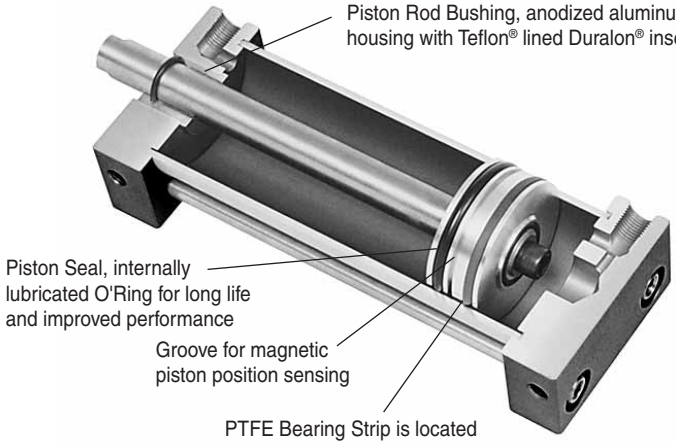
Round Head and Square Head Tie Rod Cylinders

Longstroke™ Cylinders

Available in 2 styles
4 Bore sizes 2" thru 4"
Strokes to 12"

Round Head Style

Square Head Style



Duralon® Rod Bearings Excel

Load Capacity (psi)

Machine Design 1972/73 Bearing Reference Issue

Porous Bronze	4,500
Porous iron	8,000
Phenolics	6,000
Nylon®	1,000
TFE	500
Reinforced Telfon®	2,500
*TFE fabric	60,000
Polycarbonate	1,000
Acetal	1,000
Carbon-graphite	600

Friction Properties

	Coefficient	Slip-stick
Steel-on-steel	.50	Yes
Bronze-on-steel	.35	Yes
Sintered Bronze-on-steel with mineral oil	.13	No
Bronze-on-steel with mineral oil	.16	No
Copper lead alloy-on-steel	.22	Yes
Acetal-on-steel	.20	No
Nylon-on-steel	.32	Yes
Duralon-on-steel	.05 - .16	No

* Shows Duralon bearing classification. Not to be used for design purposes.

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Ratings – Standard Units all series

- Double acting, single rod
- Duralon® rod bushing
- Female rod end with wrench flats
- Internally lubricated Buna-N O-ring piston and rod seals.
- Ports at position #1

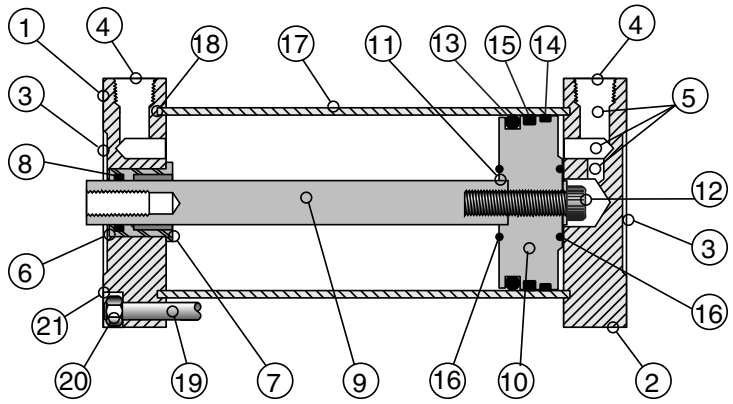
- Media . . . . . Air
- Max. operating pressure . . . . . 250 psi
- Min. operating pressure recommended . . . . . 15 psi
- Ambient & media temperature range . . . -25° to +250°F
- Prelubrication . . . . . Magnalube®–G Grease
- Stroke tolerance . . . . . ± 1/64"
- Optional – Hydraulic . . . . . 500 psi ***nonshock***

Sizing Guide

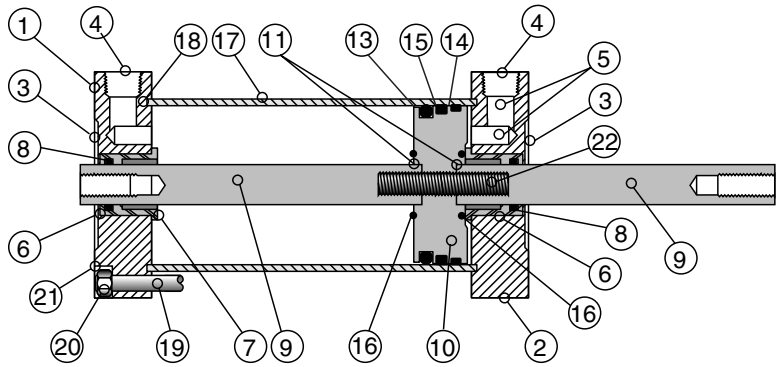
Bore Diameter	2"	2-1/2"	3"	4"
Rod Diameter	0.75	0.75	0.75	0.88
Rod Area	0.44	0.44	0.44	0.79
Push Area (Single Rod)	3.14	4.91	7.07	12.57
Pull Area	2.70	4.47	6.63	11.97
Round Head Base Weight, lb.	2.21	2.83	3.66	5.98
Square Head Weight, lb.	2.34	3.08	3.27	5.20
Weight Per Inch, lb.	0.18	0.21	0.23	0.34

