CYLINDERS

Pneumatic & Hydraulic

- **Pneumatic, hydraulic, and electric cylinders are offered in a wide range of styles, sizes, and options.**
- **Cylinders ranging from the Tom Thumb® pneumatic Cylinders known for durability and versatility, to robust compact cylinders when space requirements are a concern**
- **Full featured industry-standard ISO Cylinders designed for long travel lengths and long life**

ISO 9001 REGISTERED
Quality Management System Certified

SELECTION GUIDE: Cylinders

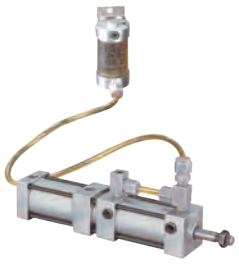
The data shown is presented as a quick reference tool for determining which cylinder may fit your requirements. It is recommended to use the PHD online sizing app to easily and confidently determine which cylinder is best suited for your requirements.

SERIES		SIZE	MAX. STROKE		MAX. FORCE	
			in	mm	lb	N
CRS					**@ 150 psi [10 bar]**	
Pneumatic Compact		12	3-1/4	80	26	113
Page 6		16	3-1/4	80	47	201
		20	4	100	73	314
		25	4	100	114	491
		32	4-1/2	115	187	804
		40	4-1/2	115	292	1257
		50	5	125	456	1964
		63	7	175	725	3117
CTS					**@ 150 psi [10 bar]**	
Guided Pneumatic Compact		12	2-1/2	60	26	113
Page 18		16	2-3/4	70	47	201
		20	3-3/8	85	73	314
		25	3-3/8	85	114	491
		32	3-5/8	90	187	804
		40	3-7/8	95	292	1257
		50	3-3/4	95	456	1964
		63	6	150	725	3117
OCQ					**@ 145 psi [10 bar]**	
Pneumatic Compact		12	—	30	25	111
Page 30		16	—	30	45	200
		20	—	50	70	311
		25	—	50	110	489
		32	—	100	180	800
		40	—	100	282	1254
		50	—	100	441	1964
		63	—	100	700	3113
		80	—	100	1129	5022
		100	—	100	1765	7851
CV					**@ 150 psi [10 bar]**	
Pneumatic ISO/VDMA		CVC20	20	500	73	314
Page 36		CVC25	20	500	114	491
		CVB20	30	750	73	314
		CVB25	30	750	114	491
		32	40	1000	187	804
		40	40	1000	292	1257
		50	40	1000	457	1964
		63	40	1000	725	3117
		80	40	1000	1169	5027
		100	40	1000	1826	7854
OCV					**@ 150 psi [10 bar]**	
Pneumatic ISO		32	—	200	187	831
Page 62		40	—	200	292	1300
		50	—	200	456	2028

NOTE: Consult PHD for longer strokes.

SELECTION GUIDE: Cylinders

The data shown is presented as a quick reference tool for determining which cylinder may fit your requirements. It is recommended to use the PHD online sizing app to easily and confidently determine which cylinder is best suited for your requirements.

SERIES		SIZE	MAX. STROKE		MAX. FORCE	
			in	mm	lb	N
OCG Pneumatic Round Body **Page 67**					**@ 140 psi [10 bar]**	
		20	8	200	68	302
		25	12	300	106	471
		32	12	300	174	774
		40	12	300	272	1209
		50	12	300	426	1895
		63	12	300	676	3006
AV, HV, A Tie Rod Hydraulic & Pneumatic NFPA 3/4", 1", & 1-1/8" tom thumb® **Page 76**					**@ 150 psi [10 bar]**	
		3/4" A, AV	12	—	66	295
		1" A, AV	18	—	118	524
		1-1/8" A, AV	18	—	149	663
		3/4" HV	12	—	663	2948
		1" HV	18	—	1178	5240
		1-1/8" HV	18	—	1491	6632
AV, A, -O Pneumatic Cleanroom tom thumb® **Page 90**						
		3/4" A, AV -O	12	—	66	295
		1" A, AV -O	18	—	118	524
		1-1/8" A, AV -O	18	—	149	663
AV, HV, A Tie Rod Hydraulic & Pneumatic NFPA, 1-3/8" tom thumb® **Page 92**		1-3/8" AV	24	—	223	991
		1-3/8" HV	24	—	2227	9907
TD Air/Oil Tandem tom thumb® **Page 102**						
		3/4" TD	6	—	125	557
		1" TD	9	—	224	997
		1-1/8" TD	9	—	282	1253
		1-3/8" TD	12	—	416	1850
		3/4" TD -X or -C	6	—	66	295
		1" TD -X or -C	9	—	118	524
		1-1/8" TD -X or -C	9	—	149	663
		1-3/8" TD -X or -C	12	—	223	991

NOTE: Consult PHD for longer strokes.

SELECTION GUIDE: Cylinders

The data shown is presented as a quick reference tool for determining which cylinder may fit your requirements. It is recommended to use the PHD online sizing app to easily and confidently determine which cylinder is best suited for your requirements.

SERIES	SIZE	MAX. STROKE		MAX. FORCE @ 150 psi [10 bar]	
		in	mm	lb	N
AV2, HV2, A2 Back-to-Back 4-Position Hydraulic & Pneumatic tom thumb® **Page 110**	3/4" A2, AV2	6	—	66	295
	1" A2, AV2	9	—	118	524
	1-1/8" A2, AV2	9	—	149	663
	1-3/8" AV2	12	—	223	991
	3/4" HV2	6	—	663	2948
	1" HV2	9	—	1178	5240
	1-1/8" HV2	9	—	1491	6632
	1-3/8" HV2	12	—	2227	9907
A3V, H3V, A3 3-Position Hydraulic & Pneumatic tom thumb® **Page 118**	3/4" A3, A3V	6	—	66	295
	1" A3, A3V	9	—	118	524
	1-1/8" A3, A3V	9	—	149	663
	1-3/8" A3V	12	—	223	991
	3/4" H3V	6	—	663	2948
	1" H3V	9	—	1178	5240
	1-1/8" H3V	9	—	1491	6632
	1-3/8" H3V	12	—	2227	9907
EA, EL, EH, ES Heavy Duty Hydraulic & Pneumatic tom thumb® **Page 126**	3/4" EA	6	—	66	295
	3/4" EL	6	—	221	983
	3/4" EH	6	—	1326	5898
	3/4" ES	6	—	2210	9830
	1-1/8" EA	6	—	149	663
	1-1/8" EL	6	—	497	2210
	1-1/8" EH	6	—	2982	13264
	1-1/8" ES	6	—	4970	22107
	1-3/8" EA	6	—	223	991
	1-3/8" EL	6	—	743	3305
	1-3/8" EH	6	—	4455	19816
	1-3/8" ES	6	—	7425	33028

NOTE: Consult PHD for longer strokes.

SELECTION GUIDE: Electric Cylinders

The data shown is presented as a quick reference tool for determining which cylinder may fit your requirements. It is recommended to use the PHD online sizing app to easily and confidently determine which cylinder is best suited for your requirements.

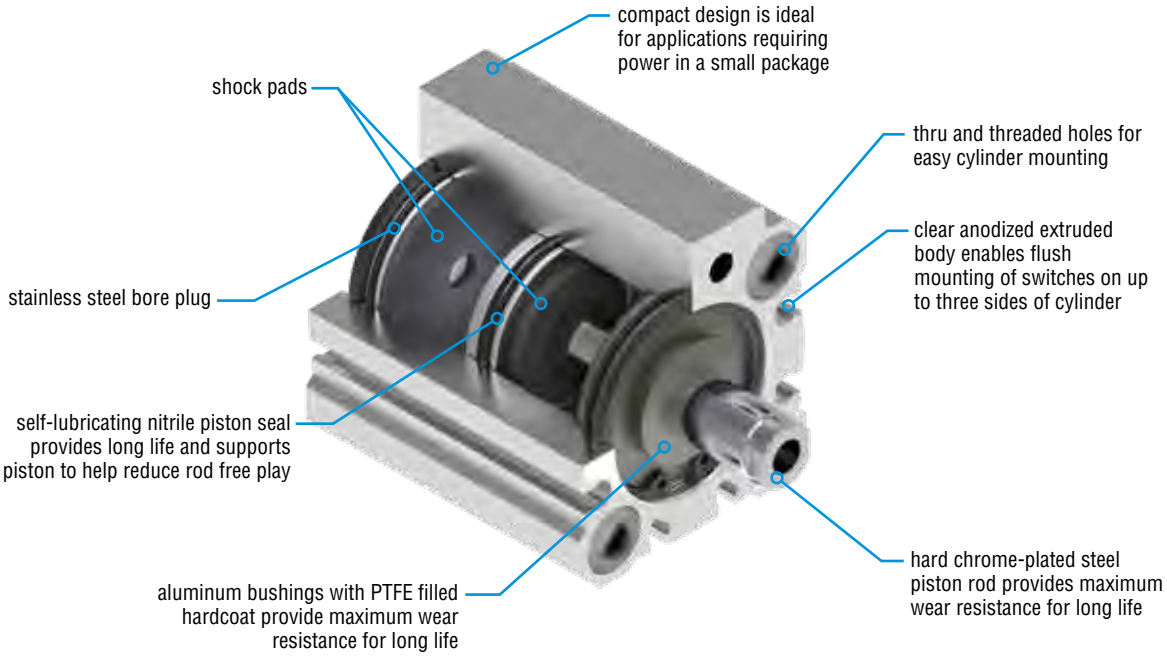
SERIES - ELECTRIC	SCREW VERSION	SIZE	LEAD	TRAVEL MAX	MAX THRUST (SEE NOTE)		MAX SPEED (SEE NOTE)	
			mm	mm	lb	N	in/sec	mm/sec
ECP Electric IP69K (Not included in this catalog) **Go to phdinc.com/cylinders for all product info** 	Lead - RL	32	3	500	67.5	300	2.3	60
			6		33.7	150	4.8	120
		40	4	600	112	500	2.3	60
			8		56	250	4.8	120
		50	4	750	180	800	3.15	80
			8		90	400	6.3	160
	Ball - RB	32	5	750	360	1600	3.15	80
			10		180	800	6.3	160
		40	10	750	562	2500	3.15	80
			16		281	1250	6.3	160
		50	10	750	306	1360	3.15	80
			20		153	680	6.3	160
ECV Electric Ball Screw & Lead Screw (Not included in this catalog) **Go to phdinc.com/cylinders for all product info** 	Lead - RL	20	1.5	400	67.5	300	0.6	15
			4		33.7	150	3.15	80
		25	1.5	400	112	500	1.2	30
			3		56	250	2.4	60
		32	3	500	180	800	2.4	60
			6		90	400	4.8	120
		40	4	600	360	1600	3.15	80
			8		180	800	6.3	160
		50	4	750	562	2500	3.15	80
			8		281	1250	6.3	160
	Ball - RB	32	5	1000	306	1360	19.6	500
			10		153	680	39.3	1000
		40	10	1000	546	2430	39.3	1000
			16		342	1520	63	1600
		50	10	1000	991	4410	39.3	1000
			20		564	2510	78.7	2000

NOTE: Refer to performance charts in engineering section of PHD Electric Actuators catalog and online sizing for specific performance limitations of a configured actuator.

CRS

Major Benefits

- Compact design for applications where space is limited
- Up to six switch slots for flush switch mounting
- Self-lubricating nitrile piston seal for long cylinder life
- Multiple mounting options
- Optional shock pads -BB in both directions add no length to cylinder, extend cylinder life, and minimize noise at end of piston travel

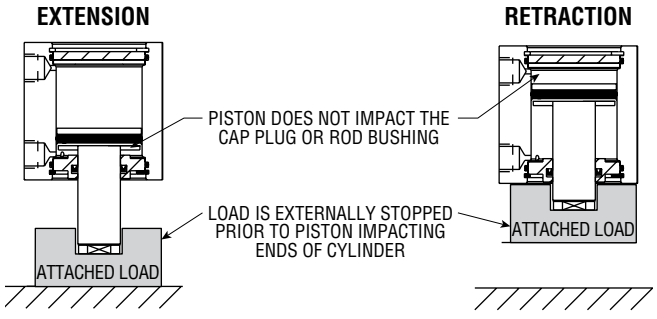


BEST PRACTICES FOR MAXIMUM CYLINDER LIFE

Shown are the best ways to apply PHD Series CRS Cylinders. The key to proper application and long cylinder life is using the cylinder to provide power and motion while externally stopping any attached loads.

APPLICATION #1 - ATTACHED LOAD

Loads connected to the cylinder rod must always be stopped externally. Strokes, rod lengths, and attached loads should be designed so that the piston never impacts the head or cap. For vertical applications only.



TO ORDER SPECIFY:
Product, Series, Type, Design No.,
Mounting Style, Bore Size, Stroke, and Options.

PRODUCT
C - Cylinder

TYPE
S - Single Rod,
Double Acting (standard)
D - Double Rod,
Double Acting (See Note 4)

MOUNTING STYLE
All units have 4 thru holes
U - Universal (standard)
Thread and C'bore
8 places, 4 each end

IMPERIAL STROKE (CRx3)
STANDARD STROKE LENGTHS
1/4" = Minimum stroke
in 1/8" increments
(See Note 5)

BORE mm	MAXIMUM STROKE (in)
12	3.25
16	3.25
20	4.00
25	4.00
32	4.50
40	4.50
50	5.00
63	7.00

METRIC STROKE (CRx6)
STANDARD STROKE LENGTHS
5 mm = Minimum stroke
in 5 mm increments
(See Note 5)

BORE mm	MAXIMUM STROKE (mm)
12	80
16	80
20	100
25	100
32	115
40	115
50	125
63	175

C R S 3 U 32 x 1/2 - M-T22

SERIES
R - Compact
Round Bore

DESIGN NO.
3 - Imperial
6 - Metric

BORE SIZE

BORE mm	BORE in	AREA mm²	AREA in²
12	0.47	113	0.175
16	0.63	201	0.312
20	0.79	314	0.486
25	0.98	490	0.760
32	1.26	804	1.247
40	1.57	1256	1.948
50	1.97	1963	3.045
63	2.48	3117	4.831

IMPERIAL OPTIONS (CRx3)
BB - Shock Pads in both directions
(No additional cylinder length)
M - Magnet for use with PHD Series JC1
Switches. See Notes 1 and 7.
WP - Wide piston for extra rod support
(standard with -M). See Note 1.
F11 - Extended length wrench flats
K_ - Extra Rod Extension in 1/8" increments.
Length code example:
K1 = 1/8", K3 = 3/8", etc.
T11 - Male Rod End, fine thread
T22 - Male Rod End, coarse thread
T44 - Female Rod End, coarse thread (available
on 20 mm through 63 mm sizes only)
T55 - Plain Rod End with wrench flats
T88 - Extended Male Rod End, fine thread
T99 - Extended Male Rod End, coarse thread
V1 - Fluoroelastomer Seals. See Note 2.
Z1 - Corrosion resistant, stainless steel rod
and electroless nickel plated retaining
rings. See Note 3.

METRIC OPTIONS (CRx6)
BB - Shock Pads in both directions
(No additional cylinder length)
M - Magnet for use with PHD Series JC1
Switches. See Notes 1, 7, and 8.
WP - Wide piston for extra rod support
(standard with -M). See Note 1.
F11 - Extended length wrench flats
K_ - Extra Rod Extension in 5 mm increments.
Length code example:
K5 = 5 mm, K15 = 15 mm, etc.
T22 - Male Rod End
T55 - Plain Rod End with wrench flats
T99 - Extended Male Rod End
V1 - Fluoroelastomer Seals. See Note 2.
Z1 - Corrosion resistant, stainless steel rod
and electroless nickel plated retaining
rings. See Note 3.

SERIES JC1 MAGNETIC SWITCHES

JC1 SWITCH	DESCRIPTION
JC1SDN-5	NPN DC Solid State, 5 meter cable
JC1SDP-5	PNP DC Solid State, 5 meter cable
JC1SDN-K	NPN DC Solid State, Quick Connect
JC1SDP-K	PNP DC Solid State, Quick Connect
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect

NOTE: See Switches and Sensors section for additional switch information and complete specification. Switches must be ordered separately.

CORDSETS FOR SERIES JC1 SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

NOTES:
1) Options -M and -WP add 1/4" [6.38 mm] to the overall length.
2) Option -V1 may reduce cylinder lifespan due to fluorocarbon seal material.
3) Option -Z1 may reduce cylinder lifespan due to stainless steel rod in place of chrome plated steel.
4) Double rod units' rear rod will receive same rod option as single rod.
5) For longer stroke lengths available, consult PHD.
6) See pages 14 to 17 for accessories.
7) PHD recommends the use of stainless steel or de-magnetized fasteners on units with the -M option.
8) See options pages for switch ordering information.

⚠ Options may affect unit length. See dimensional pages and option information details.

CAD & Sizing Assistance

Use PHD's free online Product Sizing and
CAD Configurator at **phdinc.com/myphd**

SPECIFICATIONS	SERIES CRS
OPERATING PRESSURE	10 psi min to 150 psi max at zero load [0.7 bar min to 10 bar max] air
STROKE TOLERANCE	± 0.031 inch [± 0.8 mm] (See Shock Pad Usage)
TEMPERATURE LIMITS	-20° to +180°F [-29° to +82°C]
VELOCITY	20 in/sec [0.5 m/sec] typical min, zero load at 100 psi [7 bar]
LIFE EXPECTANCY	70 million linear inches [1.77 million linear meters] minimum at operating temperatures under 120°F [49°C] (-V1 & -Z1 options may reduce life)
LUBRICATION	Pre-lubricated for use with non-lubricated or lubricated air
MAINTENANCE	Field repairable

CYLINDER FORCE AND WEIGHT

BORE SIZE		ROD DIAMETER		ROD DIRECTION	EFFECTIVE AREA		BASE WEIGHT		ADDER PER 1" [25 mm] OF STROKE	
mm	in	in	mm		in^2	mm^2	lb	kg	lb	kg
12	0.472	0.250	6.35	EXTEND	0.175	113	0.11	0.05	0.085	0.04
				RETRACT	0.126	81				
16	0.630	0.250	6.35	EXTEND	0.312	201	0.17	0.08	0.10	0.05
				RETRACT	0.263	169				
20	0.787	0.375	9.53	EXTEND	0.487	314	0.25	0.11	0.15	0.07
				RETRACT	0.376	242				
25	0.984	0.375	9.53	EXTEND	0.761	490	0.26	0.12	0.16	0.07
				RETRACT	0.650	419				
32	1.260	0.625	15.88	EXTEND	1.247	804	0.48	0.22	0.26	0.12
				RETRACT	0.940	606				
40	1.575	0.625	15.88	EXTEND	1.948	1256	0.60	0.27	0.30	0.14
				RETRACT	1.641	1058				
50	1.969	0.750	19.05	EXTEND	3.043	1963	0.78	0.35	0.40	0.18
				RETRACT	2.602	1678				
63	2.480	0.750	19.05	EXTEND	4.832	3117	0.95	0.43	0.48	0.22
				RETRACT	4.390	2832				

NOTE: Use retract figures for calculating double rod cylinder forces in both directions.

CYLINDER FORCE CALCULATIONS

	Imperial F = P x A	Metric F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in^2	mm^2

APPLICATION

The PHD Series CRS Cylinders are designed for use as a source of power and motion. As with typical compact cylinders, the Series CRS Cylinder is not intended for applications where side loads or impact with attached loads are present. PHD recommends the use of external stops to ensure maximum cylinder life. See best application practices on page 6.

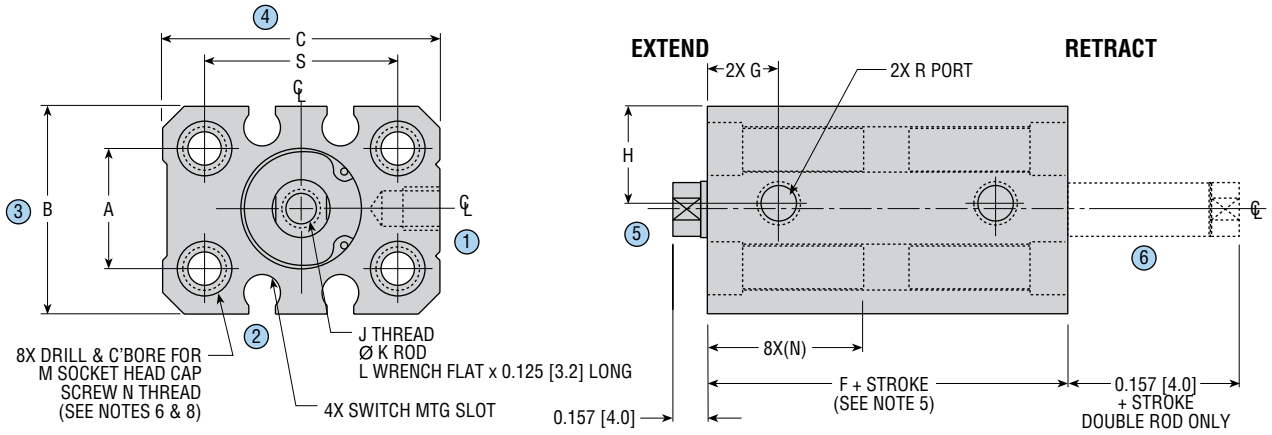
SHOCK PAD USAGE

Optional shock pads are recommended for applications where the piston travels the full stroke length and contacts the bushing and plug (with no attached loads). The use of shock pads reduces noise and provides maximum cylinder life in these applications. Stroke tolerance changes to ±0.050 [±1.3 mm] with -BB option.

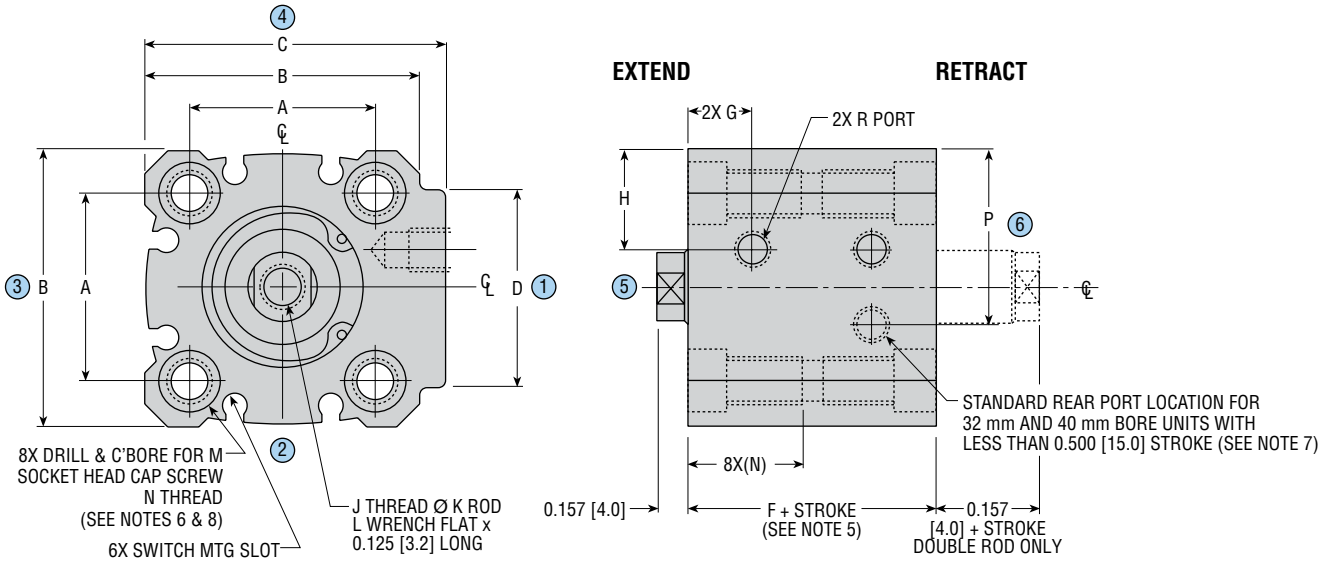
Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at **www.phdinc.com/apps/sizing**

12 mm and 16 mm BORE



20 mm through 63 mm BORE



NOTES:

1) DIMENSIONS SHOWN IN [ ] ARE IN mm FOR METRIC UNITS [CRx6]
2) DESIGNATED CENTERLINE IS CENTERLINE OF CYLINDER BORE
3) UNLESS OTHERWISE DIMENSIONED, MOUNTING HOLE PATTERNS AND OTHER FEATURES ARE CENTERED ON DESIGNATED CYLINDER CENTERLINE
4) 1/4" [5 mm] MINIMUM STROKE REQUIRED
5) SEE DIMENSION CHART ON NEXT PAGE. DIMENSION F IS DIFFERENT FOR "PLAIN" UNIT AND WITH OPTIONS -M AND -WP.
6) C'BORE DEPTH OF MOUNTING HOLES MUST BE CONSIDERED TO DETERMINE PROPER MOUNTING FASTENER LENGTH
7) FOR 32 mm AND 40 mm BORE UNITS WITH STROKES LESS THAN 0.500" [15 mm], PHD RECOMMENDS THE USE OF FITTINGS WITH A HEX NO LARGER THAN 7/16" [13 mm] AND NOTE REAR PORT LOCATION CHANGE
8) PHD RECOMMENDS THE USE OF STAINLESS STEEL OR DE-MAGNETIZED FASTENERS ON UNITS WITH THE -M OPTION.

BORE	LETTER DIMENSION											
	A	B	C	D	F PLAIN	F WITH OPTIONS -M, -WP	G	H	J THREAD	K	L	M
0.472 [12]	0.550 [13.97]	0.944 [24.0]	1.260 [32.0]	—	0.904 [23.0]	1.154 [29.4]	0.325 [8.26]	0.472 [12.0]	8-32 x 0.250 [M4 x 0.7 x 6]	0.250 [6.35]	0.219 [5.6]	#6 [M4]
0.630 [16]	0.710 [18.03]	1.104 [28.0]	1.340 [34.0]	—	0.904 [23.0]	1.154 [29.4]	0.325 [8.26]	0.454 [11.5]	8-32 x 0.250 [M4 x 0.7 x 6]	0.250 [6.35]	0.219 [5.6]	#6 [M4]
0.787 [20]	1.000 [25.4]	1.476 [37.5]	1.576 [40.0]	0.788 [20.0]	0.920 [23.4]	1.170 [29.7]	0.350 [8.89]	0.531 [13.5]	1/4-28 x 0.375 [M6 x 1.0 x 9]	0.375 [9.53]	0.312 [7.9]	#10 [M5]
0.984 [25]	1.100 [28.0]	1.576 [40.0]	1.746 [44.4]	1.000 [25.4]	0.920 [23.4]	1.170 [29.7]	0.350 [8.89]	0.552 [14.0]	1/4-28 x 0.375 [M6 x 1.0 x 9]	0.375 [9.53]	0.312 [7.9]	#10 [M5]
1.260 [32]	1.339 [34.0]	1.870 [47.5]	2.037 [52.0]	1.340 [34.0]	1.022 [26.0]	1.272 [32.3]	0.375 [9.53]	0.610 [15.5]	5/16-24 x 0.470 [M8 x 1.25 x 11]	0.625 [15.88]	0.500 [12.7]	#10 [M5]
1.575 [40]	1.575 [40.0]	2.205 [56.0]	2.363 [60.0]	1.420 [36.0]	1.022 [26.0]	1.272 [32.3]	0.360 [9.14]	0.738 [18.8]	5/16-24 x 0.470 [M8 x 1.25 x 11]	0.625 [15.88]	0.500 [12.7]	#10 [M5]
1.969 [50]	1.969 [50.0]	2.598 [66.0]	2.795 [71.0]	1.600 [40.6]	1.300 [33.0]	1.550 [39.4]	0.472 [12.00]	0.823 [21.0]	3/8-24 x 0.563 [M10 x 1.5 x 13]	0.750 [19.05]	0.625 [15.9]	1/4 [M6]
2.480 [63]	2.362 [60.0]	3.070 [78.0]	3.266 [83.0]	2.094 [53.2]	1.420 [36.0]	1.670 [42.4]	0.512 [13.00]	0.865 [22.0]	3/8-24 x 0.563 [M10 x 1.5 x 13]	0.750 [19.05]	0.625 [15.9]	1/4 [M6]

BORE	LETTER DIMENSION			
	N THREAD	P	R	S
0.472 [12]	10-24 x 0.550 [M5 x 0.8 x 14.5]	—	10-32 x 0.15 [M5 x 0.8 x 4]	0.866 [22.0]
0.630 [16]	10-24 x 0.550 [M5 x 0.8 x 14.5]	—	10-32 x 0.15 [M5 x 0.8 x 4]	0.946 [24.0]
0.787 [20]	1/4-20 x 0.875 [M6 x 1.0 x 22.5]	—	10-32 x 0.15 [M5 x 0.8 x 4]	—
0.984 [25]	1/4-20 x 0.875 [M6 x 1.0 x 22.5]	—	10-32 x 0.15 [M5 x 0.8 x 4]	—
1.260 [32]	1/4-20 x 0.875 [M6 x 1.0 x 22.5]	0.900 [22.9]	1/8 NPT [1/8 BSP]	—
1.575 [40]	1/4-20 x 0.875 [M6 x 1.0 x 22.5]	1.072 [27.2]	1/8 NPT [1/8 BSP]	—
1.969 [50]	5/16-18 x 0.900 [M8 x 1.25 x 22.5]	—	1/8 NPT [1/8 BSP]	—
2.480 [63]	5/16-18 x 0.900 [M8 x 1.25 x 22.5]	—	1/4 NPT [1/4 BSP]	—

Numbers in [ ] are in mm for metric units [CRx6].

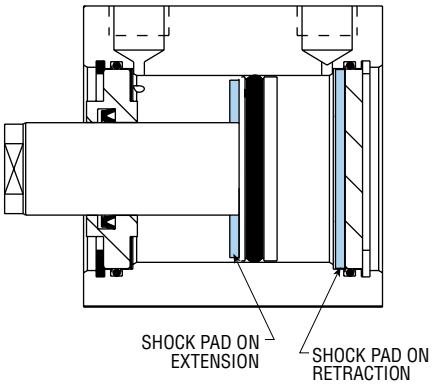
CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

All dimensions are reference only unless specifically toleranced.

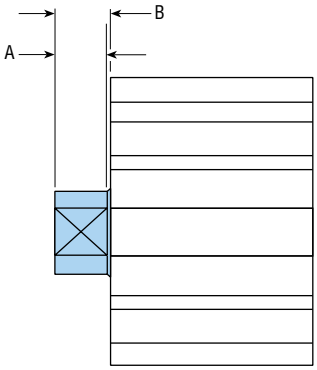
BB SHOCK PADS ON EXTENSION AND RETRACTION

Shock pads eliminate metal-to-metal contact and minimize piston impact. Shock pads are recommended for applications where the piston travels the full stroke length and contacts the head and/or cap (with no attached loads). The use of shock pads reduces noise and provides maximum cylinder life in these applications.



F11 EXTENDED LENGTH WRENCH FLATS

The design of a compact cylinder requires the length to be as short as possible. The standard wrench flat length is 0.125" [3 mm]. The option -F11 provides wrench flats which allow standard wrench access.



BORE [mm]	A EXTENDED WRENCH FLATS		B ROD EXTENSION	
12/16	0.200	[5.08]	0.250	[6.5]
20/25	0.200	[5.08]	0.250	[6.5]
32/40	0.290	[8.00]	0.344	[9.0]
50/63	0.290	[8.00]	0.344	[9.0]

Numbers in [ ] are in mm for metric units [CRx6].

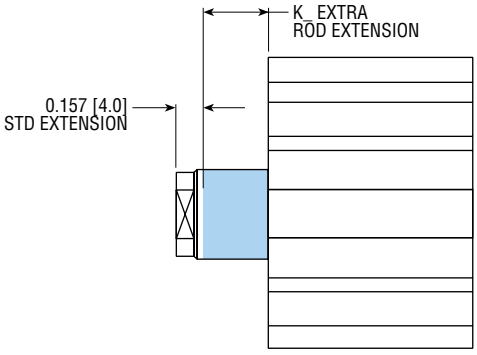
K_ EXTRA ROD EXTENSION

Extra rod extension can be achieved by specifying the option -K followed by the length code.

Length code example (for imperial CRx3 units)
K1 = 1/8" of extra rod extension
K3 = 3/8", etc.

Length code example (for metric CRx6 units)
K5 = 5 mm of extra rod extension
K15 = 15 mm, etc.

0.157" [4 mm] of rod extension is standard. Available in 1/8" [5 mm] increments only.



CAD & Sizing Assistance

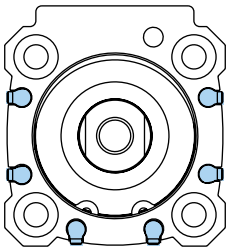
Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

All dimensions are reference only unless specifically toleranced.

M MAGNETIC PISTON FOR SERIES JC1 SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Series JC1 Switches. These switches mount easily into the integral slots in the body. **Hand tighten the setscrew until the switch is securely retained. Do not overtighten.** PHD recommends the use of stainless steel or de-magnetized fasteners on units with this option.

NOTE: Option -M adds 0.250 in [6.38 mm] to the overall length of the cylinder of a plain unit.



SERIES JC1 MAGNETIC SWITCHES

JC1 SWITCH	DESCRIPTION
JC1SDN-5	NPN DC Solid State, 5 meter cable
JC1SDP-5	PNP DC Solid State, 5 meter cable
JC1SDN-K	NPN DC Solid State, Quick Connect
JC1SDP-K	PNP DC Solid State, Quick Connect
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect

NOTE: See Switches and Sensors section for additional switch information and complete specification. Switches must be ordered separately.

CORDSETS FOR SERIES JC1 SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

WP WIDE PISTON FOR EXTRA ROD END SUPPORT

This option provides additional rod end stability. All units with magnetic pistons will automatically receive a wide piston to accommodate the magnet.

NOTE: Option -WP, adds 0.250 in [6.38 mm] to the overall length of the cylinder of a plain unit.

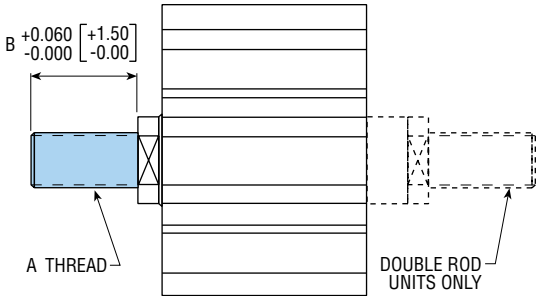
V1 FLUOROELASTOMER SEALS

Fluoroelastomer seals are compatible with certain fluids which degrade standard Nitrile seals. Seal compatibility should be checked with the fluid manufacturer for correct application. Consult PHD for high temperature use.

T11 MALE ROD END, FINE THREAD
(Not available on CRx6 units)

T22 MALE ROD END, COARSE THREAD

These options provide a studded male rod end in place of the standard female threaded rod end. The metric CRS is available with coarse threads only. See pages 9 and 10 for specifications of standard rod ends.

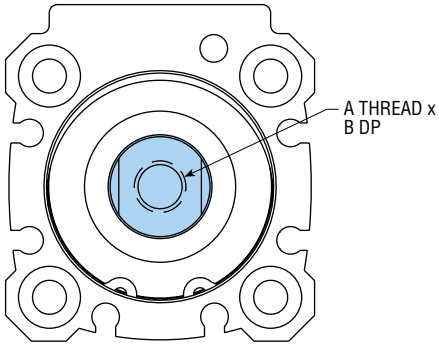


BORE [mm]	-T11 FINE A THREAD	-T22 COARSE A THREAD		B	
12/16	N/A	8-32	[M4 x 0.7]	0.325	[8.5]
20/25	1/4-28	1/4-20	[M6 x 1.0]	0.580	[14.9]
32/40	5/16-24	5/16-18	[M8 x 1.25]	0.625	[17.5]
50/63	3/8-24	3/8-16	[M10 x 1.5]	0.810	[20.5]

NOTES:
1) Numbers in [ ] are in mm for metric units [CRx6].
2) On double rod units, rear rod receives same rod end as single rod.

T44 FEMALE ROD END, COARSE THREAD
(CRx3 20-63 units only)

This option provides a female coarse thread rod end. This option can be applied to imperial 20 mm through 63 mm bore units. The imperial 12 mm and 16 mm bore units have an 8-32 coarse thread as standard. See pages 9 and 10 for standard thread sizes. The metric 12 mm through 63 mm bore units have coarse threads as standard.



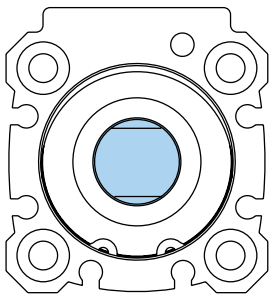
BORE [mm]	-T44 COARSE A THREAD		B	
12/16	(STD)	(STD)	(STD)	(STD)
20/25	1/4-20	(STD)	0.375	(STD)
32/40	5/16-18	(STD)	0.470	(STD)
50/63	3/8-16	(STD)	0.562	(STD)

NOTE: On double rod units, rear rod receives same rod end as single rod.

T55 PLAIN ROD END

This option provides a plain rod end with wrench flats. Standard PHD Compact Cylinders are supplied with a female rod end.

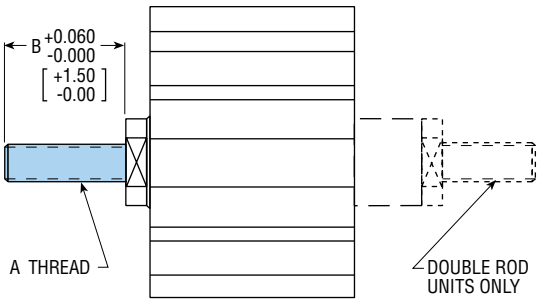
NOTE: On double rod units, rear rod receives same rod end as single rod.



T88 EXTENDED MALE ROD END, FINE THREAD
(Not available on CRx6 units)

T99 EXTENDED MALE ROD END, COARSE THREAD

These options provide a studded male rod end with extended length threads. Metric CRS units are available with coarse threads only. See previous page for standard length male rod end options.



BORE [mm]	-T88 FINE A THREAD	-T99 COARSE A THREAD		B	
12/16	N/A	8-32	[M4 x 0.7]	0.700	[17.5]
20/25	1/4-28	1/4-20	[M6 x 1.0]	1.200	[29.5]
32/40	5/16-24	5/16-18	[M8 x 1.25]	1.250	[32.5]
50/63	3/8-24	3/8-16	[M10 x 1.5]	1.690	[35.5]

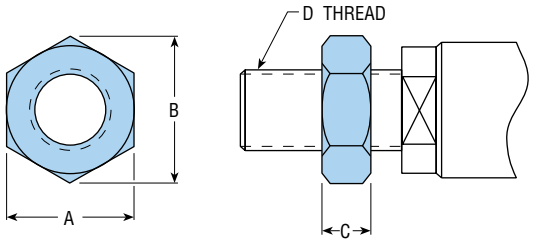
NOTES:
1) Numbers in [ ] are in mm for metric units [CRx6].
2) On double rod units, rear rod receives same rod end as single rod.

Z1 CORROSION RESISTANT

Electroless nickel plating is applied to the retaining rings and a stainless steel piston rod is supplied. Male rod ends are not plated when this option is specified. This option may reduce seal life.

ACCESSORIES: Series CRS Cylinders

HEXAGONAL NUT KIT
Nut kits include a hexagonal nut for use with male studded rod ends.
All male rod end options are shipped without hexagonal nuts.

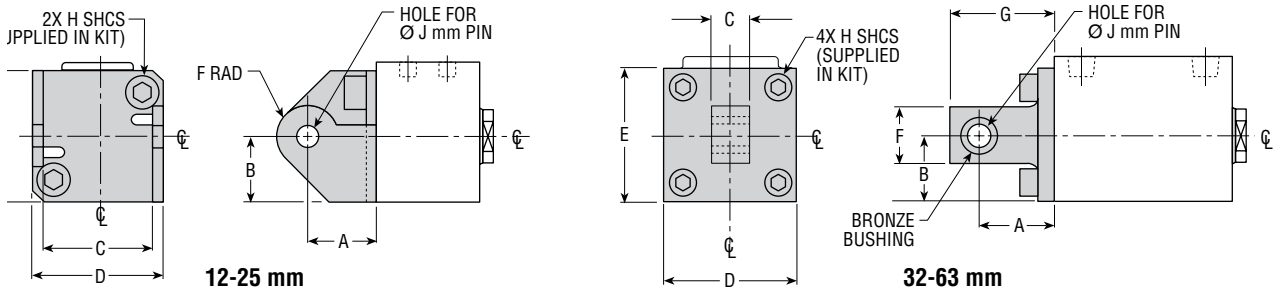


BORE [mm]	DIMENSIONS A	B	C	D THREAD FINE	KIT NO.	D THREAD COARSE	KIT NO. COARSE
12/16	0.335 [7.0]	0.385 [7.7]	0.125 [2.2]	N/A [N/A]	N/A [N/A]	8-32 [M4 x 0.7]	1972-039 [3204-035]
20/25	0.432 [10.0]	0.487 [11.0]	0.157 [3.2]	1/4-28 [N/A]	1972-015 [N/A]	1/4-20 [M6 x 1.0]	1972-014 [3204-001]
32/40	0.500 [13.0]	0.577 [14.4]	0.187 [4.0]	5/16-24 [N/A]	1972-017 [N/A]	5/16-18 [M8 x 1.25]	1972-016 [3204-002]
50/63	0.562 [17.0]	0.650 [18.9]	0.215 [5.0]	3/8-24 [N/A]	1972-019 [N/A]	3/8-16 [M10 x 1.5]	1972-018 [3204-025]

NOTE: Numbers in [ ] are in mm for metric units [CRx6].

All dimensions are reference only unless specifically toleranced.

CYLINDER PIVOT KIT

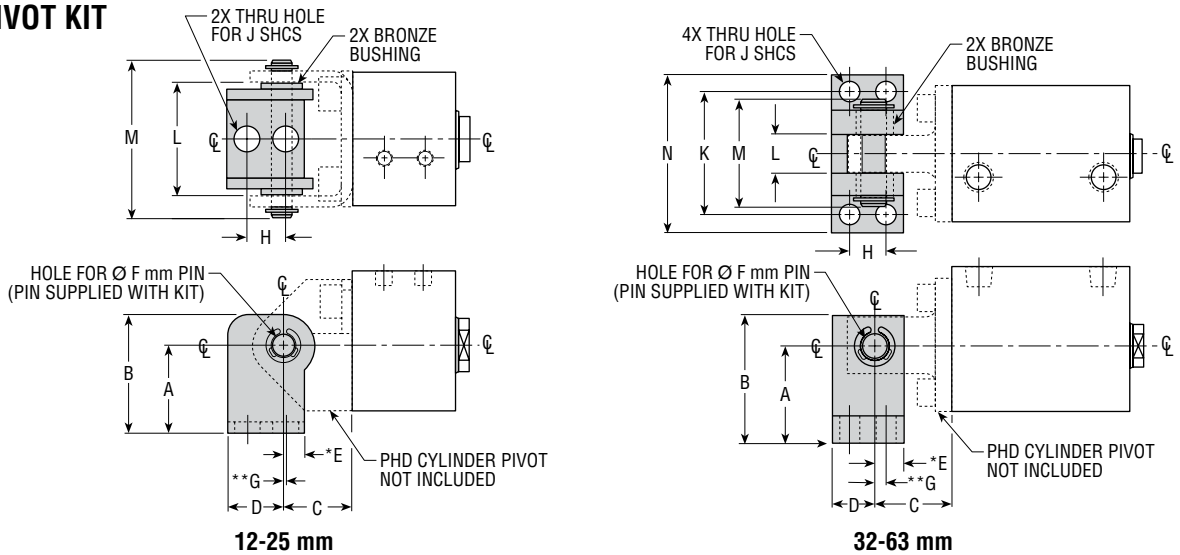


BORE [mm]	DIMENSIONS									KIT NO. IMPERIAL CRx3	KIT NO. METRIC CRx6
	A	B	C	D	E	F	G	H	Ø J		
12	0.650 [16.5]	0.638 [16.2]	0.905 [23.00]	1.064 [27.0]	1.276 [32.4]	0.281 [7.1]	—	10-24 [M5 x 0.8]	0.197 [5.0]	60278-1	60286-1
16	0.650 [16.5]	0.678 [17.2]	0.905 [23.00]	1.064 [27.0]	1.356 [34.4]	0.281 [7.1]	—	10-24 [M5 x 0.8]	0.197 [5.0]	60279-1	60287-1
20	0.790 [20.1]	0.750 [19.0]	1.250 [31.75]	1.500 [38.1]	1.500 [38.1]	0.355 [9.0]	—	1/4-20 [M6 x 1.0]	0.236 [6.0]	60280-1	60288-1
25	0.790 [20.1]	0.800 [20.3]	1.250 [31.75]	1.500 [38.1]	1.600 [40.6]	0.355 [9.0]	—	1/4-20 [M6 x 1.0]	0.236 [6.0]	60281-1	60289-1
32	1.065 [27.0]	0.935 [23.8]	0.490 [12.45]	1.870 [47.5]	1.870 [47.5]	0.820 [21.0]	1.475 [37.5]	1/4-20 [M6 x 1.0]	0.394 [10.0]	60282-1	60290-1
40	1.065 [27.0]	1.105 [28.1]	0.490 [12.45]	2.210 [56.1]	2.210 [56.1]	0.820 [21.0]	1.475 [37.5]	1/4-20 [M6 x 1.0]	0.394 [10.0]	60283-1	60291-1
50	1.460 [37.1]	1.300 [33.0]	0.600 [15.24]	2.600 [66.0]	2.600 [66.0]	1.000 [25.4]	1.970 [50.0]	5/16-18 [M8 x 1.25]	0.472 [12.0]	60284-1	60292-1
63	1.460 [37.1]	1.500 [38.1]	0.600 [15.24]	3.000 [76.2]	3.000 [76.2]	1.000 [25.4]	1.970 [50.0]	5/16-18 [M8 x 1.25]	0.472 [12.0]	60285-1	60293-1

Numbers in [ ] are in mm for metric units [CRx6].

NOTES:
1) 12-25 mm IS BRITE ZINC PLATED STEEL
2) 32-63 mm IS ANODIZED ALUMINUM WITH LUBRICATED BRONZE BUSHINGS
3) FULCRUM PIN NOT INCLUDED (SEE "FULCRUM PIN KITS" TO PURCHASE)
4) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER.
5) UNLESS OTHERWISE DIMENSIONED, FEATURES ARE CENTERED ON CYLINDER CENTERLINE.

BASE PIVOT KIT



BORE [mm]	DIMENSIONS													KIT: CRx3x, CRx6x IMPERIAL/METRIC
	A	B	C	D	E	Ø F	G	H	J	K	L	M	N	
12/16	0.865 [22.0]	1.145 [29.0]	0.650 [16.5]	0.490 [12.5]	0.220 [5.6]	0.197 [5.0]	0.060 [1.5]	0.375 [9.5]	#10 [M5]	—	0.877 [22.3]	1.300 [33.0]	—	60294-1
20/25	1.000 [25.4]	1.355 [34.4]	0.790 [20.1]	0.630 [16.0]	0.260 [6.5]	0.237 [6.0]	0.040 [1.0]	0.435 [11.0]	1/4 [M6]	—	1.221 [31.0]	1.730 [44.0]	—	60295-1
32/40	1.375 [34.9]	1.800 [45.7]	1.065 [27.0]	0.600 [15.2]	0.400 [10.2]	0.394 [10.0]	0.156 [4.0]	0.510 [13.0]	1/4 [M6]	1.695 [43.0]	0.540 [13.7]	1.490 [38.0]	2.165 [55.0]	60296-1
50/63	1.890 [48.0]	2.365 [60.0]	1.460 [37.1]	0.755 [19.2]	0.508 [12.9]	0.472 [12.0]	0.236 [6.0]	0.709 [18.0]	5/16 [M8]	2.265 [57.5]	0.659 [16.7]	1.970 [50.0]	2.835 [72.0]	60297-1

Numbers in [ ] are in mm for metric units [CRx6].

NOTES:
1) 12-25 mm IS BRITE ZINC PLATED STEEL WITH LUBRICATED BRONZE BUSHINGS
2) 32-63 mm IS ANODIZED ALUMINUM WITH LUBRICATED BRONZE BUSHINGS
3) FULCRUM PIN INCLUDED. DOES NOT INCLUDE CYLINDER PIVOT.
4) *E IS TO CENTER OF PIVOT PIN
5) **G IS FROM CENTER OF PIVOT PIN TO CENTER OF FIRST MOUNTING HOLE.
6) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER.

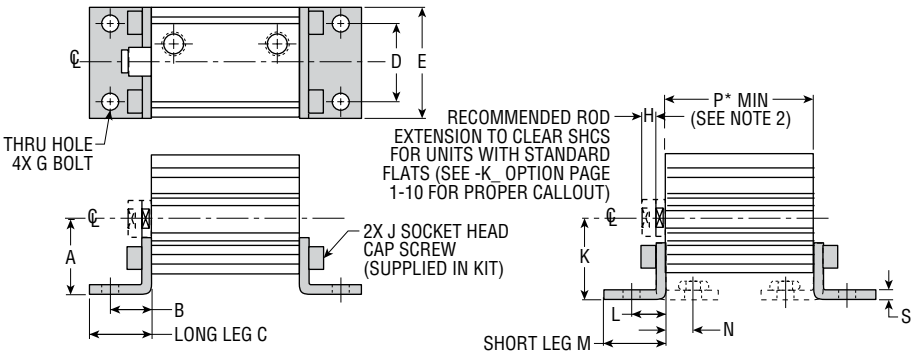
All dimensions are reference only unless specifically toleranced.

F MOUNT KIT

(Must be ordered separately)

Plated steel for use where front or rear mounting is not feasible. Brackets are narrow allowing units to be used where space to the side of the cylinder is limited.

NOTE: Brackets may be mounted in different configurations. Each kit includes 1 bracket and cylinder mounting hardware. Two kits recommended per unit.



THIS VIEW WITH LONG LEG AS MOUNTING SURFACE

THIS VIEW WITH SHORT LEG AS MOUNTING SURFACE

BORE [mm]	DIMENSIONS														KIT NO. IMPERIAL	KIT NO. METRIC
	A	B	C	D	E	G	H	J	K	L	M	N	P* MIN	S		
12	0.874 [22.2]	0.553 [14.0]	0.770 [19.6]	0.550 [14.0]	0.950 [24.13]	#10 [M5]	0.250 [5.0]	10-24 [M5 x 0.8]	0.986 [25.0]	0.441 [11.2]	0.660 [17.0]	0.336 [8.5]	3/8 [10.0]	0.105 [2.67]	58904-1	60302-1
16	0.945 [24.0]	0.589 [15.0]	0.850 [21.6]	0.710 [18.0]	1.110 [28.19]	#10 [M5]	0.250 [10.0]	10-24 [M5 x 0.8]	1.062 [27.0]	0.475 [12.1]	0.730 [18.5]	0.355 [9.0]	3/8 [10.0]	0.120 [3.05]	58905-1	60303-1
20	1.000 [25.4]	0.680 [17.3]	0.940 [23.9]	1.000 [25.4]	1.560 [39.62]	1/4 [M6]	0.375 [10.0]	1/4-20 [M6 x 1.0]	1.180 [30.0]	0.500 [12.7]	0.760 [19.3]	0.380 [9.7]	1/2 [15.0]	0.120 [3.05]	58906-1	60304-1
25	1.100 [27.9]	0.690 [17.5]	0.950 [24.1]	1.100 [27.9]	1.610 [40.90]	1/4 [M6]	0.375 [10.0]	1/4-20 [M6 x 1.0]	1.240 [31.5]	0.550 [14.0]	0.825 [21.0]	0.415 [10.5]	1/2 [15.0]	0.135 [3.43]	58907-1	60305-1
32	1.280 [32.5]	0.730 [18.5]	1.035 [26.3]	1.340 [34.0]	1.890 [48.00]	1/4 [M6]	0.375 [10.0]	1/4-20 [M6 x 1.0]	1.400 [35.5]	0.610 [15.5]	0.915 [23.2]	0.446 [11.3]	5/8 [20.0]	0.164 [4.17]	58908-1	60306-1
40	1.412 [35.9]	0.807 [20.5]	1.180 [30.00]	1.575 [40.0]	2.205 [56.00]	1/4 [M6]	0.375 [10.0]	1/4-20 [M6 x 1.0]	1.595 [40.5]	0.625 [15.9]	0.975 [24.8]	0.446 [11.3]	5/8 [20.0]	0.179 [4.55]	58909-1	60307-1
50	1.750 [44.5]	0.905 [23.0]	1.420 [36.1]	1.970 [50.0]	2.600 [66.00]	5/16 [M8]	0.500 [15.0]	5/16-18 [M8 x 1.25]	1.889 [48.0]	0.765 [19.4]	1.250 [31.8]	0.556 [14.1]	7/8 [25.0]	0.209 [5.31]	58910-1	60308-1
63	2.011 [51.1]	0.985 [25.0]	1.520 [38.6]	2.360 [60.0]	3.070 [78.00]	5/16 [M8]	0.500 [15.0]	5/16-18 [M8 x 1.25]	2.166 [55.0]	0.830 [21.0]	1.325 [33.7]	0.580 [14.7]	7/8 [25.0]	0.250 [6.35]	58911-1	60309-1

NOTES:
1) NUMBERS IN [ ] ARE IN mm FOR METRIC UNITS [CRx6].
2) *MINIMUM STROKE REQUIRED FOR LEGS OF BOTH BRACKETS TO BE UNDER UNIT (SUBTRACT 0.250 [5.0] FROM P FOR MAGNETIC UNITS)
3) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER.

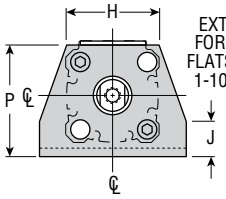
J MOUNT KIT

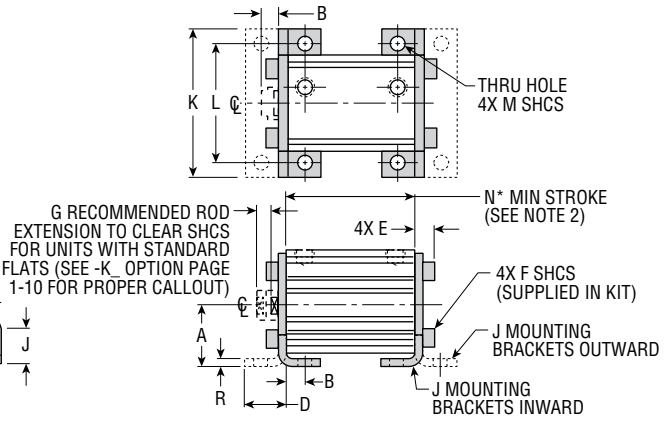
(Must be ordered separately)

Plated steel for use where height is critical, but room is available to sides of unit.

NOTE: Brackets may be mounted in different configurations. Kit includes 2 brackets and cylinder mounting hardware.

NOTES:
1) NUMBERS IN [ ] ARE IN mm FOR METRIC UNITS [CRx6].
2) *MINIMUM STROKE REQUIRED FOR LEGS OF BOTH BRACKETS TO BE UNDER UNIT (SUBTRACT 0.250 [5.0] FROM P FOR MAGNETIC UNITS)
3) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER.



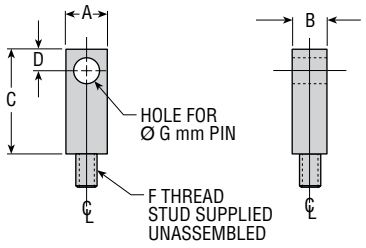


BORE [mm]	DIMENSIONS														KIT NO. IMPERIAL CRx3	KIT NO. METRIC CRx6
	A	B	D	E	F	G	H	J	K	L	M	N* MIN	P	R		
12	0.830 [21.1]	0.275 [7.0]	0.600 [15.3]	0.295 [7.5]	10-24 [M5 x 0.8]	0.250 [5.0]	0.945 [24.0]	0.390 [10.0]	1.810 [46.0]	1.380 [35.1]	#10 [M5]	0.250 [5.0]	1.510 [38.4]	0.105 [2.67]	60310-1	60318-1
16	0.870 [22.0]	0.275 [7.0]	0.610 [15.5]	0.310 [7.9]	10-24 [M5 x 0.8]	0.250 [10.0]	1.122 [28.5]	0.450 [11.5]	1.970 [50.0]	1.535 [39.0]	#10 [M5]	0.250 [5.0]	1.620 [41.2]	0.120 [3.05]	60311-1	60319-1
20	0.945 [24.0]	0.315 [8.0]	0.710 [18.0]	0.370 [9.4]	1/4-20 [M6 x 1.0]	0.375 [10.0]	1.470 [37.4]	0.450 [11.5]	2.520 [64.0]	1.969 [50.0]	1/4 [M6]	0.375 [10.0]	1.750 [44.5]	0.120 [3.05]	60312-1	60320-1
25	1.005 [25.5]	0.315 [8.0]	0.725 [18.5]	0.390 [9.9]	1/4-20 [M6 x 1.0]	0.375 [10.0]	1.581 [40.2]	0.490 [12.5]	2.600 [66.0]	2.047 [52.0]	1/4 [M6]	0.375 [10.0]	1.890 [48.0]	0.135 [3.43]	60313-1	60321-1
32	1.218 [31.0]	0.355 [9.0]	0.834 [21.2]	0.414 [10.5]	1/4-20 [M6 x 1.0]	0.375 [10.0]	1.873 [47.6]	0.630 [16.0]	2.950 [75.0]	2.362 [60.0]	1/4 [M6]	0.375 [10.0]	2.240 [57.0]	0.164 [4.17]	60314-1	60322-1
40	1.400 [35.6]	0.355 [9.0]	0.885 [22.5]	0.429 [10.9]	1/4-20 [M6 x 1.0]	0.375 [10.0]	2.190 [55.7]	0.670 [17.0]	3.310 [84.1]	2.677 [68.0]	1/4 [M6]	0.500 [10.0]	2.560 [65.0]	0.179 [4.55]	60315-1	60323-1
50	1.730 [44.0]	0.492 [12.5]	1.110 [28.2]	0.531 [13.5]	5/16-18 [M8 x 1.25]	0.500 [15.0]	2.577 [65.5]	0.850 [21.5]	3.940 [100.1]	3.189 [81.0]	5/16 [M8]	0.625 [15.0]	3.150 [80.0]	0.209 [5.31]	60316-1	60324-1
63	2.010 [51.1]	0.512 [13.0]	1.250 [31.8]	0.570 [14.5]	5/16-18 [M8 x 1.25]	0.500 [15.0]	3.055 [77.6]	1.000 [25.5]	4.530 [115.1]	3.661 [93.0]	5/16 [M8]	0.750 [20.0]	3.660 [93.0]	0.250 [6.35]	60317-1	60325-1

All dimensions are reference only unless specifically toleranced.

ROD EYE KIT

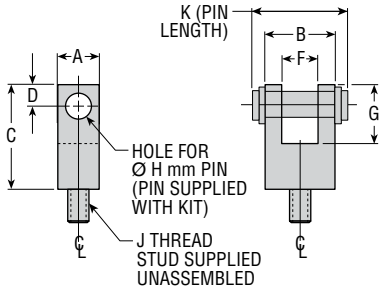
BORE [mm]	DIMENSIONS						KIT: CRx3x IMPERIAL	KIT: CRx6x METRIC
	A	B	C	D	F	G		
12/16	0.438 [11.0]	0.250 [6.5]	0.885 [22.5]	0.215 [5.5]	8-32 [M4 x 0.7]	0.197 [5.0]	59069-1	60234-1
20/25	0.500 [12.7]	0.375 [9.5]	1.065 [27.0]	0.255 [6.5]	1/4-28 [M6 x 1.0]	0.236 [6.0]	59070-1	60235-1
32/40	0.625 [16.0]	0.500 [12.5]	1.495 [38.0]	0.355 [9.0]	5/16-24 [M8 x 1.25]	0.394 [10.0]	59071-1	60236-1
50/63	0.875 [22.2]	0.625 [16.0]	1.610 [41.0]	0.430 [11.0]	3/8-24 [M10 x 1.5]	0.472 [12.0]	59072-1	60237-1



NOTES:
1) UNIT MUST BE ORDERED WITH STANDARD FEMALE THREADS
2) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF PART. ALL FEATURES CENTERED ON ℄ UNLESS OTHERWISE NOTED.
3) STANDARD PLATING IS BRITE ZINC
4) NUMBERS IN [ ] ARE IN mm FOR METRIC UNITS [CRx6]

ROD CLEVIS KIT

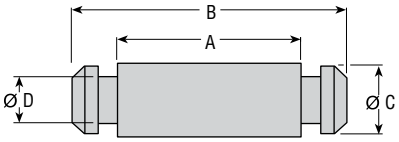
BORE [mm]	DIMENSIONS									KIT: CRx3x IMPERIAL	KIT: CRx6x METRIC
	A	B	C	D	F	G	H	J	K		
12/16	0.438 [11.0]	0.625 [15.9]	1.000 [25.4]	0.215 [5.5]	0.266 [6.8]	0.610 [15.5]	0.197 [5.0]	8-32 [M4 x 0.7]	0.845 [21.5]	59073-1	60238-1
20/25	0.500 [12.7]	0.750 [19.0]	1.255 [32.0]	0.255 [6.5]	0.391 [9.9]	0.738 [18.8]	0.236 [6.0]	1/4-28 [M6 x 1.0]	0.965 [24.5]	59074-1	60239-1
32/40	0.625 [15.9]	1.000 [25.4]	1.615 [41.0]	0.315 [8.0]	0.518 [13.2]	0.925 [23.5]	0.394 [10.0]	5/16-24 [M8 x 1.25]	1.300 [33.0]	59075-1	60240-1
50/63	0.875 [22.2]	1.250 [31.8]	1.815 [46.1]	0.435 [11.0]	0.645 [16.4]	1.165 [29.6]	0.472 [12.0]	3/8-24 [M10 x 1.5]	1.575 [40.0]	59076-1	60241-1



NOTES:
1) UNIT MUST BE ORDERED WITH STANDARD FEMALE THREADS
2) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF PART. ALL FEATURES CENTERED ON ℄ UNLESS OTHERWISE NOTED.
3) STANDARD PLATING IS BRITE ZINC (PIN & CLEVIS)
4) NUMBERS IN [ ] ARE IN mm FOR METRIC UNITS [CRx6]

ROD FULCRUM PIN KIT

Replacement for Rod Clevis pin or for use with PHD Rod Eye.
Pin is Brite Zinc plated. Retaining rings are supplied.

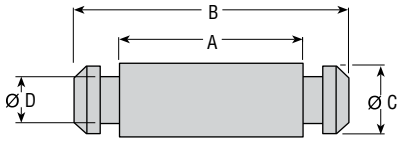


BORE [mm]	DIMENSIONS				KIT: CRx3x, CRx6x IMPERIAL/METRIC
	A	B	Ø C	Ø D	
12/16	0.665 [16.9]	0.845 [21.5]	0.197 [5.0]	0.125 [3.2]	60326-1
20/25	0.785 [19.9]	0.965 [24.5]	0.236 [6.0]	0.156 [4.0]	60327-1
32/40	1.045 [26.5]	1.300 [33.0]	0.394 [10.0]	0.274 [7.0]	60328-1
50/63	1.295 [32.9]	1.575 [40.0]	0.472 [12.0]	0.353 [9.0]	60329-1

NOTE: Numbers in [ ] are in mm for metric units [CRx6].

CYLINDER FULCRUM PIN KIT

Replacement for base pivot pin or for use with PHD Cylinder Pivot.
Pin is Brite Zinc plated. Retaining rings are supplied.



BORE [mm]	DIMENSIONS				KIT: CRx3x, CRx6x IMPERIAL/METRIC
	A	B	Ø C	Ø D	
12/16	1.120 [28.5]	1.300 [33.0]	0.197 [5.0]	0.125 [3.1]	60330-1
20/25	1.550 [39.4]	1.730 [44.0]	0.236 [6.0]	0.156 [4.0]	60331-1
32/40	1.240 [31.5]	1.490 [37.9]	0.394 [10.0]	0.274 [7.0]	60332-1
50/63	1.690 [42.9]	1.970 [50.0]	0.472 [12.0]	0.353 [9.0]	60333-1

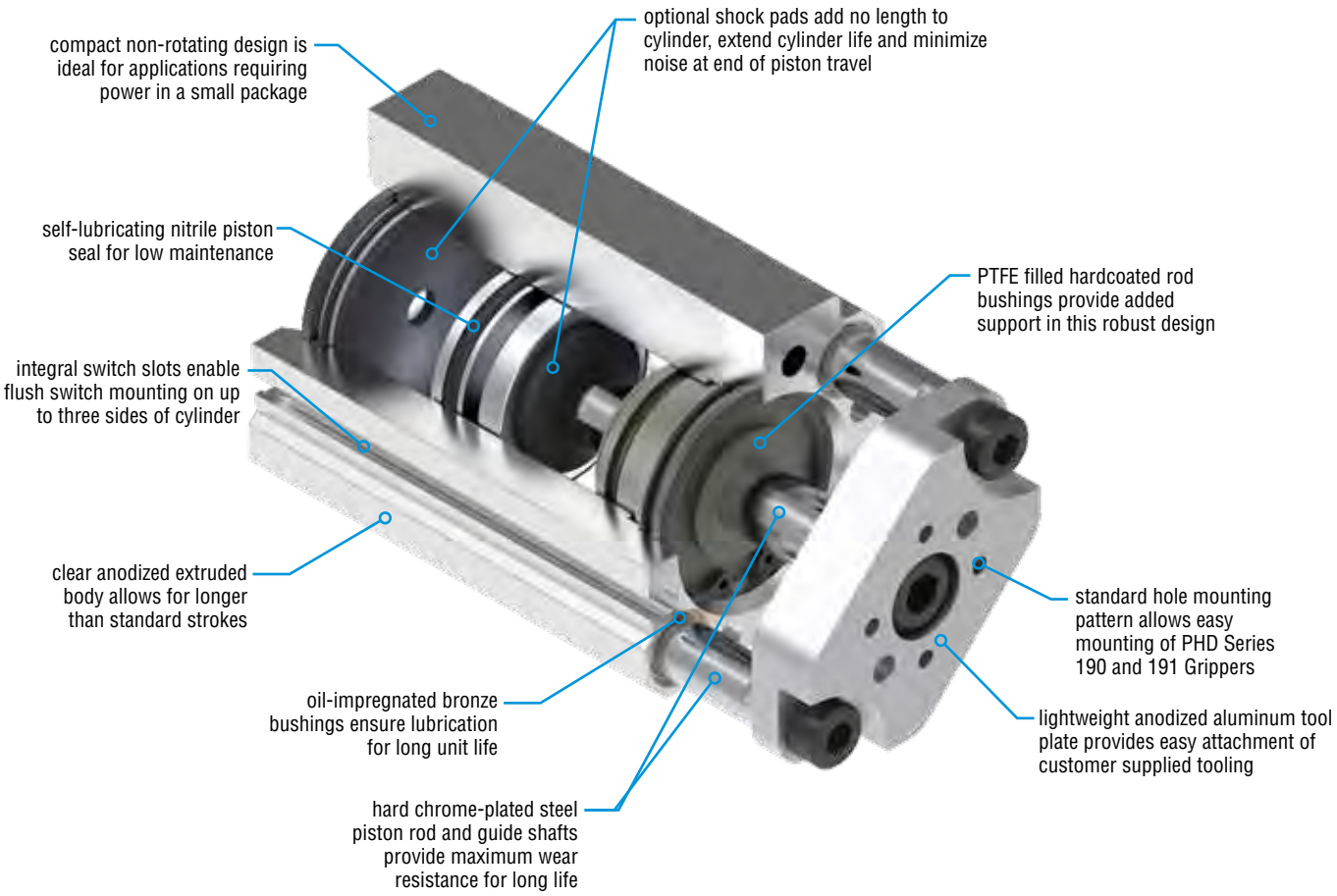
NOTE: Numbers in [ ] are in mm for metric units [CRx6].

All dimensions are reference only unless specifically toleranced.

CTS

Major Benefits

- Compact design for applications where space is limited.
- Hard chrome plated guide shafts for anti-rotation and increased side load capacity.
- Oil-impregnated bronze bushings for long cylinder life.
- Multiple mounting options.
- Easy mounting of other PHD components.
- Up to six switch slots for flush switch mounting.



ORDERING DATA: Series CTS Cylinders

TO ORDER SPECIFY:
Product, Series, Type, Design No., Mounting Style, Bore Size, Stroke, and Options.

PRODUCT
C - Cylinder

TYPE
S - Single Rod, Double Acting (standard)
D - Double Rod, Double Acting
Double Rod units include tool plate on one end only.

MOUNTING STYLE
All units have 2 thru holes
U - Universal (Standard) Thread and C'bore 4 places, 2 each end
J - Foot Mounting Foot Inward, 1 each end
K - Foot Mounting Foot Outward, 1 each end

IMPERIAL STROKE (CTx2) STANDARD STROKE LENGTHS
1/8" = Minimum stroke
in 1/8" increments

BORE mm	MAXIMUM STROKE (in)
12	2-3/4
16	2-3/4
20	3-1/2
25	3-1/2
32	4
40	4
50	4-1/2
63	6

METRIC STROKE (CTx6) STANDARD STROKE LENGTHS
5 mm = Minimum stroke
in 5 mm increments

BORE mm	MAXIMUM STROKE (mm)
12	70
16	70
20	90
25	90
32	100
40	100
50	115
63	150

C T S 2 U 32 x 1/2 - M-BB

SERIES
T - Compact Guide Rod

DESIGN NO.
2 - Imperial
6 - Metric

BORE SIZE

BORE mm	BORE in	AREA mm²	AREA in²
12	0.47	113	0.175
16	0.63	201	0.312
20	0.79	314	0.487
25	0.98	490	0.761
32	1.26	804	1.247
40	1.57	1256	1.948
50	1.97	1963	3.043
63	2.48	3117	4.832

OPTIONS
BB - Shock Pads in both directions (Option does not add any extra length)
M - Magnetic piston for use with PHD Series JC1 Switches. See Notes 2 and 4.
F11 - Extended Length Wrench Flats
K_ - Extra Tool Plate Extension in 1/8" [5 mm] increments up to 1" [25 mm] maximum. Length code example: K1 = 1/8", K3 = 3/8", or K5 = 5 mm, K15 = 15 mm, etc.
V1 - Fluoroelastomer Seals
WB - Blank Tool Plate (shipped with tool plate unassembled)
WR - Rectangular Tool Plate (12-16 mm units only)
WRB - Blank Rectangular Tool Plate (12-16 mm units only) (shipped with tool plate unassembled)
Z1 - Corrosion-resistant, stainless steel rod and guide shafts, electroless nickel plated retaining rings, fasteners, and brackets (with J & K mounting)

NOTES:
1) See pages 27 and 28 for accessories.
2) PHD recommends the use of stainless steel or de-magnetized fasteners on units with -M option.
3) Longer stroke lengths are available. Consult PHD.
4) See options page for switch ordering information.

⚠ Options may affect unit length. See dimensional pages and option information details.

SERIES JC1 MAGNETIC SWITCHES

JC1 SWITCH	DESCRIPTION
JC1SDN-5	NPN DC Solid State, 5 meter cable
JC1SDP-5	PNP DC Solid State, 5 meter cable
JC1SDN-K	NPN DC Solid State, Quick Connect
JC1SDP-K	PNP DC Solid State, Quick Connect
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect

NOTE: See Switches and Sensors section for additional switch information and complete specification. Switches must be ordered separately.

