## 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.

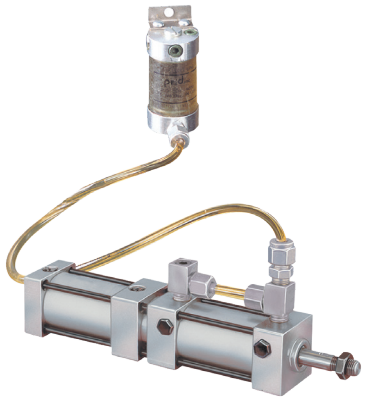
For mounting styles -K, -P, and MP1; divide table value by 2.

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

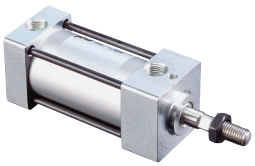
To avoid excessive wear on rod bushings and seals, it is recommended that cylinders with strokes exceeding the following lengths be equipped with 1" long stop tubes or be stopped externally 1" short of full extend stroke.

| | |
|---|---|
| 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.



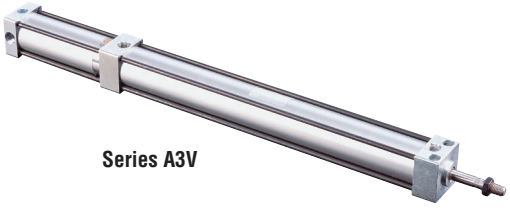
Series TD



Series A, AV Cleanroom

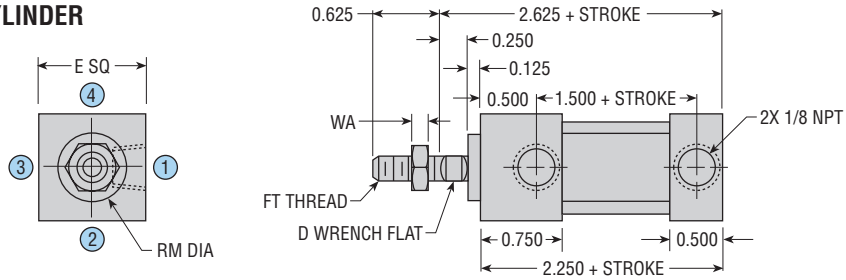
Series AV2

Series HV

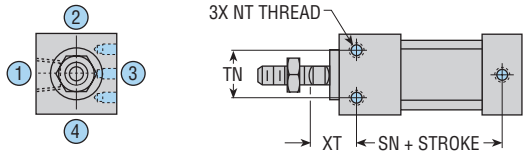


Series A3V

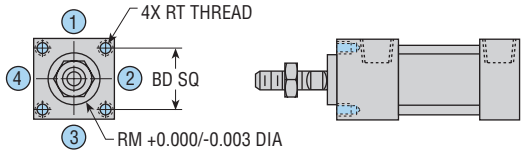
## SERIES AV BASIC CYLINDER



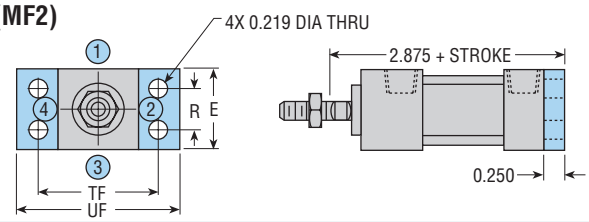

## B (MS9)



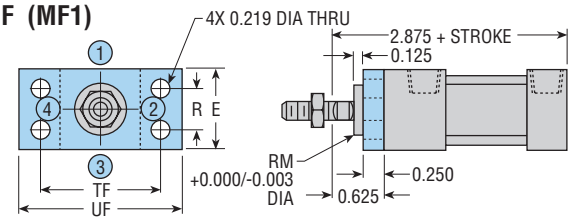

## R (MR1)



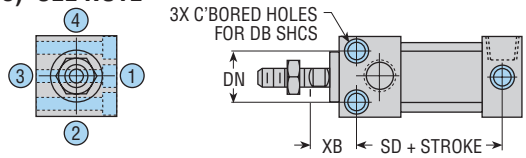

## CF (MF2)



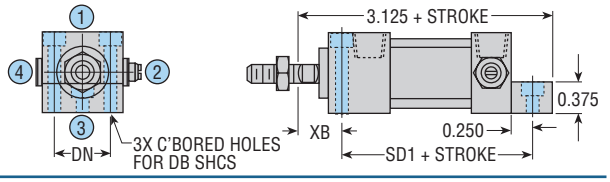

## RF (MF1)



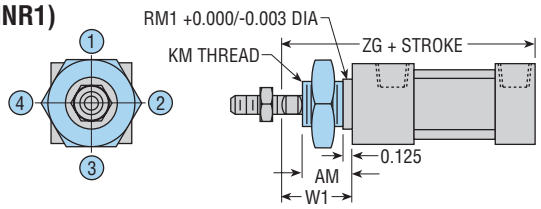

## F (MS8) SEE NOTE



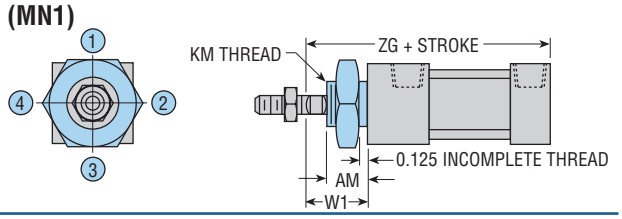

## F (MS8) - WITH PORT CONTROL® ON CAP END (-Q or -T without Port Control)



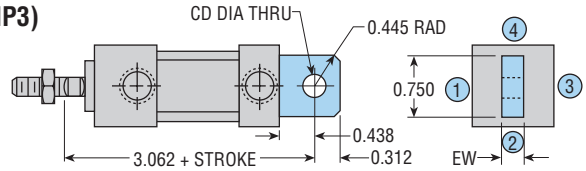

## L (MNR1)



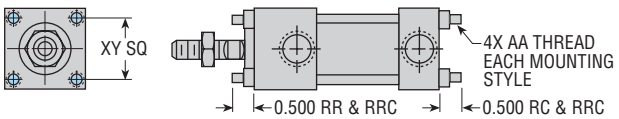

## T (MN1)




## P (MP3)




## RC, RR, RRC (Includes RR & RC)




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

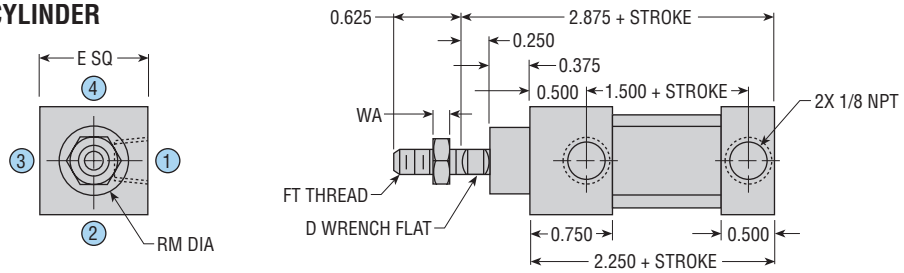
| BORE SIZE | LETTER DIMENSION | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AA | AM | BD | CD | D | DB | DN | E | EW | FT | KM | NT | R | RM | RM1 | RT | SD | SD1 | SN |
| 3/4 | #6-32 | 0.625 | 0.750 | 0.250 | 3/16 | #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 |

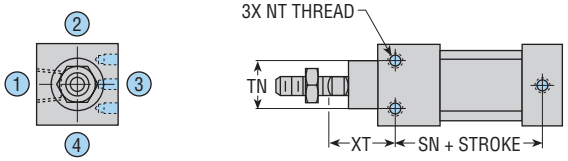
**PORT POSITIONS:** INDICATED BY CIRCLED NUMBERS
**CUSHIONS:** ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
**SHOCK PADS:** ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
**SPRING RETURN:** ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
**F (MS8) MTG:** 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 83 FOR OVERSIZE ROD SPECIFICATIONS.

All dimensions are reference only unless specifically toleranced.