Standard Models

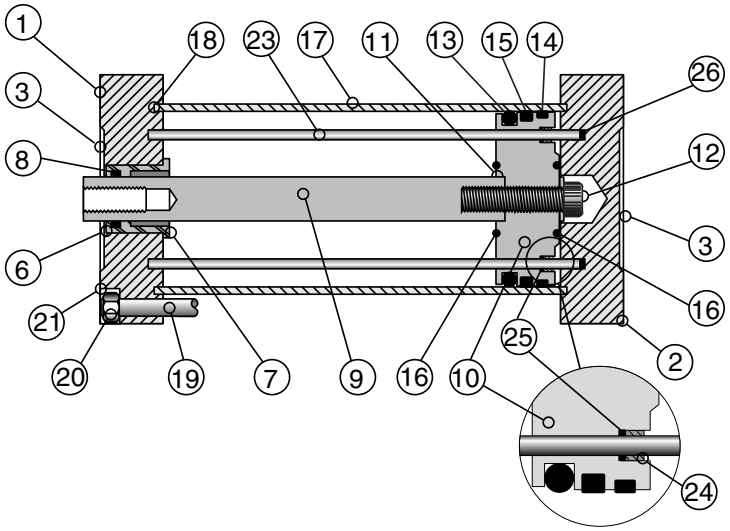
Standard: Single Rod, Double Acting



Option -DR: Double Rod, see page 3.7



Option -K: Nonrotating, see page 3.8



Basic Construction

Quick Reference to Components

No.	Description
1	Rod End Head, aluminum, black anodized
2	Cap End Head, aluminum, black anodized
3	Recessed faces assure flat mounting
4	1/4 NPT Ports
5	Full flow porting for fast response
6	Piston Rod Bushing, anodized aluminum housing with Teflon® lined Duralon® insert
7	Piston Stop
8	Rod Seal, internally lubricated O'Ring for long life
9	Piston Rod, stainless steel, centerless ground, polished, and hard chrome plated (68-72Rc)
10	Piston, aluminum
11	Counter bore locates piston rod to maintain precise concentricity
12	Piston Bolt, steel, Loctited® and torqued
13	Piston Seal, internally lubricated O'Ring for long life and improved performance
14	PTFE Bearing Strip is located away from rod bearing for maximum load support
15	Groove for magnet to activate position sensors
16	O'Ring bumpers reduce metallic slap of piston on piston stop for quiet operation
17	Cylinder Tube, aluminum
	Hard anodized ID (Rc60); Clear anodized OD
18	Cylinder Tube end seal
19	Stainless steel tie rods
20	Stainless steel hex nuts
21	Counterbore for nuts assures flat mounting
22	Steel double rod stud, Loctited® and torqued
23	Guide pin, precision ground tool steel
24	Guide pin bushing, SAE 660 bearing bronze
25	Guide pin seal, Urethane O'Ring
26	Rubber disk prevents guide pin movement

Cylinder OD – is clear anodized aluminum for corrosion resistance and an attractive appearance.

The Bore ID is Hard Anodized – Hard anodizing is an electrochemical process which provides a very dense surface of aluminum oxide that actually impregnates the base aluminum. It forms an extremely hard (60 Rc) surface with a low coefficient of friction. Hardness, corrosion resistance and wear resistance exceeds that of chrome plated steel.

An Extra Long Rod Bearing – provides long and rigid support for the piston rod. The bearing material is Duralon® on all bore sizes. See page 3.2 for a chart comparing the exceptional physical properties of Duralon® to other common, though less durable, bearing materials.

The Piston Rod – is Hard Chrome Plated Stainless Steel. The standard rod end is fine female thread tapped and has long wrench flats.

Model Number Code

321 X **8** – **MR**

Series	Bore	Specify
Round head	2"	**321**
	2-1/2"	**521**
	3"	**721**
	4"	**1221**
Square head	2"	**S321**
	2-1/2"	**S521**
	3"	**S721**
	4"	**S1221**

Stroke

Standard strokes:
1" Increments
4" minimum
through
12" maximum

Optional Strokes:
Shorter and
fractional

Mounting

Rod end face, round head only . . . . . **Standard**
Cap end face, round head only . . . . . **Standard**
Side tap, square head only . . . . . **Standard**
Cap end clevis, round head only
Ports in line with slot . . . . . **PM**
Ports 90° to slot . . . . . **SM**
Extended tie rods
Rod end only . . . . . **WF**
Cap end only . . . . . **WR**
Rod & Cap end. . . . . **WFR**

