Square Flat-1® Compact Cylinders

- Compact design provides machine designers the ability to use Flat-1® cylinders in tight spaces
- Hard chrome plated piston rod is corrosion resistant and provides a hard, smooth sealing surface extending the life of the cylinder's rod seals
- Body materials are available in standard Stainless Steel and optional Aluminum or Plastic providing design engineers with increased flexibility.
- Single acting spring return cylinders include rod seals to provide for standard fail safe operation
- New switch track options accept either Reed or Hall Effect switches allowing for either AC or DC switch circuitry.
- 3,000 mile life ratings when low frictions seals are specified provides customers the confidence associated with a low maintenance design.
- Mechanically retained bumpers reduce the sound typically associated with high cycle pneumatic cylinder applications.
- New "F Series" mounting options provide drop in interchanges for a competitive manufacturer.
- The addition of NPT rod threads on double rod end models makes it easier for designers to connect air and fluid fittings to the rod ends.
- Optional rod bearing materials are available for applications requiring smoother cylinder rod travel than is provided by the standard oil impregnated bronze rod bushings.

Approximate power factors (for all models except f02, 3, 4)	
9/16" (02) = 0.25	For example, a 3/4" bore model FO-041 will exert a force of approximately 0.4 times the air line pressure.
3/4" (04) = 0.4	
1-1/16" (09) = 0.9	
1-1/2" (17) = 1.7	
2" (31) = 3.1	
2-1/2" (50) = 5.0	
3" (70) = 7.0	
4" (125) = 12.5	

Square Flat-1®

Materials of Construction

Cylinder Body: 304 Stainless Steel

Heads: Anodized Aluminum Alloy

Piston Rod: Ground and Polished 303 Stainless Steel

Seals: Buna-N standard (high temperature seals optional)

Rod Bushing: Oil-Impregnated Bronze

Tie Rods: 303 Stainless Steel

Engineering Specifications

Pressure Rating: 200 PSI max., air only (bore sizes 3/4-2")

150 PSI max., air only (bore sizes 2-1/2-4")

Spring Forces: See page 157

Temperature*: -20° F to 150° F (-35° C to 65° C) Standard

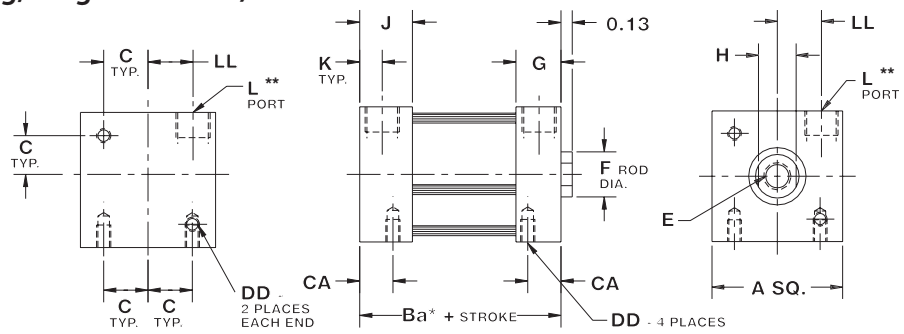
Fluoroelastomer seals rated for higher temperature applications are available. If cylinders are operated below 0° (-18° C) for extended time periods, special modifications may be required. Special seal materials are available upon request.