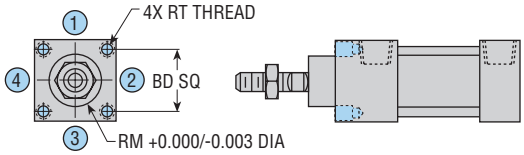
## SERIES HV BASIC CYLINDER



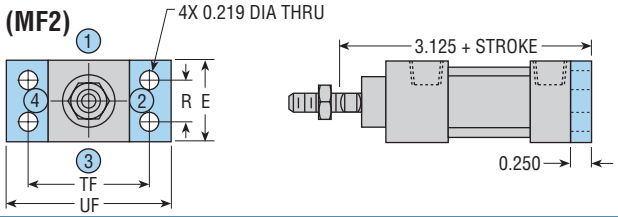

## B (MS9)



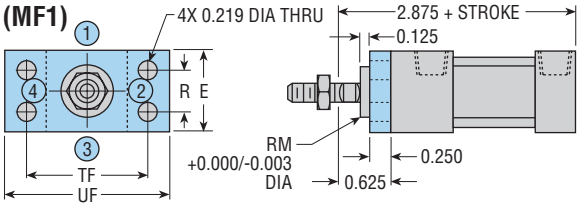

## R (MR1)



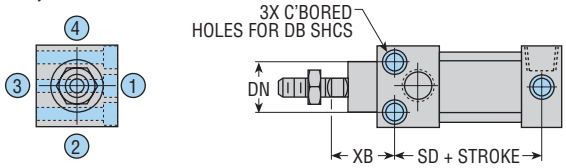

## CF (MF2)



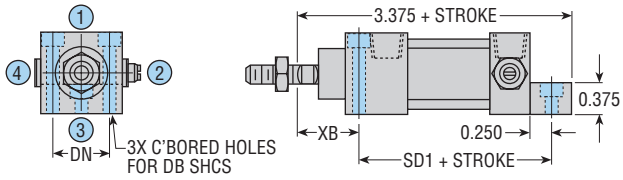

## RF (MF1)



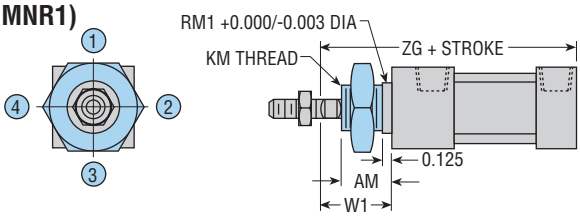

## F (MS8) SEE NOTE



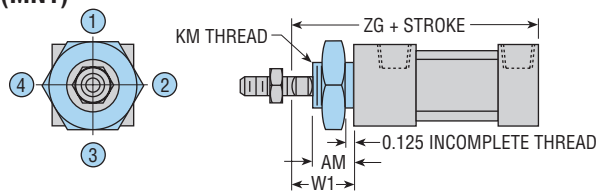

## F (MS8) - WITH PORT CONTROL ON CAP END



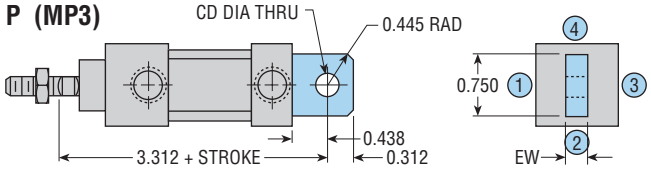

## L (MNR1)



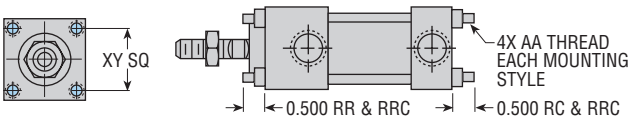

## T (MN1)




## P (MP3)




## RC, RR, RRC (Includes RR & RC)




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

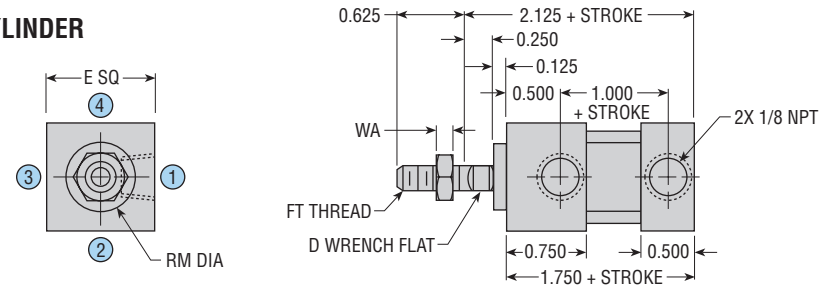
| BORE SIZE | LETTER DIMENSION | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AA | AM | BD | CD | D | DB | DN | E | EW | FT | KM | NT | R | RM | RM1 | RT | SD | SD1 | SN |
| 3/4 | #6-32 | 0.625 | 0.750 | 0.250 | 3/16 | #8 | 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 |

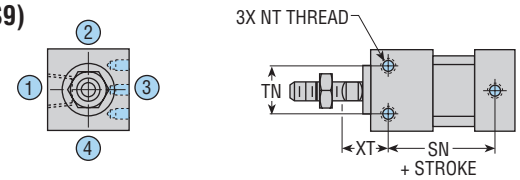
**PORT POSITIONS:** INDICATED BY CIRCLED NUMBERS
**CUSHIONS:** ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
**SPRING RETURN:** ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
**F (MS8) MTG:** 3/4" BORE UNITS ORDERED WITH AN OVERSIZE PISTON ROD WILL HAVE MTG. TABS ON THE HEAD END. CONSULT PHD FOR DIMENSIONAL INFORMATION.
**OVERSIZE RODS:** SEE PAGE 83 FOR OVERSIZE ROD SPECIFICATIONS.

All dimensions are reference only unless specifically toleranced.

