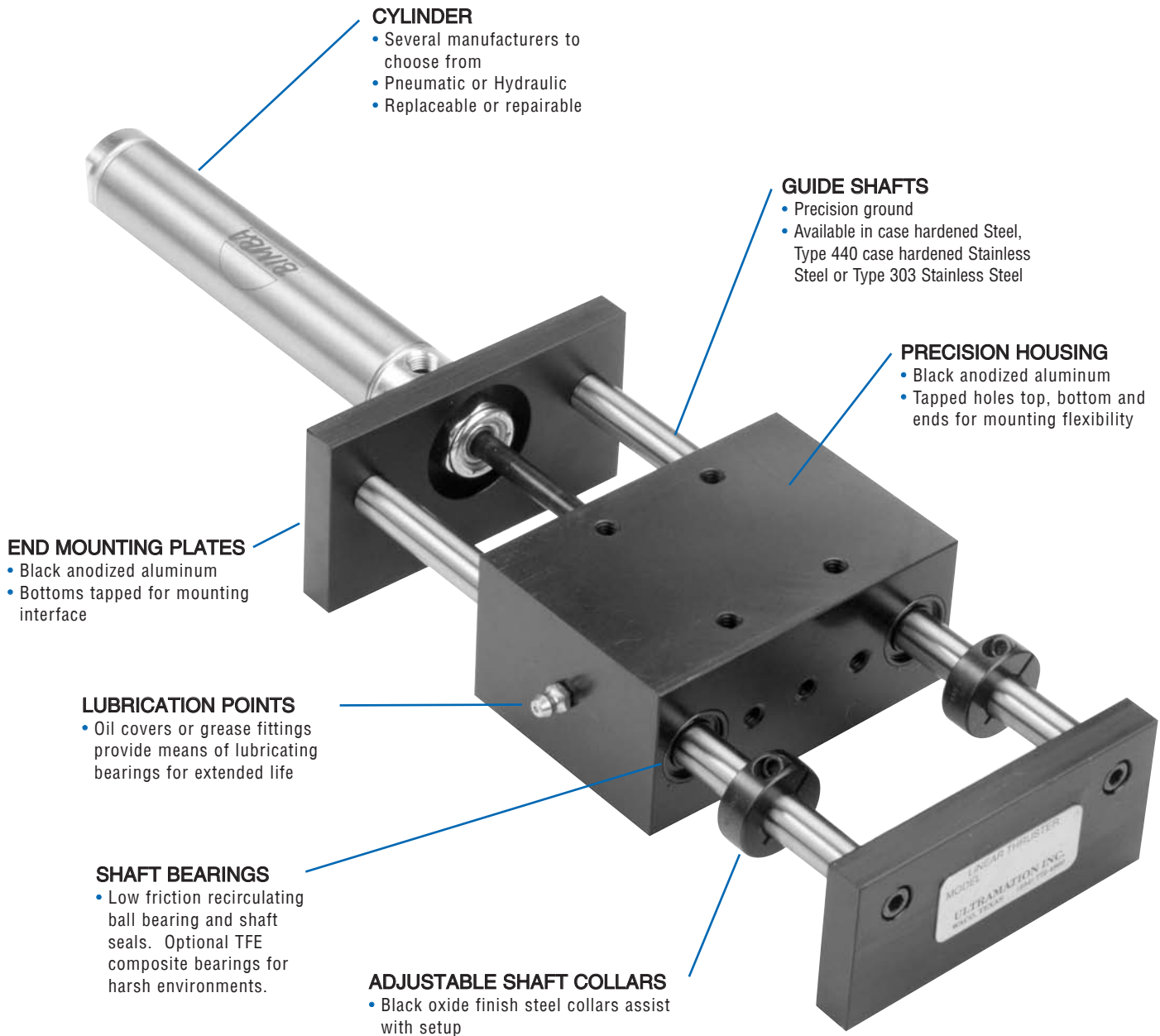


# Moveable Housing Linear Thrusters

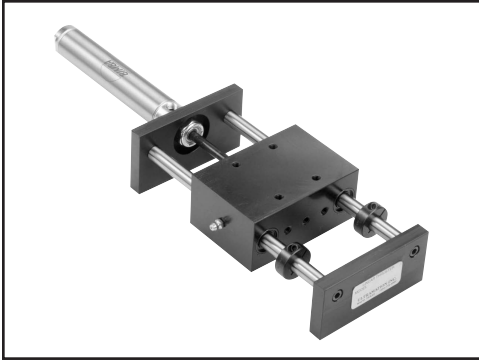
## FEATURES

- Five Models with bores from 9/16" to 4"
- Compact, light weight robust design
- Smooth linear motion
- Options include position sensors, hydraulic shock absorbers and external urethane bumpers



## Table of Contents

### Moveable Housing Linear Thrusters



How to Order .....	3
Engineering Data .....	4
Dimensions .....	5-6
Options .....	7
Technical Specifications .....	8

# General Information

## Company History

Established in 1968 to design and build innovative production machinery, Ultramation has worked successfully through the years in fields as diverse as textiles, woodworking, apparel manufacturing and food packaging. In recent years, Ultramation has focussed on the development and growth of the Linear Thruster product line. With over thirty years experience in the fields of electronics and electro-

mechanical automation, we understand the problems faced by today's design engineers and, more important, we help provide creative solutions for the implementation of their design goals. Cognizant that the "specials" of today quite often become the standard products of tomorrow, Ultramation welcomes the opportunity to work closely with its customers in every possible way.