Square Flat-1® Basic Models

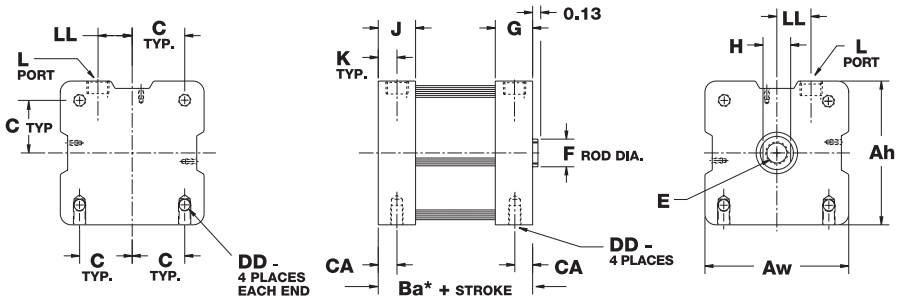
IMI Bimba is a JIT manufacturer and we are able to provide FS model cylinders in ANY 0.001" stroke length increment for all option styles within our standard three-day lead time. Longer stroke lengths are also available upon request at standard lead times. Please consult Technical Assistance at 800-44-IMI Bimba for help.

Model FS

(Double Acting, Single End Rod)



Bore sizes 3/4", 1-1/16", 1-1/2", 2"



Bore sizes 2-1/2", 3", 4"

*Some options affect cylinder length; see page 156.

**Port location is on the same side for M option only.

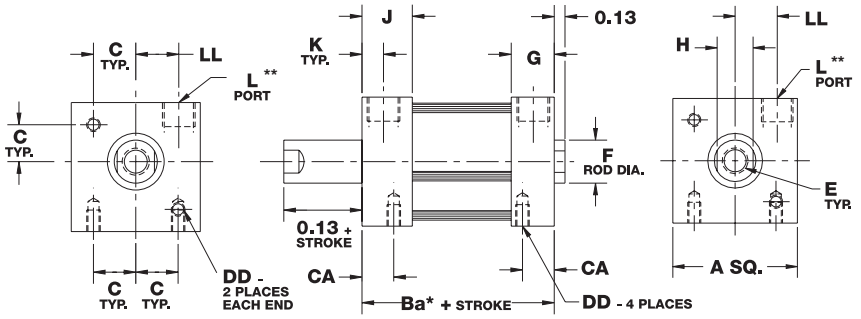
The table below represents our standard stroke lengths.

Nominal Bore Diameter	Bore Code	Standard Stroke Length Availability															
3/4"	04	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"	3"	3-1/2"	4"
1-1/16"	09	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"	3"	3-1/2"	4"
1-1/2"	17	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"	3"	3-1/2"	4"
2"	31	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"	3"	3-1/2"	4"
2-1/2"	50	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"	3"	3-1/2"	4"
3"	70	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"	3"	3-1/2"	4"
4"	125	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"	1-1/2"	1-3/4"	2"	2-1/2"	3"	3-1/2"	4"

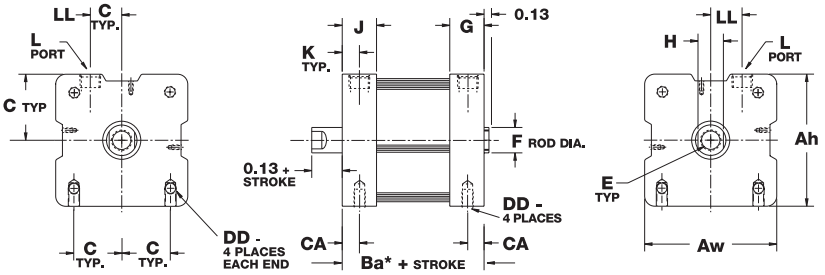
Square Flat-1® Basic Models

Model FSD
(Double Acting, Double End Rod)

Standard Strokes: 1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1", 1-1/4", 1-1/2", 1-3/4", 2", 2-1/2", 3", 3-1/2", 4"



Bore sizes 3/4", 1-1/16", 1-1/2", 2"



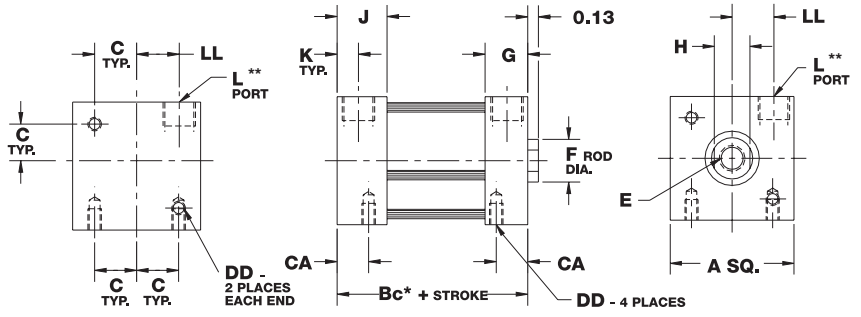
Bore sizes 2-1/2", 3", 4"

*Some options affect cylinder length; see page 156.