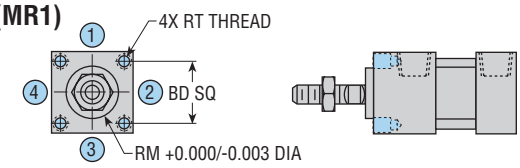
## SERIES A BASIC CYLINDER



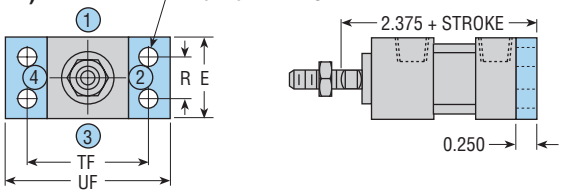

## B (MS9)



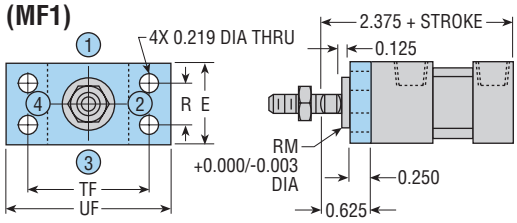

## R (MR1)



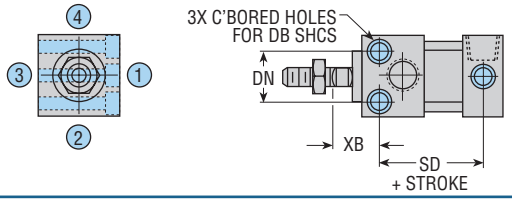

## CF (MF2)



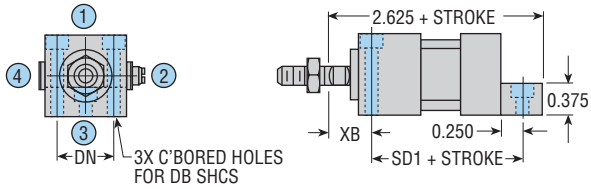

## RF (MF1)



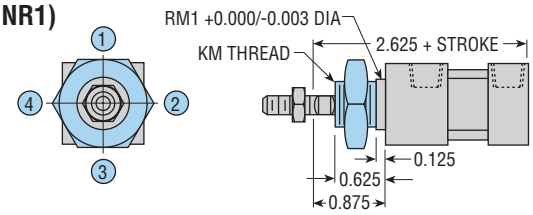

## F (MS8) SEE NOTES



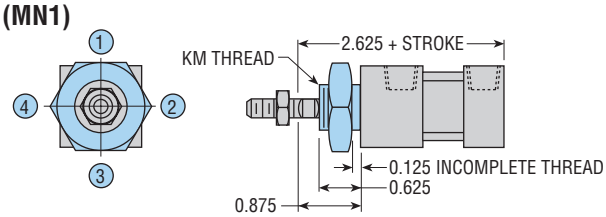

## F (MS8) - WITH PORT CONTROL ON CAP END



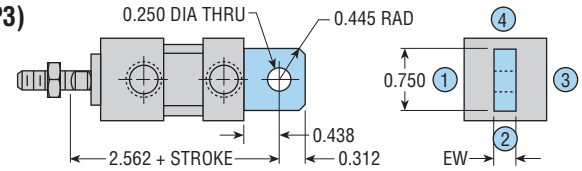

## L (MNR1)



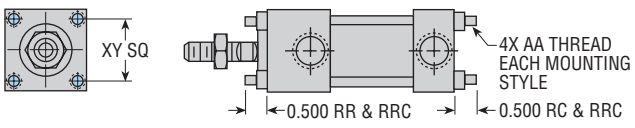

## T (MN1)




## P (MP3)




## RC, RR, RRC (Includes RR & RC)




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

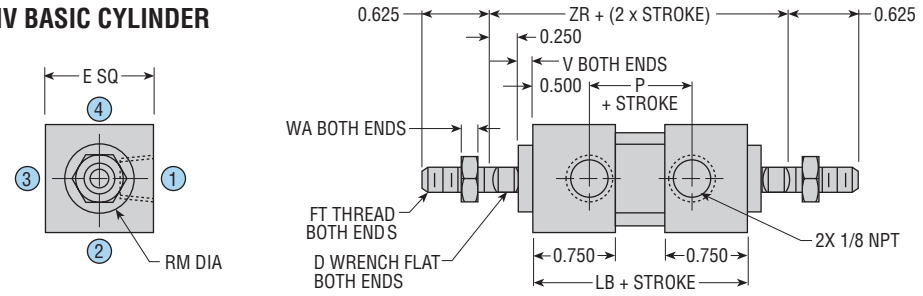
| BORE SIZE | LETTER DIMENSION | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AA | BD | D | DB | DN | E | EW | FT | KM | NT | R | RM | RM1 | RT | SD | SD1 | SN | TF | TN |
| 3/4 | #6-32 | 0.750 | 3/16 | #8 | 0.625 | 1.000 | 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 |

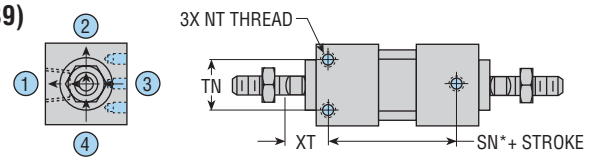
**PORT POSITIONS:** INDICATED BY CIRCLED NUMBERS
**CUSHIONS:** ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
**SHOCK PADS:** ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
**SPRING RETURN:** ADD AN ADDITIONAL STROKE LENGTH TO (+ STROKE) DIMENSIONS (2 x STROKE)
**F (MS8) MTG:** 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 83 FOR OVERSIZE ROD SPECIFICATIONS.

All dimensions are reference only unless specifically toleranced.

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

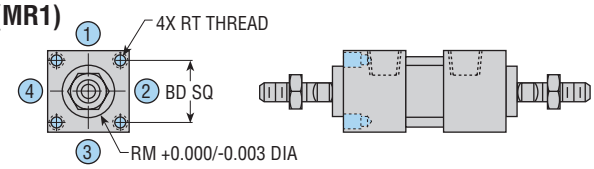



### B (MS9)

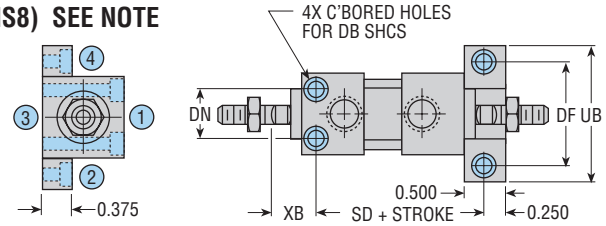



*1" AND 1-1/8" BORE: WITH PORT POSITION #3 ADD 0.062 in
WITH PORT POSITION #2 OR #4 & PORT CONTROLS ADD 0.062 in

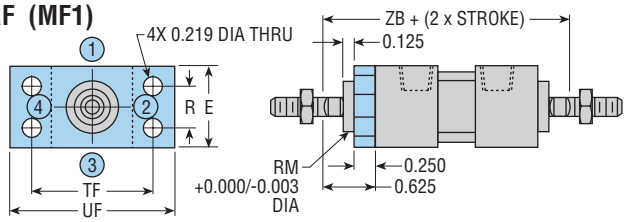
### R (MR1)



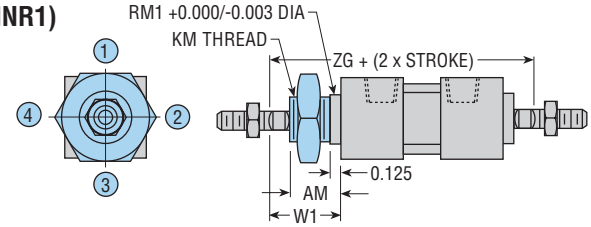

### F (MS8) SEE NOTE



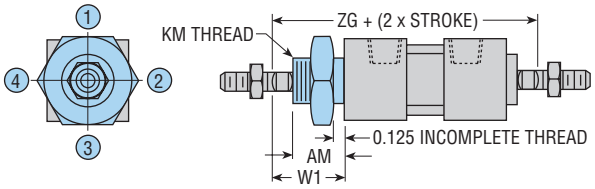

### RF (MF1)



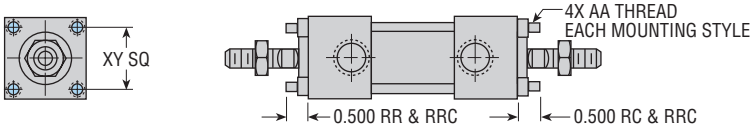

### L (MNR1)




### 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 |

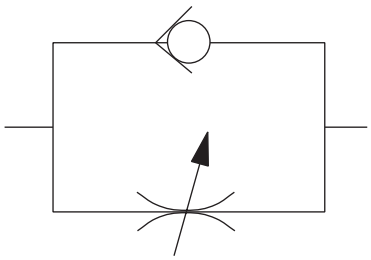
**PORT POSITIONS:** INDICATED BY CIRCLED NUMBERS
**CUSHIONS:** ADD 0.500 in TO ALL (+ STROKE) DIMENSIONS FOR EACH CUSHION
**SHOCK PADS:** ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
**SPRING RETURN:** ADD AN ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)
**F (MS8) 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 83 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

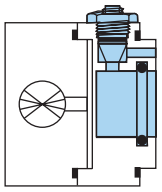
PHD Cushions are designed for smooth deceleration at the end of stroke. When the cushion is activated the remaining volume in the cylinder must exhaust past an adjustable needle which controls the amount of deceleration.

See dimension pages for dimensional information.

Effective cushion length 1/2"

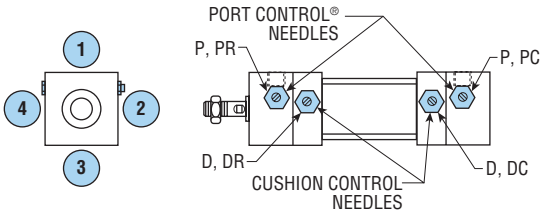
Not warranted on Series HV units

### CUSHION BLOCK



## STANDARD PORT CONTROL® AND CUSHION NEEDLE POSITIONS

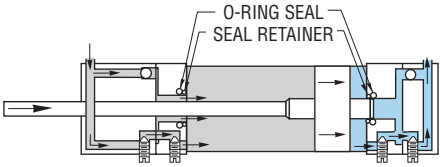
Port Control® and cushion needles are located in position 2 on standard cylinders. They may be located at position 4 when specified on all Series A, AV, and HV.