Mounting Kits for Square Head Series

Type	See page
End Lug mount kit	3.10
Side Lug mount kit	3.10

Mounting Kits for Round Head Series

Type	See page
Eye bracket kit	3.10
Rod clevis	3.10

Options

Description		Specify	See Page
Double Rod		**-DR**	3.7
Nonrotating, Square Head only 150 psi max. operating pressure		**-K**	3.8
Male Rod Thread			3.7
Single Rod		**-MR**	
Double Rod, Rod End		**-MR**	
Double Rod, Cap End		**-MR1**	
Double Rod, Both Ends		**-MR2**	
Viton Seals (-15° to +400°F)		**-V**	3.7
Hydraulic, Low Pressure to 500 psi ***NONSHOCK***		**-H**	3.7
Finish, **Pro-Coat™** ,			
Electroless Nickel		**-N**	3.8
Rubber Bumpers			3.7
Rod End		**-BF**	
Cap End		**-BR**	
Both Ends		**-BFR**	
Adjustable Extend Stroke 6" Stroke maximum Full stroke adjustment is standard		**-AS**	3.8
3/8 NPT Ports		**-P38**	3.7
Port Positions			3.5 & 3.6
All Ports	Position #1	Standard	
	Position #2	**-PA2**	
	Position #3	**-PA3**	
	Position #4	**-PA4**	
Rod End	Position #1	Standard	
	Position #2	**-PR2**	
	Position #3	**-PR3**	
	Position #4	**-PR4**	
Cap End	Position #1	Standard	
	Position #2	**-PC2**	
	Position #3	**-PC3**	
	Position #4	**-PC4**	
Any port not specified will be in Position #1 as shown on page 3.5 & 3.6			
Magnetic Piston for reed switches and Electronic Sensors (Order Sensors separately)		**-E**	3.9

How to Order

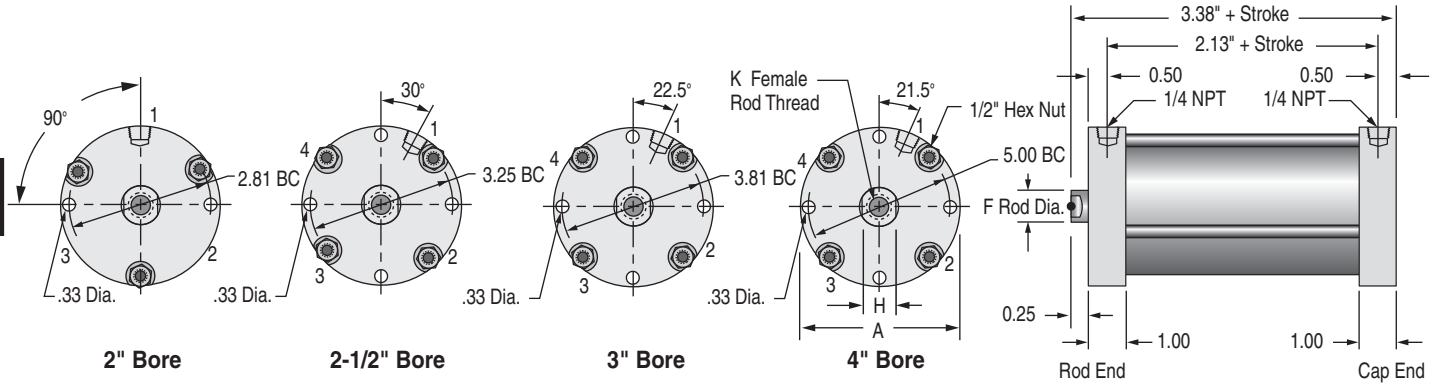
1. Specify code for Series and Bore.
2. Specify stroke
   Note standard strokes listed above.
   Any stroke not listed is available,
   to 12" maximum, at nominal increase
   in delivery time and cost.
3. Specify mounting if other than standard
4. Specify options

Examples

321 X 8 - MR
Round Head Longstroke, 2" bore, 8" stroke,
Standard Mount – Face Mount on Rod End and
Cap End, Male Rod Thread

S721 X 7 - E
Square Head Longstroke, 3" bore, 7" stroke,
Standard Mount – Side Tap Mount, Magnetic Piston