## Lubrication

Linear Thrusters are precise but simple linear actuators which utilize high pressure air (up to 250 psi) or low pressure hydraulic fluid (up to 500 psi) for their motive power. The larger models (4 through 54) are offered with hydraulic cylinders which operate at up to 3000 psi. All air cylinders are prelubricated at the factory but should be used with filtered, lubricated air for best results. Otherwise, introduce a few drops of 10 weight oil into each cylinder port every 100 hours of operation. Hydraulic cylinders should be used only with clean hydraulic fluid compatible with the specified seals.

Proper lubrication is an important prerequisite for long service life of linear ball bearings. Therefore, spring-loaded oiler ports are provided on the faces or sides of each Linear Thruster housing. Oil lubrication is preferred in order to guarantee adequate lubrication of all rolling contact areas. Introduce several drops of 10 weight oil into each port every 100 hours of normal operation, more often if rapid cycling is necessary. Standard oilers can be replaced with grease fittings and a light weight grease used as a lubricant. Grease is recommended only in those cases where rapid movements and high cyclic rates will not occur.

## Cylinder Cushions

Cylinder cushions are recommended in those cases where heavy loads are attached to the tooling plate or where longer stroke cylinders must be operated at high piston speeds. These devices utilize small, auxiliary pistons designed into either or both ends of the main piston to entrap exhaust air at either or both ends of the cylinder stroke. By controlling the trapped air exhaust rate, either

through a fixed orifice or an adjustable needle-valve, the main piston undergoes a controlled deceleration as it approaches the end of the cylinder. The following table lists the availability of cushions on the various types of cylinders most commonly used in Ultramation Linear Thrusters.

CYLINDER MFR & SERIES	CUSHION TYPES	AVAILABLE ON ULTRAMATION MODEL NUMBERS
Bimba Original Line	Adjustable: Single or Double	1B, 2A, 2B, 3A, 4A, 4B, 6A, 6B, 5A, 5B
Parker Series P	Fixed: Single or Double	2B, 3A
	Adjustable Single or Double	4A, 4B, 6A, 6B, 5A, 5B
Allentair Type E	Fixed: Single or Double	2A, 2B
	Adjustable Single or Double	3A, 4A, 4B, 6A, 6B, 5A, 5B

## Flow Controls

Except in very rare instances it is always recommended that flow controls be used on air or hydraulic cylinders to control velocities. This is particularly true in the cases where heavy tooling plate loads and long stroke lengths are planned. Unrestricted movement of the piston can result in high acceleration rates and consequent high inertias which can be very damaging to the cylinder and slide mechanisms when suddenly stopped at the end of the stroke. Even in cases with low loads and short strokes, consistently high decelerations can cause damage to the cylinder rod threads. As a

general rule, it is always better to drive air and hydraulic cylinders at the minimum speed consistent with effective operation.

Ultramation offers standard Bimba Models FCP1, FCP2, FCP4, FCP6 and FCP8 port mounted flow controls as optional accessories on all Linear Thrusters. These controls accommodate port sizes from #10-32 through 1/2 NPT and are equipped with recessed, slotted adjustment screws and rotatable plumbing inputs. They are mounted directly into the cylinder ports for maximum control over air flow.

### How to Order

3A C - 2 U E R F1 M1 JE2 YE HE FC S

#### Model & Bore

1A	2 x ∅ .375" Shafts, .56" Bore
1B	2 x ∅ .375" Shafts, .75" Bore
2A	2 x ∅ .500" Shafts, .75" Bore
2B	2 x ∅ .500" Shafts, 1.06" Bore
2C	2 x ∅ .500" Shafts, 1.25" Bore
3A	2 x ∅ .625" Shafts, 1.50" Bore
3B	2 x ∅ .625" Shafts, 1.75" Bore
4A	2 x ∅ .750" Shafts, 2.00" Bore
4B	2 x ∅ .750" Shafts, 2.50" Bore
5A	2 x ∅ 1.250" Shafts, 3.00" Bore
5B	2 x ∅ 1.250" Shafts, 4.00" Bore