## 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) ⊕**

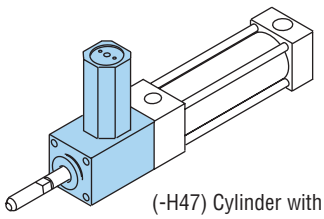
PHD's Rodlok is ideal for locking the piston rod while in a static/ stationary position. When the pressure is removed from the port of the Rodlok, the mechanism will grip the rod and prevent it from moving. The loads are held indefinitely without power. Rodlok performance is application and environment 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.

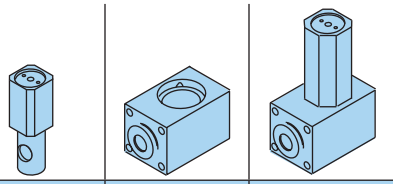
-H47 available on B, R, P, and RC only.

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



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

### REPLACEMENT RODLOK KITS

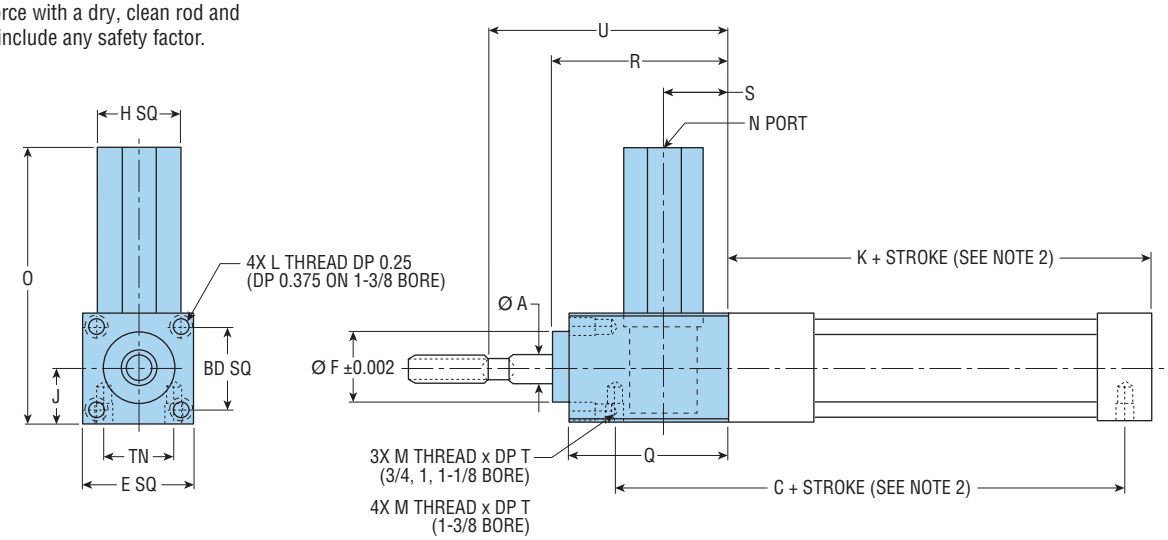


| BORE in | LOCKING DEVICE KIT | ADAPTOR KIT | COMPLETE RODLOK |
|---|---|---|---|
| 3/4 | 63932-01 | 63931-01 | 63935-01 |
| 1 | 63932-02 | 63931-02 | 63935-02 |
| 1-1/8 | 63932-03 | 63931-03 | 63935-03 |

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)

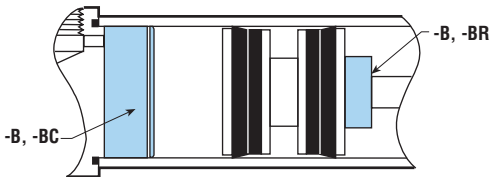
All dimensions are reference only unless specifically toleranced.

## 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

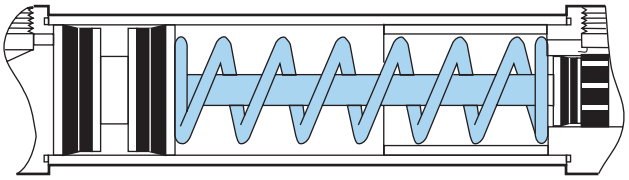
**Available in 1/4" increments**

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)**



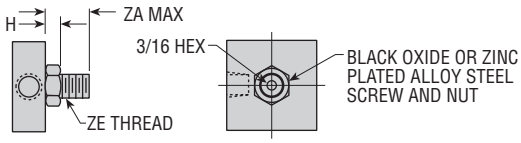
## A CYLINDER STROKE ADJUSTMENT

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**

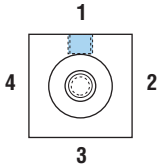



## PORT POSITIONS

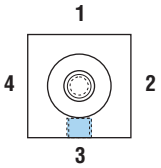
Port position 1 is standard on all cylinders except mounting style -F without port controls. The cap end port will be in position 4 standard.

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.

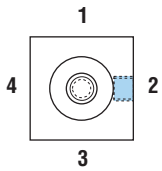
### STANDARD PORT POSITION 1



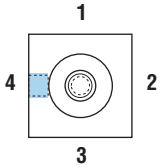

### T PORT POSITION 3




### 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 can include a magnetic band (-E) on the piston to trigger external radial sensing solid state switches. These switches enable Tom Thumb® air or hydraulic cylinders to connect with different logic systems and work with the switches listed below.

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

## M MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

A magnetic band (-M) on the piston triggers externally mounted PHD Reed Switches and Two Position Teachable Switches. Reed switches use a physical element to close the circuit, whereas solid-state switches utilize magnetoresistive principles.

The Teachable Switch enables two programmable positions with one device – no fine tuning needed. Simply align the switch, position the actuator, and program the two positions.

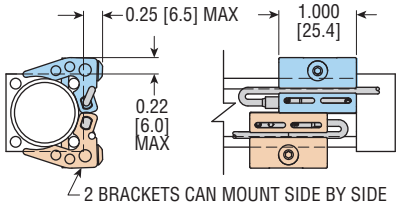
### SERIES JC1 MAGNETIC SWITCHES AND CORDSETS

| MAGNET OPTION | SENSING TYPE | OUTPUT / VOLTAGE | CABLE | SWITCH PART NO. | CORDSETS | |
|---|---|---|---|---|---|---|
| | | | | | 2 METER | 5 METER |
| -E [Radial] | Solid State | NPN / DC | 5 m, 3 Conductor | JC1HDN-5 | — | — |
| | | | .3 m, M8 3-Pin | JC1HDN-K | 63549-02 | 63549-05 |
| | | PNP / DC | 5 m, 3 Conductor | JC1HDP-5 | — | — |
| | | | .3 m, M8 3-Pin | JC1HDP-K | 63549-02 | 63549-05 |
| -M [Axial] | Reed | PNP or NPN / AC | .3 m, M12 4-Pin | JC1ADU-K | 81284-1-010 | — |
| | | PNP or NPN / DC | 5 m, 3 Conductor | JC1RDU-5 | — | — |
| | | | .3 m, M8 3-Pin | JC1RDU-K | 63549-02 | 63549-05 |
| | Solid State | PNP / DC Two Position Teachable | 2 m, 4 Conductor | JC1STP-2 | — | — |
| | | | 2 m, M8 4-Pin | JC1STP-K | — | 81284-1-001 |

### SWITCH MOUNTING BRACKET

| CYLINDER SIZE | BRACKET NO. |
|---|---|
| 3/4 | 92100 |
| 1 | |
| 1-1/8 | |

**NOTE:** Brackets are ordered separately.




## 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.

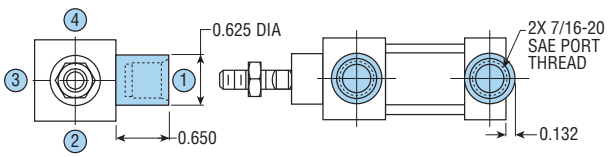
## Z1 ELECTROLESS NICKEL PLATING

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.

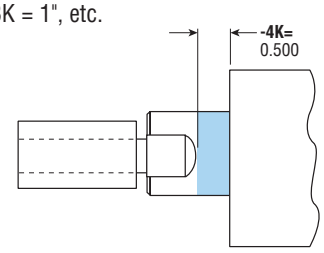
Dimensions for this boss are shown below. This option is not available on cylinders with an "F" mounting style. Consult PHD for optional port position or **units with Port Controls®**. Oversize rods are available except on T and L mounting styles on 3/4" bore cylinders.