CORDSETS FOR SERIES JC1 SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

SPECIFICATIONS	SERIES CTS
OPERATING PRESSURE	20 psi min to 150 psi max at zero load [1.4 bar min to 10 bar max] air
STROKE TOLERANCE	± 0.031 inch [± 0.8 mm] (See Shock Pad Usage)
TEMPERATURE LIMITS	-20° to +180°F [-29° to +82°C]
VELOCITY	20 in/sec [0.5 m/sec] typical min, zero load at 100 psi [7 bar]
LIFE EXPECTANCY	30 million linear inches [762000 linear meters] min (-V1 & -Z1 options may reduce life)
LUBRICATION	Pre-lubricated for use with non-lubricated or lubricated air
MAINTENANCE	Field repairable

CYLINDER FORCE AND WEIGHT

BORE SIZE		ROD DIAMETER		ROD DIRECTION	EFFECTIVE AREA		BASE WEIGHT		ADDER PER 1" [25 mm] OF STROKE	
mm	in	in	mm		in^2	mm^2	lb	kg	lb	kg
12	0.472	0.250	6.35	EXTEND	0.175	113	0.17	0.08	0.11	0.05
				RETRACT	0.126	81				
16	0.630	0.250	6.35	EXTEND	0.312	201	0.20	0.09	0.12	0.05
				RETRACT	0.263	169				
20	0.787	0.375	9.53	EXTEND	0.487	314	0.37	0.17	0.19	0.09
				RETRACT	0.376	242				
25	0.984	0.375	9.53	EXTEND	0.761	490	0.43	0.19	0.20	0.09
				RETRACT	0.650	419				
32	1.260	0.625	15.88	EXTEND	1.247	804	0.72	0.33	0.31	0.14
				RETRACT	0.940	606				
40	1.575	0.625	15.88	EXTEND	1.948	1256	0.96	0.44	0.37	0.17
				RETRACT	1.641	1058				
50	1.969	0.750	19.05	EXTEND	3.043	1963	1.65	0.75	0.49	0.22
				RETRACT	2.602	1678				
63	2.480	0.750	19.05	EXTEND	4.832	3117	2.36	1.07	0.58	0.26
				RETRACT	4.390	2832				

NOTE: Use retract figures for calculating double rod cylinder forces in both directions.

APPLICATION

The PHD Series CTS Compact Guide Rod Cylinders are designed for use as compact non-rotating cylinders and as light duty slides where precise location is not required and side loading is minimal. On double rod units, rear rod increases stability of the tool plate. Rear rod thread not intended as a load attach point. Shock pads are intended for use where there is end-of-stroke impact with an attached load. For maximum cylinder life with attached load, PHD recommends the use of external stops or shock absorbers. See best application practices on page 29.

Proper application of CTS Cylinders in horizontal applications is dependent upon travel and attached load. In addition, where there is end-of-stroke impact with an attached load, cylinder speed must be considered. Refer to page 21.

Proper application of CTS Cylinders in vertical applications is dependent upon both attached load and cylinder speed. Refer to page 22.

CYLINDER FORCE CALCULATIONS

	Imperial F = P x A	Metric F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in^2	mm^2

SHOCK PAD USAGE

Optional shock pads are recommended for applications where the piston contacts the bushing and plug ends with an attached load. The use of shock pads reduces noise and provides maximum cylinder life in these applications. Shock pads are not required for applications where external stops prevent end-of-stroke impact or where end impact occurs without an attached load. See best application practices on page 29. Stroke tolerance changes to ±0.050 [±1.3 mm] with -BB option.

HORIZONTAL APPLICATIONS

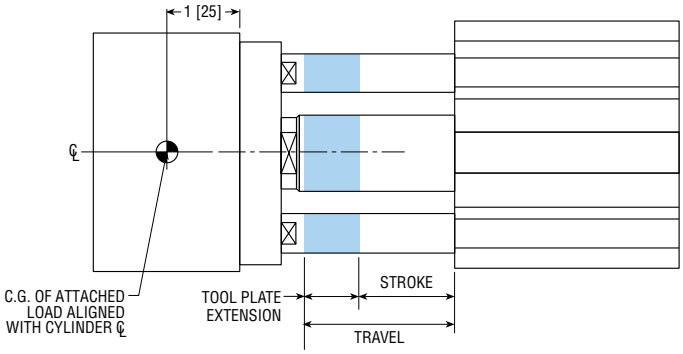
Proper application of CTS Cylinders in horizontal applications is dependent upon travel and attached load. In addition, where there is end-of-stroke impact with an attached load, cylinder speed must be considered.

ATTACHED LOAD WITHOUT END OF STROKE IMPACT

Use the charts below to determine the Maximum Rolling Side Load for a given bore size and travel. Optimum performance will be achieved with positive external stops aligned with the cylinder centerline.

ATTACHED LOAD WITH END OF STROKE IMPACT

Use the charts below to determine the Maximum Rolling Side Load and speed for a given bore size and travel. Optional shock pads are required for end-of-stroke impact with attached load.

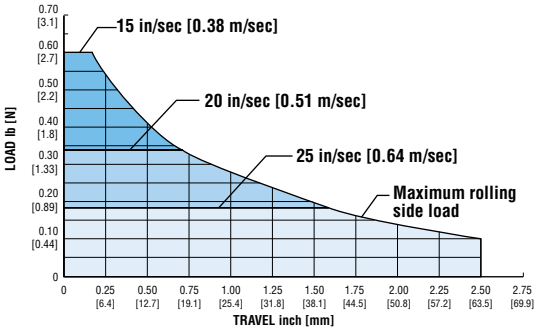


NOTES:

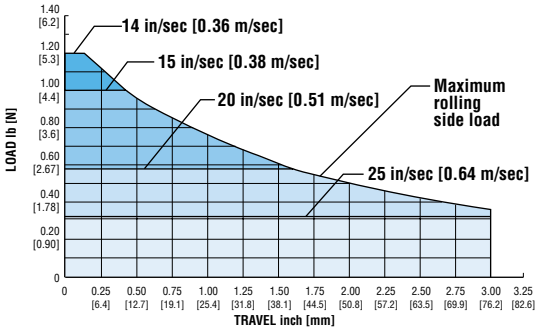
1) HORIZONTAL SIDE LOAD PERFORMANCE DATA IS BASED UPON
   A) THE CENTER OF GRAVITY (C.G.) OF THE ATTACHED LOAD LOCATED AS SHOWN ABOVE. LOCATING THE C.G. BEYOND THE STATED DISTANCE MAY DECREASE THE LIFE OF THE UNIT.
   B) A STANDARD UNIT. USE OF FLUOROELASTOMER SEALS OR THE -Z1 OPTION MAY DECREASE THE SIDE LOADING CAPABILITY OF THE UNIT.
2) SPEEDS ARE BASED ON END-OF-STROKE IMPACT CAPABILITY OF UNITS WITH OPTIONAL SHOCK PADS.

MAXIMUM HORIZONTAL LOAD CAPACITY & SPEED

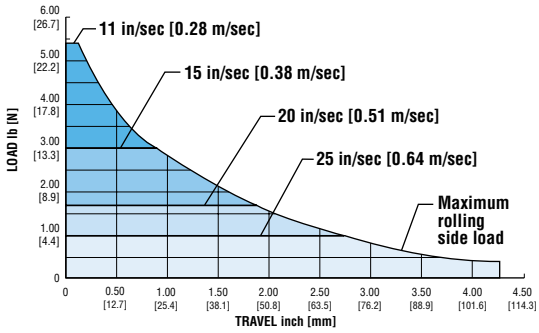
CTx12



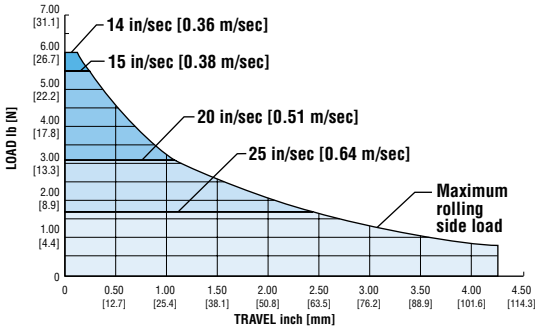
CTx16



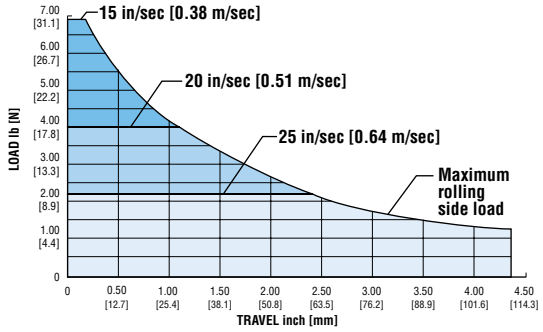
CTx20



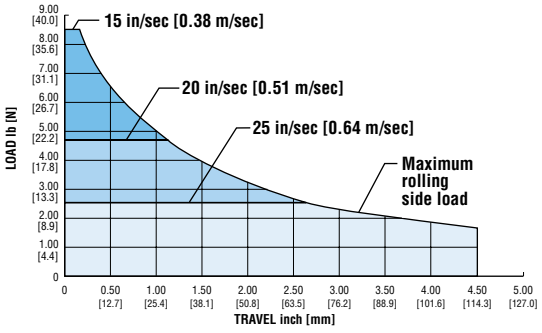
CTx25



CTx32



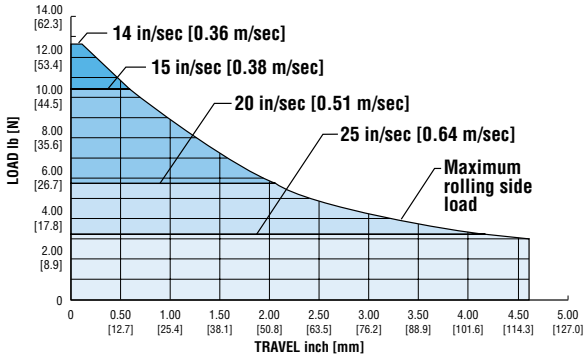
CTx40



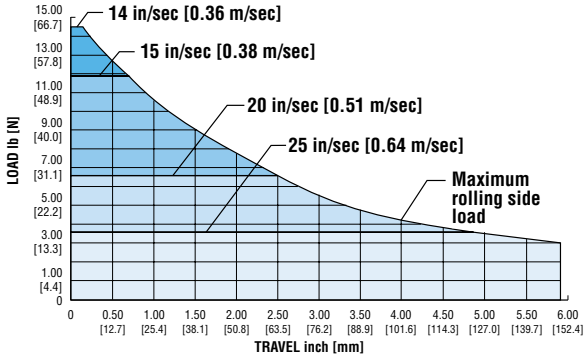
HORIZONTAL APPLICATIONS

MAXIMUM HORIZONTAL LOAD CAPACITY & SPEED

CTx50



CTx63



VERTICAL APPLICATIONS

Proper application of CTS Cylinders in vertical applications is dependent upon both attached load and cylinder speed.

ATTACHED LOAD WITHOUT END OF STROKE IMPACT

See cylinder force calculation on page 20. Optimum performance will be achieved with positive external stops aligned with the cylinder centerline.

ATTACHED LOAD WITH END OF STROKE IMPACT

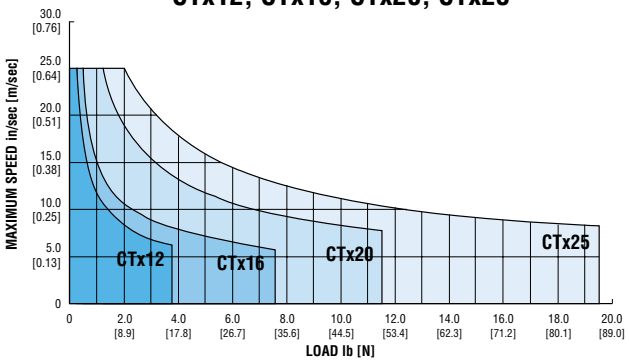
Use the charts below to determine the maximum speed for a given load. Optional shock pads are required for end-of-stroke impact with attached load.

NOTES:

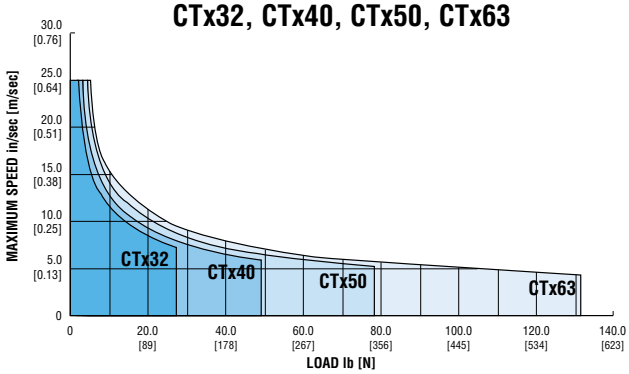
1) VERTICAL PERFORMANCE DATA IS BASED UPON:
   A) THE CENTER OF GRAVITY (C.G.) OF THE ATTACHED LOAD IN LINE WITH THE CYLINDER CENTERLINE. LOCATING THE C.G. OFF OF THE CYLINDER CENTERLINE MAY RESULT IN DECREASED CYLINDER LIFE.
   B) A STANDARD UNIT. USE OF FLUOROELASTOMER SEALS OR THE -Z1 OPTION MAY DECREASE THE LIFE OF THE UNIT.
2) SPEEDS ARE BASED ON END OF STROKE IMPACT CAPABILITY OF UNITS WITH OPTIONAL SHOCK PADS

VERTICAL APPLICATION WITH END OF STROKE IMPACT MAXIMUM SPEED & LOAD

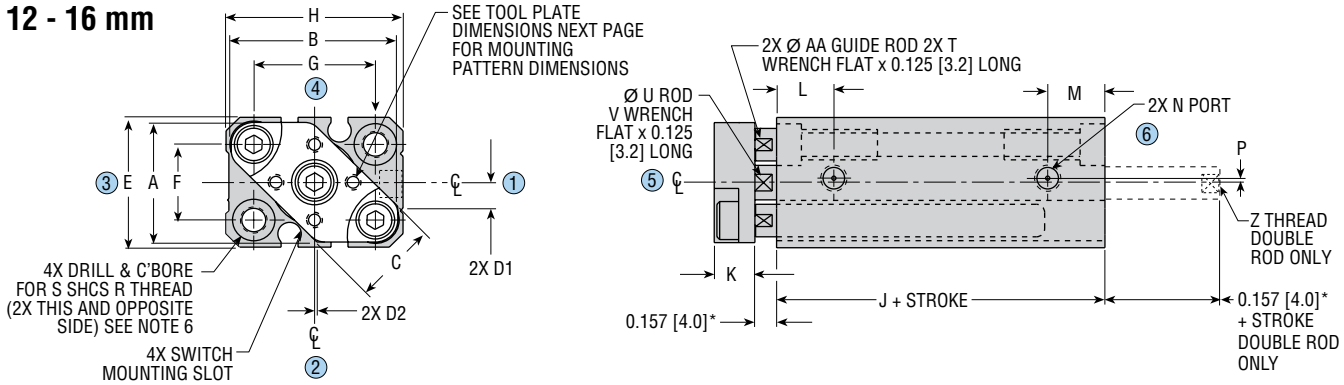
CTx12, CTx16, CTx20, CTx25



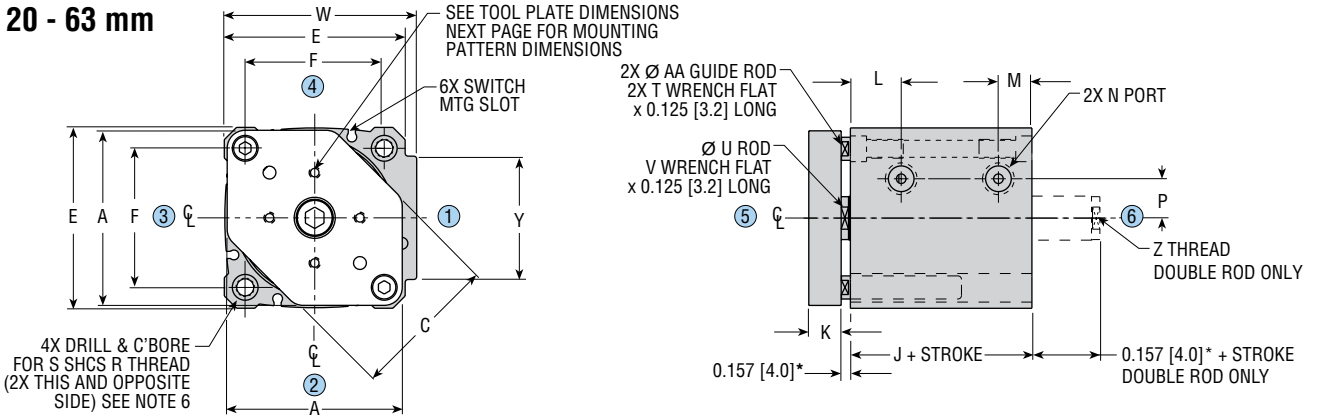
CTx32, CTx40, CTx50, CTx63



12 - 16 mm



20 - 63 mm



BORE [mm]	LETTER DIMENSION															
	A	B	C	D1	D2	E	F	G	H	J	K	L	M	N	P	R THREAD
12	0.876 [22.25]	1.200 [30.48]	0.591 [15]	0.182 [4.62]	0.020 [0.51]	0.944 [24.0]	0.550 [13.97]	0.866 [22.0]	1.260 [32.0]	1.380 [35.05]	0.295 [7.5]	0.415 [10.5]	0.415 [10.5]	10-32 x 0.15 [M5 x 0.8 x 4]	0.032 [0.8]	10-24 x 0.550 [M5 x 0.8 x 14.5]
16	1.000 [25.40]	1.250 [31.75]	0.710 [18]	0.025 [0.64]	0.075 [1.91]	1.91 [28.0]	0.710 [18.03]	0.946 [24.0]	1.340 [34.0]	1.380 [35.05]	0.295 [7.5]	0.415 [10.5]	0.415 [10.5]	10-32 x 0.15 [M5 x 0.8 x 4]	0.098 [2.5]	10-24 x 0.550 [M5 x 0.8 x 14.5]
20	1.374 [34.90]	—	0.906 [23]	—	—	1.476 [37.5]	1.000 [25.4]	—	—	1.615 [41.02]	0.394 [10.0]	0.670 [17.0]	0.415 [10.5]	10-32 x 0.15 [M5 x 0.8 x 4]	0.207 [5.3]	1/4-20 x 0.875 [M6 x 1.0 x 22.5]
25	1.500 [38.10]	—	1.024 [26]	—	—	1.576 [40.0]	1.100 [28.0]	—	—	1.615 [41.02]	0.394 [10.0]	0.670 [17.0]	0.398 [10.1]	10-32 x 0.15 [M5 x 0.8 x 4]	0.236 [6.0]	1/4-20 x 0.875 [M6 x 1.0 x 22.5]
32	1.744 [44.30]	—	1.378 [35]	—	—	1.870 [47.5]	1.339 [34.0]	—	—	1.790 [45.47]	0.394 [10.0]	0.710 [18.0]	0.450 [11.4]	1/8 NPT [1/8 BSP]	0.324 [8.2]	1/4-20 x 0.875 [M6 x 1.0 x 22.5]
40	2.000 [50.80]	—	1.650 [42]	—	—	2.205 [56.0]	1.574 [40.0]	—	—	1.790 [45.47]	0.394 [10.0]	0.710 [18.0]	0.450 [11.4]	1/8 NPT [1/8 BSP]	0.364 [9.3]	1/4-20 x 0.875 [M6 x 1.0 x 22.5]
50	2.500 [63.50]	—	2.086 [53]	—	—	2.598 [66.0]	1.968 [50.0]	—	—	1.970 [50.04]	0.551 [14.0]	0.790 [20.1]	0.535 [13.6]	1/8 NPT [1/8 BSP]	0.476 [12.1]	5/16-18 x 0.900 [M8 x 1.25 x 22.5]
63	2.974 [75.54]	—	2.560 [65]	—	—	3.070 [78.0]	2.362 [60.0]	—	—	2.090 [53.09]	0.551 [14.0]	0.865 [22.0]	0.570 [14.5]	1/4 NPT [1/4 BSP]	0.670 [17.0]	5/16-18 x 0.900 [M8 x 1.25 x 22.5]

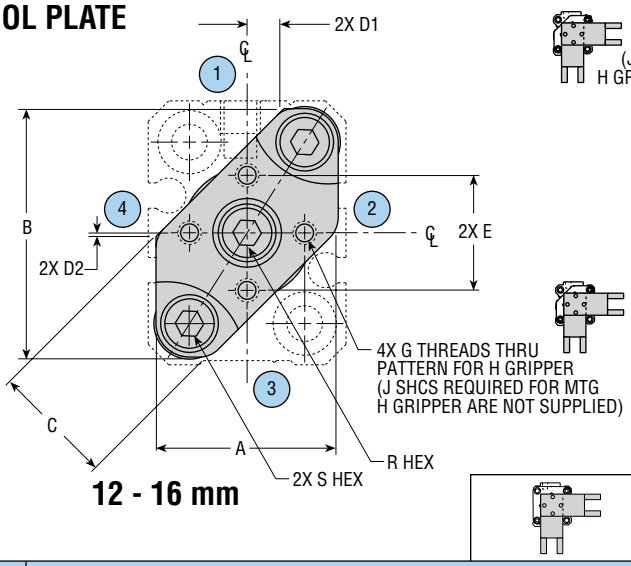
BORE [mm]	LETTER DIMENSION							
	S	T	U	V	W	Y	Z THREAD	AA
12	#6 [M4]	0.219 [5.6]	0.250 [6.35]	0.219 [5.6]	—	—	6-32 x 0.210 [M4 x 0.7 x 7]	0.236 [6.0]
16	#6 [M4]	0.219 [5.6]	0.250 [6.35]	0.219 [5.6]	—	—	6-32 x 0.210 [M4 x 0.7 x 7]	0.236 [6.0]
20	#10 [M5]	0.250 [6.4]	0.375 [9.53]	0.312 [7.9]	1.576 [40.0]	0.788 [20.0]	10-32 x 0.285 [M5 x 0.8 x 7]	0.314 [8.0]
25	#10 [M5]	0.250 [6.4]	0.375 [9.53]	0.312 [7.9]	1.746 [44.4]	1.000 [25.4]	10-32 x 0.285 [M5 x 0.8 x 7]	0.314 [8.0]
32	#10 [M5]	0.250 [6.4]	0.625 [15.88]	0.500 [12.7]	2.037 [52.0]	1.340 [34.0]	1/4-28 x 0.375 [M6 x 1.0 x 9]	0.314 [8.0]
40	#10 [M5]	0.250 [6.4]	0.625 [15.88]	0.500 [12.7]	2.363 [60.0]	1.420 [36.0]	1/4-28 x 0.375 [M6 x 1.0 x 9]	0.314 [8.0]
50	1/4 [M6]	0.312 [7.9]	0.750 [19.05]	0.625 [15.9]	2.795 [71.0]	1.600 [40.6]	5/16-24 x 0.312 [M8 x 1.25 x 8]	0.394 [10.0]
63	1/4 [M6]	0.312 [7.9]	0.750 [19.05]	0.625 [15.9]	3.266 [83.0]	2.094 [53.2]	5/16-24 x 0.312 [M8 x 1.25 x 8]	0.394 [10.0]

NOTES:
1) DIMENSION SHOWN IN [ ] ARE IN mm FOR METRIC UNITS [CTx6].
2) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER BORE.
3) UNLESS OTHERWISE DIMENSIONED, MOUNTING HOLE PATTERNS AND OTHER FEATURES ARE CENTERED ON DESIGNATED CYLINDER CENTERLINE.
4) 1/8" [5 mm] MINIMUM STROKE REQUIRED
5) *SEE J & K MOUNTING DIMENSIONS FOR STANDARD EXTENSION WITH THOSE OPTIONS.
6) PHD RECOMMENDS THE USE OF STAINLESS STEEL OR DE-MAGNETIZED FASTENERS ON UNITS WITH THE -M OPTION.

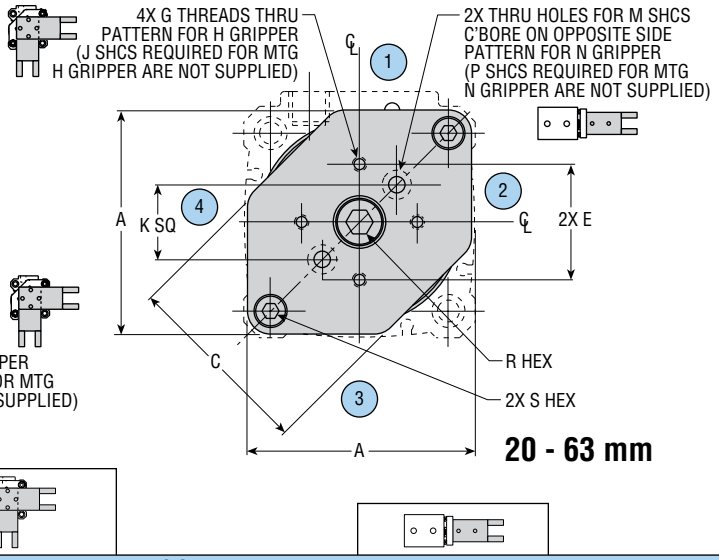
CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

TOOL PLATE



12 - 16 mm



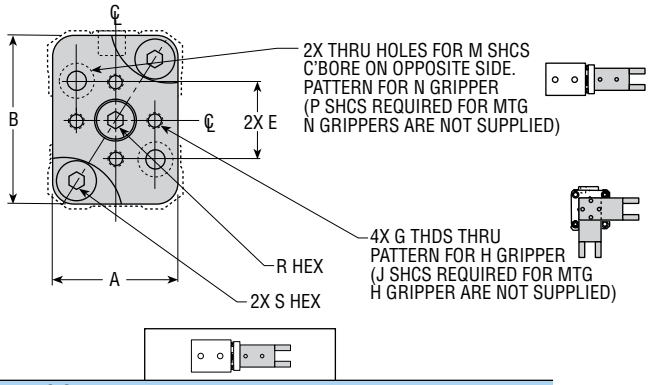
20 - 63 mm

BORE [mm]	LETTER DIMENSION																	
								H (SERIES 190°)					N (SERIES 19x)*					
	A	B	C	D1	D2	E	G	ANGULAR	PARALLEL	J	K	M	ANGULAR	PARALLEL	P	R	S
12	0.876 [22.25]	1.200 [30.48]	0.591 [15.0]	0.182 [4.62]	0.020 [0.51]	0.550 [13.97]	4-40 [M3 x 0.5]	— [19002]	1906x [1906x]	4-40 x 1 [M3 x 0.5 x 20]	—	—	—	—	—	[3.0]	[3.0]
16	1.000 [25.40]	1.250 [31.75]	0.710 [18.0]	0.025 [0.64]	0.075 [1.91]	0.550 [13.97]	4-40 [M3 x 0.5]	— [19002]	1906x [1906x]	4-40 x 1 [M3 x 0.5 x 20]	—	—	—	—	—	[3.0]	[3.0]
20	1.374 [34.90]	—	0.906 [23.0]	—	—	0.710 [18.03]	6-32 [M3 x 0.5]	— [19012]	1907x [1907x]	6-32 x 1-1/4 [M3 x 0.5 x 30]	0.550 [13.97]	#4 [M3]	— [19x02]	19x6x [19x6x]	4-40 x 3/8 [M3 x 0.5 x 10]	[5.0]	[4.0]
25	1.500 [38.10]	—	1.024 [26.0]	—	—	0.710 [18.03]	6-32 [M3 x 0.5]	— [19012]	1907x [1907x]	6-32 x 1-1/4 [M3 x 0.5 x 30]	0.550 [13.97]	#4 [M3]	— [19x02]	19x6x [19x6x]	4-40 x 3/8 [M3 x 0.5 x 10]	[5.0]	[4.0]
32	1.744 [44.30]	—	1.378 [35.0]	—	—	1.100 [27.94]	8-32 [M4 x 0.7]	— [19022]	1908x [1908x]	8-32 x 1-5/8 [M4 x 0.7 x 40]	0.710 [18.03]	#6 [M3]	— [19x12]	19x7x [19x7x]	6-32 x 3/8 [M3 x 0.5 x 8]	[6.0]	[4.0]
40	2.000 [50.80]	—	1.650 [42.0]	—	—	1.100 [27.94]	8-32 [M4 x 0.7]	— [19022]	1908x [1908x]	8-32 x 1-5/8 [M4 x 0.7 x 40]	0.710 [18.03]	#6 [M3]	— [19x12]	19x7x [19x7x]	6-32 x 3/8 [M3 x 0.5 x 8]	[6.0]	[4.0]
50	2.500 [63.5]	—	2.086 [53.0]	—	—	1.535 [38.99]	10-24 [M5 x 0.8]	— [19032]	1909x [1909x]	10-24 x 2-1/4 [M5 x 0.8 x 55]	1.100 [27.94]	#8 [M4]	— [19x22]	19x8x [19x8x]	8-32 x 5/8 [M4 x 0.7 x 12]	[8.0]	[5.0]
63	2.974 [75.54]	—	2.560 [65.0]	—	—	1.535 [38.99]	10-24 [M5 x 0.8]	— [19032]	1909x [1909x]	10-24 x 2-1/4 [M5 x 0.8 x 55]	1.535 [38.99]	#10 [M5]	— [19x32]	19x9x [19x9x]	10-24 x 3/4 [M5 x 0.8 x 12]	[8.0]	[5.0]

NOTES:
1) NUMBERS IN [ ] ARE IN mm FOR METRIC UNITS [CTx6].
2) *IMPERIAL GRIPPERS MOUNT TO CTx2 ONLY. METRIC GRIPPERS MOUNT TO CTx6 ONLY.
3) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER BORE
4) UNLESS OTHERWISE DIMENSIONED, MOUNTING HOLE PATTERNS AND OTHER FEATURES ARE CENTERLINE ON DESIGNATED CYLINDER CENTERLINE.

OPTIONAL RECTANGULAR TOOL PLATE (12 - 16 mm ONLY) -WR OPTION

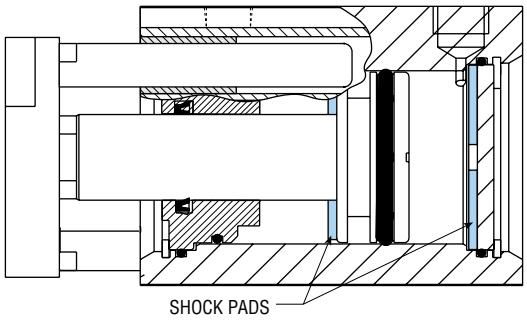
NOTES:
1) NUMBERS IN [ ] ARE IN mm FOR METRIC UNITS [CTx6].
2) *IMPERIAL GRIPPERS MOUNT TO CTx2 ONLY.
   METRIC GRIPPERS MOUNT TO CTx6 ONLY.
3) SEE J & K MOUNTING DIMENSIONS FOR STANDARD
   ROD EXTENSION WITH THOSE OPTIONS.



BORE [mm]	LETTER DIMENSION												
					H (SERIES 190°)				N (SERIES 19x)*				
	A	B	E	G	ANGULAR	PARALLEL	J	M	ANGULAR	PARALLEL	P	R	S
12	0.876 [22.25]	1.200 [30.5]	0.550 [13.97]	4-40 [M3 x 0.5]	— [19002]	1906x [1906x]	4-40 x 1 [M3 x 0.5 x 20]	#4 [M3]	— [19x02]	19x6x [19x6x]	4-40 x 3/8 [M5 x 0.5 x 8]	[3.0]	[3.0]
16	1.000 [25.5]	1.250 [31.75]	0.550 [13.97]	4-40 [M3 x 0.5]	— [19002]	1906x [1906x]	4-40 x 1 [M3 x 0.5 x 20]	#4 [M3]	— [19x02]	19x6x [19x6x]	4-40 x 3/8 [M3 x 0.5 x 8]	[3.0]	[3.0]

BB SHOCK PADS ON EXTENSION AND RETRACTION

Shock pads eliminate metal-to-metal contact and minimize piston impact. Shock pads are recommended for applications where the piston contacts the head and/or cap (with attached loads). The use of shock pads reduces noise and provides maximum cylinder life in these applications.

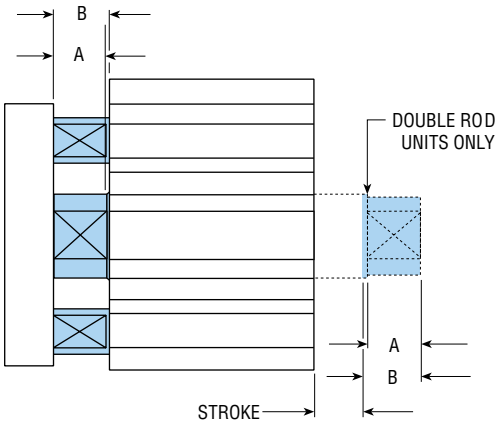


F11 EXTENDED LENGTH WRENCH FLATS

The design of a compact guide rod cylinder requires the length to be as short as possible. The standard wrench flat length is 0.125" [3 mm]. The option -F11 provides wrench flats which allow standard wrench access. On double rod units, rear rod also receives extended flats with option -F11.

BORE [mm]	A EXTENDED ROD & GUIDE SHAFT WRENCH FLATS		B ROD EXTENSION	
12/16	0.200	[5.08]	0.250	[6.5]
20/25	0.200	[5.08]	0.250	[6.5]
32/40	0.315	[8.00]	0.344	[9.0]
50/63	0.315	[8.00]	0.344	[9.0]

Numbers in [ ] are in mm for metric units [CTx6].



K_ EXTRA TOOL PLATE EXTENSION

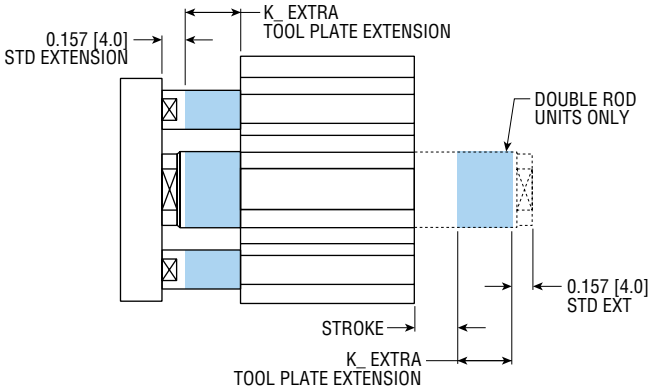
Extra rod extension can be achieved by specifying the option -K followed by the length code.

Length code example (for imperial CTx2 units)
K1 = 1/8" of extra tool plate extension
K3 = 3/8", etc.

Length code example (for metric CTx6 units)
K5 = 5 mm of extra tool plate extension
K15 = 15 mm, etc.

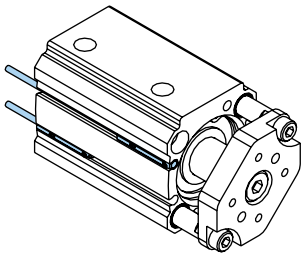
0.157" [4 mm] of tool plate extension is standard. Available in 1/8" [5 mm] increments only. Maximum extension is 1" [25 mm].

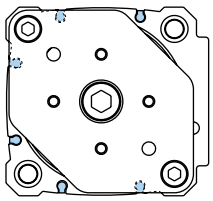
NOTE: On double rod units, rear rod receives same extension as tool plate (tool plate on front end only).



M MAGNETIC PISTON FOR PHD SERIES JC1 SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Series JC1 Switches. These switches mount easily into the integral slots in the body and are locked into place with a setscrew. **Hand tighten the setscrew until the switch is securely retained. Do not overtighten.** PHD recommends the use of stainless steel or de-magnetized fasteners when mounting Series CTx Cylinders equipped with the -M option. The design of a compact guide rod cylinder requires the length to be as short as possible. Installation of switches on units with J or K mounts will require temporary removal of the rear bracket prior to mounting the cylinder.





SERIES JC1 MAGNETIC SWITCHES

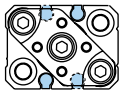
JC1 SWITCH	DESCRIPTION
JC1SDN-5	NPN DC Solid State, 5 meter cable
JC1SDP-5	PNP DC Solid State, 5 meter cable
JC1SDN-K	NPN DC Solid State, Quick Connect
JC1SDP-K	PNP DC Solid State, Quick Connect
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect

NOTE: See Switches and Sensors section for additional switch information and complete specification. Switches must be ordered separately.

CORDSETS FOR SERIES JC1 SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.



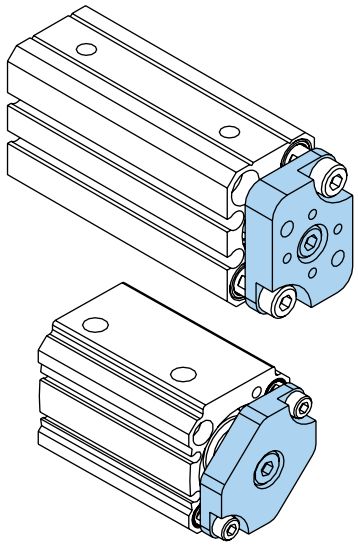
WR RECTANGULAR TOOL PLATE
(Available on Sizes 12 & 16 Only)

With this option, available only on the 12-16 mm cylinders, the unit is assembled with a rectangular tool plate. This provides an additional mounting orientation for Series 190 and 191 Grippers. This option with J or K mounting affects tool plate extension. See next page.

WB BLANK TOOL PLATE
(Sizes 12 through 63)

WRB BLANK RECTANGULAR TOOL PLATE
(Available on Sizes 12 & 16 Only)

With these options, PHD provides a tool plate without mounting threads and counterbores. The tool plate is supplied unassembled for easy modification by the customer. Assembly and torque specifications are furnished with each unit. When assembling the unit, a threadlocking adhesive is required on tool plate mounting screws. This option with J or K mounting affects tool plate extension. See next page.



NOTE: Blank tool plates are shipped unassembled.

V1 FLUOROELASTOMER SEALS

Fluoroelastomer seals are compatible with certain fluids which degrade standard Nitrile seals. Seal compatibility should be checked with the fluid manufacturer for correct application. Consult PHD for high temperature use.

Z1 CORROSION RESISTANT

Electroless nickel plating is provided on the retaining rings, tool plate mounting screws, “J” and “K” brackets, and bracket mounting screws. Stainless steel rod and guideshafts are also supplied. This option may reduce unit life.

J MOUNTS

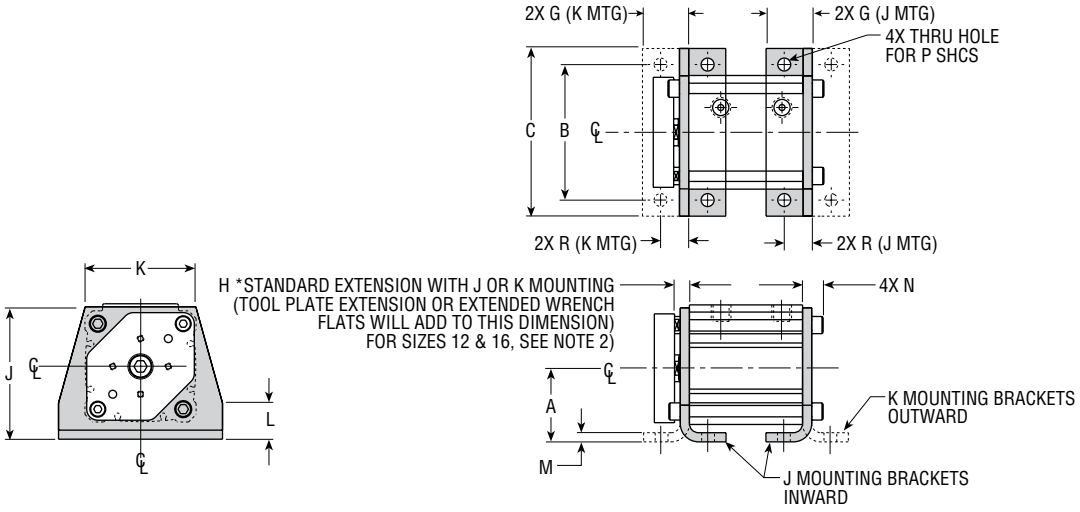
J mounting provides foot brackets (with mounting feet under the cylinder) with minimal distance between the cylinder and mounting surface. This mounting comes preassembled by PHD with proper tool plate extension.

NOTE: Double rods will also receive H standard extension.

K MOUNTS

K mounting provides foot brackets (with mounting feet extended outward from the cylinder.) Mounting is simplified with mounting holes away from the body. This mounting comes preassembled by PHD with proper tool plate extension.

NOTE: Double rods will also receive H standard extension.



BORE [mm]	LETTER DIMENSION											
	A	B	C	G	H	J	K	L	M	N	P	R
12	0.830 [21.1]	1.380 [35.1]	1.810 [46.0]	0.600 [15.2]	0.282 [9.0]	1.510 [38.4]	0.945 [24.0]	0.390 [9.9]	0.105 [2.67]	0.295 [7.5]	#10 [M5]	0.380 [9.7]
16	0.870 [22.1]	1.535 [39.0]	1.970 [50.0]	0.610 [15.5]	0.282 [9.0]	1.620 [41.2]	1.122 [28.5]	0.450 [11.4]	0.120 [3.05]	0.310 [7.9]	#10 [M5]	0.395 [10.0]
20	0.945 [24.0]	1.969 [50.0]	2.520 [64.0]	0.710 [18.0]	0.282 [9.0]	1.750 [44.5]	1.470 [37.4]	0.450 [11.4]	0.120 [3.05]	0.370 [9.4]	1/4 [M6]	0.435 [11.1]
25	1.005 [25.5]	2.047 [52.0]	2.600 [66.0]	0.725 [18.4]	0.282 [9.0]	1.890 [48.0]	1.581 [40.2]	0.490 [12.5]	0.135 [3.43]	0.390 [9.9]	1/4 [M6]	0.450 [11.4]
32	1.221 [31.0]	2.362 [60.0]	2.950 [74.9]	0.834 [21.2]	0.282 [9.0]	2.240 [57.0]	1.873 [47.6]	0.630 [16.0]	0.179 [4.55]	0.414 [10.5]	1/4 [M6]	0.519 [13.2]
40	1.400 [35.6]	2.677 [68.0]	3.310 [84.1]	0.885 [22.5]	0.282 [9.0]	2.560 [65.0]	2.190 [55.7]	0.670 [17.0]	0.179 [4.55]	0.429 [10.9]	1/4 [M6]	0.534 [13.6]
50	1.730 [44.0]	3.189 [81.0]	3.940 [100.1]	1.110 [28.2]	0.407 [11.0]	3.150 [80.0]	2.577 [65.5]	0.850 [21.6]	0.199 [5.05]	0.531 [13.5]	5/16 [M8]	0.699 [17.8]
63	2.010 [51.1]	3.661 [93.0]	4.530 [115.1]	1.250 [31.8]	0.407 [11.0]	3.660 [93.0]	3.055 [77.6]	1.000 [25.4]	0.250 [6.35]	0.570 [14.5]	5/16 [M8]	0.760 [19.3]

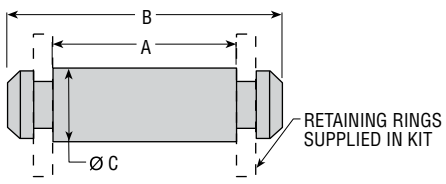
NOTES:

1) NUMBERS IN [ ] ARE IN mm FOR METRIC UNITS [CTx6].
2) *STANDARD ROD EXTENSION ON SIZE 12 & 16 UNITS WITH J OR K MOUNTS AND -WR OR -WRB OPTION IS 0.407 [10].
3) INSTALLATION OF SWITCHES ON UNITS WITH J OR K MOUNTS WILL REQUIRE TEMPORARY REMOVAL OF THE REAR BRACKET PRIOR TO THE MOUNTING CYLINDER.
4) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER.

ACCESSORIES: Series CTS Cylinders

CYLINDER FULCRUM PIN KIT

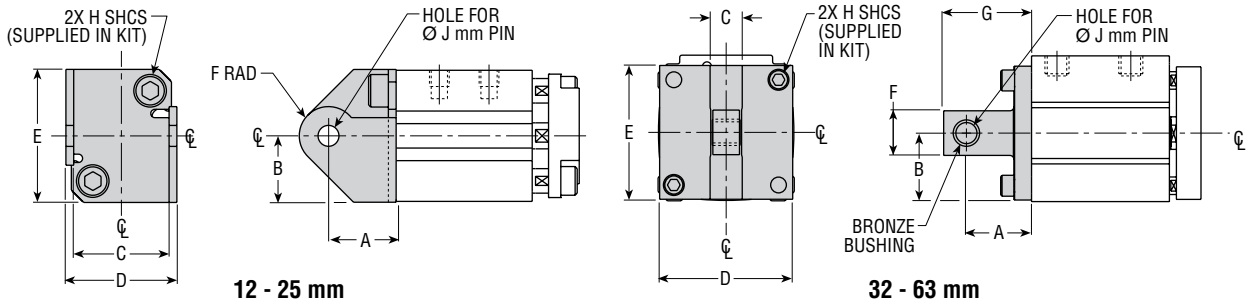
Cylinder Fulcrum Pin Kit replacement for base pivot or for use with PHD cylinder pivot. Pin is Brite Zinc plated. Retaining rings supplied.



BORE [mm]	DIMENSIONS			KIT: CTx2x, CTx6x IMPERIAL/METRIC
	A	B	Ø C	
12/16	1.120 [28.5]	1.300 [33.0]	0.197 [5.0]	60330-1
20/25	1.550 [39.4]	1.730 [44.0]	0.236 [6.0]	60331-1
32/40	1.240 [31.5]	1.490 [37.9]	0.394 [10.0]	60332-1
50/63	1.690 [42.9]	1.970 [50.0]	0.472 [12.0]	60333-1

Numbers in [ ] are in mm for metric units [CTx6].

CYLINDER PIVOT KIT

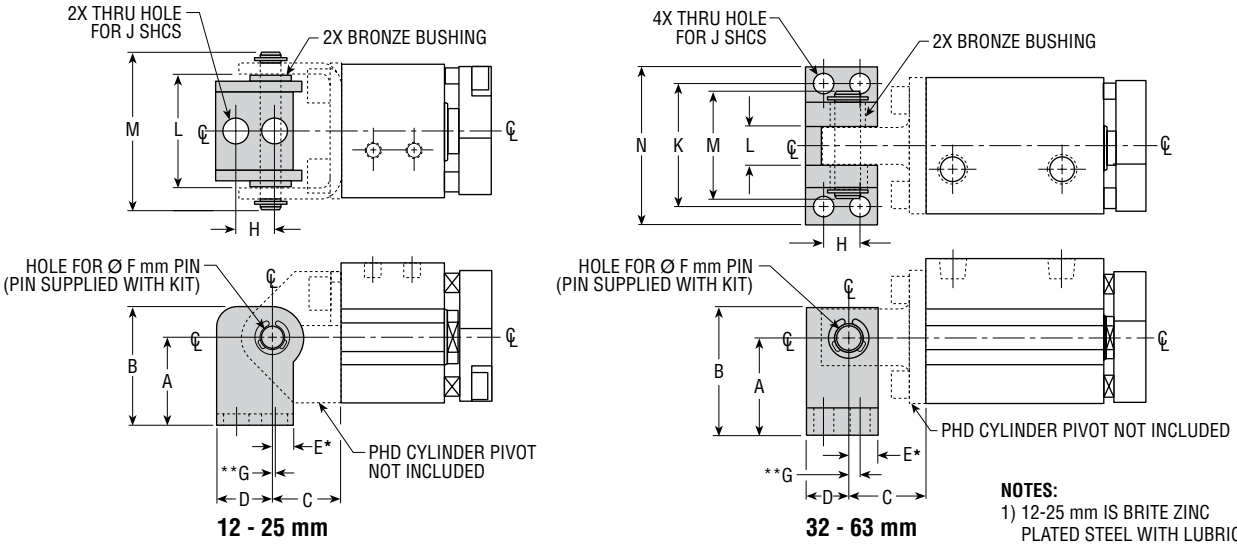


BORE [mm]	DIMENSIONS									KIT NO. IMPERIAL CTx2	KIT NO. METRIC CTx6
	A	B	C	D	E	F	G	H	J		
12	0.650 [16.5]	0.638 [16.2]	0.905 [23.00]	1.064 [27.0]	1.276 [32.9]	0.281 [7.1]	—	10-24 [M5 x 0.8]	0.197 [5.0]	60278-1	60286-1
16	0.650 [16.5]	0.678 [17.2]	0.905 [23.00]	1.064 [27.0]	1.356 [34.9]	0.281 [7.1]	—	10-24 [M5 x 0.8]	0.197 [5.0]	60279-1	60287-1
20	0.790 [20.1]	0.750 [19.1]	1.250 [31.75]	1.500 [38.1]	1.500 [38.1]	0.355 [9.0]	—	1/4-20 [M6 x 1.0]	0.236 [6.0]	60280-1	60288-1
25	0.790 [20.1]	0.800 [20.3]	1.250 [31.75]	1.500 [38.1]	1.600 [40.6]	0.355 [9.0]	—	1/4-20 [M6 x 1.0]	0.236 [6.0]	60281-1	60289-1
32	1.065 [27.0]	0.935 [23.8]	0.490 [12.45]	1.870 [47.5]	1.870 [47.5]	0.820 [21.0]	1.475 [37.5]	1/4-20 [M6 x 1.0]	0.394 [10.0]	60282-1	60290-1
40	1.065 [27.0]	1.105 [28.1]	0.490 [12.45]	2.210 [56.1]	2.210 [56.1]	0.820 [21.0]	1.475 [37.5]	1/4-20 [M6 x 1.0]	0.394 [10.0]	60283-1	60291-1
50	1.460 [37.1]	1.300 [33.0]	0.600 [15.24]	2.600 [66.0]	2.600 [66.0]	1.000 [25.4]	1.970 [50.0]	5/16-18 [M8 x 1.25]	0.472 [12.0]	60284-1	60292-1
63	1.460 [37.1]	1.500 [38.1]	0.600 [15.24]	3.000 [76.2]	3.000 [76.2]	1.000 [25.4]	1.970 [50.0]	5/16-18 [M8 x 1.25]	0.472 [12.0]	60285-1	60293-1

Numbers in [ ] are in mm for metric units [CTx6].

NOTES:
1) 12-25 mm IS BRITE ZINC PLATED STEEL
2) 32-63 mm IS ANODIZED ALUMINUM WITH LUBRICATED BRONZE BUSHINGS
3) FULCRUM PIN NOT INCLUDED (SEE "FULCRUM PIN KITS" TO PURCHASE)
4) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER
5) UNLESS OTHERWISE DIMENSIONED, FEATURES ARE CENTERED ON CYLINDER CENTERLINE

BASE PIVOT KIT



BORE [mm]	DIMENSIONS													KIT: CTx2x, CTx6x IMPERIAL/METRIC
	A	B	C	D	E	Ø F	G	H	J	K	L	M	N	
12/16	0.865 [22.0]	1.145 [29.0]	0.650 [16.5]	0.490 [12.5]	0.220 [5.6]	0.197 [5.0]	0.060 [1.5]	0.375 [9.5]	#10 [M5]	N/A	0.877 [22.3]	1.300 [33.0]	N/A	60294-1
20/25	1.000 [25.4]	1.355 [34.4]	0.790 [20.1]	0.630 [16.0]	0.260 [6.5]	0.237 [6.0]	0.040 [1.0]	0.435 [11.0]	1/4 [M6]	N/A	1.221 [31.0]	1.730 [44.0]	N/A	60295-1
32/40	1.375 [34.9]	1.800 [45.7]	1.065 [27.0]	0.600 [15.2]	0.400 [10.2]	0.394 [10.0]	0.156 [4.0]	0.510 [13.0]	1/4 [M6]	1.695 [43.0]	0.540 [13.7]	1.490 [38.0]	2.165 [55.0]	60296-1
50/63	1.890 [48.0]	2.365 [60.0]	1.460 [37.1]	0.755 [19.2]	0.508 [12.9]	0.472 [12.0]	0.236 [6.0]	0.709 [18.0]	5/16 [M8]	2.265 [57.5]	0.659 [16.7]	1.970 [50.0]	2.835 [72.0]	60297-1

Numbers in [ ] are in mm for metric units [CTx6].

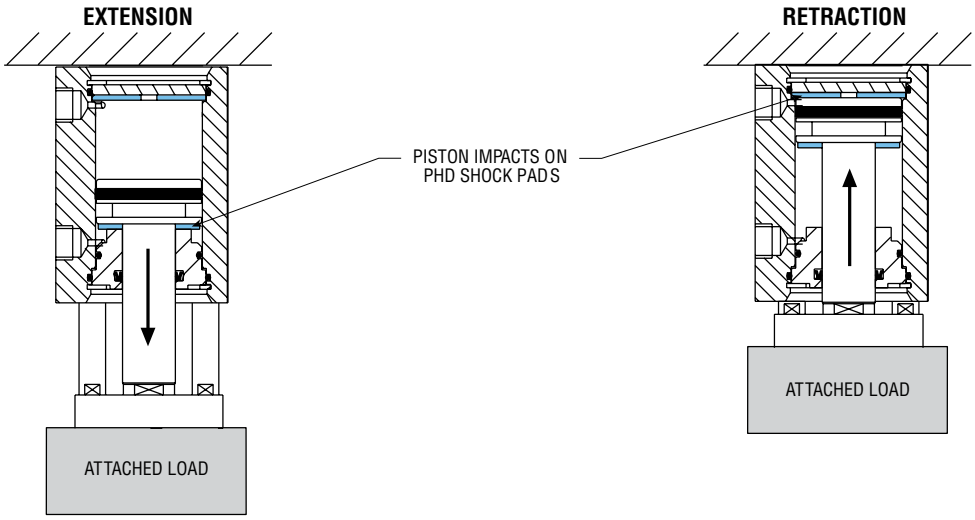
NOTES:
1) 12-25 mm IS BRITE ZINC PLATED STEEL WITH LUBRICATED BRONZE BUSHINGS
2) 32-63 mm IS ANODIZED ALUMINUM WITH LUBRICATED BRONZE BUSHINGS
3) FULCRUM PIN INCLUDED. DOES NOT INCLUDE CYLINDER PIVOT KIT
4) *E IS TO CENTER OF PIVOT PIN
5) **G IS FROM CENTER OF PIVOT PIN TO CENTER OF FIRST MOUNTING HOLE
6) DESIGNATED CENTERLINE ℄ IS CENTERLINE OF CYLINDER AND PIVOT PIN.

BEST PRACTICES FOR MAXIMUM CYLINDER LIFE

Maximum cylinder life can be achieved by using the cylinder to provide power and motion while externally stopping any attached loads. Shown below are examples of how to apply the Series CTS Cylinder.

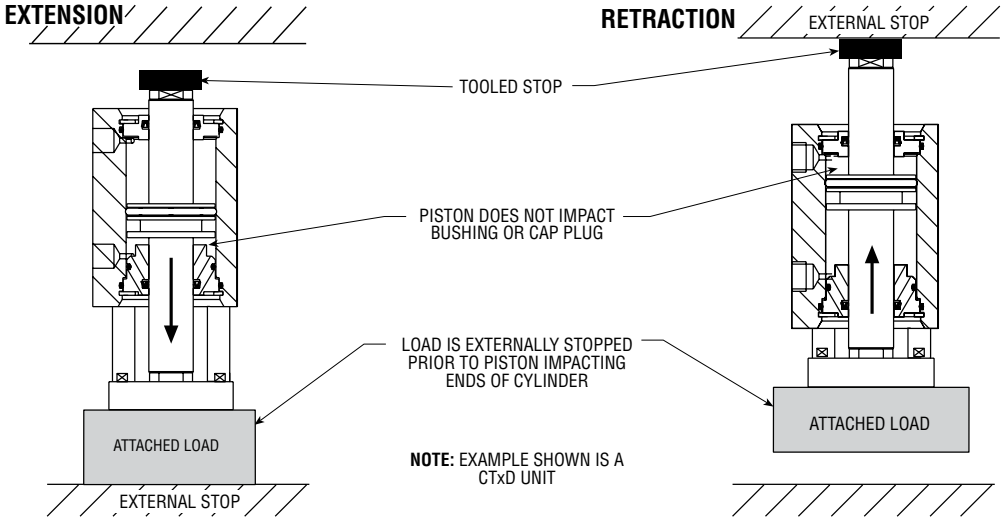
APPLICATION #1 - ATTACHED LOAD (WITH INTERNAL SHOCK PADS)

When attached loads cannot be stopped externally, optional internal shock pads are required for maximum cylinder life. It is also recommended that flow controls are used to regulate the velocity of the load and limit the kinetic energy at end of stroke.



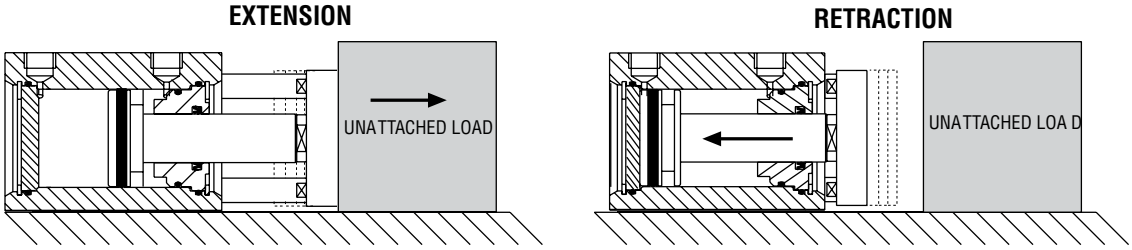
APPLICATION #2 - ATTACHED LOADS EXTERNALLY STOPPED (WITHOUT INTERNAL SHOCK PADS)

Shock pads are not required if an attached load is externally stopped to prevent piston from contacting the bushings or cap plugs.



APPLICATION #3 - UNATTACHED LOADS (WITHOUT INTERNAL SHOCK PADS)

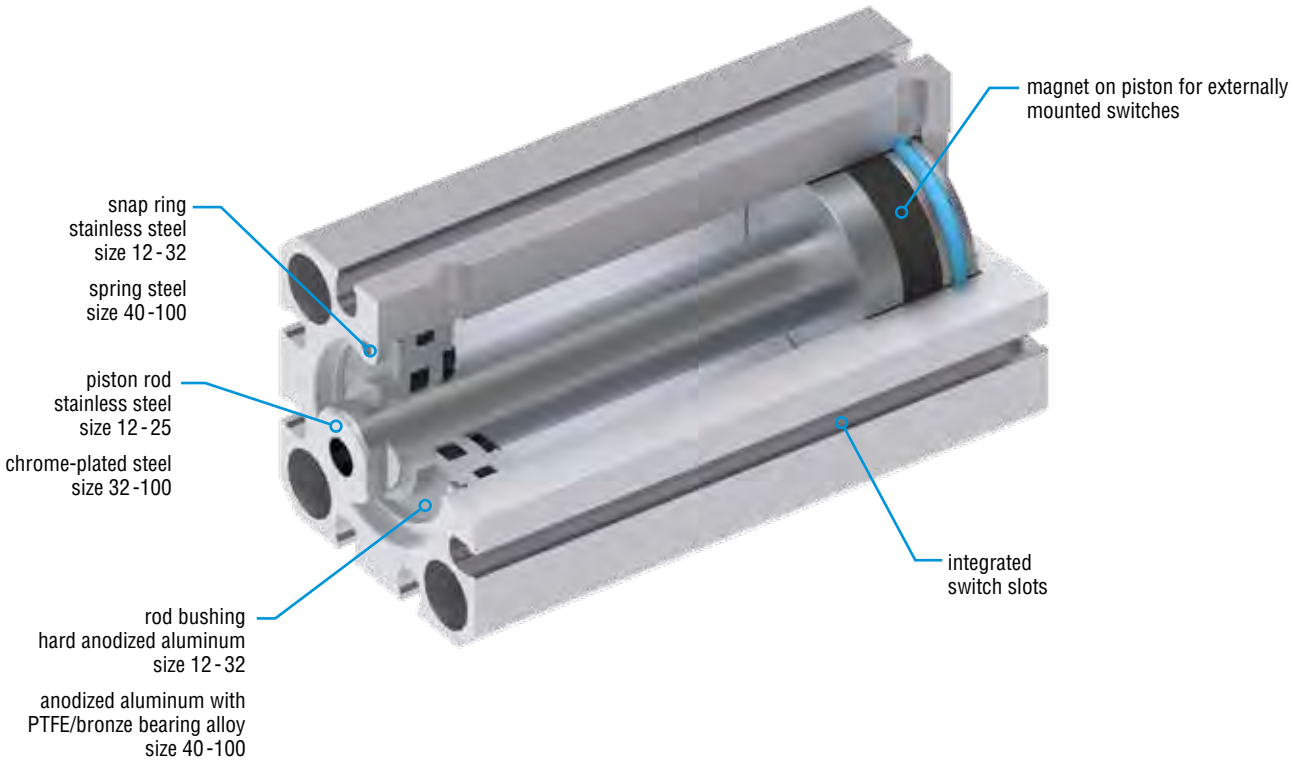
Shock pads are not required on units with unattached loads.



OCQ

Major Benefits

- Standard shock pads reduce end of travel impact
- 10 bore sizes available in incremental stroke lengths
- Standard magnets for switch sensing capability
- Drop-in metric mounting matching global standard
- Proven Optimax® performance at a competitive price



COMPONENT	MATERIALS
BODY	Anodized Aluminum Alloy
BORE PLUG	
SNAP RING	See Figure
PISTON ROD	
ROD BUSHING	
ROD SEAL	NBR
SHOCK PADS	
PISTON SEAL	
O-RINGS	
PISTON WEAR RING*	PTFE

*Size 32 through 100 only

TO ORDER SPECIFY:
Model No., Design No., Travel, Size, and any options required.

SIZE	BORE	AREA	AREA
mm	in	sq mm	sq in
12	0.472	113	0.18
16	0.630	201	0.31
20	0.787	314	0.49
25	0.984	491	0.76
32	1.260	804	1.25
40	1.575	1257	1.95
50	1.969	1963	3.04
63	2.480	3117	4.83
80	3.150	5027	7.79
100	3.937	7854	12.17

MODEL NO.

TYPE
S - Single Rod, Double Acting

OCQ S 5 - 12 x 20 - SDNK2

DESIGN NO.
5 - Metric

STANDARD TRAVEL LENGTHS

SIZE	mm											
12	5	10	15	20	25	30	—	—	—	—	—	—
16	5	10	15	20	25	30	—	—	—	—	—	—
20	5	10	15	20	25	30	35	40	45	50	—	—
25	5	10	15	20	25	30	35	40	45	50	—	—
32	5	10	15	20	25	30	35	40	45	50	75	100
40	5	10	15	20	25	30	35	40	45	50	75	100
50	—	10	15	20	25	30	35	40	45	50	75	100
63	—	10	15	20	25	30	35	40	45	50	75	100
80	—	10	15	20	25	30	35	40	45	50	75	100
100	—	10	15	20	25	30	35	40	45	50	75	100

SWITCH BUNDLE OPTION CODE
(see Notes 3-4)

SD x K2

SWITCH CIRCUITRY
D - DC Reed
N - DC Solid State NPN - Sink
P - DC Solid State PNP - Source

CABLE TYPE
K - Quick Connect

NOTES:
1) Switch bundle includes 2 switches
2) Switch bundle available with actuator only
3) Switches available in Quick Connect only
4) Magnets standard for switch sensing

SWITCHES

PART NO.	DESCRIPTION
86725-0	Reed DC 5-30 V, 50 mA, Quick Connect
86726-0	Sink Type (NPN), DC 5-30 V, 50 mA, Quick Connect
86727-0	Source Type (PNP), DC 5-30 V, 50 mA, Quick Connect

Includes one switch.

CORDSETS

MODEL NO.	CABLE LENGTH
63549-02	78.74 in [2 m]
63549-05	196.85 in [5 m]

Includes one cordset.

CAD & Sizing Assistance

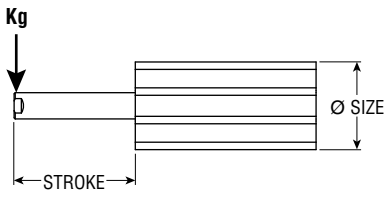
Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

SPECIFICATIONS	SERIES OCQ CYLINDER			
	12 - 16 mm	20 - 50 mm	63 - 80 mm	100 mm
OPERATING AIR PRESSURE	0.7 - 10 bar [10.2 - 145 psi]	0.5 - 10 bar [7.3 - 145 psi]		
OPERATING TEMPERATURE	5° - 60°C [41° - 140°F]			
VELOCITY	50 - 500 mm/s [2 - 20 in/s]		50 - 300 mm/s [2 - 13 in/s]	50 - 200 mm/s [2 - 8 in/s]
RATED LIFE	3 million cycles			
LUBRICATION	Factory lubricated for rated life			

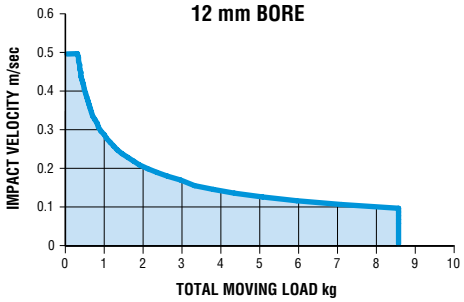
SIZE	ROD DIAMETER mm	EFFECTIVE AREA			UNIT WEIGHT (g) BY STROKE											
		DIRECTION	mm^2	in^2	5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	50 mm	75 mm	100 mm
12	6	Extend	113	0.18	32	39	46	52	60	67	—	—	—	—	—	—
		Retract	85	0.13												
16	8	Extend	201	0.31	43	51	60	69	78	86	—	—	—	—	—	—
		Retract	151	0.23												
20	10	Extend	314	0.49	67	80	95	109	123	138	152	165	180	194	—	—
		Retract	236	0.37												
25	12	Extend	491	0.76	104	121	140	157	176	194	212	230	249	266	—	—
		Retract	378	0.59												
32	16	Extend	804	1.25	130	152	173	193	215	236	257	278	299	320	475	581
		Retract	603	0.93												
40	16	Extend	1257	1.95	194	217	240	263	287	309	332	356	378	402	587	708
		Retract	1056	1.64												
50	20	Extend	1963	3.04	—	343	378	412	446	480	515	549	583	617	897	1074
		Retract	1649	2.56												
63	20	Extend	3117	4.83	—	493	534	574	615	655	696	737	776	818	1168	1377
		Retract	2803	4.34												
80	25	Extend	5027	7.79	—	925	987	1050	1114	1177	1239	1302	1366	1428	1971	2282
		Retract	4536	7.03												
100	30	Extend	7854	12.17	—	1720	1809	1898	1988	2076	2166	2255	2343	2433	3244	3697
		Retract	7147	11.08												

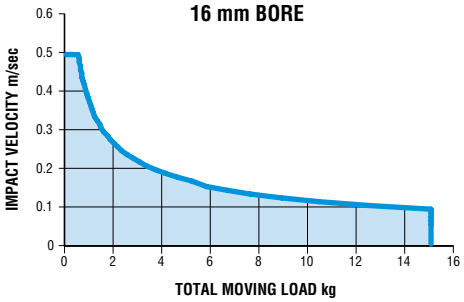
SIZE	WEIGHT (g) OF MOVING COMPONENTS BY STROKE											
	5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	50 mm	75 mm	100 mm
12	8	9	10	11	12	13	—	—	—	—	—	—
16	16	18	20	22	24	26	—	—	—	—	—	—
20	25	28	30	33	36	40	43	46	49	51.4	—	—
25	39	43	48	52	57	60	65	69	74	77.6	—	—
32	73	80	87	95	103	110	118	126	133	140	178	217
40	101	109	117	125	132	140	148	156	164	172	210	249
50	—	176	188	200	211	224	236	248	260	273	333	393
63	—	244	257	269	282	295	307	320	332	346	409	472
80	—	405	426	445	464	483	503	522	541	561	657	753
100	—	710	738	767	795	824	853	881	910	939	1081	1223

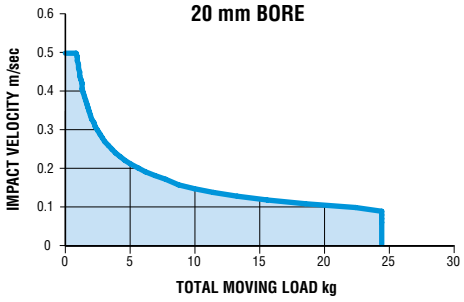
SIZE	MAXIMUM LATERAL LOAD (kg) BY STROKE											
	5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	50 mm	75 mm	100 mm
12	0.22	0.19	0.16	0.14	0.12	0.11	—	—	—	—	—	—
16	0.44	0.37	0.32	0.29	0.25	0.22	—	—	—	—	—	—
20	0.76	0.64	0.56	0.50	0.45	0.41	0.38	0.35	0.32	0.30	—	—
25	1.1	0.98	0.87	0.77	0.69	0.62	0.57	0.52	0.49	0.46	—	—
32	1.8	1.5	1.4	1.2	1.1	1.0	0.92	0.84	0.76	0.71	0.56	0.45
40	2.1	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.99	0.76	0.61
50	—	3.0	2.7	2.4	2.2	2.0	1.8	1.7	1.6	1.5	1.2	0.94
63	—	4.8	4.4	4.0	3.7	3.4	3.1	2.8	2.6	2.4	2.0	1.6
80	—	8.2	7.5	6.9	6.4	5.9	5.5	5.1	4.8	4.6	3.6	2.9
100	—	12.4	11.5	10.7	10.0	9.4	8.9	8.4	7.9	7.5	6.1	5.1

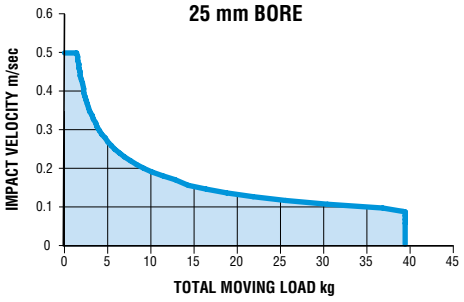


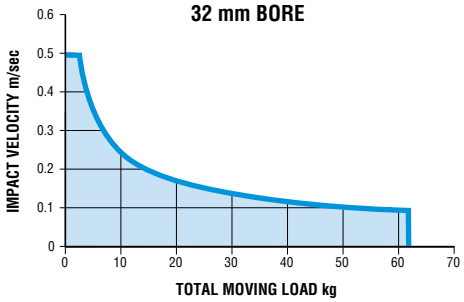
MAXIMUM ALLOWABLE KINETIC ENERGY

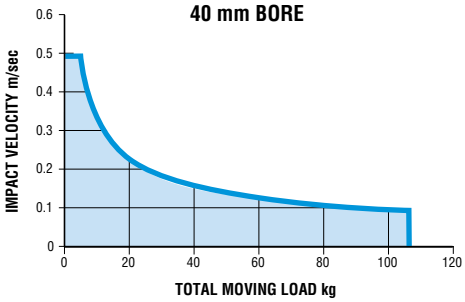


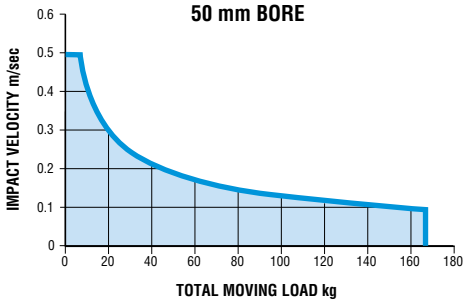


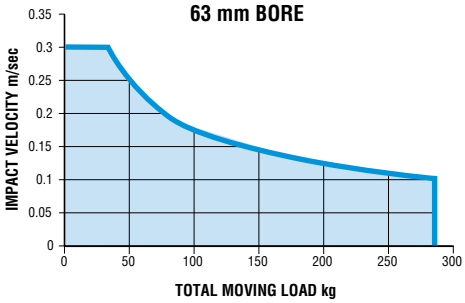


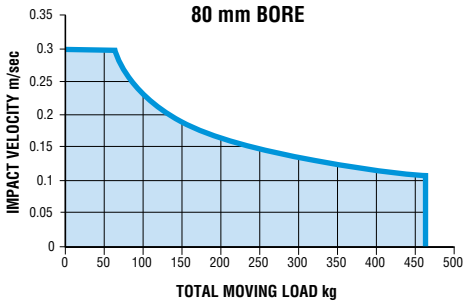


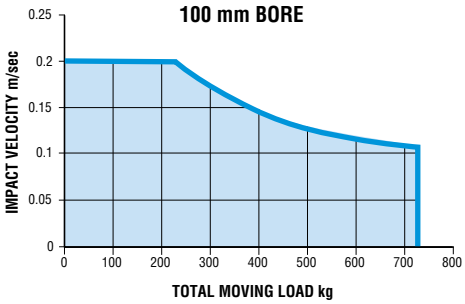




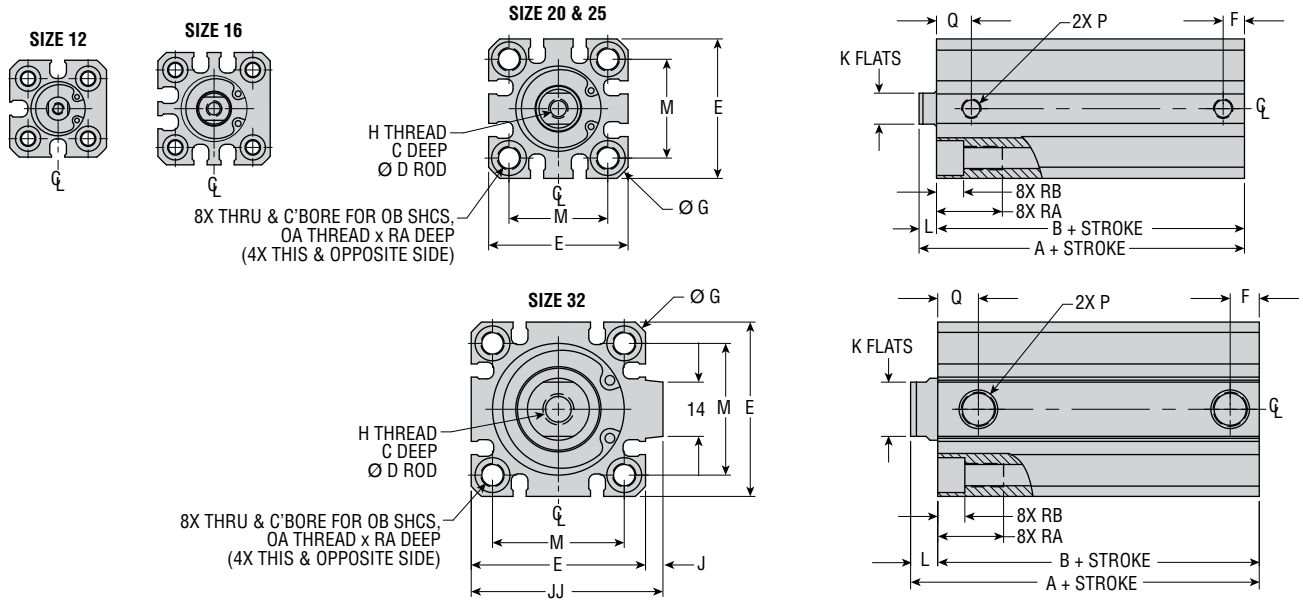








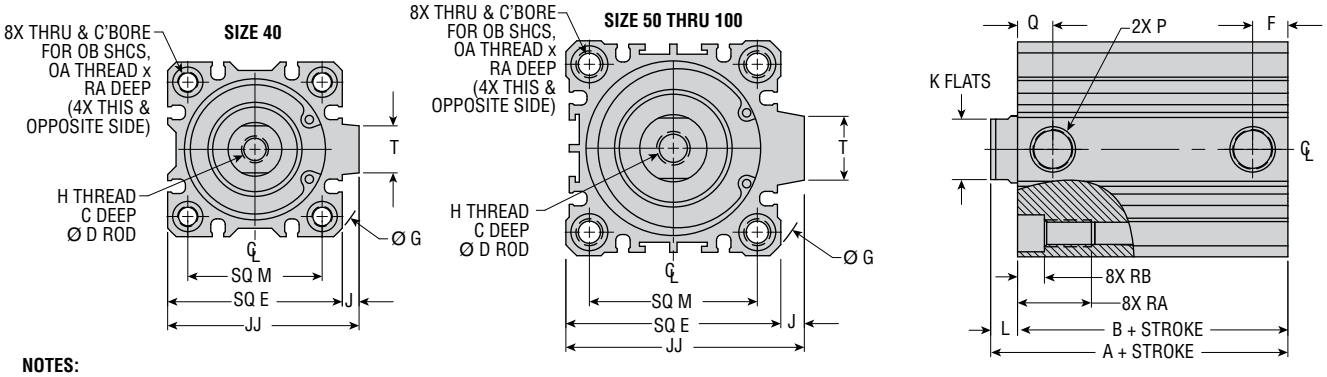
SIZES 12 THRU 32



NOTES:
1) DESIGNATED CENTERLINE IS CENTERLINE OF CYLINDER
2) UNLESS OTHERWISE DIMENSIONED, MOUNTING HOLE PATTERNS ARE CENTERED ON DESIGNATED CENTERLINE OF CYLINDER

BORE SIZE	A	B	C	Ø D	E	F	Ø G	H	J	JJ	K	L	M	P	OA	OB	Q	RA	RB
12	25.5	22	6	6	25	5	32	M3 x 0.5	—	—	5	3.5	15.5	M5 x 0.8	M4 x 0.7	M3	7.5	11	4
16	25.5	22	8	8	29	5	38	M4 x 0.7	—	—	6	3.5	20	M5 x 0.8	M4 x 0.7	M3	7.5	11	4
20	34	29.5	7	10	36	5.5	47	M5 x 0.8	—	—	8	4.5	25.5	M5 x 0.8	M6 x 1	M5	9	17	7
25	37.5	32.5	12	12	40	5.5	52	M6 x 1	—	—	10	5	28	M5 x 0.8	M6 x 1	M5	11	17	7
32	40	33	13	16	45	7.5	60	M8 x 1.25	4.5	49.5	14	7	34	G 1/8	M6 x 1	M5	10.5	17	7

SIZES 40 THRU 100



NOTES:
1) DESIGNATED CENTERLINE IS CENTERLINE OF CYLINDER
2) UNLESS OTHERWISE DIMENSIONED, MOUNTING HOLE PATTERNS ARE CENTERED ON DESIGNATED CENTERLINE OF CYLINDER

BORE SIZE	A	B	C	Ø D	E	F	Ø G	H	J	JJ	K	L	M	P	OA	OB	Q	RA	RB	T
40	46.5	39.5	13	16	52	8	70	M8 x 1.25	5	57	14	7	40	G 1/8	M6 x 1	M5	11	17	7	14
50	48.5	40.5	15	20	64	10.5	86	M10 x 1.5	7	71	17	8	50	G 1/4	M8 x 1.25	M6	10.5	22	8	19
63	54	46	15	20	77	10.5	103	M10 x 1.5	7	84	17	8	60	G 1/4	M10 x 1.5	M8	15	28.5	10.5	19
80	63.5	53.5	21	25	98	12.5	132	M16 x 2	6	104	22	10	77	G 3/8	M12 x 1.75	M10	16	35.5	13.5	26
100	75	63	27	30	117	13	156	M20 x 2.5	6.5	123.5	27	12	94	G 3/8	M12 x 1.75	M10	23	35.5	13.5	26

All dimensions are reference only unless specifically toleranced.

