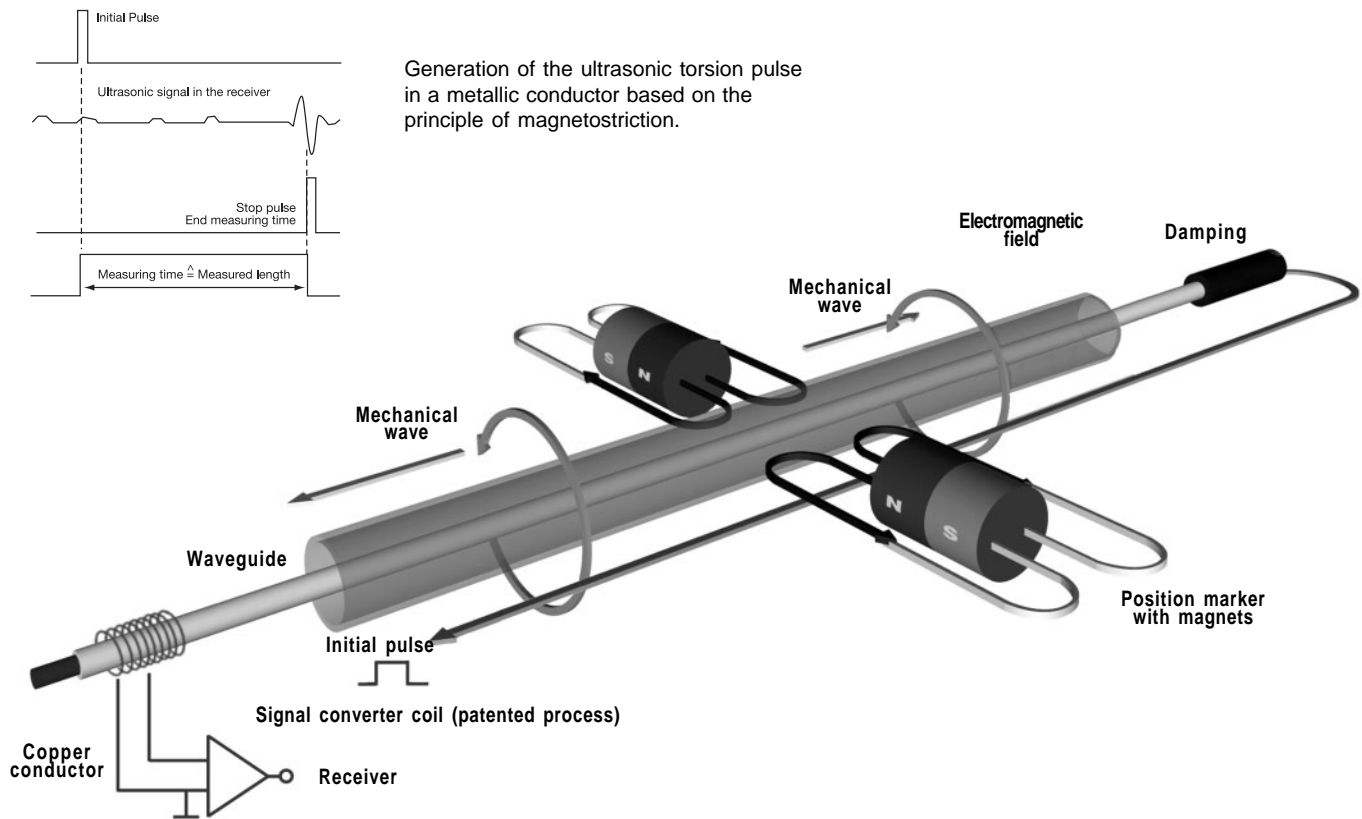
Applications

Pneumatic Cylinders	Tooling and Tool Handling	Presses
Foundries	Casting and Rolling Mills	Injection Molding
Leveling Machines	Transport Systems	Lift Controls
Level Monitoring	Tunnel Boring Equipment	Die Casting
Portal Robots	Wood Working Machinery	Flight Simulators
Conveying	Cutting/Slitting Machinery	Windmills
Elevators	Packaging Machines	X-Y Tables

-Anywhere linear motion must be monitored -

Miller AL4 Series Air Cylinders

Linear Position Sensor Option



Generation of the ultrasonic torsion pulse in a metallic conductor based on the principle of magnetostriction.

Principles of Operation

The measuring element ("waveguide"), consists of a special nickel-alloy tube.

A copper conductor is introduced through the length of this tube. The start of measurement is initiated by a short current pulse.

This current generates a circular magnetic field which rotates around the waveguide. A permanent magnet at the point of measurement is used as the marker element, whose lines of field run at right angles to the electromagnetic field. In the area on the waveguide where the two fields intersect, a magneto-strictive effect causes an elastic deformation of the waveguide, which propagates along the wave guide in both directions in the form of a mechanical wave.

The propagation velocity of this wave in the waveguide is 2830 m/s, and is nearly insensitive to environmental effects (e.g., temperature, shock, contamination).

The component of the wave which reaches the far end of the waveguide is damped there, whereas the component which arrives at the signal converter is changed into an electrical signal by reversing the magnetostrictive effect.

The wave travel time from its point of origin to the signal converter is directly proportional to the distance between the permanent magnet and the signal converter. A time measurement then allows the distance to be determined with extremely high accuracy.

Design

The transducers are made to the same safety and reliability standards for use in the harshest conditions:

- The electronics unit is compactly designed using SMD technology. The boards are protected in a space-saving, rugged aluminum extruded housing.
- The waveguide is protected in the extruded aluminum housing.

Quality

Each and every transducer undergoes a specially designed, computer-controlled testing procedure which includes 100% checking of all specified data.

Miller AL4 Series Air Cylinders

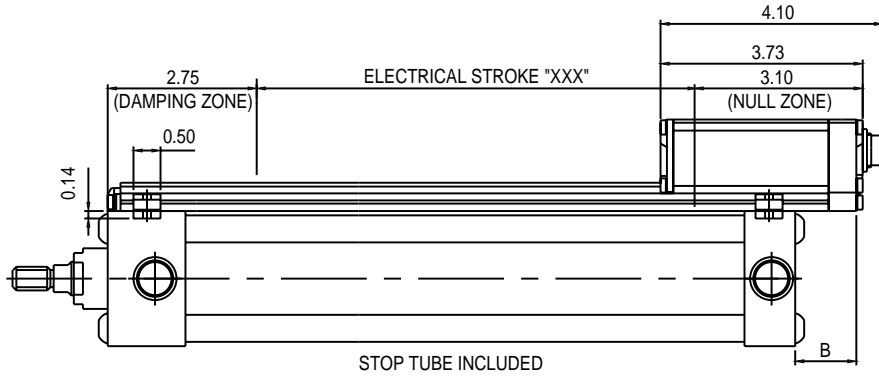
Linear Position Sensor Option

The drawings below show that the Linear Position Sensor is longer than the cylinder of the same stroke length. The sensor overhang on the head end of the cylinder, as indicated by dimension A, may be eliminated by adding stop tubing, which effectively increases the gross stroke of the cylinder. The recommended stop tube lengths are provided in the table below for each bore size. The