## _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.

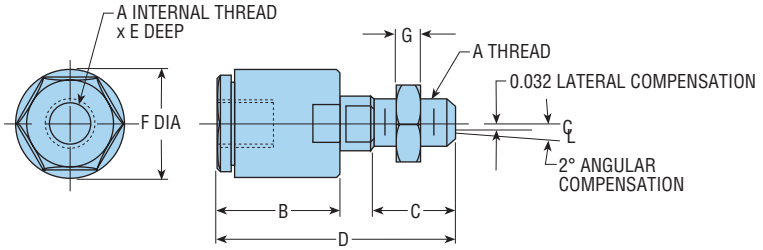
## SELF-ALIGNING PISTON ROD COUPLERS

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 |

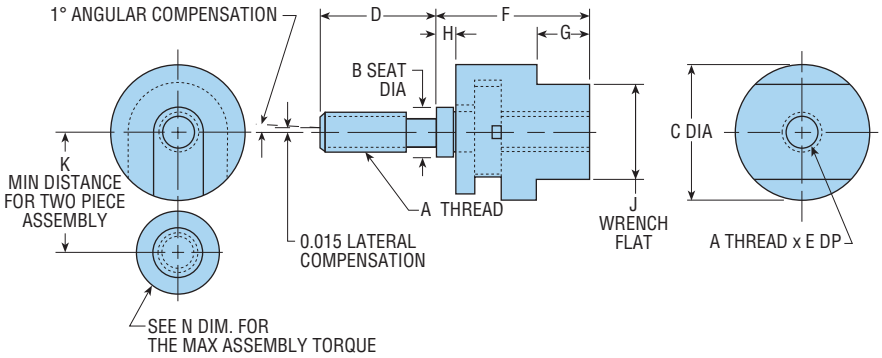
TO ORDER, SPECIFY THE MODEL NUMBER.




## MINIATURE COUPLERS

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

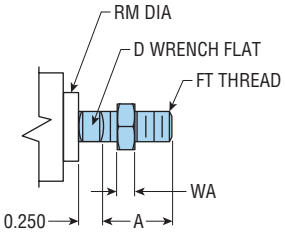
Rod Couplers are manufactured from high tensile and hardened steel components.



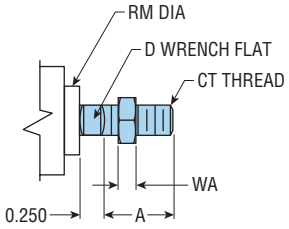

| MODEL NO. | LETTER DIMENSION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | J | K | N |
| 19300-01 | 5-40 | 0.160 | 0.440 | 0.375 | 0.250 | 0.500 | 0.170 | 0.066 | 5/16 | 0.390 | 20 in-lbs |
| 19300-02 | 10-32 | 0.250 | 0.560 | 0.500 | 0.281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

All dimensions are reference only unless specifically toleranced.

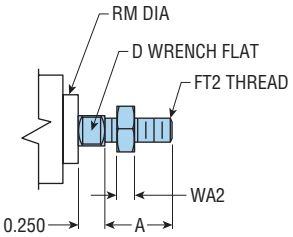
## STANDARD (#1 ROD END)



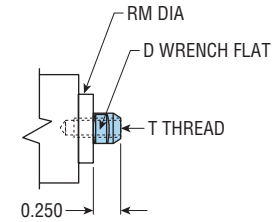

## L COARSE THREAD ROD END



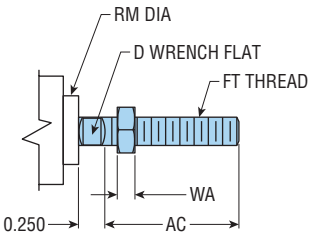

## G ROD END STYLE #2



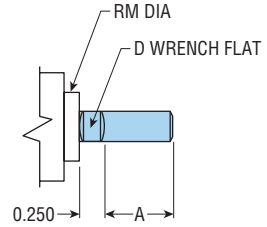

## I ROD END STYLE #4




## J ROD END STYLE #2X




## N PLAIN ROD END



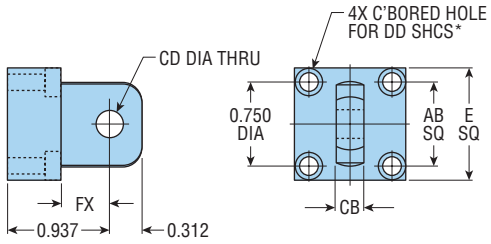

All standard rod ends have four wrench flats (two wrench flats with "I" option).

| 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 | 3/16 | 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.

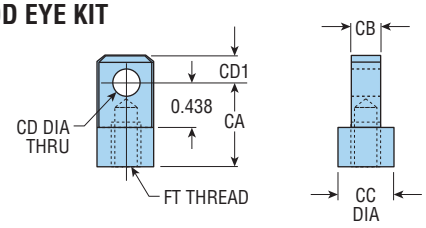
## EYE BRACKET KIT




| 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 |

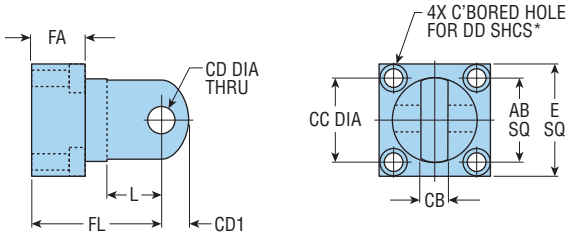
*FOR 3/4 BORE THRU HOLE ONLY.
**NOTE:** THESE BRACKETS MOUNT TO CUSTOMER MOUNTING SURFACE AND ARE USED WITH CORRESPONDING CYLINDER ROD CLEVIS KITS

## 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 |

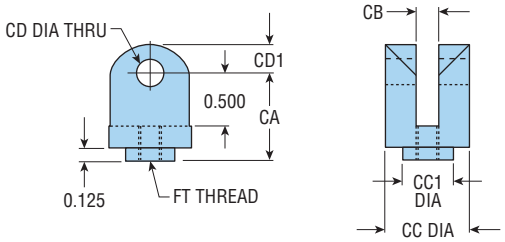
## CLEVIS BRACKET KIT - PIN INCLUDED




| 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.