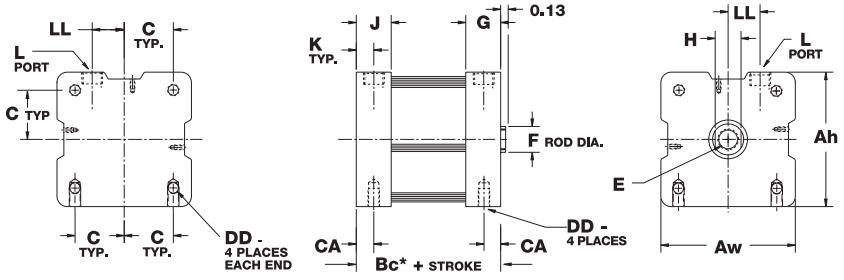
**Port location is on the same side for M option only.

Model FSS
(Single Acting, Spring Return, Rod Normally Retracted)

Standard Strokes: 1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1", 1-1/4", 1-1/2", 1-3/4", 2", 2-1/2", 3", 3-1/2", 4"



Bore sizes 3/4", 1-1/16", 1-1/2", 2"



Bore sizes 2-1/2", 3", 4"

See page 157 for spring forces.

*Some options affect cylinder length; see page 156.

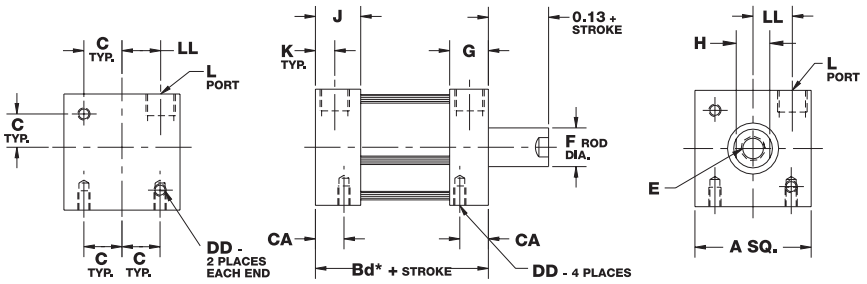
**Port location is on the same side for M option only.

Square Flat-1® Basic Models

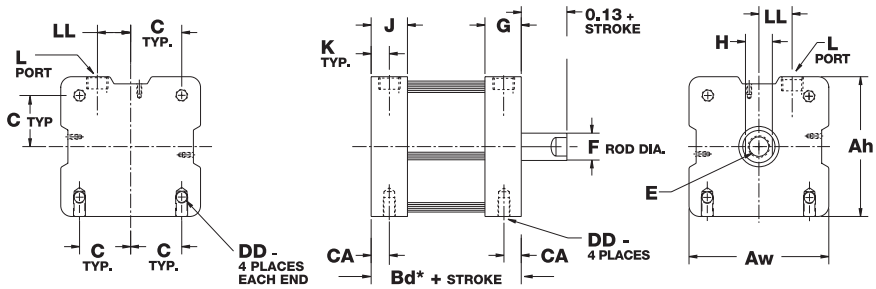
Model FSR
(Reverse Acting, Spring Return, Rod Normally Extended)

Standard Strokes: 1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 7/8", 1", 1-1/4", 1-1/2", 1-3/4", 2", 2-1/2", 3", 3-1/2", 4"

2"-4" Bores: 3" stroke max



Bore sizes 3/4", 1-1/16", 1-1/2", 2"



Bore sizes 2-1/2", 3", 4"

See page 157 for spring forces.