#### Cylinder

-	Bimba Original Line (Standard)
A	Bimba Original Line , Dry Service
B	Bimba Original Line , Magnetic Piston
C	Bimba Original Line, Dry Service, Magnetic Piston
D	Bimba Double-Wall
E	Bimba 500 - Hydraulic
F	Allenair - Pneumatic/Hydraulic
G	P/H Series P
H	P/H Series P with Magnetic Piston
J	P/H Series SR
K	P/H Series SRM
M	P/H Series 2A - Pneumatic Heavy Duty
N	P/H Series 2H - Hydraulic Heavy Duty
V	No cylinder

#### Cylinder Stroke (inches)

#### Moveable Housing Designation

#### Cylinder Options

-	No internal bumpers/cushions (Standard)
B	Double Internal Bumpers
C	Double Cushions
D	Nose Cushion Only
E	Tail Cushion Only

#### Bearing Options

-	Ball Bearing (Standard)
R	Composite TFE Lined

#### Stainless Steel Options

F1	440 Shafts, 300 Series Cyl Rod & Collars
F2	300 Series Shafts, Cyl Rod & Collars
G	F1 + Stainless Steel Bearings and Seals

\*F2 option only available with composite bearings.

#### Special Modification

#### Miscellaneous Options

X	No Shaft Collars
FC	Flow Controls

#### Hydraulic Shock Options

HE	Hydraulic Shock Absorber on Extend
HR	Hydraulic Shock Absorber on Retract
HB	Hydraulic Shock Absorber - Both Ends

#### External Bumper Options

YE	External Urethane Bumpers on Extend
YR	External Urethane Bumpers on Retract
YB	External Urethane Bumpers - Both Ends

#### External Proximity Switch Options

JE	Proximity Switch on Extend
JR	Proximity Switch on Retract
JB	Proximity Switch - Both Ends
-	No Proximity Switch - Switch Ready
1	2 Wire, NO, 15-58 VDC, 6 ft leads
2	3 Wire, PNP, NO, 15-58 VDC, 6 ft leads
3	3 Wire, NPN, NO, 15-58 VDC, 6 ft leads
4	2 Wire, NO, 93-264 VAC, 6 ft leads

#### Solid State Switch Options

NH	Solid State Switch - Nose End
PH	Solid State Switch - Tail End
MH	Solid State Switch - Both Ends
1	Bimba HSK Sinking Switch (NPN)
2	Bimba HSKX Sinking Switch (NPN) (12' Leads)
3	Bimba HSC Sourcing Switch (PNP)
4	Bimba HSCX Sourcing Switch (PNP) (12' Leads)
5	P/H (1467140000) Sinking Switch (NPN)
6	P/H (1467150000) Sourcing Switch (PNP)

#### Magnetic Reed Switch Options

N	Magnetic Reed Switch - Nose End
P	Magnetic Reed Switch - Tail End
M	Magnetic Reed Switch - Both Ends
1	Bimba MRS-.087-B
2	Bimba MRS-.087-XB (12' Leads)
3	Bimba MRS-.087-BL
4	Bimba MRS-.087-XBL (12' Leads)
5	Bimba MRS-1.5-B
6	Bimba MRS-1.5-XB (12' Leads)
7	Bimba MRS-.087-PBL
8	Bimba MRS-.087-PXBL (12' Leads)
9	P/H 1459030000

#### NOTES:

1) Options not selected are left blank in the model number.

#### Caution:

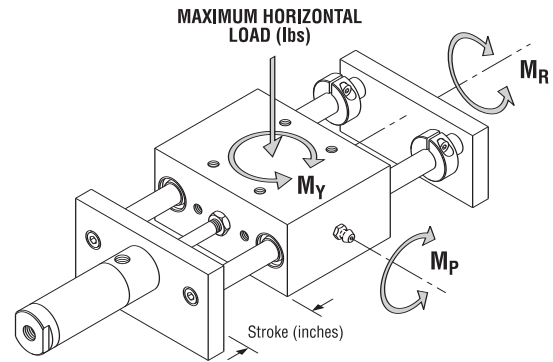
Certain configurations of the External Bumper and Hydraulic Shock Options may affect the effective stroke length of the Linear Thruster. Refer to the options section for stroke reduction details.

## Horizontal & Torsional Load Capacities

The following charts and tables provide loading and deflection data to assist in the sizing of Moveable Housing Linear Thrusters. The Capacity tables provide the maximum loading for the thrusters under dynamic and static conditions. The dynamic capacities are presented as a function of travel life stated in millions of linear inches. As shown by the tables, the travel life is a function of load. Therefore, higher dynamic loads can be applied but will reduce travel life.

The deflection curves shown reflect the theoretical deflections of the guide shafts at mid-stroke.