Round Head, Standard, Face Mount Rod and Cap End

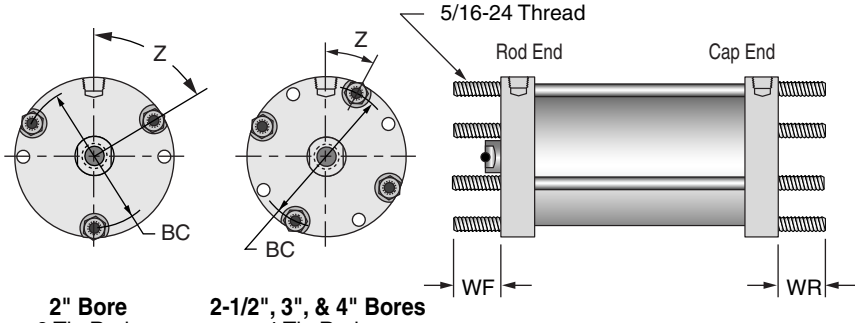


2" Bore **2-1/2" Bore** **3" Bore** **4" Bore**

Extended Tie Rod Mount for Round Head Models

Specify mounting option

Rod End Only	**WF**
Cap End Only	**WR**
Rod and Cap Ends	**WFR**



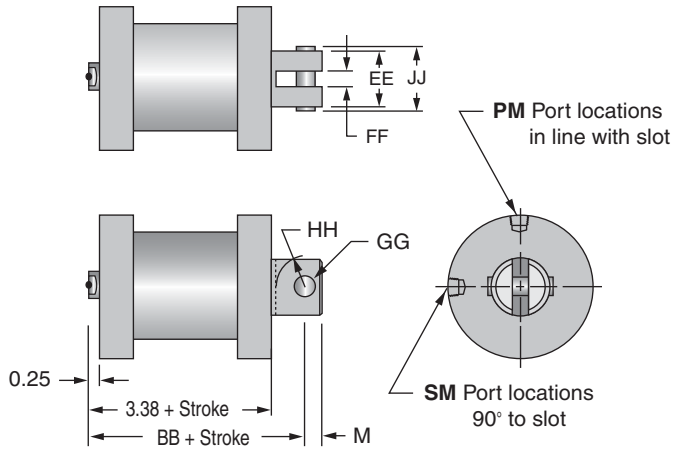
2" Bore
3 Tie Rods
Equally Spaced

2-1/2", 3", & 4" Bores
4 Tie Rods
Equally Spaced

Round Head Clevis Mount Option

Specify mounting option

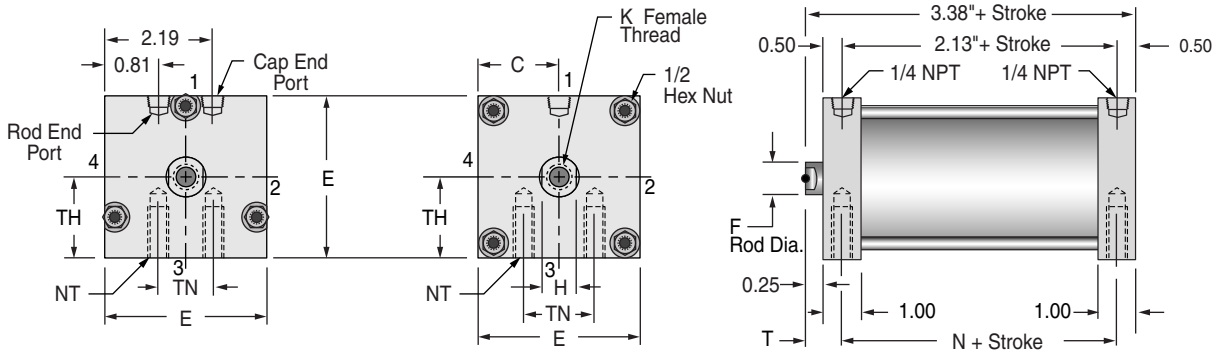
Ports in line with slot	**PM**
Ports 90° to slot	**SM**



Dimensions

Bore	A	BB	BC	C	E	EE	F Dia.	FF	GG Pin	GG Hole	H	HH
2"	3.25	4.13	2.81	NA	3.00	1.25	.750	.38	.3745	.376	.63	0.69
2-1/2"	3.75	4.38	3.25	1.75	3.50	1.63	.750	.50	.4995	.501	.63	0.97
3"	4.25	4.38	3.81	1.75	3.50	1.63	.750	.50	.4995	.501	.63	0.97
4"	5.50	4.63	4.63	2.25	4.50	2.00	.875	.63	.6245	.626	.75	1.22