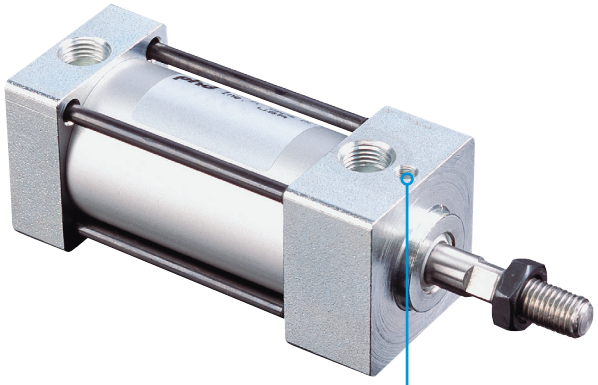
# AV & A Cleanroom

tom thumb®

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

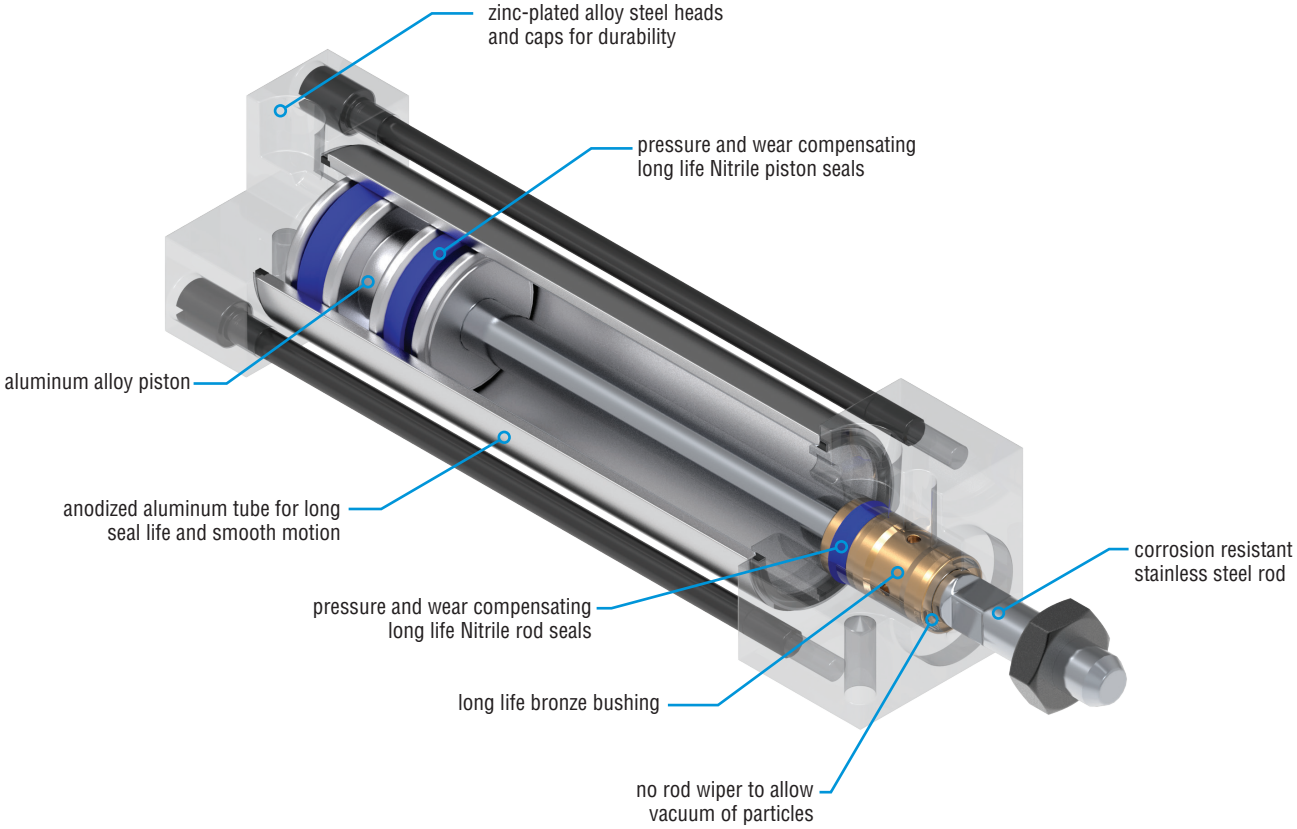
### Major Benefits

- 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**

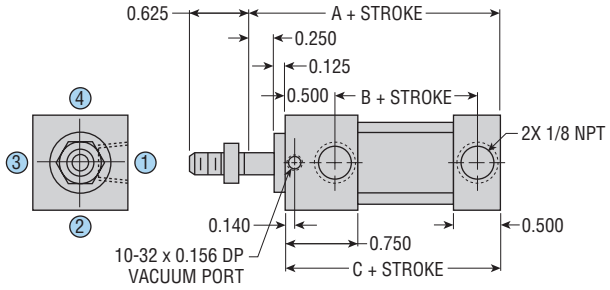
**MOUNTING STYLE**
F - Foot Mount, C'bored through holes
B - Bottom Mount, Tapped holes in head and cap
R - Rod Mount, Tapped holes on front face of head
T - Thread Mount, Threaded snout on head (shipped with mounting nut)
RF - Rod End Flange
CF - Cap End Flange
L - Pilot Mount, Threaded snout and pilot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

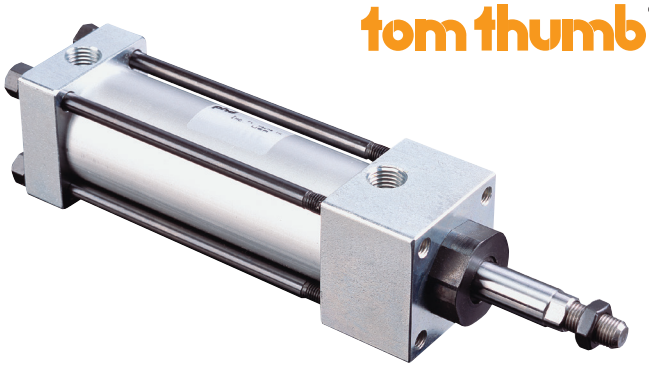
| | Imperial F = P x A |
|---|---|
| F = Cylinder Force | lbs |
| P = Operating Pressure | psi |
| A = Effective Area (Extend or Retract) | $in^2$ |

All dimensions are reference only unless specifically toleranced.

# AV & HV

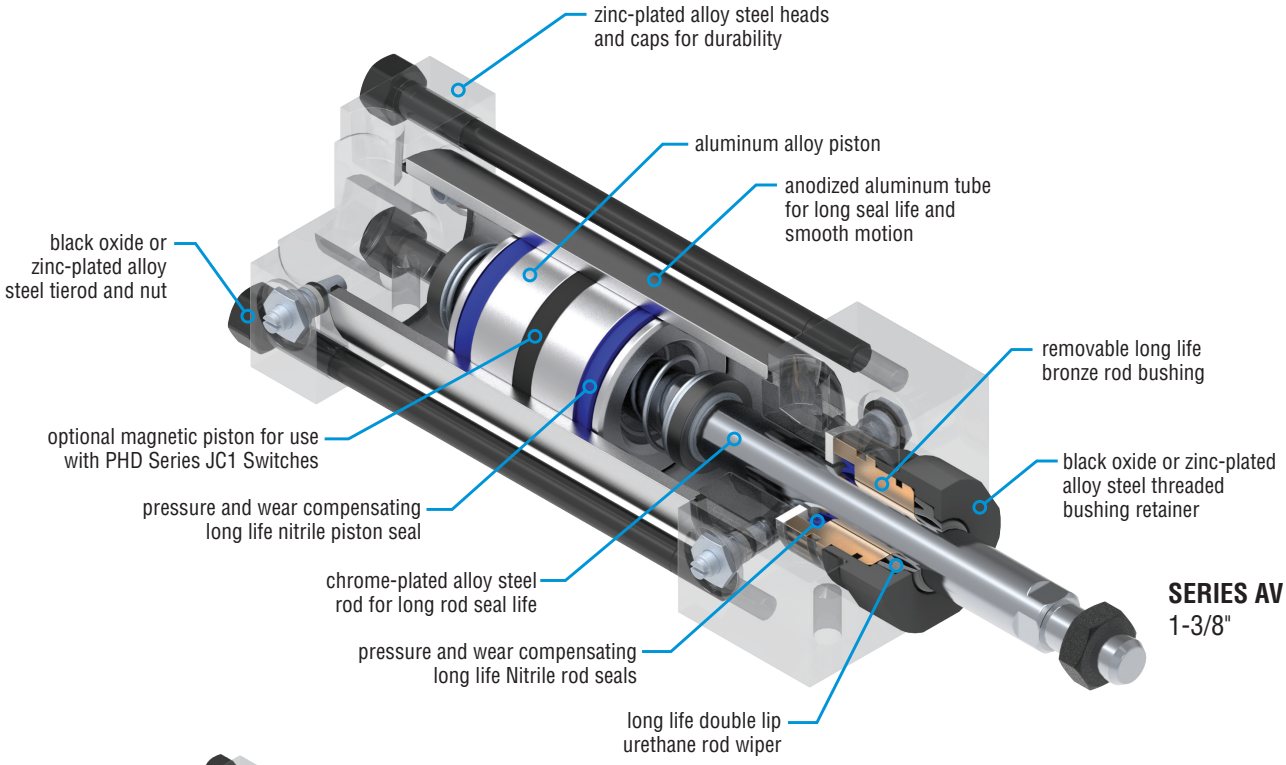
## 1-3/8" Bore

tom thumb®

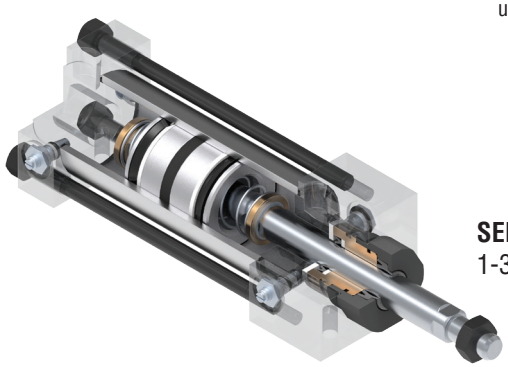


### Major Benefits

- 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 96.