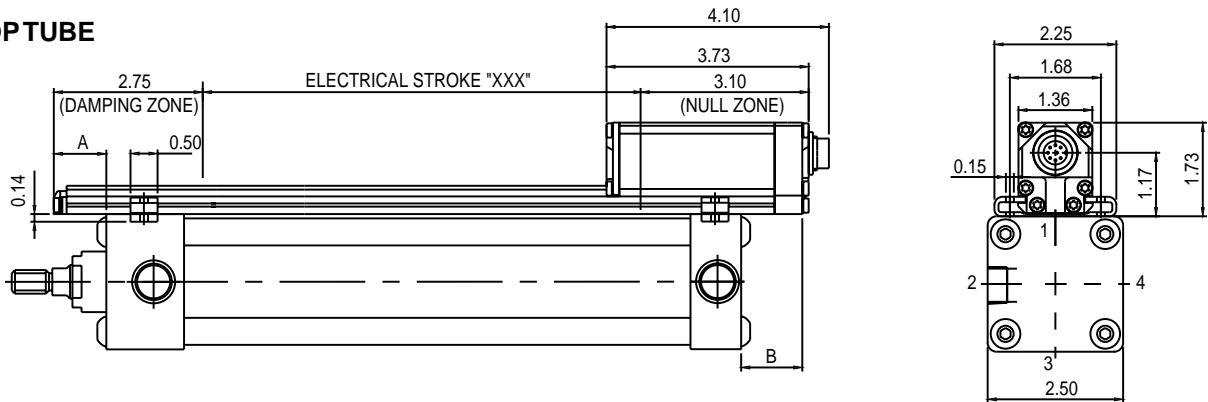
examples show that the electrical stroke of the sensor will always match the **net** stroke of the cylinder.

As a result of the limited sensing range of the sensor, it will overhang at the cap end of the cylinder by the amount of dimension B. For rear clevis and eye mounts, rotation is limited due to sensor interference.

WITH STOPTUBE



NO STOPTUBE



Example B: To eliminate sensor overhang on the head end of a 2.0" bore cylinder, add 1.0" of recommended stop tube length. The cylinder gross stroke becomes 13" and the net stroke remains 12". Specify a sensor with an electrical stroke of 12". Note that the electrical stroke equals cylinder **net** stroke length.

Example C: To eliminate sensor overhang on the head end of a 5.0" bore cylinder, add .625" of recommended stop tube length. The cylinder gross stroke becomes 12.625" and the net stroke remains 12". Specify a sensor with an electrical stroke of 12". Note that the electrical stroke equals cylinder **net** stroke length.

Bore	Rod Diameter	No Stop Tube		With Stop Tube		
		A	B	Stop Tube Length	Transducer Overhang	B
2	5/8	.95	1.3	1.0	0	1.3
	1					
2 1/2	5/8	.90	1.25	1.0	0	1.25
	1					
3 1/4	1	.64	1.0	.75	0	1.0
	1 3/8					
4	1	.63	.99	.75	0	.99
	1 3/8					
5	1	.55	.79	.625	0	.79
	1 3/8					
6	1 3/8	.47	.46	.50	0	.45
	1 3/4					
8	1 3/8	.28	.44	.375	0	.44
	1 3/4					

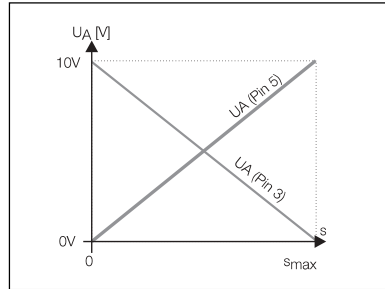
Miller AL4 Series Air Cylinders

Linear Position Sensor Option

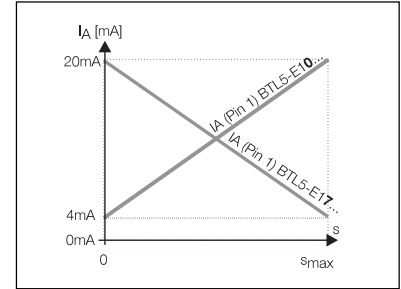
Output signal
Transducer interface
Input interface

analog
A
analog

analog
E
analog



BTL5-A11-M -R-S32



BTL5-E1 -M -R-S32

Ordering code

Output voltage
Output current
Load current
max. ripple.
Load resistance
System resolution

0...10 V
max. 10 mA
≤5 mV
≤0.1 mV

4...20 mA or 20...4mA
≤500 Ohm
≤0.2 μA

Hysteresis
Repeatability
Output update rate
max. non-linearity

-4 μm
≤6 μm (hysteresis + resolution)
STANDARD = 1 ms ≤1400 mm
±100 μm to 500 mm stroke

Temperature coefficient Voltage output
Current output

±0.02 % 501...3606 mm stroke
[150 μV/°C + (5 ppm/°C x PxU/L)] x DT
[0.6 μA/°C + (10 ppm/°C x PxI/L)] x DT

Shock loading
Vibration
Traverse velocity of magnet
Operating voltage
Current draw
Polarity reversal protected
Overvoltage protection
Dielectric constant
Operating temperature
Storage temperature

100 g/11 ms per IEC 68-2-27
12 g, 10...2000 Hz per IEC 68-2-6
any
24 V DC ± 20%
≤150 mA
yes
Transorb protection diodes
500 V (Ground to housing)
-40...185°F (-40...85°C)
-40...212°F (-40...100°C)

S32 Pin assignments	Pin	Color
Output signals	1	YE
	2	GY
	3	PK
	5	GN
Supply voltage	6	BU
	7	BN
	8	WH

BTL5-A11...
not used
signal GND
10...0 V
0...10 V
GND
+24 V DC
(GND)

BTL5-E1...BTL5-E1...
4...20 mA 20...4 mA
0 V output
20-4 mA
4-20 mA
GND
+24 V DC
(GND)

Connect shield to housing.

Specifications subject to change.

Please enter code for output signal and nominal stroke in ordering code.

BTL transducers with analog outputs are available in the ranges of 0...10V, 4...20mA with rising or falling signal.

Ordering Sample:

BTL5-A11-M -R-SU 022-S32

Output signal
1 increasing and decreasing (for A)
0 increasing
7 decreasing (for E)

Standard stroke lengths (mm)

Miller AL4 Series Air Cylinders

Linear Position Sensor Option

M Interface

Differential **START/STOP** control-specific interface.

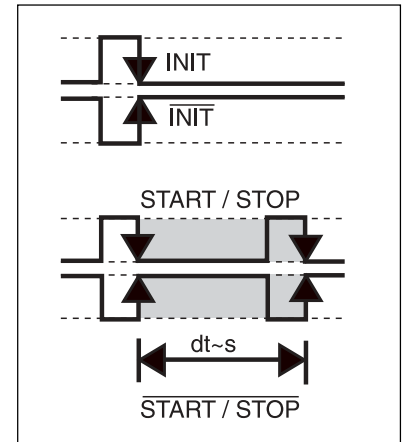
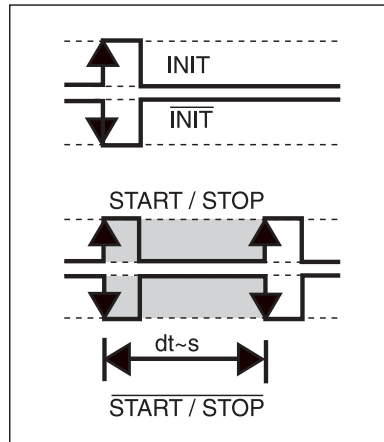
P Interface

Compatible with BTA processors and various OEM controls. Reliable signal transmission, even over cable lengths up to 500 m (1640 ft.) between BTA and BTL, is assured by the especially noise-immune RS485 differential drivers and receivers. Noise signals are effectively suppressed.