Square Head, Standard, Side Tap Mount



2" Bore

Note:
Ports at Position #3
are not available

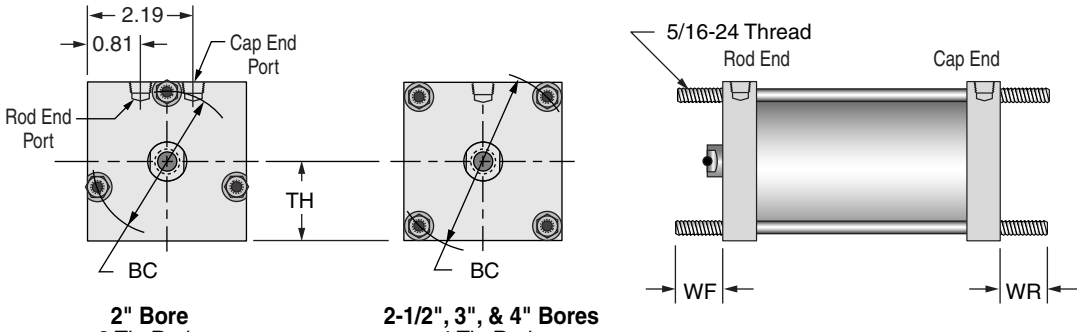
2-1/2", 3", & 4" Bores

Note:
3/8 NPT Ports (-P38)
at Position #3
are not available

Extended Tie Rod Mount for Square Head Models

Specify mounting option

Rod End Only	**WF**
Cap End Only	**WR**
Rod and Cap Ends	**WFR**

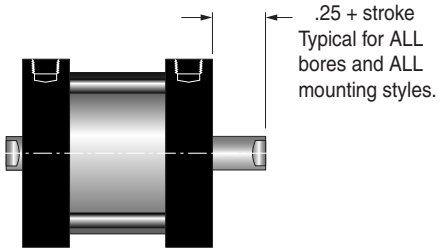


2" Bore
3 Tie Rods
Equally Spaced

2-1/2", 3", & 4" Bores
4 Tie Rods
Equally Spaced

JJ	K	M	N	NT	T	TH	TN	WF	WR	Z
1.48	1/2-20 x 1.00	.38	2.25	5/16-18 x .62	.69	1.375	0.875	1.3	1.3	60°
1.86	1/2-20 x 1.00	.50	2.38	3/8-16 x .75	.63	1.750	1.250	1.3	1.3	30°
1.86	1/2-20 x 1.00	.50	2.13	1/2-13 x 1.00	.75	1.750	1.500	1.4	1.4	22.5°
2.24	5/8-18 x 1.25	.63	2.13	1/2-13 x 1.00	.75	2.250	2.060	1.4	1.4	23.5°

Double Rod **Option -DR**



Standard piston rod and rod bushing on both ends of the cylinder.

Use when attachment to both ends of the cylinder is required, or to indicate piston position location. Also see Option –E on page 3.9.

3

Hydraulic
Low Pressure Service to 500 psi non-shock **Option -H**

A U Cup rod seal is placed inboard in an SAE 660 bronze bushing to eliminate leakage past the rod seal. An additional O'ring is used as an outboard wiper.

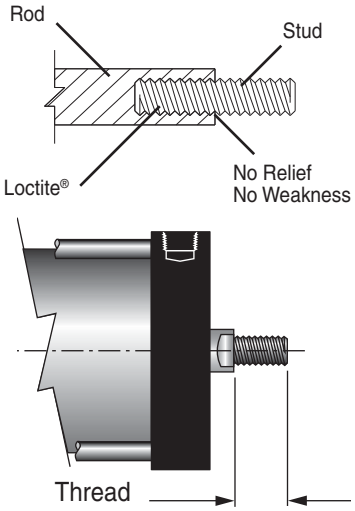
Use with Air-Oil systems and low pressure hydraulic systems when the rigidity and precision smoothness of hydraulics and control is required.

Viton Seals **Option -V**

Use for elevated temperatures (–15° to + 400°F) or compatibility with exotic media.

Consult engineering for compatibility information.

Male Rod Thread	**Option**
Single Rod	**-MR**
Double Rod, Rod End Only	**-MR**
Double Rod, Cap End Only	**-MR1**
Double Rod, Rod & Cap Ends	**-MR2**



A high strength stud is threaded into the standard female rod end and retained with Loctite®. This method eliminates the small diameter thread relief area normally required when machining male threads. This provides a much stronger rod end which can be repaired, rather than replacing the complete rod, should the thread be damaged.

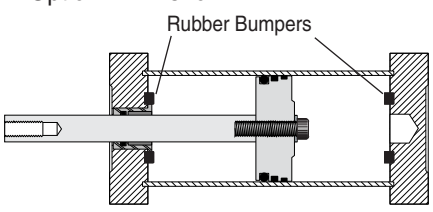
BORE	THREAD
2"	1/2–20 x 1.00
2 1/2"	1/2–20 x 1.00
3"	1/2–20 x 1.00
4"	5/8-18 x 1.25

3/8 NPT Ports **Option -P38**

Use 3/8 NPT ports for higher flows, air over oil systems, etc.

Rubber Bumpers	**Option**
Rod End only	**-BF**
Cap End only	**-BR**
Both Rod & Cap Ends	**-BFR**

Option -BFR shown



Standard rubber mass will compress and give full stoke at 60 to 80 psi. This mass can be adjusted to meet your specific pressure and/or dynamic load requirements.

Temperature Range (–25° to + 220°F)

A rubber doughnut is bonded to the cylinder head to act as the piston stop and absorb the impact of the piston. This reduces noise and absorbs energy, thus reducing destruction of the cylinder and tooling due to pounding. The amount of rubber that extends beyond the normal piston stop is designed to compress and allow full stroke of the cylinder at 60 to 80 psi. If your application uses lower pressure or has high energy, consult engineering with application details so that rubber mass can be adjusted to meet your specific requirements.

Because of the temperature limitations of the adhesives involved (-25° to + 220°F) Rubber Bumpers are available in cylinders with standard internally lubricated Buna-N seals only.

Use to reduce noise and absorb impact.

Note! On applications such as punching, shearing, setting blind rivets, etc. where high forces are built up and then released very quickly, the proper method of "CATCHING" this type of load is to adjust the cylinder piston and the tooling so that at the point of breakthrough the piston is very close to the bumper. This reduces the dynamic load that the piston and bumper are required to absorb.