FLANGE MOUNTING KITS

87785 - 016

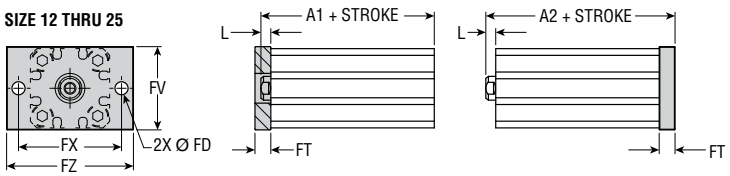
IT BASE PART NUMBER

CYLINDER BORE SIZE

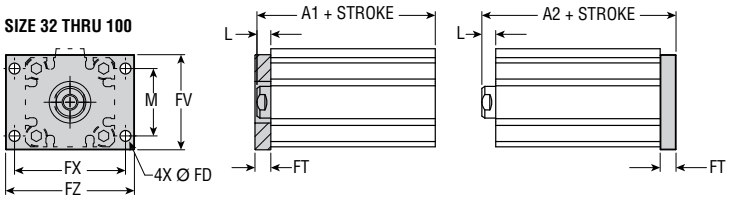
012 = 12 mm	040 = 40 mm
016 = 16 mm	050 = 50 mm
020 = 20 mm	063 = 60 mm
025 = 25 mm	080 = 80 mm
032 = 32 mm	100 = 100 mm

SIZE	FLANGE MOUNT DIMENSIONS								
	A1	A2	FD	FT	FV	FX	FZ	L	M
12	25.5	31	4.5	5.5	25	45	55	3.5	—
16	25.5	31	4.5	5.5	30	45	55	3.5	—
20	34	42	6.6	8	39	48	60	4.5	—
25	37.5	45.5	6.6	8	42	52	64	5	—
32	40	48	5.5	8	48	56	65	7	34
40	46.5	54.5	5.5	8	54	62	72	7	40
50	48.5	57.5	6.6	9	67	76	89	8	50
63	54	63	9	9	80	92	108	8	60
80	63.5	74.5	11	11	99	116	134	10	77
100	75	86	11	11	117	136	154	12	94

SIZE 12 THRU 25



SIZE 32 THRU 100



NOTES:
1) KIT MAY BE ATTACHED TO EITHER END OF CYLINDER. EACH KIT CONTAINS SINGLE FLANGE MOUNTING PLATE AND NECESSARY FASTENERS FOR MOUNTING TO CYLINDER.
2) CYLINDER SHOWN FOR REFERENCE ONLY.

FOOT MOUNTING KITS

87784 - 016

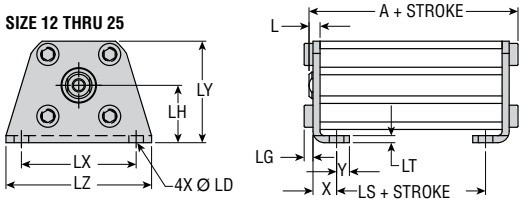
BASE PART NUMBER

CYLINDER BORE SIZE

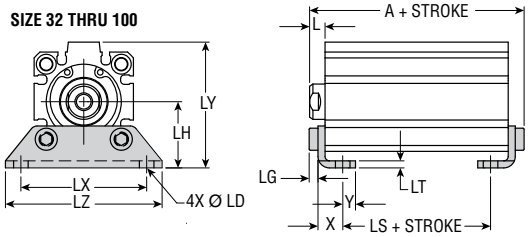
012 = 12 mm	040 = 40 mm
016 = 16 mm	050 = 50 mm
020 = 20 mm	063 = 60 mm
025 = 25 mm	080 = 80 mm
032 = 32 mm	100 = 100 mm

SIZE	FOOT MOUNT DIMENSIONS											
	A	LS	L	LD	LG	LH	LT	LX	LY	LZ	X	Y
12	30.3	10	3.5	4.5	2.8	17	2	34	29.5	44	8	4.5
16	30.3	10	3.5	4.5	2.8	19	2	38	33.5	48	8	5
20	41.2	17.5	4.5	6.6	4	24	3.2	48	42	62	9.2	5.8
25	44.7	17.5	5	6.6	4	26	3.2	52	46	66	10.7	5.8
32	47.2	17	7	6.6	4	30	3.2	57	57	71	11.2	5.8
40	53.7	23.5	7	6.6	4	33	3.2	64	64	78	11.2	7
50	56.7	17.5	8	9	5	39	3.2	79	78	95	14.7	8
63	62.2	20	8	11	5	46	3.2	95	91.5	113	16.2	9
80	75	23.5	10	13	7	59	4.5	118	114	140	19.5	11
100	88	29	12	13	7	71	6	137	136	162	23	12.5

SIZE 12 THRU 25



SIZE 32 THRU 100



NOTES:
1) EACH KIT CONTAINS BRACKET AND MOUNTING HARDWARE FOR ONE END ONLY.
2) CYLINDER SHOWN FOR REFERENCE ONLY.

REAR FORK MOUNTING KITS

87788 - 016

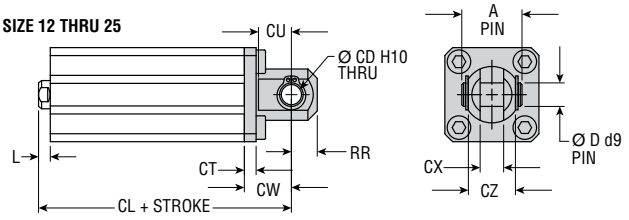
KIT BASE PART NUMBER

CYLINDER BORE SIZE

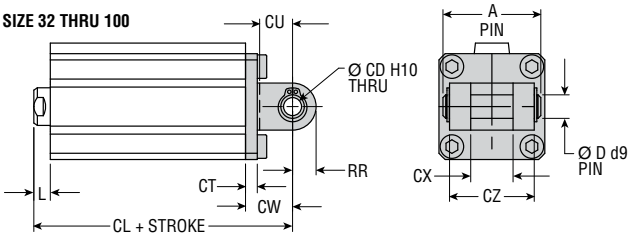
012 = 12 mm	040 = 40 mm
016 = 16 mm	050 = 50 mm
020 = 20 mm	063 = 60 mm
025 = 25 mm	080 = 80 mm
032 = 32 mm	100 = 100 mm

SIZE	REAR FORK MOUNT DIMENSIONS										
	A	CL	Ø CD	Ø D	CT	CU	CW	CX	CZ	L	RR
12	14.6	39.5	5	5	4	7	14	5	10	3.5	6
16	16.6	40.5	5	5	4	10	15	6.5	12	3.5	6
20	21	52	8	8	5	12	18	8	16	4.5	9
25	25.6	57.5	10	10	5	14	20	10	20	5	10
32	41.6	60	10	10	5	14	20	18	36	7	10
40	41.6	68.5	10	10	6	14	22	18	36	7	10
50	50.6	76.5	14	14	7	20	28	22	44	8	14
63	50.6	84	14	14	8	20	30	22	44	8	14
80	64	101.5	18	18	10	27	38	28	56	10	18
100	72	120	22	22	13	31	45	32	64	12	22

SIZE 12 THRU 25



SIZE 32 THRU 100



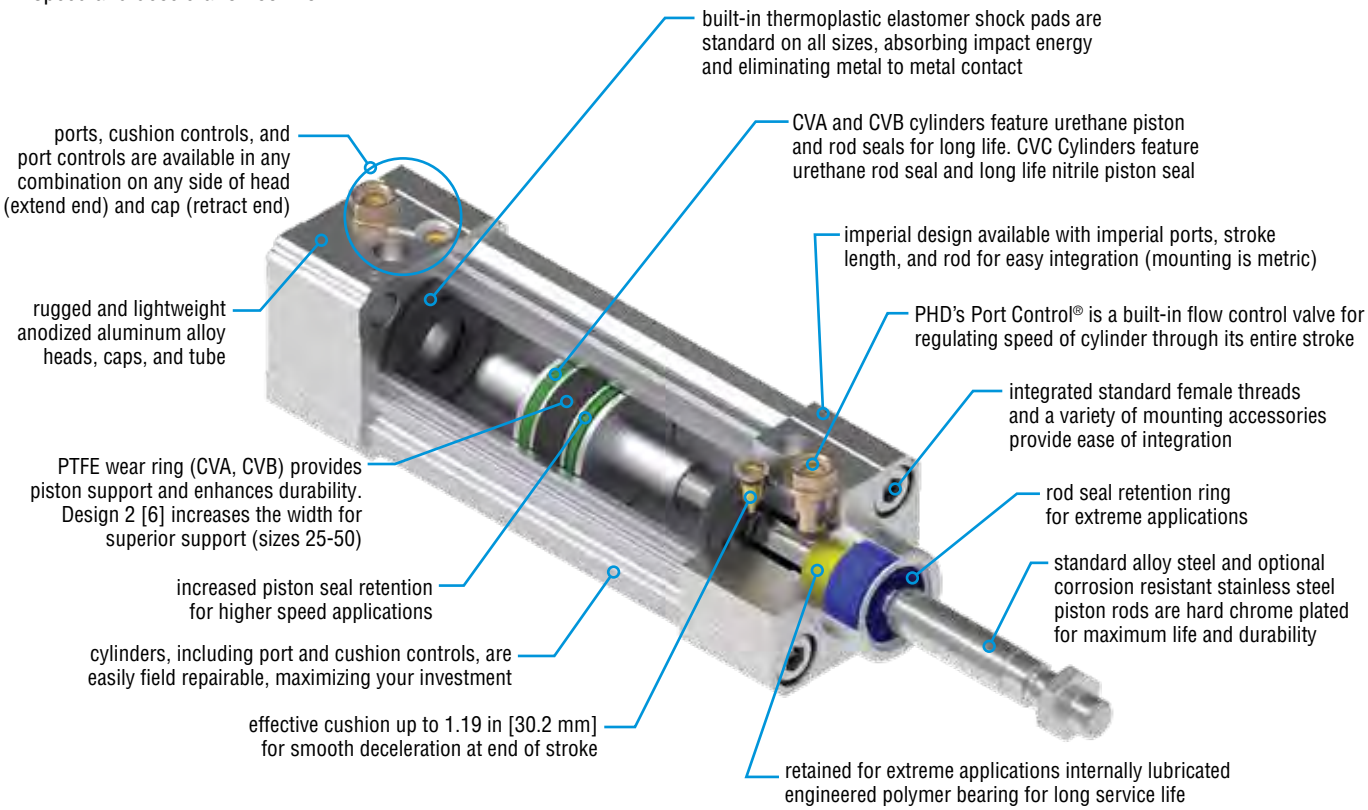
NOTES:
1) EACH KIT CONTAINS: REAR FORK, FASTENERS FOR MOUNTING TO CYLINDER, PIN, AND RETAINING RINGS
2) CYLINDER SHOWN FOR REFERENCE ONLY.

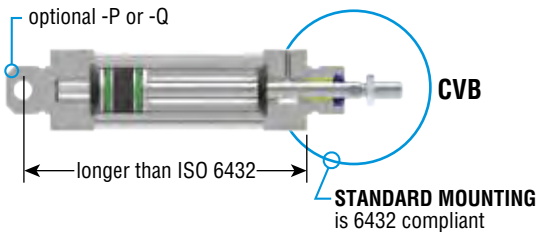
All dimensions are reference only unless specifically toleranced.

CV

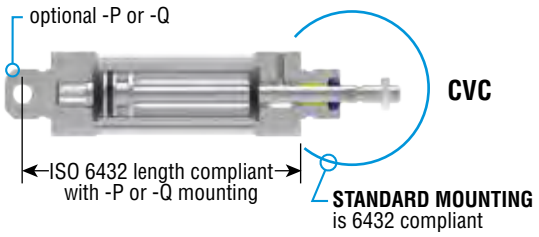
Major Benefits

- ISO/VDMA interchange for easy mounting (metric unit).
- Imperial unit provides simplified integration in imperial facilities.
- PTFE wear ring and built-in shock pads for long cylinder life.
- Rodlok option for easy and dependable locking of piston rod.
- Optional built-in port controls and cushions for superior speed and deceleration control.





- Available in 20 & 25 mm bores
- Same construction as CVA
- ISO 6432 compliant rod and mountings (metric unit)
- Longer strokes and lower breakaway than CVC
- Distance between mountings is longer than ISO 6432 specifications (metric unit)



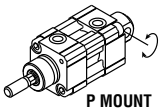
- Available in 20 & 25 mm bores
- Same construction as CVA and CVB, uses compression piston seal
- ISO 6432 compliant rod and mountings (metric unit)
- ISO 6432 compliant length between mountings (metric unit)
- Shorter length than CVB

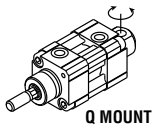
ORDERING DATA: Series CV Cylinders

TO ORDER, SPECIFY:
Product, Series, Type, Design No., Mounting Style, Bore Size, Stroke, and any Options.

THREE POSITION UNIT
Specify only if needed. Not available on Series CVC. See note 7.

REAR PIVOT MOUNTING STYLES (20 and 25 mm BORES ONLY)

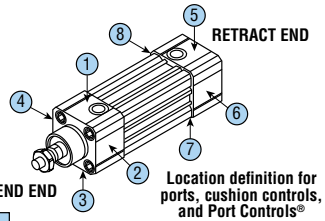




STROKE LENGTHS
(15 mm (5/8") = minimum stroke in 1 mm (1/8") increments)

BORE	METRIC MAXIMUM STROKE mm	IMPERIAL MAXIMUM STROKE in
CVC20	500	20
CVC25	500	20
CVB20	750	30
CVB25	750	30
32	1000	40
40	1000	40
50	1000	40
63	1000	40
80	1000	40
100	1000	40

Contact PHD for shorter or longer strokes.



PRODUCT
C - Cylinder

TYPE
S - Single Rod, double acting (Standard)
D - Double Rod, ⊛ double acting (Not available on 3 position units.)

MOUNTING STYLE
P - Rear pivot in position 5
Q - Rear pivot in position 6
V - Standard mounting 4 female threads each end per ISO 6431/VDMA 24562 & ISO 6432*
(-P and -Q available on 20 & 25 mm bores only)

CUSHION CONTROL
DB - Cushion Controls Both Ends
DE - Cushion Control Extend Only
DR - Cushion Control Retract Only
Standard cushion control locations are 1 & 5. See note 7.

OPTIONAL PORT LOCATION
UB00 - Ports on all sides, both ends (Not available with Port Controls on same end) Contact PHD For other combinations. Standard port locations are 1 & 5. See note 7.

C VB S E 6 P 20 x 25 x 25 - PB DB - UB00 - M-Z1

SERIES SIZES 20 & 25 mm ONLY
VB - ISO 6432 150 psi [10 bar] air See note 8.
VC - ISO 6432 150 psi [10 bar] air See note 9.

SERIES SIZES 32-100 mm ONLY
VA - VDMA 24562 ISO 6431 150 psi [10 bar] air

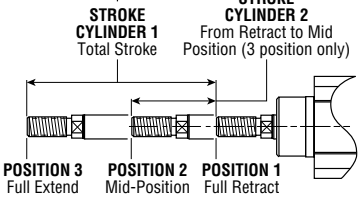
DESIGN NO.
2 - Imperial ⊛ (See note 5.)
6 - Metric

BORE SIZE

BORE mm	BORE in	PISTON AREA sq mm	PISTON AREA sq in
20	0.787	314	0.486
25	0.984	491	0.760
32	1.26	804	1.25
40	1.58	1257	1.95
50	1.97	1963	3.05
63	2.48	3117	4.83
80	3.15	5027	7.79
100	3.94	7854	12.17

PORT CONTROL® ⊛ BUILT-IN METER OUT FLOW CONTROL VALVE
PB - Port Controls Both Ends
PE - Port Control Extend Only
PR - Port Control Retract Only
Standard cushion control locations are 1 & 5. See note 7.

CYLINDER OPTIONS
F22 - 4 Wrench Flats on Rod
F44 - No Wrench Flats on Rod ⊛
H46 - Rodlok ready cylinder (CVxS only) ⊛ See Note 2.
H47 - Rodlok unit includes locking device ⊛ Adaptor and cylinder preassembled (CVxS only). See Note 2.
K_ - Extra Rod Extension ⊛ in 5 mm (1/8") increments. Length code is K5 = 5 mm (5/8"), K15 = 15 mm (1-7/8"), etc.
L7 - G Port (BSPP) on imperial units
L9 - NPT Ports ⊛ on metric units
M - Magnetic piston for use with PHD Miniature Reed and Solid State Switches
T44 - Female Rod End Undersized Thread ⊛
T55 - Plain Rod End ⊛
TEE - Male Rod with Oversized Thread (CVAx only) ⊛
Z1 - Corrosion Resistant, chrome-plated Stainless Steel Rod, and appropriate coating on ferrous parts.



NOTES:
1) -Z1 option may have reduced cylinder performance due to chrome-plated stainless steel rod in place of chrome-plated alloy steel.
2) -H46 & -H47 is not available in -Z1.
3) *For mounting accessories and dimensions, see accessories section.
4) ⊛ Marked options provide additional cylinder flexibility, but do not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.
5) Imperial unit provides imperial ports, rod ends, and stroke. Mountings are metric.
6) For switch information, see switch option page and Switches section.
7) On 3 position units, ports, options -DB and/or -PB are available in locations 1 and 5 only. Contact PHD for other configurations. See option pages.
8) Customer interface conforms to ISO 6432, but longer length than ISO 6432.
9) Customer interface and lengths conform to ISO 6432 with optional -P or -Q mounting specified on CVC only.

⚠ Options may affect unit length. See dimensional pages and option information details.

SERIES 6250 SOLID STATE SWITCHES

PART NO.	DESCRIPTION	COLOR
62505-1-02	NPN (Sink) DC Solid State, 2 m cable	Brown
62506-1-02	PNP (Source) DC Solid State, 2 m cable	Tan
62515-1	NPN (Sink) DC Solid State, Quick Connect	Brown
62516-1	PNP (Source) DC Solid State, Quick Connect	Tan

NOTE: Switches must be ordered separately. See Switches and Sensors section for complete switch information.

SERIES 6250 REED SWITCHES

PART NO.	DESCRIPTION	COLOR
62507-1-02	AC/DC Reed, 2 m cable	Silver
62517-1	AC/DC Reed, Quick Connect	Silver

CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

SPECIFICATIONS	SERIES CVA, CVB	SERIES CVC
OPERATING PRESSURE SINGLE ROD	7.5 to 150 psi [0.5 bar to 10 bar]	10 to 150 psi [0.67 bar to 10 bar]
DOUBLE ROD	15 to 150 psi [1.0 bar to 10 bar]	
TEMPERATURE LIMITS	-20° to +180°F [-29° to +82°C]	
VELOCITY	20 in/sec [0.5 m/sec] typical min, zero load at 100 psi [7 bar]	
LIFE EXPECTANCY	130 million linear inches [3.3 million linear meters] min	100 million linear inches [2.5 million linear meters] min
LUBRICATION	Factory lubricated for rated life	
MAINTENANCE	Field repairable	

BORE mm	NOMINAL STROKE (L)		NOMINAL STROKE CYL. 1 FULL STROKE TOLERANCE*		NOMINAL STROKE 3 POSITION STROKE TOLERANCE*	
	in	mm	in	mm	in	mm
20, 25	L ≤ 4	L ≤ 100	+0.059/-0	+1.5/-0	+0.059/-0.046	+1.5/-1.2
	L > 4	L > 100	+0.079/-0	+2.0/-0	+0.079/-0.046	+2.0/-1.2
32, 40, 50	L ≤ 20	L ≤ 500	+0.079/-0	+2.0/-0	+0.079/-0.050	+2.0/-1.3
	L > 20	L > 500	+0.126/-0	+3.2/-0	+0.126/-0.050	+3.2/-1.3
63, 80, 100	L ≤ 20	L ≤ 500	+0.098/-0	+2.5/-0	+0.098/-0.070	+2.5/-1.8
	L > 20	L > 500	+0.157/-0	+4.0/-0	+0.157/-0.070	+4.0/-1.8

NOTE: *Stroke tolerances/values measured at 60 ±4 psi [4 ±0.27 bar] due to impact seal design.

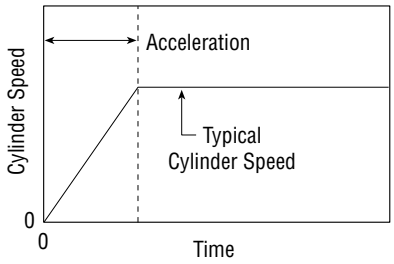
CYLINDER WEIGHTS

BORE DIA		BASE WEIGHT		ADDER PER	
in	mm	lb	kg	1 in	25 mm
0.787	20	0.55	0.25	0.1	0.04
0.984	25	0.69	0.31	0.12	0.05
1.260	32	1.45	0.66	0.17	0.08
1.575	40	2.08	0.94	0.23	0.10
1.969	50	3.28	1.49	0.32	0.15
2.480	63	4.87	2.21	0.36	0.16
3.150	80	7.78	3.53	0.52	0.24
3.937	100	11.03	5.00	0.6	0.27

CYLINDER SPEEDS

The cylinder speed and time required for the cylinder to extend or retract are dependent upon many application conditions including supply line pressure, valve rating, line size, attached tooling, flow controls, etc. Upon actuation, the cylinder will accelerate from rest to some final speed prior to end of stroke. This is illustrated by the Idealized Cylinder Speed graph. Using the speed data, the total time to extend or retract can be approximated. Actual extend and retract times will vary, especially as the application conditions change from those stated below.

IDEALIZED CYLINDER SPEED



CYLINDER SPEED CALCULATIONS

	STANDARD & CUSHION UNIT		PORT CONTROL UNIT (FULL OPEN)	
	METRIC	IMPERIAL	METRIC	IMPERIAL
Approximate Extend or Retract Time (seconds)	$A + \left[\frac{\text{Stroke - B}}{1000 \times C}\right]$	$A + \left[\frac{\text{Stroke - B}}{C}\right]$	$D + \left[\frac{\text{Stroke - E}}{1000 \times F}\right]$	$D + \left[\frac{\text{Stroke - E}}{F}\right]$
EXAMPLE 50 mm bore cylinder with 200 mm stroke	$0.053 + \left[\frac{200 - 48}{1000 \times 2.03}\right] = 0.13$ sec		$0.159 + \left[\frac{200 - 52}{1000 \times 0.53}\right] = 0.44$ sec	

Equation not applicable for imperial values.

SPEED DATA

BORE mm	STANDARD & CUSHION UNITS					PORT CONTROL UNITS (FULL OPEN)				
	[A] ACCELERATION TIME	[B] STROKE DURING ACCELERATION		[C] TYPICAL CYLINDER SPEED		[D] ACCELERATION TIME	[E] STROKE DURING ACCELERATION		[F] TYPICAL CYLINDER SPEED	
	s	in	mm	in/sec	m/sec	s	in	mm	in/sec	m/sec
20	0.025	2.3	58	200	5.08	0.065	1.2	31	35	0.89
25	0.023	1.8	46	150	3.81	0.103	1.5	38	24	0.61
32	0.027	1.3	33	105	2.67	0.120	2.1	52	33	0.84
40	0.033	1.3	33	80	2.03	0.109	2.4	61	36	0.91
50	0.053	1.9	48	80	2.03	0.159	2.1	52	21	0.53
63	0.056	1.2	30	35	0.89	0.116	2.3	58	25	0.64
80	0.079	1.2	30	25	0.64	0.143	2.0	51	18	0.46
100	0.075	1.4	36	25	0.64	0.143	2.2	56	20	0.51

NOTES: The above speed data is based on:
1) No attached load with a line pressure of 80 psi [5.5 bar] with a valve rated at Cv=9.0.
2) 20 mm and 25 mm cylinders tested with 0.17" ID tubing.
3) 32 mm and 40 mm cylinders tested with 0.28" ID tubing.
4) 50 mm, 63 mm, and 80 mm cylinders tested with 0.38" ID tubing.
5) 100 mm cylinders tested with two 0.38" ID tubes to each port from the valve.

METRIC TO IMPERIAL CONVERSION

	MULTIPLY	BY	TO OBTAIN
LENGTH	mm	0.0394	in
SPEED	m/sec	39.37	in/sec

	IMPERIAL TO METRIC CONVERSION			METRIC TO IMPERIAL CONVERSION		
	MULTIPLY	BY	TO OBTAIN	MULTIPLY	BY	TO OBTAIN
LENGTH	in	25.4	mm	mm	0.0394	in
FORCE	lbs	4.45	N	N	0.225	lbs
PRESSURE	psi	0.069	bar	bar	14.5	psi

HOW TO DETERMINE CORRECT CYLINDER SIZE

Step 1. Determine stroke and force required for the application.

Step 2. Determine the force produced by the cylinder using the force calculations below. The cylinder force is based on the following formulas and the data from the cylinder force table.

	Imperial F = P x A	Metric F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in^2	mm^2

CYLINDER FORCE

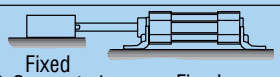
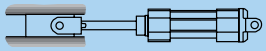
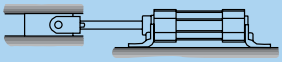
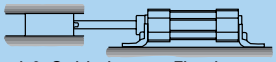
BORE DIAMETER		ROD DIAMETER		ROD DIRECTION	EFFECTIVE AREA	
in	mm	in	mm		in^2	mm^2
0.787	20	0.315	8	EXTEND	0.49	314
				RETRACT	0.41	264
0.984	25	0.394	10	EXTEND	0.76	491
				RETRACT	0.64	412
1.260	32	0.472	12	EXTEND	1.25	804
				RETRACT	1.07	691
1.575	40	0.630	16	EXTEND	1.95	1257
				RETRACT	1.64	1056
1.969	50	0.787	20	EXTEND	3.04	1963
				RETRACT	2.56	1649
2.480	63	0.787	20	EXTEND	4.83	3117
				RETRACT	4.34	2803
3.150	80	0.984	25	EXTEND	7.79	5027
				RETRACT	7.03	4536
3.937	100	0.984	25	EXTEND	12.17	7854
				RETRACT	11.41	7363

NOTE: Use retract figures for calculating double rod cylinder forces in both directions.

Step 3. For the selected cylinder, verify that there is sufficient rod column strength based on the cylinder extend force and stroke length. Rod column strength curves are based on the following formula:

$$F_c = \frac{\pi^2 E I}{(LK)^2 S_f}$$

	IMPERIAL	METRIC
F_c = Maximum Column Force	lbs	N
E = Modulus of Elasticity	30 x 10^6 psi	207 GPa
L = Stroke Length	in	mm
I = Moment of Inertia = π (Rod Diameter)^4/64	in^4	mm^4
K = Stroke Factor	(see chart)	(see chart)
S_f = Safety Factor	5	5

ROD END CONDITION / CYLINDER MOUNT	COLUMN STRENGTH CURVE	STROKE FACTOR K
 Fixed & Supported — Fixed	A	2
 Pivoted & Guided — Pivot at Rear	A	2
 Pivoted & Guided — Fixed	See Note	0.7
 Fixed & Guided — Fixed	See Note	0.5

NOTE: In these two cases, column strength is sufficient for stroke lengths less than or equal to 40 in [1000 mm] for CVA units and 30 in [750 mm] for CVB and CVC units.

Example:

Step 1. For a specific application, it has been determined that a cylinder is required to operate within the following parameters:

P = Operating Pressure = 80 psi [5.5 bar]
F = Required Extend Force = 150 lbs [667 N]
L = Required Stroke = 30 in [762 mm]
V = Required Maximum Velocity = 20 in/sec [0.51 m/sec]
M = Attached Load = 75 lbs [35 kg]

Mounting type: Rod end is pivoted and guided
Cylinder is pivoted at rear

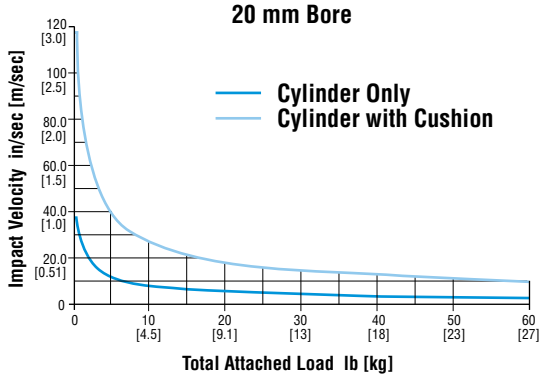
Step 2. Using the Cylinder Force Graphs on page 42, locate 80 psi [5.5 bar] on the horizontal axis. Follow the line vertically until it intersects the solid (extend) diagonal line on the chart. The 32 mm cylinder extend force is only 100 lbs [445 N] at 80 psi [5.5 bar] less than the required 150 lbs [667 N]. The 40 mm is capable of just over 150 lbs [667 N] extend force at this pressure. Select the 40 mm and proceed to the next step.

Step 3. Check column strength. Based on the mounting types, use curve A on the 40 mm Rod Column Strength Chart on page 42. At 150 lbs [667 N] extend force, the maximum allowable cylinder stroke is 27 in [686 mm]. However, the required stroke is 30 in [762 mm]. Assuming the stroke cannot be changed, it is necessary to select a cylinder with a larger rod diameter. Checking the 50 mm cylinder in the same way as was done for the 40 mm shows that the 50 mm cylinder is acceptable.

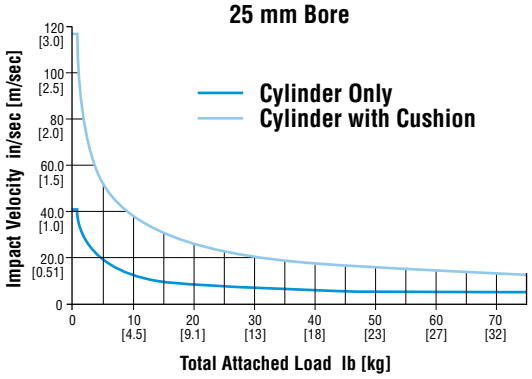
Step 4. Using the Kinetic Energy Graphs on page 41, find the point on the 50 mm chart that corresponds to the given maximum velocity and attached load. The chart shows that the cylinder must be specified with cushions to properly decelerate the load.

MAXIMUM ALLOWABLE KINETIC ENERGY GRAPHS

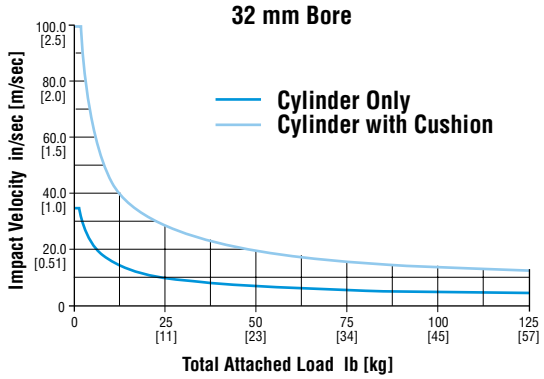
20 mm Bore



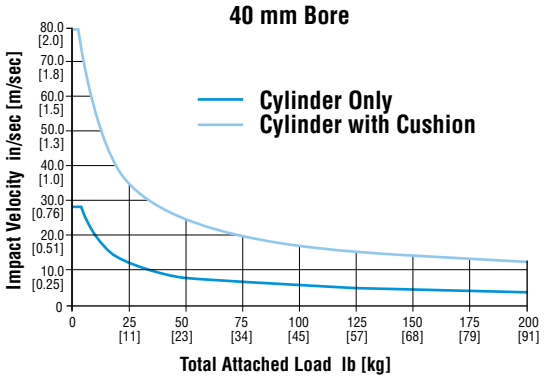
25 mm Bore



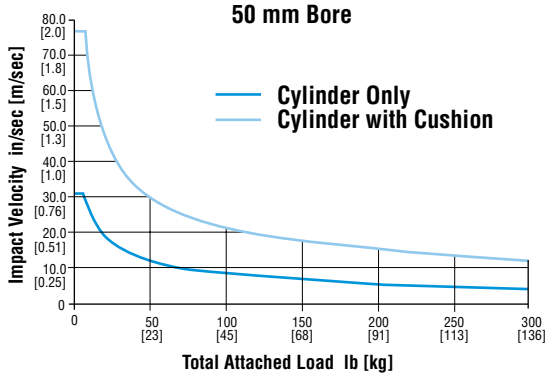
32 mm Bore



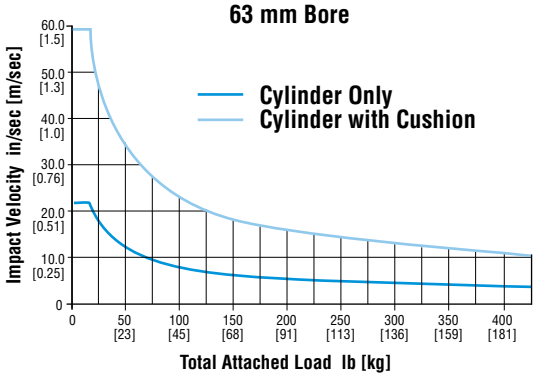
40 mm Bore



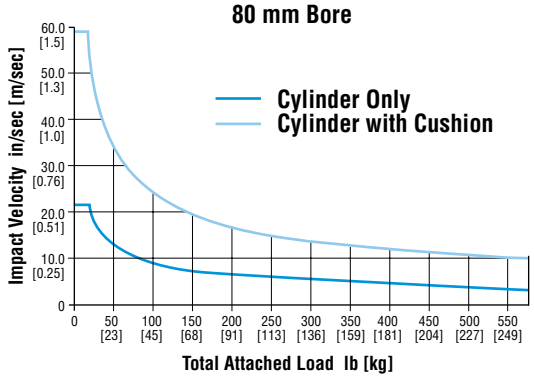
50 mm Bore



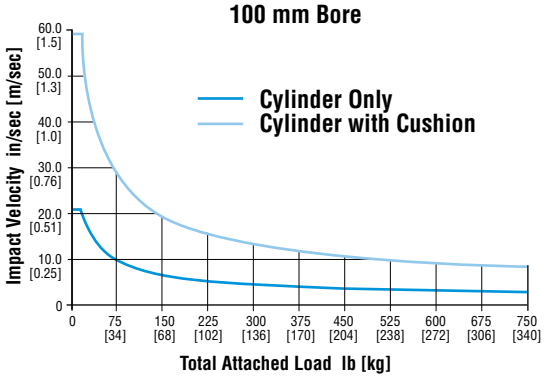
63 mm Bore



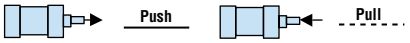
80 mm Bore



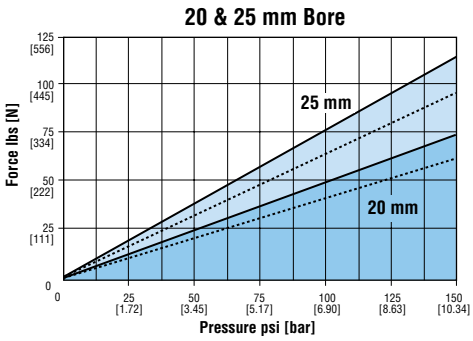
100 mm Bore



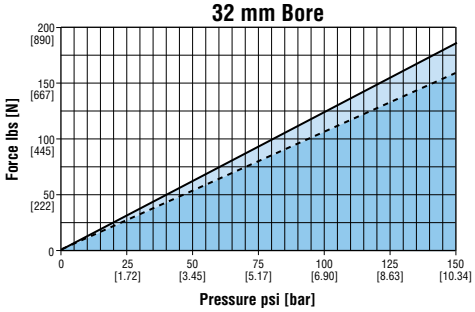
CYLINDER FORCE GRAPHS



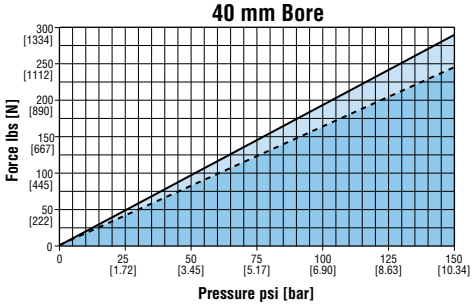
20 & 25 mm Bore



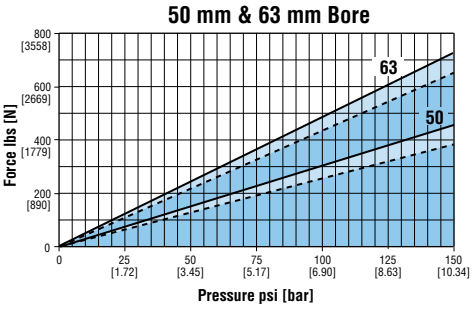
32 mm Bore



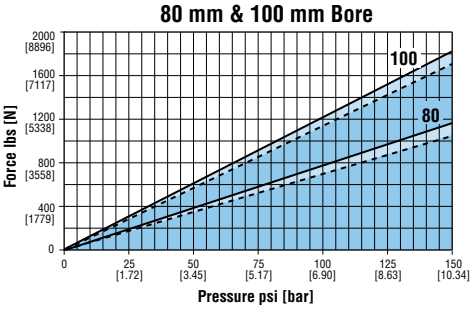
40 mm Bore



50 mm & 63 mm Bore

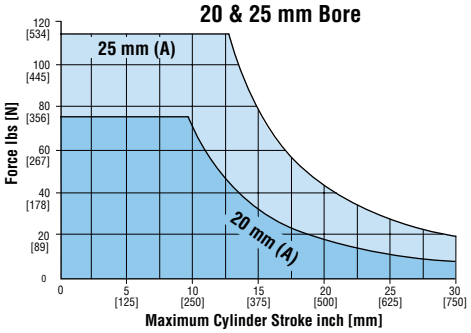


80 mm & 100 mm Bore

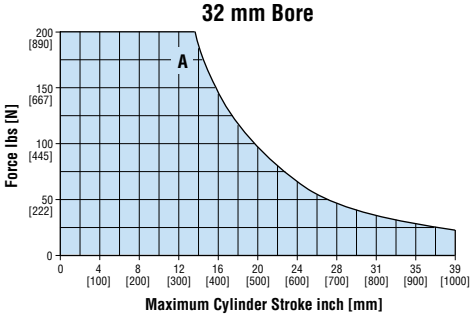


ROD COLUMN STRENGTH GRAPHS

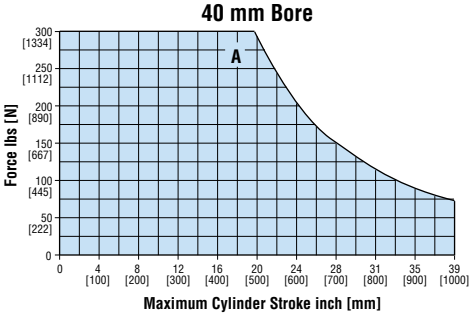
20 & 25 mm Bore



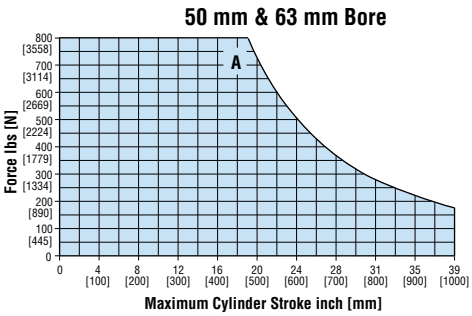
32 mm Bore



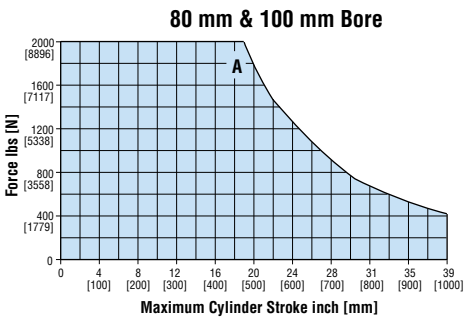
40 mm Bore



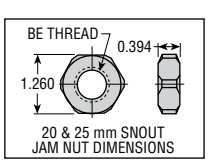
50 mm & 63 mm Bore

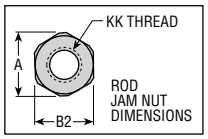


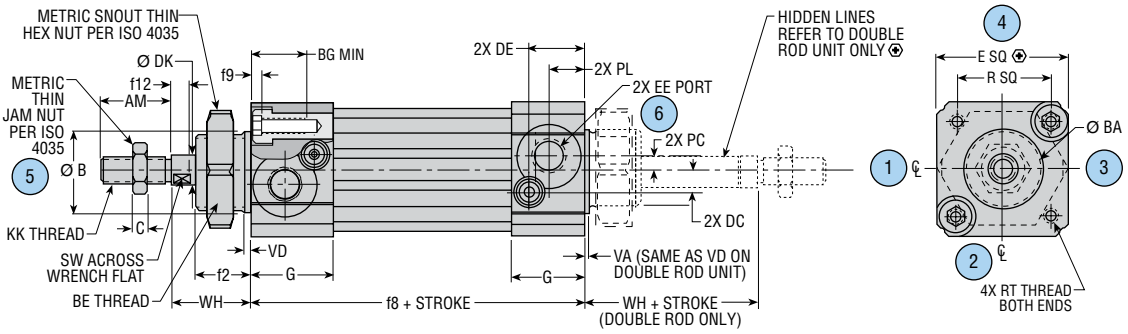
80 mm & 100 mm Bore



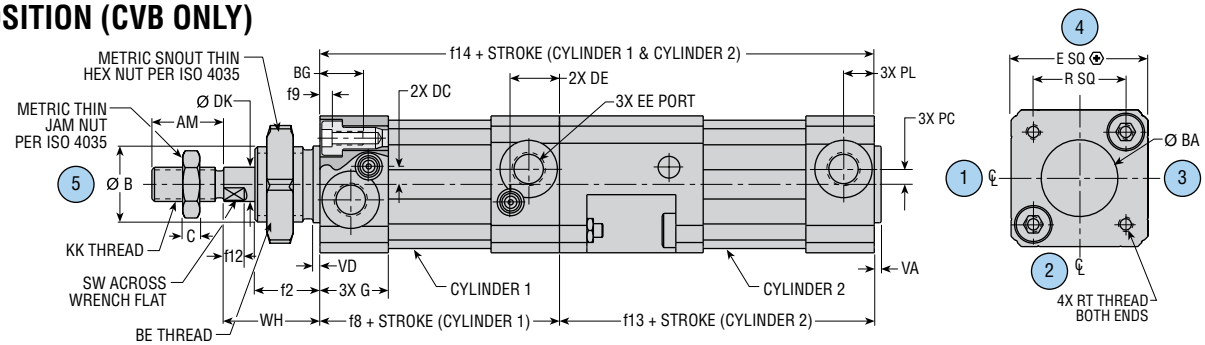
SIZES 20 & 25 mm



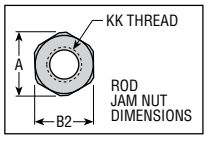


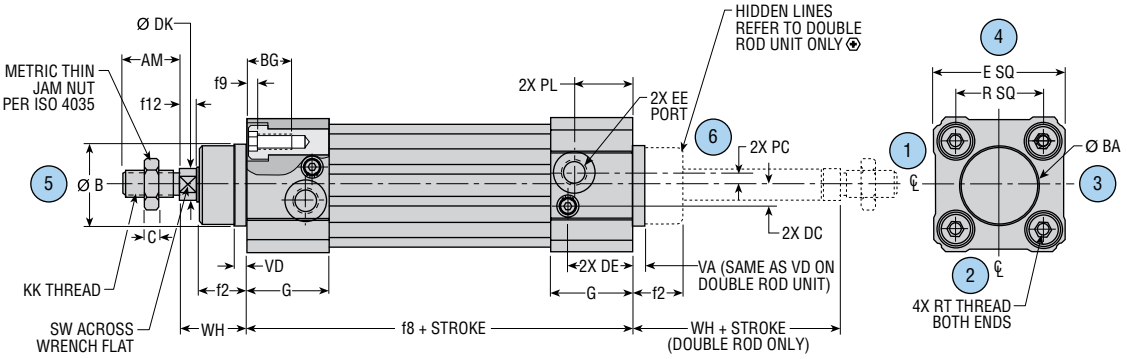


3 POSITION (CVB ONLY)

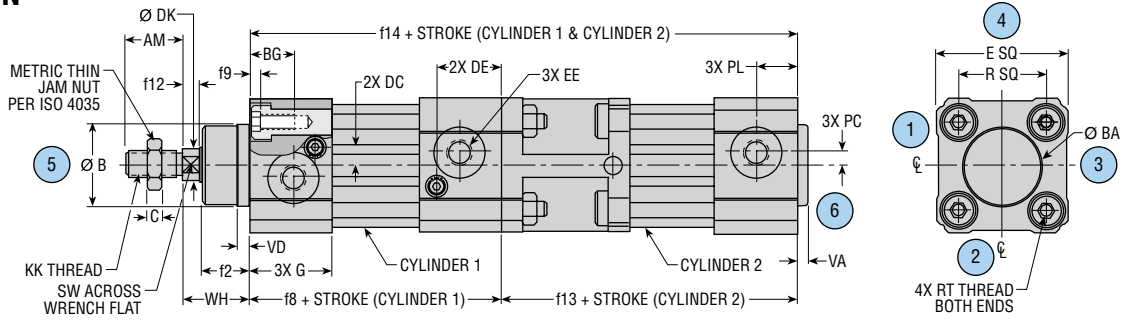


SIZES 32-100 mm





3 POSITION



Port Position: Indicated by circled numbers

LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A	0.577	14.7	0.650	16.5	0.650	16.5	0.819	20.8	1.083	27.5	1.083	27.5	1.299	33.0	1.299	33.0
AM	0.748	19.0	0.827	21.0	0.827	21.0	0.906	23.0	1.220	31.0	1.220	31.0	1.535	39.0	1.535	39.0
Ø B	0.864	22.0	0.864	22.0	1.178	30.0	1.374	34.9	1.571	39.9	1.768	44.9	1.768	44.9	2.161	54.9
B2	0.500	12.7	0.562	14.3	0.562	14.3	0.709	18.0	0.938	23.8	0.938	23.8	1.125	28.6	1.125	28.6
BA	0.864	22.0	0.864	22.0	1.178	30.0	1.374	34.9	1.571	39.9	1.768	44.9	1.768	44.9	2.161	54.9
BE	M22 x 1.5		M22 x 1.5		—		—		—		—		—		—	
BG min	0.472	12.0	0.472	12.0	0.709	18.0	0.709	18.0	0.787	20.0	0.787	20.0	0.787	20.0	0.787	20.0
C	0.188	4.8	0.219	5.6	0.219	5.6	0.323	8.2	0.375	9.5	0.385	9.5	0.422	10.7	0.442	11.2
DC***	0.190	4.8	0.226	5.7	0.276	7.0	0.374	9.5	0.394	10.0	0.354	9.0	0.591	15.0	0.630	16.0
DE***	0.581	14.8	0.561	14.2	0.965	24.5	1.083	27.5	1.043	26.5	1.201	30.5	1.181	30.0	1.339	34.0
DK	0.315	8.0	0.394	10.0	0.472	12.0	0.630	16.0	0.787	20.0	0.787	20.0	0.984	25.0	0.984	25.0
E	1.457	37.0	1.575	40.0	1.949	49.5	2.205	56.0	2.697	68.5	3.150	80.0	3.858	98.0	4.528	115.0
EE PORT**	1/8 NPT	G 1/8	1/8 NPT	G 1/8	1/8 NPT	G 1/8	1/4 NPT	G 1/4	1/4 NPT	G 1/4	3/8 NPT	G 3/8	3/8 NPT	G 3/8	1/2 NPT	G 1/2
EE G PORT DEPTH	—	8.0	—	8.0	—	8.0	—	9.0	—	9.0	—	12.0	—	12.0	—	14.0
f2	0.670	17.0	0.748	19.0	0.729	18.5	0.802	20.4	1.085	27.5	1.084	27.5	1.316	33.4	1.438	36.5
f8 CVA	—	—	—	—	3.702	94.0	4.133	105.0	4.173	106.0	4.764	121.0	5.039	128.0	5.434	138.0
f8 CVB	2.637	67.0	2.755	70.0	—	—	—	—	—	—	—	—	—	—	—	—
f8 CVC	2.323	59.0	2.520	64.0	—	—	—	—	—	—	—	—	—	—	—	—
f9	0.140	3.6	0.140	3.6	0.158	4.0	0.158	4.3	0.210	5.3	0.210	5.3	0.256	6.5	0.256	6.5
f12	0.196	5.0	0.236	6.0	0.236	6.0	0.256	6.5	0.315	8.0	0.315	8.0	0.394	10.0	0.394	10.0
f13	3.504	89.0	3.622	92.0	4.371	111.0	4.822	122.5	5.728	145.5	6.181	157.0	6.772	172.0	7.008	178.0
f14	6.141	156.0	6.377	162.0	8.073	205.0	8.955	227.5	9.901	251.5	10.945	278.0	11.811	300.0	12.441	316.0
G	0.787	20.0	0.787	20.0	1.221	31.0	1.358	34.5	1.358	34.5	1.496	38.0	1.496	38.0	1.654	42.0
KK	5/16-24	M8 x 1.25	3/8-24	M10 x 1.25	3/8-24	M10 x 1.25	1/2-20	M12 x 1.25	5/8-18	M16 x 1.5	5/8-18	M16 x 1.5	3/4-16	M20 x 1.5	3/4-16	M20 x 1.5
PC***	0.167	4.2	0.177	4.5	0.197	5.0	0.236	6.0	0.236	6.0	0.394	10.0	0.394	10.0	0.472	12.0
PL***	0.354	9.0	0.354	9.0	0.630	16.0	0.728	18.5	0.728	18.5	0.787	20.0	0.709	18.0	0.867	22.0
R	1.024	26.0	1.063	27.0	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
RT	M4 x 0.7		M4 x 0.7		M6 x 1		M6 x 1		M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5	
SW	0.270	6.9	0.315	8.0	0.389	9.9	0.507	12.9	0.625	15.9	0.625	15.9	0.828	21.0	0.822	20.9
VA	0.079	2.0	0.079	2.0	0.142	3.6	0.142	3.6	0.142	3.6	0.143	3.6	0.143	3.6	0.142	3.6
VD	0.079	2.0	0.079	2.0	0.179	4.5	0.182	4.6	0.182	4.6	0.184	4.7	0.184	4.7	0.176	4.5
WH*	0.945	24.0	1.102	28.0	1.024	26.0	1.181	30.0	1.457	37.0	1.457	37.0	1.811	46.0	2.008	51.0

NOTES:

1) Unless otherwise dimensioned, mounting hole patterns are centered on the cylinder.
2) Ports and cushions may appear on either side of the cylinder centerline based on option combinations.
3) **All metric (CVxx6) units, except port with Port Control® on same side, comply with ISO 16030 and DIN 3852 part 2 port specifications for short stud and large sealing surface. See Port Control® option sheet for port and Port Control® dimensions on units with ports and Port Controls® on the same side.
4) *WH values are determined with cylinder at 60 ± 4 psi [4 ±0.27 bar] due to impact seal design.
5) *** ⊕ Marked dimensions on the previous page provide additional flexibility, but do not dimensionally comply with ISO 6431/VDMA 24562 or ISO 6432 specifications.

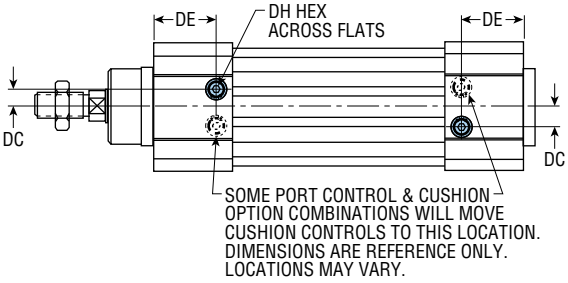
DB CUSHION CONTROL IN BOTH DIRECTIONS
(standard location 1 & 5, see note)

DE CUSHION CONTROL ON EXTEND ONLY
(standard location 1, not available on 3 position units)

DR CUSHION CONTROL ON RETRACT ONLY
(standard location 5, not available on 3 position units)

PHD cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration. The effective cushion lengths for each bore size are shown in the table below. To specify different cushion control locations on the head or cap, see option code above.

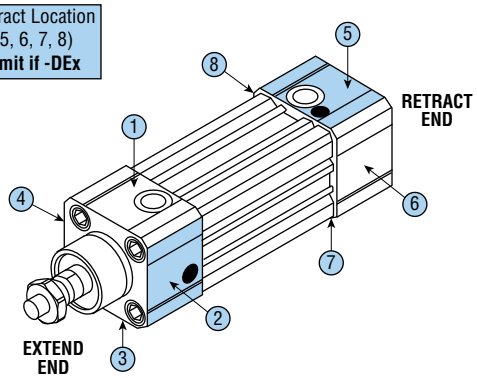
NOTE: Cushion controls on 3 position units are available only with -DB option in locations 1 and 5 only. 3 position units will have cushion on full extend and full retract.



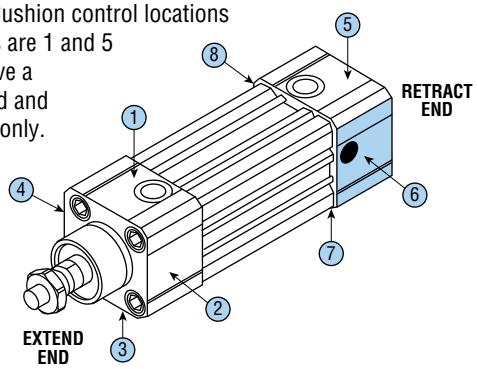
CUSHION CONTROL OPTIONS

-D x x x

- Cushion Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Retract Location (5, 6, 7, 8) **Omit if -DEx**
- Extend Location (1, 2, 3, 4) **Omit if -DRx**



Unit shown is -DB25, cushion in location 2 on extend end and cushion in location 5 on retract end. (Ports are shown in standard locations 1 & 5.) Cushion control locations on 3 position units are 1 and 5 only and will receive a control on the head and intermediate head only.



Unit shown is -DR6, cushion in location 6 on retract end and none on extend end. (Ports are shown in standard locations 1 & 5.)

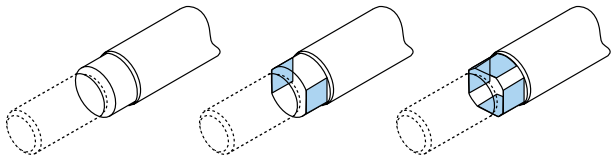
LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
DC	0.190	4.8	0.226	5.7	0.276	7.0	0.374	9.5	0.394	10.0	0.354	9.0	0.591	15.0	0.630	16.0
DE	0.581	14.8	0.561	14.2	0.965	24.5	1.083	27.5	1.043	26.5	1.201	30.5	1.181	30.0	1.339	34.0
DH	—	2.5	0.561	2.5	—	2.5	—	2.5	—	2.5	—	2.5	—	3.0	—	3.0
EFFECTIVE CUSHION LENGTH	0.441	11.2	0.469	11.9	0.598	15.2	0.807	20.5	0.870	22.1	0.870	20.4	0.894	22.7	1.189	30.2

F22 4 WRENCH FLATS ON ROD END ⊕

This option omits rod end wrench flats. If this option is specified on double rod units, both rod ends will be supplied without wrench flats.

F44 NO WRENCH FLATS ON ROD END ⊕

With this option, the rod is supplied with four rod end flats instead of the standard two flats. If this option is specified on double rod units, both rod ends will be supplied with four wrench flats.



⊕ For metric units (CVxx6).

This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

H46 RODLOK READY CYLINDER

Available on single rod units only (Rodlok sold separately) ⊕

H47 RODLOK CYLINDER & RODLOK

Available on single rod units only (Preassembled) ⊕

PHD's Rodlok is ideal for locking the piston rod while in a static/ stationary position. When the pressure is removed from the port of the Rodlok, the mechanism will grip the rod and prevent it from moving. The loads are held indefinitely without power. Rodlok performance is application and environment sensitive (cleanliness of rod or Rodlok will also affect performance). THE RODLOK IS NOT DESIGNED TO BE USED AS A PERSONAL SAFETY DEVICE.

Option -H46 provides a Rodlok ready cylinder with appropriate rod extension and materials for use with PHD's Rodlok.

Option -H47 provides a cylinder and Rodlok pre-assembled. The port for the Rodlok will be assembled in the same position as the port on the extend end of the cylinder.

The Rodlok locking device and adaptor can be purchased separately as kits. See chart at right. The locking device and adaptor are not available with the -Z1 corrosion resistant finish.

Dimensions continued on next page.

BORE mm	STATIC LOCKING FORCE*	
	lb	N
20	79	350
25	90	400
32	135	600
40	225	1000
50	337	1500
63	495	2200
80	674	3000
100	1124	5000

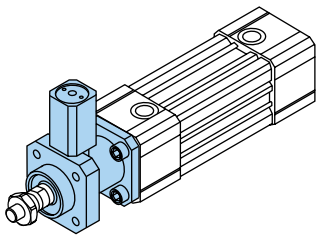
NOTE: *Locking force indicated above is the actual locking force with a dry, clean rod and does not include any safety factor.

OPERATING PRESSURE

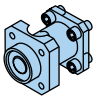
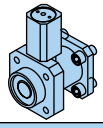
The operating pressure for the locking device is different than the operating pressure for the cylinder with the Rodlok attached. The locking device of the Rodlok is designed with an operating pressure range of 60 psi minimum to 150 psi maximum [4 to 10 bar]. The Series CV Cylinder with a Rodlok attached has an operating pressure range of 22 psi minimum to 150 psi maximum [1.5 to 10 bar].

⊕ For metric units (CVxx6).

This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.



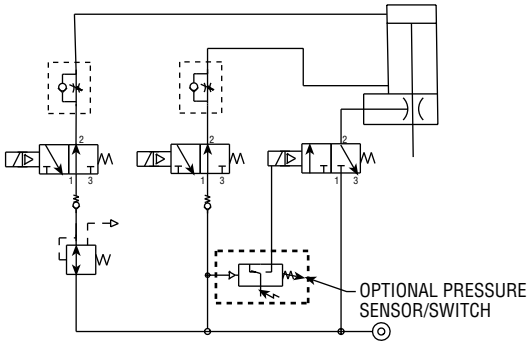
RODLOK KITS


BORE mm	LOCKING DEVICE KIT	ADAPTOR KIT*	COMPLETE RODLOK*	IMPERIAL PORT ADAPTOR**
20	63459-07-1	63460-07-1	63461-07-1	—
25	63459-08-1	63460-08-1	63461-08-1	—
32	63459-01-1	63460-01-1	63461-01-1	63465-1
40	63459-02-1	63460-02-1	63461-02-1	63465-1
50	63459-03-1	63460-03-1	63461-03-1	63465-1
63	63459-04-1	63460-04-1	63461-04-1	63465-1
80	63459-05-1	63460-05-1	63461-05-1	63465-1
100	63459-06-1	63460-06-1	63461-06-1	63465-1

NOTES:
1) *Kits ship with cylinder mounting hardware.
2) Rodlok is intended for use only on -H46 cylinder.
3) Imperial port adaptor converts port from G1/8 to 1/8" NPT for use with -L9 cylinders or imperial units.
4) **Adaptor must be ordered separately. Required to convert to imperial port.

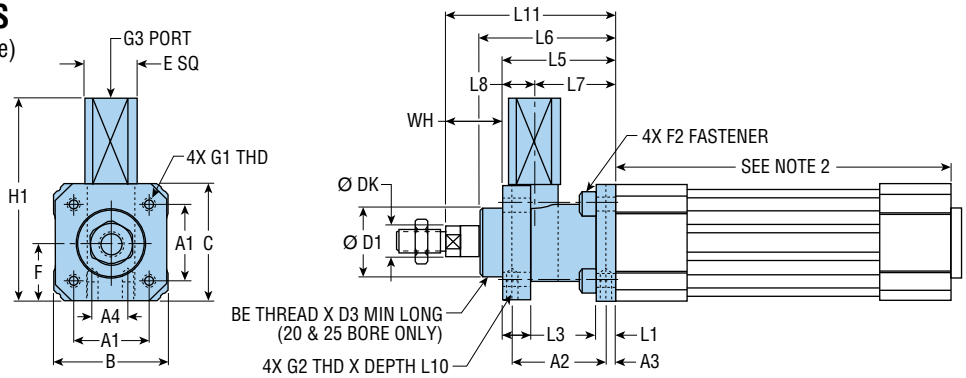
Plumbing Schematic Example:



The pneumatic schematic above shows typical valving for cylinder and Rodlok for both horizontal and vertical operation. The schematic shows three 3/2 way valves, one for each port on the cylinder and one for the Rodlok port. The use of two valves on the cylinder allows for both ports to be pressurized when valves are de-energized. The use of an in-line regulator allows the cylinder ports to be pressurized at different pressures. This allows the cylinder to balance out the opposing pressure and force of the attached load. Once piston rod motion has stopped, the Rodlok can be engaged by de-energizing its valve and releasing its pressure. The use of check valves and built in PHD Port Controls® is recommended. Pressure switch shown is optional and application specific.

RODLOK DIMENSIONS

(continued from previous page)



LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A1	1.024	26.0	1.063	27.0	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
A2	—	—	—	—	1.575	40.0	1.811	46.0	2.126	54.0	2.165	55.0	2.756	70.0	2.756	70.0
A3	—	—	—	—	0.165	4.2	0.177	4.5	0.453	11.5	0.295	7.5	0.394	10.0	0.394	10.0
A4	—	—	—	—	0.630	16.0	0.827	21.0	0.945	24.0	1.260	32.0	1.732	44.0	2.362	60.0
B	1.457	37.0	1.575	40.0	1.890	48.0	2.205	56.0	2.677	68.0	3.228	82.0	3.937	100.0	4.724	120.0
BE	M22 x 1.5		M22 x 1.5		—		—		—		—		—		—	
C	1.457	37.0	1.575	40.0	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
D1	0.866	22.0	0.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.772	45.0	1.772	45.0	2.165	55.0
D3	0.590	15.0	0.669	17.0	—	—	—	—	—	—	—	—	—	—	—	—
DK	0.315	8.0	0.394	10.0	0.472	12.0	0.630	16.0	0.787	20.0	0.787	20.0	0.984	25.0	0.984	25.0
E	0.807	20.5	0.807	20.5	0.984	25.0	1.083	27.5	1.280	32.5	1.614	41.0	1.929	49.0	2.087	53.0
F	0.728	18.5	0.787	20.0	0.984	25.0	1.142	29.0	1.378	35.0	1.673	42.5	2.067	52.5	2.559	65.0
F2	M4 x 0.7 x 20		M4 x 0.7 x 20		M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 30		M8 x 1.25 x 30		M10 x 1.5 x 30		M10 x 1.5 x 30	
G1	M4 x 0.7		M4 x 0.7		M6 x 1		M6 x 1		M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5	
G2	—		—		M5		M5		M6		M8		M8		M8	
G3	M5 x 0.8		M5 x 0.8		G 1/8*		G 1/8*		G 1/8*		G 1/8*		G 1/8*		G 1/8*	
H1	2.775	70.5	2.854	72.5	3.524	89.5	3.856	97.9	4.645	118.0	5.256	133.5	6.732	171.0	7.441	189.0
L1	0.354	9.0	0.315	8.0	0.315	8.0	0.394	10.0	0.591	15.0	0.591	15.0	0.630	16.0	0.630	16.0
L3	0.354	9.0	0.315	8.0	0.473	12.0	0.472	12.0	0.630	16.0	0.590	15.0	0.630	16.0	0.709	18.0
L5	1.575	40.0	1.732	44.0	1.890	48.0	2.165	55.0	2.756	70.0	2.756	70.0	3.543	90.0	3.622	92.0
L6	2.244	57.0	2.480	63.0	2.283	58.0	2.559	65.0	3.228	82.0	3.228	82.0	4.331	110.0	4.528	115.0
L7	1.142	29.0	1.220	31.0	1.260	32.0	1.398	35.5	1.929	49.0	1.929	49.0	2.441	62.0	2.559	65.0
L8	0.433	11.0	0.512	13.0	0.630	16.0	0.768	19.5	0.827	21.0	0.827	21.0	1.102	28.0	1.063	27.0
L10	—	—	—	—	0.315	8.0	0.394	10.0	0.472	12.0	0.472	12.0	0.630	16.0	0.630	16.0
L11	2.520	64.0	2.835	72.0	2.913	74.0	3.346	85.0	4.213	107.0	4.213	107.0	5.354	136.0	5.630	143.0
WH	0.945	24.0	1.102	28.0	1.024	26.0	1.181	30.0	1.457	37.0	1.457	37.0	1.811	46.0	2.008	51.0

NOTES:

1) -H47 units have Rodlok port aligned with cylinder port on extend.
2) All dimensions not noted are standard. See pages 43 and 44 for complete cylinder dimensions.
3) * = Port supplied on Rodlok device, requires port adaptor from previous page to convert to 1/8 NPT.

L9 NPT PORTS (Metric Units) ⊕

This option provides NPT ports instead of the standard G (BSPP) ports. The NPT ports are located in the same location as the G (BSPP) ports.

L7 BSPP PORTS (Imperial Units)

This option provides G (BSPP) ports instead of the standard NPT ports. The G (BSPP) ports are located in the same location as the NPT ports.

BORE (mm)	IMPERIAL NPT PORT	METRIC BSPP PORT
20	1/8*	G 1/8*
25	1/8*	G 1/8*
32	1/8	G 1/8
40	1/4	G 1/4
50	1/4	G 1/4
63	3/8	G 3/8
80	3/8	G 3/8
100	1/2	G 1/2

*When Port Controls® (-PB, -PR, -PE) are specified on the same face as port, the ports change to M5 on metric and 10-32 on imperial.