**Example:** The Model 1 unit has a maximum dynamic load capacity of 45 lbs. for a travel life of 200 million inches.



### Horizontal Load Capacity

MODEL	MAXIMUM DYNAMIC LOAD (lbs)				MAXIMUM STATIC LOAD (lbs)
	TRAVEL LIFE (x 10 <sup>6</sup> inches)				
	50	200	500	1000	
1	71	45	32	26	87
2	209	131	96	76	256
3	328	231	169	133	328
4	403	259	190	150	403
5	938	579	419	326	1062

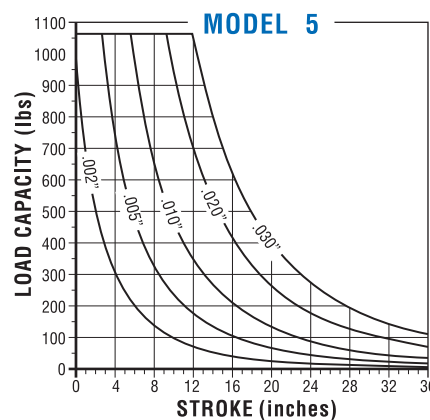
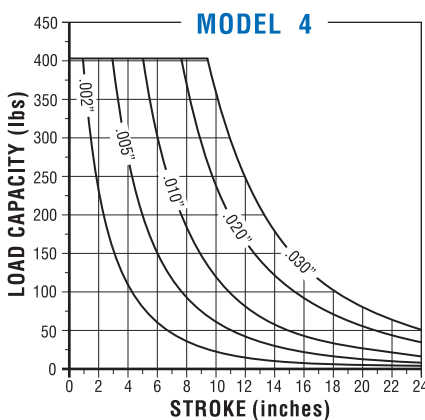
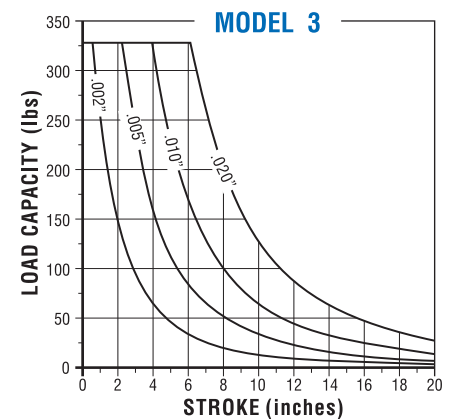
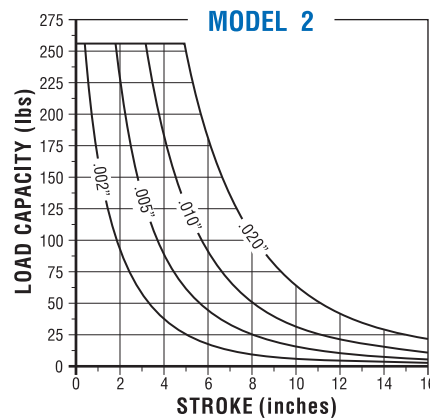
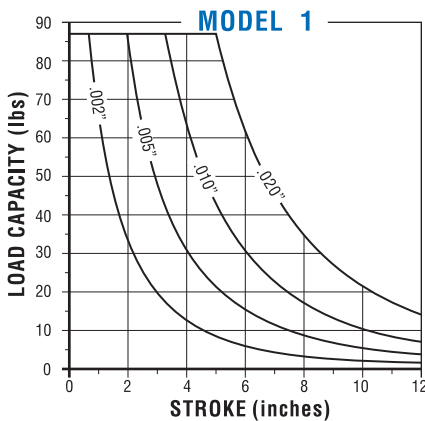
### Torque Capacity - M<sub>p</sub>

MODEL	MAX DYNAMIC TORQUE (in-lbs)				
	TRAVEL LIFE (x 10 <sup>6</sup> inches)				
	50	200	500	1000	
1	68	43	32	25	82
2	159	100	74	59	193
3	372	267	196	156	372
4	430	279	205	163	430
5	1756	1106	815	647	1952

### Torque Capacity - M<sub>R</sub> & M<sub>Y</sub>

MODEL	MAX DYNAMIC TORQUE (in-lbs)				MAX STATIC TORQUE (in-lbs)
	TRAVEL LIFE (x 10 <sup>6</sup> inches)				
	50	200	500	1000	
1	77	48	36	28	93
2	331	209	154	122	403
3	662	474	349	277	662
4	1012	655	483	383	1012
5	3875	2441	1798	1427	4308

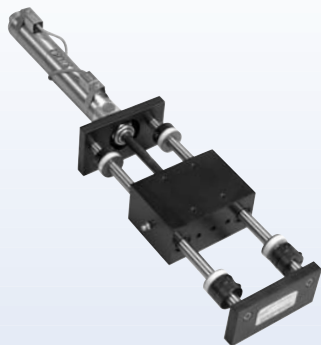
## Horizontal Load and Deflection Charts