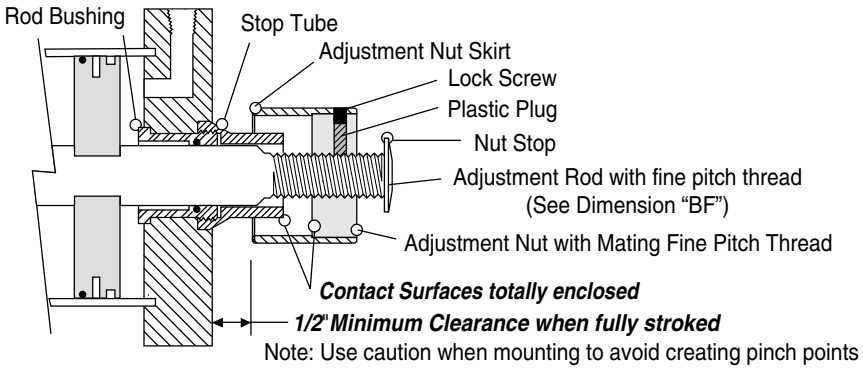
Adjustable extend stroke

Option -AS

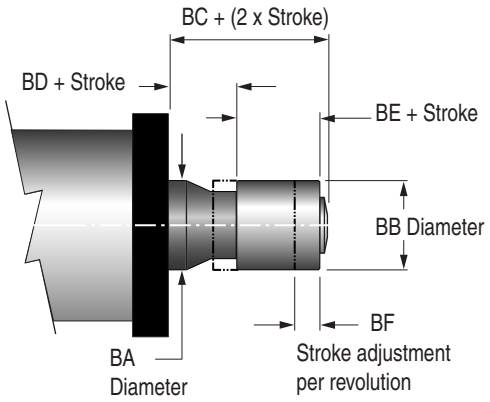
For strokes through 6"
Full stroke adjustment is standard.

Note!

To maintain operator safety features of this option, it is NOT available with mounting styles: WR and WFR.
Use caution when mounting to avoid creating pinch points.



Note: Use caution when mounting to avoid creating pinch points

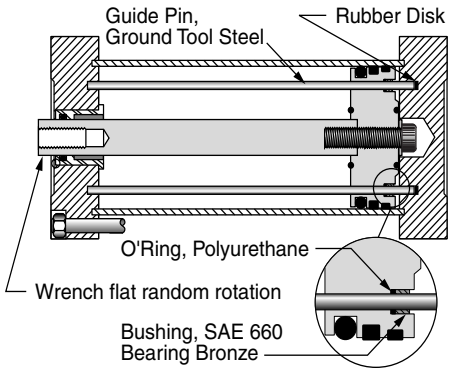


Bore	2"	2-1/2"	3"	4"	
BA	1.50	1.50	1.50	2.00	
BB	2.00	2.00	2.00	2.00	
BC	1.65	1.65	1.65	1.42	+ (2 x Stroke)
BD	0.75	0.75	0.75	0.50	+ Stroke
BE	0.75	0.75	0.75	0.75	
BF	.063	.063	.063	.063	

Nonrotating **Option -K**

150 psi Max. Operating Pressure

Square Head Series only in Single Rod and optional Double Rod (-DR)



Two guide pins incorporated inside the cylinder pass through the piston head. These guide pins prevent rotation of the rod with a tolerance of ±1°. The guide pins, being incorporated inside, are protected from the environment, physical damage, and are lubricated by the system lubrication, and require NO additional space, leaving the rod end area free for attachments and tooling as required by your application.

The guide pins are precision ground tool steel and run in SAE 660 bearing bronze bushings and Polyurethane O'rings. These features provide precision guiding and long, trouble free life. A rubber disk is included at the end of each guide pin to take up end play and firmly seat the pins in the precision guide pin holes.

An information label is applied to each cylinder to warn against damage.

WARNING
THIS CYLINDER HAS A NONROTATING ROD. TO PREVENT INTERNAL DAMAGE HOLD ROD BY WRENCH FLATS WHEN INSTALLING OR REMOVING ATTACHMENTS.

Use when any attachment to the piston rod must not rotate.

Finish

Plating; ***Pro-Coat™***, Electroless Nickel, Heads & Tube **Option -N**

Pro-Coat™, Electroless Nickel Plating is a hard, smooth, corrosion and wear resistant coating. It will often suffice for applications where stainless steel is specified. Its lasting luster provides high eye appeal.

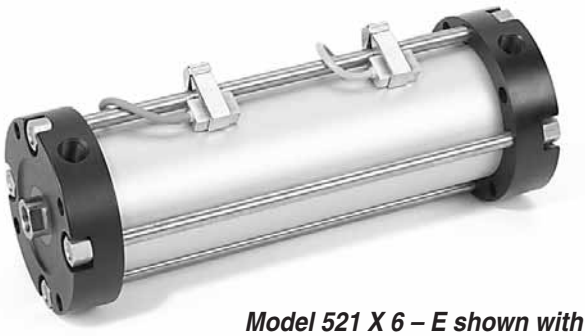
The coating is a high nickel, low phosphorous alloy deposited by chemical reduction without electric current that is "mil-for-mil" more corrosion resistant than electroplated nickel. The surface is virtually pore free. The thickness of the nickel deposit is constant over the entire surface. Blind holes, threads, small diameter holes and internal surfaces all receive the same amount of plating. It has natural lubricity and a high resistance to abrasion. As shipped hardness of the coating is approximately 49 Rockwell C. Heat treating can increase hardness to approximately 60 Rockwell C. For specific applications, consult engineering.