*Some options affect cylinder length; see page 156.

Dimensions (in)

Bore	A	Aw	Ah	Ba*	Bc*				Bd*			
					0-1" Stk	1.001-2" Stk	2.001-3" Stk	3.001-4" Stk	0-1" Stk	1.001-2" Stk	2.001-3" Stk	3.001-4" Stk
3/4" (04)	1.25	N/A	N/A	0.75	1.00	1.56	2.13	2.69	1.25	1.81	2.38	2.94
1-1/16" (09)	1.50	N/A	N/A	1.25	1.25	1.88	2.50	3.13	1.75	2.38	3.00	3.63
1-1/2" (17)	2.00	N/A	N/A	1.25	1.25	1.88	2.50	3.13	1.75	2.38	3.00	3.63
2" (31)	2.5	N/A	N/A	1.31	1.31	1.94	2.56	3.19	1.81	2.44	3.06	N/A
2-1/2" (50)	N/A	3.28	3.25	1.66	1.66	2.54	3.41	4.29	2.39	3.27	3.29	N/A
3" (70)	N/A	3.78	3.75	1.71	1.71	2.58	3.46	4.33	2.44	3.31	3.33	N/A
4" (125)	N/A	5.04	5.00	2.00	2.00	2.88	3.75	4.63	2.75	3.62	3.63	N/A

Bore	C	CA	DD	E Standard	E Coarse	E Depth	F	G	H	J	K	L	LL
3/4" (04)	0.38	0.28	#6-32 UNC	#10-32 UNF	#10-24 UNC	0.46	0.31	0.42	0.25	0.42	0.14	#10-32	0.30
1-1/16" (09)	0.50	0.38	#8-32 UNC	5/16-24 UNF	5/16-18 UNC	0.70	0.50	0.58	0.44	0.50	0.25	1/8 NPT	0.50
1-1/2" (17)	0.69	0.31	#10-24 UNC	3/8-24 UNF	3/8-16 UNC	0.70	0.63	0.58	0.50	0.50	0.25	1/8 NPT	0.69
2" (31)	0.88	0.38	1/4-20 UNC	1/2-20 UNF	1/2-13 UNC	0.70	0.75	0.63	0.63	0.63	0.25	1/8 NPT	0.77
2-1/2" (50)	1.18	0.42	5/16-18	1/2-20 UNF	1/2-13 UNC	0.70	0.75	0.84	0.62	0.84	0.42	1/4 NPT	0.78
3" (70)	1.44	0.44	5/16-18	5/8-18 UNF	5/8-11 UNC	0.73	0.88	0.88	0.75	0.88	0.44	1/4 NPT	0.98
4" (125)	1.81	0.50	7/16-14	3/4-16 UNF	3/4-10 UNC	0.83	1.00	1.00	0.88	1.00	0.50	3/8 NPT	1.25

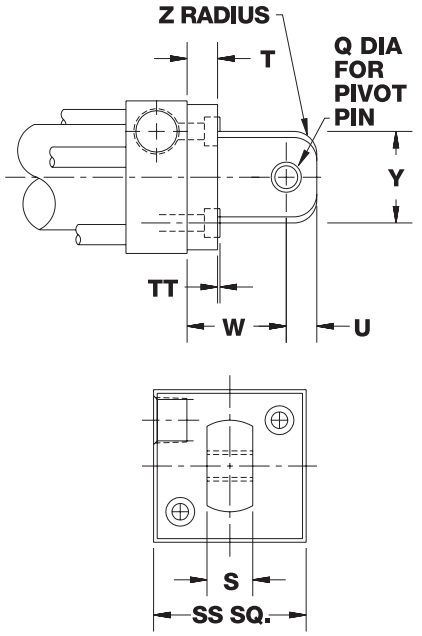
Square Flat-1® Accessory Options and Dimensions (in)

Mounting Options

Pivot Attachment

Anodized aluminum alloy. Complete with mounting screws. Not necessary if ordered as part of complete Square Flat-1® cylinder (1 or 1N option).