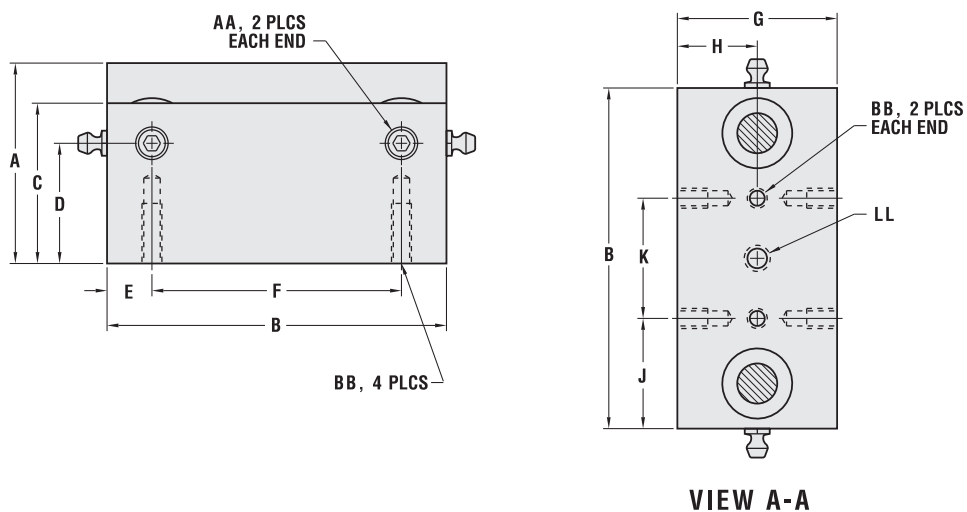
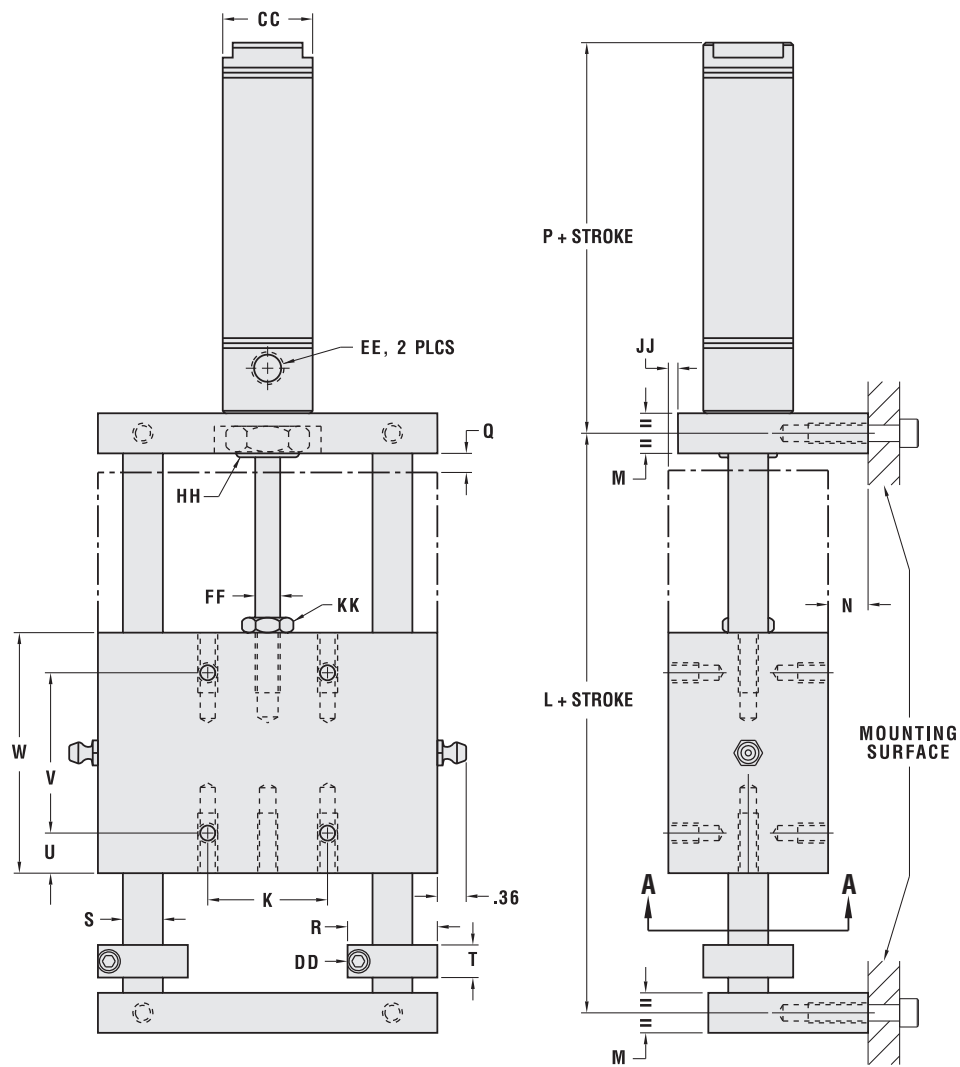
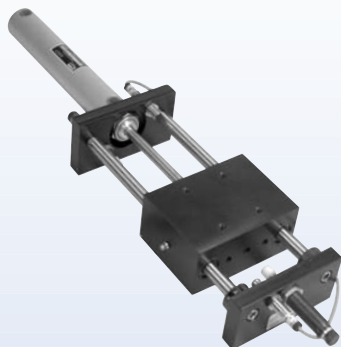
MODEL 1A-4UYB