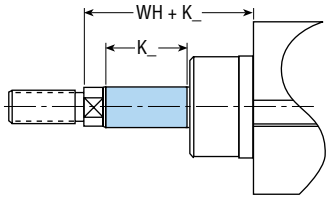
⊕ This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

K_ EXTRA ROD EXTENSION ⊕

Extra rod extension can be achieved by specifying the option -K followed by the length code. Rod extension is available in 1/8" or 5 mm increments. If this option is specified on double rod units, both rod ends will be supplied with the same extra rod extension. Contact PHD for other combinations.

Length Code

Imperial	Metric
K5 = 5/8" extra rod extension	K5 = 5 mm extra rod extension
K15 = 1-7/8" extra rod extension	K15 = 15 mm extra rod extension



⊕ For metric units (CVxx6).

This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

BORE	WH	
mm	in	mm
20	0.945	24.0
25	1.102	28.0
32	1.024	26.0
40	1.181	30.0
50	1.457	37.0
63	1.457	37.0
80	1.811	46.0
100	2.008	51.0

Z1 CORROSION RESISTANT

By specifying this option, a stainless steel rod with hard chrome plating is supplied in place of the standard hard chrome plated steel material. Appropriate coating is supplied on ferrous parts.

M MAGNETIC PISTON FOR PHD MINIATURE REED AND SOLID STATE SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Miniature Reed and Solid State Switches listed below. These switches mount easily to the cylinder using "T" slots in the body. Three position units will receive a magnet on both cylinder 1 and cylinder 2 when specified with -M option.

SERIES 6250 SOLID STATE SWITCHES

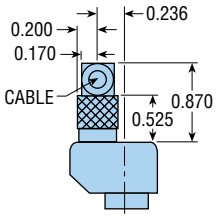
PART NO.	DESCRIPTION	COLOR
62505-1-02	NPN (Sink) DC Solid State, 2 m cable	Brown
62506-1-02	PNP (Source) DC Solid State, 2 m cable	Tan
62515-1	NPN (Sink) DC Solid State, Quick Connect	Brown
62516-1	PNP (Source) DC Solid State, Quick Connect	Tan

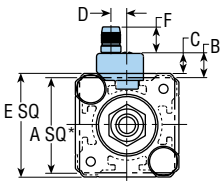
NOTE: Switches must be ordered separately. See Switches and Sensors section for complete switch information.

SERIES 6250 REED SWITCHES

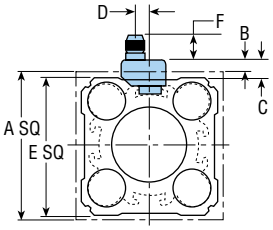
PART NO.	DESCRIPTION	COLOR
62507-1-02	AC/DC Reed, 2 m cable	Silver
62517-1	AC/DC Reed, Quick Connect	Silver

Connector Detail

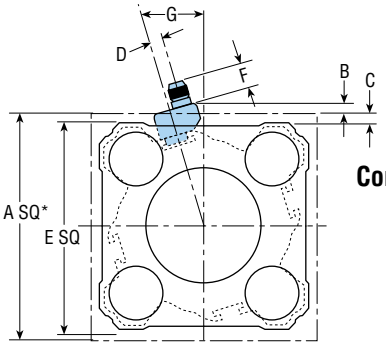




20 & 25 mm units

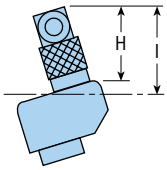


32, 40, & 50 mm units



63, 80, & 100 mm units

Connector Detail



LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A*	1.339	34.0	1.339	34.0	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
B	0.343	8.7	0.441	11.2	0.276	7.0	0.197	5.0	0.236	6.0	0.236	6.0	0.157	4.0	0.020	0.5
C	0.283	7.2	0.323	8.2	0.295	7.5	0.256	6.5	0.276	7.0	0.335	8.5	0.295	7.5	0.315	8.0
D	0.236	6.0	0.236	6.0	0.236	6.0	0.236	6.0	0.236	6.0	0.236	6.0	0.236	6.0	0.236	6.0
E	1.457	37.0	1.575	40.0	1.949	49.5	2.205	56.0	2.697	68.5	3.150	80.0	3.858	98.0	4.528	115.0
F	0.374	9.5	0.374	9.5	0.374	9.5	0.374	9.5	0.374	9.5	0.374	9.5	0.374	9.5	0.374	9.5
G	—	—	—	—	—	—	—	—	—	—	17°	17°	20°	20°	24°	24°
H	0.870	22.1	0.870	22.1	0.870	22.1	0.870	22.1	0.870	22.1	0.831	21.1	0.819	20.8	0.795	20.2
I	1.213	30.8	1.311	33.3	1.146	29.1	1.087	27.6	1.106	28.1	1.059	26.9	0.965	24.5	0.811	20.6

NOTE: *ISO/VDMA max square size

PB **PORT CONTROLS® ON BOTH ENDS**
(standard location 1 & 5, see note) ⊕

PE **PORT CONTROLS® ON EXTEND ONLY**
(standard location 1, not available on 3 position units) ⊕

PR **PORT CONTROLS® ON RETRACT ONLY**
(standard location 5, not available on 3 position units) ⊕

PORT CONTROL OPTIONS

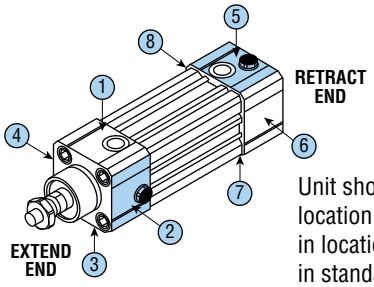
-P x x x

- Port Control Locations: B - Both ends; E - Extend end only; R - Retract end only
- Extend Location (1, 2, 3, 4) **Omit if -PRx**
- Retract Location (5, 6, 7, 8) **Omit if -PEx**

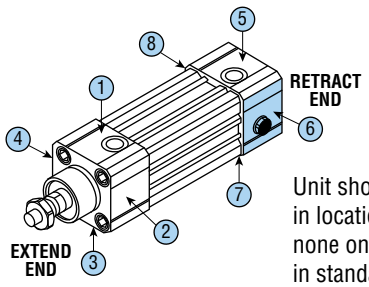
PHD's Port Control® is a built-in flow control for regulating the speed of the cylinder through its entire stroke. The Port Control operates on the "meter-out" principle and features an adjustable needle in a cartridge with a check seal. The self-locking needle has micrometer threads and is adjustable under pressure. The needle determines the orifice size which controls the exhaust flow rate of the actuator. The check seal expands while air is exhausting from the actuator, forcing the air to exhaust past the adjustable needle. The check seal collapses to allow a free flow of incoming air. The PHD Port Control saves space and eliminates the cost of fittings and installation for external flow control valves. See engineering data for cylinder speeds with PHD's Port Controls. Refer to option code below to specify port control locations. Three position port control locations are 1 and 5 only and will receive a control on the head, intermediate head, and cap.

NOTE: Port Controls are not available on same end which has -UB0x or -UBx0 (four ports) specified. Port Controls on 3 position units are available only with -PB option in locations 1 and 5 only.

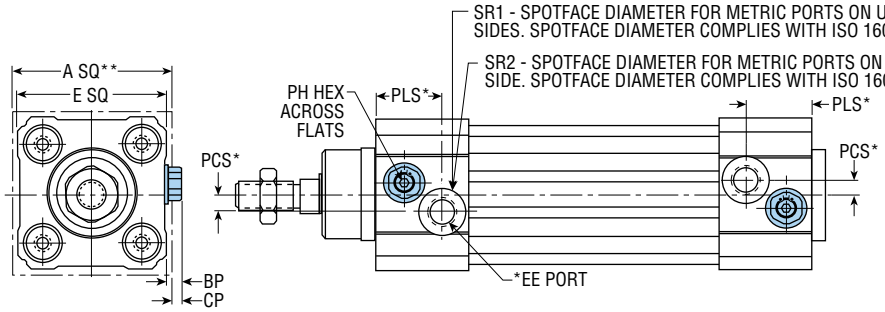
⊕ For 32, 40, 50, and 63 mm, the Port Control extends beyond VDMA specified square size. See dimension BP.



Unit shown is -PB25, Port Control® in location 2 on extend end and Port Control in location 5 on retract end. (Ports shown in standard locations 1 & 5.)



Unit shown is -PR6, Port Control® in location 6 on retract end and none on extend end. (Ports shown in standard locations 1 & 5.)



⊕ For metric units (CVxx6).

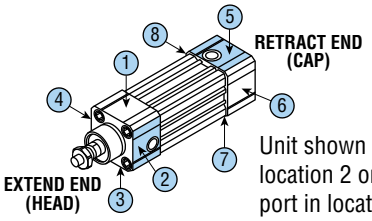
This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.

LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A**	1.339	34.0	1.339	34.0	1.969	50.0	2.283	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
BP	0.125	3.2	0.153	3.9	0.177	4.5	0.240	6.1	0.110	2.8	0.201	5.1	0.134	3.4	0.20	55.2
CP	0.184	4.7	0.271	6.9	0.169	4.3	0.201	5.1	0.083	2.1	0.102	2.6	-0.004	-0.1	-0.091	-2.3
E	1.457	37.0	1.575	40.0	1.949	49.5	2.205	56.0	2.697	68.5	3.150	80.0	3.858	98.0	4.528	115.0
EE*	10-32	M5	10-32	M5	1/8 NPT	G1/8	1/4 NPT	G1/4	1/4 NPT	G1/4	3/8 NPT	G3/8	3/8 NPT	G3/8	1/2 NPT	G1/2
PCS*	0.276	7.0	0.276	7.0	0.197	5.0	0.236	6.0	0.236	6.0	0.449	11.4	0.512	13.0	0.906	23.0
PH	—	2.5	—	2.5	—	2.5	—	2.5	—	2.5	—	3.0	—	3.0	—	6.0
PLS*	0.571	14.5	0.571	14.5	0.866	22.0	0.925	23.5	0.906	23.0	0.984	25.0	1.024	26.0	1.142	29.0
SR1	—	16.5	—	16.5	—	19.0	—	25.0	—	25.0	—	28.0	—	28.0	—	34.0
SR2	0.354	9.0	0.354	9.0	—	16.5	—	19.0	—	19.0	—	23.0	—	23.0	—	27.0

NOTES:
1) *Port dimensions shown are for units with port and Port Control® in the same location. For units with other port and Port Control® combinations, standard port size and location dimensions apply. Ports may be located on either side of the cylinder centerline depending on Port Control® and cushion option combinations.
in = Table information for imperial ports mm = Table information for metric ports
2) **VDMA max square size

UB ALTERNATE PORT LOCATION
(not available on 3 position units)

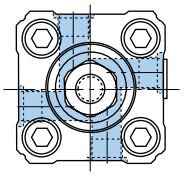
With this option, alternate port locations can be specified, providing increased flexibility and customer convenience. See option code below to specify port locations. Three position units available with ports in standard locations 1 and 5 only.



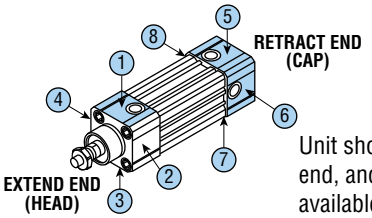
Unit shown is -UB25, port in location 2 on extend end and port in location 5 on retract end.

PORT LOCATION OPTIONS
-UB x x

Extend Location (Head)	Retract Location (Cap)
(0, 1, 2, 3, 4)	(0, 5, 6, 7, 8)
0 = All four sides	0 = All four sides



PORTS ON ALL 4 SIDES
(0 IN PORT OPTION CODE)
NOT AVAILABLE WITH
PHD PORT CONTROLS
ON SAME END



Unit shown is -UB10, port in location 1 on extend end, and ports on all 4 sides on retract end. (Not available with PHD port controls on retract.)

T44 FEMALE ROD END ⊕

This option provides a female rod end in place of the standard male rod end. See catalog dimensional pages for standard rod ends. This rod end deviates from ISO 6431/VDMA 24562 or ISO 6432 on metric units (CVxx6).

Double rod units will receive the same rod end on both rods unless otherwise specified as shown in the double rod option description.

T55 PLAIN ROD END ⊕

This option provides a plain rod end with wrench flats. Standard PHD Series CV Cylinders are supplied with a male rod end. This rod end deviates from ISO 6431/VDMA 24562 or ISO 6432 on metric units (CVxx6).

Double rod units will receive the same rod end on both rods unless otherwise specified as shown in the double rod option description.

TEE MALE OVERSIZE ROD END ⊕
(N/A on 20 & 25 mm bores)

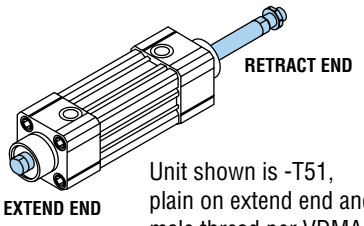
This option provides a male oversize thread rod end in place of the standard male rod end. See catalog dimensional pages for standard rod ends. Double rod units will receive the same rod end on both rods unless otherwise specified as shown in the double rod option description.

DOUBLE ROD END OPTIONS
-T x x

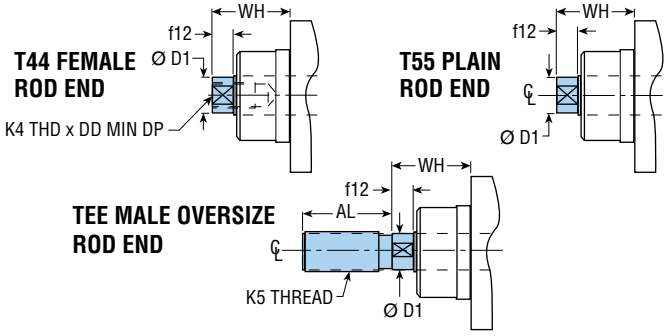
Extend End	Retract End
1 = Male thread VDMA 24562 (Standard)	1 = Male thread VDMA 24562 (Standard)
4 = Female undersized thread	4 = Female undersized thread
5 = Plain	5 = Plain
E = Male oversized thread	E = Male oversized thread

⊕ For metric units (CVxx6).

This option does not dimensionally comply with the ISO 6431/VDMA 24562 or ISO 6432 specifications.



Unit shown is -T51, plain on extend end and male thread per VDMA 24562 on retract end.



LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
AL	—	—	—	—	0.827	21.0	0.906	23.0	1.220	31.0	1.220	31.0	1.535	39.0	1.535	39.0
D1	0.315	8.00	0.375*	9.53*	0.447	11.35	0.599	15.22	0.757	19.23	0.757	19.23	0.954	24.23	0.954	24.23
f12	0.196	5.0	0.236	6.0	0.236	6.0	0.256	6.5	0.315	8.0	0.315	8.0	0.394	10.0	0.394	10.0
K4	#10-32	M5 x 0.8	1/4-28	M6 x 1.0	5/16-24	M8 x 1.25	7/16-20	M10 x 1.5	1/2-20	M12 x 1.75	1/2-20	M12 x 1.75	5/8-11	M16 x 2.0	5/8-11	M16 x 2.0
K5	—	—	—	—	7/16-20	M12 x 1.25	5/8-18	M16 x 1.5	3/4-16	M20 x 1.5	3/4-16	M20 x 1.5	1-12	M24 x 3	1-12	M24 x 3
DD min	0.413	10.5	0.492	12.5	0.551	14.0	0.669	17.0	0.748	19.0	0.748	19.0	0.827	21.0	0.827	21.0
WH	0.945	24.0	1.102	28.0	1.024	26.0	1.181	30.0	1.457	37.0	1.457	37.0	1.811	46.0	2.008	51.0

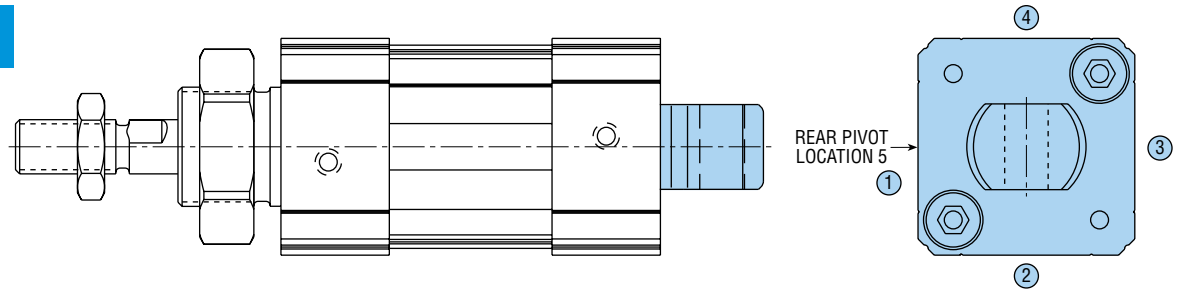
*Dimension shown is for -T44 rod end only. -T55 option dimension is 0.394 in [10.0 mm].

P&Q PIVOT MOUNT ON SIZES 20 & 25 ONLY

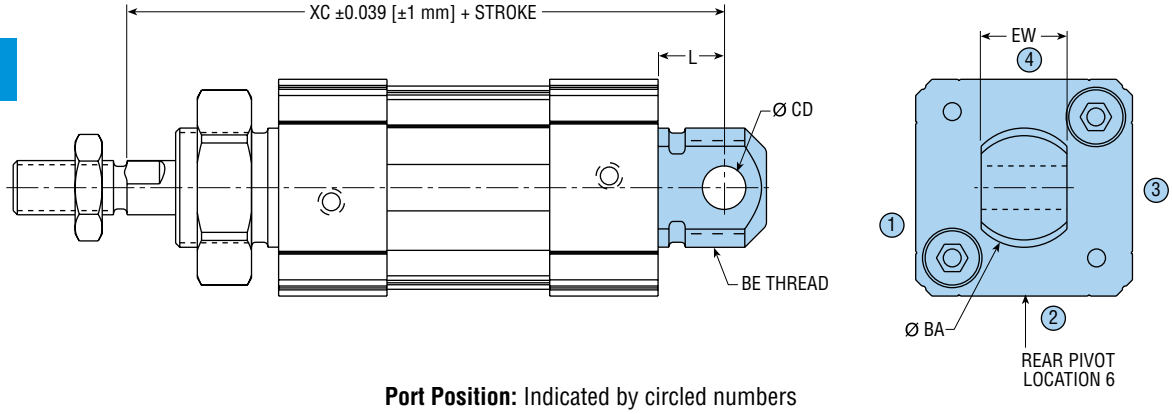
This style specifies a pivot mount cap. This style conforms to ISO 6432 customer interface and overall unit length on metric units (CVxx6) when specified with optional -P or -Q mounting. Pivot pins and base mounting brackets are available, see mounting accessories.

LETTER DIM/ TOLERANCE	BORE SIZE			
	20 mm		25 mm	
	in	mm	in	mm
BA	0.866	22.0	0.866	22.0
B	M22 x 1.5		M22 x 1.5	
CD/H9	0.315	8.0	0.315	8.0
EW/d13	0.630	16.0	0.630	16.0
L MIN	0.472	12.0	0.472	12.0
XC CVB	4.055	103.0	4.330	110.0
XC CVC	3.740	95.0	4.094	104.0

P



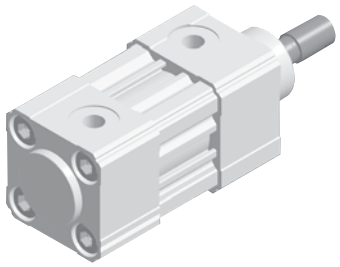
Q

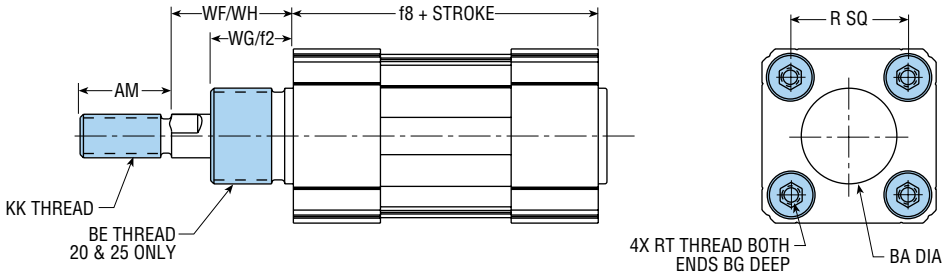


Port Position: Indicated by circled numbers

V

STANDARD MOUNTING
(ISO 6431/VDMA 24562 & ISO 6432 for metric units CVxx6)

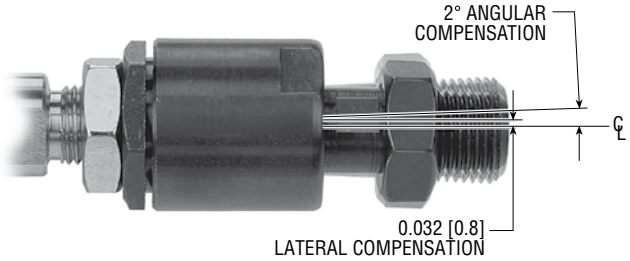




LETTER DIM/ TOLERANCE	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
AM	0.748	19.0	0.827	21.0	0.827	21.0	0.906	23.0	1.220	31.0	1.220	31.0	1.535	39.0	1.535	39.0
BA	0.864	21.9	0.864	21.9	1.178	29.9	1.374	34.9	1.571	40.0	1.768	44.9	1.768	44.9	2.161	55.0
BE	M22 x 1.5		M22 x 1.5		—		—		—		—		—		—	
BG min	0.472	12.0	0.472	12.0	0.709	18.0	0.709	18.0	0.787	20.0	0.787	20.0	0.787	20.0	0.787	20.0
f8 CVA	—	—	—	—	3.702	94.0	4.133	105.0	4.173	106.0	4.764	121.0	5.039	128.0	5.434	138.0
f8 CVB	2.637	67.0	2.755	70.0	—	—	—	—	—	—	—	—	—	—	—	—
f8 CVC	2.323	59.0	2.520	64.0	—	—	—	—	—	—	—	—	—	—	—	—
KK	5/16-24	M8 x 1.25	3/8-24	M10 x 1.25	3/8-24	M10 x 1.25	1/2-20	M12 x 1.25	5/8-18	M16 x 1.5	5/8-18	M16 x 1.5	3/4-16	M20 x 1.5	3/4-16	M20 x 1.5
R	1.024	26.0	1.063	27.0	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
RT	M4 x 0.7		M4 x 0.7		M6 x 1		M6 x 1		M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5	
WF	0.945	24.0	1.102	28.0	—		—		—		—		—		—	
WH	—		—		1.024	26.0	1.181	30.0	1.457	37.0	1.457	37.0	1.811	46.0	2.008	51.0
WG	0.669	17.0	0.748	19.0	—		—		—		—		—		—	
f2	—		—		0.729	18.5	0.802	20.4	1.084	27.5	1.084	27.5	1.316	33.4	1.438	36.5

SELF-ALIGNING PISTON ROD COUPLERS - METRIC

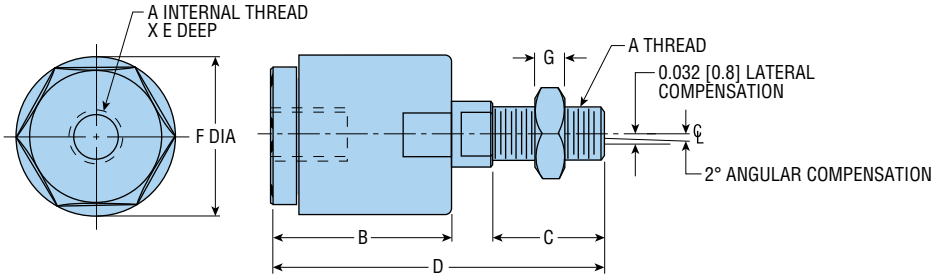
Metric rod couplers are an ideal accessory for use with Series CV ISO/VDMA cylinders.



To order, specify the model number.

BENEFITS

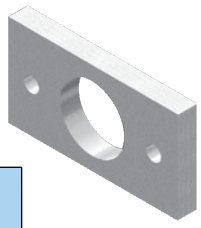
- Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.
- Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" [0.8 mm] lateral misalignment on push and pull stroke.
- Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.
- Rod Couplers are manufactured from high tensile and hardened steel components.

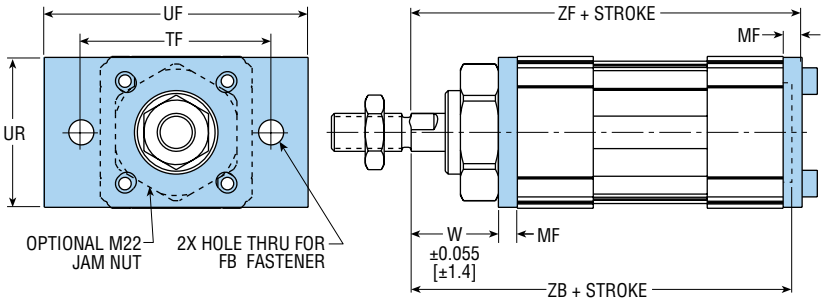


MODEL NO.		LETTER DIMENSION								CV CYLINDER BORE*	
		A	B MIN	C MIN	D MIN	E	F	G			
IMPERIAL	METRIC							IMPERIAL	METRIC	IMPERIAL	METRIC
312	M8	5/16-24 [M8 x 1.25]	1.00 [25.4]	0.625 [15.9]	1.875 [47.6]	0.50 [12.7]	0.875 [22.2]	0.187	0.197 [5.0]	20	20
375	M10	3/8-24 [M10 x 1.25]	1.00 [25.4]	0.625 [15.9]	1.875 [47.6]	0.50 [12.7]	0.875 [22.2]	0.219	0.197 [5.0]	25, 32	25, 32
437	—	7/16-20	1.13	0.650	2.187	0.50	1.0	0.250	—	—	—
500	M12	1/2-20 [M12 x 1.25]	1.13 [28.6]	0.650 [16.5]	2.187 [55.5]	0.50 [12.7]	1.0 [25.4]	0.312	0.236 [6.0]	40	40
625	M16	5/8-18 [M16 x 1.5]	1.75 [44.5]	1.125 [28.5]	3.312 [84.1]	0.812 [20.6]	1.562 [39.7]	0.375	0.314 [8.0]	50, 63	50, 63
750	M20	3/4-16 [M20 x 1.5]	1.75 [44.5]	1.125 [28.5]	3.312 [84.1]	0.812 [20.6]	1.562 [39.7]	0.421	0.394 [10.0]	80, 100	80, 100

NOTES:
1) NUMBERS IN [ ] ARE mm. IMPERIAL EQUIVALENTS ARE PROVIDED FOR CONVENIENCE.
2) *UNITS SHOWN ARE WITH STANDARD ROD ENDS. OPTIONAL ROD ENDS MAY USE OTHER MODEL NUMBERS.

RECTANGULAR FLANGE MOUNTING KIT
SIZES 20 & 25 mm (MF8 PER ISO 6432)

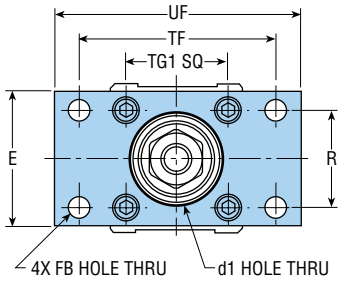


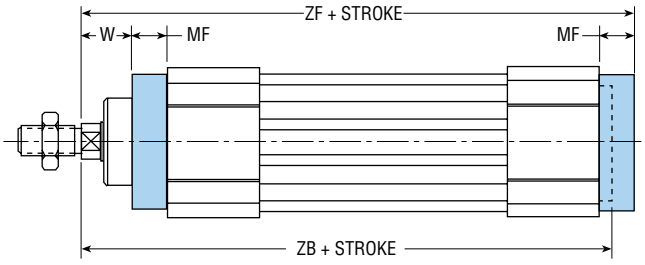


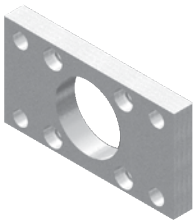
LETTER DIM / TOLERANCE	BORE SIZE			
	20 mm		25 mm	
	in	mm	in	mm
d1/H11	0.890	22.6	0.890	22.6
FB/H13	M6 x 1.0		M6 x 1.0	
FD	M4 x 0.7 x 18		M4 x 0.7 x 18	
TG1	1.024	26.0	1.063	27.0
MF	0.197	5.0	0.197	5.0
TF/JS14	1.969	50.0	1.969	50.0
UF max	2.756	70.0	2.756	70.0
UR max	1.575	40.0	1.575	40.0
W	0.748	19.0	0.906	23.0
ZB max (CVB)	3.504	89.0	3.858	98.0
ZF (CVB)	3.701	94.0	4.055	103.0
ZB max (CVC)	3.189	81.0	3.622	92.0
ZF (CVC)	3.386	86.0	3.819	97.0
Kit No.	52484-07-1		52484-07-1	
-Z1 Kit No.	52484-07-3		52484-07-3	

NOTE: Kits include flange and cylinder mounting hardware for one end only.

SIZES 32 - 100 mm (MF1/MF2 PER VDMA 24562)







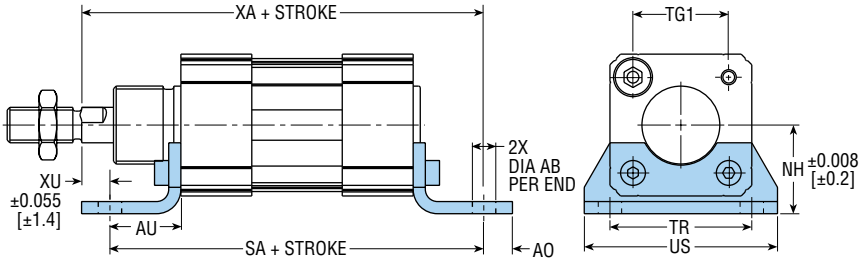
LETTER DIM / TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
d1/H11	1.184	30.1	1.381	35.0	1.578	40.1	1.775	46.1	1.775	45.1	2.169	55.0
FB/H13	0.265	7.0	0.346	8.8	0.346	8.8	0.346	8.8	0.448	11.4	0.527	14.0
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
E max	1.968	50.0	2.284	58.0	2.756	70.0	3.347	85.0	4.134	105.0	5.118	130.0
R/JS14	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.953	75.0
MF	0.394	10.0	0.394	10.0	0.472	12.0	0.472	12.0	0.630	16.0	0.630	16.0
TF/JS14	2.520	64.0	2.835	72.0	3.543	90.0	3.937	100.0	4.961	126.0	5.906	150.0
UF max	3.386	86.0	3.780	96.0	4.528	115.0	5.118	130.0	6.496	165.0	7.362	187.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.25 x 25		M10 x 1.25 x 25	
W	0.630	16.0	0.787	20.0	0.984	25.0	0.984	25.0	1.181	30.0	1.378	35.0
ZB max	4.882	124.0	5.591	142.0	5.866	149.0	6.496	165.0	7.165	182.0	7.795	198.0
ZF	5.118	130.0	5.709	145.0	6.102	155.0	6.693	170.0	7.480	190.0	8.071	205.0
Kit No.	52484-01-1		52484-02-1		52484-03-1		52484-04-1		52484-05-1		52484-06-1	
-Z1 Kit No.	52484-01-3		52484-02-3		52484-03-3		52484-04-3		52484-05-3		52484-06-3	

NOTE: Kits include flange and cylinder mounting hardware for one end only

BASE MOUNTING KIT
SIZES 20 & 25 mm (MS3 PER ISO 6432)

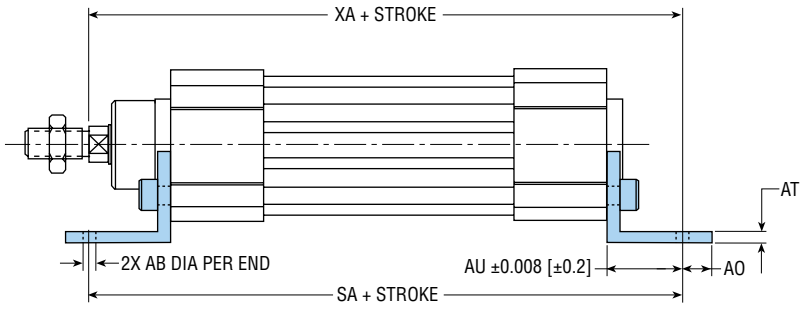
LETTER DIM / TOLERANCE	BORE SIZE			
	20 mm		25 mm	
	in	mm	in	mm
AB/H13	0.260	6.6	0.260	6.6
AO max	0.315	8.0	0.315	8.0
AU max	0.787	20.0	0.787	20.0
NH	0.984	25.0	0.984	25.0
SA (CVB)	4.211	107.0	4.329	110.0
SA (CVC)	3.897	99.0	4.094	104.0
TG1	1.024	26.0	1.063	27.0
TR/JS14	1.575	40.0	1.575	40.0
US max	2.146	54.5	2.146	54.5
XA (CVB)	4.370	111.0	4.645	118.0
XA (CVC)	4.055	103.0	4.409	112.0
XU	0.157	4.0	0.315	8.0
Kit No.	52487-07-1		52487-07-1	
-Z1 Kit No.	52487-07-3		52487-07-3	

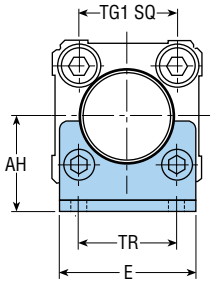
NOTE: Kits include bracket and cylinder mounting hardware for one end only.



Kit can only be mounted in orientation shown.

SIZES 32 - 100 mm (MS1 PER VDMA 24562)



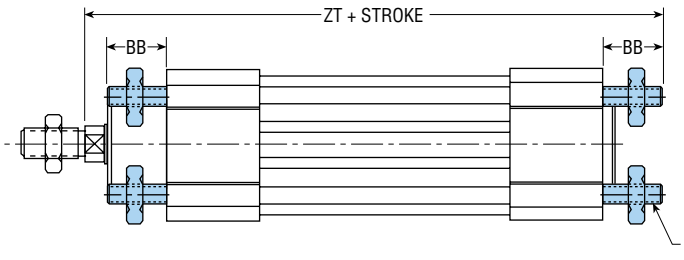


LETTER DIM / TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
AB	0.270	6.9	0.369	9.37	0.369	9.37	0.369	9.37	0.449	11.41	0.538	13.66
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
E max	1.969	50.0	2.284	58.0	2.756	70.0	3.347	85.0	4.134	105.0	5.118	130.0
TR	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.953	75.0
AO max	0.433	11.0	0.591	15.0	0.591	15.0	0.591	15.0	0.787	20.0	0.984	25.0
AU	0.945	24.0	1.102	28.0	1.260	32.0	1.260	32.0	1.614	41.0	1.614	41.0
AH	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.795	71.0
AT	0.177	4.5	0.177	4.5	0.217	5.5	0.217	5.5	0.256	6.5	0.256	6.5
SA	5.592	142.0	6.337	161.0	6.693	170.0	7.284	185.0	8.267	210.0	8.662	220.0
XA	5.669	144.0	6.417	163.0	6.890	175.0	7.480	190.0	8.465	215.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 25		M8 x 1.25 x 25		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52487-01-1		52487-02-1		52487-03-1		52487-04-1		52487-05-1		52487-06-1	
-Z1 Kit No.	52487-01-3		52487-02-3		52487-03-3		52487-04-3		52487-05-3		52487-06-3	

NOTE: Kits include bracket and cylinder mounting hardware for one end only

FASTENER MOUNTING KIT

SIZES 20 & 25 mm (MX1)
SIZES 32 - 100 mm (MX1 PER ISO 6431)

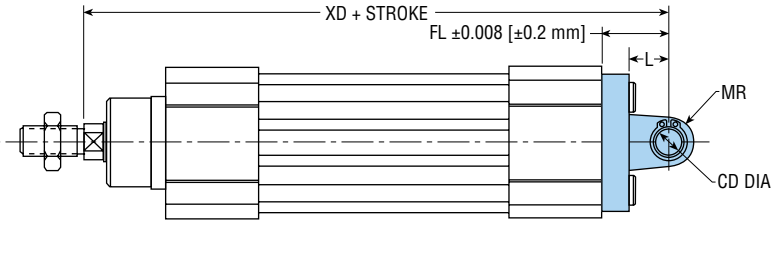


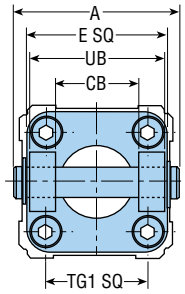
LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
BB min	0.512	13.0	0.512	13.0	0.669	17.0	0.669	17.0	0.906	23.0	0.906	23.0	1.102	28.0	1.102	28.0
DD	M4 x 0.7		M4 x 0.7		M6 x 1.0		M6 x 1.0		M8 x 1.25		M8 x 1.25		M10 x 1.5		M10 x 1.5	
ZT (CVA)	—	—	—	—	5.394	137.0	5.984	152.0	6.535	166.0	7.126	181.0	7.953	202.0	8.543	217.0
ZT (CVB)	4.095	104.0	4.370	111.0	—	—	—	—	—	—	—	—	—	—	—	—
ZT (CVC)	3.780	96.0	4.134	105.0	—	—	—	—	—	—	—	—	—	—	—	—
TG	1.024	26.0	1.063	27.0	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
Kit No.	63480-04-1		63480-04-1		63480-01-1		63480-01-1		63480-02-1		63480-02-1		63480-03-1		63480-03-1	
-Z1 Kit No.	63480-04-3		63480-04-3		63480-01-3		63480-01-3		63480-02-3		63480-02-3		63480-03-3		63480-03-3	

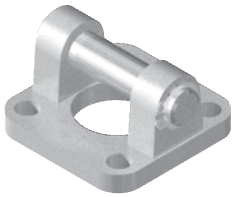
NOTE: Kit includes cylinder mounting hardware for one end only.

REAR FORK MOUNTING KIT

SIZES 32 - 100 mm (MP2 PER VDMA 24562)







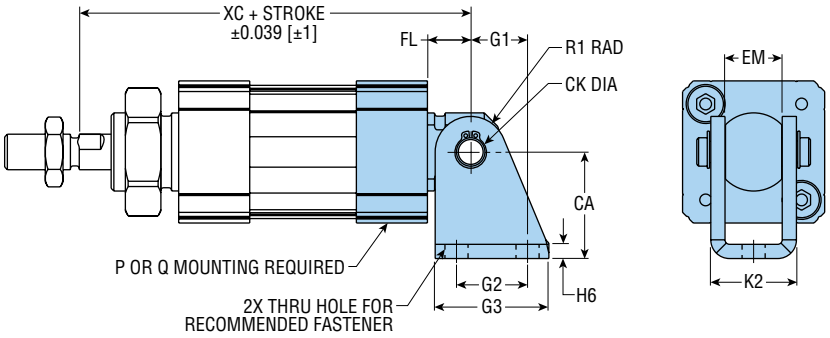
LETTER DIM / TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
A max	2.559	65.0	2.839	72.1	3.149	80.0	3.739	95.0	4.529	115.0	5.319	135.1
E max	1.968	50.0	2.284	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
UB/h14	1.759	44.7	2.033	51.6	2.348	59.6	2.741	69.6	3.526	89.6	4.314	109.6
CB/H14	1.034	26.3	1.113	28.3	1.272	32.3	1.587	40.3	1.981	50.3	2.377	60.4
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
FL	0.866	22.0	0.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
L min	0.482	12.2	0.601	15.3	0.601	15.3	0.797	20.2	0.797	20.2	0.994	25.2
CS/H9	0.394	10.0	0.473	12.0	0.473	12.0	0.631	16.0	0.631	16.0	0.789	20.0
MR max	0.433	11.0	0.512	13.0	0.512	13.0	0.669	17.0	0.669	17.0	0.827	21.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52485-01-1		52485-02-1		52485-03-1		52485-04-1		52485-05-1		52485-06-1	
-Z1 Kit No.	52485-01-3		52485-02-3		52485-03-3		52485-04-3		52485-05-3		52485-06-3	

NOTES:
1) Kit includes rear fork, cylinder mounting fasteners, pivot pin, and pivot pin retainer clips.
2) Mounting is compatible with MP4 male hinge and BMP4 pillow block.

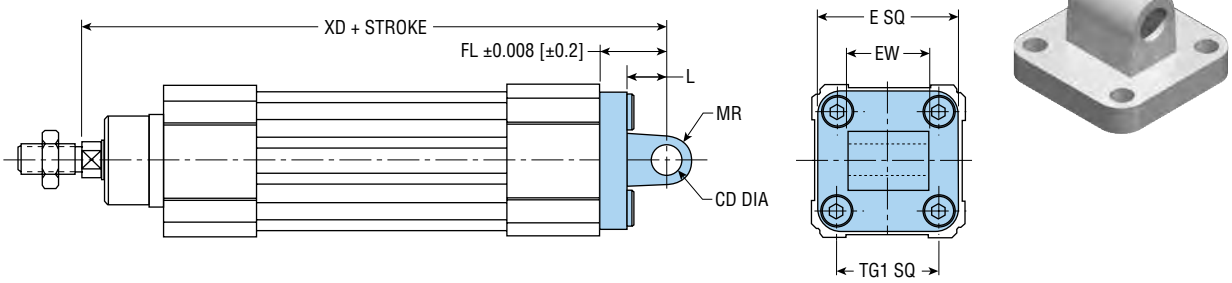
REAR MALE HINGE MOUNTING KIT
SIZES 20 & 25 mm

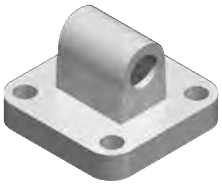
LETTER DIM / TOLERANCE	BORE SIZE			
	20 mm		25 mm	
	in	mm	in	mm
CA	1.181	30.0	1.181	30.0
CK	0.315	8.0	0.315	8.0
EM	0.634	16.1	0.634	16.1
FL min	0.472	12.0	0.472	12.0
G1	0.630	16.0	0.630	16.0
G2	0.787	20.0	0.787	20.0
G3	1.260	32.0	1.260	32.0
H6	0.157	4.0	0.157	4.0
K2	0.949	24.1	0.949	24.1
R1	0.394	10.0	0.394	10.0
XC (CVB)	4.055	103.0	4.330	110.0
XC (CVC)	3.740	95.0	4.094	104.0
Fastener	M6		M6	
Kit No.	65778-01-1		65778-01-1	
-Z1 Kit No.	65778-01-3		65778-01-3	

NOTE: Kits include hinge bracket, retaining rings, pivot pins, and cylinder mounting fasteners when required.



SIZES 32 - 100 mm (MP4 PER VDMA 24562)

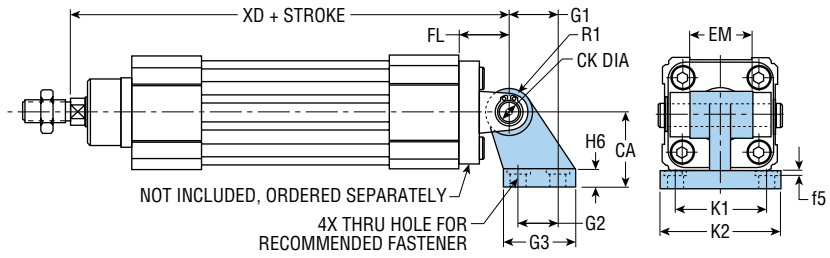




LETTER DIM / TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
E max	1.968	50.0	2.284	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
EW max	1.008	25.6	1.103	28.0	1.260	32.0	1.575	40.0	1.969	50.0	2.362	60.0
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
FL	0.866	22.0	0.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
L min	0.482	12.2	0.601	15.3	0.601	15.3	0.797	20.2	0.797	20.2	0.994	25.2
CD/H9	0.394	10.0	0.472	12.0	0.472	12.0	0.630	16.0	0.630	16.0	0.787	20.0
MR max	0.433	11.0	0.512	13.0	0.512	13.0	0.669	17.0	0.669	17.0	0.827	21.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52486-01-1		52486-02-1		52486-03-1		52486-04-1		52486-05-1		52486-06-1	
-Z1 Kit No.	52486-01-3		52486-02-3		52486-03-3		52486-04-3		52486-05-3		52486-06-3	

NOTES:
1) Rear male hinge is compatible with MP2 mounting.
2) Kit includes hinge and cylinder mounting fasteners.

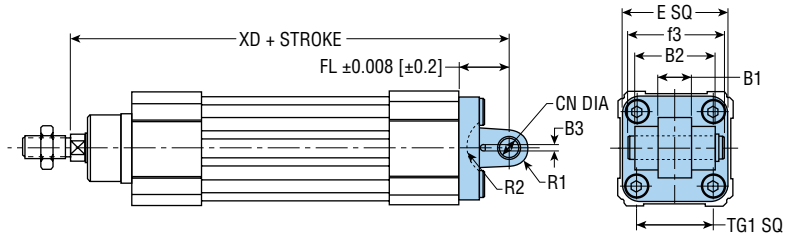
PILLOW BLOCK MOUNTING WITH RIGID BEARINGS KIT (BMP4, CETOP RP 107P)

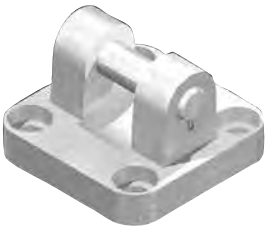


LETTER DIM / TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
CK/H9	0.394	10.0	0.473	12.0	0.473	12.0	0.631	16.0	0.631	16.0	0.788	20.0
K1/JS14	1.496	38.0	1.614	41.0	1.969	50.0	2.047	52.0	2.598	66.0	2.992	76.0
K2 max	2.008	51.0	2.126	54.0	2.559	65.0	2.638	67.0	3.386	86.0	3.780	96.0
G1/JS14	0.827	21.0	0.945	24.0	1.299	33.0	1.457	37.0	1.850	47.0	2.165	55.0
f5 max	0.063	1.6	0.063	1.6	0.063	1.6	0.063	1.6	0.098	2.5	0.098	2.5
G2	0.709	18.0	0.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.969	50.0
EM max	1.016	25.8	1.094	27.8	1.252	31.8	1.567	39.8	1.961	49.8	2.354	59.8
G3 max	1.220	31.0	1.378	35.0	1.772	45.0	1.969	50.0	2.362	60.0	2.756	70.0
CA/JS15	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.795	71.0
H6	0.315	8.0	0.394	10.0	0.472	12.0	0.472	12.0	0.551	14.0	0.591	15.0
R1 max	0.394	10.0	0.433	11.0	0.482	12.25	0.591	15.0	0.591	15.0	0.748	19.0
FL	0.866	22.0	0.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6	M6	M6	M6	M8	M8	M8	M8	M10	M10	M10	M10
Kit No.	62818-001-00		62818-002-00		62818-003-00		62818-004-00		62818-005-00		62818-006-00	

NOTES:
1) Kit includes pillow block only (no pin or fasteners).
2) Pillow block is compatible with MP2 rear fork.

REAR FORK MOUNTING FOR SPHERICAL BEARING KIT (PHD MSB2 PER VDMA 24562)

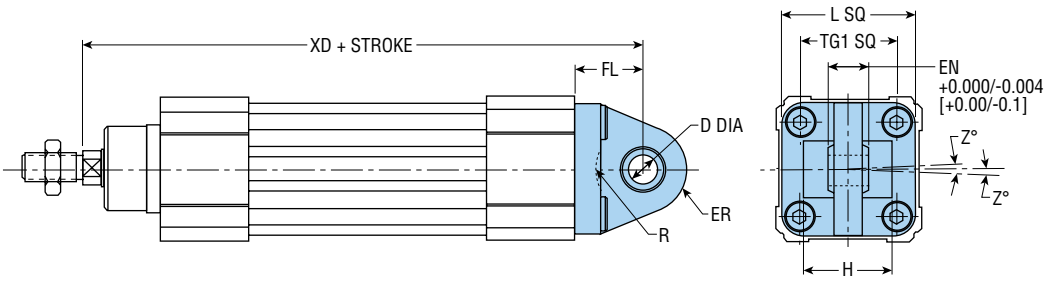


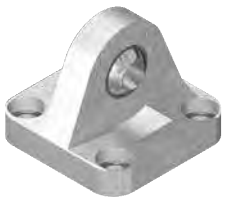


LETTER DIM / TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
E max	2.086	53.0	2.285	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
B2/d12	1.331	33.8	1.567	39.8	1.764	44.8	1.998	50.7	2.549	64.7	2.943	74.8
B1/H14	0.560	14.2	0.638	16.2	0.837	21.3	0.837	21.3	0.995	25.3	0.995	25.3
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
B3/*	0.130	3.3	0.169	4.3	0.169	4.3	0.169	4.3	0.169	4.3	0.248	6.3
R2 min	0.650	16.5	0.769	19.5	0.846	21.5	0.965	24.5	1.161	29.5	1.161	29.5
f3	1.811	46.0	2.087	53.0	2.283	58.0	2.598	66.0	3.150	80.0	3.543	90.0
FL	0.866	22.0	0.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
CN/F7	0.394	10.0	0.473	12.0	0.631	16.0	0.631	16.0	0.789	20.0	0.789	20.0
R1 max	0.433	11.0	0.512	13.0	0.709	18.0	0.709	18.0	0.866	22.0	0.866	22.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52489-01-1		52489-02-1		52489-03-1		52489-04-1		52489-05-1		52489-06-1	
-Z1 Kit No.	52489-01-3		52489-02-3		52489-03-3		52489-04-3		52489-05-3		52489-06-3	

NOTES:
1) Kit includes rear fork, cylinder mounting fasteners, pivot pin, and pivot pin retainer clips.
2) Mounting is compatible with MP4 male hinge and BMP4 pillow block.

REAR MALE HINGE MOUNTING WITH SPHERICAL BEARING KIT (PHD MSB1)

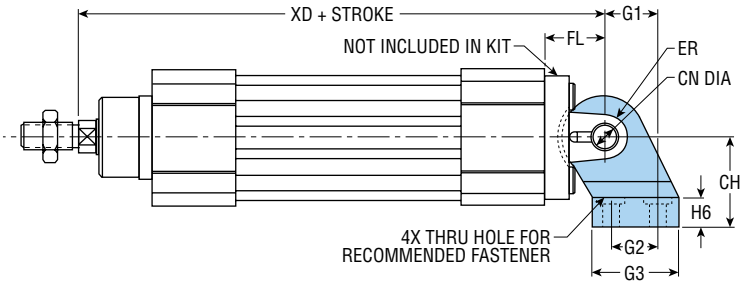


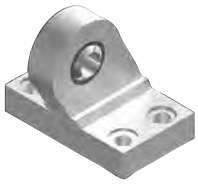


LETTER DIM / TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
TG1	1.280	32.5	1.496	38.0	1.831	46.5	2.224	56.5	2.835	72.0	3.504	89.0
FL/JS15	0.866	22.0	0.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
D/H7	0.394	10.0	0.472	12.0	0.630	16.0	0.630	16.0	0.787	20.0	0.787	20.0
EN	0.549	14.0	0.628	16.0	0.825	21.0	0.825	21.0	0.982	25.0	0.982	25.0
ER max	0.630	16.0	0.748	19.0	0.827	21.0	0.945	24.0	1.102	28.0	1.181	30.0
L max	1.968	50.0	2.285	58.0	2.756	70.0	3.346	85.0	4.134	105.0	5.118	130.0
Z°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°
H	—	—	—	—	2.008	51.0	—	—	—	—	—	—
R	—	—	—	—	0.748	19.0	—	—	—	—	—	—
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Fastener	M6 x 1 x 20		M6 x 1 x 20		M8 x 1.25 x 20		M8 x 1.25 x 20		M10 x 1.5 x 25		M10 x 1.5 x 25	
Kit No.	52488-01-1		52488-02-1		52488-03-1		52488-04-1		52488-05-1		52488-06-1	
-Z1 Kit No.	52488-01-3		52488-02-3		52488-03-3		52488-04-3		52488-05-3		52488-06-3	

NOTES:
1) Kit includes hinge and cylinder mounting fasteners.
2) Rear male hinge is compatible with MSB2 rear fork for spherical bearing.

PILLOW BLOCK MOUNTING WITH SPHERICAL BEARING KIT (PHD BSB1 PER VDMA 24562)

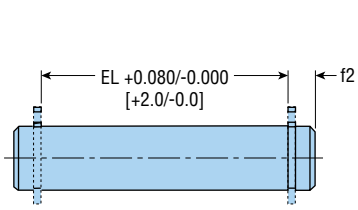




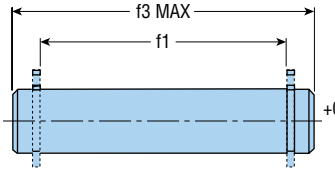
LETTER DIM / TOLERANCE	BORE SIZE											
	32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
CN/H7	0.394	10.0	0.472	12.0	0.630	16.0	0.630	16.0	0.787	20.0	0.787	20.0
K1/JS14	1.496	38.0	1.614	41.0	1.969	50.0	2.047	52.0	2.598	66.0	2.992	76.0
K2 max	2.008	51.0	2.126	54.0	2.559	65.0	2.638	67.0	3.386	86.0	3.780	96.0
G1/JS14	0.827	21.0	0.945	24.0	1.299	33.0	1.457	37.0	1.850	47.0	2.165	55.0
f5 max	0.063	1.6	0.063	1.6	0.063	1.6	0.063	1.6	0.098	2.5	0.098	2.5
G2/JS14	0.709	18.0	0.866	22.0	1.181	30.0	1.378	35.0	1.575	40.0	1.969	50.0
EN	0.549	14.0	0.628	16.0	0.825	21.0	0.825	21.0	0.982	25.0	0.982	25.0
G3 max	1.220	31.0	1.378	35.0	1.772	45.0	1.969	50.0	2.362	60.0	2.756	70.0
CH/JS15	1.260	32.0	1.417	36.0	1.772	45.0	1.969	50.0	2.480	63.0	2.795	71.0
H6	0.394	10.0	0.394	10.0	0.472	12.0	0.472	12.0	0.551	14.0	0.591	15.0
ER max	0.630	16.0	0.709	18.0	0.827	21.0	0.906	23.0	1.102	28.0	1.181	30.0
FL	0.866	22.0	0.984	25.0	1.063	27.0	1.260	32.0	1.417	36.0	1.614	41.0
XD	5.591	142.0	6.299	160.0	6.693	170.0	7.480	190.0	8.268	210.0	9.055	230.0
Z°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°	4°
Fastener	M6	M6	M6	M6	M8	M8	M8	M8	M10	M10	M10	M10
Kit No.	62822-001-00		62822-002-00		62822-003-00		62822-004-00		62822-005-00		62822-006-00	

NOTES:
1) Kit includes pillow block only. No mounting fasteners.
2) Pillow block is compatible with MSB2 rear fork for spherical bearing.
3) Not available in -Z1.

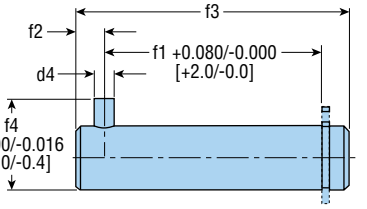
PIVOT PIN KIT



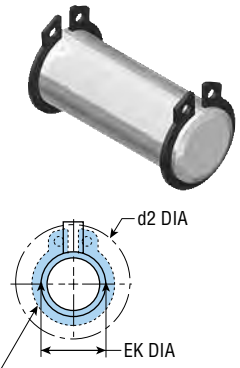
PIVOT PIN FOR MP2 PER VDMA 2456
(SIZES 32-100 mm)



MALE HINGE MOUNTING PIVOT PIN
(SIZES 20-25 mm)



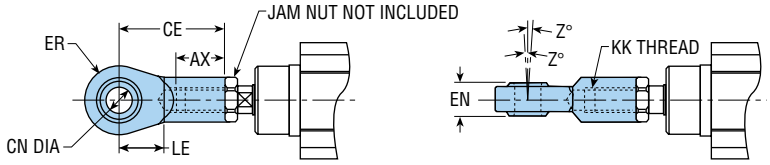
SPHERICAL BEARING PIVOT PIN
FOR ANTI-ROTATION (MSB2)
(SIZES 32-100 mm)



RETAINER CLIPS INCLUDED IN KIT AND SHIPPED UNASSEMBLED. RETAINER CLIP SHOWN MAY NOT BE STYLE SUPPLIED.

LETTER DIM / TOLERANCE	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
	MP2 PIVOT PIN															
d2 max	—	—	—	—	0.906	23.0	0.984	25.0	0.984	25.0	1.260	32.0	1.260	32.0	1.575	40.0
EK/e8	—	—	—	—	0.392	10.0	0.471	12.0	0.471	12.0	0.628	16.0	0.628	16.0	0.785	20.0
EL	—	—	—	—	1.850	47.0	2.126	54.0	2.441	62.0	2.835	72.0	3.622	92.0	4.409	112.0
f2 max	—	—	—	—	0.335	8.5	0.335	8.5	0.335	8.5	0.433	11.0	0.433	11.0	0.433	11.0
Kit No.	—		—		52490-01-1		52490-02-1		52490-03-1		52490-04-1		52490-05-1		52490-06-1	
-Z1 Kit No.	—		—		52490-01-3		52490-02-3		52490-03-3		52490-04-3		52490-05-3		52490-06-3	
	MALE HINGE PINS				MSB2 PIVOT PIN											
d2 max	—	—	—	—	0.906	23.0	0.984	25.0	0.984	25.0	1.260	32.0	1.260	32.0	1.575	40.0
d4/H12	—	—	—	—	0.120	3.0	0.160	4.0	0.160	4.0	0.160	4.0	0.160	4.0	0.160	4.0
EK/h9	0.315	8.0	0.315	8.0	0.392	10.0	0.472	12.0	0.629	16.0	0.629	16.0	0.786	20.0	0.788	20.0
f1	0.945	24.0	0.945	24.0	1.280	32.5	1.500	38.1	1.697	43.1	1.933	49.1	2.484	63.1	2.878	73.1
f2 max	—	—	—	—	0.177	4.5	0.236	6.0	0.236	6.0	0.236	6.0	0.236	6.0	0.236	6.0
f3 max	1.260	32.0	1.260	32.0	1.811	46.0	2.087	53.0	2.283	58.0	2.598	66.0	3.150	80.0	3.543	90.0
f4	—	—	—	—	0.543	13.8	0.622	15.8	0.780	19.8	0.780	19.8	0.937	23.8	0.937	23.8
Kit No.	52491-07-1		52491-07-1		52491-01-1		52491-02-1		52491-03-1		52491-04-1		52491-05-1		52491-06-1	
-Z1 Kit No.	52491-07-3		52491-07-3		52491-01-3		52491-02-3		52491-03-3		52491-04-3		52491-05-3		52491-06-3	

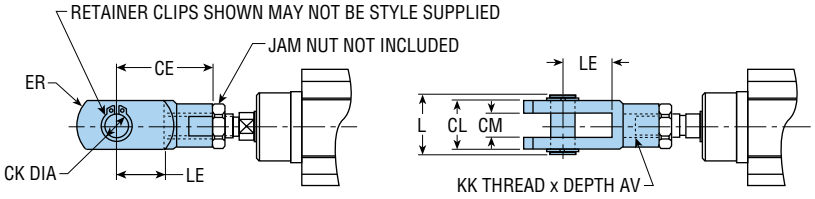
ROD EYE MOUNTING WITH SPHERICAL BEARING KIT FOR METRIC ROD ENDS
(CONTACT PHD FOR IMPERIAL STYLE)
SIZES 20 - 100 mm (DIN 8139)



LETTER DIM / TOLERANCE	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm
AX min	0.630	16.0	0.787	20.0	0.787	20.0	0.866	22.0	1.102	28.0	1.102	28.0	1.299	33.0	1.299	33.0
CE	1.417	36.0	1.693	43.0	1.693	43.0	1.969	50.0	2.520	64.0	2.520	64.0	3.031	77.0	3.031	77.0
CN/H9	0.315	8.0	0.394	10.0	0.394	10.0	0.473	12.0	0.631	16.0	0.631	16.0	0.788	20.0	0.788	20.0
EN/h12	0.470	12.0	0.547	13.9	0.547	13.9	0.626	15.9	0.823	20.9	0.823	20.9	0.980	24.9	0.980	24.9
ER max	0.482	12.2	0.541	13.7	0.541	13.7	0.620	15.7	0.817	20.8	0.817	20.8	0.974	24.7	0.974	24.7
KK	—	M8 x 1.25	—	M10 x 1.25	—	M10 x 1.25	—	M12 x 1.25	—	M16 x 1.5	—	M16 x 1.5	—	M20 x 1.5	—	M20 x 1.5
LE min	0.512	13.0	0.591	15.0	0.591	15.0	0.669	17.0	0.906	23.0	0.906	23.0	1.063	27.0	1.063	27.0
Z°	4°		4°		4°		4°		4°		4°		4°		4°	
Metric Kit No.*	52493-05-1		52493-01-1		52493-01-1		52493-02-1		52493-03-1		52493-03-1		52493-04-1		52493-04-1	

NOTES:
1) 32-100 mm sizes compatible with MSB2 rear fork for spherical bearing.
2) Not available in -Z1 or with imperial threads.
3) *Consult PHD for imperial rod eye mounting components and availability. Inch dimensions are given for metric conversion convenience only.

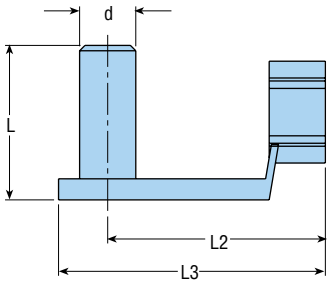
ROD CLEVIS MOUNTING KIT FOR METRIC ROD ENDS
(CONTACT PHD FOR IMPERIAL STYLE)
SIZES 20 - 100 mm (DIN 8140)



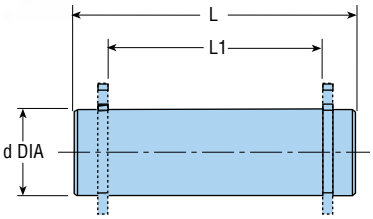
LETTER DIM / TOLERANCE	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm	in*	mm
AV min	0.630	16.0	0.787	20.0	0.787	20.0	0.866	22.0	1.102	28.0	1.102	28.0	1.299	33.0	1.299	33.00
CE	1.260	32.0	1.575	40.0	1.575	40.0	1.890	48.0	2.520	64.0	2.520	64.0	3.150	80.0	3.150	80.0
CL/H9	0.316	8.03	0.394	10.00	0.394	10.0	0.473	12.0	0.631	16.0	0.631	16.0	0.780	20.0	0.787	20.0
CL max	0.630	16.0	0.787	20.0	0.787	20.0	0.945	24.0	1.260	32.0	1.260	32.0	1.575	40.0	1.575	40.0
CM min	0.315	8.0	0.394	10.0	0.394	10.0	0.472	12.0	0.630	16.0	0.630	16.0	0.787	20.0	0.787	20.0
ER max	0.512	13.0	0.630	16.0	0.630	16.0	0.748	19.0	0.984	25.0	0.984	25.0	1.260	32.0	1.260	32.0
KK	—	M8 x 1.25	—	M10 x 1.25	—	M10 x 1.25	—	M12 x 1.25	—	M16 x 1.5	—	M16 x 1.5	—	M20 x 1.5	—	M20 x 1.5
L	0.827	21.0	0.984	25.0	0.984	25.0	1.181	30.0	1.535	39.0	1.535	39.0	1.890	48.0	1.890	48.0
LE min	0.650	16.5	0.807	20.5	0.807	20.5	0.965	24.5	1.279	32.5	1.279	32.5	1.594	40.5	1.594	40.5
Metric Kit No.*	52492-05-1		52492-01-1		52492-01-1		52492-02-1		52492-03-1		52492-03-1		52492-04-1		52492-04-1	
Metric -Z1 Kit No.*	52492-05-3		52492-01-3		52492-01-3		52492-02-3		52492-03-3		52492-03-3		52492-04-3		52492-04-3	

NOTES:
1) Kit includes clevis, pivot pin, and retainer rings. Jam nut not included.
2) *Consult PHD for imperial rod eye mounting components and availability. Imperial dimensions are given for metric conversion convenience only.

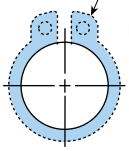
ROD CLEVIS PIVOT PIN KIT
SIZES 20 - 100 mm



SIZE 20 mm



SIZES 25-100 mm (DIN 8140)



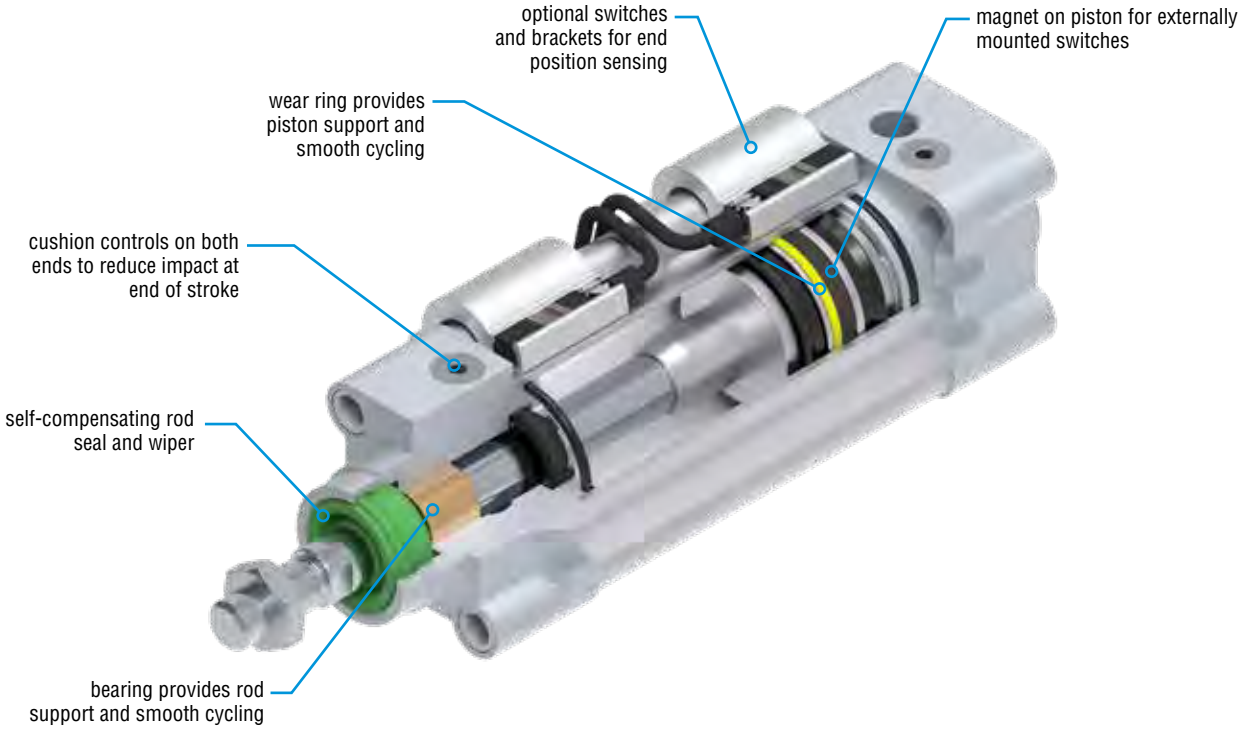
RETAINER CLIPS INCLUDED IN KIT AND SHIPPED UNASSEMBLED. RETAINER CLIP SHOWN MAY NOT BE STYLE SUPPLIED.

LETTER DIM	BORE SIZE															
	20 mm		25 mm		32 mm		40 mm		50 mm		63 mm		80 mm		100 mm	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
d	0.315	8.0	0.394	10.0	0.394	10.0	0.472	12.0	0.630	16.0	0.630	16.0	0.787	20.0	0.787	20.0
L	0.827	21.0	0.984	25.0	0.984	25.0	1.181	30.0	1.535	39.0	1.535	39.0	1.890	48.0	1.890	48.0
L1	—	—	0.791	20.1	0.791	20.1	0.949	24.1	1.264	32.1	1.264	32.1	1.579	40.1	1.579	40.1
L2	1.220	31.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L3	1.457	37.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kit No.	63463-05-1		63463-01-1		63463-01-1		63463-02-1		63463-03-1		63463-03-1		63463-04-1		63463-04-1	
-Z1 Kit No.	63463-05-3		63463-01-3		63463-01-3		63463-02-3		63463-03-3		63463-03-3		63463-04-3		63463-04-3	

OCV

Major Benefits

- Series OCV Cylinders are ISO 6431
- The price alternative to the PHD Series CV Pneumatic Cylinder
- 32, 40 & 50 mm bores
- 25, 50, 100 & 200 mm stroke lengths



COMPONENT	MATERIALS
HEAD & CAP	Painted Aluminum Alloy
CYLINDER TUBE	Anodized Aluminum Alloy
ROD SEAL	Polyurethane
PISTON SEAL	NBR
O-RINGS	
CUSHION SEAL	
PISTON ROD	Carbon Steel
ROD NUT	
CUSHION NEEDLE	Brass
ROD BUSHING	PTFE and Bronze Alloy

TO ORDER SPECIFY:
Model No., Design No., Travel, Size, and any options required.

SIZE		
BORE	**AREA**	
mm	**mm²**	**in²**
32	804	1.25
40	1257	1.95
50	1963	3.05

MODEL NO.

TYPE
S - Single Rod

OCV S 5 - 32 x 25 - STNK2

DESIGN NO.
5 - Metric

STROKE
Standard Stroke Lengths
mm
25
50
100
200
Contact PHD for other strokes

SWITCH BUNDLE OPTION CODE
ST x K2

SWITCH CIRCUITRY
D - DC Reed
N - DC Solid State NPN - Sink
P - DC Solid State PNP - Source

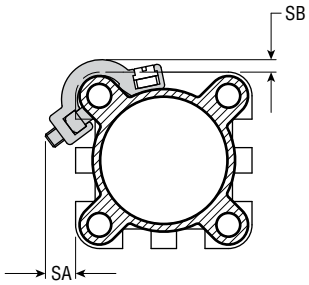
CABLE TYPE
K - Quick Connect
2 - 2 Meter Cable

NOTES:
1) Switch bundle option includes 2 switches and 2 mounting brackets
2) Switch bundle available with actuator only
3) Magnets standard on all units
4) Cushions and cushion controls standard on all units

SWITCHES

PART NO.	DESCRIPTION
85844-0	Reed, DC 5-30 V, 50 mA w/Quick Connect
85844-2	Reed, DC 5-30 V, 50 mA w/2 m cable
85845-0	Solid State NPN, DC 5-30 V, 50 mA w/Quick Connect
85845-2	Solid State NPN, DC 5-30 V, 50 mA w/2 m cable
85846-0	Solid State PNP, DC 5-30 V, 50 mA w/Quick Connect
85846-2	Solid State PNP, DC 5-30 V, 50 mA w/2 m cable

Includes one switch.



CORDSETS

MODEL NO.	CABLE LENGTH
63549-02	78.74 in [2 m]
63549-05	196.85 in [5 m]

Includes one cordset.

SWITCH BRACKET

BORE	SA	SB
32	7.6	3.4
40	6.3	2.2
50	5.8	1.2

TRUNNION MOUNT

BORE	PART NO.
32	85841-032-00-1
40	85841-040-00-1
50	85841-050-00-1

NOTES:
1) Trunnion mount incompatible on 25 mm stroke units with a single switch.
2) Trunnion mount incompatible on 25 mm and 50 mm stroke units with two switches.
3) Trunnion installation requires end user to remove and reinstall the cylinder cap.