Series
Transducer interface
User interface

BTL5 Low Profile
pulse M
pulse M

BTL5 Low Profile
pulse P
pulse P



Ordering code
System resolution
Repeatability
Resolution
Hysteresis
Standard sampling rate
max. non-linearity
Temperature coefficient of overall system
Traverse velocity of magnet
Operating voltage
Current draw
Operating temperature
Storage temperature

BTL5-M1-M -R-S 32
Process-dependent/control dependent
Hysteresis + Resolution
≤2 μm
≤4 μm
fSTANDARD = 1 kHz ≤1400 mm
±100 μm to 500 mm nominal stroke
±0.02 % 501...3750 mm nominal stroke
(6 μm + 5 ppm x L)/°C
any
24 V DC ±20 % or ±15V DC ±2% (optional)
≤100 mA
-40...185°F (-40...85°C)
-40...212°F (-40...100°C)

BTL5-P1-M -R-S 32
Process-dependent/control dependent
Hysteresis + Resolution
≤2 μm
≤4 μm
fSTANDARD = 1 kHz ≤1400 mm
±100 μm to 500 mm nominal stroke
±0.02 % 501...3750 mm nominal stroke
(6 μm + 5 ppm x L)/°C
any
24 V DC ±20 % or ±15V DC ±2% (optional)
≤100 mA
-40...185°F (-40...85°C)
-40...212°F (-40...100°C)

S32 Pin assignments	Pin	Color
Input/output signals	Input	1 YE
	Output	2 GY
	Input	3 PK
	Output	5 GN
Supply voltage	6	BU
	7	BN
	8	WH

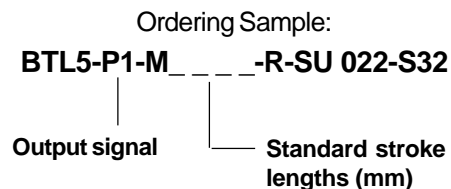
BTL5-M1-M...
INIT
START/STOP
INIT
START/STOP
GND
+24 V DC
(GND)

BTL5-P1-M...
INIT
START/STOP
INIT
START/STOP
GND
+24 V DC
(GND)

Shield connected to housing

Specifications subject to change.

Please enter code for nominal stroke in ordering code.



Miller AL4 Series Air Cylinders

Linear Position Sensor Option
Ordering Code

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
B	T	L	-	5	-	A	1	1	-	M	0	3	0	5	-	R	SU022	S	3	2	-
																		K	A	0	5

Transducer - Linear

Generation 5

Output Signal

- A = 0...10V
- E = 4...20 mA
- M = differential Start/Stop - leading edge active
- P = differential Start/Stop - trailing edge active

Supply Voltage

1 = 24 V ±20%

Output Signal Used for analog only.

Leave position #9 blank for digital.

If A in position

1 = Vmin or Vmax at connector end, i.e. user selectable rising or falling

If E in position

0 = Imin at connector end (rising towards opposite end)
7 = Imax at connector end (falling towards opposite end)

Nominal stroke in mm

= 305 mm active electrical stroke.

See chart below for std. stroke length.

Note: Electrical stroke = Net Cylinder Stroke

Housing geometry

R = Low Profile extrusion

Connection type

= 8 pin quick disconnect metal connector

= integral axial cable (with 5 m cable; specify length)

Cable Required = BKS - 532M - 05 (straight connector), 5 meter cable length

BKS - 533M - 05 (right angle, 90° connector), 5 meter cable length

Standard Lengths

Electrical Stroke

inches	mm
2	0051
3	0077
4	0102
5	0127
6	0152
7	0178
8	0203
9	0230
10	0254
11	0280
12	0305
13	0330

inches	mm
15	0381
16	0407
18	0457
20	0508
22	0560
24	0610
26	0661
28	0711
30	0762
32	0813
36	0914
40	1016

inches	mm
42	1067
48	1220
50	1270
60	1524
70	1778
80	2032
90	2286
100	2540
110	2794
120	3048

Miller AL4 Series Air Cylinders

Transducer Information

Special Sensor Modification

When specifying the Linear Position Option, the Series letter "S" (example - AL4S) must be used and the cylinder part number must include a magnet, along with the number "9" in the "modified" identification. Please include the following information in the Special Modifications:

1. Sensor part number from the previous page.
2. Sensor position.
3. Port position (not position 1).
4. Length of stop tubing, gross stroke and net stroke (if required). Ordering Example: AL4S 72 B 2N 00400-00800 0100 N 22 M 9

Table A – Cylinder Mounting Styles without Stop Tube Option

Mounting Style Code	N.F.P.A. Style	Mounting Description	Mounting Style Code	N.F.P.A. Style	Mounting Description
50	MX0	No Mount (Basic)	81	MT1	Head Trunnion
			82	MT2	Cap Trunnion
			96****†	MP4	Detachable Pivot Eye
72	MS2	Side Lug	84****†	MP1	Cap Fixed Clevis
71	MS1	Single End Angle	86****†	MP2	Cap Detachable Clevis
74	MS4	Side Tapped			
77	MS7	End Lug Mount			
62	MF2	Cap Rectangular Flange (6" only)			

**** Mounting styles with asterisks (****) can be ordered assembled to the cylinder or as a basic no-mount cylinder with a bolt on mounting kit as a separate item (1-1/2" to 4" only). † For rear clevis mounts, 84, 86 and 96, rotation is limited due to sensor interference.

Table B – Cylinder Mounting Styles with Stop Tube Option

Mounting Style Code	N.F.P.A. Style	Mounting Description	Mounting Style Code	N.F.P.A. Style	Mounting Description
50	MX0	No Mount (Basic)	61****	MF1	Head Rectangular Flange (2"-6")
			62****	MF2	Cap Rectangular Flange (6"-8" only)
53	MX3	Tie Rods Extended Head End	81	MT1	Head Trunnion
			82	MT2	Cap Trunnion
55	MX5	Sleeve Nut Mount	96****†	MP4	Detachable Pivot Eye
72	MS2	Side Lug	84****†	MP1	Cap Fixed Clevis
71****	MS1	Side End Angle	86****†	MP2	Cap Detachable Clevis
74	MS4	Side Tapped	63	ME3	Head Square (8")
77	MS7	End Lug Mount			

**** Mounting styles with asterisks (****) can be ordered assembled to the cylinder or as a basic no-mount cylinder with a bolt on mounting kit as a separate item (1-1/2" to 4" only). † For rear clevis mounts, 84, 86 and 96, rotation is limited due to sensor interference.

Transducer Warranty

The Company's products are guaranteed to be free from defect in material and workmanship for the period defined below:

The Company offers a standard 2-year warranty from the date of shipment for magnetostrictive transducers.

The Company will repair or replace, without charge, any unit, which fails because of defective workmanship or material, during this guarantee period and which is returned to The Company, transportation prepaid. The guarantee will not apply if, in the judgement of The Company, damage or failure has resulted from accident, alteration, misuse, abuse, or operation on an incorrect power supply. The guarantee expressly does not include any other costs such as the cost of removal of the defective part, installation, labor or consequential damages of any kind. The Company assumes no responsibility for selection and installation of its products. The foregoing is in lieu of all other guarantees expressed, implied or statutory and The Company neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with said products.