MODEL 2CB-6UM2YB



MODEL 4AD-6UJB2HB



All dimensions are in inches.

MODEL	1A	1B	2A	2B	2C	3A	3B	4A	4B	5A	5B	MODEL
BORE	0.56	0.75	0.75	1.06	1.25	1.50	1.75	2.00	2.50	3.00	4.00	BORE
A	1.50	1.50	2.50	2.50	2.50	3.00	3.00	3.50	3.50	* 5.00	* 5.00	A
B	3.00	3.00	4.25	4.25	4.25	5.50	5.50	7.00	7.00	11.00	11.00	B
C	1.25	1.25	2.00	2.00	2.00	2.50	2.50	3.00	3.00	4.00	4.00	C
D	0.87	0.87	1.50	1.50	1.50	1.75	1.75	2.00	2.00	2.75	2.75	D
E	0.44	0.44	0.56	0.56	0.56	0.75	0.75	1.00	1.00	1.50	1.50	E
F	2.125	2.125	3.125	3.125	3.125	4.000	4.000	5.000	5.000	8.000	8.000	F
G	1.25	1.25	2.00	2.00	2.00	2.50	2.50	3.00	3.00	4.00	4.00	G
H	0.62	0.62	1.00	1.00	1.00	1.25	1.25	1.50	1.50	2.00	2.00	H
J	1.00	1.00	1.38	1.38	1.38	1.75	1.75	2.00	2.00	3.50	3.50	J
K	1.00	1.00	1.50	1.50	1.50	2.00	2.00	3.00	3.00	4.00	4.00	K
L	4.38	4.38	4.63	4.63	4.63	6.00	6.00	6.50	6.50	11.00	11.00	L
M	0.38	0.38	0.50	0.50	0.50	0.75	0.75	0.75	0.75	1.00	1.00	M
N	0.25	0.25	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.75	0.75	N
P	2.14	2.71	2.78	2.93	3.44	3.25	4.07	3.94	3.94	4.62	5.63	P
Q	0.21	0.32	0.21	0.21	0.63	0.38	0.62	@ 0.91	@ 0.83	0.51	0.83	Q
R	0.87	0.87	1.12	1.12	1.12	1.31	1.31	1.50	1.50	2.06	2.06	R
S	0.375	0.375	0.500	0.500	0.500	0.625	0.625	0.750	0.750	1.250	1.250	S
T	0.34	0.34	0.41	0.41	0.41	0.44	0.44	0.50	0.50	0.50	0.50	T
U	0.50	0.50	0.50	0.50	0.50	0.75	0.75	0.75	0.75	1.00	1.00	U
V	2.00	2.00	2.00	2.00	2.00	2.50	2.50	2.50	2.50	5.00	5.00	V
W	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	7.00	7.00	W
AA	10-32	10-32	1/4-20	1/4-20	1/4-20	3/8-16	3/8-16	3/8-16	3/8-16	1/2-13	1/2-13	AA
BB	10-32	10-32	1/4-20	1/4-20	1/4-20	5/16-18	5/16-18	3/8-16	3/8-16	1/2-13	1/2-13	BB
CC	0.62	0.81	0.81	1.12	1.34	1.56	1.84	2.08	2.62	3.16	4.38	CC
DD	6-32	6-32	8-32	8-32	8-32	10-32	10-32	1/4-28	1/4-28	1/4-28	1/4-28	DD
EE	10-32	1/8 NPT	1/8 NPT	1/8 NPT	1/8 NPT	1/8 NPT	1/4 NPT	1/4 NPT	1/4 NPT	3/8 NPT	1/2 NPT	EE
FF	0.188	0.250	0.250	0.312	0.437	0.437	0.500	0.625	0.625	0.750	1.000	FF
HH	7/16-20	5/8-18	5/8-18	5/8-18	3/4-16	3/4-16	1-14	1 1/4-12	1 3/8-12	1 1/2-12	1 3/4-12	HH
JJ	0.06	0.06	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.00	0.00	JJ
KK	10-32	1/4-28	1/4-28	5/16-24	7/16-20	7/16-20	1/2-20	# 1/2-20	# 1/2-20	5/8-18	1-14	KK
LL	1/4-28	10-32	5/16-24	1/4-28	1/4-28	1/2-20	7/16-20	5/8-18	5/8-18	1-14	5/8-18	LL