The cylinder heads and tube, inside and outside, are plated. Tie rods and nuts are standard stainless steel. Rod bushing is standard hard anodized aluminum and Duralon®.

Magnetic Piston

Option -E

(Order Sensors and Sensor Clamps Separately)



Model 521 X 6 – E shown with 2 prewired electronic sensors

- ***Option -E*** consists of a magnet bonded into the piston head. When the piston magnet moves past an external sensor, the magnetic field activates the sensor without physical contact.
- ***Mounting*** – The sensor snaps into a 2-part clamp that attaches rigidly to any of the tie rods and can be positioned anywhere along the length of the cylinder.
- ***Reliability*** – The annular piston magnet is permanently bonded into a groove in the piston. It is a polarized permanent magnet of rubber bonded barium ferrite that is very stable and is not affected by shock. Under normal usage it will remain magnetized indefinitely.
- ***Warning*** – External magnetic fields and/or ferrous objects may affect the strength of the piston magnet therefore affecting sensor actuation and piston position indication. Warning labels (shown left) are affixed to the cylinder.
- ***Sensor clamps and sensors are ordered separately.***

2-Piece Sensor Clamp shown with quick disconnect sensor snapped in place

Quick Disconnect Sensor Shown

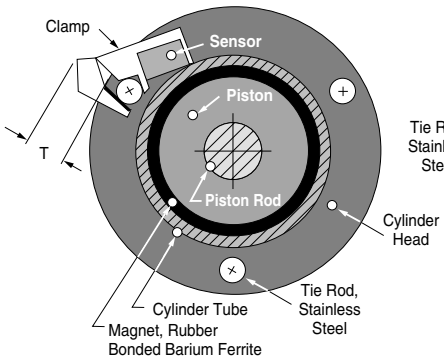
Socket Head Screw

WARNING
This cylinder is equipped with a Magnetic Piston for use with Magnetically Operated Sensors. Other Magnetic Sensitive Devices Should be Kept at a Distance to Avoid Inadvertent Operation.

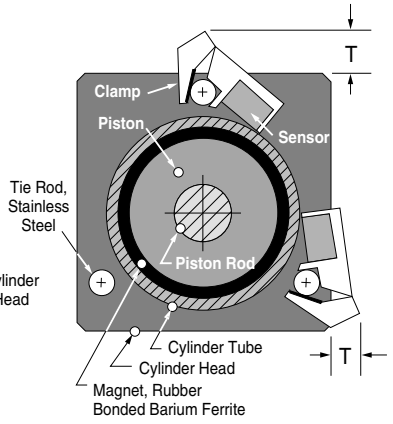
Female Cordsets available in 1, 2, & 5 meter lengths

9 foot prewired sensor

Sensor Clamp Stick Out Dimensions								
Model	321	S321	521	S521	721	S721	1221	S1221
T	.50"	.50"	.50"	.10"	.50"	.30	.30"	.30"



Top View Round Head Style



Top View Square Head Style

Sensor & Clamp Ordering Guide

Temperature Range: –20° to + 80°C (–4° to + 176°F)
Sensor housing rated NEMA 6/IP67.

LED Lighted Magnetic Piston Position Sensors			
Product Type	**Prewired 9 ft. Part No.**	**Quick Disconnect Part Number.**	**Electrical Characteristics**
Reed Switch	9-2A197-1004	9-2A197-1304	5-120 VDC/VAC, 0.5 Amp Max., 10 Watt Max., SPST N.O., 3.5 Voltage Drop
Electronic	9-2A197-1033	9-2A197-1333	Sourcing, PNP, 6-24 VDC, 0.5 Amp Max., 1.0 Voltage Drop
Electronic	9-2A197-1034	9-2A197-1334	Sinking, NPN, 6-24VDC, 0.5 Amp Max., 1.0 Voltage Drop

Female Cordsets for Quick Disconnect			
Length	1 Meter	2 Meter	5 Meter
Part Number	CFC-1M	CFC-2M	CFC-5M

Sensor Mounting Clamp - for all Longstroke Models
For all Longstroke Models Order **Part Number 800-200-000**

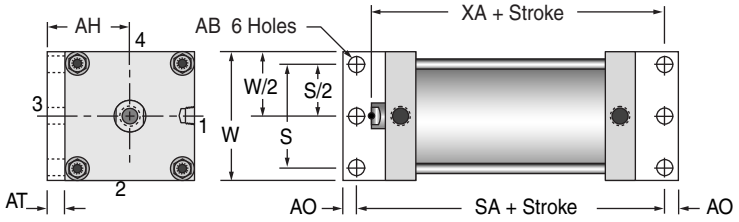
Warning!

Do not exceed sensor ratings. Permanent damage to sensor may occur.

Power supply polarity ***MUST*** be observed for proper operation of sensors.

See wiring diagrams included with each sensor.