Miller AL4 Series Air Cylinders

How to Select a Miller Cylinder

Miller cylinders are available based on air or hydraulic operating pressure. The many styles, sizes and optional features available assure that your application requirements are met precisely. To select a Miller cylinder, follow these simple steps:

- Step 1 - **Determine the correct cylinder bore size** necessary to achieve required force using the available operating pressure.
- Step 2 - **Determine the series cylinder to use**, based on operating pressure.
- Step 3 - **Turn to the appropriate cylinder selection section.** Select the mounting style (Model No.) which fits your installation needs. Determine the bore and rod sizes available for the model you select. Then complete model selection.
- Choose a rod end style and the desired rod end accessories.
 - Size the cylinder to meet your application requirements.
- Step 4 - **Consider the following conditions** which may require further modifications to the cylinder you have selected. See Table of Contents for location of additional information on each subject.

Application Condition	Check the Following
Quick Starts or Stops	Confirm that determined thrust is sufficient to accelerate or decelerate cylinder and load within prescribed distance. Optional cushions should be used to reduce shock during deceleration, check that peak pressures will be within tolerable limits.
Long Push Stroke	Check whether stop tube is required to prevent excessive bearing loads and wear.
High Column Loading - Long Push Stroke	Determine if standard size piston rod is strong enough to accommodate intended load.
Long Horizontal Stroke	Determine if standard size piston rod is strong enough to accommodate intended load.
High Operating Temperatures	For temperatures between 165° F and 250° F use AL4 cylinder with high temperature seals. For 250° F to 450° F use Series A cylinder with high temperature seals.
Options and Modifications	<ul style="list-style-type: none"> - Adjustable Cushions - Piston Bumper Seals (1-1/2" through 4") - Adjustable Switches - Linear Position Sensing - Piston Bumpers (1-1/2" through 8") - Port and Cushion Adjust Relocation <ul style="list-style-type: none"> - Stop Tube - Mixed Mountings - Rod End Modifications - Double Rod End - Multiple Ports

Mounting Styles

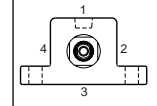
Model 50	No Mount	Model 63*	Head Square	Model 82	Cap Trunnion
Model 51	Tie Rods Extended Both Ends	Model 64*	Cap Square	Model 84	Cap Fixed Clevis
Model 52	Tie Rods Extended Cap End	Model 71	Side End Angle	Model 86	Cap Detachable Clevis
Model 53	Tie Rods Extended Head End	Model 72	Side Lug	Model 89	Intermediate Trunnion
Model 55	Sleeve Nut	Model 74	Side Tap	Model 96	Cap Detachable Eye
Model 61	Head Rectangular Flange	Model 77	Side End Lug	Model DAL4	Double Rod End
Model 62	Cap Rectangular Flange	Model 81	Head Trunnion		

*8" bore only

Miller AL4 Series Air Cylinders

How to Order Example: AL4-72B2N-00400-00800-0138 N11M-0

AL4	72	B	2	N	004.00-008.00-01.38	N	1	1	M†	0		
Series	Mounting Style	Bushing	Rod End Style	Cushions	Bore Dia.	Stroke	Rod Dia.	Port Type	Port Location		Piston Magnet	Modified
AL4 DAL4 (D = Dbl. Rod End) AL4H DAL4H (H = Hyd. Service) AL4S DAL4S (S = Pos. Sensing)		B Externally Removable Bushing	2 (Standard) 4 5 9 x (special)	R = Rod End Cushioned C = Cap End Cushioned B = Both Ends Cushioned N = Non-Cushioned				N = NPTF R = BSPP	Head End 1 2 3 4 (Std.) 1 2 3 4	Cap End 1 2 3 4	M = Magnet N = No Magnet	0 = Standard 9* = Modified



9* The number 9 refers to special options or modifications that deviate from the standard product offering. Non-standard modifications and options not identified in the cylinder model number should be added in the notes when placing an order.

† Specify piston magnet for actuation of reed or solid state switches or no magnet when switches will not be used. Magnet and switches are available with standard Nitrile seals only. Order switches and switch brackets separately.

Modifications which can be placed under the designator “9” are as follows:

- Fluorocarbon Seals – for applications which experience operating temperatures up to and including 250° F
- Standard Bumpers – placed on either the head end, cap end, or both ends**
- Bumper Seals – For stroke loss, see bumper seal section of this catalog.
- Cushion Location
- Multiple Ports
- Special Port Threads
- Stop Tubing
- Special Mounts

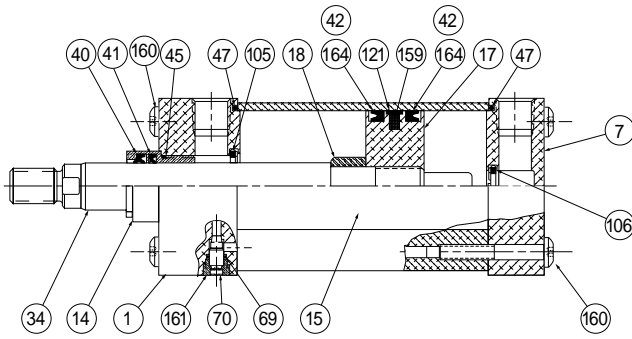
** Standard bumpers are available in 1-1/2" - 4" bore sizes only. Use of standard bumpers will result in a 1/4" stroke loss per bumper, per end. For example, a 6" stroke cylinder with standard bumpers at both ends has an effective stroke length of 5-1/2". When specifying standard bumpers, please indicate: "Head End", "Cap End", or "Both Ends".

For cylinders with unassembled mounting kits, see minimum stroke lengths.

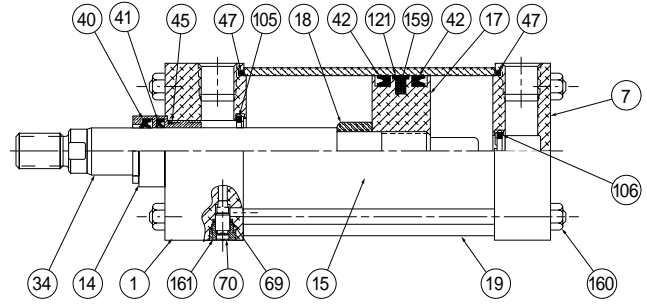
Note: The standard #1 port location is at the top of the cylinder, and the standard cushion adjustment screw is in position #2 when facing the rod end of the cylinder. If multiple ports are required, the last number of the part number should be 9, indicating modified and the location of ports desired.

Miller AL4 Series Air Cylinders

Parts List - Seal Kits for AL4 Cylinder



1 1/2" to 4" Bore Sizes



5" to 8" Bore Sizes

Symbol Number	Description
1	Head
7	Cap
14	Bushing
15	Tube
17	Piston
18	Cushion Sleeve
19	Tie Rod
23	Tie Rod Nut
34	Piston Rod
40	Rod Wiper
41	Rod Seal
42	Lip Seal - Piston

Symbol Number	Description
45	O-Ring - Head to Bushing
47	O-Ring - End Seal
69*	O-Ring - Needle Valve
70*	Needle Valve
105*	Cushion Check Seal - Head
106*	Cushion Check Seal - Cap
121	Wear Band
159	Magnetic Ring
160	Fastener - Tie Bolt
161*	Needle Valve - Retainer
164	Bumper Seal - Piston

*For Cushion Kits see following page.