**NOTES:**

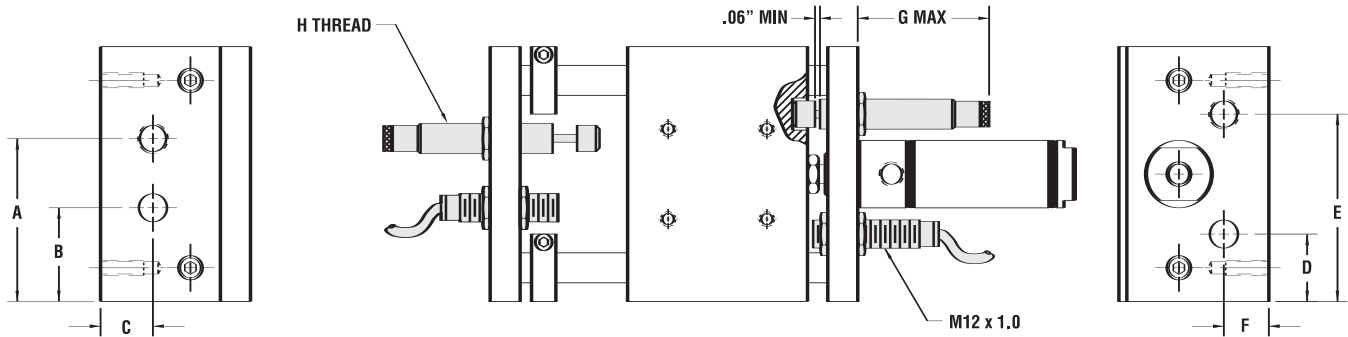
- @ Dimension Q = 0.70 inches for strokes longer than 6 inches.
- \* Dimension shown is to top of cylinder end mounting plate. Dimension to top of housing is 4.75 inches.
- # 5/8-18 on strokes longer than 6 inches.

## Shock Absorber & Proximity Switch Options

Small, self-contained hydraulic shock absorbers can be installed on both the extend and retract strokes to provide a controlled deceleration of the housing to a specific and accurate stopping point. Shown below are the dimensions for both the hydraulic shock absorbers and

proximity switches for the Moveable Housing Series. Contact Ultramation for applications having larger shock absorber and/or special proximity switch requirements.

**NOTE:** *Maintain the .06 inch clearance gap between the nylon cap and shock absorber housing to prevent damage to the shock absorber.*



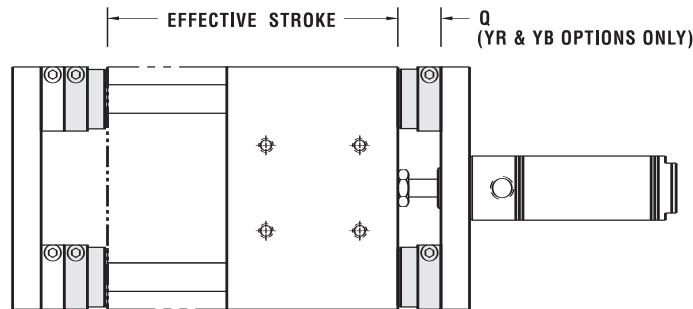
MODEL	A	B	C	D	E	F	G	H
1	1.88	1.13	0.56	0.84	2.17	0.40	3.00	.500-20
2	2.65	1.60	1.50	1.13	3.13	0.75	3.75	.750-16
3	3.50	2.00	1.75	1.46	4.00	0.84	3.25	.750-16
4	3.50	2.25	2.00	1.75	5.31	0.90	4.75	1.00-12
5	5.50	3.50	2.75	1.75	9.25	4.19	4.80	1.00-12

## External Bumper Option

Linear Thrusters may be equipped with external urethane bumpers on both the extend and the retract strokes. The external bumpers fit over the guide shafts and a pair of stainless steel washers protect the shaft seals from impact damage. An extra set of shaft collars is supplied on the extension side in order to maintain a constant position

on the shafts. External bumpers are a necessity where either or both of the strokes must be limited. Stroke reduction often occurs with the use of external bumpers and should be reviewed to determine its relevance in an application.