**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 96 for dimensions) (see note 1)
I - #4 Rod End, Female thread on rod (see page 96 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 96 for dimensions)
_K - Extra Rod Extension, in 1/8" increments (see page 94) (see note 2)
L - Coarse Thread Rod End (see page 96 for dimensions) (see note 1)
M - Magnetic Piston for Series JC1 reed and teachable switches
N - Plain Rod End (see page 96 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

| CYLINDER SIZE | BRACKET NO. | DESCRIPTION |
|---|---|---|
| 1-3/8 | 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" | — | — | — |

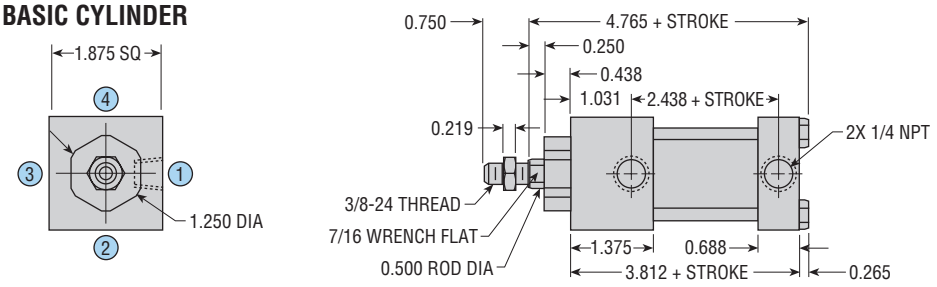
| SERIES | UNIT WEIGHTS (lb) | |
|---|---|---|
| | ZERO STROKE | ADDER PER INCH OF STROKE |
| PLAIN UNIT | 2.56 | 0.12 |

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

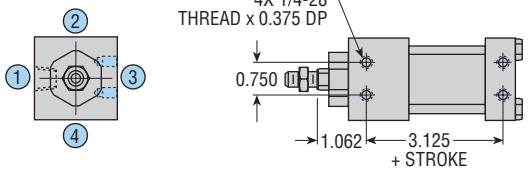
## Application & Sizing Assistance

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

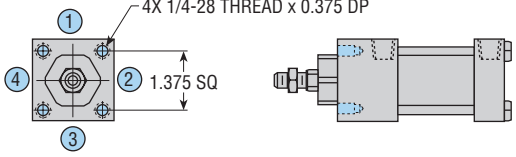
## SERIES AV/HV BASIC CYLINDER



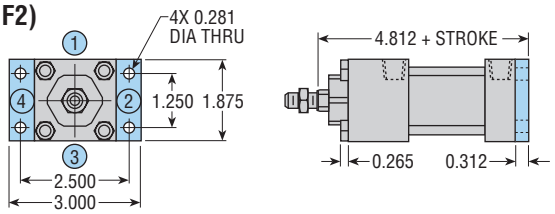

## B (MS4)



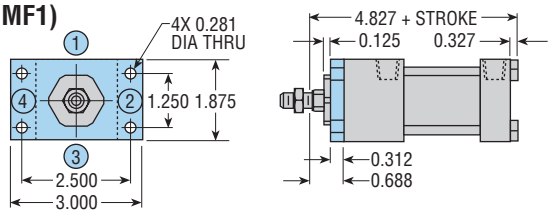

## R (MR1)



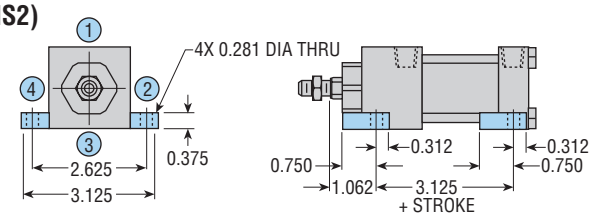

## CF (MF2)



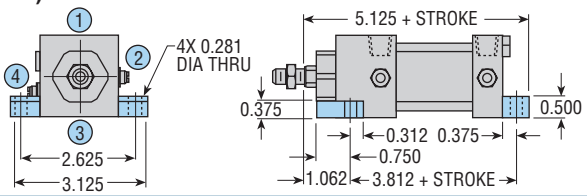

## RF (MF1)



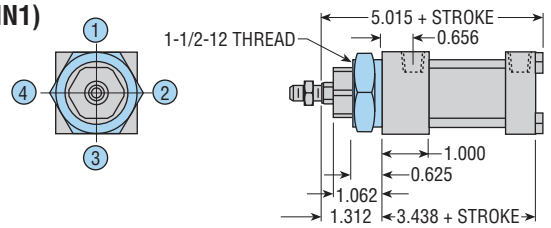

## F (MS2)



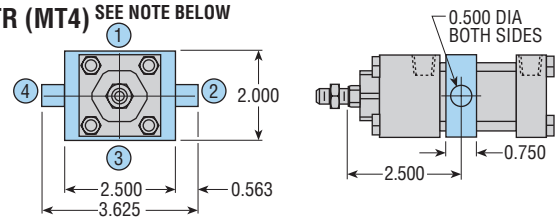

## F (MS2) - WITH PORT CONTROL & CUSHION ON CAP END



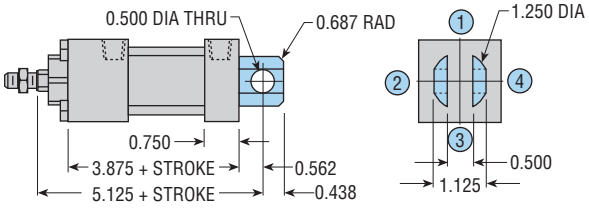

## T (MN1)



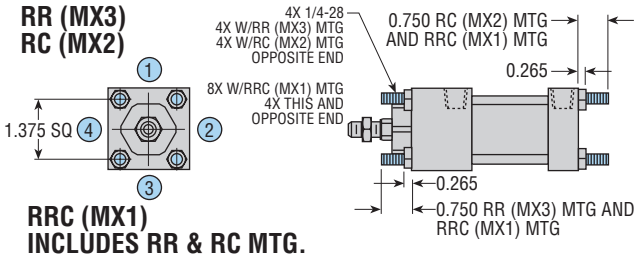

## TR (MT4) SEE NOTE BELOW




## K (MP1)




## RR (MX3) RC (MX2)



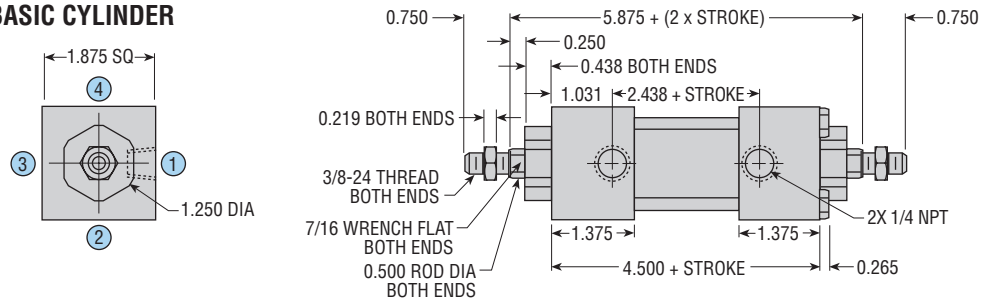

**RRC (MX1) INCLUDES RR & RC MTG.**

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

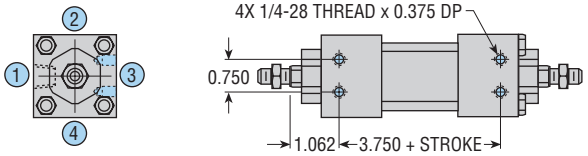
**PORT POSITIONS:** INDICATED BY CIRCLED NUMBERS
**CUSHIONS:** CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
**SHOCK PADS:** ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
**SPRING RETURN:** ADD AN ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)
**OVERSIZE RODS:** SEE PAGE 96 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.