CAD & Sizing Assistance

Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

SPECIFICATIONS	SERIES OCV CYLINDER
OPERATING AIR PRESSURE	1 - 10 bar [15 - 150 psi]
TEMPERATURE LIMITS	-5° to +70°C [23° - 158°F]
VELOCITY	50 - 800 mm/s [2 - 31 in/s]
RATED LIFE	3 million cycles
LUBRICATION	Factory lubricated for rated life

BORE	ROD DIA	ROD DIRECTION	EFFECTIVE AREA		BASE WEIGHT		ADDER PER 25 mm	
	mm		mm²	in²	g	oz	g	oz
32	12	Extend	804	1.25	485	17.1	23	0.8
		Retract	691	1.07				
40	16	Extend	1257	1.95	739	26.1	82	2.9
		Retract	1056	1.64				
50	20	Extend	1963	3.04	1143	40.3	113	4.0
		Retract	1649	2.56				

Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at **www.phdinc.com/apps/sizing**

SPEED DATA - STANDARD UNITS

BORE	ACCELERATION TIME	STROKE DURING ACCELERATION	
	s	mm	in
32	0.015	16	0.63
40	0.019	24	0.94
50	0.024	29	1.14

NOTES:
The above speed data is based on:
A) No attached loads
B) Line pressure of 6 bar [87 psi]
C) Valve and tubing rated at Cv=50

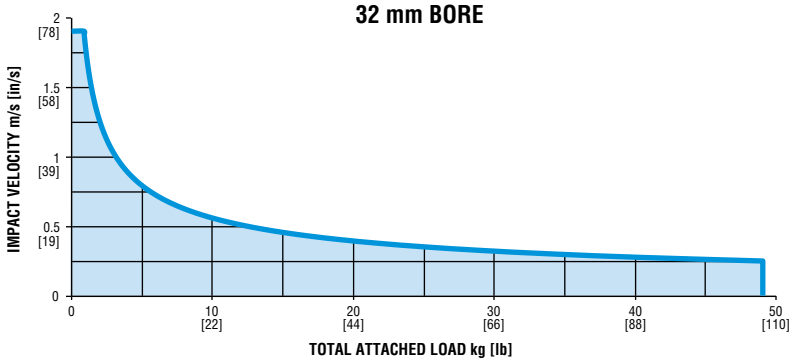
CYLINDER FORCE TABLE

BORE	ROD DIA	ROD DIRECTION	EFFECTIVE AREA	
	mm		mm²	in²
32	12	Extend	804	1.25
		Retract	691	1.07
40	16	Extend	1257	1.95
		Retract	1056	1.64
50	20	Extend	1963	3.04
		Retract	1649	2.56

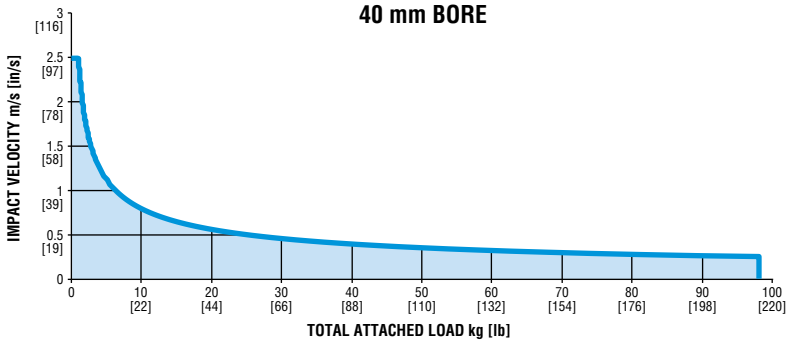
BORE	NORMAL STROKE [L]	FULL STROKE TOLERANCE	
	mm	mm	in
32	L ≤ 500	+2.0/-0	+0.08/-0
	500 < L ≤ 1000	+3.2/-0	+0.13/-0
40	L ≤ 500	+2.0/-0	+0.08/-0
	500 < L ≤ 1000	+3.2/-0	+0.13/-0
50	L ≤ 500	+2.0/-0	+0.08/-0
	500 < L ≤ 1000	+3.2/-0	+0.13/-0

MAXIMUM ALLOWABLE KINETIC ENERGY

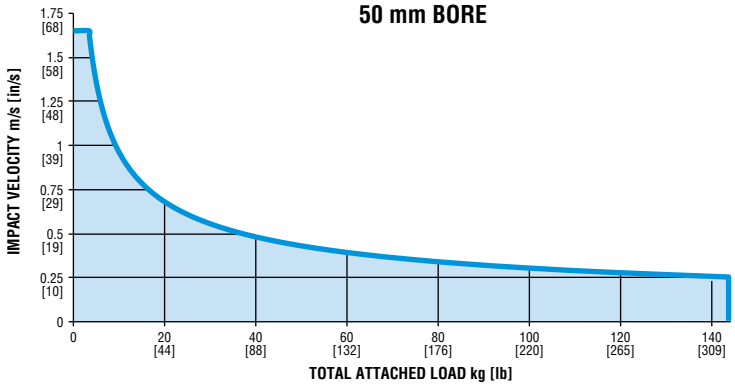
32 mm BORE

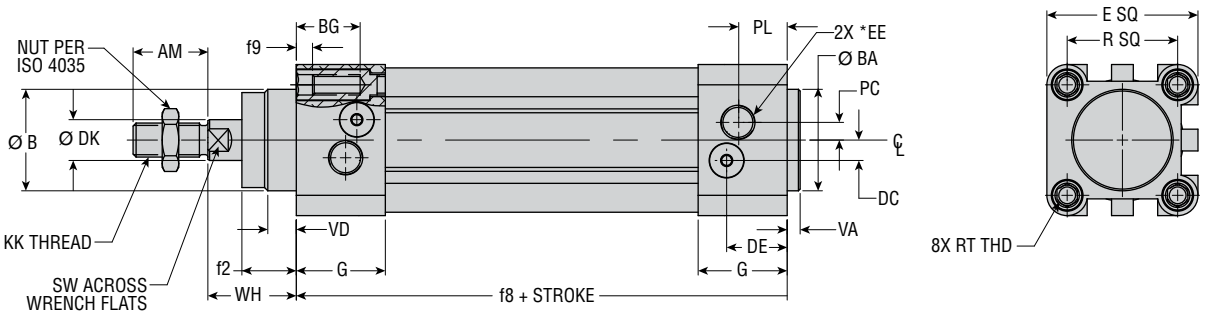


40 mm BORE



50 mm BORE

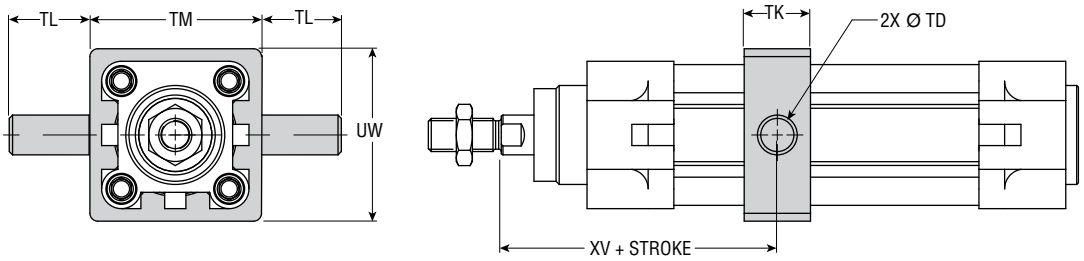




NOTES:
1) DIMENSIONS ARE IN MM.
2) DESIGNATED CENTERLINE IS CENTERLINE OF CYLINDER.
3) UNLESS OTHERWISE DIMENSIONED, MOUNTING HOLE PATTERNS ARE CENTERED ON DESIGNATED CYLINDER CENTERLINE.
4) *EE CONFORMS TO ISO 16030.

BORE	Ø B	RT	WH	f2	R SQ	BG MIN	VD	VA MAX	G	f8	f9	E SQ MAX	SW (WRENCH FLAT)	Ø BA	KK	AM	*EE PORT	PL	PC	DE	DC	Ø DK
32	30.0	M6 x1	26.0	18.0	32.5	16.0	10.0	4.0	26.0	94.0	5.0	50.0	10.0	30.0	M10 x 1.25	22.0	G 1/8	13.0	5.2	16.3	6.0	12.0
40	35.0	M6 x1	30.0	21.5	38.0	16.0	10.5	4.0	29.6	105.0	5.0	58.0	13.0	35.0	M12 x 1.25	24.0	G 1/4	14.0	6.0	17.6	8.0	16.0
50	40.0	M8 x1.25	37.0	28.0	46.5	16.0	11.5	4.0	30.0	106.0	5.0	70.0	17.0	40.0	M16 x 1.5	32.0	G 1/4	14.0	8.5	19.1	10.0	20.0

TRUNNION MOUNT ACCESSORY



NOTES:
1) DIMENSIONS SHOWN ASSUME NO SWITCH BRACKETS ARE INSTALLED.
2) TRUNNION MOUNT INCOMPATIBLE ON 25 mm STROKE UNITS WITH A SINGLE SWITCH.
3) TRUNNION MOUNT INCOMPATIBLE ON 25 mm AND 50 mm STROKE UNITS WITH TWO SWITCHES.
4) TRUNNION INSTALLATION REQUIRES END USER TO INSTALL.

BORE	PART NO.	Ø TD E9	TK MAX	TL** MAX	TM MAX	UW MAX	XV MIN
32	85841-032-00-1	12	25	25	53	65	73
40	85841-040-00-1	16	28	25	63	75	82.5
50	85841-050-00-1	16	28	25	75	95	90

* TM max for bore size 32 mm does not conform to ISO 6431 (MT4) and ISO 15552 (MT4)
** TL max dimensions do not conform to ISO 6431 (MT4) and ISO 15552 (MT4)

SWITCHES AND BRACKETS

BRACKETS

BORE	SWITCH BRACKET NO.
32	85843-01
40	85843-01
50	85843-03

Includes one bracket.

CORDSETS

MODEL NO.	CABLE LENGTH
63549-02	78.74 in [2 m]
63549-05	196.85 in [5 m]

Includes one cordset.

SWITCHES

PART NO.	DESCRIPTION
85844-0	Reed, DC 5-30 V, 50 mA w/Quick Connect
85844-2	Reed, DC 5-30 V, 50 mA w/2 m cable
85845-0	Solid State NPN, DC 5-30 V, 50 mA w/Quick Connect
85845-2	Solid State NPN, DC 5-30 V, 50 mA w/2 m cable
85846-0	Solid State PNP, DC 5-30 V, 50 mA w/Quick Connect
85846-2	Solid State PNP, DC 5-30 V, 50 mA w/2 m cable

Includes one switch.

All dimensions are reference only unless specifically toleranced.

MP2 PIVOT PINS

BORE	STD KIT NO.	-Z1 KIT NO.
32	52490-01-1	52490-01-3
40	52490-02-1	52490-02-3
50	52490-03-1	52490-03-3

REAR FORK MOUNTING (MP2 PER VDMA 24562)

BORE	STD KIT NO.	-Z1 KIT NO.
32	52485-01-1	52485-01-3
40	52485-02-1	52485-02-3
50	52485-03-1	52485-03-3

NOTE: Includes pivot pin hardware.

PILLOW BLOCK MOUNTING WITH RIGID BEARINGS (BMP4, CETOP RP 107P)

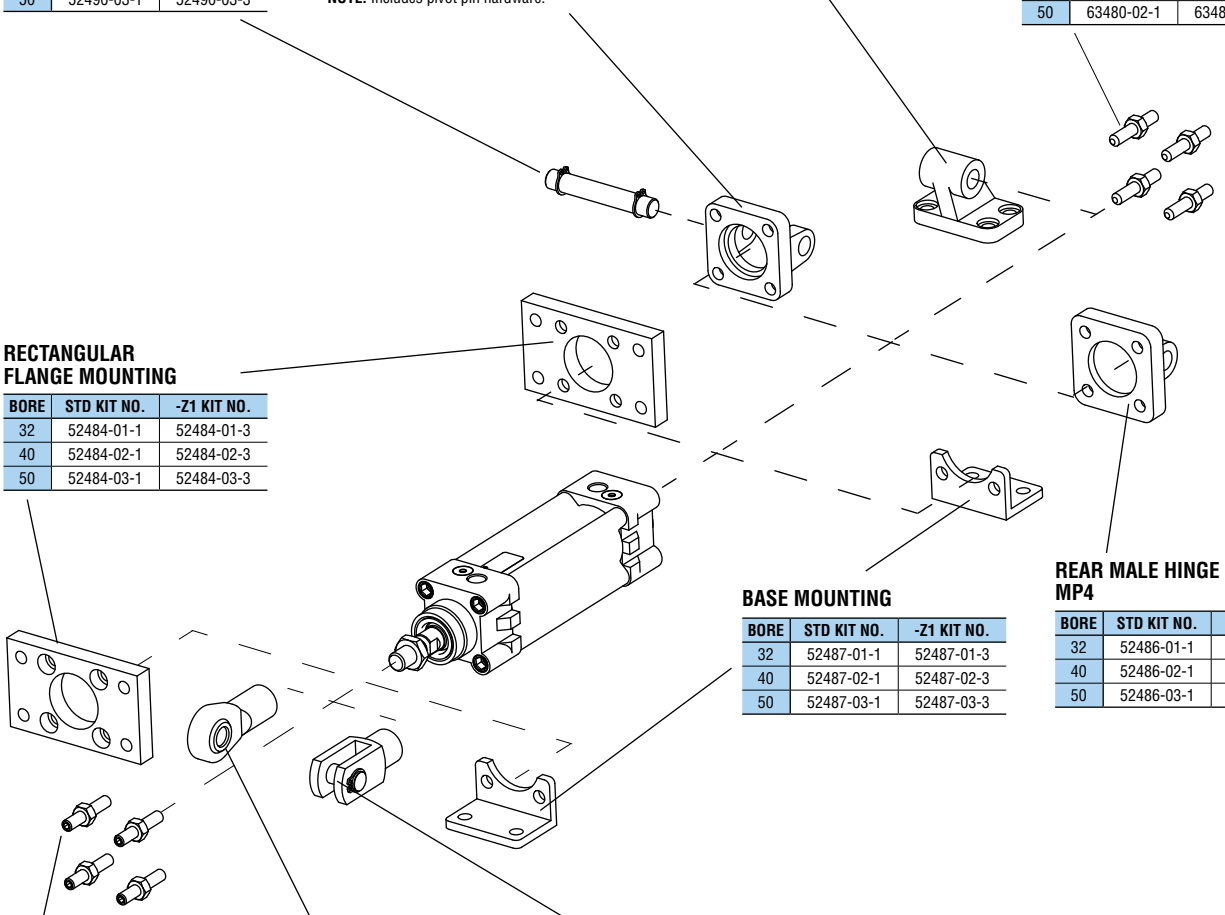
BORE	STD KIT NO.
32	62818-001-00
40	62818-002-00
50	62818-003-00

FASTENER MOUNTING (MX1)

BORE	STD KIT NO.	-Z1 KIT NO.
32	63480-01-1	63480-01-3
40	63480-01-1	63480-01-3
50	63480-02-1	63480-02-3

RECTANGULAR FLANGE MOUNTING

BORE	STD KIT NO.	-Z1 KIT NO.
32	52484-01-1	52484-01-3
40	52484-02-1	52484-02-3
50	52484-03-1	52484-03-3



BASE MOUNTING

BORE	STD KIT NO.	-Z1 KIT NO.
32	52487-01-1	52487-01-3
40	52487-02-1	52487-02-3
50	52487-03-1	52487-03-3

REAR MALE HINGE MOUNTING MP4

BORE	STD KIT NO.	-Z1 KIT NO.
32	52486-01-1	52486-01-3
40	52486-02-1	52486-02-3
50	52486-03-1	52486-03-3

ROD CLEVIS MOUNTING (DIN 8140)

BORE	STD KIT NO.	-Z1 KIT NO.
32	52492-01-1	52492-01-3
40	52492-02-1	52492-02-3
50	52492-03-1	52492-03-3

FASTENER MOUNTING (MX1)

BORE	STD KIT NO.	-Z1 KIT NO.
32	63480-01-1	63480-01-3
40	63480-01-1	63480-01-3
50	63480-02-1	63480-02-3

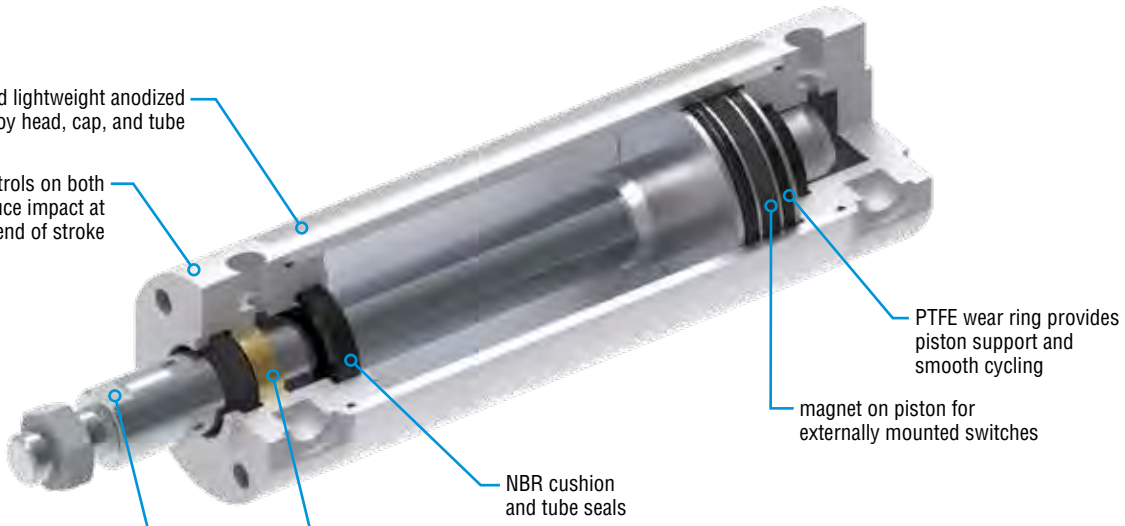
ROD EYE WITH SPHERICAL BEARING (DIN 8139)

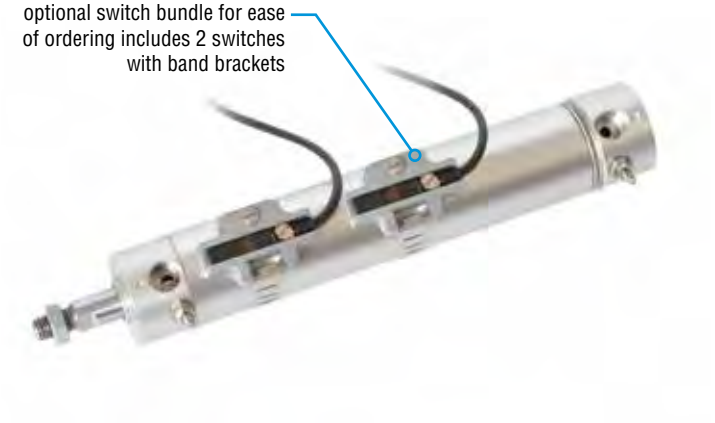
BORE	STD KIT NO.
32	52493-01-1
40	52493-02-1
50	52493-03-1

OCG

Major Benefits

- Imperial and metric models to match machine builders' specifications
- Magnets standard for switch sensing capability
- Standard cushions to reduce end of travel impact
- 6 bore sizes with 10 stroke lengths available to fit a variety of applications
- Drop-in mounting to match global standard





COMPONENT	MATERIALS
HEAD & CAP	Anodized Aluminum Alloy
CYLINDER TUBE	
ROD SEAL	NBR
PISTON SEAL	
O-RINGS	
CUSHION SEAL	
CUSHION NEEDLE	Brass
PISTON WEAR RING	PTFE
ROD BUSHING	PTFE and Bronze Alloy
ROD NUT	Carbon Steel
PISTON ROD*	

*Stainless steel sizes 3/4", 1", 20 mm and 25 mm

TO ORDER SPECIFY:
Model No., Design No., Bore, Stroke, and any options required.

IMPERIAL

DESIGN NO.
1 - Imperial

BORE in	AREA in²
3/4	0.49
1	0.76
1-1/4	1.25
1-1/2	1.95
2	3.04
2-1/2	4.83

STROKE Standard Lengths in
1
2
3
4
5
6
7
8
10*
12*

*Not available 3/4 in Bore

MODEL NO.

OCG 1 1-1/2 x 4 - STNK2

METRIC

DESIGN NO.
6 - Metric

BORE mm	AREA mm²
20	314
25	491
32	804
40	1256
50	1963
63	3116

STROKE Standard Lengths mm
25
50
75
100
125
150
—
200
250*
300*

*Not available 20 mm Bore

SWITCH BUNDLE OPTION CODE

ST x K2

SWITCH CIRCUITRY
D - DC Reed
N - DC Solid State NPN - Sink
P - DC Solid State PNP - Source

CABLE TYPE
K - Quick Connect
2 - 2 Meter Cable

NOTES:
1) Switch bundle option includes 2 switches and 2 mounting brackets
2) Switch bundle available with actuator only
3) Magnets and cushions standard both directions.
4) See page 9 for mounting accessories.

REPAIR KITS

BORE SIZE in	BORE SIZE mm	PART NO.
3/4	20	87000-01
1	25	87000-02
1-1/4	32	87000-03
1-1/2	40	87000-04
2	50	87000-05
2-1/2	63	87000-06

SWITCHES

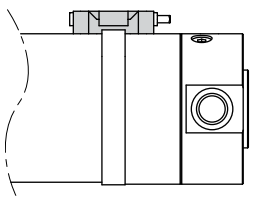
PART NO.	DESCRIPTION
85844-0	Reed, DC 5-30 V, 50 mA w/Quick Connect
85844-2	Reed, DC 5-30 V, 50 mA w/2 m cable
85845-0	Solid State NPN, DC 5-30 V, 50 mA w/Quick Connect
85845-2	Solid State NPN, DC 5-30 V, 50 mA w/2 m cable
85846-0	Solid State PNP, DC 5-30 V, 50 mA w/Quick Connect
85846-2	Solid State PNP, DC 5-30 V, 50 mA w/2 m cable
86999	Round Cylinder Switch Band Bracket

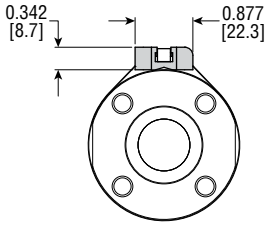
Includes one switch.

CORDSETS

MODEL NO.	CABLE LENGTH
63549-02	78.74 in [2 m]
63549-05	196.85 in [5 m]

Includes one cordset.





CAD & Sizing Assistance

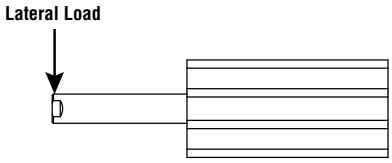
Use PHD's free online Product Sizing and CAD Configurator at **phdinc.com/myphd**

SPECIFICATIONS	SERIES OCG CYLINDER
OPERATING AIR PRESSURE	8 - 140 psi [0.5 - 9.7 bar]
TEMPERATURE LIMITS	32° - 140°F [0° - 60°C]
VELOCITY	2 - 20 in/s [50 - 500 mm/s]
RATED LIFE	3 million cycles
LUBRICATION	Factory lubricated for rated life

BORE SIZE		ROD DIAMETER		ROD DIRECTION	TOTAL PISTON AREA		BASE WEIGHT		ADDER PER 1 in [25 mm]	
in	mm	in	mm		in²	mm²	lb	kg	lb	kg
3/4	20	0.315	8	Extend	0.49	314	0.20	0.09	0.06	0.03
				Retract	0.41	264				
1	25	0.394	10	Extend	0.76	491	0.35	0.16	0.08	0.04
				Retract	0.64	412				
1-1/4	32	0.472	12	Extend	1.25	804	0.55	0.25	0.10	0.05
				Retract	1.07	691				
1-1/2	40	0.630	16	Extend	1.95	1256	0.90	0.41	0.17	0.08
				Retract	1.64	1055				
2	50	0.787	20	Extend	3.04	1963	1.68	0.76	0.25	0.11
				Retract	2.56	1649				
2-1/2	63	0.787	20	Extend	4.83	3116	2.34	1.06	0.29	0.13
				Retract	4.34	2802				

Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at **www.phdinc.com/apps/sizing**

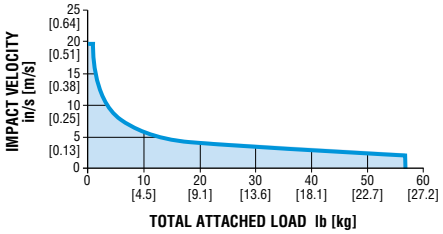


MAXIMUM LATERAL LOAD BY STROKE

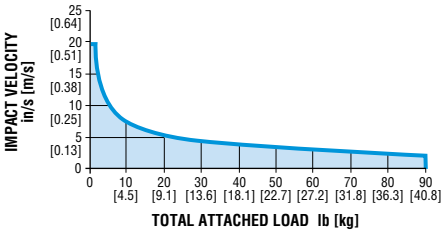
BORE SIZE		1 in 25 mm		2 in 50 mm		3 in 75 mm		4 in 100 mm		5 in 125 mm		6 in 150 mm		7 in —		8 in 200 mm		10 in 250 mm		12 in 300 mm	
in	mm	oz	g	oz	g	oz	g	oz	g	oz	g	oz	g	oz	g	oz	g	oz	g	oz	g
3/4	20	18	505	15	414	12	337	10	275	8	228	6.9	195	6.3	177	6.2	174	—	—	—	—
1	25	24	675	20	563	17	475	14	408	13	358	11.4	323	10.5	298	9.9	281	9.1	257	8	225
1-1/4	32	43	1223	35	983	28	798	23	661	20	564	18	497	16	453	15	425	13	379	10	295
1-1/2	40	55	1552	47	1323	40	1141	35	999	31	889	29	808	26	747	25	701	22	628	19	540
2	50	86	2429	76	2157	68	1925	61	1729	55	1565	50	1427	46	1311	43	1211	37	1043	31	882
2-1/2	63	140	3959	121	3435	106	3001	94	2647	83	2362	76	2138	69	1966	65	1834	59	1659	54	1535

MAXIMUM KINETIC ENERGY

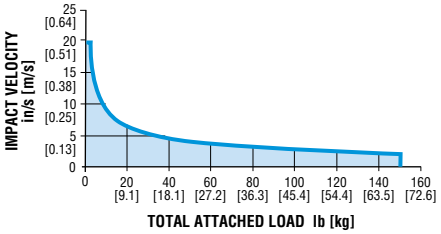
OCG1-3/4 & OCG6-20



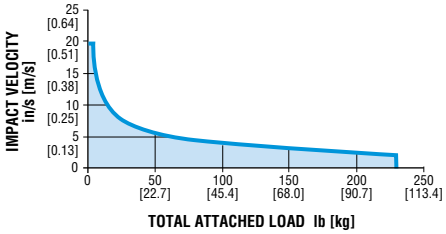
OCG1-1 & OCG6-25



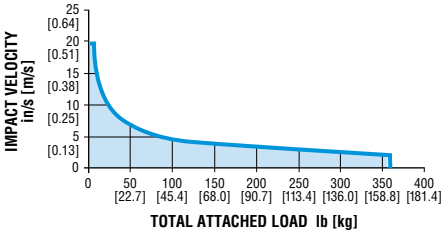
OCG1-1-1/4 & OCG6-32



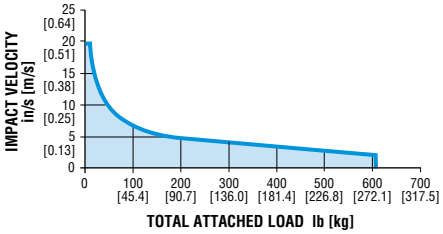
OCG1-1-1/2 & OCG6-40



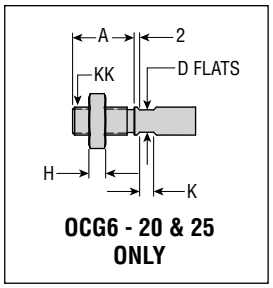
OCG1-2 & OCG6-50



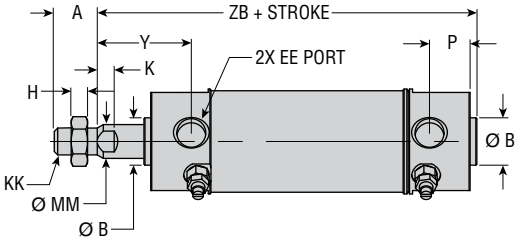
OCG1-2-1/2 & OCG6-63

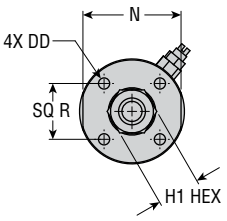


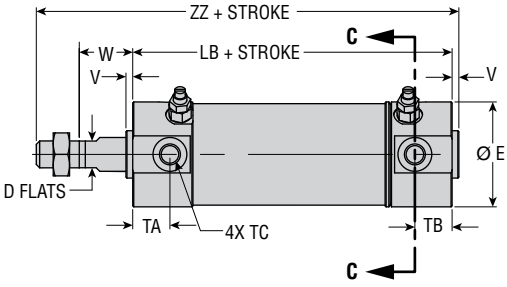
DIMENSIONS: Series OCG Cylinders

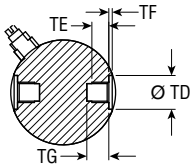


OCG6 - 20 & 25 ONLY

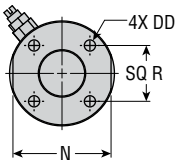






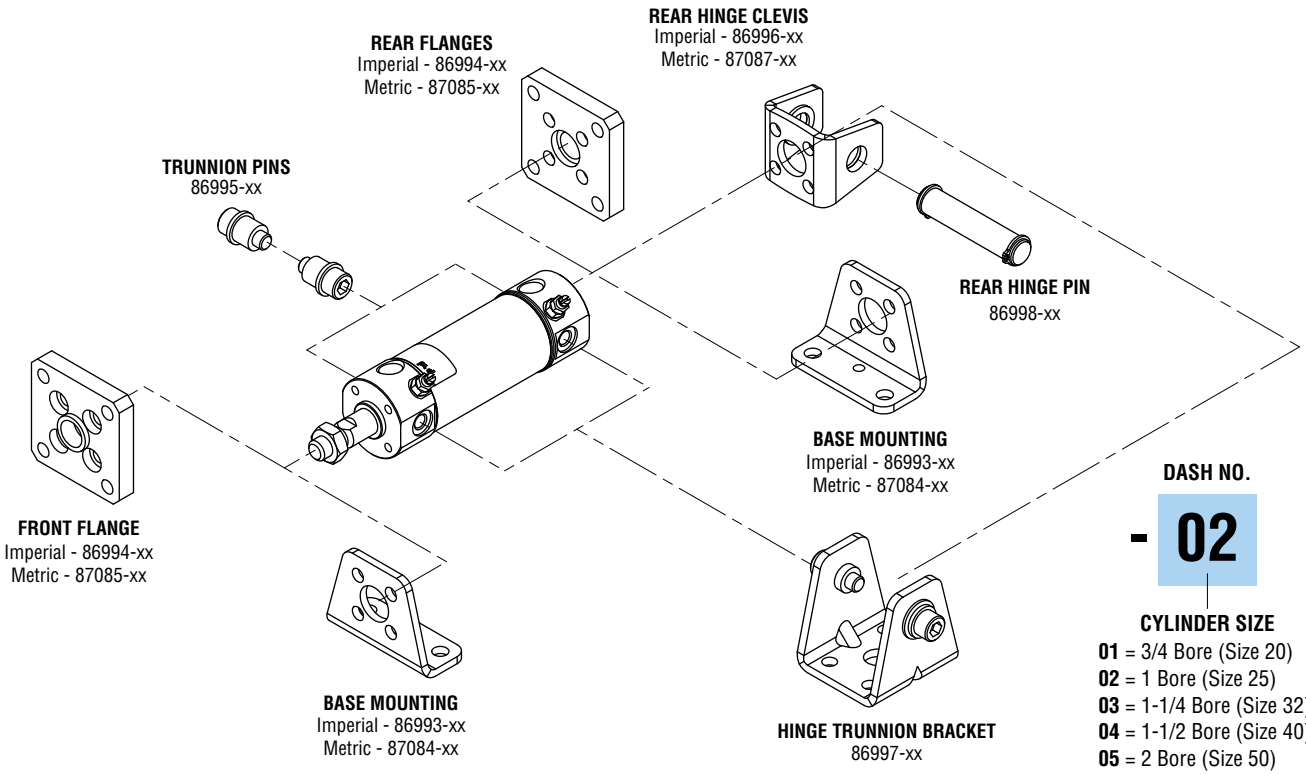


SECTION C-C
4X EACH FEATURE DIMENSION



LETTER DIM	IMPERIAL						METRIC					
	3/4 in	1 in	1-1/4 in	1-1/2 in	2 in	2-1/2 in	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm
A	0.50	0.50	0.75	0.75	0.88	0.88	18	22	22	30	35	35
B	0.472 +0.0000 /-0.0011	0.551 +0.0000 /-0.0011	0.709 +0.0000 /-0.0011	0.984 +0.0000 /-0.0013	1.181 +0.0000 /-0.0013	1.260 +0.0000 /-0.0015	12 +0.00 /-0.05	14 +0.00 /-0.05	18 +0.00 /-0.05	25 +0.00 /-0.05	30 +0.00 /-0.05	32 +0.00 /-0.05
D	0.24	0.31	0.39	0.55	0.71	0.71	6	8	10	14	18	18
DD	8-32 x 0.28 DP	10-32 x 0.30 DP	10-32 x 0.30 DP	1/4-28 x 0.47 DP	5/16-24 x 0.63 DP	3/8-24 x 0.63 DP	M4 x 0.7 x 7 DP	M5 x 0.8 x 7.5 DP	M5 x 0.8 x 8 DP	M6 x 1.0 x 12 DP	M8 x 1.25 x 16 DP	M10 x 1.5 x 16 DP
E	1.02	1.22	1.50	1.85	2.28	2.83	26	31	38	47	58	72
EE	1/8 NPT	1/8 NPT	1/8 NPT	1/8 NPT	1/4 NPT	1/4 NPT	Rc 1/8	Rc 1/8	Rc 1/8	Rc 1/8	Rc 1/4	Rc 1/4
H	0.16	0.19	0.26	0.26	0.32	0.32	5	6	6	8	11	11
H1	0.44	0.50	0.69	0.69	0.75	0.75	13	17	17	22	27	27
K	0.157	0.197	0.217	0.236	0.276	0.276	4	5	5.5	6	7	7
KK	1/4-28	5/16-24	7/16-20	7/16-20	1/2-20	1/2-20	M8 x 1.25	M10 x 1.25	M10 x 1.25	M14 x 1.5	M18 x 1.5	M18 x 1.5
LB	2.72	2.72	2.80	3.07	3.54	3.54	69	69	71	78	90	90
MM	0.315	0.394	0.472	0.630	0.787	0.787	8	10	12	16	20	20
N	0.94	1.14	1.42	1.73	2.17	2.72	24	29	36	44	55	69
P	0.47	0.47	0.43	0.47	0.51	0.51	12	12	11	12	13	13
R	0.55 ±0.004	0.65 ±0.004	0.79 ±0.004	1.02 ±0.004	1.26 ±0.004	1.50 ±0.004	14 ±0.1	16.5 ±0.1	20 ±0.1	26 ±0.1	32 ±0.1	38 ±0.1
TA	0.433	0.433	0.433	0.472	0.512	0.512	11	11	11	12	13	13
TB	0.433	0.433	0.394	0.394	0.472	0.472	11	11	10	10	12	12
TC	M5 x 0.8	M6 x 0.75	M8 x 1.0	M10 x 1.25	M12 x 1.25	M14 x 1.5	M5 x 0.8	M6 x 0.75	M8 x 1.0	M10 x 1.25	M12 x 1.25	M14 X 1.5
TD	0.315 +0.0014 /-0.000	0.394 +0.0014 /-0.000	0.472 +0.0017 /-0.000	0.551 +0.0017 /-0.000	0.630 +0.0017 /-0.000	0.709 +0.0017 /-0.000	8 +0.036 /-0.000	10 +0.036 /-0.000	12 +0.043 /-0.000	14 +0.043 /-0.000	16 +0.043 /-0.000	18 +0.043 /-0.000
TE	0.157	0.197	0.217	0.240	0.295	0.453	4	5	5.5	6	7.5	11.5
TF	0.020	0.039	0.049	0.049	0.079	0.118	0.5	1	1.25	1.25	2	3
TG	0.217	0.256	0.295	0.335	0.394	0.571	5.5	6.5	7.5	8.5	10	14.5
V	0.08	0.08	0.08	0.08	0.08	0.08	2	2	2	2	2	2
W	0.50	0.62	0.88	0.88	1.19	1.19	17	18	18	20	23	23
Y	0.97	1.09	1.35	1.39	1.74	1.74	29	30	30	33	37	37
ZB	3.30	3.42	3.76	4.03	4.81	4.81	88	89	91	100	115	115
ZZ	3.80	3.92	4.51	4.78	5.69	5.69	106	111	113	130	150	150

All dimensions are reference only unless specifically toleranced.



DASH NO.

- 02

CYLINDER SIZE

01 = 3/4 Bore (Size 20)
02 = 1 Bore (Size 25)
03 = 1-1/4 Bore (Size 32)
04 = 1-1/2 Bore (Size 40)
05 = 2 Bore (Size 50)
06 = 2-1/2 Bore (Size 63)

MOUNTING ATTACHMENTS

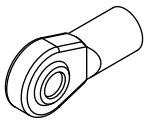
BASE PART NO.		CYLINDER SIZE DASH NO.	DESCRIPTION
IMPERIAL	METRIC		
86993	87084	-xx	Base Mounting
86994	87085	-xx	Front or Rear Flange Mounting
86995	86995	-xx	Trunnions
86996	87087	-xx	Rear Hinge Clevis
86997	86997	-xx	Rear Hinge & Trunnion Bracket
86998	86998	-xx	Rear Hinge Pin

Example: 86993-03 is a base mounting kit for size 1-1/4 bore cylinders.

RECOMMENDED ATTACHMENT MOUNTING TORQUES

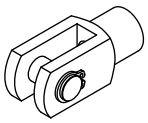
BORE SIZE		MOUNTING TORQUE		TRUNNION TORQUE	
in	mm	in-lb	Nm	in-lb	Nm
3/4	20	13.3	1.5	20	2.2
1	25	26	3	32	3.6
1-1/4	32	26	3	80	9
1-1/2	40	43	5	160	18
2	50	104	12	280	32
2-1/2	63	217	25	460	52

METRIC



ROD EYE WITH SPHERICAL BEARING (DIN 8139)

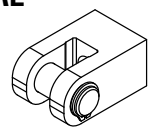
CYLINDER	STANDARD KIT NO.
OCG6-20	52493-05-1
OCG6-25	52493-01-1
OCG6-32	52493-01-1



ROD CLEVIS MOUNTING (DIN 8140)

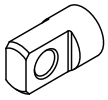
CYLINDER	STANDARD KIT NO.	-Z1 KIT NO.
OCG6-20	52492-05-1	52492-05-3
OCG6-25	52492-01-1	52492-01-3
OCG6-32	52492-01-1	52492-01-3

IMPERIAL



ROD CLEVIS MOUNTING

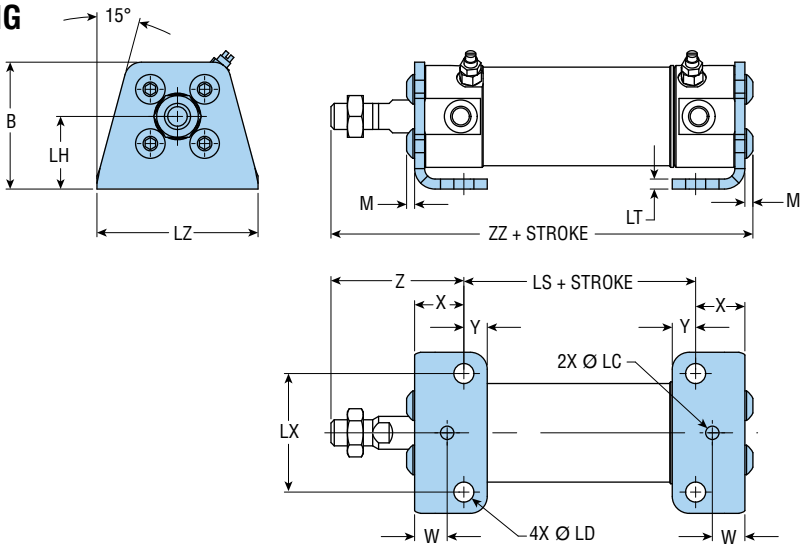
CYLINDER	STANDARD KIT NO.
OCG1 3/4	12904
OCG1 1	12906
OCG1 1-1/4	12910
OCG1 1-1/2	12910
OCG1 2	12911
OCG1 2-1/2	12911

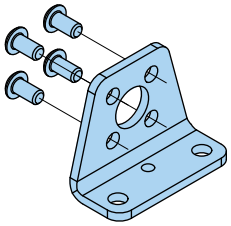


ROD EYE MOUNTING

CYLINDER	STANDARD KIT NO.
OCG1 3/4	1075-01
OCG1 1	1075-04
OCG1 1-1/4	1375-02
OCG1 1-1/2	1375-02
OCG1 2	1375-03
OCG1 2-1/2	1375-03

BASE MOUNTING

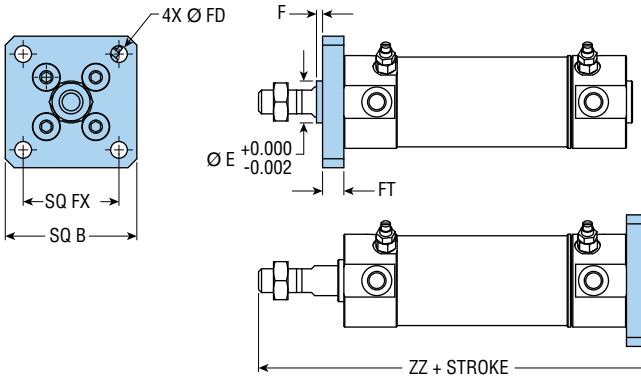


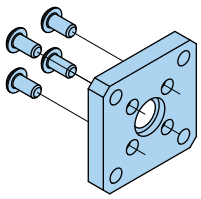


NOTE: Kit includes one base mounting bracket and fasteners.

LETTER DIM	IMPERIAL						METRIC					
	3/4 in	1 in	1-1/4 in	1-1/2 in	2 in	2-1/2 in	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm
	86993-01	86993-02	86993-03	86993-04	86993-05	86993-06	87084-01	87084-02	87084-03	87084-04	87084-05	87084-06
B	1.34	1.52	1.77	2.15	2.78	3.25	34	38.5	45	54.5	70.5	82.5
LC	0.16	0.16	0.16	0.16	0.20	0.20	4	4	4	4	5	5
LD	0.24	0.24	0.26	0.26	0.35	0.43	6	6	6.6	6.6	9	11
LH	0.79	0.87	0.98	1.18	1.57	1.77	20	22	25	30	40	45
LS	1.78	1.78	1.78	2.01	2.16	2.16	45	45	45	51	55	55
LT	0.12	0.12	0.12	0.12	0.18	0.18	3	3	3	3	4.5	4.5
LX	1.26	1.42	1.73	2.13	2.60	3.23	32	36	44	54	66	82
LZ	1.73	1.93	2.28	2.80	3.39	4.17	44	49	58	71	86	106
M	0.09	0.11	0.11	0.13	0.17	0.22	2.2	2.8	2.8	3.3	4.4	5.5
W	0.39	0.39	0.39	0.39	0.69	0.69	10	10	10	10	17.5	17.5
X	0.59	0.59	0.63	0.65	0.87	0.87	15	15	16	16.5	22	22
Y	0.28	0.28	0.31	0.33	0.43	0.51	7	7	8	8.5	11	13
Z	1.47	1.59	2.14	2.16	2.76	2.76	47	52	53	63.5	75.5	75.5
ZZ	3.93	4.07	4.66	4.95	5.96	6.01	109.2	114.8	116.8	134.3	156.9	158

FRONT OR REAR FLANGE MOUNTING



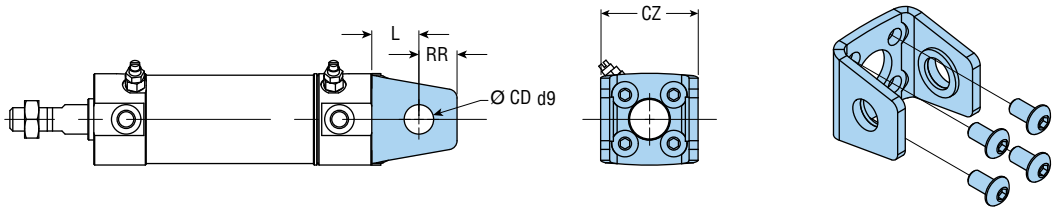


NOTE: Kit includes one flange mounting bracket and fasteners.

LETTER DIM	IMPERIAL						METRIC					
	3/4 in	1 in	1-1/4 in	1-1/2 in	2 in	2-1/2 in	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm
	86994-01	86994-02	86994-03	86994-04	86994-05	86994-06	87085-01	87085-02	87085-03	87085-04	87085-05	87085-06
B	1.57	1.73	2.09	2.40	2.99	3.62	40	44	53	61	76	92
E	0.472 +0.000 /-0.002	0.551 +0.000 /-0.002	0.709 +0.000 /-0.002	0.984 +0.000 /-0.002	1.181 +0.000 /-0.002	1.260 +0.000 /-0.002	12 +0.00 /-0.05	14 +0.00 /-0.05	18 +0.00 /-0.05	25 +0.00 /-0.05	30 +0.00 /-0.05	32 +0.00/ -0.05
F	0.08	0.08	0.08	0.08	0.08	0.08	2	2	2	2	2	2
FX	1.10	1.26	1.50	1.81	2.28	2.76	28	32	38	46	58	70
FD	0.22	0.22	0.26	0.26	0.35	0.43	5.5	5.5	6.6	6.6	9	11
FT	0.24	0.28	0.28	0.31	0.35	0.35	6	7	7	8	9	9
ZZ	4.04	4.20	4.79	5.09	6.04	6.04	112	118	120	138	159	159

All dimensions are reference only unless specifically toleranced.

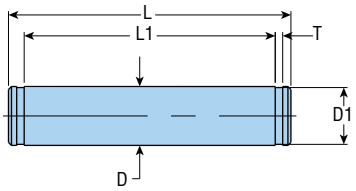
REAR CLEVIS HINGE MOUNTING

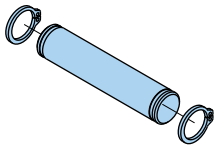


NOTE: Kit includes rear clevis hinge mounting bracket and fasteners.

LETTER DIM	IMPERIAL						METRIC					
	3/4 in	1 in	1-1/4 in	1-1/2 in	2 in	2-1/2 in	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm
	86996-01	86996-02	86996-03	86996-04	86996-05	86996-06	87087-01	87087-02	87087-03	87087-04	87087-05	87087-06
CD d9	0.315	0.394	0.472	0.551	0.630	0.709	8	10	12	14	16	18
CZ	1.14	1.30	1.57	1.93	2.36	2.91	29	33	40	49	60	74
L	0.55	0.63	0.79	0.87	0.98	1.18	14	16	20	22	25	30
RR	0.43	0.51	0.59	0.71	0.79	0.87	11	13	15	18	20	22

REAR HINGE PIN



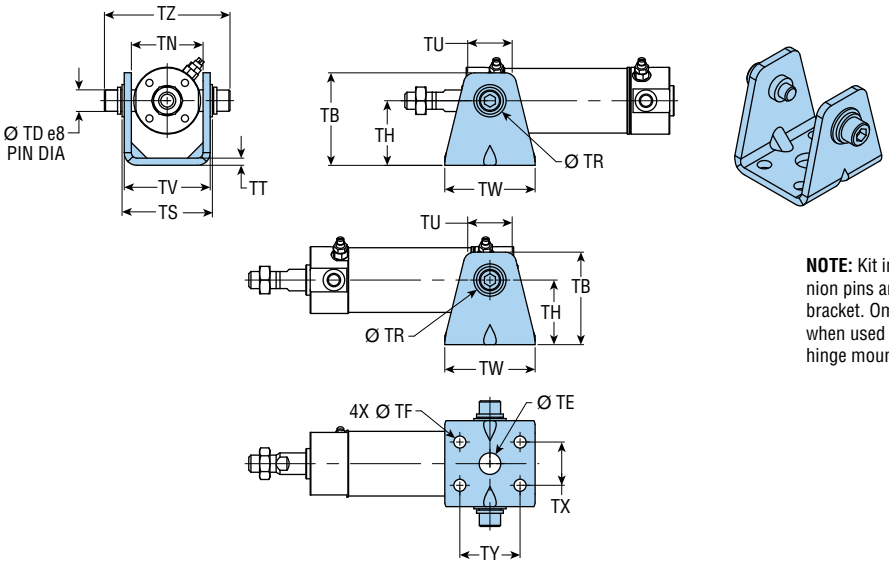


NOTE: For use with rear clevis hinge mount. Kit includes two retaining rings and one rear hinge pin.

LETTER DIM	IMPERIAL						METRIC					
	3/4 in	1 in	1-1/4 in	1-1/2 in	2 in	2-1/2 in	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm
	86998-01	86998-02	86998-03	86998-04	86998-05	86998-06	86998-01	86998-02	86998-03	86998-04	86998-05	86998-06
D d9	0.315	0.394	0.472	0.551	0.630	0.709	8	10	12	14	16	18
D1	0.30	0.38	0.45	0.53	0.60	0.67	7.6	9.6	11.5	13.4	15.2	17
L	1.71	1.89	2.34	2.81	3.39	4.15	43.4	48	59.4	71.4	86	105.4
L1	1.52	1.68	2.13	2.56	3.13	3.85	38.6	42.6	54	65	79.6	97.8
T	0.04	0.05	0.05	0.05	0.05	0.05	0.9	1.15	1.15	1.15	1.15	1.35

All dimensions are reference only unless specifically toleranced.

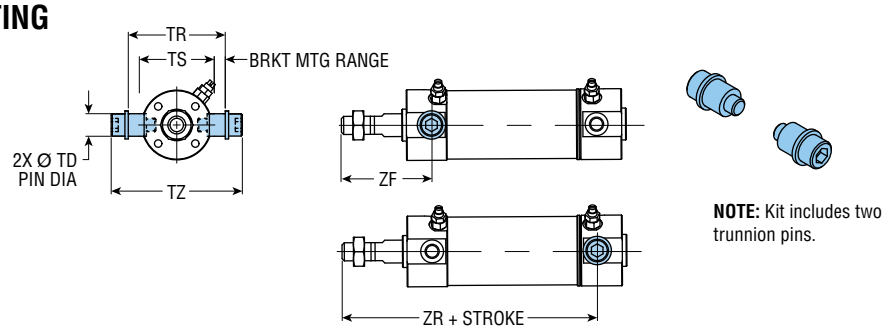
HINGE AND TRUNNION BRACKET



NOTE: Kit includes two trunnion pins and one trunnion bracket. Omit trunnion pins when used with rear clevis hinge mount.

LETTER DIM	IMPERIAL						METRIC					
	3/4 in	1 in	1-1/4 in	1-1/2 in	2 in	2-1/2 in	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm
	86997-01	86997-02	86997-03	86997-04	86997-05	86997-06	86997-01	86997-02	86997-03	86997-04	86997-05	86997-06
TB	1.42	1.69	1.97	2.28	2.76	3.23	36	43	50	58	70	82
TE	0.394 +0.0039 /-0.0000	0.394 +0.0039 /-0.0000	0.394 +0.0039 /-0.0000	0.394 +0.0039 /-0.0000	0.787 +0.0039 /-0.0000	0.787 +0.0039 /-.00000	10 +0.1/-0.0	10 +0.1/-0.0	10 +0.1/-0.0	10 +0.1/-0.0	20 +0.1/-0.0	20 +0.1/-0.0
TF	0.22	0.22	0.26	0.26	0.35	0.43	5.5	5.5	6.6	6.6	9	11
TH	0.98 ±0.0039	1.18 ±0.0039	1.38 ±0.0039	1.57 ±0.0039	1.97 ±0.0039	2.36 ±0.0039	25 ±0.1	30 ±0.1	35 ±0.1	40 ±0.1	50 ±0.1	60 ±0.1
TN	1.15	1.30	1.59	1.94	2.38	2.94	29.3	33.1	40.4	49.2	60.4	74.6
TR	0.51	0.59	0.67	0.83	0.94	1.02	13	15	17	21	24	26
TT	0.13	0.13	0.18	0.18	0.24	0.31	3.2	3.2	4.5	4.5	6	8
TU	0.71	0.81	0.93	1.07	1.17	1.35	18.1	20.7	23.6	27.3	29.7	34.3
TV	1.41	1.57	1.94	2.30	2.85	3.56	35.8	39.8	49.4	58.4	72.4	90.4
TW	1.65	1.65	1.89	2.20	2.52	2.91	42	42	48	56	64	74
TX	0.63	0.79	0.87	1.18	1.42	1.81	16	20	22	30	36	36
TY	1.10	1.10	1.10	1.18	1.42	1.81	28	28	28	30	36	46
TS	1.50	1.65	2.06	2.50	3.10	3.80	38	42	52.4	63.4	78.8	96.6
TZ	2.00	2.27	2.88	3.52	4.29	5.15	51	57.9	73.3	89.5	109.2	131
TD	0.315	0.394	0.472	0.551	0.630	0.709	8	10	12	14	16	18

TRUNNION MOUNTING



NOTE: Kit includes two trunnion pins.

LETTER DIM	IMPERIAL						METRIC					
	3/4 in	1 in	1-1/4 in	1-1/2 in	2 in	2-1/2 in	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm
	86995-01	86995-02	86995-03	86995-04	86995-05	86995-06	86995-01	86995-02	86995-03	86995-04	86995-05	86995-06
TD e8	0.315	0.394	0.472	0.551	0.630	0.709	8	10	12	14	16	18
TR	1.54	1.69	2.11	2.54	3.15	3.86	39	43	53.5	64.5	80	98
TS	1.14	1.30	1.57	1.93	2.36	2.91	29	33	40	49	60	74
TZ	2.00	2.27	2.88	3.52	4.29	5.15	51	57.9	73.3	89.5	109.2	131
ZF	1.43	1.55	2.06	2.10	2.58	2.58	46	51	51	62	71	71
ZR	3.28	3.40	4.03	4.31	5.14	5.14	93	98	101	118	136	136

All dimensions are reference only unless specifically toleranced.

AV, HV, A

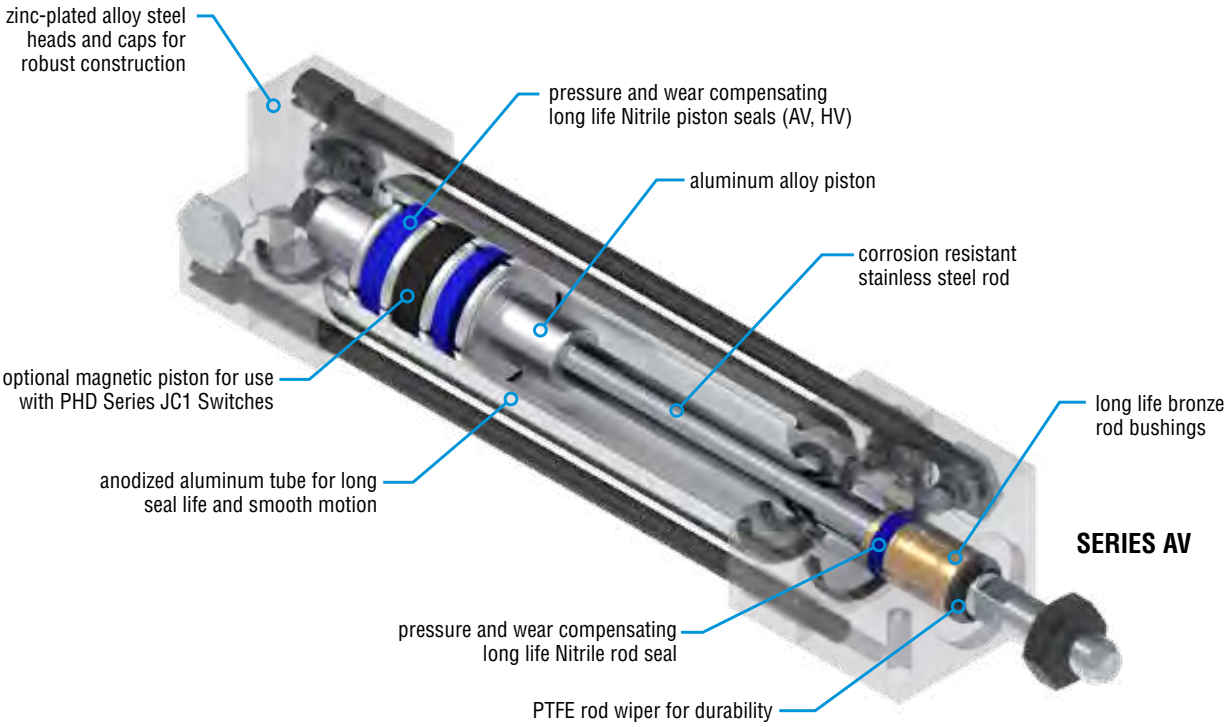
3/4", 1", 1-1/8" Bore

tom thumb®

Major Benefits

- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Wide range of mounting styles for easy installation

Cleanroom option available on Series AV and A Cylinders. See page 90.



SERIES AV

SERIES HV
Hydraulic Service

SERIES A
Shortest Length

ORDERING DATA: Series AV, HV, A Cylinders - 3/4", 1", 1-1/8" Bore

TO ORDER SPECIFY:
Spring Return/Double Rod End, Series, Mounting Style, Bore Size, Stroke, Port Control®, and any Options. Also specify rod diameter if non-standard. Rod couplings and mounting attachments must be ordered separately.

⚠ Options may affect unit length. See dimensional pages and option information details.

SERIES
AV - 150 psi Air
HV - 1500 psi Hyd.
A - 150 psi Air

BORE SIZE
3/4" BORE
1/4" Std. Rod Dia.
1/4-28 Thread

1" BORE
5/16" Std. Rod Dia.
5/16-24 Thread

1-1/8" BORE
3/8" Std. Rod Dia.
3/8-24 Thread

STANDARD STROKE LENGTHS
3/4" BORE
1/4" to 12"

1" BORE
1/4" to 18"

1-1/8" BORE
1/4" to 18"

All in 1/4" increments
Consult PHD for longer lengths.

CUSHION OR SHOCK PAD
D - Cushions on both ends (see note 4)
DR - Cushion on rod end (see note 4)
DC - Cushion on cap end (see note 4)
B - Shock Pads on both ends
BR - Shock Pad on rod end
BC - Shock Pad on cap end
(Cushions, Shock Pads, and Spring Return are not available on the same end of cylinder. Shock Pads not available on Series HV.)

OVERSIZE ROD
To be specified only when using a non-standard diameter. Rod diameters available are shown on page 88.

SC AV F 1 x 2 - P - D - 3/8 ROD - G-M-V

SPRING RETURN
SC - Spring on cap end
SR - Spring on rod end (Strokes available in 1/4" increments up to 6".) ⊕ See option pages.

and/or

DOUBLE ROD END
D - Double Rod End Cylinders

Leave blank if not needed.

MOUNTING STYLE
F - Foot Mount, c'bored thru holes
B - Bottom Mount, tapped holes in head and cap
R - Rod Mount, tapped holes on front face of head
T - Thread Mount, threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
L - Pilot Mount, threaded snout and pilot diameter on head (shipped with mounting nut)
P - Pivot Mount, pivot on cap
RR - Tierod Mount, tierods extend out rod end
RC - Tierod Mount, tierods extend out cap end
RRC - Tierod Mount, tierods extend out both ends

PORT CONTROL®

BUILT-IN METER OUT FLOW CONTROL VALVE
P - Flow control on both ends
PR - Flow control on head end
PC - Flow control on cap end

OPTIONS
A - Stroke Adjustment, 1/2" of adjustment standard (not available on Series HV)
E - Magnetic Piston for Series JC1 radial sensing switches (not available on Series A)
G - #2 Rod End (see page 88 for dimensions) (see note 1)
I - #4 Rod End, Female thread on rod (see page 88 for dimensions) (see note 1)
H47 - Rodlok (Rod clamping device installed. Not available with Z1 or on HV. See option page.) ⊕
J - #2X Rod End, twice as long as standard thread (see page 88 for dimensions)
_K - Extra Rod Extension, in 1/8" increments (see page 88) (see note 2)
L - Coarse Thread Rod End (see page 88 for dimensions) (see note 1)
M - Magnetic Piston for Series JC1 reed and teachable switches (not applicable on Series A)
N - Plain Rod End (see page 88 for dimensions) (see note 1)
Q - Port in Position #1, must be specified if required with mounting style "F" ("F" mounting tab on cap end)
R - Ports in Position #2
T - Ports in Position #3 ("F" mounting tab on cap end)
U - Ports in Position #4
V - Fluoroelastomer Seals
W - Close Tolerance Stroke, ±0.005" stroke length
Y - SAE Ports (Series HV Only) 3/4, 1, 1-1/8" bore
Z1 - Electroless Nickel Plate all ferrous parts excluding Rod Ends

NOTES:
1) For double rod cylinders, rod end options will be applied to both ends of cylinder.
2) For double rod cylinders, -_K extension will be applied to one end only (head end/primary mounting end).
3) ⊕ Marked options provide additional cylinder flexibility, but may alter the dimensions.
4) Cushion available, but not warranted, on HV units.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

SWITCH MOUNTING BRACKET

PART NO.	DESCRIPTION
92100	Mounts Series JC1 Switch to Tie Rod

NOTE: Brackets are ordered separately.

SPECIFICATIONS	SERIES AV	SERIES HV	SERIES A
OPERATING PRESSURE			
STANDARD CYLINDER (NO RODLOK)	20 to 150 psi air	40 to 1500 psi hyd*	20 to 150 psi air
CYLINDER WITH RODLOK	30 to 150 psi air	—	30 to 150 psi air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]
STROKE TOLERANCE	±0.032	±0.032	±0.032
LUBRICATION	Permanently lubricated	—	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	AIR CONSUMPTION at 80 psi CUBIC ft/in OF STROKE	DISPLACEMENT gal/in OF STROKE
AV HV A	3/4	1/4	EXTEND	0.442	0.0016	0.0019
			RETRACT	0.393	0.0014	0.0017
		5/16	EXTEND	0.442	0.0016	0.0019
			RETRACT	0.365	0.0013	0.0016
	1	5/16	EXTEND	0.785	0.0029	0.0034
			RETRACT	0.709	0.0026	0.0031
		3/8	EXTEND	0.785	0.0029	0.0034
			RETRACT	0.676	0.0025	0.0029
	1-1/8	3/8	EXTEND	0.994	0.0037	0.0043
			RETRACT	0.883	0.0032	0.0038
		1/2	EXTEND	0.994	0.0037	0.0043
			RETRACT	0.799	0.0029	0.0034

NOTE: Use the RETRACT figures for calculating double rod cylinder forces in both directions.

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb)							
		100	200	500	1000	1500	2000	3000	5000
3/4", 1", 1-1/8" AV, HV, A	1/4	12"	9"	6"	4"	3"	—	—	—
	5/16	18"	13"	8"	6"	5"	—	—	—
	3/8	26"	18"	12"	9"	7"	—	—	—
	1/2	46"	32"	21"	15"	12"	—	—	—

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb)	
		ZERO STROKE	ADDER PER INCH OF STROKE
PLAIN UNIT	3/4	0.42	0.04
	1	0.87	0.07
	1-1/8	0.95	0.10

CYLINDER FORCE CALCULATIONS	Imperial F = P x A
F = Cylinder Force	lbs
P = Operating Pressure	psi
A = Effective Area (Extend or Retract)	in^2

All Series

AV, HV, A Cylinders

Series AV

HOW TO DETERMINE BORE AND PISTON SIZE

1. Determine stroke and force required.
2. Calculate the force (lb) produced by using the effective area figures in cylinder force table and multiplying them times the operating pressure (psi).
3. Check maximum allowable extend stroke table to verify that rod size is sufficient for force. If stroke required is greater than length listed in table, increase rod diameter or go to larger bore size.

NOTE: Maximum allowable extend stroke table shows maximum stroke lengths for mounting styles -F, -B, -R, -T, -RF, -CF, RR, RC, RRC, MS9, MS10, MR1, MF1, MF2, MN1 fastened to rigid base.

For mounting styles -K, -P, and MP1; divide table value by 2.

For mounting styles -TR and MT1; divide table value by 1.75.

To avoid excessive wear on rod bushings and seals, it is recommended that cylinders with strokes exceeding the following lengths be equipped with 1" long stop tubes or be stopped externally 1" short of full extend stroke.

3/4" Bore x 8"	1-1/8" Bore x 12"
1" Bore x 10"	1-3/8" Bore x 18"

For -P, -K, MP1, MT1 and -TR mountings use 2/3 of above values.

Series TD

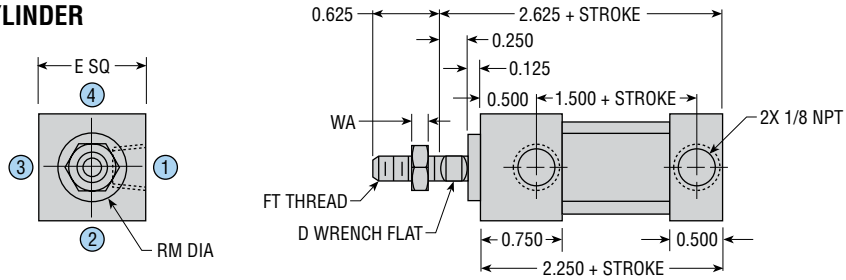
Series A, AV Cleanroom

Series AV2

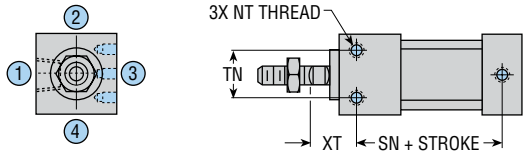
Series HV

Series A3V

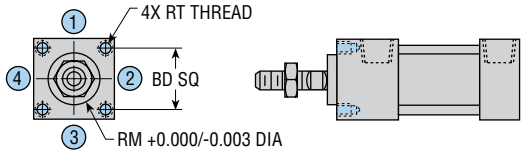
SERIES AV BASIC CYLINDER



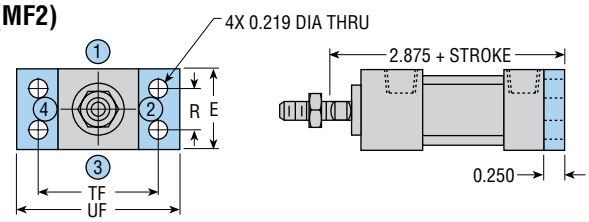
B (MS9)



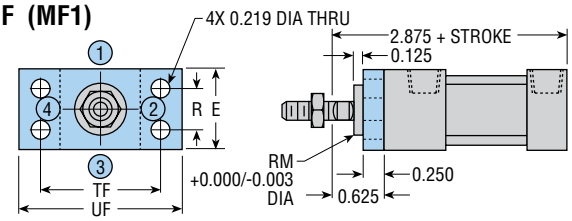
R (MR1)



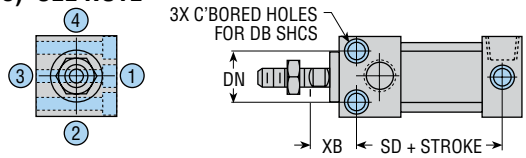
CF (MF2)



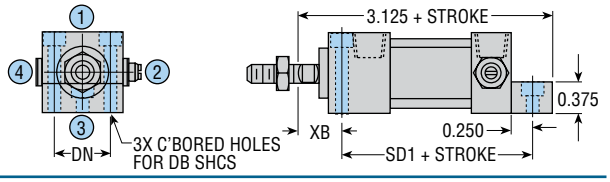
RF (MF1)



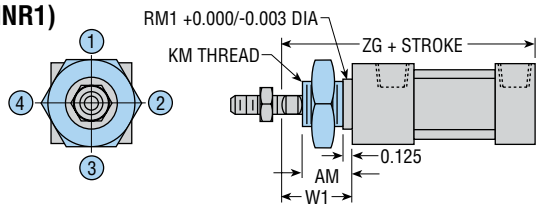
F (MS8) SEE NOTE



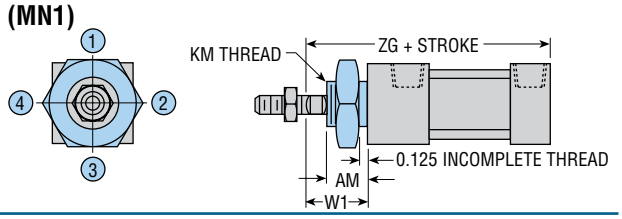
F (MS8) - WITH PORT CONTROL® ON CAP END (-Q or -T without Port Control)



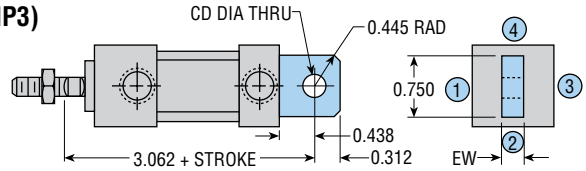
L (MNR1)



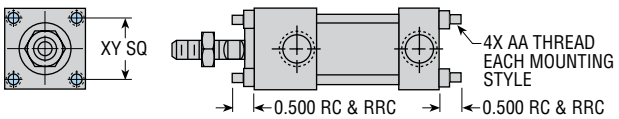
T (MN1)



P (MP3)



RC, RR, RRC (Includes RR & RC)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

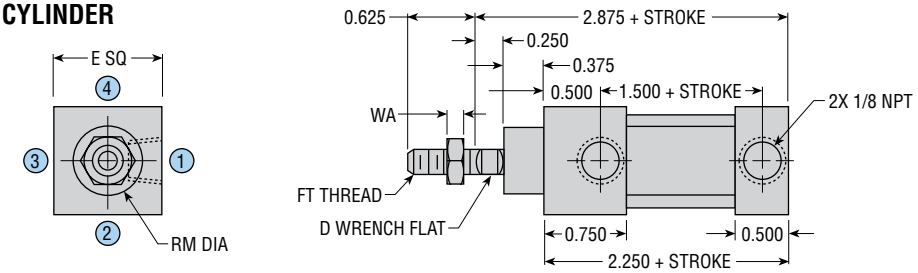
BORE SIZE	LETTER DIMENSION																			
	AA	AM	BD	CD	D	DB	DN	E	EW	FT	KM	NT	R	RM	RM1	RT	SD	SD1	SN
3/4	#6-32	0.625	0.750	0.250	3/16	#8	0.625	1.000	0.250	1/4-28	5/8-18	8-32 x 0.18 DP	0.500	0.625	0.687	8-32 x 0.25 DP	1.812	2.312	1.812
1	#8-32	0.625	1.000	0.375	1/4	#10	0.875	1.375	0.375	5/16-24	3/4-16	10-32 x 0.25 DP	0.875	0.750	0.812	8-32 x 0.25 DP	1.750	2.250	1.750
1-1/8	#10-32	0.875	1.125	0.375	5/16	#10	1.000	1.500	0.375	3/8-24	1-14	10-32 x 0.25 DP	1.000	0.750	1.062	10-32 x 0.25 DP	1.750	2.250	1.750

BORE SIZE	LETTER DIMENSION								
	TF	TN	UF	WA	W1	XB	XT	ZG	XY
3/4	1.500	0.625	2.000	0.156	0.875	0.562	0.562	3.125	0.750
1	1.875	0.875	2.375	0.188	0.875	0.625	0.625	3.125	1.030
1-1/8	2.000	1.000	2.500	0.219	1.125	0.625	0.625	3.375	1.125

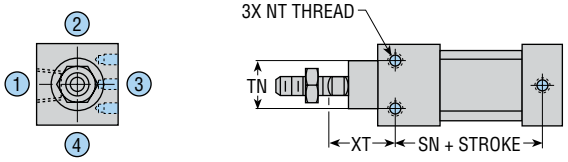
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SHOCK PADS: ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
F (MS8) MTG: 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
OVERSIZE RODS: SEE PAGE 88 FOR OVERSIZE ROD SPECIFICATIONS.

All dimensions are reference only unless specifically toleranced.