**NOTE:** *The single shaft collars supplied with each Linear Thruster are intended for setup purposes only. They must not be used to limit the stroke or serious damage to the Linear Thruster may occur!*



## Stroke Reduction Tables

MODEL	EXTERNAL BUMPER OPTION			Q
	YR	YE	YB	
1A	0.41	0.17	0.58	0.62
1B	0.30	0.28	0.58	0.62
2A	0.48	0.18	0.66	0.69
2B	0.48	0.18	0.66	0.69

MODEL	EXTERNAL BUMPER OPTION			Q
	YR	YE	YB	
2C	0.06	0.60	0.66	0.69
3A	0.37	0.32	0.69	0.75
3B	0.13	0.56	0.69	0.75
4A	0.00	0.47	0.47	0.81

MODEL	EXTERNAL BUMPER OPTION			Q
	YR	YE	YB	
4B	0.00	0.39	0.39	0.81
5A	0.80	0.00	0.80	1.31
5B	0.48	0.00	0.48	1.31



## Cylinder Specifications

	CYLINDER DESIGNATION													
	-	A	B	C	D	E	F	G	H	J	K	M	N	
FLUID	AIR	AIR	AIR	AIR	AIR	HYD	AIR / HYD	AIR	AIR	AIR	AIR	AIR	HYD	
MAX OPERATING PRESSURE (psi)	250	250	250	250	200	500	200 / 500	150	150	250	250	250	3000	
OPERATING TEMPERATURE														
BUNA-N SEALS	-20°F to +200°F						-40 to +250°F		-10°F to +165°F					
VITON SEALS	0°F to +400°F						+10 to +350°F		0°F to +400°F					
REPAIRABLE	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	

## Sizing

A pneumatic or hydraulic cylinder must be oversized to move a load. Otherwise, the cylinder will simply balance or hold the load in place.

### Pneumatic Linear Thrusters

With pneumatic cylinders, the more the cylinder is oversized (either by bore size or by pressure) the faster the load will move. As a rule of thumb, *slow* speeds require a force about 25% greater than the load, *moderate* speeds require about 50% greater and *fast* speeds require about 100% greater.

For a vertically mounted unit, determine how fast the cylinder must move and oversize the cylinder by either increasing the system pressure or the cylinder bore size by the desired speed factor. Note

that the tooling plate and guide rod weights can be a significant portion of the total weight and should therefore be included in the force calculations.

For horizontally mounted units moving a sliding load, the required force can be calculated by first multiplying the weight of the load by the coefficient of friction of the two sliding surfaces. Then, use the same rules of thumb for oversizing the cylinder using the calculated force.

### Hydraulic Linear Thrusters

Hydraulic cylinder speed (unlike that of a pneumatic cylinder) is not a function of cylinder oversizing but rather a function of fluid flow rate.

## Theoretical Force Table

MODEL	BORE (inches)	ROD DIA. (inches)	EFF. AREA (in <sup>2</sup> )	DIRECTION	OPERATING PRESSURE (PSI)										
					20	30	40	50	60	70	80	90	100	110	120
1A	9/16"	3/16"	.248	EXTEND	5	7	10	12	15	17	20	22	25	27	30
			.220	RETRACT	4	7	9	11	13	15	18	20	22	24	26
1B, 2A	3/4"	1/4"	.441	EXTEND	9	13	18	22	26	31	35	40	44	49	53
			.392	RETRACT	8	12	16	20	24	27	31	35	39	43	47
2B	1-1/16"	5/16"	.886	EXTEND	18	27	35	44	53	62	71	80	89	97	106
			.809	RETRACT	16	24	32	40	49	57	65	73	81	89	97
2C	1-1/4"	7/16"	1.227	EXTEND	25	37	49	61	74	86	98	110	123	135	147
			1.076	RETRACT	22	32	43	54	65	75	86	97	108	118	129
3A	1-1/2"	7/16"	1.767	EXTEND	35	53	71	88	106	124	141	159	177	194	212
			1.616	RETRACT	32	48	65	81	97	113	129	145	162	178	194
3B	1-3/4"	1/2"	2.405	EXTEND	48	72	96	120	144	168	192	216	241	265	289
			2.208	RETRACT	44	66	88	110	132	155	177	199	221	243	265
4A	2"	5/8"	3.141	EXTEND	63	94	126	157	188	220	251	283	314	346	377
			2.834	RETRACT	57	85	113	142	170	198	227	255	283	312	340
4B	2-1/2"	5/8"	4.908	EXTEND	98	147	196	245	294	344	393	442	491	540	589
			4.601	RETRACT	92	138	184	230	276	322	368	414	460	506	552
5A	3"	3/4"	7.068	EXTEND	141	212	283	353	424	495	565	636	707	777	848
			6.626	RETRACT	133	199	265	331	398	464	530	596	663	729	795
5B	4"	1"	12.566	EXTEND	251	377	503	628	754	880	1005	1131	1257	1382	1508
			11.780	RETRACT	236	353	471	589	707	825	942	1060	1178	1296	1414

## Unit Weights

### MOVEABLE HOUSING SERIES

MODEL	UNIT WEIGHT (LBS)
1	1.8 + (0.10 x Stroke)
2	3.6 + (0.20 x Stroke)
3	8.5 + (0.29 x Stroke)
4	12.5 + (0.42 x Stroke)
5	47.5 + (1.12 x Stroke)