Model	Bore	Q	S	SS	T	TT	U	W	Y	Z
PM-1	3/4" (04)	0.19	0.38	1.13	0.19	0.020	0.25	0.75	0.75	–
PM-2	1-1/16" (09)	0.19	0.38	1.25	0.25	0.020	0.25	0.81	0.75	–
PM-3	1-1/2" (17)	0.38	0.75	1.75	0.25	0.025	0.44	1.19	1.38	–
PM-4	2" (31)	0.38	0.75	2.25	0.31	0.080	0.44	1.38	1.38	–
PM-5	2-1/2" (50)	0.38	0.75	3.00	0.38	0.05	0.44	1.31	1.38	0.38
PM-6	3" (70)	0.63	1.00	3.50	0.38	0.05	0.56	1.69	1.88	0.38
PM-7	4" (125)	0.63	1.00	4.50	0.44	0.12	0.56	1.75	1.88	0.38



Length Adder Dimensions for Options

(Dimensional variations from standard as shown)

Bore	Length Adder		
	Low Friction Seals (L)	Magnetic Position Sensing* (M)	Low Friction Seals and Magnetic Position Sensing
3/4" (04)	0.25	0.75	0.75
1-1/16" (09)	0.38	0.50	0.50
1-1/2" (17)	0.38	0.63	0.63
2" (31)	0.38	0.63	0.63
2-1/2" (50)	0.38	0.88	0.88
3" (70)	0.50	0.88	0.88
4" (125)	0.50	0.88	0.88

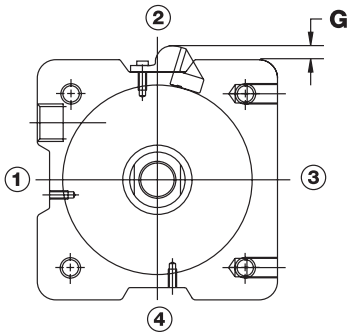
*A minimum stroke of 0.38" is required to sense extending end-of-stroke position. For port locations with Option-M, see below.

Weights

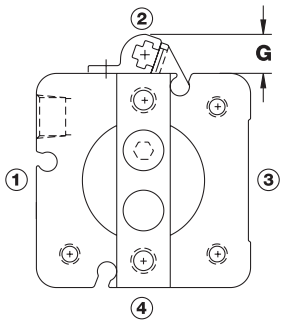
Bore	Approximate Cylinder Weights (oz.)	
	Base	Adder per 1/8" of stroke
3/4" (04)	2.7	0.1
1-1/16" (09)	6.4	0.5
1-1/2" (17)	12.2	0.7
2" (31)	18.4	0.9

MRS Switch Option Dimensions

For all SQUARE Flat-1® Series Cylinder -M option, the default switch mounting post location is Position 2. To locate the post to other positions, please specify options M1 or M4. For additional tracks, please specify options T1 or T4 for the appropriate location.



Square Flat-1®



Square Flat-II®

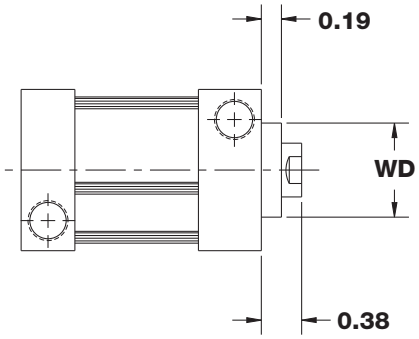
Bore Designator	Bore	G inch (mm)
04*	3/4" (19mm)	0.365 (9.3)
09	1-1/16" (27mm)	0.365 (9.3)
17	1-1/2" (38mm)	0.365 (9.3)
31	2" (50mm)	0.365 (9.3)
50	2-1/2" (63mm)	0.270 (6.9)
70	3" (76mm)	0.300 (7.6)
125	4" (101mm)	0.160 (4.1)

*Note: Option combinations MT1 and M1T4 cannot be ordered in combination due to interference concerns.