Rod Dia.	Rod Bushing Kit Consisting of: 1 ea. Symbol #14, 40, 41, 45		Rod Seal Kit Consisting of: 1 ea. Symbol #40, 41, 45		Bushing to Head Torque Units	
	Standard Seals	Fluorocarbon Seals	Standard Seals	Fluorocarbon Seals	U.S.A.	Metric
	Part No.	Part No.	Part No.	Part No.	Ft. Lbs.	N m
5/8"	AL4-KR100-63	AL4-KR200-63	AL4-KR300-63	AL4-KR400-63	40-45	54-61
1"	AL4-KR100-100	AL4-KR200-100	AL4-KR300-100	AL4-KR400-100	45-50	61-68
1-3/8"	AL4-KR100-138	AL4-KR200-138	AL4-KR300-138	AL4-KR400-138	75-80	102-108
1-3/4"	AL4-KR100-175	AL4-KR200-175	AL4-KR300-175	AL4-KR400-175	90-95	122-129

Bore Dia.	Piston Seal Kit		Bumper Seal Kit	Magnetic Ring (If required)	Cylinder Tube End Seal Kit		Fastener Bolt / Tie Rod Torque Units	
	Consisting of: 2 ea. Symbol #42 & 47 plus 1 each Symbol #121. NOTE: (Order-Magnetic Ring Symbol #159 - separately if required)		Consisting of: 2 ea. Symbol #164	SYMBOL #159	Consisting of: 2 ea. Symbol #47			
	Standard Seals	Fluorocarbon Seals	Standard Seals Only	Standard Seals Only	Standard Seals	Fluorocarbon Seals	U.S.A.	Metric
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.		
1-1/2"	AL4-KB100-150	AL4-KB200-150	AL4-PS300-150	AL4-FM100-150	AL4-ES100-150	AL4-ES200-150	32 + 4 in. lbs.	3.6 + 0.5 nm
2"	AL4-KB100-200	AL4-KB200-200	AL4-PS300-200	AL4-FM100-200	AL4-ES100-200	AL4-ES200-200	72 + 10 in. lbs.	8 + 1 nm
2-1/2"	AL4-KB100-250	AL4-KB200-250	AL4-PS300-250	AL4-FM100-250	AL4-ES100-250	AL4-ES200-250	72 + 10 in. lbs.	8 + 1 nm
3-1/4"	AL4-KB100-325	AL4-KB200-325	AL4-PS300-325	AL4-FM100-325	AL4-ES100-325	AL4-ES200-325	216 + 12 in. lbs.	24 + 1.3 nm
4"	AL4-KB100-400	AL4-KB200-400	AL4-PS300-400	AL4-FM100-400	AL4-ES100-400	AL4-ES200-400	216 + 12 in. lbs.	24 + 1.3 nm
5"	AL4-KB100-500	AL4-KB200-500	-	AL4-FM100-500	AL4-ES100-500	AL4-ES200-500	30 + 1 ft. lbs.	41 + 1 nm
6"	AL4-KB100-600	AL4-KB200-600	-	AL4-FM100-600	AL4-ES100-600	AL4-ES200-600	35 + 1 ft. lbs.	48 + 1 nm
8"	AL4-KB100-800	AL4-KB200-800	-	AL4-FM100-800	AL4-ES100-800	AL4-ES200-800	80 + 1 ft. lbs.	109 + 6 nm

Miller AL4 Series Air Cylinders

Dis-assembly, Reassembly of Cylinder
Mounting Kits, Cushion Kits
1-1/2" - 8" Bores

Perform the following steps when Dis-assembling, installing mounting kits and reassembling AL4 Series cylinders (1 1/2" - 4" Bores).

Dis-assembly of Cylinder to add Mounting Kit*

Un-torque cylinder mounting fasteners using corner to corner sequence until finger tight then remove all four fasteners. Clean mating parts to remove oil, grease and dirt. Mounting fasteners should be clean, dry, and burr-free. Brush mounting fastener threads thoroughly with anti-seize lubricant. Follow the appropriate procedure for the desired mounting.

Choose the appropriate mounting kit instructions

Rear Pivot Mount Kits — Models 84, 86 and 96 — Place pivot mount kit over end cap, lining up the four fastener holes in the end cap with the pivot mount plate. Note that the pivot mount can be rotated to the cylinder allowing for different port locations. Secure mounting to cap (finger tight) using the four fasteners. Torque the bolts to specifications below.

End Angle Mount Kits — Model 71 — The end angles bolt to the front and rear of the end caps of the cylinder. The spacer plate▲ provided is to be assembled at rod end under the angle plate. Line up the two holes of the spacer and angle plate with the two fastener holes of the head. Secure (finger tight) using the fasteners. Repeat this assembly at the end opposite the rod (less spacer). Place the assembly with the end angles down on a flat surface and torque the four fasteners to specification below.

Mounting Kit Assembly — Use for Single and Double Rod End Styles

Flange Mount Kits — Models 61 and 62 — Place rectangular flange plate over appropriate end cap. Line up the four holes in the plate with the four fastener holes in the end cap. Note that the rectangular plate can be

rotated to allow for different port locations. Secure the rectangular plate to the end cap (finger tight) using the four fasteners. Then torque the four fasteners to specification.

Re-Assembly and Torquing of Cylinder Mounting Kits After Maintenance

The following procedure is recommended to ensure the correct re-assembly of the mounting kits. Tighten mounting fasteners in opposite corner sequence to approximately 3/4 of final tightening torque. Using a calibrated torque wrench, tighten mounting fasteners to the final torque listed repeating the opposite corner sequence procedure.

▲ Note: Spacer plate not used for 4" bore or double rod assemblies

* Note: Mounting Kits on cylinders with strokes shorter than those listed on minimum stroke chart must be added by factory to ensure proper fastener thread engagement.

Bore Size	Fastener Torque	Fastener Torque
1 1/2"	32 + 4 inch lbs.	3 1/2 + 1/2 nm
2"	72 + 10 inch lbs.	8 + 1 nm
2 1/2"	72 + 10 inch lbs.	8 + 1 nm
3 1/4"	216 + 12 inch lbs.	24 + 1 1/4 nm
4"	216 + 12 inch lbs.	24 + 1 1/4 nm

AL4 Series Mounting Kits										Minimum Stroke
Bore Size	Rod Dia.	61 (MF1)	62 (MF2)	84 (MP1)	96 (MP4)	71 (MS1)	86 (MP2)	77 (MS7)	For customer assembled mounting kits only!	
		Head Rectangular Flange	Cap Rectangular Flange	Cap Clevis	Cap Pivot	Side End Angles	Cap Detachable Clevis	Side End Lug		
		Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.		
1 1/2"	5/8"	AL4-MK61A-150	AL4-MK61A-150	AL4-MK84A-150	AL4-MK96A-150	AL4-MK71A-150	AL4-MK86A-150	AL4-MK77A-150	1"	
2"	5/8"	AL4-MK61A-200	AL4-MK61A-200	AL4-MK84A-200	AL4-MK96A-200	AL4-MK71A-200	AL4-MK86A-200	AL4-MK77A-200	1"	
	1"									
2 1/2"	5/8"	AL4-MK61A-250	AL4-MK61A-250	AL4-MK84A-250	AL4-MK96A-250	AL4-MK71A-250	AL4-MK86A-250	AL4-MK77A-250	7/8"	
	1"									
3 1/4"	1"	AL4-MK61A-325	AL4-MK61A-325	AL4-MK84A-325	AL4-MK96A-325	AL4-MK71A-325	AL4-MK86A-325	AL4-MK77A-325	1 3/8"	
	1 3/8"									
4"	1"	AL4-MK61A-400	AL4-MK61A-400	AL4-MK84A-400	AL4-MK96A-400	AL4-MK71A-400	AL4-MK86A-400	AL4-MK77A-400	1 3/8"	
	1 3/8"									