End Lug Mount Kit

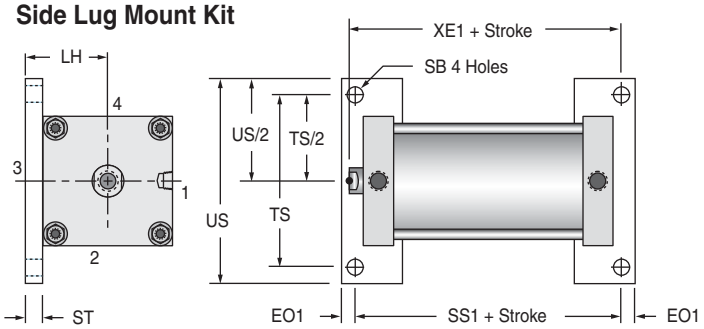


Kit includes:
2 brackets and 4 bolts for attaching the brackets to the cylinder heads.

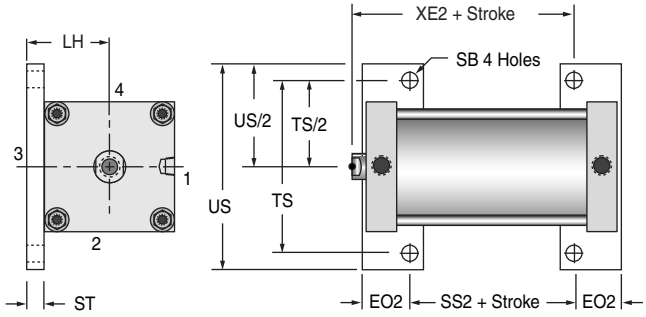
Material:
Brackets, plated steel
Screws, Black Oxide Steel

Bore	Kit No.	S	W	AB	AH	AO	AT	SA	XA
2"	**EL-20**	1.75	2.50	.41	1.63	.44	.25	3.75	3.69
2-1/2"	**EL-25**	2.25	3.00	.41	2.00	.44	.25	3.88	3.75
3"	**EL-30**	2.75	3.50	.53	2.13	.56	.38	4.38	4.00
4"	**EL-40**	3.50	4.50	.53	2.63	.56	.38	4.38	4.00

Side Lug Mount Kit



Position #1



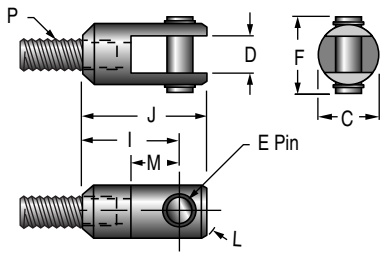
Position #2

Kit includes:
2 brackets and 4 bolts for attaching the brackets to the cylinder heads.

Material:
Brackets, plated steel
Screws, Black Oxide Steel

Bore	Kit No.	EO1	EO2	LH	SB	SS1	SS2	ST	TS	US	XE1	XE2
2"	**SL-20**	0.50	0.50	1.63	.41	2.38	2.13	.25	3.75	4.50	3.00	2.88
2-1/2"	**SL-25**	0.50	0.63	2.00	.41	2.63	2.13	.25	4.25	5.00	3.13	2.88
3"	**SL-30**	0.56	1.19	2.13	.53	3.25	1.00	.38	4.75	5.88	3.44	2.31
4"	**SL-40**	0.56	1.19	2.63	.53	3.25	1.00	.38	5.50	6.63	3.44	2.31

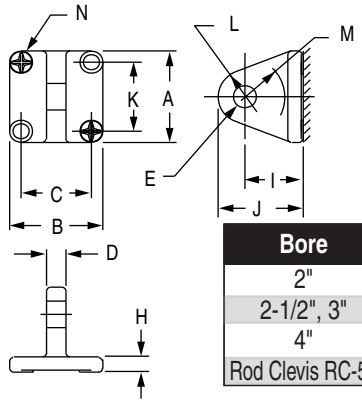
Rod Clevises



Materials
Clevis and Stud: Steel, black oxided
Pin: 416 Stainless Steel
Clips: Steel, plated

Bore	Part #	C	D	E PIN	F	I	J	L	M	P	Mating Eye Bkt
2", 2-1/2", & 3"	**RC-56**	1.00	.32	.3120	1.21	1.31	1.69	.61	.63	1/2-20x.62	**EM-121**
4"	**RC-63**	1.38	.50	.4995	1.62	1.63	2.13	.80	.94	5/8-18x.75	**EM-521**

Eye Bracket Kits mate with Option -PM or -SM and Rod Clevis



Materials
Bracket: High strength Zinc die casting
Bushings: Oil filled powdered metal
Screws: 4, Steel, plated or black oxided

Bore	Part #	A	B	C	D	E	H	I	J	K	L	M	N
2"	**EM-321**	2.50	2.50	2.00	.36	.376	.31	1.13	1.69	2.00	0.56	0.81	5/16-18x1.00FHSCS
2-1/2", 3"	**EM-521**	2.00	2.00	1.38	.47	.501	.38	1.50	2.25	1.38	0.75	1.13	5/16-18x1.00FHSCS
4"	**EM-1221**	2.50	2.25	1.50	.58	.626	.38	1.63	2.63	1.75	1.00	1.10	5/16-18x1.00FHSCS
Rod Clevis RC-56	**EM-121**	1.50	1.50	1.13	.30	.3135	.25	0.94	1.38	1.13	0.44	0.69	1/4-20X.75 FH(#12)MS