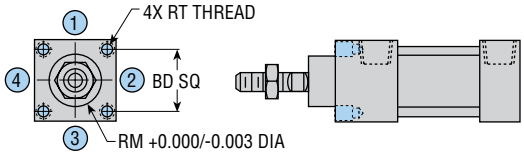
SERIES HV BASIC CYLINDER



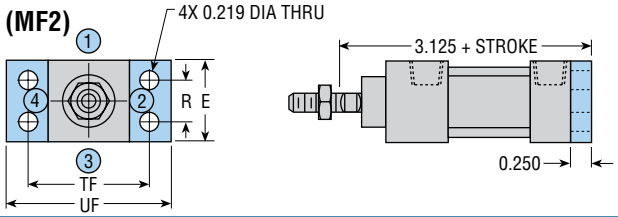
B (MS9)



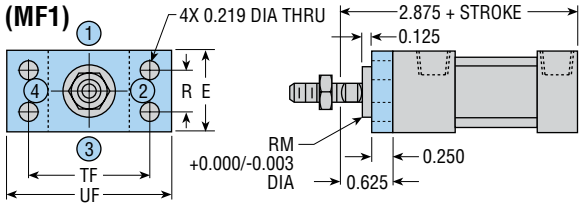
R (MR1)



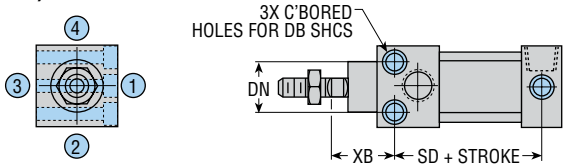
CF (MF2)



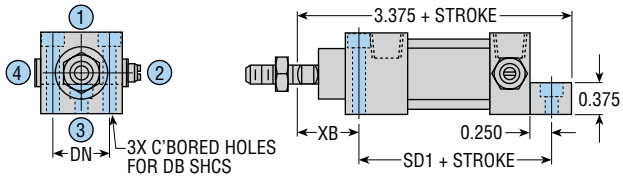
RF (MF1)



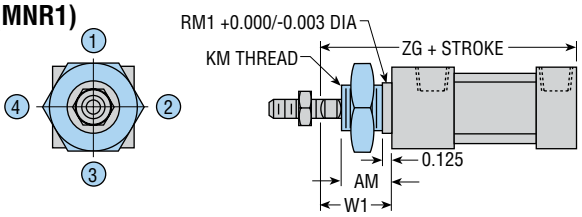
F (MS8) SEE NOTE



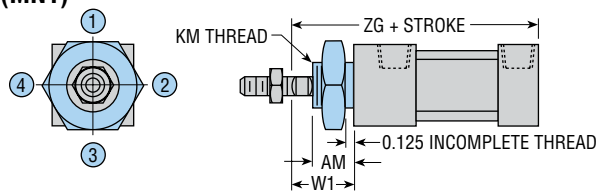
F (MS8) - WITH PORT CONTROL ON CAP END



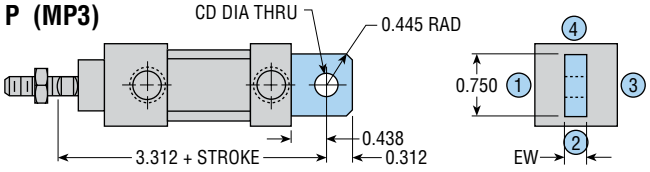
L (MNR1)



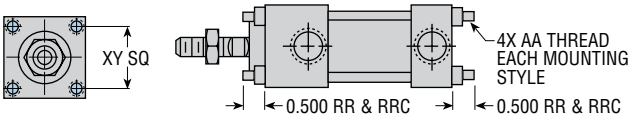
T (MN1)



P (MP3)



RC, RR, RRC (Includes RR & RC)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

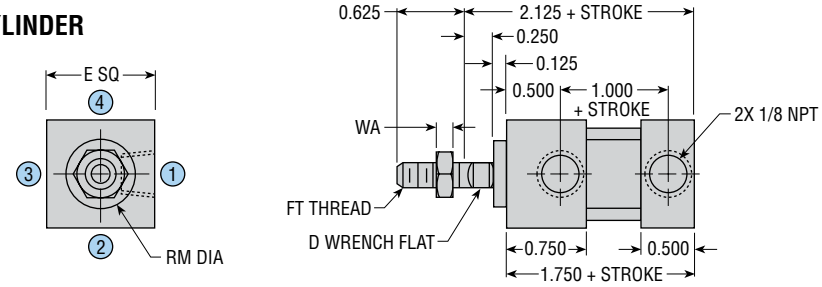
BORE SIZE	LETTER DIMENSION																		
	AA	AM	BD	CD	D	DB	DN	E	EW	FT	KM	NT	R	RM	RM1	RT	SD	SD1	SN
3/4	#6-32	0.625	0.750	0.250	3/16	#8	0.625	1.000	0.250	1/4-28	5/8-18	8-32 x 0.18 DP	0.500	0.625	0.687	8-32 x 0.25 DP	1.812	2.312	1.812
1	#8-32	0.625	1.000	0.375	1/4	#10	0.875	1.375	0.375	5/16-24	3/4-16	10-32 x 0.25 DP	0.875	0.750	0.812	8-32 x 0.25 DP	1.750	2.250	1.750
1-1/8	#10-32	0.875	1.125	0.375	5/16	#10	1.000	1.500	0.375	3/8-24	1-14	10-32 x 0.25 DP	1.000	0.750	1.062	10-32 x 0.25 DP	1.750	2.250	1.750

BORE SIZE	LETTER DIMENSION								
	TF	TN	UF	WA	W1	XB	XT	ZG	XY
3/4	1.500	0.625	2.000	0.156	0.875	0.812	0.812	3.125	0.750
1	1.875	0.875	2.375	0.188	0.875	0.875	0.875	3.125	1.030
1-1/8	2.000	1.000	2.500	0.219	1.125	0.875	0.875	3.375	1.125

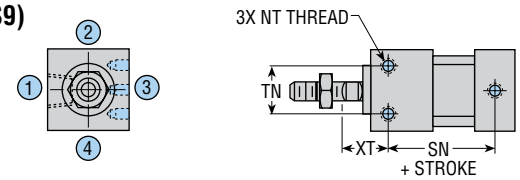
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
F (MS8) MTG: 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
OVERSIZE RODS: SEE PAGE 88 FOR OVERSIZE ROD SPECIFICATIONS.

All dimensions are reference only unless specifically toleranced.

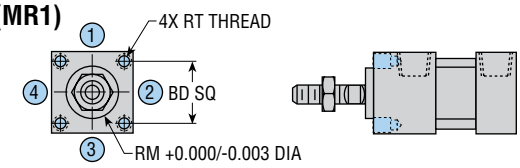
SERIES A BASIC CYLINDER



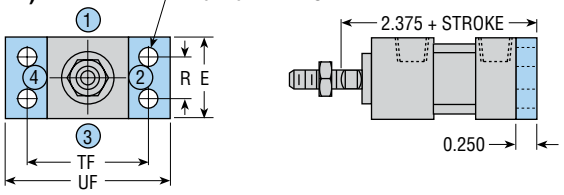
B (MS9)



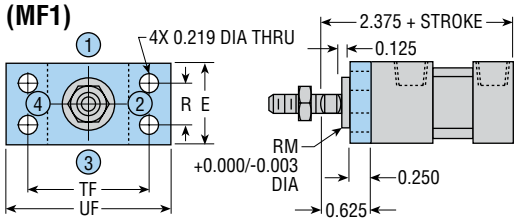
R (MR1)



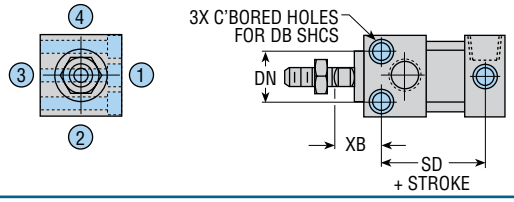
CF (MF2)



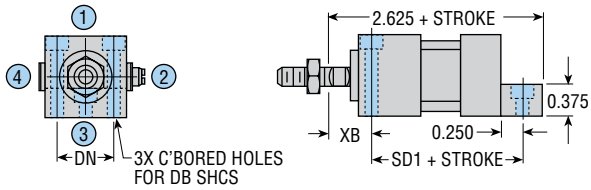
RF (MF1)



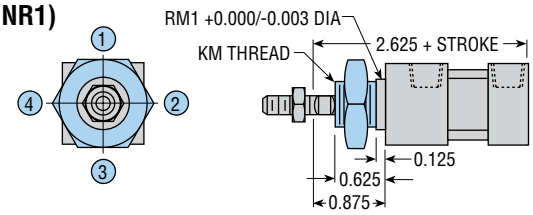
F (MS8) SEE NOTES



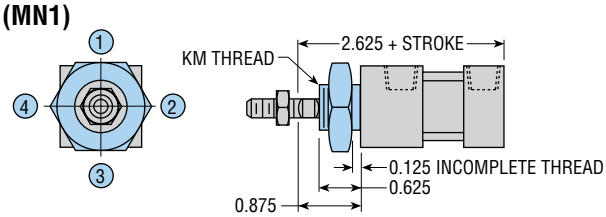
F (MS8) - WITH PORT CONTROL ON CAP END



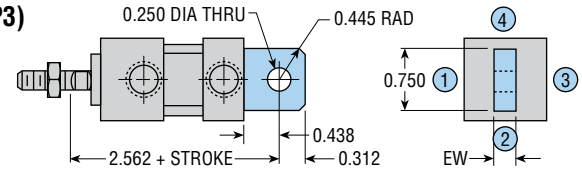
L (MNR1)



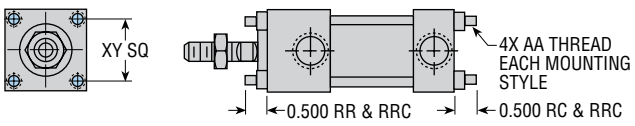
T (MN1)



P (MP3)



RC, RR, RRC (Includes RR & RC)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

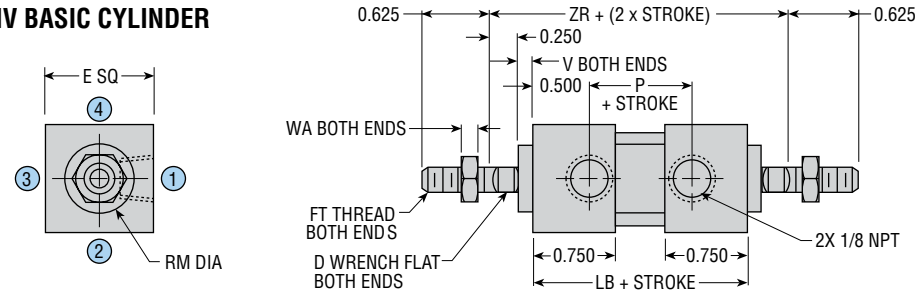
BORE SIZE	LETTER DIMENSION																		
	AA	BD	D	DB	DN	E	EW	FT	KM	NT	R	RM	RM1	RT	SD	SD1	SN	TF	TN
3/4	#6-32	0.750	3/16	#8	0.625	1.000	0.250	1/4-28	5/8-18	8-32 x 0.18 DP	0.500	0.625	0.687	8-32 x 0.25 DP	1.312	1.812	1.312	1.500	0.625
1	#8-32	1.000	1/4	#10	0.875	1.375	0.375	5/16-24	3/4-16	10-32 x 0.25 DP	0.875	0.750	0.812	8-32 x 0.25 DP	1.250	1.750	1.250	1.875	0.875
1-1/8	#10-32	1.125	5/16	#10	1.000	1.500	0.375	3/8-24	3/4-16	10-32 x 0.25 DP	1.000	0.750	0.812	10-32 x 0.25 DP	1.250	1.750	1.250	2.000	1.000

BORE SIZE	LETTER DIMENSION				
	UF	WA	XB	XT	XY
3/4	2.000	0.156	0.562	0.562	0.750
1	2.375	0.188	0.625	0.625	1.030
1-1/8	2.500	0.219	0.625	0.625	1.125

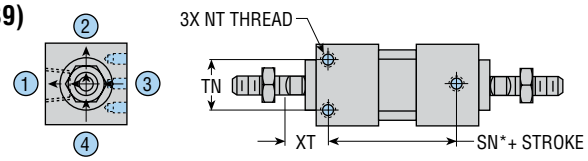
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SHOCK PADS: ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
F (MS8) MTG: 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
OVERSIZE RODS: SEE PAGE 88 FOR OVERSIZE ROD SPECIFICATIONS.

All dimensions are reference only unless specifically toleranced.

SERIES DA/DAV/DHV BASIC CYLINDER
(shown as DAV)

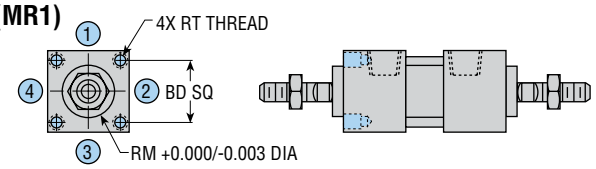


B (MS9)

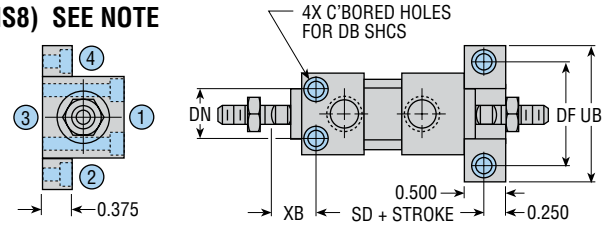


*1" AND 1-1/8" BORE: WITH PORT POSITION #3 ADD 0.062 in
WITH PORT POSITION #2 OR #4 & PORT CONTROLS ADD 0.062 in

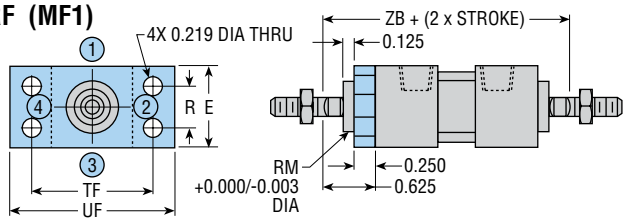
R (MR1)



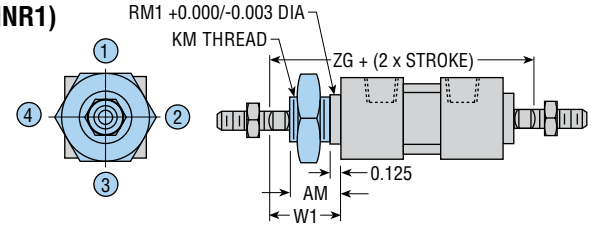
F (MS8) SEE NOTE



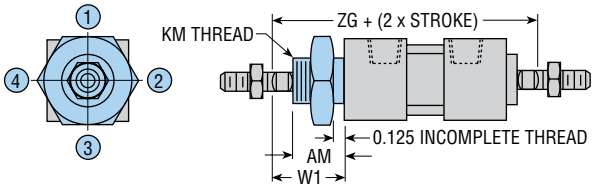
RF (MF1)



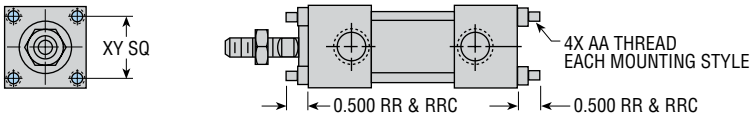
L (MNR1)



T (MN1)



RC, RR, RRC (Includes RR & RC)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

DIMENSIONS COMMON TO ALL SERIES

BORE SIZE	LETTER DIMENSION																	
	AA	BD	D	DB	DF	DN	E	FT	NT	R	RM	RT	TF	TN	UB	UF	WA	XY
3/4	#6-32	0.750	3/16	#8	1.375	0.625	1.000	1/4-28	8-32 x 0.18 DP	0.500	0.625	8-32 x 0.25 DP	1.500	0.625	1.750	2.000	0.156	0.750
1	#8-32	1.000	1/4	#10	1.750	0.875	1.375	5/16-24	10-32 x 0.25 DP	0.875	0.750	8-32 x 0.25 DP	1.875	0.875	2.125	2.375	0.188	1.030
1-1/8	#10-32	1.125	5/16	#10	1.875	1.000	1.500	3/8-24	10-32 x 0.25 DP	1.000	0.750	10-32 x 0.25 DP	2.000	1.000	2.250	2.500	0.219	1.125

SERIES DA CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	0.625	5/8-18	2.000	1.000	0.687	2.063	1.562	0.125	0.875	0.562	0.562	3.000	3.250	2.750
1	0.625	3/4-16	2.000	1.000	0.812	2.000	1.500	0.125	0.875	0.625	0.625	3.000	3.250	2.750
1-1/8	0.625	3/4-16	2.000	1.000	0.812	2.000	1.500	0.125	0.875	0.625	0.625	3.000	3.250	2.750

SERIES DHV CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	0.625	5/8-18	2.500	1.500	0.687	2.562	2.062	0.375	0.875	0.812	0.812	3.750	4.000	3.750
1	0.625	3/4-16	2.500	1.500	0.812	2.500	2.000	0.375	0.875	0.875	0.875	3.750	4.000	3.750
1-1/8	0.875	1-14	2.500	1.500	1.062	2.500	2.000	0.375	1.125	0.875	0.875	3.750	4.250	3.750

SERIES DAV CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	0.625	5/8-18	2.500	1.500	0.687	2.562	2.062	0.125	0.875	0.562	0.562	3.500	3.750	3.250
1	0.625	3/4-16	2.500	1.500	0.812	2.500	2.000	0.125	0.875	0.625	0.625	3.500	3.750	3.250
1-1/8	0.875	1-14	2.500	1.500	1.062	2.500	2.000	0.125	1.125	0.625	0.625	3.500	4.000	3.250

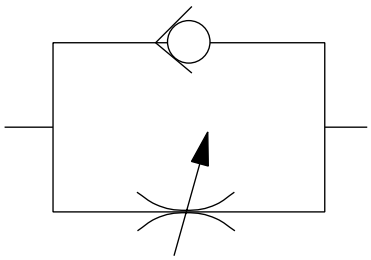
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
SHOCK PADS: ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)
F (MS8) MTG: 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
OVERSIZE RODS: SEE PAGE 88 FOR OVERSIZE ROD SPECIFICATIONS.

All dimensions are reference only unless specifically toleranced.

P PC PR PORT CONTROL®

The exclusive PHD Port Control®, based on the "meter-out" principle, features an adjustable needle and a separate ball check. Both are built into the cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume. The separate ball check is closed while fluid is exhausting from the cylinder, but opens to permit full flow of



incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.

D DC DR ADJUSTABLE CUSHION

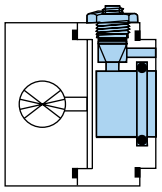
PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

See dimension pages for dimensional information.

Effective cushion length 1/2"

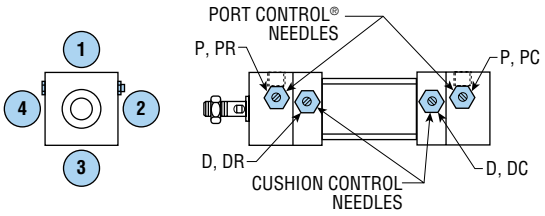
Not warranted on Series HV units

CUSHION BLOCK



STANDARD PORT CONTROL® AND CUSHION NEEDLE POSITIONS

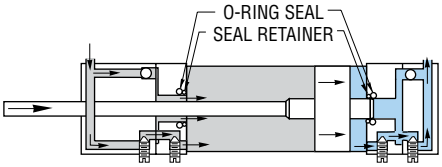
Port Control® and cushion needles are located in position 2 on standard cylinders. They may be located at position 4 when specified on all Series A, AV, and HV.



PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

Cushion and Port Control® combination arranged in series provides a compact efficient control system for maximum space weight and cost savings. The cushion is activated when the piston extension enters a seal in the cushion block. The remaining volume in the cylinder exhausts past an adjustable needle. A check seal in the adjusting needle is closed during deceleration, but opens to permit full flow for immediate reversing. The cushion seal in the block is an O-ring for air units.

CUSHION BLOCK STYLE



H47 RODLOK CYLINDER & RODLOK

Available on single rod Series A and AV units only. (Preassembled) ⊕

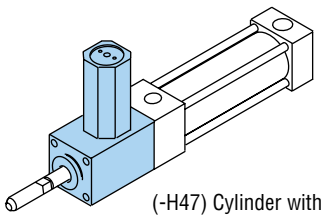
PHD's Rodlok is ideal for locking the piston rod while in a static/ stationary position. When the pressure is removed from the port of the Rodlok, the mechanism will grip the rod and prevent it from moving. The loads are held indefinitely without power. Rodlok performance is application and environment sensitive (cleanliness of rod or Rodlok will also affect performance). THE RODLOK IS NOT DESIGNED TO BE USED AS A PERSONAL SAFETY DEVICE.

Option -H47 provides a cylinder and Rodlok pre-assembled. The port for the Rodlok will be assembled in the same position as the port on the extend end of the cylinder.

Replacement Rodlok kits can be purchased separately. See chart at right. The locking device and adaptor are not available with the -Z1 corrosion resistant finish.

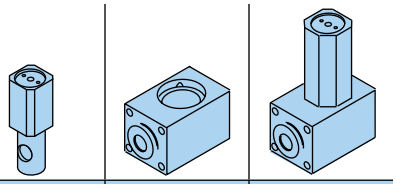
-H47 available on B, R, P, and RC only.

⊕ This option does not dimensionally comply with the NFPA standard specifications.



(-H47) Cylinder with rod locking device and adaptor preassembled

REPLACEMENT RODLOK KITS

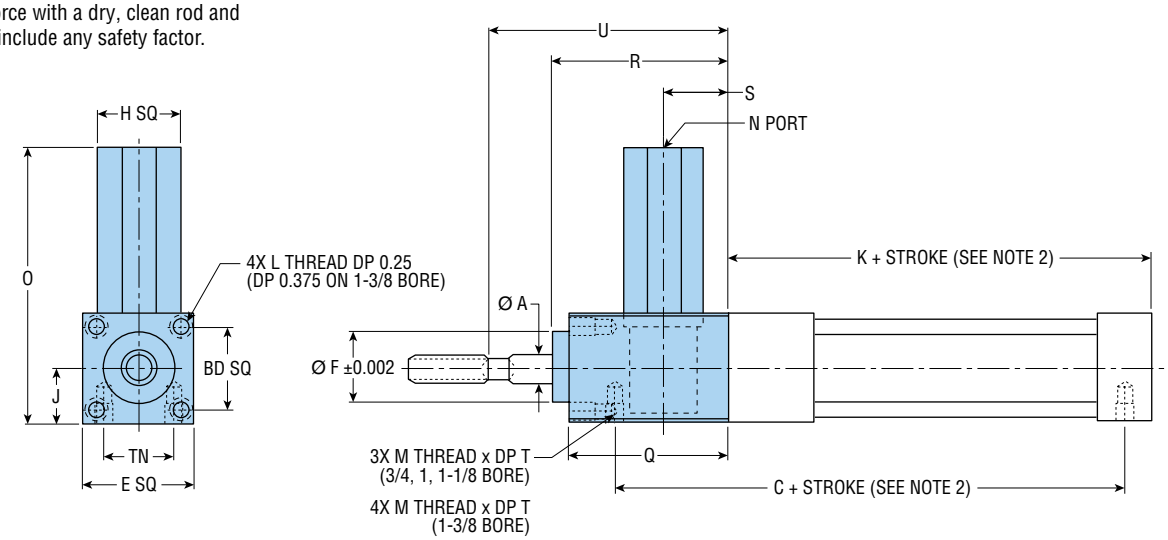


BORE in	LOCKING DEVICE KIT	ADAPTOR KIT	COMPLETE RODLOK
3/4	63932-01	63931-01	63935-01
1	63932-02	63931-02	63935-02
1-1/8	63932-03	63931-03	63935-03

Part numbers listed above are intended for replacement purposes only.

BORE in	STATIC LOCKING FORCE*	
	lbf	N
3/4	40	180
1	56	250
1-1/8	79	350

NOTE: *Locking force given is the actual locking force with a dry, clean rod and does not include any safety factor.



BORE in	LETTER DIMENSION																	
	A	C	E	F	H	J	K	L	M	N	O	Q	R	S	T	U	BD	TN
3/4	0.250 [6.4]	3.063 [77.8]	1.000 [25.4]	0.622 [15.8]	0.728 [18.5]	0.500 [12.7]	2.250 [57.2]	8-32 UNC-2B	8-32 UNC-2B	10-32 UNF-2B	2.409 [61.2]	1.500 [38.1]	1.625 [41.3]	0.625 [15.9]	0.187 [4.7]	1.875 [47.6]	0.750 [19.1]	0.625 [15.9]
1	0.312 [7.9]	3.000 [76.2]	1.375 [34.9]	0.747 [19.0]	0.787 [20.0]	0.688 [17.5]	2.250 [57.2]	8-32 UNC-2B	8-32 UNC-2B	10-32 UNF-2B	2.756 [70.0]	1.500 [38.1]	1.625 [41.3]	0.625 [15.9]	0.250 [6.4]	1.875 [47.6]	1.000 [25.4]	0.875 [22.2]
1-1/8	0.375 [9.5]	3.000 [76.2]	1.500 [38.1]	0.747 [19.0]	0.787 [20.0]	0.750 [19.1]	2.250 [57.2]	10-32 UNF-2B	10-32 UNF-2B	10-32 UNF-2B	2.819 [71.6]	1.500 [38.1]	1.625 [41.3]	0.625 [15.9]	0.250 [6.4]	1.875 [47.6]	1.125 [28.6]	1.000 [25.4]

NOTES:
1) BREAKAWAY FORCE ON CYLINDERS WITH RODLOK APPROXIMATELY 30 PSI.
2) FOR SERIES A 3/4", 1", AND 1-1/8" BORES, SUBTRACT 0.500 (K = 1.750, C : 3/4 = 2.563, 1, 1-1/8 = 2.500)

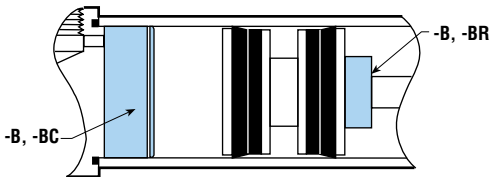
All dimensions are reference only unless specifically toleranced.

B BC BR SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on HV hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available with all options EXCEPT:

- **Same end as Cushion (-D, -DC, or -DR)**
- **Spring end of Spring Return cylinder (-SC or -SR)**
- **Same end as Stroke Adjustment (-A)**



SR SC SPRING RETURN

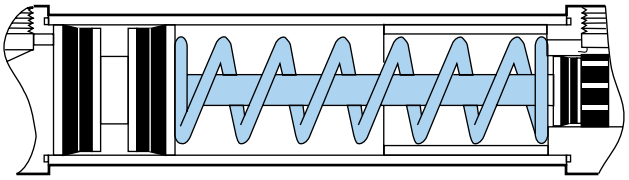
Available in 1/4" increments

All standard A, AV and HV Cylinders from 1/4" to 6" of stroke can be built with internal springs to return or extend the piston rod in single acting applications. The standard spring provides a preload and a spring rate per chart below. Other spring combinations will be quoted on request.

STROKE	PRELOAD	RATE
1/4" - 3"	4 lb	7 lb/in
3-1/4" - 6"	2 lb	3-1/2 lb/in

Available with all options EXCEPT:

- **Cushion on the spring end (-D, -DC, or -DR)**
- **Shock pad on the spring end (-B, -BC, or -BR)**
- **Stroke adjustment on the spring end (-A)**



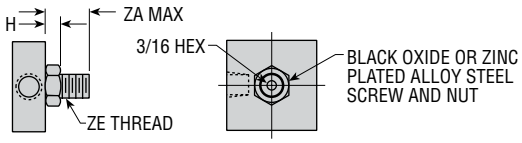
A CYLINDER STROKE ADJUSTMENT

Stroke adjustment screws are available to decrease the retraction stroke of any Series AV or A cylinders. The standard adjusting range is 1/2 inch. Longer adjusting lengths are available on request.

BORE SIZE	H	ZA	ZE STANDARD	ZE WITH -P OR -PC
3/4	0.370	1.031	3/8-24	5/16-24
1	0.462	1.156	1/2-20	3/8-24
1-1/8	0.462	1.156	1/2-20	1/2-20

Available with all options EXCEPT:

- **Cushion on the cap end (-D or -DC)**
- **Shock pad on the cap end (-B or -BC)**
- **Spring on the cap end (-SC)**
- **Pivot Mount, Pivot on cap (P Mounting)**
- **Cap flange mount, flange on cap (CF Mounting)**
- **F Mounting on 3/4 bore with -P or -PC**

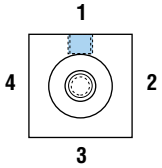


PORT POSITIONS

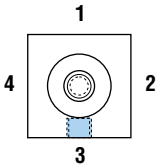
Port position 1 is standard on all cylinders except mounting style -F without port controls. The cap end port will be in position 4 standard.

If port position 1 (-Q) or 3 (-T) is desired, add -Q or -T to unit description and -F mounting tab will be added to unit to accommodate units.

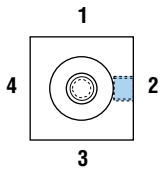
STANDARD PORT POSITION 1



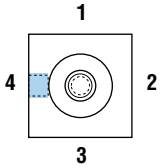
T PORT POSITION 3



R PORT POSITION 2



U PORT POSITION 4



All dimensions are reference only unless specifically toleranced.

E MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted radial sensing switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

M MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the radial sensing switches are not applicable. As with the radial sensing switches, a magnetic band (specify -M) on the piston activates the externally mounted PHD Reed Switches. The Reed Switches may be used to signal a programmable controller, sequencer, relay, or in some cases, a valve solenoid. This option is for use with the following switches.

The Teachable Switch provides the ability to identify two separately programmable positions with a single switch. Programmable capability means no “fine tuning.” With switch properly aligned, just place actuator in desired positions and program. Solid-state sensing technology provides a highly reliable switch.

See Series JC1 Switches at phdinc.com for more information.

SERIES JC1ST REED SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)

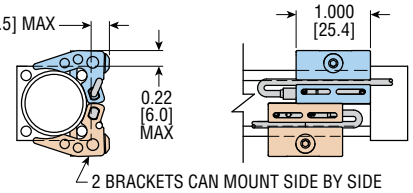
NOTE: Switches must be ordered separately.

SERIES JC1ST TEACHABLE SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

SWITCH BRACKET NO. 92100



V FLUOROELASTOMER SEALS

Fluoroelastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application. Consult PHD for high temperature use.

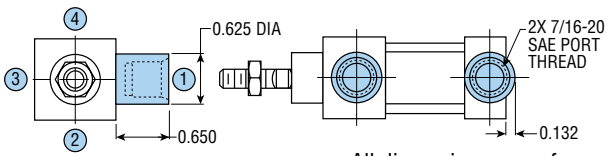
Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except rods and rod end, or parts made of stainless steel or aluminum. This optional plating treatment gives an alternative method of protecting the cylinder from severe environments.

Y SAE PORTS FOR SERIES HV

SAE Ports are available on most Tom Thumb Hydraulic Cylinders. Series HV Cylinders require a boss which is brazed to the head and cap.

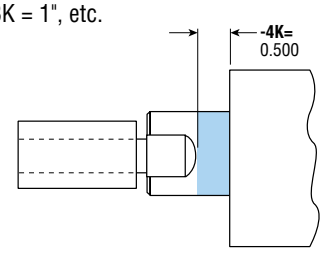
Dimensions for this boss are shown below. This option is not available on cylinders with an “F” mounting style. Consult PHD for optional port position or **units with Port Controls®**. Oversize rods are available except on T and L mounting styles on 3/4" bore cylinders.



_K EXTRA ROD EXTENSION

This option may be specified when extra plain rod extension between rod flats and cylinder snout is desired. Length is specified in 1/8" increments.

Length code example:
-4K = 1/2" of extra rod extension
-8K = 1", etc.



NOTE: On double rod end cylinders with -_K specified will be applied to one end of cylinder only (head end/ primary mounting end).

W CLOSE TOLERANCE STROKE

This option may be specified when a precise stroke length is required and stroke adjustment is not acceptable. By specifying this option, a stroke length with a tolerance of ±0.005 will be supplied. Standard stroke tolerance is ±0.032.

Maximum stroke for cylinders with close tolerance is 18".

NOTE: This option is not available with shock pads (-B, -BC, or -BR).

All dimensions are reference only unless specifically toleranced.

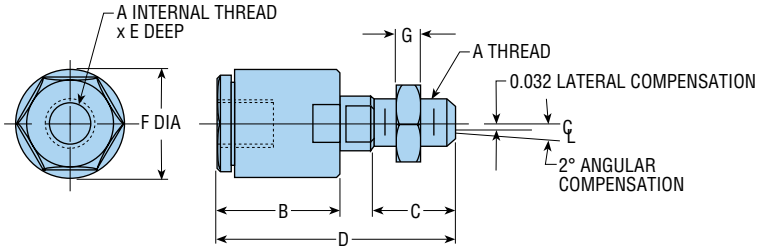
SELF-ALIGNING PISTON ROD COUPLERS

Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.

MODESL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	0.625	1.875	0.500	0.875	0.156
312	5/16-24	1.000	0.625	1.875	0.500	0.875	0.187
375	3/8-24	1.000	0.625	1.875	0.500	0.875	0.219
437	7/16-20	1.125	0.650	2.187	0.500	1.000	0.250
500	1/2-20	1.125	0.650	2.187	0.500	1.000	0.312
625	5/8-18	1.750	1.125	3.312	0.812	1.562	0.375
750	3/4-16	1.750	1.125	3.312	0.812	1.562	0.421

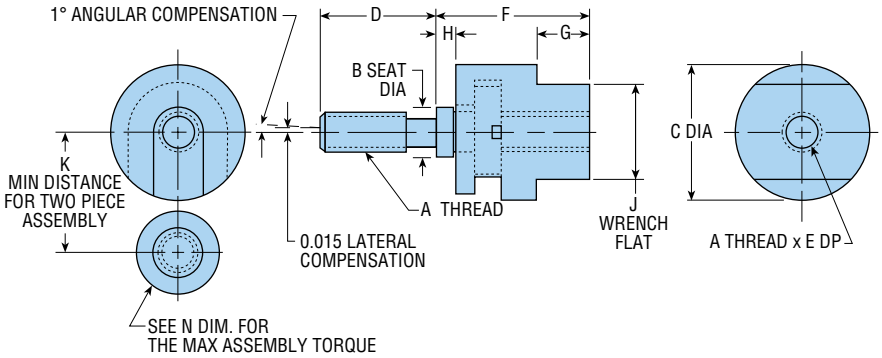
TO ORDER, SPECIFY THE MODEL NUMBER.



MINIATURE COUPLERS

Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.

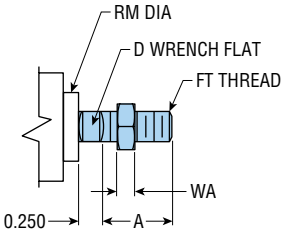
Rod Couplers are manufactured from high tensile and hardened steel components.



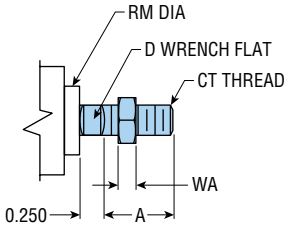
MODEL NO.	LETTER DIMENSION										
	A	B	C	D	E	F	G	H	J	K	N
19300-01	5-40	0.160	0.440	0.375	0.250	0.500	0.170	0.066	5/16	0.390	20 in-lbs
19300-02	10-32	0.250	0.560	0.500	0.281	0.558	0.200	0.058	3/8	0.490	70 in-lbs

All dimensions are reference only unless specifically toleranced.

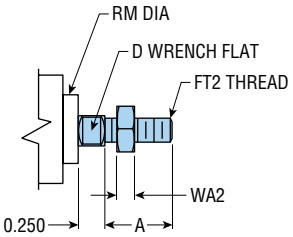
STANDARD (#1 ROD END)



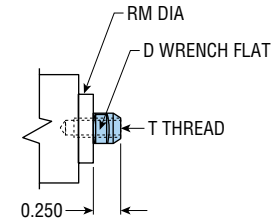
L COARSE THREAD ROD END



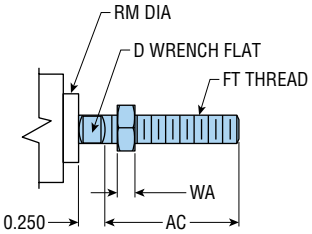
G ROD END STYLE #2



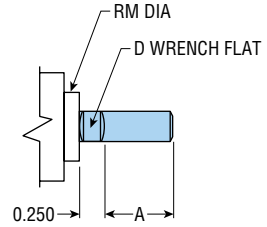
I ROD END STYLE #4



J ROD END STYLE #2X



N PLAIN ROD END



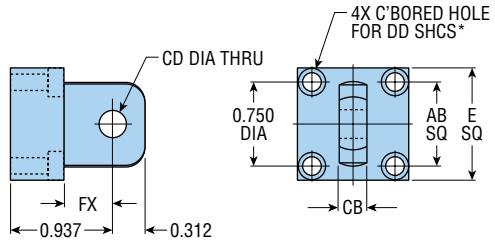
All standard rod ends have four wrench flats (two wrench flats with "I" option).

BORE SIZE	ROD TYPE	ROD DIAMETER	LETTER DIMENSION									
			A	AC	CT	D	FT	FT2	RM	T	WA	WA2
3/4	STANDARD	0.250	0.625	1.250	1/4-20	7/32	1/4-28	10-32	0.625	6-32 x 0.437 DP	0.156	0.130
	OVERSIZE	0.312	0.625	1.250	5/16-18	1/4	5/16-24	1/4-28	0.625	10-32 x 0.625 DP	0.187	0.156
1	STANDARD	0.312	0.625	1.250	5/16-18	1/4	5/16-24	1/4-28	0.750	10-32 x 0.625 DP	0.187	0.156
	OVERSIZE	0.375	0.625	1.250	3/8-16	5/16	3/8-24	5/16-24	0.750	1/4-28 x 0.625 DP	0.219	0.187
1-1/8	STANDARD	0.375	0.625	1.250	3/8-16	5/16	3/8-24	5/16-24	0.750	1/4-28 x 0.625 DP	0.219	0.187
	OVERSIZE	0.500	0.750	1.500	1/2-13	7/16	1/2-20	7/16-20	A: 0.750, AV-HV: 1.000	3/8-24 x 0.625 DP	0.312	0.250

NOTE: On double rod cylinders, both rod ends will be the same on both ends of the cylinder.

All dimensions are reference only unless specifically toleranced.

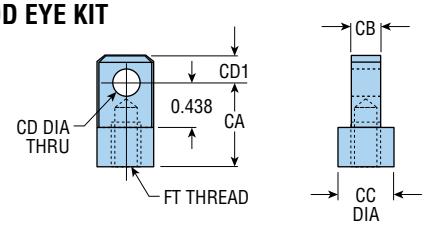
EYE BRACKET KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION					
			AB	CB	CD	DD*	E	FX
3/4	A, AV, HV	1077-01	0.750	0.248	0.250	#6	1.000	0.577
1 & 1-1/8	A	1077-02	1.000	0.373	0.250	#10	1.375	0.437
	AV, HV	1077-03	1.000	0.373	0.375	#10	1.375	0.437

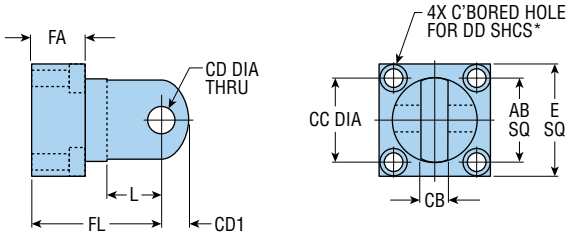
*FOR 3/4 BORE THRU HOLE ONLY.
NOTE: THESE BRACKETS MOUNT TO CUSTOMER MOUNTING SURFACE AND ARE USED WITH CORRESPONDING CYLINDER ROD CLEVIS KITS

ROD EYE KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION					
			CA	CB	CC	CD	CD1	FT
3/4	A, AV, HV	1075-01	0.750	0.248	0.500	0.250	0.250	1/4-28 x 0.375 DP
1	A	1075-02	0.875	0.373	0.750	0.250	0.375	5/16-24 x 0.375 DP
	AV, HV	1075-04	0.875	0.373	0.750	0.375	0.375	5/16-24 x 0.375 DP
1-1/8	A	1075-03	0.875	0.373	0.750	0.250	0.375	3/8-24 x 0.312 DP
	AV, HV	1075-05	0.875	0.373	0.750	0.375	0.375	3/8-24 x 0.312 DP

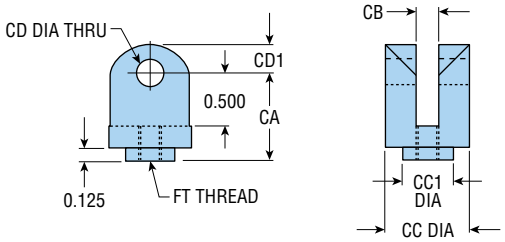
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION								
			AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	A, AV, HV	12901	0.750	0.254	0.750	0.250	0.250	#6	1.000	0.360	1.187	0.500
1 & 1-1/8	A	12902	1.000	0.379	0.875	0.250	0.375	#10	1.375	0.500	1.250	0.531
	AV, HV	12903	1.000	0.379	0.875	0.375	0.375	#10	1.375	0.500	1.250	0.531

*FOR 3/4 BORE THRU HOLE ONLY.
NOTE: THESE BRACKETS MOUNT TO CUSTOMER MOUNTING SURFACE AND ARE USED WITH CORRESPONDING CYLINDER PIVOT MOUNTING (P MOUNTING)

ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION						
			CA	CB	CC	CC1	CD	CD1	FT
3/4	A, AV, HV	12904	0.812	0.254	0.750	0.437	0.250	0.250	1/4-28 TO SLOT
1	A	12905	0.875	0.379	0.875	0.562	0.250	0.375	5/16-24 TO SLOT
	AV, HV	12906	0.875	0.379	0.875	0.562	0.375	0.375	5/16-24 TO SLOT
1-1/8	A	12907	0.875	0.379	0.875	0.562	0.250	0.375	3/8-24 TO SLOT
	AV, HV	12908	0.875	0.379	0.875	0.562	0.375	0.375	3/8-24 TO SLOT

All dimensions are reference only unless specifically toleranced.

AV & A Cleanroom

tom thumb®

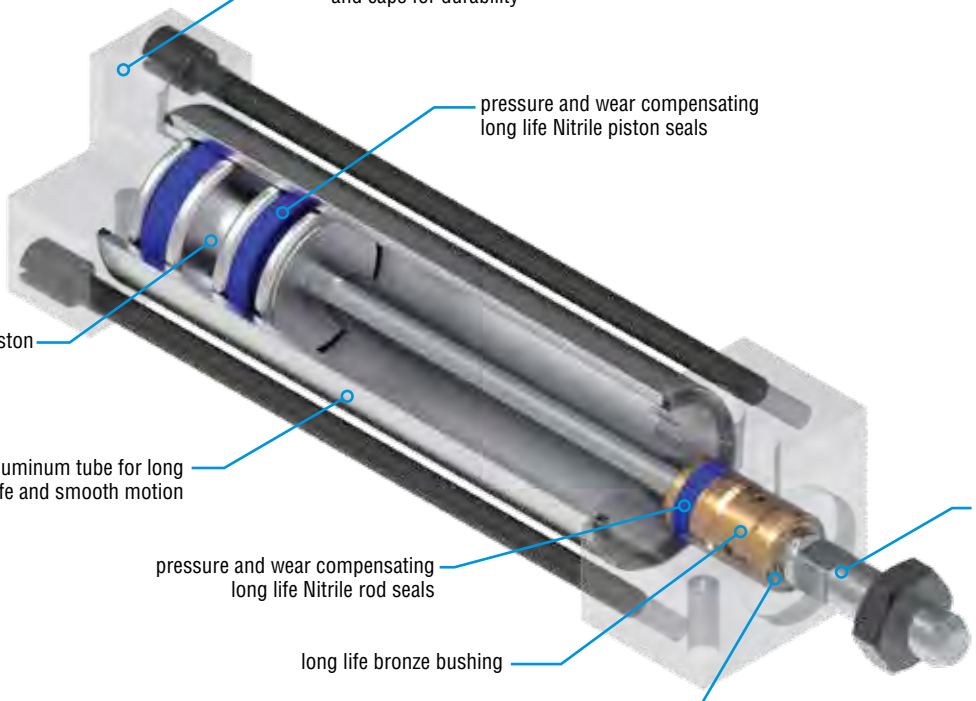
3/4", 1", 1-1/8" Bore

Major Benefits

- This option allows PHD Tom Thumb® Cylinders to be used in Class 100 cleanroom applications
- Vacuum port and special bushing minimize particles from rod gland area
- Wide range of mounting styles for easy installation

#10-32 vacuum port for particulate removal (fittings not provided)

(Requires Option -0)



ORDERING DATA: Cleanroom Cylinders - 3/4", 1", 1-1/8" Bore

TO ORDER SPECIFY:
Series, Mounting Style, Bore Size, Stroke, and Options.

SERIES
AV - 150 psi Air
A - 150 psi Air

BORE SIZE
3/4" BORE
1/4" Rod Dia.
1/4-28 Thread
1" BORE
5/16" Rod Dia.
5/16-24 Thread
1-1/8" BORE
3/8" Rod Dia.
3/8-24 Thread

REQUIRED OPTION
O - Cleanroom Vacuum Port

OPTION
Z1 - Electroless Nickel Plate all ferrous parts excluding Rod Ends.

AV F 1 x 2 - O - Z1

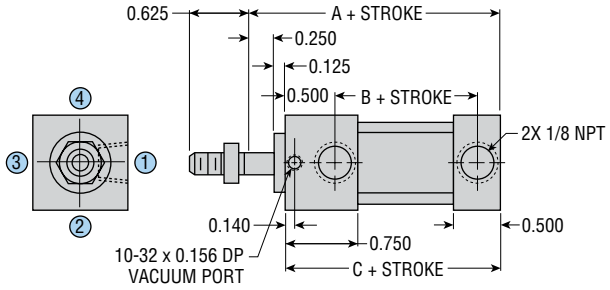
MOUNTING STYLE
F - Foot Mount, C'bored through holes
B - Bottom Mount, Tapped holes in head and cap
R - Rod Mount, Tapped holes on front face of head
T - Thread Mount, Threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
L - Pilot Mount, Threaded snout and pilot diameter on head (shipped with mounting nut)
P - Pivot Mount, Pivot on cap

STANDARD STROKE LENGTHS
3/4" BORE SIZE
1/4" to 12"
1" and 1-1/8" BORE SIZES
1/4" to 8"
in 1/4" increments

NOTES:
1) Some cleanroom applications may require -Z1 electroless nickel plating of all ferrous parts.
2) Consult PHD for any special lubrication requirements.
3) PHD Tom Thumb® Cylinders with vacuum ports have been tested and comply with class 100 cleanroom requirements for particle count and size.

ENGINEERING DATA & DIMENSIONS: Cleanroom Cylinders

SPECIFICATIONS	SERIES AV	SERIES A
OPERATING PRESSURE STANDARD CYLINDER	20 to 150 psi air	20 to 150 psi air
OPERATING TEMPERATURE	-20° to 180°F [-29° to 82°C]	-20° to 180°F [-29° to 82°C]
STROKE TOLERANCE	±0.032	±0.032
LUBRICATION	Permanently lubricated	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable



CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	AIR CONSUMPTION at 80 psi CUBIC ft/in OF STROKE	DISPLACEMENT gal./in OF STROKE
AV, A	3/4	1/4	EXTEND	0.442	0.0016	0.0019
			RETRACT	0.393	0.0014	0.0017
	1	5/16	EXTEND	0.785	0.0029	0.0034
			RETRACT	0.709	0.0026	0.0031
	1-1/8	3/8	EXTEND	0.994	0.0037	0.0043
			RETRACT	0.883	0.0032	0.0038

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb)	
		ZERO STROKE	ADDER PER INCH OF STROKE
PLAIN UNIT	3/4	0.42	0.04
	1	0.87	0.07
	1-1/8	0.95	0.10

VACUUM RATING
Vacuum Port - up to 25 In. Hg.

VACUUM CONNECTIONS
Manufacturer fittings differ. Due to close proximity of vacuum port to cylinder head port, the 10-32 vacuum port may require the use of a 10-32 barb fitting depending on fitting manufacturer used.

BORE SIZE 3/4", 1", 1-1/8"	LETTER DIMENSION		
	A	B	C
SERIES AV	2.625	1.500	2.250
SERIES A	2.125	1.000	1.750

See Series A, AV, HV section of catalog for complete cylinder dimensions and mounting styles.

MAX. ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE 100 lb
3/4", 1", 1-1/8" AV, HV, A	1/4	12"
	5/16	18"
	3/8	26"

CYLINDER FORCE CALCULATIONS

	Imperial F = P x A
F = Cylinder Force	lbs
P = Operating Pressure	psi
A = Effective Area (Extend or Retract)	in^2

All dimensions are reference only unless specifically toleranced.

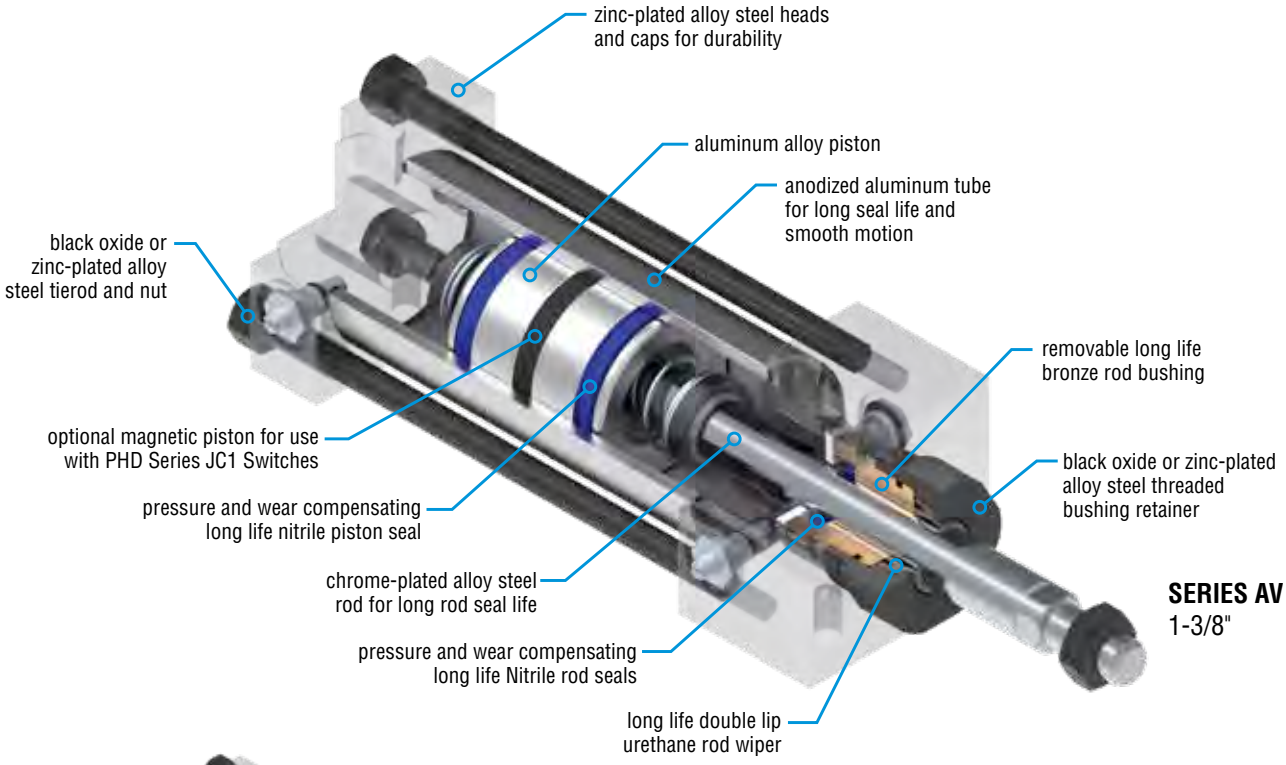
AV & HV

1-3/8" Bore

tom thumb®

Major Benefits

- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Wide range of mounting styles for easy installation



SERIES AV
1-3/8"

SERIES HV
1-3/8"

TO ORDER SPECIFY:
Series, Mounting Style, Bore Size, Stroke, Port Control®, and any Options. Also specify rod diameter if non-standard. Rod couplings and mounting attachments must be ordered separately.

SERIES
AV - 150 psi Air
HV - 1500 psi Hyd.

BORE SIZE
1-3/8" BORE
1/2" Std. Rod Dia.
3/8-24 Thread

STANDARD STROKE LENGTHS
1-3/8" BORE
1/2" to 24"
In 1/2" increments
Consult PHD for longer lengths.

CUSHION OR SHOCK PAD
D - Cushions on both ends
DR - Cushion on rod end
DC - Cushion on cap end
B - Shock Pads on both ends
BR - Shock Pad on rod end
BC - Shock Pad on cap end
Cushions, Shock Pads, and Spring Return are not available on the same end of cylinder. Shock Pads are not available on Series HV units.

OVERSIZE ROD
To be specified only when using a non-standard diameter. Rod diameters available are shown on page 101.

SC AV F 1-3/8 x 2 - P - D - 5/8 ROD - M-V

SPRING RETURN
SC - Spring on cap end
SR - Spring on rod end (Strokes available in 1/4" increments up to 6".) ⊕ See option pages.
and/or
DOUBLE ROD END
D - Double Rod End Cylinders
Leave blank if not needed.

MOUNTING STYLE
F - Foot Mount
B - Bottom Mount, tapped holes in head and cap
R - Rod Mount, tapped holes on front face of head
T - Thread Mount, threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
K - Clevis Mount, clevis on cap
TR - Trunnion Mount
RR - Tierod Mount, tierods extend out rod end
RC - Tierod Mount, tierods extend out cap end
RRC - Tierod Mount, tierods extend out both ends

PORT CONTROL®

BUILT-IN METER OUT FLOW CONTROL VALVE
P - Flow control on both ends
PR - Flow control on head end
PC - Flow control on cap end

OPTIONS
A - Stroke Adjustment, 1/2" of adjustment standard (not available on Series HV)
E - Magnetic Piston for Series JC1 radial sensing switches
F - #1 Rod End (see page 101 for dimensions) (see note 1)
I - #4 Rod End, Female thread on rod (see page 101 for dimensions) (see note 1)
H47 - Rodlok (Rod clamping device installed. Not available with Z1 or on HV. See option page.) ⊕
J - #2X Rod End, twice as long as standard thread (see page 101 for dimensions)
_K - Extra Rod Extension, in 1/8" increments (see page 99) (see note 2)
L - Coarse Thread Rod End (see page 101 for dimensions) (see note 1)
M - Magnetic Piston for Series JC1 reed and teachable switches
N - Plain Rod End (see page 101 for dimensions) (see note 1)
R - Ports in Position #2
T - Ports in Position #3
U - Ports in Position #4
V - Fluoroelastomer Seals
W - Close Tolerance Stroke, ±0.005" stroke length
Z1 - Electroless Nickel Plate all ferrous parts excluding Rod Ends

NOTES:
1) For double rod cylinders, rod end options will be applied to both ends of cylinder.
2) For double rod cylinders, -_K extension will be applied to one end only (head end/primary mounting end).
3) ⊕ Marked options provide additional cylinder flexibility, but may alter the dimensions.

⚠ Options may affect unit length. See dimensional pages and option information details.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

SWITCH MOUNTING BRACKET

PART NO.	DESCRIPTION
92101	Mounts Series JC1 Switch to Tie Rod

NOTE: Brackets are ordered separately.

SPECIFICATIONS	SERIES AV	SERIES HV
OPERATING PRESSURE		
STANDARD CYLINDER (NO RODLOK)	20 to 150 psi air	40 to 1500 psi hyd*
CYLINDER WITH RODLOK	30 to 150 psi air	—
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]
STROKE TOLERANCE	±0.032	±0.032
LUBRICATION	Permanently lubricated	—
MAINTENANCE	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	AIR CONSUMPTION at 80 psi CUBIC ft/in OF STROKE	DISPLACEMENT gal/in OF STROKE
AV HV	1-3/8	1/2	EXTEND	1.485	0.0055	0.0064
			RETRACT	1.289	0.0048	0.0056
		5/8	EXTEND	1.485	0.0055	0.0064
			RETRACT	1.178	0.0044	0.0051

NOTE: Use the RETRACT figures for calculating double rod cylinder forces in both directions.

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb)							
		100	200	500	1000	1500	2000	3000	5000
1-3/8" AV, HV	1/2	48"	34"	21"	15"	12"	—	—	—
	5/8	74"	53"	33"	24"	19"	—	—	—

SERIES	UNIT WEIGHTS (lb)	
	ZERO STROKE	ADDER PER INCH OF STROKE
PLAIN UNIT	2.56	0.12

CYLINDER FORCE CALCULATIONS

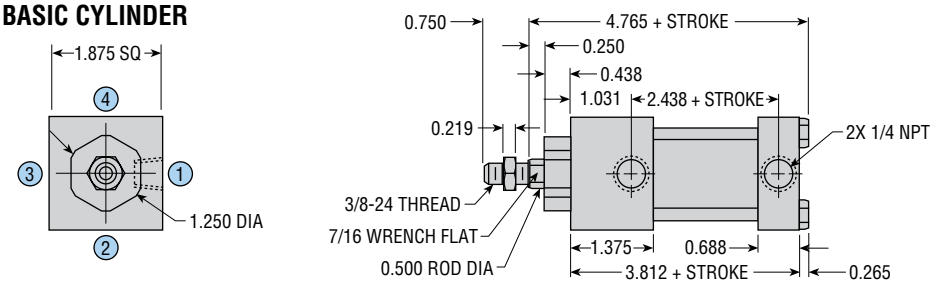
Imperial
F = P x A

F = Cylinder Force	lbs
P = Operating Pressure	psi
A = Effective Area (Extend or Retract)	in^2

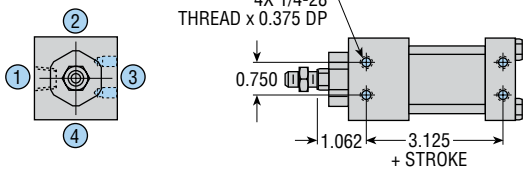
Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at **www.phdinc.com/apps/sizing**

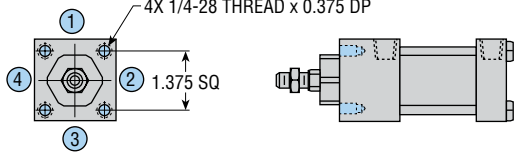
SERIES AV/HV BASIC CYLINDER



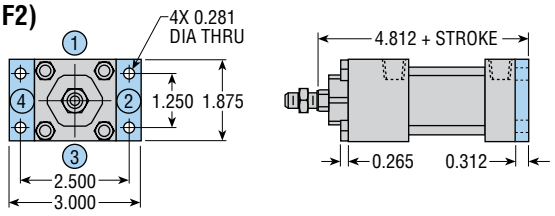
B (MS4)



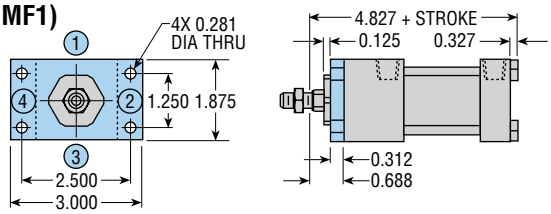
R (MR1)



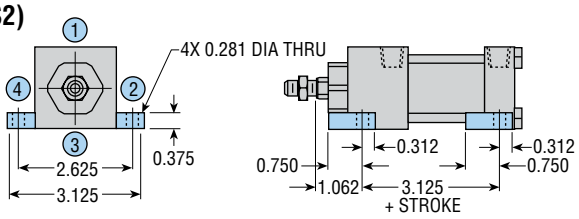
CF (MF2)



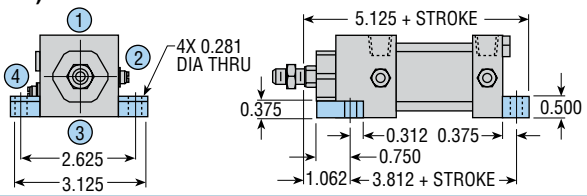
RF (MF1)



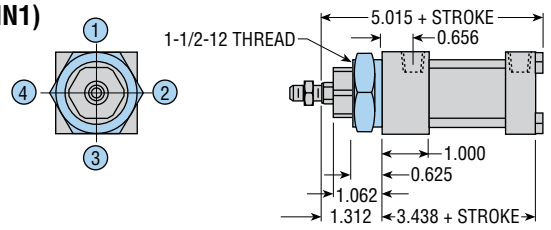
F (MS2)



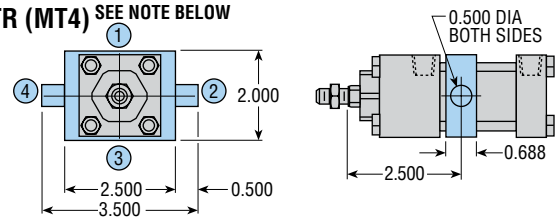
F (MS2) - WITH PORT CONTROL & CUSHION ON CAP END



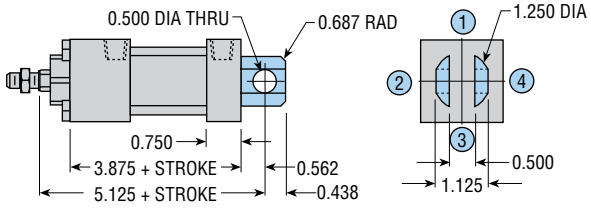
T (MN1)



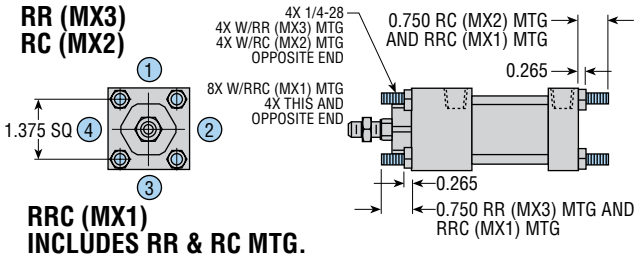
TR (MT4) SEE NOTE BELOW



K (MP1)



RR (MX3) RC (MX2)



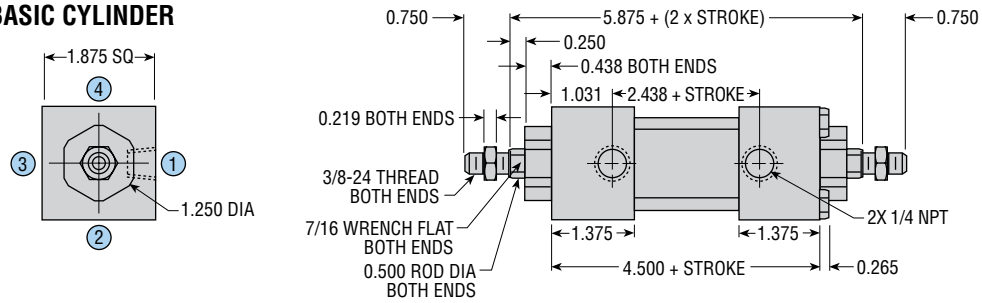
RRC (MX1) INCLUDES RR & RC MTG.

All standard rod ends have four wrench flats (two wrench flats with "I" option).

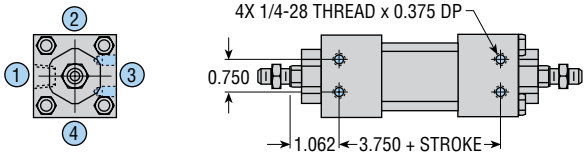
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
SHOCK PADS: ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)
OVERSIZE RODS: SEE PAGE 101 FOR OVERSIZE ROD SPECIFICATIONS.
TR MOUNTING NOTE: SENSING IN THE EXTEND DIRECTION WILL BE AFFECTED ON UNITS WITH -E OR -M OPTION BECAUSE OF THE TRUNNION MOUNTING BLOCK.

All dimensions are reference only unless specifically toleranced.

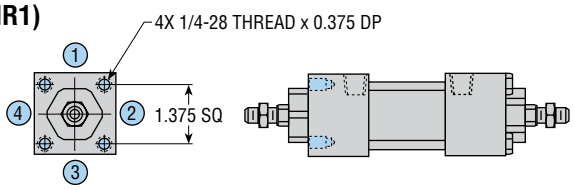
SERIES DAV/DHV BASIC CYLINDER



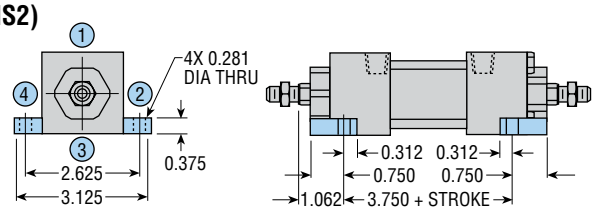
B (MS4)



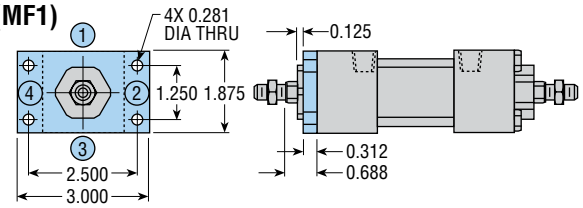
R (MR1)



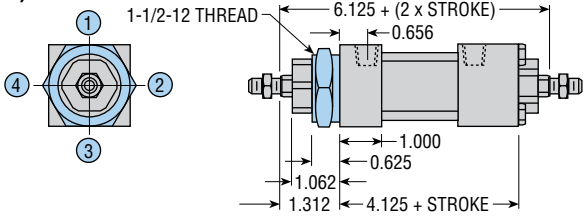
F (MS2)



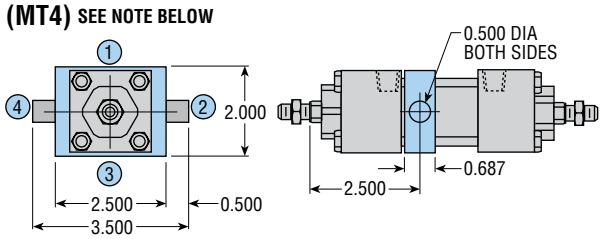
RF (MF1)



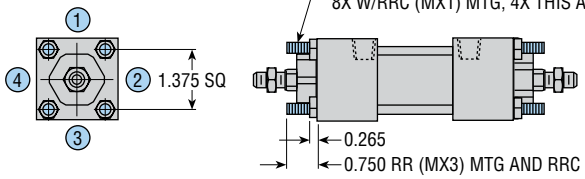
T (MN1)



TR (MT4) SEE NOTE BELOW



RR (MX3)



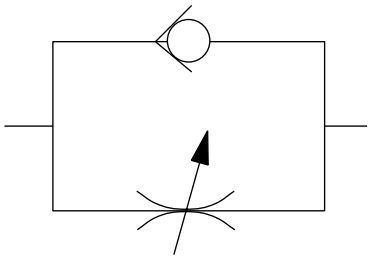
RRC (MX1)
THREADED TIEROD ON BOTH ENDS

All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
SHOCK PADS: ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
SPRING RETURN: ADD AN ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)
OVERSIZE RODS: SEE PAGE 101 FOR OVERSIZE ROD SPECIFICATIONS.
TR MOUNTING NOTE: SENSING IN THE EXTEND DIRECTION WILL BE AFFECTED ON UNITS WITH -E OR -M OPTION BECAUSE OF THE TRUNNION MOUNTING BLOCK.

All dimensions are reference only unless specifically toleranced.

P PC PR PORT CONTROL®



The exclusive PHD Port Control®, based on the "meter-out" principle, features an adjustable needle and a separate ball check. Both are built into the cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

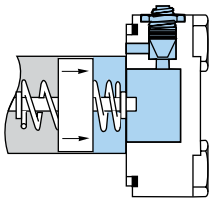
The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume. The separate ball check is closed while fluid is exhausting from the cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.

D DC DR ADJUSTABLE CUSHION

PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

Effective cushion length 1/2"

POPPET STYLE

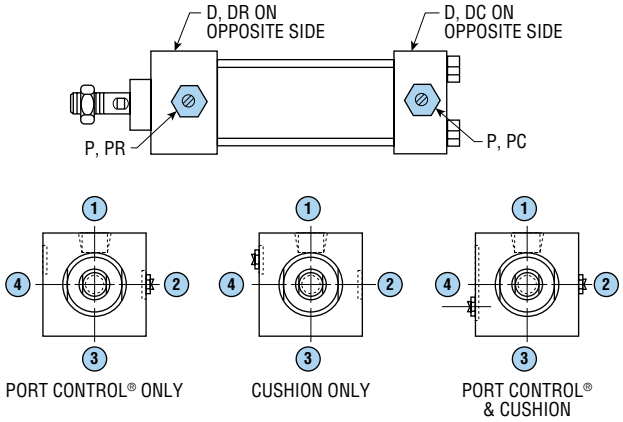


1-3/8" BORE

STANDARD PORT CONTROL® AND CUSHION NEEDLE POSITIONS

Port Control® and cushion needles are located on opposite sides adjacent to port. Please consult distributor or PHD to check availability of special Port Control® or cushion needle positions.

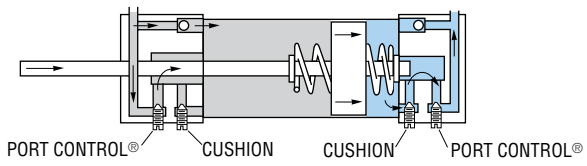
Location may vary depending on mounting and option combinations.



PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION

The cushion and Port Control® combination is available on the 1-3/8" bore. This cushion is activated when a seal, which is traveling with the piston, seals against the cylinder end cap. This causes the remaining volume in the cylinder to exhaust past an adjustable needle which controls the amount of deceleration. The spring, which extends the seal from the piston, permits the seal to act as a check valve to allow full flow back into the cylinder for immediate reversing. The cushion seal for air units is made of urethane while seals for oil units are close tolerance metal.

POPPET STYLE

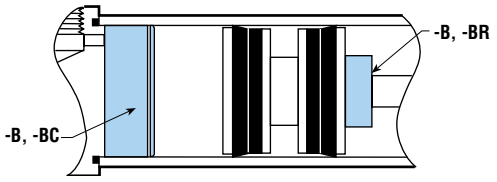


B BC BR SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on HV hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available with all options EXCEPT:

- **Same end as Cushion (-D, -DC, or -DR)**
- **Spring end of Spring Return cylinder (-SC or -SR)**
- **Same end as Stroke Adjustment (-A)**



SR SC SPRING RETURN

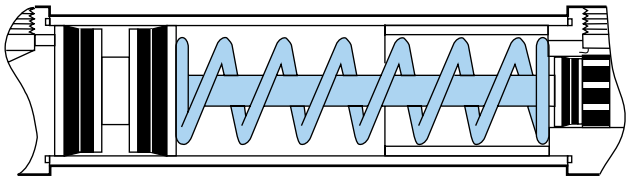
Available in 1/4" increments

All standard A, AV and HV Cylinders from 1/4" to 6" of stroke can be built with internal springs to return or extend the piston rod in single acting applications. The standard spring provides a preload and a spring rate per chart below. Other spring combinations will be quoted on request.

STROKE	PRELOAD	RATE
1/4" - 3"	4 lb	7 lb/in
3-1/4" - 6"	2 lb	3-1/2 lb/in

Available with all options EXCEPT:

- **Cushion on the spring end (-D, -DC, or -DR)**
- **Shock pad on the spring end (-B, -BC, or -BR)**
- **Stroke adjustment on the spring end (-A)**



A CYLINDER STROKE ADJUSTMENT

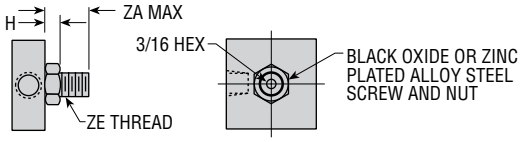
(SERIES AV)

Stroke adjustment screws are available to decrease the retraction stroke of any Series AV. The standard adjusting range is 1/2 inch. Longer adjusting lengths are available on request.