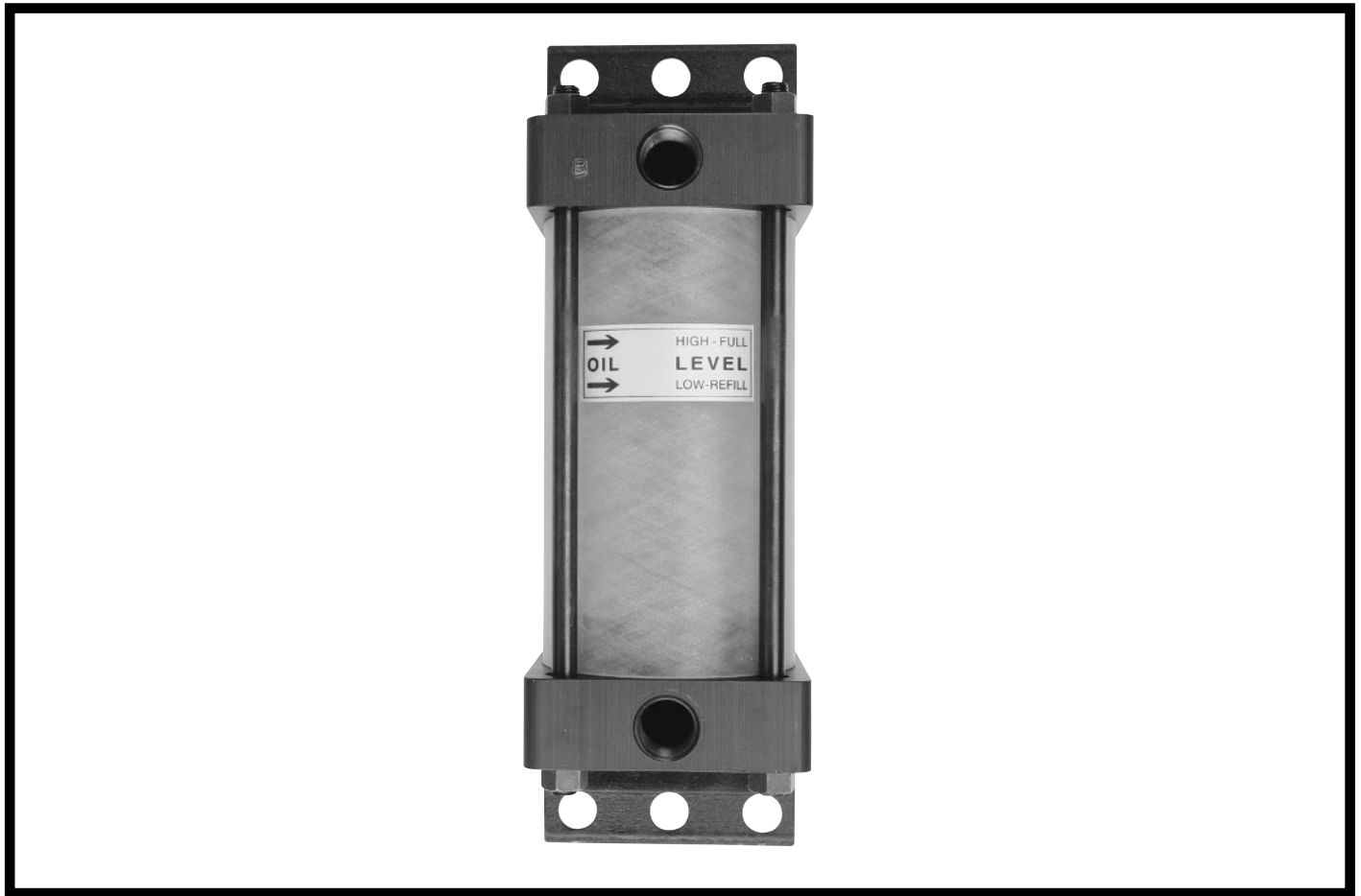
Bore Size	Rod Dia.	Head (Rod End) Cushion Kit		Cap End Cushion Kit	
		Consisting of: 1 Ea. – Sym. # 69, 70, 105 & 161			
		Nitrile Seals	Fluorocarbon Seals	Nitrile Seals	Fluorocarbon Seals
1 1/2"	5/8"	AL4-CUKH1-150-63	AL4-CUKH5-150-63	AL4-CUKC1-150	AL4-CUKC5-150
2"	5/8"	AL4-CUKH1-200-63	AL4-CUKH5-200-63	AL4-CUKC1-200	AL4-CUKC5-200
	1"	AL4-CUKH1-200-100	AL4-CUKH5-200-100		
2 1/2"	5/8"	AL4-CUKH1-250-63	AL4-CUKH5-250-63	AL4-CUKC1-250	AL4-CUKC5-250
	1"	AL4-CUKH1-250-100	AL4-CUKH5-250-100		
3 1/4"	1"	AL4-CUKH1-325-100	AL4-CUKH5-325-100	AL4-CUKC1-325	AL4-CUKC5-325
	1 3/8"	AL4-CUKH1-325-138	AL4-CUKH5-325-138		
4"	1"	AL4-CUKH1-400-100	AL4-CUKH5-400-100	AL4-CUKC1-400	AL4-CUKC5-400
	1 3/8"	AL4-CUKH1-400-138	AL4-CUKH5-400-138		
5"	1"	AL4-CUKH1-500-100	AL4-CUKH5-500-100	AL4-CUKC1-500	AL4-CUKC5-500
	1 3/8"	AL4-CUKH1-500-138	AL4-CUKH5-500-138		
6"	1 3/8"	AL4-CUKH1-600-138	AL4-CUKH5-600-138	AL4-CUKC1-600	AL4-CUKC5-600
	1 3/4"	AL4-CUKH1-600-175	AL4-CUKH5-600-175		
8"	1 3/8"	AL4-CUKH1-800-138	AL4-CUKH5-800-138	AL4-CUKC1-800	AL4-CUKC5-800
	1 3/4"	AL4-CUKH1-800-175	AL4-CUKH5-800-175		

Miller AL4 Series Air Cylinders

Notes

NOTES

Miller AL4T Series Air-Oil Tank

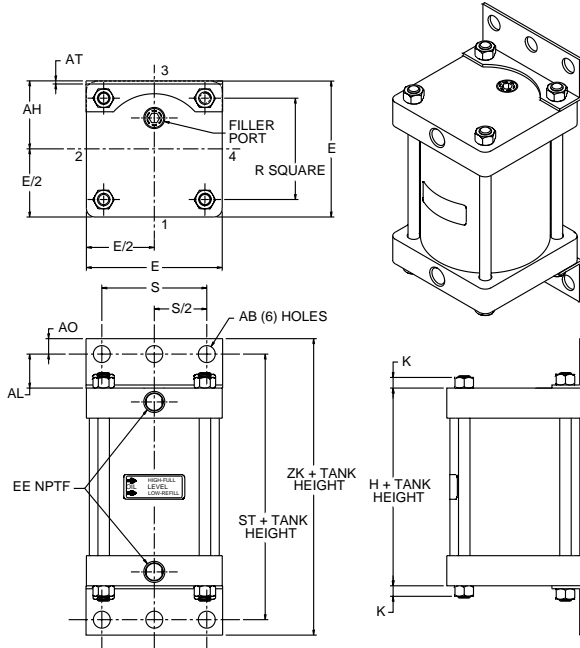


Air-Oil Tanks Series AL4T

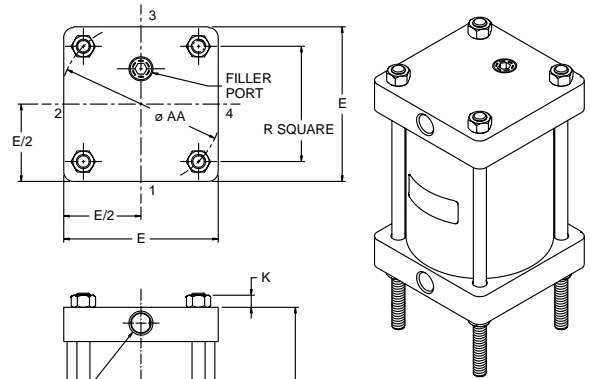
- 6 Standard Bore Sizes 2½"- 8" Bores
- Operating Pressure: Up to 250 psi
- Operating Temperature: 165°F Max.
- Lightweight Aluminum/Fiberglass Design
- Premium Quality and Economy
- Larger Bore Sizes Available