Square Flat-1® Accessory Options and Dimensions (in)

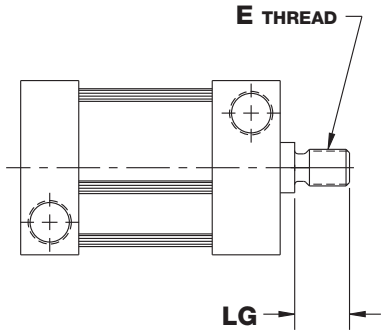
Options

Rod Wiper (Option W)
(Buna N standard, not available in FKM)



Bore	WD
3/4" (04)	0.69
1-1/16" (09)	0.88
1-1/2" (17)	1.00
2" (31)	1.12
2-1/2" (50)	1.13
3" (70)	1.25
4" (125)	1.38

Male Rod Ends (Option MT or CMT)



Bore	E		LG
	MT	CMT	
3/4" (04)	#10-32 UNF	#10-24 UNC	0.38
1-1/16" (09)	5/16-24 UNF	5/16-18 UNC	0.50
1-1/2" (17)	3/8-24 UNF	3/8-16 UNC	0.50
2" (31)	1/2-20 UNF	1/2-13 UNC	0.62
2-1/2" (50)	1/2-20 UNF	1/2-13 UNC	0.63
3" (70)	5/8-18 UNF	5/8-11 UNC	0.75
4" (125)	3/4-16 UNF	3/4-10 UNC	0.75

Enclosed Spring Forces

Bore	Maximum Force (lbs)	Spring Rate			
		0.12 to 1" Stroke (lbs/in)	1.001 to 2" Stroke (lbs/in)	2.001 to 3" Stroke (lbs/in)	3.001 to 4" Stroke (lbs/in)
3/4" (04)	10	6	2.5	1.76	1.25
1-1/16" (09)	11.5	6	2.5	1.76	1.25
1-1/2" (17) 2" (31)	13	5.5	2.25	1.60	1.13
2-1/2" (50) 3" (70) 4" (125)	25	6.5	2.75	1.93	1.38

FSD Hollow Rods (Option H)

Bore	Hole Diameter	
	Female Rod Thread	Male Rod Thread
3/4" (04)	0.14	0.09
1-1/16" (09)	0.22	0.16
1-1/2" (17)	0.28	0.19
2" (31)	0.38	0.25
2-1/2" (50)	0.38	0.25
3" (70)	0.44	0.31
4" (125)	0.50	0.38

Weights

Bore	Approximate Cylinder Weights (oz.)						
	FS, FSS		FSD			FSR	
	Base	Adder per 1/8" of stroke	Base	Adder per 1/8" of stroke	Adder per 1/8" of stroke for -H option	Base	Adder per 1/8" of stroke
3/4" (04)	2.2	0.1	2.4	0.2	0.15	2.2	0.1
1-1/16" (09)	5.1	0.2	5.7	0.4	0.3	5.5	0.2
1-1/2" (17)	10.1	0.3	10.5	0.6	0.5	10.4	0.3
2" (31)	14.2	0.4	16.0	0.8	0.6	15.0	0.4
2-1/2" (50)	28.6	0.4	34.2	0.6	0.5	31.2	0.4
3" (70)	40.2	0.6	49.3	0.9	0.7	43.8	0.6
4" (125)	71.6	0.6	87.7	0.9	0.7	77.7	0.6

The Model Number for all Square Flat-1® cylinders consists of alphanumeric clusters. These designate type, bore size, stroke length, and mounting and special options. Please refer to the charts below for an example of a standard Square Flat-1® model. This is a double acting, 1-1/2" bore, 3/8" stroke, pivot mount cylinder with high temperature option.