BORE SIZE	H	ZA	ZE
1-3/8	0.462	1.000	1/2-20

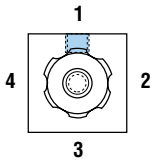
Available with all options EXCEPT:

- **Cushion on the cap end (-D or -DC)**
- **Shock pad on the cap end (-B or -BC)**
- **Spring on the cap end (SC)**
- **Cap flange mounting (CF)**
- **Clevis mount on cap (K)**

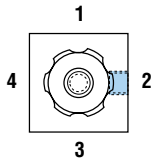


PORT POSITIONS

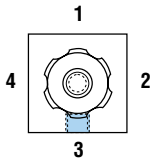
STANDARD PORT POSITION 1



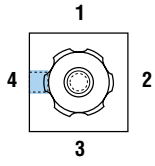
R PORT POSITION 2



T PORT POSITION 3



U PORT POSITION 4



E MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted radial sensing switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

M MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the radial sensing switches are not applicable. As with the radial sensing switches, a magnetic band (specify -M) on the piston activates the externally mounted PHD Reed Switches. The Reed Switches may be used to signal a programmable controller, sequencer, relay, or in some cases, a valve solenoid. This option is for use with the following switches.

The Teachable Switch provides the ability to identify two separately programmable positions with a single switch. Programmable capability means no “fine tuning.” With switch properly aligned, just place actuator in desired positions and program. Solid-state sensing technology provides a highly reliable switch.

See Series JC1 Switches at phdinc.com for more information.

SERIES JC1ST REED SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)

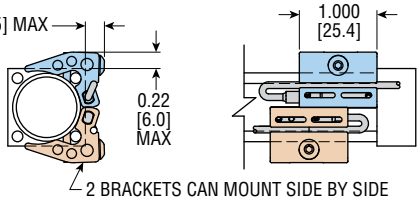
NOTE: Switches must be ordered separately.

SERIES JC1ST TEACHABLE SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

SWITCH BRACKET NO. 92100



V FLUOROELASTOMER SEALS

Fluoroelastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application. Consult PHD for high temperature use.

Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except rods and rod end, or parts made of stainless steel or aluminum. This optional plating treatment gives an alternative method of protecting the cylinder from severe environments.

NOTE: Standard plating is Brite Zinc.

W CLOSE TOLERANCE STROKE

This option may be specified when a precise stroke length is required and stroke adjustment is not acceptable. By specifying this option, a stroke length with a tolerance of ±0.005 will be supplied. Standard stroke tolerance is ±0.032.

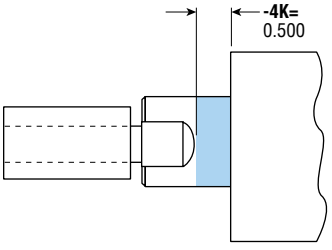
Maximum stroke for cylinders with close tolerance is 18".

NOTE: This option is not available with shock pads (-B, -BC, or -BR).

_K EXTRA ROD EXTENSION

This option may be specified when extra plain rod extension between rod flats and cylinder snout is desired. Length is specified in 1/8" increments.

Length code example:
-4K = 1/2" of extra rod extension
-8K = 1", etc.



NOTE: On double rod end cylinders with -_K specified will be applied to one end of cylinder only (head end/ primary mounting end).

All dimensions are reference only unless specifically toleranced.

H47 RODLOK CYLINDER & RODLOK

Available on single rod Series AV units only. ⊕

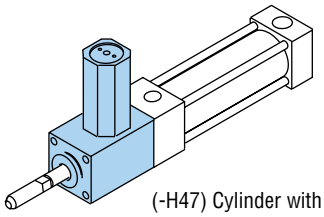
PHD's Rodlok is ideal for locking the piston rod while in a static/ stationary position. When the pressure is removed from the port of the Rodlok, the mechanism will grip the rod and prevent it from moving. The loads are held indefinitely without power. Rodlok performance is application and environment sensitive (cleanliness of rod or Rodlok will also affect performance). THE RODLOK IS NOT DESIGNED TO BE USED AS A PERSONAL SAFETY DEVICE.

Option H47 provides a cylinder and Rodlok pre-assembled. The port for the Rodlok will be assembled in the same position as the port on the extend end of the cylinder.

Replacement Rodlok kits can be purchased separately. See chart at right. The locking device and adaptor are not available with the -Z1 corrosion resistant finish.

-H47 available on B, R, and RC mounting only.

⊕ This option does not dimensionally comply with the NFPA standard specifications.

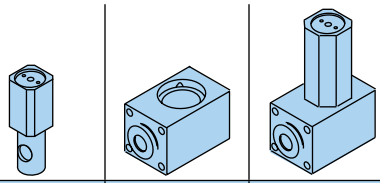


(-H47) Cylinder with rod locking device and adaptor preassembled

BORE in	STATIC LOCKING FORCE*	
	lb	N
1-3/8	135	600

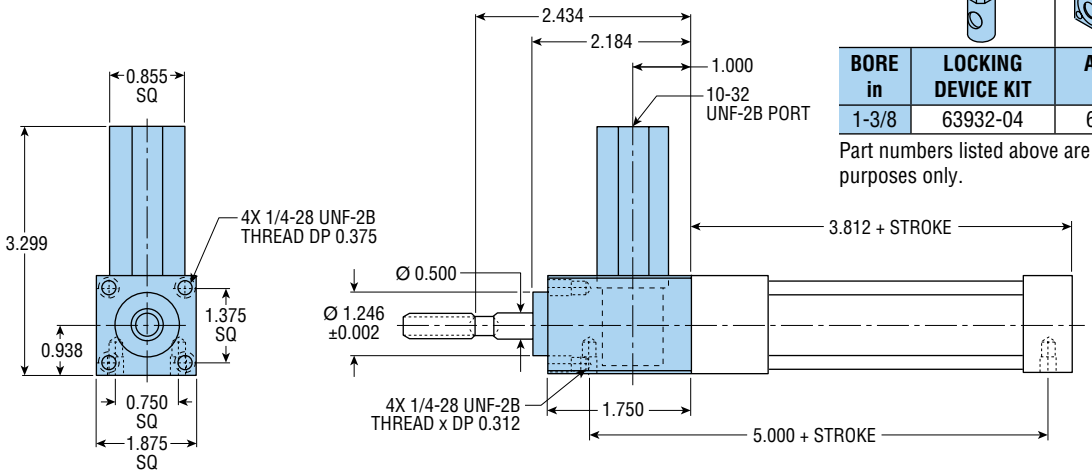
NOTE: *Locking force given is the actual locking force with a dry, clean rod and does not include any safety factor.

REPLACEMENT RODLOK KITS



BORE in	LOCKING DEVICE KIT	ADAPTOR KIT	COMPLETE RODLOK
1-3/8	63932-04	63931-04	63935-04

Part numbers listed above are intended for replacement purposes only.

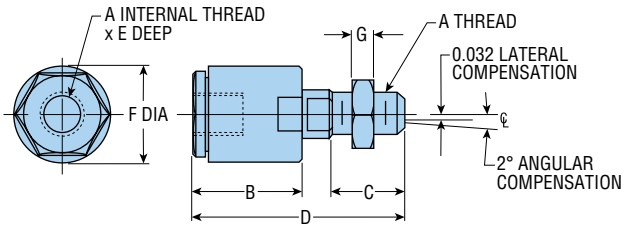


NOTE:
BREAKAWAY FORCE ON CYLINDERS WITH RODLOK APPROXIMATELY 30 psi.

SELF-ALIGNING PISTON ROD COUPLERS

Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.



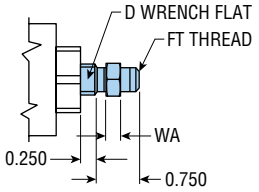
MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
375	3/8-24	1.000	0.625	1.875	0.500	0.875	0.219
437	7/16-20	1.125	0.650	2.187	0.500	1.000	0.250
500	1/2-20	1.125	0.650	2.187	0.500	1.000	0.312

To order, specify the model number.

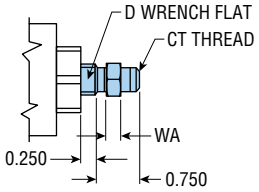
All dimensions are reference only unless specifically toleranced.

1-3/8" BORE CYLINDERS

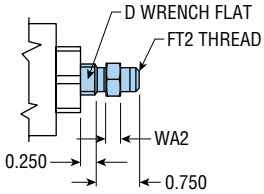
G
ROD END STYLE #2
STANDARD ON:
(1-3/8" BORE)



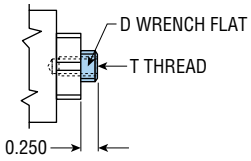
L
COARSE THREAD ROD END



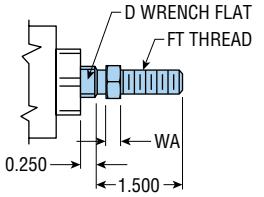
F
ROD END STYLE #1



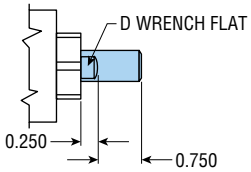
I
ROD END STYLE #4



J
ROD END STYLE #2X



N
PLAIN ROD END

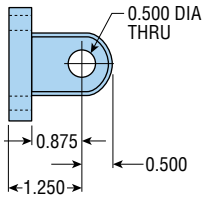


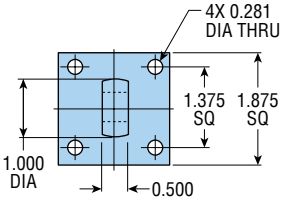
All standard rod ends have four wrench flats (two wrench flats with "I" option).

BORE SIZE	ROD TYPE	ROD DIAMETER	CT	D	FT	FT2	T	WA	WA2
1-3/8	STANDARD	0.500	3/8-16	7/16	3/8-24	7/16-20	3/8-24 x 0.625 DP	0.219	0.250
	OVERSIZE	0.625	7/16-14	9/16	7/16-20	1/2-20	7/16-20 x 0.625 DP	0.250	0.312

NOTE: On double rod cylinders, both rod ends will be the same on both ends of the cylinder.

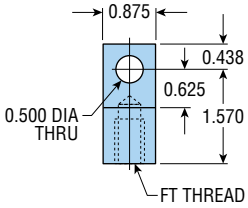
EYE BRACKET KIT

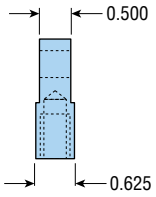




BORE SIZE	PART NO.
1-3/8	1330

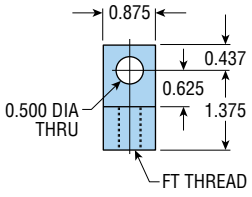
ROD EYE KIT

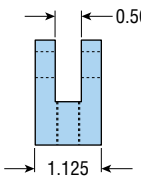




BORE SIZE	PART NO.	LETTER DIMENSION FT
1-3/8	1375-01	3/8-24 x 0.750 DP
	1375-02	7/16-20 x 0.750 DP
	1375-03	1/2-20 x 0.750 DP

ROD CLEVIS KIT - PIN INCLUDED





BORE SIZE	KIT NO.	LETTER DIMENSION FT
1-3/8	12909	3/8-24 TO SLOT
	12910	7/16-20 TO SLOT
	12911	1/2-20 TO SLOT

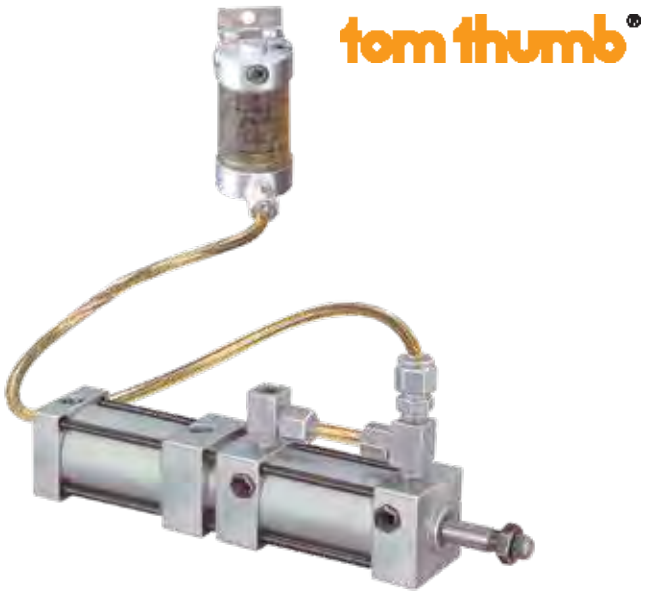
All dimensions are reference only unless specifically toleranced.

TD

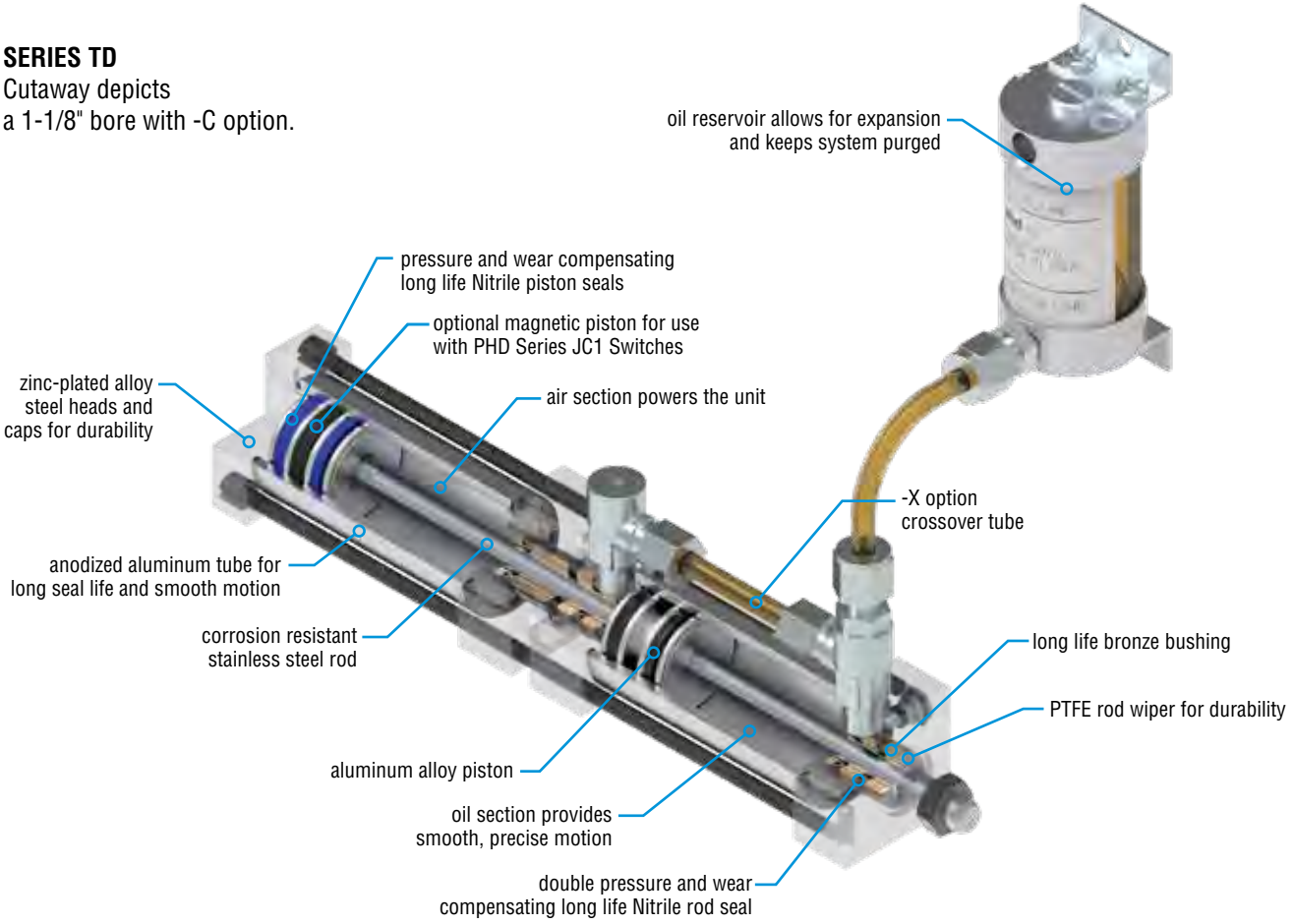
3/4", 1", 1-1/8", 1-3/8" Bore

Major Benefits

- Precise speed control and smooth operation at low velocities with -C option
- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Wide range of mounting styles for easy installation



SERIES TD
Cutaway depicts
a 1-1/8" bore with -C option.



ORDERING DATA: Series TD Cylinders - 3/4", 1", 1-1/8", 1-3/8" Bore

TO ORDER SPECIFY:
Series, Mounting Style,
Bore Size, Stroke, and Options.

BORE SIZE
3/4" BORE
1/4" Rod Dia.
1/4-28 Thread

1" BORE
5/16" Rod Dia.
5/16-24 Thread

1-1/8" BORE
3/8" Rod Dia.
3/8-24 Thread

1-3/8" BORE
1/2" Rod Dia.
3/8-24 Thread

Options may affect unit length. See dimensional pages and option information details.

CYLINDER SERIES
TD - 150 psi air

OPTIONS
E - Magnetic Piston for Series JC1 radial sensing switches
M - Magnetic Piston for Series JC1 reed and teachable switches
V - Fluoroelastomer Seals

TD F 1-1/8 x 3 - X - M

MOUNTING STYLE
F - Foot Mount, c'bored thru holes
B - Bottom Mount, tapped holes in head and cap
R - Rod Mount, tapped holes on front face of head
T - Thread Mount, threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
*L - Mount, Threaded snout and pilot diameter on head (shipped with mounting nut)
*P - Pivot Mount, pivot on cap
**K - Clevis Mount, clevis on cap

*Available on 3/4", 1", and 1-1/8" bore only
**Available on 1-3/8" bore only

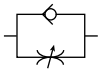
STANDARD STROKE LENGTHS
3/4" BORE SIZE
1/4" to 6"
1" and 1-1/8" BORE SIZES
1/4" to 9"
in 1/4" increments

1-3/8" BORE SIZE
1/2" to 12"
in 1/2" increments

For longer strokes, consult PHD.

TANDEM OPTION
X - Crossover Tube must be specified to receive the unit with Crossover Tube and Fittings filled with oil for use as Air/Oil Tandem (crossover tube only)
C - Includes -X above with the reservoir plumbed to the head end. For use as Air/Oil crossover with reservoir

Standard Feature
PORT CONTROL®



BUILT-IN METER OUT FLOW CONTROL VALVE

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

SWITCH MOUNTING BRACKET

PART NO.	DESCRIPTION
92101	Mounts Series JC1 Switch to Tie Rod

NOTE: Brackets are ordered separately.

SPECIFICATIONS	SERIES AV
OPERATING PRESSURE STANDARD WITH -X OR -C	 20 to 150 psi air 30 to 150 psi air
RESERVOIR PRESSURE	20 psi recommended
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]
STROKE TOLERANCE	±0.032
LUBRICATION	Permanently lubricated
TANDEM FLUID	SAE 32 weight oil (viscosity at 100°F is 158. SSU at 250° is 45.1)
MAINTENANCE	Field repairable

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE		AIR CONSUMPTION at 80 psi CUBIC ft/in OF STROKE		DISPLACEMENT gal/in OF STROKE
				WITH -C OR -X	W/OUT -C OR -X			
				lb/psi	lb/psi	WITH -C OR -X	W/OUT -C OR -X	
TD	3/4	1/4	EXTEND	0.442	0.835	0.0016	0.0030	0.0019
			RETRACT	0.393	0.786	0.0014	0.0028	0.0017
	1	5/16	EXTEND	0.785	1.494	0.0029	0.0055	0.0034
			RETRACT	0.709	1.418	0.0026	0.0052	0.0031
	1-1/8	3/8	EXTEND	0.994	1.877	0.0037	0.0069	0.0043
			RETRACT	0.883	1.766	0.0032	0.0064	0.0038
	1-3/8	1/2	EXTEND	1.485	2.774	0.0055	0.0103	0.0064
			RETRACT	1.289	2.578	0.0048	0.0096	0.0056

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb)							
		100	200	500	1000	1500	2000	3000	5000
3/4", 1", 1-1/8" TD	1/4	12"	9"	6"	—	—	—	—	—
	5/16	18"	13"	8"	—	—	—	—	—
	3/8	26"	18"	12"	—	—	—	—	—
1-3/8" TD	1/2	48"	34"	21"	—	—	—	—	—

MAXIMUM AIR/OIL TANDEM CYLINDER VELOCITY (in/sec)

PRESSURE (psi)		BORE			
		3/4"	1"	1-1/8"	1-3/8"
40	EXTEND	0.68	2.26	2.66	3.07
	RETRACT	1.00	2.26	2.30	2.60
60	EXTEND	1.26	3.07	3.33	4.13
	RETRACT	1.50	3.00	3.24	3.52
80	EXTEND	1.71	3.42	4.28	4.80
	RETRACT	2.00	3.42	3.87	4.44
100	EXTEND	2.06	4.28	5.00	5.21
	RETRACT	2.44	4.44	4.61	4.80

Minimum recommended velocity for all bore sizes at pressures from 40 to 150 psi is 0.133 in/sec.

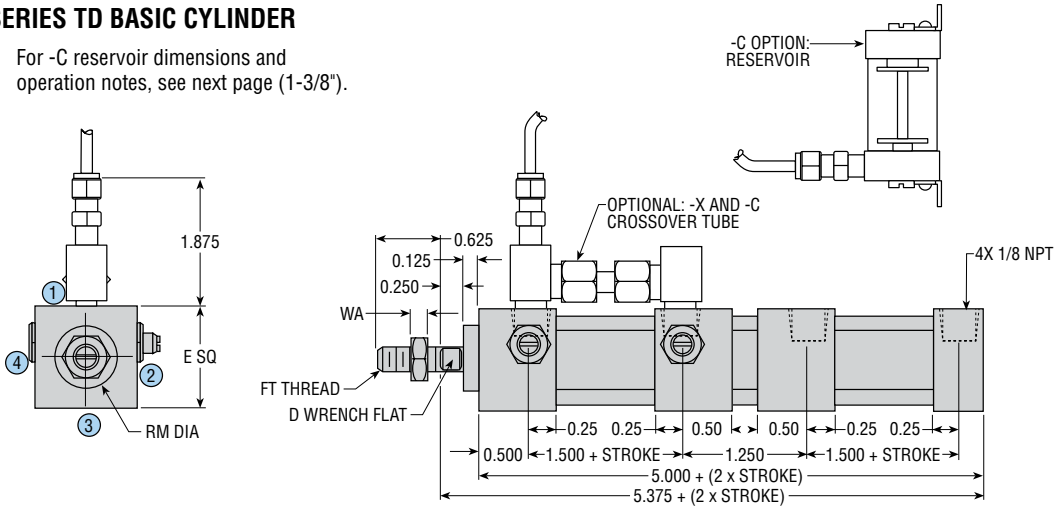
Field Maintenance Videos on filling and bleeding Air/Oil Tandem Actuators are available. Contact your local PHD distributor or call our toll free number: 1-800-624-8511. Or go online to www.phdinc.com to view working cutaways and applications.

CYLINDER FORCE CALCULATIONS

	Imperial F = P x A
F = Cylinder Force	lbs
P = Operating Pressure	psi
A = Effective Area (Extend or Retract)	in^2

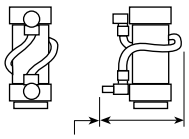
SERIES TD BASIC CYLINDER

For -C reservoir dimensions and operation notes, see next page (1-3/8").



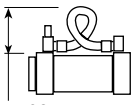
TUBE CROSSOVER VIEW

FOR NON F OR B MOUNT UNITS



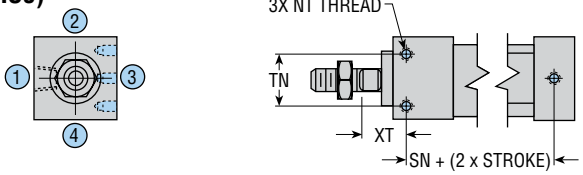
TUBE COIL DIAMETER APPROXIMATELY 9" SEE NOTE 1*

F & B MOUNT UNITS

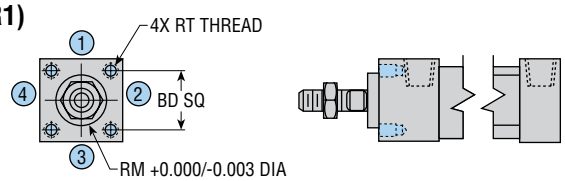


TUBE COIL DIAMETER APPROXIMATELY 9" SEE NOTE 1*

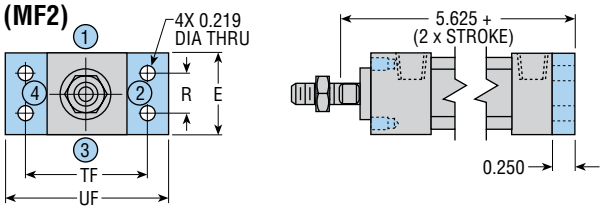
B (MS9)



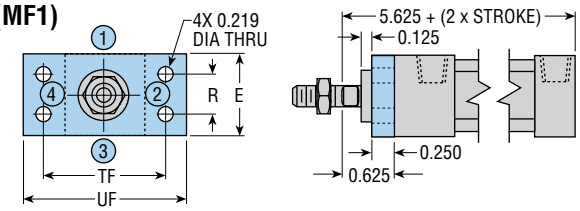
R (MR1)



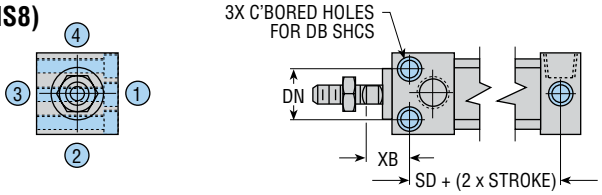
CF (MF2)



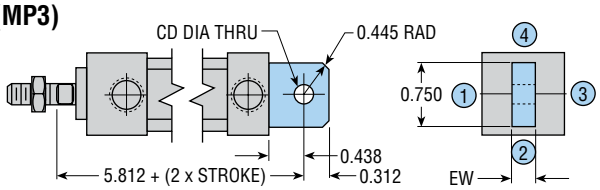
RF (MF1)



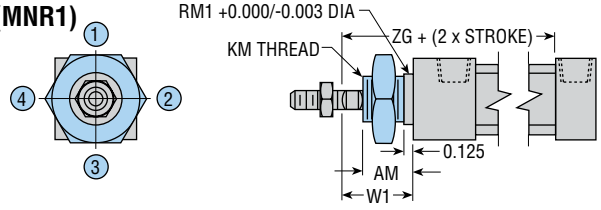
F (MS8)



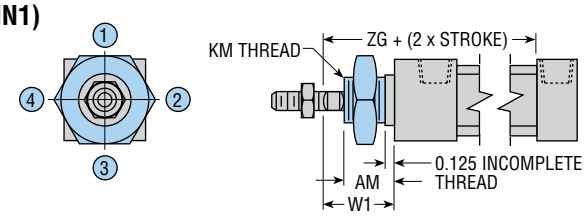
P (MP3)



L (MNR1)



T (MN1)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

BORE SIZE	LETTER DIMENSION																		
	AM	BD	CD	D	DB	DN	E	EW	FT	KM	NT	R	RM	RM1	RT	SD	SN	TF	TN
3/4	0.625	0.750	0.250	3/16	#8	0.625	1.000	0.250	1/4-28	5/8-18	8-32 x 0.18 DP	0.500	0.625	0.687	8-32 x 0.25 DP	4.562	4.562	1.500	0.625
1	0.625	1.000	0.375	1/4	#10	0.875	1.375	0.375	5/16-24	3/4-16	10-32 x 0.25 DP	0.875	0.750	0.812	8-32 x 0.25 DP	4.500	4.500	1.875	0.875
1-1/8	0.875	1.125	0.375	5/16	#10	1.000	1.500	0.375	3/8-24	1-14	10-32 x 0.25 DP	1.000	0.750	1.062	10-32 x 0.25 DP	4.500	4.500	2.000	1.000

BORE SIZE	LETTER DIMENSION					
	UF	WA	W1	XB	XT	ZG
3/4	2.000	0.156	0.875	0.562	0.562	5.875
1	2.375	0.188	0.875	0.625	0.625	5.875
1-1/8	2.500	0.219	1.125	0.625	0.625	6.125

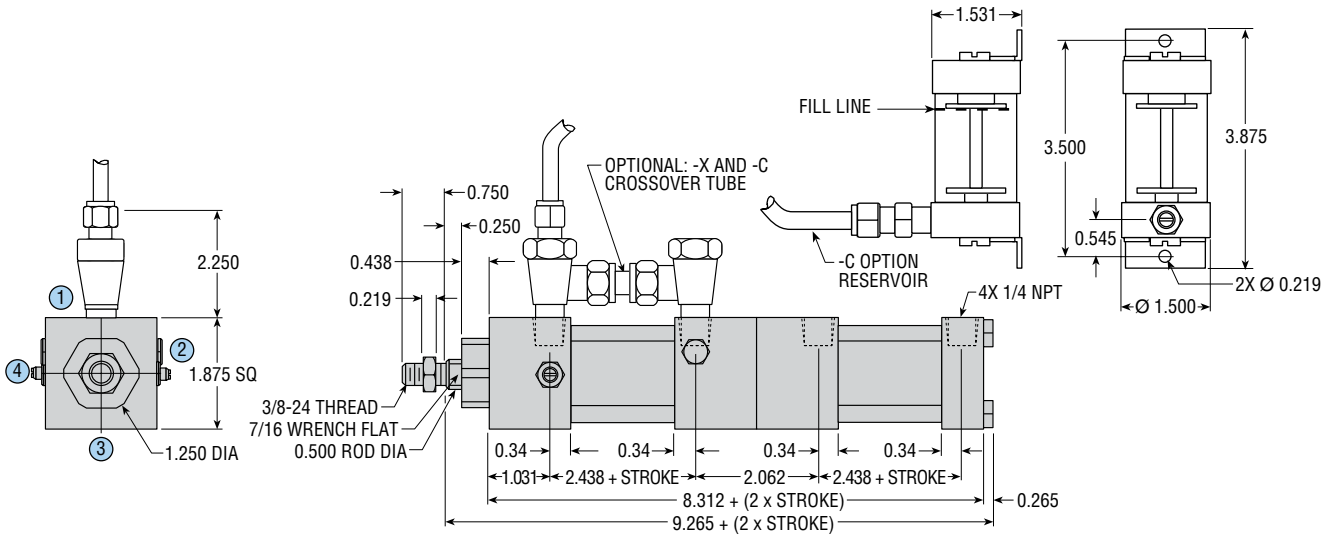
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS

NOTE: *FOR -X AND -C OPTIONS WITH STROKES OF 0.250 in OR LESS, THE CROSSOVER TUBE WILL BE COILED AROUND CYLINDERS FOR ALL NON B OR F MOUNTING UNITS. F & B MOUNTING UNITS WILL HAVE TUBE COILED ABOVE CYLINDER DUE TO DISTANCE BETWEEN FITTINGS. SEE DETAIL ABOVE.

All dimensions are reference only unless specifically toleranced.

SERIES TD BASIC CYLINDER

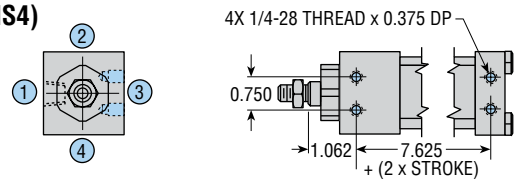
TANK DIMENSIONS



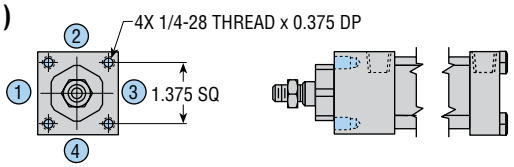
-C Option Air/Oil Tandem Mounting and Operation Notes:

1. Mount reservoir vertically above hydraulic section. Excess tubing may be coiled or cut off. Shortening of tubing should be done in a fashion as to keep oil loss to a minimum. Tubing and crossover below cut must be kept full of oil at all times.
2. A constant air supply of 20 psi to be on inlet port of reservoir during operation. Use of E-stop or other applications with pressure lost to reservoir may cause rod seal seepage. PHD recommends use of check valve in circuit on reservoir port.
3. Oil level in reservoir should be kept at level indicated on label of tube.

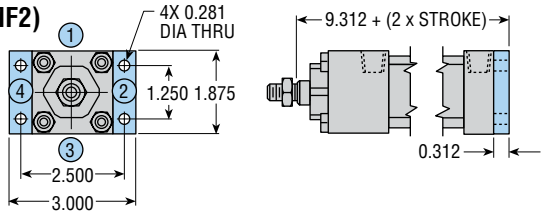
B (MS4)



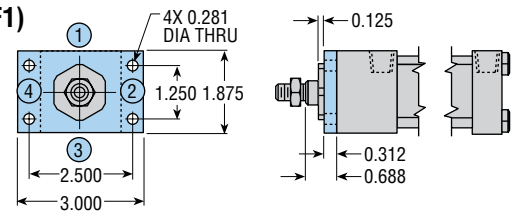
R (MR1)



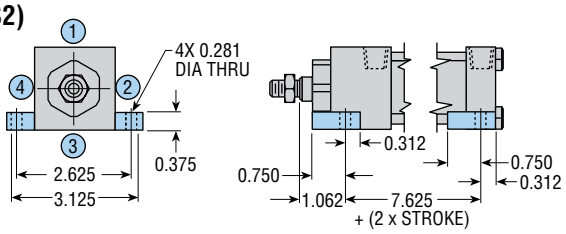
CF (MF2)



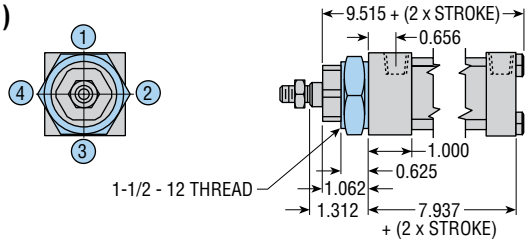
RF (MF1)



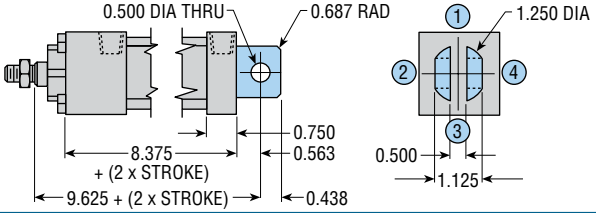
F (MS2)



T (MN1)



K (MP1)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS

All dimensions are reference only unless specifically toleranced.

E MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted radial sensing switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

M MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the radial sensing switches are not applicable. As with the radial sensing switches, a magnetic band (specify -M) on the piston activates the externally mounted PHD Reed Switches. The Reed Switches may be used to signal a programmable controller, sequencer, relay, or in some cases, a valve solenoid. This option is for use with the following switches.

The Teachable Switch provides the ability to identify two separately programmable positions with a single switch. Programmable capability means no "fine tuning." With switch properly aligned, just place actuator in desired positions and program. Solid-state sensing technology provides a highly reliable switch.

See Series JC1 Switches at phdinc.com for more information.

SERIES JC1ST REED SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)

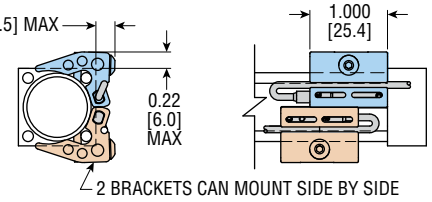
NOTE: Switches must be ordered separately.

SERIES JC1ST TEACHABLE SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

SWITCH BRACKET NO. 92100



V FLUOROELASTOMER SEALS

Fluoroelastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application. Consult PHD for high temperature use.

C RESERVOIR ASSEMBLY PLUMBED
Air/Oil Tandem models only (Series TD)

See previous page for dimensions.

Available on Series TD tandem models only. The reservoir assembly is plumbed to the unit and is bled of air for easy installation. (Includes -X option).

1) Mount reservoir vertically above hydraulic section. Extra tubing may be coiled or cut off. Shorten tubing in a manner that minimizes oil loss. Tubing and crossover should be kept full at all times.

2) Keep a constant 20 psi on inlet port of reservoir during operation.

3) Oil level in reservoir should be kept at levels indicated on tube label.

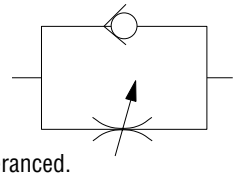
X CROSSOVER TUBE
Air/Oil Tandem models only (Series TD)

Available on Series TD tandem models only. These tandem models provide the smooth control of hydraulics with the simplicity of pneumatics. The -X option must be specified to receive the air/oil tandem units filled with oil and bled of air. (It is recommended that these units be used with reservoir and 20 psi oil pressure.)

STANDARD PORT CONTROL®

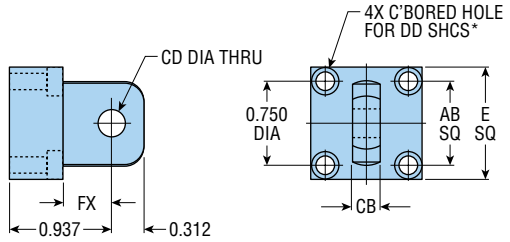
The exclusive PHD Port Control®, based on the "meter-out" principle, features an adjustable needle and a separate ball check. Both are built into the cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume. The separate ball check is closed while fluid is exhausting from the cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



All dimensions are reference only unless specifically toleranced.

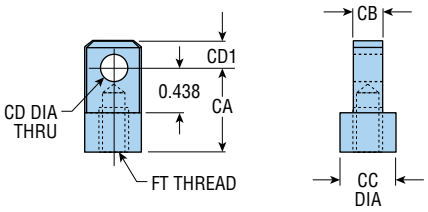
EYE BRACKET KIT



BORE SIZE	PART NO.	LETTER DIMENSION					
		AB	CB	CD	DD*	E	FX
3/4	1077-01	0.750	0.248	0.250	#6	1.000	0.577
1 & 1-1/8	1077-03	1.000	0.373	0.375	#10	1.375	0.437

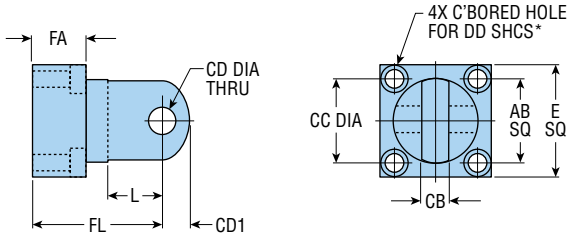
*For 3/4 bore thru hole only.

ROD EYE KIT



BORE SIZE	PART NO.	LETTER DIMENSION					
		CA	CB	CC	CD	CD1	FT
3/4	1075-01	0.750	0.248	0.500	0.250	0.250	1/4-28 x 0.375 DP
1	1075-04	0.875	0.373	0.750	0.375	0.375	5/16-24 x 0.375 DP
1-1/8	1075-05	0.875	0.373	0.750	0.375	0.375	3/8-24 x 0.312 DP

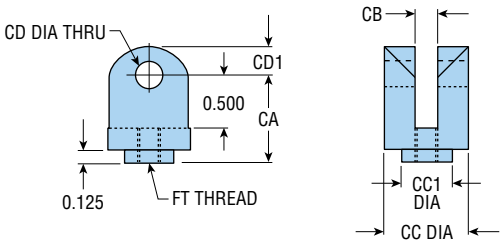
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	PART NO.	LETTER DIMENSION									
		AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	12901	0.750	0.254	0.750	0.250	0.250	#6	1.000	0.360	1.187	0.500
1 & 1-1/8	12903	1.000	0.379	0.875	0.375	0.375	#10	1.375	0.500	1.250	0.531

*For 3/4 bore thru hole only.

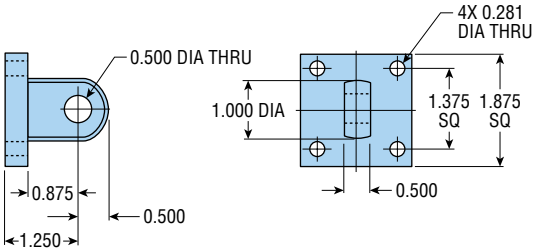
ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	PART NO.	LETTER DIMENSION						
		CA	CB	CC	CC1	CD	CD1	FT
3/4	12904	0.812	0.254	0.750	0.437	0.250	0.250	1/4-28 TO SLOT
1	12906	0.875	0.379	0.875	0.562	0.375	0.375	5/16-24 TO SLOT
1-1/8	12908	0.875	0.379	0.875	0.562	0.375	0.375	3/8-24 TO SLOT

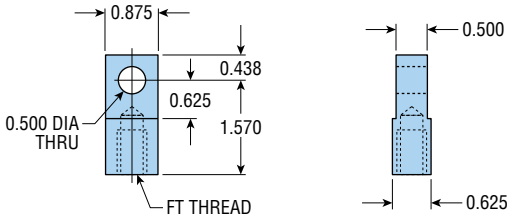
All dimensions are reference only unless specifically toleranced.

EYE BRACKET KIT



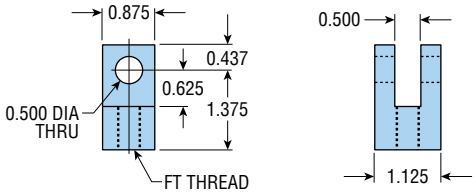
BORE SIZE	PART NO.
1-3/8	1330

ROD EYE KIT



BORE SIZE	PART NO.	LETTER DIMENSION FT
1-3/8	1375-01	3/8-24 x 0.750 DP
1-3/8	1375-02	7/16-20 x 0.750 DP

ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	PART NO.	LETTER DIMENSION FT
1-3/8	12909	3/8-24 TO SLOT
1-3/8	12910	7/16-20 TO SLOT

All dimensions are reference only unless specifically toleranced.

AV2, HV2, A2

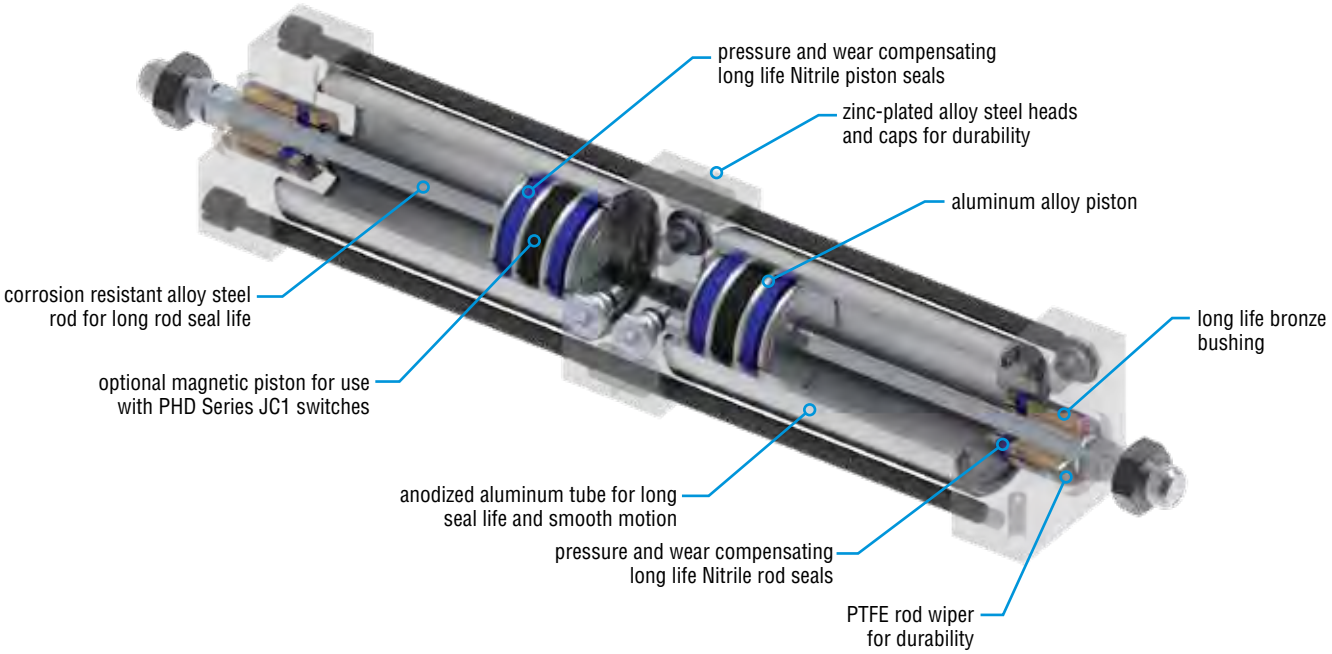
tom thumb®

3/4", 1", 1-1/8", 1-3/8" Bore

Major Benefits

- Four linear positions with double rod
- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Wide range of mounting styles for easy installation
- Simple four position operation

Series AV2
Cutaway depicts
a 1-1/8" bore AV2 unit.



ORDERING DATA: Series AV2, HV2, A2 Cylinders - 3/4", 1", 1-1/8", 1-3/8" Bore

TO ORDER SPECIFY:
Series, Type, Mounting Style, Bore Size, Cylinder 1 Stroke, Cylinder 2 Stroke, and Options.

CYLINDER SERIES
AV - 150 psi Air
HV - 1500 psi Hyd.
*A - 150 psi Air
*Not available in 1-3/8" bore

BORE SIZE
3/4" BORE
1/4" Rod Dia.
1/4-28 Thread
1" BORE
5/16" Rod Dia.
5/16-24 Thread
1-1/8" BORE
3/8" Rod Dia.
3/8-24 Thread
1-3/8" BORE
1/2" Rod Dia.
3/8-24 Thread

STANDARD STROKE CYLINDER 1

BORE	STROKE
3/4"	1/4" to 6"
1" & 1-1/8"	1/4" to 9"
1-3/8"	1/2" to 12"

Consult PHD for longer lengths.

STANDARD STROKE CYLINDER 2

BORE	STROKE
3/4"	1/4" to 6"
1" & 1-1/8"	1/4" to 9"
1-3/8"	1/2" to 12"

Consult PHD for longer lengths.

AV 2 B 1-3/8 x 2 x 1 - P-M

TYPE
2 - Back-to-Back Cylinder

MOUNTING STYLE
F - Foot Mount, c'bored through holes
B - Bottom Mount, tapped holes in head and cap
R - Rod Mount, tapped holes on front face of head
T - Thread Mount, threaded snout on head (shipped with mounting nut)
RF - Rod end flange
*L - Pilot Mount, threaded snout and pilot diameter on head (shipped with mounting nut)
*Available on 3/4", 1", and 1-1/8" bore only

OPTIONS
B - Shock Pads on both ends of each cylinder (not available on Series HV2)
D - Cushion on both ends of each cylinder (Cushion available, but not warranted, on Series HV2 3/4", 1", and 1-1/8" sizes)
E - Magnetic Pistons on both cylinders for Series JC1 radial sensing switches (not available on Series A)
M - Magnetic Pistons on both cylinders for Series JC1 reed and teachable switches (not available on Series A)
P - Port Controls® on both ends of each cylinder

⚠ Options may affect unit length. See dimensional pages and option information details.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

SWITCH MOUNTING BRACKET

PART NO.	DESCRIPTION
92101	Mounts Series JC1 Switch to Tie Rod

NOTE: Brackets are ordered separately.

SPECIFICATIONS	SERIES AV2	SERIES HV2	SERIES A2
OPERATING PRESSURE	20 to 150 psi air	40 to 1500 psi hyd*	20 to 150 psi air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]
STROKE TOLERANCE	±0.032	±0.032	±0.032
LUBRICATION	Permanently lubricated	—	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	AIR CONSUMPTION at 80 psi CUBIC ft/in OF STROKE*	DISPLACEMENT gal/in OF STROKE*
AV2 HV2 A2	3/4	1/4	EXTEND	0.442	0.0016	0.0019
			RETRACT	0.393	0.0014	0.0017
	1	5/16	EXTEND	0.785	0.0029	0.0034
			RETRACT	0.709	0.0026	0.0031
	1-1/8	3/8	EXTEND	0.994	0.0037	0.0043
			RETRACT	0.883	0.0032	0.0038
	1-3/8	1/2	EXTEND	1.485	0.0055	0.0064
			RETRACT	1.289	0.0048	0.0056

*Value per cylinder (Cyl 1 or Cyl 2). Total = 2X value.

MAXIMUM ALLOWABLE EXTEND STROKE

SERIES	ROD DIAMETER	CYLINDER FORCE (lb)							
		100	200	500	1000	1500	2000	3000	5000
3/4", 1", 1-1/8" AV2, HV2, A2	1/4	12"	9"	6"	4"	3"	—	—	—
	5/16	18"	13"	8"	6"	5"	—	—	—
	3/8	26"	18"	12"	9"	7"	—	—	—
1-3/8" AV2, HV2	1/2	48"	34"	21"	15"	12"	—	—	—

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb)	
		ZERO STROKE	ADDER PER INCH OF STROKE*
AV2 PLAIN	3/4	0.84	0.04
	1	1.74	0.07
	1-1/8	1.90	0.10
	1-3/8	5.12	0.12

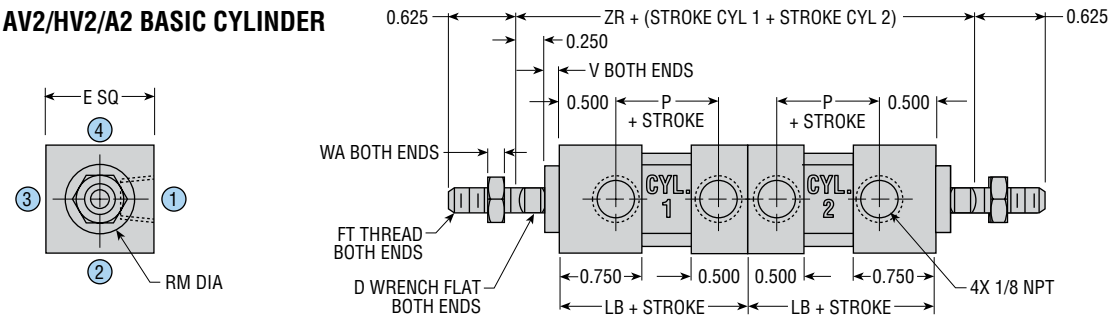
*Total Stroke = Stroke Cylinder 1 + Stroke Cylinder 2

CYLINDER FORCE CALCULATIONS	Imperial F = P x A
F = Cylinder Force	lbs
P = Operating Pressure	psi
A = Effective Area (Extend or Retract)	in^2

Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at **www.phdinc.com/apps/sizing**

SERIES AV2/HV2/A2 BASIC CYLINDER



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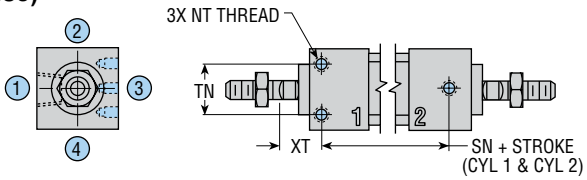

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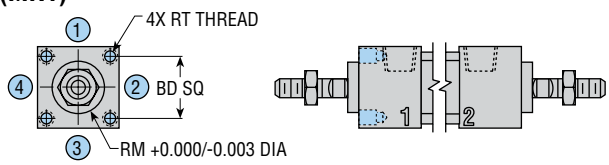

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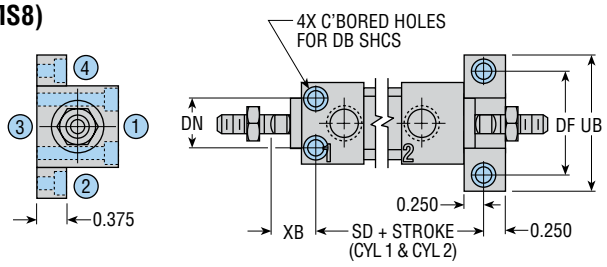

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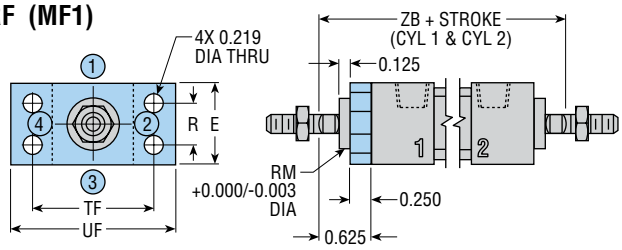
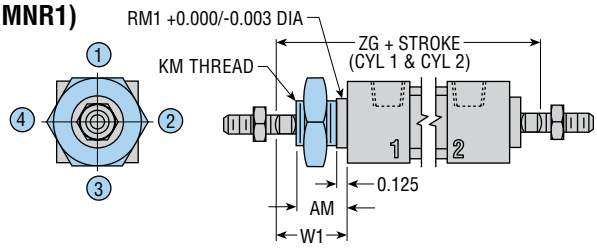


L (MNR1)



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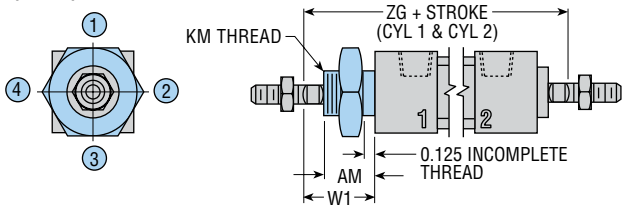


All standard rod ends have four wrench flats (two wrench flats with "I" option).

DIMENSIONS COMMON TO ALL SERIES

BORE SIZE	LETTER DIMENSION															
	BD	D	DB	DF	DN	E	FT	NT	R	RM	RT	TF	TN	UB	UF	WA
3/4	0.750	3/16	#8	1.375	0.625	1.000	1/4-28	8-32 x 0.18 DP	0.500	0.625	8-32 x 0.25 DP	1.500	0.625	1.750	2.000	0.156
1	1.000	1/4	#10	1.750	0.875	1.375	5/16-24	10-32 x 0.25 DP	0.875	0.750	8-32 x 0.25 DP	1.875	0.875	2.125	2.375	0.188
1-1/8	1.125	5/16	#10	1.875	1.000	1.500	3/8-24	10-32 x 0.25 DP	1.000	0.750	10-32 x 0.25 DP	2.000	1.000	2.250	2.500	0.219

SERIES A2 CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	0.625	5/8-18	1.750	1.000	0.687	3.562	3.062	0.125	0.875	0.562	0.562	4.500	4.750	4.250
1	0.625	3/4-16	1.750	1.000	0.812	3.500	3.000	0.125	0.875	0.625	0.625	4.500	4.750	4.250
1-1/8	0.625	3/4-16	1.750	1.000	0.812	3.500	3.000	0.125	0.875	0.625	0.625	4.500	4.750	4.250

SERIES HV2 CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	0.625	5/8-18	2.250	1.500	0.687	4.562	4.062	0.375	0.875	0.812	0.812	5.750	6.000	5.750
1	0.625	3/4-16	2.250	1.500	0.812	4.500	4.000	0.375	0.875	0.875	0.875	5.750	6.000	5.750
1-1/8	0.875	1-14	2.250	1.500	1.062	4.500	4.000	0.375	1.125	0.875	0.875	5.750	6.250	5.750

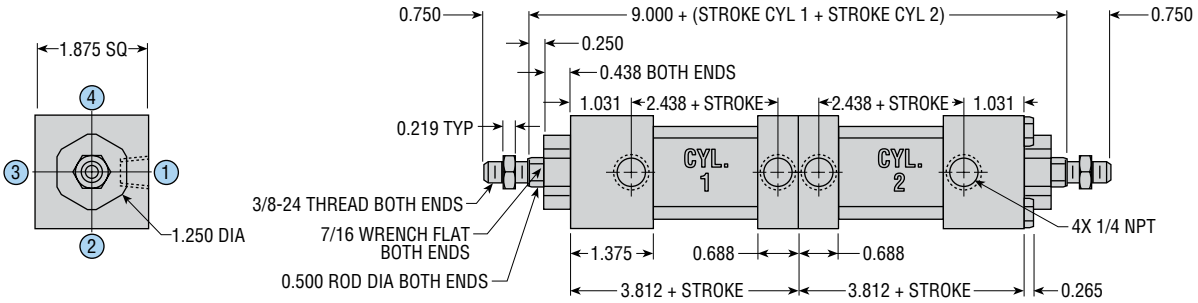
SERIES AV2 CYLINDERS

BORE SIZE	LETTER DIMENSION													
	AM	KM	LB	P	RM1	SD	SN	V	W1	XB	XT	ZB	ZG	ZR
3/4	0.625	5/8-18	2.250	1.500	0.687	4.562	4.062	0.125	0.875	0.562	0.562	5.500	5.750	5.250
1	0.625	3/4-16	2.250	1.500	0.812	4.500	4.000	0.125	0.875	0.625	0.625	5.500	5.750	5.250
1-1/8	0.875	1-14	2.250	1.500	1.062	4.500	4.000	0.125	1.125	0.625	0.625	5.500	6.000	5.250

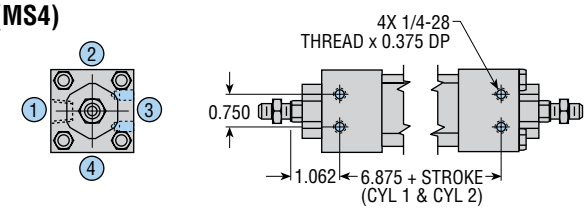
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 1.000 in TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (2" TOTAL TO OVERALL)
SHOCK PADS: ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (1" TOTAL TO OVERALL)

All dimensions are reference only unless specifically toleranced.

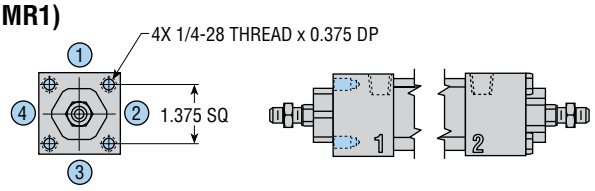
SERIES AV2/HV2 BASIC CYLINDER



B (MS4)



R (MR1)



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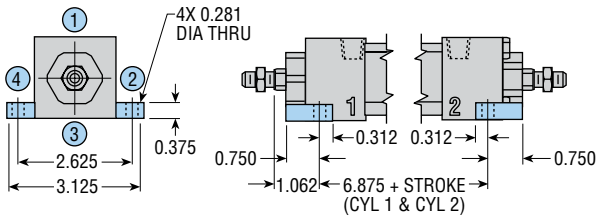
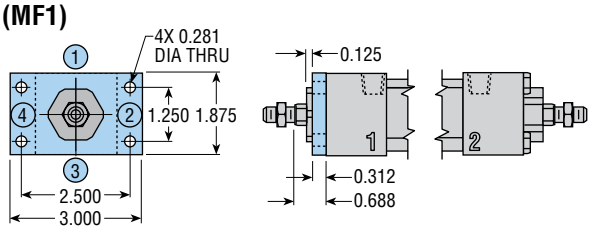
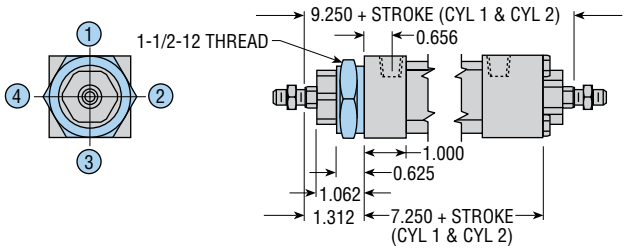


RF (MF1)



T (MN1)



All standard rod ends have four wrench flats (two wrench flats with “I” option).

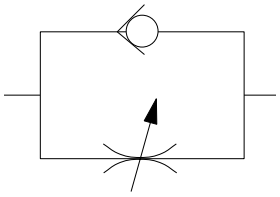
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
SHOCK PADS: ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 (1" TOTAL TO OVERALL)

All dimensions are reference only unless specifically toleranced.

P PORT CONTROL®

The exclusive PHD Port Control®, based on the "meter-out" principle, features an adjustable needle and a separate ball check. Both are built into the cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume. The separate ball check is closed while fluid is exhausting from the cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



D ADJUSTABLE CUSHION

PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

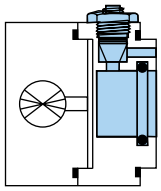
See dimension pages for dimensional information.

3/4", 1", 1-1/8" Series A2, A2V, H2V = Cushion Block
1-3/8" Series A2V, H2V = Poppet Style

Effective cushion length 1/2"

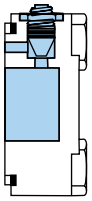
Not warranted on Series HV2 3/4", 1", 1-1/8" units

CUSHION BLOCK



3/4", 1", 1-1/8" BORE

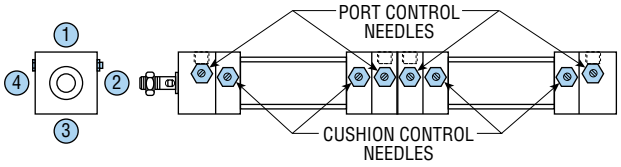
POPPET STYLE



1-3/8" BORE

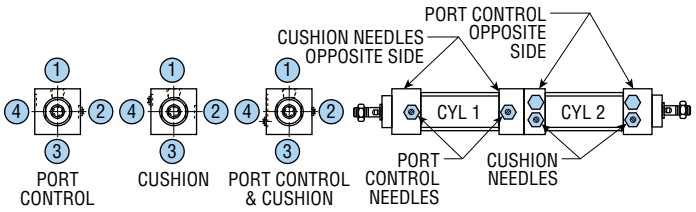
STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS
(3/4", 1", 1-1/8" Bore Series A2, AV2, and HV2 Cylinders)

Port Control® and cushion needles are located in position 2 on standard cylinders. They may be located at position 4 when specified on all Series A2, AV2, and HV2. Consult PHD for special Port Control® or cushion needle positions.



STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS
(1-3/8" Bore Series AV and HV Cylinders)

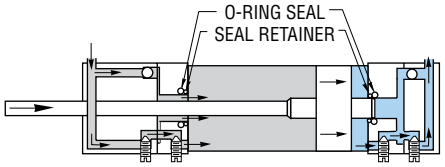
Port Control® and cushion needles are located on opposite sides adjacent to port. Please consult distributor or PHD to check availability of special Port Control® or cushion needle positions.



PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION
(3/4", 1", 1-1/8" Bore Series A2, AV2, and HV2 Cylinders)

Cushion and Port Control® combination arranged in series provides a compact efficient control system for maximum space weight and cost savings. The cushion is activated when the piston extension enters a seal in the cushion block. The remaining volume in the cylinder exhausts past an adjustable needle. A check seal in the adjusting needle is closed during deceleration, but opens to permit full flow for immediate reversing. The cushion seal in the block is an o-ring for air units.

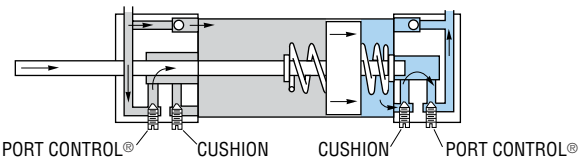
CUSHION BLOCK STYLE



PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION
(1-3/8" Bore Series AV2 and HV2 Cylinders)

The cushion and Port Control® combination is also available on the 1-3/8" Bore. This cushion is activated when a seal, which is traveling with the piston, seals against the cylinder end cap. This causes the remaining volume in the cylinder to exhaust past an adjustable needle which controls the amount of deceleration. The spring, which extends the seal from the piston, permits the seal to act as a check valve to allow full flow back into the cylinder for immediate reversing. The cushion seal for air units is made of urethane while seals for oil units are close tolerance metal.

POPPET STYLE

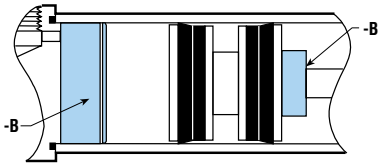


B SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available together with all options EXCEPT:

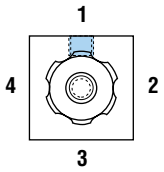
- **Same end as Cushion (-D)**



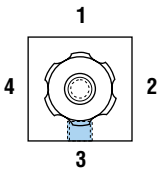
PORT POSITIONS

Port position 1 is standard on all cylinders.

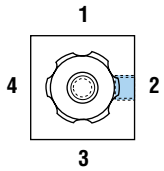
PORT POSITION 1 (STANDARD)



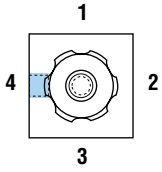
T PORT POSITION 3



R PORT POSITION 2



U PORT POSITION 4



E MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted radial sensing switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

M MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the radial sensing switches are not applicable. As with the radial sensing switches, a magnetic band (specify -M) on the piston activates the externally mounted PHD Reed Switches. The Reed Switches may be used to signal a programmable controller, sequencer, relay, or in some cases, a valve solenoid. This option is for use with the following switches.

The Teachable Switch provides the ability to identify two separately programmable positions with a single switch. Programmable capability means no “fine tuning.” With switch properly aligned, just place actuator in desired positions and program. Solid-state sensing technology provides a highly reliable switch.

See Series JC1 Switches at phdinc.com for more information.

SERIES JC1ST REED SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)

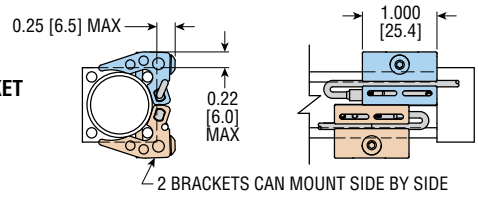
NOTE: Switches must be ordered separately.

SERIES JC1ST TEACHABLE SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

SWITCH BRACKET NO. 92100



V FLUOROELASTOMER SEALS

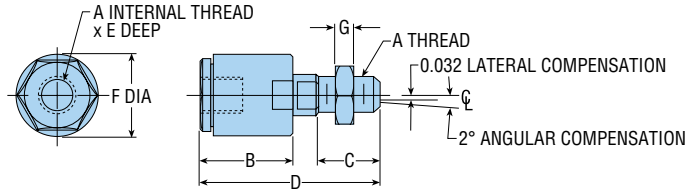
Fluoroelastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application. Consult PHD for high temperature use.

All dimensions are reference only unless specifically toleranced.

SELF-ALIGNING PISTON ROD COUPLERS

Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

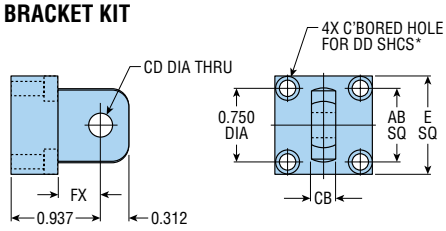
Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.



MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	0.625	1.875	0.500	0.875	0.156
312	5/16-24	1.000	0.625	1.875	0.500	0.875	0.187
375	3/8-24	1.000	0.625	1.875	0.500	0.875	0.219
437	7/16-20	1.125	0.650	2.187	0.500	1.000	0.250

To order, specify the model number.

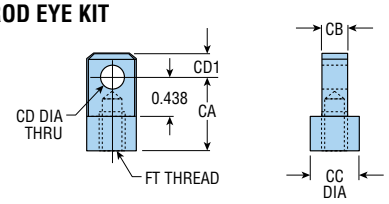
EYE BRACKET KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION					
			AB	CB	CD	DD*	E	FX
3/4	A2, AV2, HV2	1077-01	0.750	0.248	0.250	#6	1.000	0.577
1 & 1-1/8	A2	1077-02	1.000	0.373	0.250	#10	1.375	0.437
	AV2, HV2	1077-03	1.000	0.373	0.375	#10	1.375	0.437

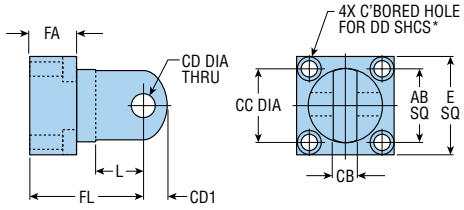
*For 3/4 bore thru hole only.

ROD EYE KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION					
			CA	CB	CC	CD	CD1	FT
3/4	A2, AV2	1075-01	0.750	0.248	0.500	0.250	0.250	1/4-28 x 0.375 DP
1	A2	1075-02	0.875	0.373	0.750	0.250	0.375	5/16-24 x 0.375 DP
	AV2	1075-04	0.875	0.373	0.750	0.375	0.375	5/16-24 x 0.375 DP
1-1/8	A2	1075-03	0.875	0.373	0.750	0.250	0.375	3/8-24 x 0.312 DP
	AV2	1075-05	0.875	0.373	0.750	0.375	0.375	3/8-24 x 0.312 DP

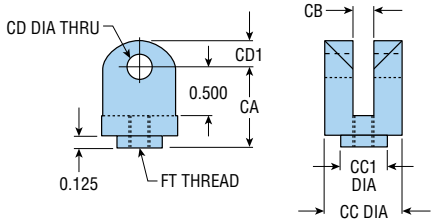
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION								
			AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	A2, AV2	12901	0.750	0.254	0.750	0.250	0.250	#6	1.000	0.360	1.187	0.500
1 & 1-1/8	A2	12902	1.000	0.379	0.875	0.250	0.375	#10	1.375	0.500	1.250	0.531
	AV2	12903	1.000	0.379	0.875	0.375	0.375	#10	1.375	0.500	1.250	0.531

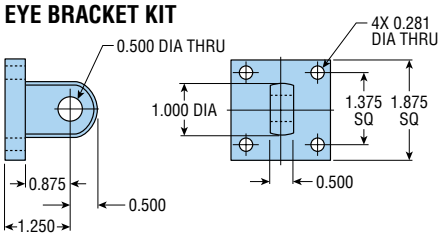
*For 3/4 bore thru hole only.

ROD CLEVIS KIT - PIN INCLUDED



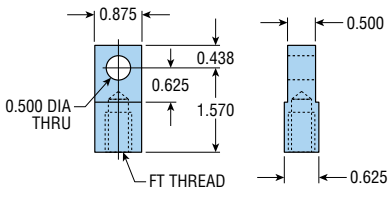
BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION						
			CA	CB	CC	CC1	CD	CD1	FT
3/4	A2, AV2	12904	0.812	0.254	0.750	0.437	0.250	0.250	1/4-28 TO SLOT
1	A2	12905	0.875	0.379	0.875	0.562	0.250	0.375	5/16-24 TO SLOT
	AV2	12906	0.875	0.379	0.875	0.562	0.375	0.375	5/16-24 TO SLOT
1-1/8	A2	12907	0.875	0.379	0.875	0.562	0.250	0.375	3/8-24 TO SLOT
	AV2	12908	0.875	0.379	0.875	0.562	0.375	0.375	3/8-24 TO SLOT

EYE BRACKET KIT



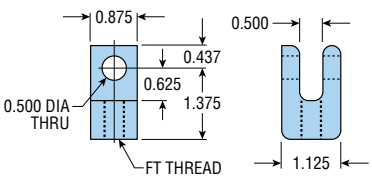
BORE SIZE	CYLINDER SERIES	PART NO.
1-3/8	AV2, HV2	1330

ROD EYE KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION
			FT
1-3/8	AV2, HV2	1375-01	3/8-24 x 0.750 DP

ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION
			FT
1-3/8	AV2, HV2	12909	3/8-24 TO SLOT

All dimensions are reference only unless specifically toleranced.