Miller AL4T Series Air-Oil Tank

Dimensions - Air-Oil Tanks

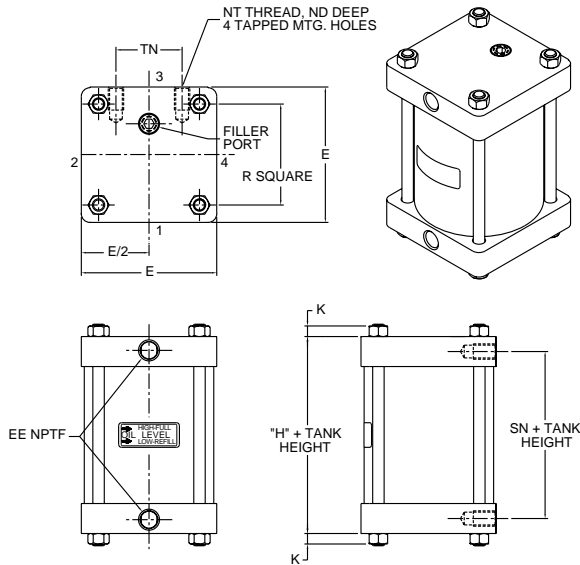


Mounting 71
Side end angles



Mounting 52
Tie rods extended - oil end

Mounting 53
Tie rods extended - air end



Mounting 74
Side tap

Air-Oil Tanks Dimensions

Bore Size	E	H	K	R	S	AB	AH	AL	AO	AT	BB	DD	EE	ST	ZK	NT	SN	TN
2 1/2	3	2	5/16	2.19	2 1/4	7/16	1 5/8	1	3/8	1/8	1 1/8	5/16-24	3/8	4	4 3/4	3/8-16	2 3/8	1 1/4
3 1/4	3 3/4	2 1/2	3/8	2.76	2 3/4	9/16	1 15/16	1 1/4	1/2	1/8	1 3/8	3/8-24	1/2	5	6	1/2-13	2 5/8	1 1/2
4	4 1/2	2 1/2	3/8	3.32	3 1/2	9/16	2 1/4	1 1/4	1/2	1/8	1 3/8	3/8-24	1/2	5	6	1/2-13	2 5/8	2 1/16
5	5 1/2	3	7/16	4.10	4 1/4	1 1/16	2 3/4	1 3/8	5/8	3/16	1 13/16	1/2-20	1/2	5 3/4	7	5/8-11	2 7/8	2 11/16
6	6 1/2	3	7/16	4.88	5 1/4	1 3/16	3 1/4	1 3/8	5/8	3/16	1 13/16	1/2-20	3/4	5 3/4	7	3/4-10	3 1/8	3 1/4
8	8 1/2	3	9/16	6.44	7 1/8	1 3/16	4 1/4	1 13/16	1 1/16	1/4	2 5/16	5/8-18	3/4	6 5/8	8	3/4-10	3 1/4	4 1/2

Miller AL4T Series Air-Oil Tank

In a basic air-oil circuit the advance tank is connected to the cap end port of a hydraulic cylinder and the return tank to the head end port. Shop air is applied alternately to the two tanks through a 4-way air control valve. The oil in the advance tank is forced into the cap end of the cylinder to cause the piston rod to extend. At the same time, oil from the head end port is forced into the return tank, the air side of which is open to exhaust. To return cylinder to retract position, air pressure is applied to the oil in return tank.

To limit the fluid velocity, speed controls should be applied to the air side of the tank to restrict the exhaust.

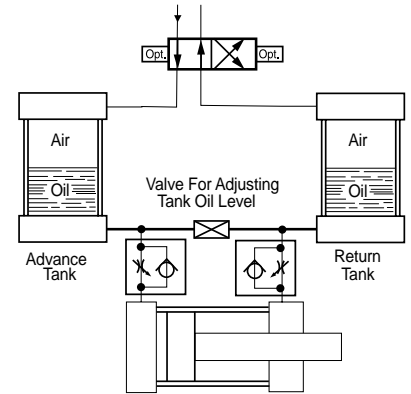


Table A Rated Capacities – Cubic Inches

Usable Tank Volume (Cubic Inches)											
Internal Length of Tank											
Bore	5	6	7	8	9	10	12	14	16	18	20
2 1/2	12	16.6	21.6	25.5	30	34	43	52	61	70	78
3 1/4	19	26	34	41	49	56	74	86	101	116	131
4	28	40	51	62	74	85	107	129	153	175	195
5	39	57	75	92	110	128	163	199	234	269	305
6	62	86	111	137	161	186	232	284	333	386	432
8	109	146	195	239	280	324	414	504	592	684	774

How to Select

Step 1: Determine the volume (cu. in.) of fluid required to fill the work cylinder at full stroke by taking the bore area times the stroke length.

Step 2: Select the proper tank bore height from the chart. Since there are usually several combinations with similar capacities, select the one having a rated capacity closest to but slightly greater than your volume requirements. Generally, the most economical choice is a higher tank with a smaller bore.

Air-Oil Tanks – For Air Power with Hydraulic Control

Miller Air-Oil Tanks provide a means to convert shop air pressure into hydraulic pressure. Compressed air is applied directly to the oil in the air-oil tank to convert it into hydraulic pressure. The hydraulic pressure is at a 1-to-1 ratio, i.e. 80 psi air produces 80 psi hydraulic pressure.

All Miller Air-Oil Tanks have a fiberglass tube which shows the proper oil level. They also contain two fluid flow baffles. The top baffle disperses the incoming air over the surface of the oil in such a way to avoid agitation and aeration. The bottom baffle insures a smooth flow pattern that minimizes oil turbulence and eliminates swirling, funneling or splashing which in turn could cause oil aeration or the oil to be blown from the tank into the exhaust air.

Air-Oil Tanks are used to smooth out the cylinder piston rod travel and to prevent chatter. They are mainly used in slow speed circuits. Fluid velocity in or out of the tank through standard ports should be less than 6 feet per second to prevent aeration of the oil. Since each tank is designed for a specific port size, increasing the port size in a tank to lower the fluid velocity is not recommended. A tank with a larger port size should be selected.

How To Order

When ordering Miller Air-Oil Tanks, specify:

1. Quantity
2. Series
3. Model Number
4. Tank Diameter (3 digits)
5. Tank Height (3 digits)

Notes: Standard air-oil tanks are designed for use with petroleum base hydraulic oil. If other fluids will be used, please consult the factory. For larger than 8" Bore Sizes consult factory.

Example: Quantity 2, Series AL4T, Model 71, 5" Tank Diameter, 6" Tank Height.

Quantity 2, Order Number AL4T 71-500-600.