Type	
FS	Double Acting, Single End Rod
FSD	Double Acting, Double End Rod
FSR	Reverse Acting
FSS	Single Acting

Bore Size	
04	3/4"
09	1-1/16"
17	1-1/2"
31	2"
50	2-1/2"
70	3"
125	4"

Mounting Options	
No number	Basic model
1	Pivot mount
1N	Pivot mount 90° from standard

FS - 17 0.375 - 1 V

Stroke Length	
0.125	1/8"
0.25	1/4"
0.375	3/8"
etc.	

Options	
(Enter in alphabetical order, except for EE which is last)	
B	Bumpers, both ends[1]
BF	Bumper, front only[1]
BR	Bumper, rear only[1]
CFT	Coarse female rod thread (fine thread standard) (see page 155)
CMT	Coarse male rod thread (see page 157)
G	Magnalube® G
H	Hollow rod (double end models only) (see page 157)
J	Failsafe operation (FSS models)
L	Low friction seals (see table page 156 for length adders)
M, M1, M4	Magnetic position sensing. Switch post designed for HC and HK style Hall Effect switches (see table page 156 for length adders and envelope dimensions)
MT	Male rod end (fine thread) (see page 157)
NT	Non-threaded rod
Q	Low temperature operation (-40° F to 200° F)
T1, T4	Additional Hall Effect switch mounting post located in position #1 or #4
V	High temperature option (0° F to 400° F)
W	Rod wiper (Buna-N, see page 157)[2]
X	X-ring piston seal[3]
Y	Molycoat (MoS_2 I.D. coating)
EE0.375	3/8" extra rod extension, etc.
EE1	1" extra rod extension, etc.

[1] Stroke is reduced by .03" per end (.06" for option B); FSS, BR only; FSR, BF only.

[2] If magnetic position sensing is specified with option V, standard Buna-N based magnet will be provided. Magnetic position sensing is not reliable above 200° F.

[3] Optional piston seal which may improve performance in certain short stroke applications where back pressure due to flow controls or reduced exhaust flow may exist.

Square Flat-1® Repair Kits

IMI Bimba Square Flat-1® cylinders are repairable. To order repair kits, please provide the correct bore code in the kit part number blank for the desired size repair kit. Optional seals are designated by the suffix option. Repair kits include the standard bronze rod bushing, piston, rod, and body seals. For cylinders with optional composite bushings, please order those bushing as a separate repair part with part number (PF4-__). For cylinders where FKM seals, wipers, or scrapers are required, complete end caps assemblies are provided to allow for easier repair.

Single End Rod Repair Kits

Basic Repair Kit (K-B-FS-__)*		
Part No.	**Description**	**Quantity**
PF-1	Rod Seal	1
PF-2	Piston Seal	1
PF-41	Tube Seal	2
PF-4	Bushing	2

Wiper Option Basic Repair Kit (K-B-FS-W-__)*		
Part No.	**Description**	**Quantity**
PF-1	Rod Seal	1
PF-2	Piston Seal	1
PF-41	Tube Seal	2
PF-4	Bushing	1
PF-5	Wiper Bushing	1
PF-6	Wiper	1

Double End Rod Repair Kits

Basic Repair Kit (K-B-FSD-__)*		
Part No.	**Description**	**Quantity**
PF-1	Rod Seal	2
PF-2	Piston Seal	1
PF-41	Tube Seal	2
PF-4**	Bushing	3

Wiper Option Basic Repair Kit (K-B-FSD-W-__)*		
Part No.	**Description**	**Quantity**
PF-1	Rod Seal	2
PF-2	Piston Seal	1
PF-41	Tube Seal	2
PF-4**	Bushing	1
PF-5	Wiper Bushing	2
PF-6	Wiper	2

* Must specify bore size when ordered. Contact your local IMI Bimba Distributor for pricing on kits and other repair parts.

** On FSD (Double Acting, Double End Rod) models, two bushings are provided on the head end with tie rod nuts. Opposite head end has one bushing.