A3V, H3V, A3

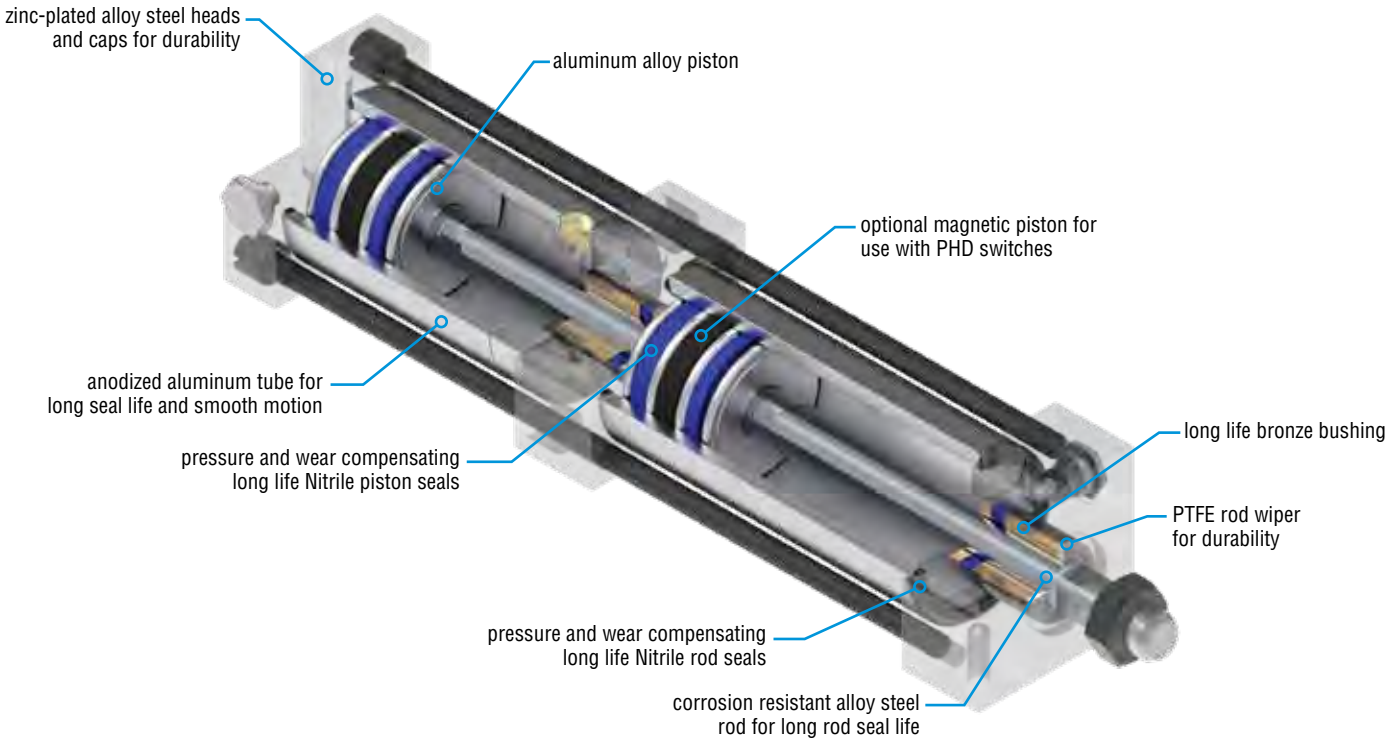
tom thumb®

3/4", 1", 1-1/8", 1-3/8" Bore

Major Benefits

- Three linear positions from piston rod
- Long life design for low maintenance
- NFPA repairable for extended life providing long term savings
- Wide range of options for easy application and reduced design time
- Wide range of mounting styles for easy installation
- Simple three position operation

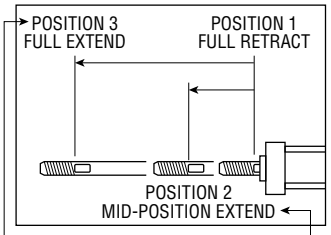
SERIES A3V
Cutaway depicts
a 1-1/8" bore A3V unit.



ORDERING DATA: Series A3V, H3V, A3 Cylinders - 3/4", 1", 1-1/8", 1-3/8" Bore

TO ORDER SPECIFY:
Series, Type, Mounting Style, Bore Size,
Cylinder 1 Stroke, Cylinder 2 Stroke, and Options.

CAUTION: HYDRAULIC THREE POSITION CYLINDER (H3V) MUST BE VALVED PROPERLY TO PREVENT BLOCKING OF FLOW FROM THE CENTER PORT WHEN PRESSURIZING THE REAR (CAP) PORT. FAILURE TO DO SO MAY RESULT IN AN INTENSIFICATION OF PRESSURE IN CYLINDER NUMBER 1 CAUSING TIEROD FAILURE.



CYLINDER SERIES
AV - 150 psi Air
HV - 1500 psi Hyd.
*A - 150 psi Air
*Not available in 1-3/8" bore

BORE SIZE
3/4" BORE
1/4" Rod Dia.
1/4-28 Thread
1" BORE
5/16" Rod Dia.
5/16-24 Thread
1-1/8" BORE
3/8" Rod Dia.
3/8-24 Thread
1-3/8" BORE
1/2" Rod Dia.
3/8-24 Thread

STANDARD STROKE CYLINDER 1 (TOTAL STROKE)
3/4" BORE SIZE
1/4" to 6"
1" and 1-1/8" BORE SIZES
1/4" to 9"
in 1/4" increments
1-3/8" BORE SIZE
1/2" to 12"
in 1/2" increments
For longer strokes, consult PHD.

STANDARD STROKE CYLINDER 2 (FROM RETRACT TO MID POSITION)
3/4" BORE SIZE
1/4" to 6"
1" and 1-1/8" BORE SIZES
1/4" to 9"
in 1/4" increments
1-3/8" BORE SIZE
1/2" to 12"
in 1/2" increments
For longer strokes, consult PHD.

A 3 V R - 3/4 x 1 x 1/2 - P-M

TYPE
3 - Three Position Cylinder

MOUNTING STYLE
F - Foot Mount, c'bored through holes
B - Bottom Mount, tapped holes in head and cap
R - Rod Mount, tapped holes on front face of head
T - Thread Mount, threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
*L - Pilot Mount, threaded snout and pilot diameter on head (shipped with mounting nut)
*P - Pivot Mount, pivot on cap
**K - Clevis Mount, clevis on cap
*Available on 3/4", 1", and 1-1/8" bore only
**Available on 1-3/8" bore only

OPTIONS
B - Shock Pads on full extension and retraction only (not available on Series HV)
D - Cushion on full extension and retraction only (Cushions available, but not warranted, on Series HV 3/4", 1", or 1-1/8" sizes)
E - Magnetic Pistons on both cylinders for Series JC1 radial sensing switches (not available on Series A)
M - Magnetic Pistons on both cylinders for Series JC1 reed and teachable switches (not available on Series A)
P - Port Controls® on all heads and cap, full extension and retraction only, not on mid-position extension
V - Fluoroelastomer Seals

⚠ Options may affect unit length. See dimensional pages and option information details.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

SWITCH MOUNTING BRACKET

PART NO.	DESCRIPTION
92101	Mounts Series JC1 Switch to Tie Rod

NOTE: Brackets are ordered separately.

SPECIFICATIONS	SERIES A3V	SERIES H3V	SERIES A3
OPERATING PRESSURE	20 to 150 psi air	40 to 1500 psi hyd*	20 to 150 psi air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]	-20° to +180°F [-29° to +82°C]
STROKE TOLERANCE	±0.032	±0.032	±0.032
LUBRICATION	Permanently lubricated	—	Permanently lubricated
MAINTENANCE	Field repairable	Field repairable	Field repairable

*Hydraulic rating is based on non-shock hydraulic service.

CYLINDER FORCE TABLE

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	AIR CONSUMPTION at 80 psi CUBIC ft/in OF STROKE*	DISPLACEMENT gal/in OF STROKE*
A3V H3V A3	3/4	1/4	EXTEND	0.442	0.0016	0.0019
			RETRACT	0.393	0.0014	0.0017
	1	5/16	EXTEND	0.785	0.0029	0.0034
			RETRACT	0.709	0.0026	0.0031
	1-1/8	3/8	EXTEND	0.994	0.0037	0.0043
			RETRACT	0.883	0.0032	0.0038
	1-3/8	1/2	EXTEND	1.485	0.0055	0.0064
			RETRACT	1.289	0.0048	0.0056

*Value per cylinder (Cyl 1 or Cyl 2). Total = 2X value.

MAXIMUM ALLOWABLE EXTEND STROKE

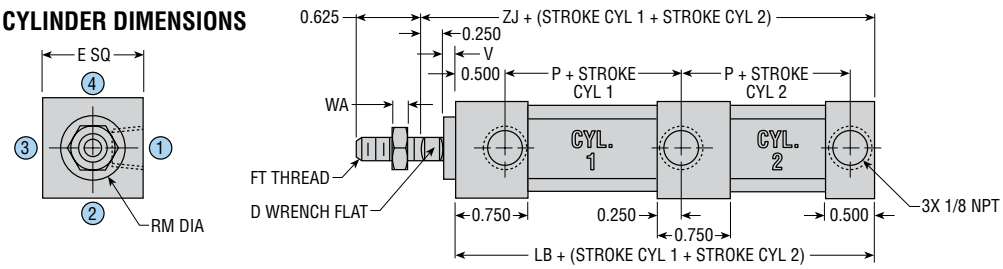
SERIES	ROD DIAMETER	CYLINDER FORCE (lb)							
		100	200	500	1000	1500	2000	3000	5000
3/4", 1", 1-1/8" A3V, H3V, A3	1/4	12"	9"	6"	4"	3"	—	—	—
	5/16	18"	13"	8"	6"	5"	—	—	—
	3/8	26"	18"	12"	9"	7"	—	—	—
1-3/8" A3V, H3V	1/2	48"	34"	21"	15"	12"	—	—	—

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb)	
		ZERO STROKE	ADDER PER INCH OF STROKE*
AVR	3/4	0.67	0.04
	1	1.39	0.07
	1-1/8	1.52	0.10
	1-3/8	4.12	0.12

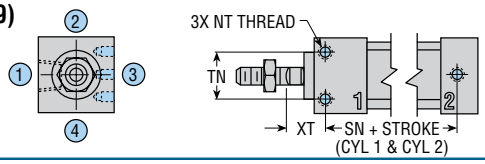
*Total Stroke = Stroke Cylinder 1 (Total) + Stroke Cylinder 2 (3 Position Stroke)

CYLINDER FORCE CALCULATIONS	Imperial F = P x A
F = Cylinder Force	lbs
P = Operating Pressure	psi
A = Effective Area (Extend or Retract)	in^2

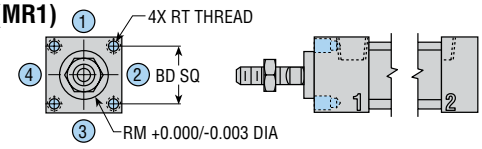
BASIC CYLINDER DIMENSIONS



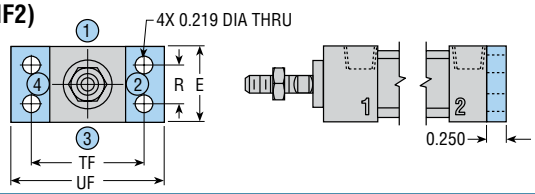
B (MS9)



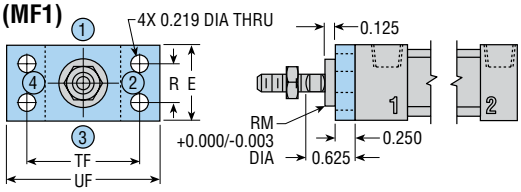
R (MR1)



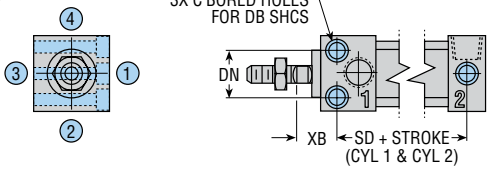
CF (MF2)



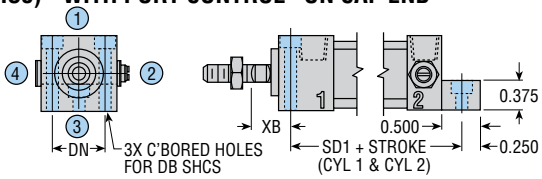
RF (MF1)



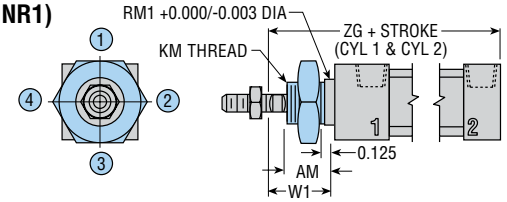
F (MS8)



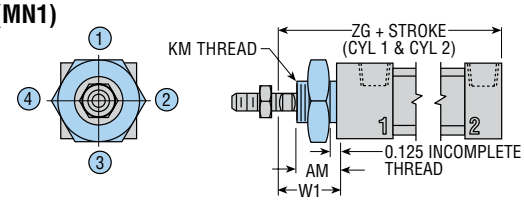
F (MS8) - WITH PORT CONTROL® ON CAP END



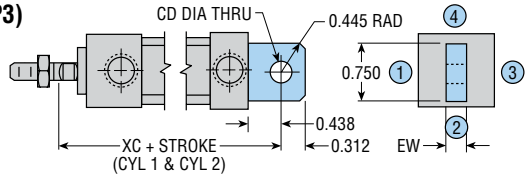
L (MNR1)



T (MN1)



P (MP3)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: ADD 0.500 in TO (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 FOR CUSHIONS (ADD TOTAL OF 1.000 in TO OVERALL LENGTH)
SHOCK PADS: ADD 0.250 in TO (+ STROKE) DIMENSIONS OF CYLINDER 1 AND CYLINDER 2 FOR SHOCK PADS (ADD TOTAL OF 0.500 in TO OVERALL LENGTH)

DIMENSIONS COMMON TO ALL SERIES

BORE SIZE	LETTER DIMENSION							
	BD	D	DB	DF	DN	E	EW	FT	NT
3/4	0.750	3/16	#8	1.375	0.625	1.000	0.250	1/4-28	8-32 x 0.18 DP
1	1.000	1/4	#10	1.750	0.875	1.375	0.375	5/16-24	10-32 x 0.25 DP
1-1/8	1.125	5/16	#10	1.875	1.000	1.500	0.375	3/8-24	10-32 x 0.25 DP

DIMENSIONS COMMON TO ALL SERIES

BORE SIZE	LETTER DIMENSION							
	R	RM	RT	TF	TN	UB	UF	WA
3/4	0.500	0.625	8-32 x 0.25 DP	1.500	0.625	1.750	2.000	0.156
1	0.875	0.750	8-32 x 0.25 DP	1.875	0.875	2.125	2.375	0.188
1-1/8	1.000	0.750	10-32 x 0.25 DP	2.000	1.000	2.250	2.500	0.219

SERIES A3 CYLINDERS

BORE SIZE	LETTER DIMENSION																
	AM	CD	KM	LB	P	P1	RM1	SD	SD1	SN	V	W1	XB	XC	XT	ZG	ZJ
3/4	0.625	0.250	5/8-18	3.312	1.000	1.562	0.687	2.875	3.375	2.875	0.125	0.875	0.562	4.125	0.562	4.187	3.687
1	0.625	0.250	3/4-16	3.312	1.000	1.562	0.812	2.812	3.312	2.812	0.125	0.875	0.625	4.125	0.625	4.187	3.687
1-1/8	0.625	0.250	3/4-16	3.312	1.000	1.562	0.812	2.812	3.312	2.812	0.125	0.875	0.625	4.125	0.625	4.187	3.687

SERIES A3V CYLINDERS

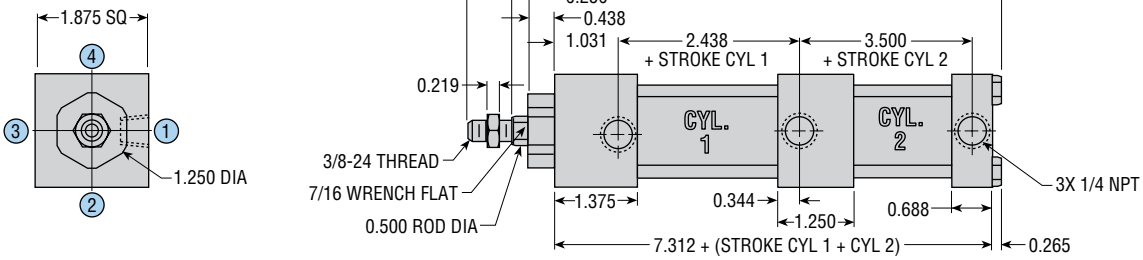
BORE SIZE	LETTER DIMENSION																
	AM	CD	KM	LB	P	P1	RM1	SD	SD1	SN	V	W1	XB	XC	XT	ZG	ZJ
3/4	0.625	0.250	5/8-18	4.312	1.500	2.062	0.687	3.875	4.375	3.875	0.125	0.875	0.562	5.125	0.562	5.187	4.687
1	0.625	0.375	3/4-16	4.312	1.500	2.062	0.812	3.812	4.312	3.812	0.125	0.875	0.625	5.125	0.625	5.187	4.687
1-1/8	0.875	0.375	1-14	4.312	1.500	2.062	1.062	3.812	4.312	3.812	0.125	1.125	0.625	5.125	0.625	5.437	4.687

SERIES H3V CYLINDERS

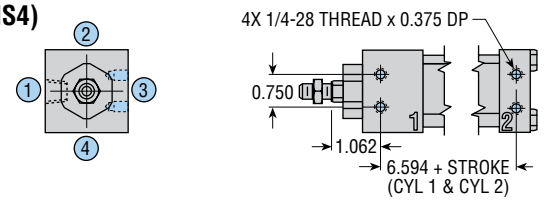
BORE SIZE	LETTER DIMENSION																
	AM	CD	KM	LB	P	P1	RM1	SD	SD1	SN	V	W1	XB	XC	XT	ZG	ZJ
3/4	0.625	0.250	5/8-18	4.312	1.500	2.062	0.687	3.875	4.375	3.875	0.375	0.875	0.812	5.375	0.812	5.187	4.937
1	0.625	0.375	3/4-16	4.312	1.500	2.062	0.812	3.812	4.312	3.812	0.375	0.875	0.875	5.375	0.875	5.187	4.937
1-1/8	0.875	0.375	1-14	4.312	1.500	2.062	1.062	3.812	4.312	3.812	0.375	1.125	0.875	5.375	0.875	5.437	4.937

All dimensions are reference only unless specifically toleranced.

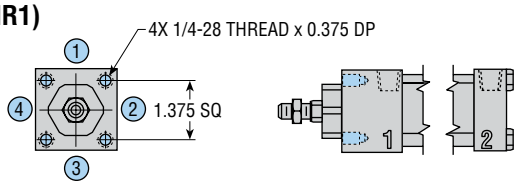
BASIC CYLINDER DIMENSIONS



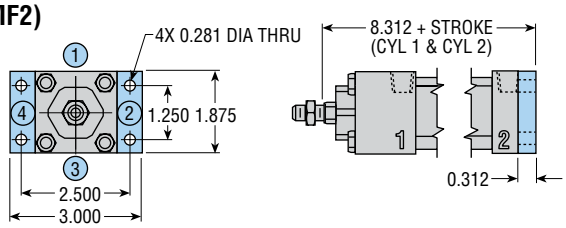
B (MS4)



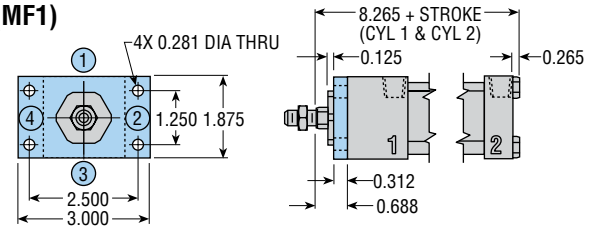
R (MR1)



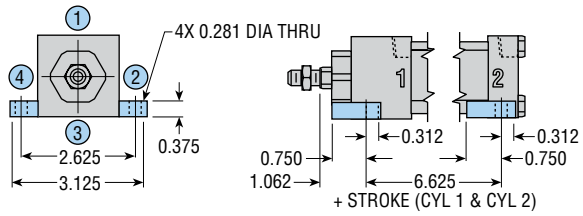
CF (MF2)



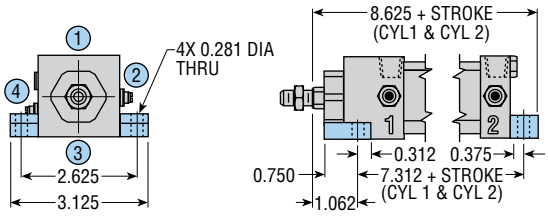
RF (MF1)



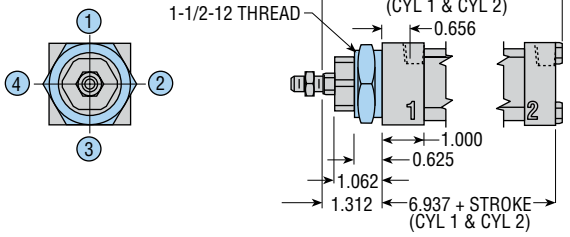
F (MS2)



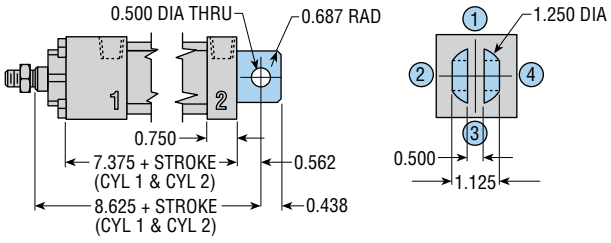
F (MS2)-WITH PORT CONTROL® & CUSHION ON CAP END



T (MN1)



K (MP1)



All standard rod ends have four wrench flats (two wrench flats with "I" option).

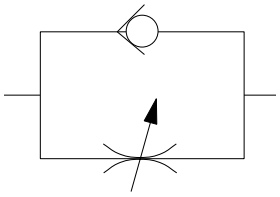
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
SHOCK PADS: ADD 0.250 in TO (+ STROKE) DIMENSIONS OF EACH CYLINDER 1 AND CYLINDER 2 (ADD A TOTAL OF 0.500 in TO OVERALL LENGTH)

All dimensions are reference only unless specifically toleranced.

P PORT CONTROL®

The exclusive PHD Port Control®, based on the "meter-out" principle, features an adjustable needle and a separate ball check. Both are built into the cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume. The separate ball check is closed while fluid is exhausting from the cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



D ADJUSTABLE CUSHION

PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

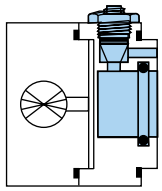
See dimension pages for dimensional information.

3/4", 1", 1-1/8" Series A3, A3V, H3V = Cushion Block
1-3/8" Series A3V, H3V = Poppet Style

Effective cushion length 1/2"

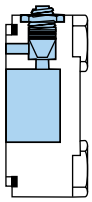
Not warranted on Series H3V 3/4", 1", 1-1/8" units

CUSHION BLOCK



3/4", 1", 1-1/8" BORE

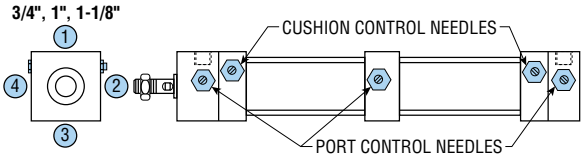
POPPET STYLE



1-3/8" BORE

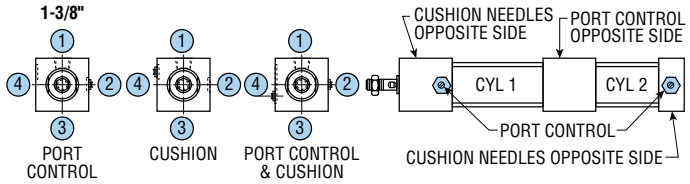
STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS
(3/4", 1", 1-1/8" Bore Series A3, AV3, and HV3 Cylinders)

Port Control® and cushion needles are located in position 2 on standard cylinders. They may be located at position 4 when specified on all Series A3, A3V, and H3V. Consult PHD for special Port Control® or cushion needle positions.



STANDARD PORT CONTROL® & CUSHION NEEDLE POSITIONS
(1-3/8" Bore Series A3V and H3V Cylinders)

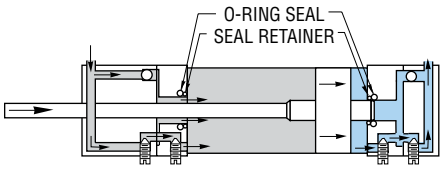
Port Control® and cushion needles are located on opposite sides adjacent to port. Please consult distributor or PHD to check availability of special Port Control® or cushion needle positions.



PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION
(3/4", 1", 1-1/8" Bore Series A2, A3V, and H3V Cylinders)

Cushion and Port Control® combination arranged in series provides a compact efficient control system for maximum space weight and cost savings. The cushion is activated when the piston extension enters a seal in the cushion block. The remaining volume in the cylinder exhausts past an adjustable needle. A check seal in the adjusting needle is closed during deceleration, but opens to permit full flow for immediate reversing. The cushion seal in the block is an o-ring for air units.

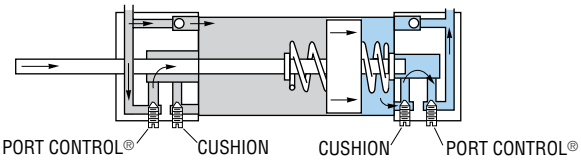
CUSHION BLOCK STYLE



PORT CONTROL® AND ADJUSTABLE CUSHION COMBINATION
(1-3/8" Bore Series A3V and H3V Cylinders)

The cushion and Port Control® combination is also available on the 1-3/8" bore. This cushion is activated when a seal, which is traveling with the piston, seals against the cylinder end cap. This causes the remaining volume in the cylinder to exhaust past an adjustable needle which controls the amount of deceleration. The spring, which extends the seal from the piston, permits the seal to act as a check valve to allow full flow back into the cylinder for immediate reversing. The cushion seal for air units is made of urethane while seals for oil units are close tolerance metal.

POPPET STYLE

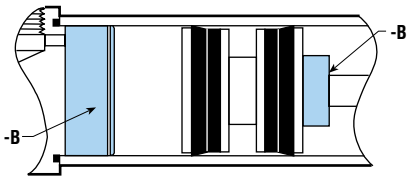


B SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available together with all options EXCEPT:

- **Same end as Cushion (-D)**



E MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted radial sensing switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

M MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the radial sensing switches are not applicable. As with the radial sensing switches, a magnetic band (specify -M) on the piston activates the externally mounted PHD Reed Switches. The Reed Switches may be used to signal a programmable controller, sequencer, relay, or in some cases, a valve solenoid. This option is for use with the following switches.

The Teachable Switch provides the ability to identify two separately programmable positions with a single switch. Programmable capability means no “fine tuning.” With switch properly aligned, just place actuator in desired positions and program. Solid-state sensing technology provides a highly reliable switch.

See Series JC1 Switches at phdinc.com for more information.

SERIES JC1ST REED SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)

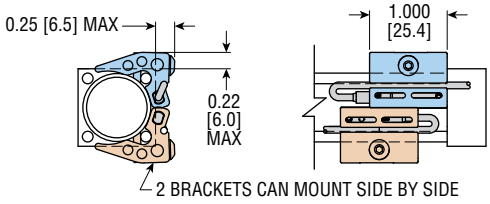
NOTE: Switches must be ordered separately.

SERIES JC1ST TEACHABLE SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

SWITCH BRACKET 92100



V FLUOROELASTOMER SEALS

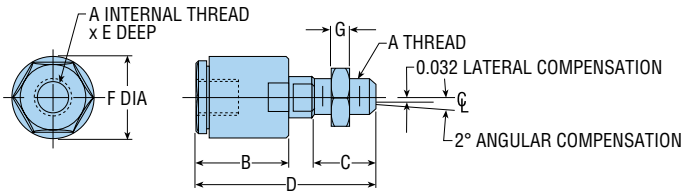
Fluoroelastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application. Consult PHD for high temperature use.

All dimensions are reference only unless specifically toleranced.

SELF-ALIGNING PISTON ROD COUPLERS

Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

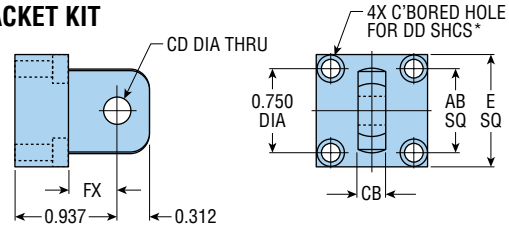
Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke.



MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	0.625	1.875	0.500	0.875	0.156
312	5/16-24	1.000	0.625	1.875	0.500	0.875	0.187
375	3/8-24	1.000	0.625	1.875	0.500	0.875	0.219
437	7/16-20	1.125	0.650	2.187	0.500	1.000	0.250

To order, specify the model number.

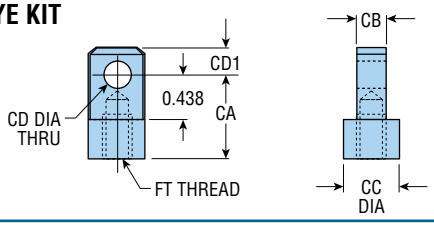
EYE BRACKET KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION					
			AB	CB	CD	DD*	E	FX
3/4	A3, A3V, H3V	1077-01	0.750	0.248	0.250	#6	1.000	0.577
1 & 1-1/8	A3	1077-02	1.000	0.373	0.250	#10	1.375	0.437
	A3V, H3V	1077-03	1.000	0.373	0.375	#10	1.375	0.437

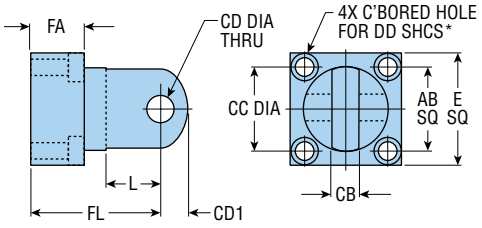
*For 3/4 bore thru hole only.

ROD EYE KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION					
			CA	CB	CC	CD	CD1	FT
3/4	A3, A3V, H3V	1075-01	0.750	0.248	0.500	0.250	0.250	1/4-28 x 0.375 DP
1	A3	1075-02	0.875	0.373	0.750	0.250	0.375	5/16-24 x 0.375 DP
	A3V, H3V	1075-04	0.875	0.373	0.750	0.375	0.375	5/16-24 x 0.375 DP
1-1/8	A3	1075-03	0.875	0.373	0.750	0.250	0.375	3/8-24 x 0.312 DP
	A3V, H3V	1075-05	0.875	0.373	0.750	0.375	0.375	3/8-24 x 0.312 DP

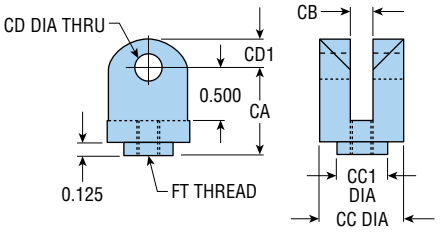
CLEVIS BRACKET KIT - PIN INCLUDED



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION								
			AB	CB	CC	CD	CD1	DD*	E	FA	FL	L
3/4	A3, A3V, H3V	12901	0.750	0.254	0.750	0.250	0.250	#6	1.000	0.360	1.187	0.500
1 & 1-1/8	A3	12902	1.000	0.379	0.875	0.250	0.375	#10	1.375	0.500	1.250	0.531
	A3V, H3V	12903	1.000	0.379	0.875	0.375	0.375	#10	1.375	0.500	1.250	0.531

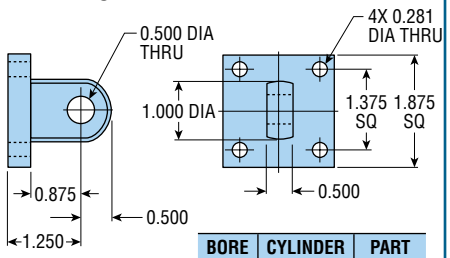
*For 3/4 bore thru hole only.

ROD CLEVIS KIT - PIN INCLUDED



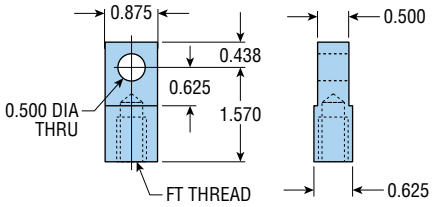
BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION						
			CA	CB	CC	CC1	CD	CD1	FT
3/4	A3, A3V, H3V	12904	0.812	0.254	0.750	0.437	0.250	0.250	1/4-28 TO SLOT
1	A3	12905	0.875	0.379	0.875	0.562	0.250	0.375	5/16-24 TO SLOT
	A3V, H3V	12906	0.875	0.379	0.875	0.562	0.375	0.375	5/16-24 TO SLOT
1-1/8	A3	12907	0.875	0.379	0.875	0.562	0.250	0.375	3/8-24 TO SLOT
	A3V, H3V	12908	0.875	0.379	0.875	0.562	0.375	0.375	3/8-24 TO SLOT

EYE BRACKET KIT



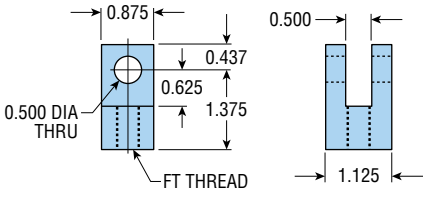
BORE SIZE	CYLINDER SERIES	PART NO.
1-3/8	A3V, H3V	1330

ROD EYE KIT



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION
			FT
1-3/8	A3V, H3V	1375-01	3/8-24 x 0.750 DP

ROD CLEVIS KIT - PIN INCLUDED



BORE SIZE	CYLINDER SERIES	PART NO.	LETTER DIMENSION
			FT
1-3/8	A3V, H3V	12909	3/8-24 TO SLOT

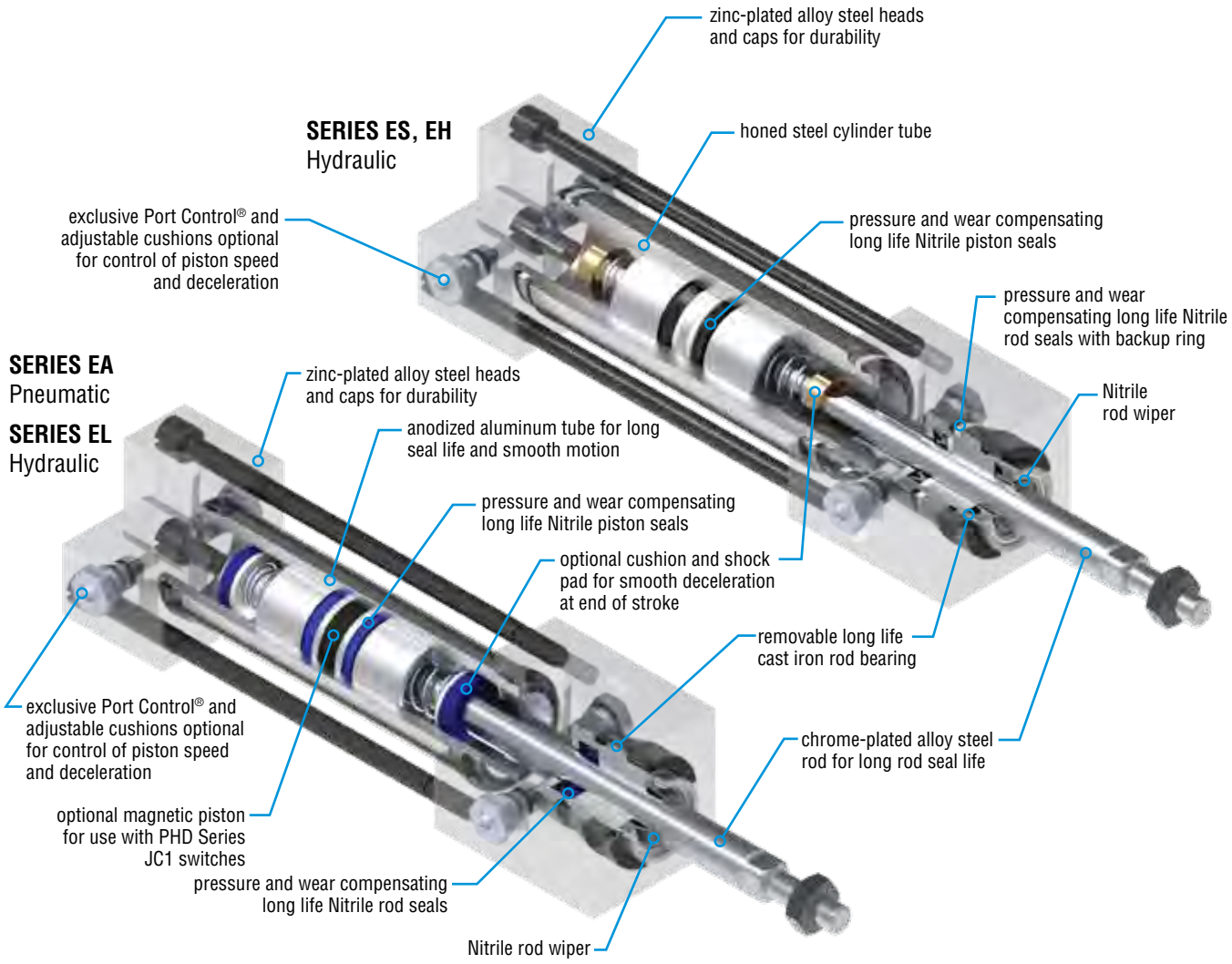
All dimensions are reference only unless specifically toleranced.

EA, EL, EH, ES

tom thumb®

Major Benefits

- Designed to provide long life and high performance in applications requiring a more rugged, higher pressurized cylinder.
- Standard bore sizes include 3/4", 1-1/8", and 1-3/8".
- Standard stroke lengths range from 1/2" to 6" in 1/2" increments.
- Can be specified with built-in flow controls, cushions, shock pads, stroke adjustment, and magnetic piston for axial sensing or reed switches.
- Wide range of options and sizes makes it fast and easy to select a cylinder to fit your application.
- The tie rod construction of the Tom Thumb® cylinders permit field repairing for extended life.



TO ORDER SPECIFY:
Series, Mounting Style, Bore Size, Stroke, Port Controls, Cushions and Shock Pads, Oversize Rod, and Options.

DOUBLE ROD END

SERIES
EA - 150 psi Air
EL - 500 psi Hyd.
EH - 3000 psi Hyd.
ES - 5000 psi Hyd.

BORE SIZE
3/4" BORE
3/8" Std. Rod Dia.
1/4-28 Thread

1-1/8" BORE
1/2" Std. Rod Dia.
3/8-24 Thread

1-3/8" BORE
5/8" Std. Rod Dia.
7/16-20 Thread

BUILT-IN METER OUT FLOW CONTROL VALVE
P - Flow control both ends
PR - Flow control on head end
Not available on MT1
PC - Flow control on cap end
Not available on MT2

OVERSIZED ROD
1-1/8 and 1-3/8" bore only. To be specified only when using a non-standard rod diameter. See page 1-114.

D EA MS4 1-1/8 x 2 - P - D - 5/8 ROD - F-M-V

MOUNTING STYLE
MS2 - Foot Mount through holes (Not available on 1-1/8" and 1-3/8" Series ES.)
MS4 - Bottom Mount, tapped holes in head and cap
MF1 - Rod End Flange
MF2 - Cap End Flange
MT1 - Head Trunnion
MT2 - Cap Trunnion
MP1 - Clevis Mount, cap end with pin
MR1 - Rod Mount, tapped holes on front face of head

STANDARD STROKE LENGTHS
STOCK STROKE LENGTHS
1/2" to 6"
In 1/2" increments

Consult PHD for longer lengths.

CUSHION OR SHOCK PAD
D - Cushions on both ends
DR - Cushion on rod end
DC - Cushion on cap end
B - Shock Pads on both ends
BR - Shock Pad on rod end
BC - Shock Pad on cap end

(Cushions and Shock Pads are not available on the same end of cylinder. Shock Pads are not available for hydraulic use.)

OPTIONS
A - Stroke Adjustment (1/2" standard)
E - Magnetic Piston for Series JC1 radial sensing switches (Series EA and EL only)
F - #1 Rod End (see note 1)
I - #4 Rod End, female thread on rod (see note 1)
J - #2X Rod End, twice as long as standard thread (see note 1)
_K - Extra Rod Extensions (see note 2)
L - Coarse Thread Rod End (see note 1)
M - Magnetic Piston for Series JC1 reed and teachable switches (Series EA and EL only)
N - Plain Rod End (see note 1)
R - Port in Position 2
T - Port in Position 3
U - Port in Position 4
V - Fluoroelastomer Seals
W - Close Tolerance Stroke, ±0.005 stroke length
Y - SAE Ports on Series EH and ES Cylinders
Z1 - Electroless Nickel Plate all ferrous parts excluding rod ends

NOTES:
1) For double rod cylinders, rod end options will be applied to both ends of cylinder.
2) For double rod cylinders, -_K extension will be applied to one end only (head end/primary mounting end).

⚠ Options may affect unit length. See dimensional pages and option information details.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

SWITCH MOUNTING BRACKET

PART NO.	DESCRIPTION
92101	Mounts Series JC1 Switch to Tie Rod

NOTE: Brackets are ordered separately.

SPECIFICATIONS	SERIES EA	SERIES EL	SERIES EH	SERIES ES
ROD SEALS	Single block vee	(2) Block vee with back-up ring		
PISTON SEALS	(2) Block vee		(2) Block vee with back-up ring	
TUBE SEALS	O-ring		O-ring with back-up ring	
ROD WIPER	Nitrile rod wiper			
PISTON ROD	Hardchrome plated high strength steel 100,000 psi min. yield			
ROD BUSHING	Cast iron rod cartridge			
CYLINDER BARREL	Hardcoated aluminum		Honed steel	
END CAPS	Zinc-plated steel			
TIERODS	High tensile steel			Heat treated stainless steel
PORTS	NPT			
LUBRICATION	Permanently lubricated for non-lube air			
WORKING PRESSURE	150 psi air max.	500 psi hyd. max.	3000 psi hyd. max.	5000 psi hyd. max.
STANDARD STROKES	1/2" to 6" in 1/2" increments (longer strokes available, consult PHD)			

DIRECTION	FORCE (lb)/psi		
	3/4" BORE	1-1/8" BORE	1-3/8" BORE
PUSH	0.442	0.994	1.485
PULL	0.332	0.798	1.178

CYLINDER FORCE (TABLE 1)

SERIES	CYLINDER BORE	ROD DIAMETER	ROD DIRECTION	EFFECTIVE AREA FORCE lb/psi	AIR CONSUMPTION at 80 psi CUBIC ft/in OF STROKE	DISPLACEMENT gal/in OF STROKE
EA, EL, EH, ES	3/4	3/8	Push	0.442	0.0016	0.0019
			Pull	0.332	0.0012	0.0015
	1-1/8	1/2	Push	0.994	0.0037	0.0043
			Pull	0.798	0.0030	0.0034
	1-1/8	5/8	Push	0.994	0.0037	0.0043
			Pull	0.687	0.0026	0.0030
	1-3/8	5/8	Push	1.485	0.0055	0.0065
			Pull	1.178	0.0044	0.0051
	1-3/8	3/4	Push	1.485	0.0055	0.0065
			Pull	1.043	0.039	0.0045

NOTE: Use the Pull figures for calculating double rod cylinder forces in both directions.

SERIES	CYLINDER BORE	UNIT WEIGHTS (lb)	
		ZERO STROKE	ADDER PER INCH OF STROKE
EAMR1	3/4	1.42	0.96
	1-1/8	2.70	0.15
	1-3/8	5.05	0.22

MAXIMUM ALLOWABLE PUSH FORCE (TABLE 2)

SERIES	ROD DIAMETER	CYLINDER FORCE (lb)							
		100	200	500	1000	1500	2000	3000	5000
1-3/8" AV, HV EA, EL, EH, ES	3/8	27"	19"	12"	8"	7"	6"	5"	4"
	1/2	48"	34"	21"	15"	12"	11"	9"	7"
	5/8	74"	53"	33"	24"	19"	17"	14"	11"
	3/4	107"	76"	48"	34"	28"	24"	20"	15"

LUBRICATION - HYDRAULIC FLUIDS

All air units are permanently lubricated at the factory and can be used for non-lubricated air service. Static and dynamic seals are compatible with standard petroleum-based oil used for lubrication of air cylinders or as a power source for hydraulic cylinders. For service with other lubricants or hydraulic media, please specify to insure proper seals are supplied.

TEMPERATURE LIMITS - SEALS

All series have Nitrile seals and rod wipers for general use between -20° and +180°F. Consult PHD for higher temperatures.

HOW TO DETERMINE BORE AND PISTON SIZE

1. Determine stroke and force required.
2. Calculate the force (lb) produced by using the effective area figures in Table 1 on page 128 and multiplying them times the operating pressure (psi).
3. Check Table 2 on page 128 to verify that rod size is sufficient for force. If stroke required is greater than length listed in Table 2, increase rod diameter or go to larger bore size.

NOTE: Table 2 shows maximum stroke lengths for mounting styles MS2, MS4, MR1, MF1, MF2 fastened to rigid base.

For mounting style MP1; divide table value by 2.

For mounting styles MT1, and MT2; divide table value by 1.75.

To avoid excessive wear on rod bushings and seals, it is recommended that cylinders with strokes exceeding the following lengths be equipped with 1" long stop tubes or stopped externally 1" short of full push stroke.

3/4" Bore x 8" 1-1/8" Bore x 12" 1-3/8" Bore x 18"

BREAKAWAY

The breakaway pressure for all pneumatic cylinders is 20 psi at zero load. The breakaway pressure for all hydraulic cylinders is 40 psi at zero load.

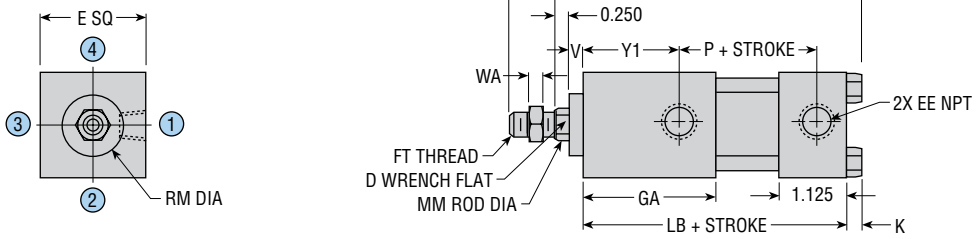
MAXIMUM WORKING PRESSURES

SERIES	AIR MAX. psi	HYDRAULIC	
		MAX. psi	WITH -E OR -M OPTION
EA	150	—	—
EL	—	500	500
EH	—	3000	—
ES	—	5000	—

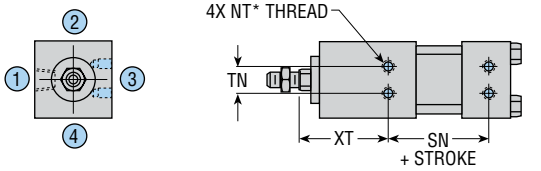
STROKE TOLERANCE

Tolerance on the nominal stroke length is ±0.032 for all cylinders.

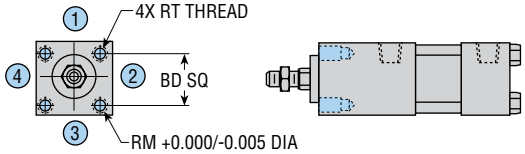
BASIC CYLINDER DIMENSIONS



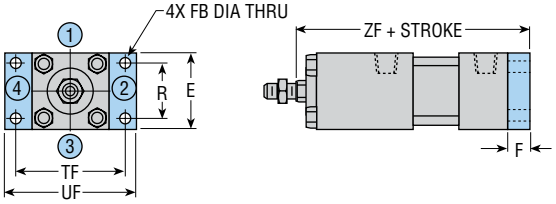
MS4



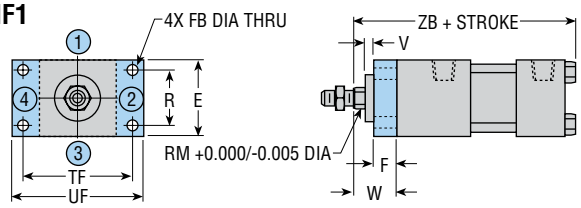
MR1



MF2



MF1



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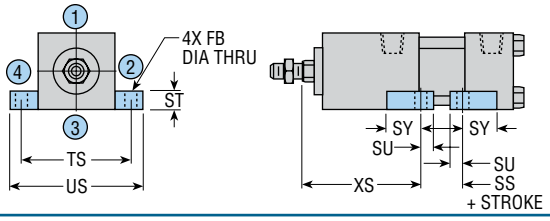
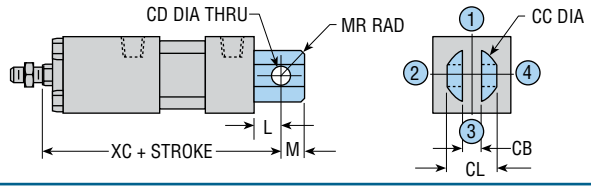
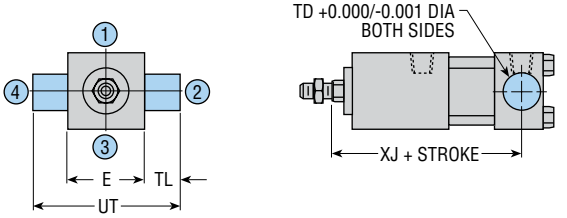


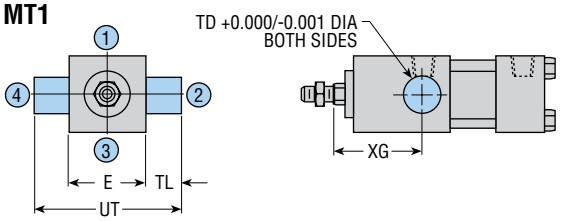
MP1 (CLEVIS PIN INCLUDED)



MT2



MT1



All standard rod ends have four wrench flats (two wrench flats with "I" option).

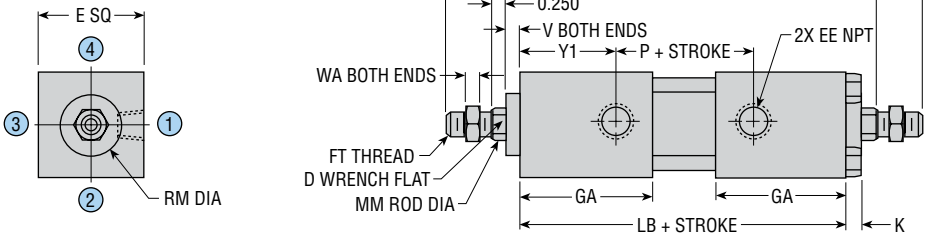
BORE SIZE	LETTER DIMENSION																						
	A	BD	CB	CC	CD	CL	D	E	EE	F	FB	FT	GA	K	L	LB	M	MM	MR	NT*	P	R	RM
3/4	0.750	1.000	0.375	1.000	0.375	0.875	0.312	1.375	1/4	0.312	0.219	1/4-28	1.812	0.00	0.500	4.000	0.375	0.375	0.570	10-32 x 0.25 DP	2.188	0.938	0.750
1-1/8	0.750	1.250	0.500	1.250	0.500	1.125	0.438	1.750	1/4	0.500	0.281	3/8-24	2.188	0.250	0.625	4.375	0.500	0.500	0.720	1/4-28 x 0.31 DP	2.312	1.250	1.000
1-3/8	0.750	1.625	0.625	1.750	0.625	1.500	0.562	2.250	3/8	0.500	0.344	7/16-20	2.625	0.312	0.750	4.812	0.625	0.625	0.910	5/16-24 x 0.50 DP	2.438	1.625	1.250

BORE SIZE	LETTER DIMENSION																							
	RT	SN	SS	ST	SU	SY	TD	TF	TL	TN	TS	UF	US	UT	V	W	WA	XC	XG	XJ	XS	XT	Y1	ZB	ZF
3/4	10-32 x 0.25 DP	2.188	1.062	0.281	0.250	0.500	0.500	1.938	0.500	0.562	1.938	2.375	2.375	2.375	0.125	0.688	0.156	4.875	1.625	3.812	2.188	1.625	1.250	4.375	4.688
1-1/8	1/4-28 x 0.50 DP	2.312	0.938	0.344	0.312	0.812	0.750	2.500	0.750	0.625	2.500	3.000	3.000	3.250	0.250	1.000	0.219	5.500	2.062	4.375	2.750	2.062	1.562	5.125	5.375
1-3/8	5/16-24 x 0.62 DP	2.438	0.938	0.469	0.438	1.062	0.875	3.000	0.875	0.875	3.000	3.750	3.750	4.000	0.250	1.000	0.250	6.062	2.438	4.875	3.188	2.438	1.938	5.625	5.812

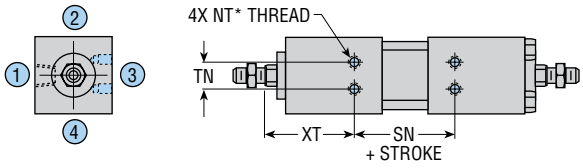
PORT POSITIONS: INDICATED BY CIRCLED NUMBERS.
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS. MT1 (-DR) & MT2 (-DC) CUSHION NEEDLES ARE IN POSITION 3.
SHOCK PADS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF SHOCK PADS
MS2 MTG. STYLE: NOT AVAILABLE ON 1-1/8" & 1-3/8" SERIES ES CYLINDERS
***MS4 MTG. STYLE:** UNITS WITH OPTION -R OR -U WITH/-P. THE NT THREAD SIZE AND DEPTH WILL BE REDUCED AS FOLLOWS: 3/4" BORE NOT AVAILABLE WITH -R OR -U WITH/-P. 1-1/8" BORE NT=10-32 x 0.19, 1-3/8" BORE NT=1/4-28 x 0.25

All dimensions are reference only unless specifically toleranced.

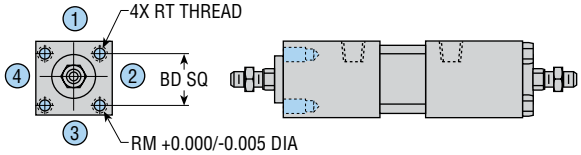
BASIC CYLINDER DIMENSIONS



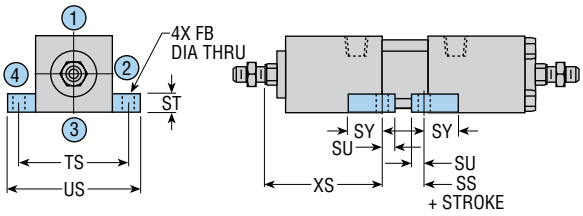
MS4



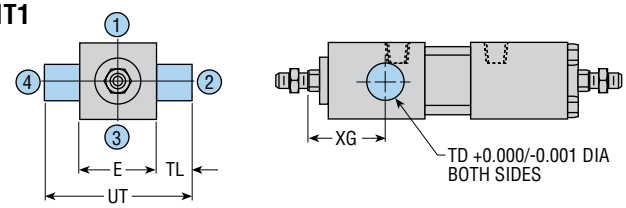
MR1



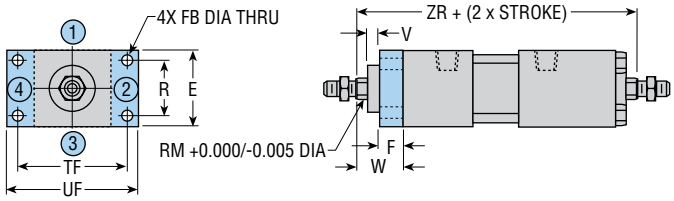
MS2



MT1



MF1



All standard rod ends have four wrench flats (two wrench flats with "I" option).

BORE SIZE	LETTER DIMENSION																
	A	BD	D	E	EE	F	FB	FT	GA	K	LB	MM	NT*	P	R	RM	RT
3/4	0.750	1.000	0.312	1.375	1/4	0.312	0.219	1/4-28	1.812	0.00	4.687	0.375	10-32 x 0.25 DP	2.188	0.938	0.750	10-32 x 0.25 DP
1-1/8	0.750	1.250	0.438	1.750	1/4	0.500	0.281	3/8-24	2.188	0.250	5.437	0.500	1/4-28 x 0.31 DP	2.312	1.250	1.000	1/4-28 x 0.50 DP
1-3/8	0.750	1.625	0.562	2.250	3/8	0.500	0.344	7/16-20	2.625	0.312	6.312	0.625	5/16-24 x 0.50 DP	2.438	1.625	1.250	5/16-24 x 0.62 DP

BORE SIZE	LETTER DIMENSION																				
	SN	SS	ST	SU	SY	TD	TF	TL	TN	TS	UF	US	UT	V	W	WA	XG	XS	XT	Y1	ZR
3/4	2.188	1.062	0.281	0.250	0.500	0.500	1.938	0.500	0.562	1.938	2.375	2.375	2.375	0.125	0.688	0.156	1.625	2.188	1.625	1.250	5.438
1-1/8	2.312	0.938	0.344	0.312	0.812	0.750	2.500	0.750	0.625	2.500	3.000	3.000	3.250	0.250	1.000	0.219	2.062	2.750	2.062	1.562	6.438
1-3/8	2.438	0.938	0.469	0.438	1.062	0.875	3.000	0.875	0.875	3.000	3.750	3.750	4.000	0.250	1.000	0.250	2.438	3.188	2.438	1.938	7.312

PORT POSITIONS: INDICATED BY CIRCLED NUMBERS.
CUSHIONS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS. MT1 (-DR) CUSHION NEEDLES ARE IN POSITION 3.
SHOCK PADS: CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF SHOCK PADS
MS2 MTG. STYLE: NOT AVAILABLE ON 1-1/8" & 1-3/8" SERIES ES CYLINDERS
***MS4 MTG. STYLE:** UNITS WITH OPTION -R OR -U WITH/-P. THE NT THREAD SIZE AND DEPTH WILL BE REDUCED AS FOLLOWS: 3/4" BORE NOT AVAILABLE WITH -R OR -U WITH/-P. 1-1/8" BORE NT=10-32 x 0.19, 1-3/8" BORE NT=1/4-28 x 0.25

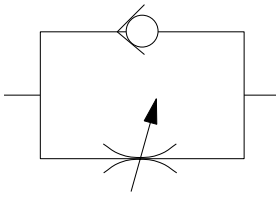
All dimensions are reference only unless specifically toleranced.

P PORT CONTROL®

Not available with -Y SAE ports option

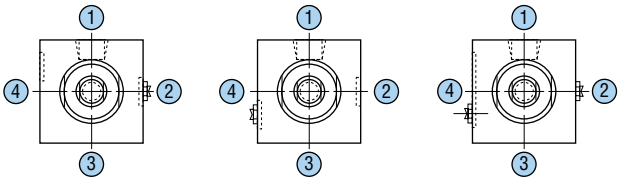
The exclusive PHD Port Control®, based on the "meter-out" principle, features an adjustable needle and a separate ball check. Both are built into the cylinder end cap and are used to control the speed of the cylinder over its entire stroke.

The self-locking needle has micrometer threads and is adjustable under pressure. It determines the orifice size which controls the exhaust volume. The separate ball check is closed while fluid is exhausting from the cylinder, but opens to permit full flow of incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.



STANDARD PORT CONTROL AND CUSHION NEEDLE POSITIONS

Port Control® and cushion needles are located on opposite sides adjacent to port. Please consult distributor or PHD to check availability of special Port Control® or cushion needle positions.

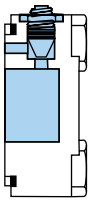


D ADJUSTABLE CUSHION

PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

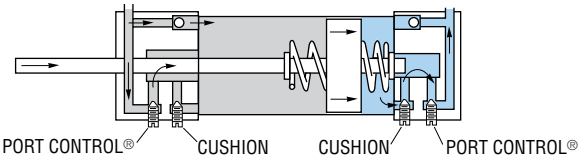
See dimension pages for dimensional information.
Series E = Poppet Style

POPPET STYLE



PORT CONTROL AND ADJUSTABLE CUSHION COMBINATION

The cushion and Port Control® combination is also available. This cushion is activated when a seal, which is traveling with the piston, seals against the cylinder end cap. This causes the remaining volume in the cylinder to exhaust past an adjustable needle which controls the amount of deceleration. The spring, which extends the seal from the piston, permits the seal to act as a check valve to allow full flow back into the cylinder for immediate reversing. The cushion seal for air units is made of urethane while seals for oil units are close tolerance metal.

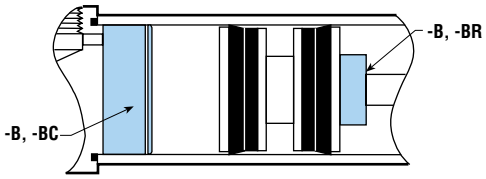


B SHOCK PADS

Polyurethane pads for absorption of shock and noise (not available on hydraulic units). Reducing shock permits higher piston velocities for shorter cycle times. Reducing noise levels provides improved environment for increased productivity. Eliminates metal to metal contact between piston and end caps.

Available together with all options EXCEPT:

- **Same end as Cushion**
- **Same end as Stroke Adjustment**

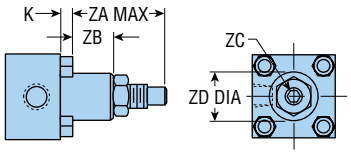


A CYLINDER STROKE ADJUSTMENT

Stroke adjustment screws are available to decrease the retraction stroke. The standard adjusting range is 1/2 inch. Longer adjusting lengths are available on request.

Available with all options EXCEPT:

- **Cushion on the cap end**
- **Shock pad on the cap end**
- **Pivot Mount**

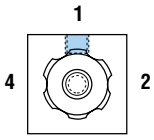


BORE SIZE	LETTER DIMENSION				
	K	ZA	ZB	ZC	ZD
3/4	0.000	2.219	1.125	1/8 HEX	0.750
1-1/8	0.250	2.125	0.875	1/4 HEX	1.000
1-3/8	0.312	2.125	0.812	1/4 HEX	1.250

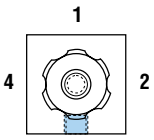
PORT POSITIONS

Port position 1 is standard on all cylinders.

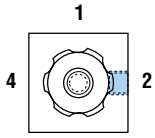
PORT POSITION 1 (STANDARD)



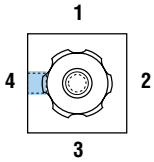
T PORT POSITION 3



R PORT POSITION 2



U PORT POSITION 4



Y SAE PORTS FOR SERIES EH AND ES 3/4", 1-1/8", 1-3/8" Bore

SAE Ports are available on Series EH and ES Hydraulic Cylinders. Port locations are the same as the NPT ports. Port sizes are shown to right.

BORE SIZE	3/4"	1-1/8"	1-3/8"
SAE PORT	7/16 - 20	7/16 - 20	9/16 - 18

E MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

PHD Cylinders may be equipped with a magnetic band (specify -E) on the piston which activates externally mounted radial sensing switches. These switches allow the interfacing of the Tom Thumb® air or hydraulic cylinder to various logic systems. This option is for use with the following switches.

See Series JC1 Switches at phdinc.com for more information.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

M MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

The PHD Magnetic Reed Switches may be used in situations where the radial sensing switches are not applicable. As with the radial sensing switches, a magnetic band (specify -M) on the piston activates the externally mounted PHD Reed Switches. The Reed Switches may be used to signal a programmable controller, sequencer, relay, or in some cases, a valve solenoid. This option is for use with the following switches.

The Teachable Switch provides the ability to identify two separately programmable positions with a single switch. Programmable capability means no "fine tuning." With switch properly aligned, just place actuator in desired positions and program. Solid-state sensing technology provides a highly reliable switch.

SERIES JC1ST REED SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)

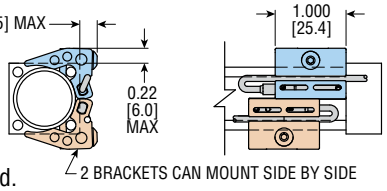
NOTE: Switches must be ordered separately.

SERIES JC1ST TEACHABLE SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

SWITCH BRACKET NO. 92100



All dimensions are reference only unless specifically toleranced.

OPTIONS: Series EA, EL, EH, ES Cylinders

V FLUOROELASTOMER SEALS

Fluoroelastomer seals are available to achieve seal compatibility with certain fluids. Seal compatibility should be checked with the fluid manufacturer for proper application. Consult PHD for high temperature use.

Z1 ELECTROLESS NICKEL PLATING

Electroless nickel plating is done on all externally exposed ferrous parts except rods and rod end, or parts made of stainless steel or aluminum. This optional plating treatment gives an alternative method of protecting the cylinder from severe environments.

NOTE: Standard plating is Brite Zinc.

W CLOSE TOLERANCE STROKE

This option may be specified when a precise stroke length is required and stroke adjustment is not acceptable. By specifying this option, a stroke length with a tolerance of ±0.005 will be supplied. Standard stroke tolerance is ±0.032.

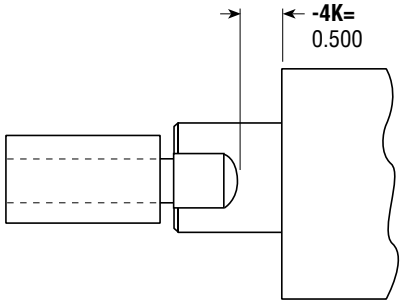
Maximum stroke for cylinders with close tolerance is 18".

NOTE: This option is not available with shock pads (-B).

_K EXTRA ROD EXTENSION

This option may be specified when extra plain rod extension between rod flats and cylinder snout is desired. Length is specified in 1/8" increments.

Length code example:
-4K = 1/2 of extra rod extension
-8K = 1, etc.



ACCESSORIES: Series EA, EL, EH, ES Cylinders

SELF-ALIGNING PISTON ROD COUPLERS

Rod Couplers eliminate expensive precision machining for mounting fixed or rigid cylinder on guide or slide applications.

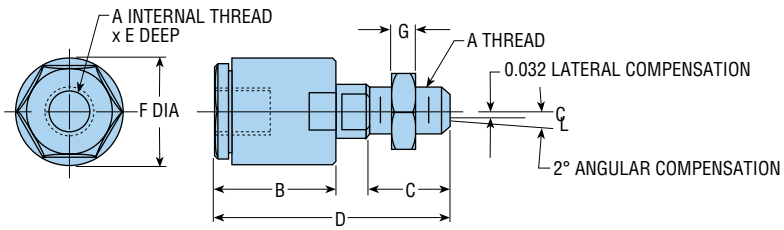
Cylinder efficiency is increased by eliminating friction caused by misalignment. Couplers compensate for 2° angular error and 1/32" lateral misalignment on push and pull stroke. (Miniature Couplers compensate for 1° of angular error.)

Couplers provide greater reliability and reduce cylinder and component wear, simplifying alignment problems in the field.

Rod Couplers are manufactured from high tensile and hardened steel components.

To order, specify the model number.

MODEL NO.	LETTER DIMENSION						
	A	B	C	D	E	F	G
250	1/4-28	1.000	0.625	1.875	0.500	0.875	0.156
312	5/16-24	1.000	0.625	1.875	0.500	0.875	0.187
375	3/8-24	1.000	0.625	1.875	0.500	0.875	0.219
437	7/16-20	1.125	0.750	2.187	0.500	1.000	0.250
500	1/2-20	1.125	0.750	2.187	0.500	1.000	0.312
625	5/8-18	1.750	1.125	3.312	0.812	1.562	0.375
750	3/4-16	1.750	1.125	3.312	0.812	1.562	0.421



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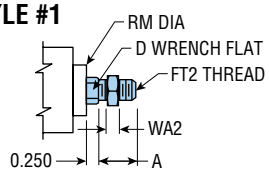
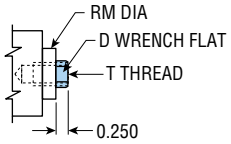
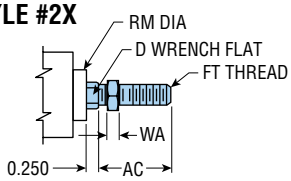
F
ROD END STYLE #1



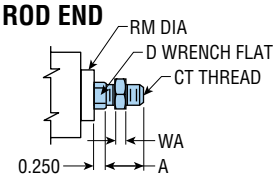
I
ROD END STYLE #4



J
ROD END STYLE #2X



L
COARSE THREAD ROD END

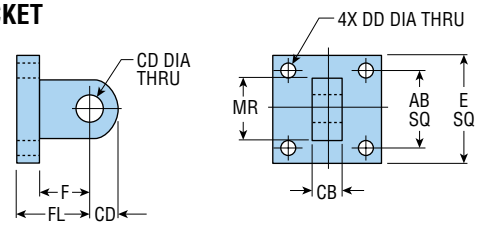


CLEVIS BRACKET - PIN INCLUDED

BORE SIZE	ROD TYPE	ROD DIAMETER	LETTER DIMENSION									
			A	AC	CT	D	FT	FT2	RM	T	WA	WA2
3/4	STANDARD	0.375	0.750	1.500	1/4-20	0.312	1/4-28	5/16-24	0.750	1/4-28 x 0.625 DP	0.156	0.187
1-1/8	STANDARD	0.500	0.750	1.500	3/8-16	0.438	3/8-24	7/16-20	1.000	3/8-24 x 0.625 DP	0.219	0.250
	OVERSIZE	0.625	0.750	1.500	7/16-14	0.562	7/16-20	1/2-20	1.000	7/16-20 x 0.625 DP	0.250	0.312
1-3/8	STANDARD	0.625	0.750	1.500	7/16-14	0.562	7/16-20	1/2-20	1.250	7/16-20 x 0.625 DP	0.250	0.312
	OVERSIZE	0.750	1.000	2.000	9/16-12	0.688	9/16-18	5/8-18	1.250	9/16-18 x 0.625 DP	0.312	0.375

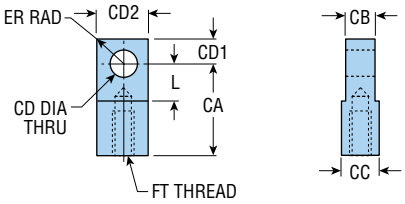
All standard rod ends have four wrench flats (except -I rod end style).

E SERIES MOUNTING ATTACHMENTS
EYE BRACKET



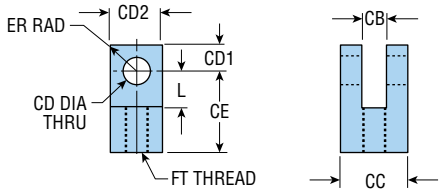
BORE SIZE	PART NO.	LETTER DIMENSION							
		AB	CB	CD	DD	E	F	FL	MR
3/4	2412-01	1.000	0.375	0.375	0.219	1.375	0.812	1.125	0.750
1-1/8	1330	1.375	0.500	0.500	0.281	1.875	0.875	1.250	1.000
1-3/8	2412-02	1.625	0.625	0.625	0.344	2.250	1.062	1.562	1.250

ROD EYE



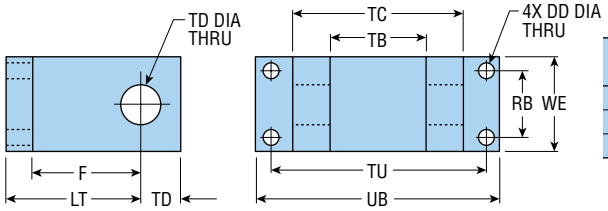
BORE SIZE	PART NO.	LETTER DIMENSION								
		CA	CB	CC	CD	CD1	CD2	ER	FT	L
3/4	2414-01	1.500	0.375	0.500	0.375	0.375	0.750	0.531	1/4-28 x 0.75 DP	0.562
1-1/8	1375-01	1.562	0.500	0.625	0.500	0.438	0.875	0.625	3/8-24 x 0.75 DP	0.625
1-3/8	2414-02	2.000	0.625	0.750	0.625	0.625	1.250	0.906	7/16-20 x 1.00 DP	0.812
	2414-03	2.000	0.625	0.750	0.625	0.625	1.250	0.906	9/16-18 x 1.00 DP	0.812

ROD CLEVIS - PIN INCLUDED



BORE SIZE	PART NO.	LETTER DIMENSION								
		CB	CC	CD	CD1	CD2	CE	ER	FT	L
3/4	12912	0.375	0.875	0.375	0.375	0.750	1.312	0.531	1/4-28	0.562
1-1/8	12909	0.500	1.125	0.500	0.438	0.875	1.375	0.625	3/8-24	0.625
1-3/8	12914	0.625	1.375	0.625	0.625	1.250	1.812	0.906	7/16-20	0.812
	12915	0.625	1.375	0.625	0.625	1.250	1.812	0.906	9/16-18	0.812

TRUNNION BRACKET



BORE SIZE	PART NO.	LETTER DIMENSION									
		DD	F	LT	RB	TB	TC	TD	TU	UB	WE
3/4	2415-01	0.281	1.750	2.250	1.000	1.375	2.375	0.500	3.125	3.625	1.500
1-1/8	2415-02	0.281	2.000	2.500	1.250	1.750	3.250	0.750	4.000	4.500	1.750
1-3/8	2415-03	0.344	2.625	3.125	1.375	2.250	4.000	0.875	4.875	5.500	2.000

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2/23 11562

phd Empowering Automation

9009 Clubridge Drive
Fort Wayne, Indiana 46809
Ph (260) 747-6151
phdinc.com • phdinfo@phdinc.com

Zum Carl-Alexander-Park 6
52499 Baesweiler, Germany
Tel. +49 (0)2401-619 77 0
phdinc.com • info@PHDinEurope.de