Miller AL4 Series Air Cylinders

Storage
Installation
Mounting Recommendations
Cylinder Trouble Shooting

Storage

At times cylinders are delivered before a customer is ready to install them and must be stored for a period of time. When storage is required the following procedures are recommended.

1. Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.
2. Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder. This will also minimize seal damage.
3. Port protector plugs should be left in the cylinder until the time of installation.
4. If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

Installation

1. Cleanliness is an important consideration, and Miller cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.
2. Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.
3. Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

Mounting Recommendations

1. Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.
2. Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.
3. Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. The standard tie rod extension is shown as BB in dimension tables. Longer or shorter extensions can be supplied. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.
4. Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.
5. Trunnion Mountings – Cylinders require lubricated bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to the trunnion pins.
6. Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

Cylinder Trouble Shooting

External Leakage

1. Rod seal leakage can generally be traced to worn or damaged seals. Examine the piston rod for dents, gouges or score marks, and replace piston rod if surface is rough.

Rod seal leakage could also be traced to gland bearing wear. If clearance is excessive, replace rod gland and seal. Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.

2. Cylinder body seal leak can generally be traced to loose tie rods. Torque the tie rods to manufacturer's recommendation for that bore size.

Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorque tie rods as in paragraph above. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the tie rods replaced.

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and retorque as in paragraph above.

Cylinder body seal leakage due to loss of radial squeeze which shows up in the form of flat spots or due to wear on the O.D. or I.D. – Either of these are symptoms of normal wear due to high cycle rate or length of service. Replace seals as per paragraph above.

Internal Leakage

1. Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.
2. With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.
3. What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

Cylinder Fails to Move the Load

1. Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.
2. Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.
3. Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.
4. Piston rod broken. Bring the operating conditions of the cylinder to the attention of our engineering department and have our factory repair the cylinder.

Erratic or Chatter Operation

1. Excessive friction at gland or piston bearing due to load misalignment – Correct cylinder-to-load alignment.
2. Cylinder sized too close to load requirements – Reduce load or install larger cylinder.
3. Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

Miller AL4 Series Air Cylinders

Safety Guide for Selecting and Using Hydraulic, Pneumatic Cylinders and Their Accessories

WARNING: ⚠ FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF CYLINDERS AND THEIR RELATED ACCESSORIES CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

Before selecting or using Miller cylinders or related accessories, it is important that you read, understand and follow the following safety information.

User Responsibility

Due to very wide variety of cylinder applications and cylinder operating conditions, The Company does not warrant that any particular cylinder is suitable for any specific application. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The hydraulic and pneumatic cylinders outlined in this catalog are designed to The Company's design guidelines and do not necessarily meet the design guide lines of other agencies such as American Bureau of Shipping, ASME Pressure Vessel Code etc. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that the user's requirements are met, OSHA requirements are met, and safety guidelines from the applicable agencies such as but not limited to ANSI are followed and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

Seals

Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection, consult "How to Select a Miller Cylinder" opposite the "How to Order" page, or contact our engineering department.

The application of cylinders may allow fluids such as cutting fluids, wash down fluids etc. to come in contact with the external area of the cylinder. These fluids may attack the piston rod wiper and or the primary seal and must be taken into account when selecting and specifying seal compounds.

Dynamic seals will wear. The rate of wear will depend on many operating factors. Wear can be rapid if a cylinder is mis-aligned or if the cylinder has been improperly serviced. The user must take seal wear into consideration in the application of cylinders.

Piston Rods

Possible consequences of piston rod failure or separation of the piston rod from the piston include, but are not limited to are:

- Piston rod and or attached load thrown off at high speed.
- High velocity fluid discharge.
- Piston rod extending when pressure is applied in the piston retract mode.

Piston rods or machine members attached to the piston rod may move suddenly and without warning as a consequence of other conditions occurring to the machine such as, but not limited to:

- Unexpected detachment of the machine member from the piston rod.
- Failure of the pressurized fluid delivery system (hoses, fittings, valves, pumps, compressors) which maintain cylinder position.
- Catastrophic cylinder seal failure leading to sudden loss of pressurized fluid.
- Failure of the machine control system.

Following the recommendation of the "Piston Rod Selection Chart and Data" found in this catalog. The suggested piston rod diameter in these charts must be followed in order to avoid piston rod bucking.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion.

These additional loads can cause the piston rod to fail. If these types of additional loads are expected to be imposed on the piston rod, their magnitude should be made known to our engineering department.

The cylinder user should always make sure that the piston rod is securely attached to the machine member.

On occasion cylinders are ordered with double rods (a piston rod extended from both ends of the cylinder). In some cases a stop is threaded on to one of the piston rods and used as an external stroke adjuster. On occasions spacers are attached to the machine member connected to the piston rod and also used as a stroke adjuster. In both cases the stops will create a pinch point and the user should consider appropriate use of guards. If these external stops are not perpendicular to the mating contact surface, or if debris is trapped between the contact surfaces, a bending moment will be placed on the piston rod, which can lead to piston rod failure. An external stop will also negate the effect of cushioning and will subject the piston rod to impact loading. Those two (2) conditions can cause piston rod failure. Internal stroke adjusters are available with and without cushions. The use of external stroke adjusters should be reviewed with our engineering department.

The piston rod to piston and the stud to piston rod threaded connections are secured with an anaerobic adhesive. The strength of the adhesive decreases with increasing temperature. Cylinders which can be exposed to temperatures above +250°F (+121°C) are to be ordered with a non studded piston rod and a pinned piston to rod joint.

Cushions

Cushions should be considered for cylinder applications when the piston velocity is expected to be over 4 inches/second.

Cylinder cushions are normally designed to absorb the energy of a linear applied load. A rotating mass has considerably more energy than the same mass moving in a linear mode. Cushioning for a rotating mass application should be reviewed by our engineering department.

Cylinder Mountings

Some cylinder mounting configurations may have certain limitations such as but not limited to minimum stroke for side or foot mounting cylinders or pressure de-ratings for certain flange mounts. Carefully review the catalog for these types of restrictions.

Always mount cylinders using the largest possible high tensile alloy steel socket head cap screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

Port Fittings

Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end.

The rod end pressure is approximately equal to:

$$\frac{\text{operating pressure} \times \text{effective cap end area}}{\text{effective rod end piston area}}$$

Contact your connector supplier for the pressure rating of individual connectors.

Cylinder Modifications or Repairs

Cylinders as shipped from the factory are not to be disassembled and or modified. If cylinders require modifications, these modifications must be done at company locations or by The Company's certified facilities. It is allowed to disassemble cylinders for the purpose of replacing seals or seal assemblies. However, this work must be done by strictly following all the instructions provided with the seal kits.

Miller AL4 Series Air Cylinders

Offer of Sale

The items described in this document and other documents or descriptions provided by the Company, its subsidiaries and its authorized distributors are hereby offered for sale at prices to be established by the Company, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such item, when communicated to the Company, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

1. **Terms and Conditions of Sale:** All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.

2. **Payment:** Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. **Delivery:** Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. **Warranty:** Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 60 months* from date of shipment from the Company. THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED.

NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.

5. **Limitation of Remedy:** SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. **Changes, Reschedules and Cancellations:** Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. **Special Tooling:** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. **Buyer's Property:** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer, or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. **Taxes:** Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller thereupon upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. **Indemnity for Infringement of Intellectual Property Rights:** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (hereinafter "Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. **Force Majeure:** Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. **Entire Agreement/Governing Law:** The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

*See Transducer Information page for specific warranties.

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Catalog M0917-4
03/03