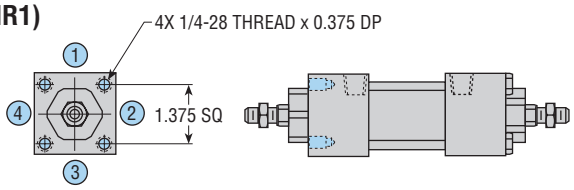
## SERIES DAV/DHV BASIC CYLINDER



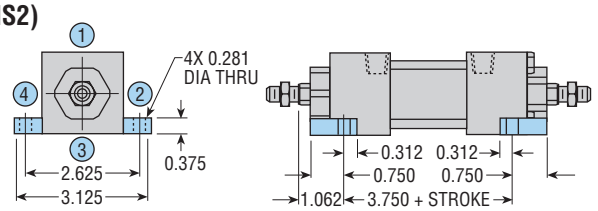

## B (MS4)



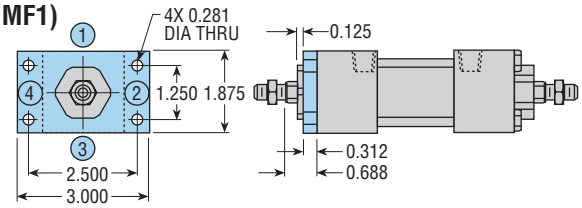

## R (MR1)



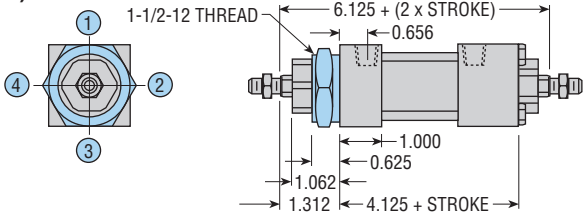

## F (MS2)



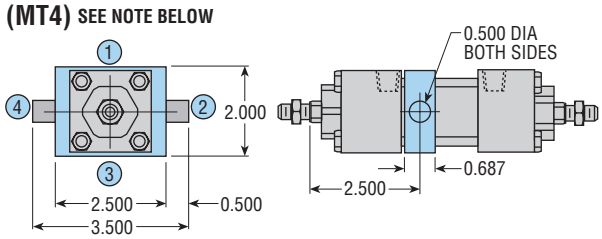

## RF (MF1)



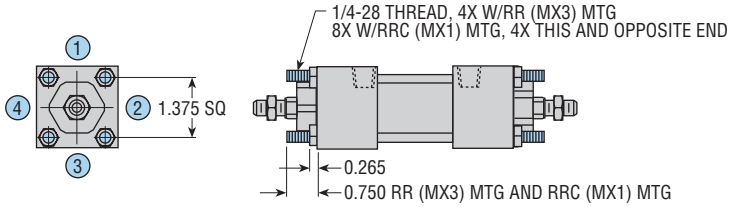

## T (MN1)




## 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).

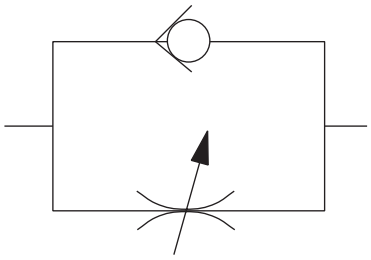
**PORT POSITIONS:** INDICATED BY CIRCLED NUMBERS
**CUSHIONS:** CYLINDER LENGTH IS NOT AFFECTED BY ADDITION OF CUSHIONS
**SHOCK PADS:** ADD 0.250 in TO ALL (+ STROKE) DIMENSIONS FOR EACH SHOCK PAD
**SPRING RETURN:** ADD AN ADDITIONAL STROKE LENGTH TO ALL (+ STROKE) DIMENSIONS (2 x STROKE)
**OVERSIZE RODS:** SEE PAGE 96 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



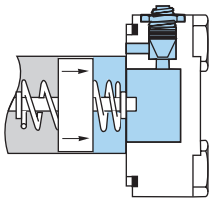
incoming fluids. The PHD Port Control® provides the optimum in speed control for small bore cylinders. It saves space and eliminates the cost of installation and fittings for external flow control valves.

## 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**

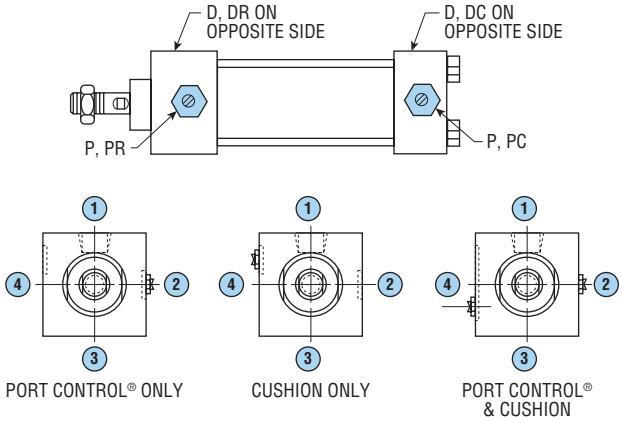


**1-3/8" BORE**

## 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.

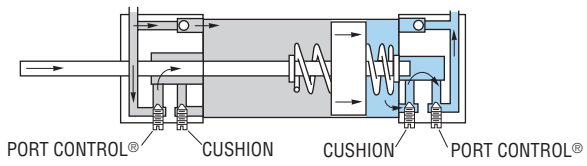
Location may vary depending on mounting and option combinations.




## 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**

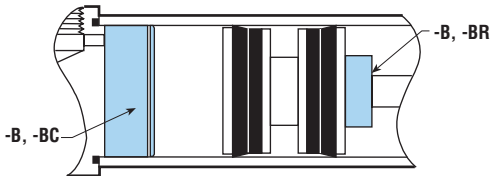


## B BC BR SHOCK PADS

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

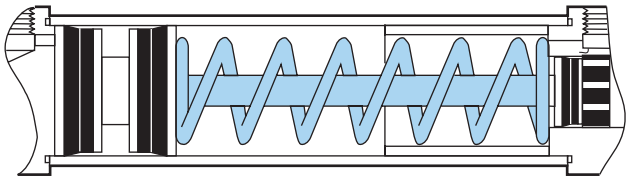
**Available in 1/4" increments**

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

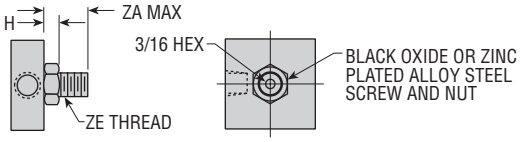
**(SERIES AV)**

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 |

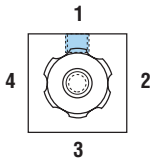
**Available with all options EXCEPT:**

- **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)**

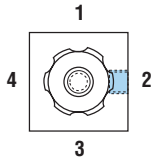



## PORT POSITIONS

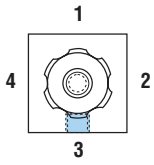
### STANDARD PORT POSITION 1



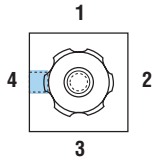

### R PORT POSITION 2




### T PORT POSITION 3




### U PORT POSITION 4



## E MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

PHD Cylinders can include a magnetic band (-E) on the piston to trigger external radial sensing solid state switches. These switches enable Tom Thumb® air or hydraulic cylinders to connect with different logic systems and work with the switches listed below.

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

## M MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

A magnetic band (-M) on the piston triggers externally mounted PHD Reed Switches and Two Position Teachable Switches. Reed switches use a physical element to close the circuit, whereas solid-state switches utilize magnetoresistive principles.

The Teachable Switch enables two programmable positions with one device – no fine tuning needed. Simply align the switch, position the actuator, and program the two positions.

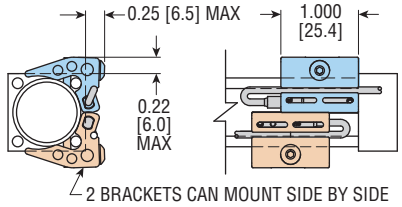
### SERIES JC1 MAGNETIC SWITCHES AND CORDSETS

| MAGNET OPTION | SENSING TYPE | OUTPUT / VOLTAGE | CABLE | SWITCH PART NO. | CORDSETS | |
|---|---|---|---|---|---|---|
| | | | | | 2 METER | 5 METER |
| -E [Radial] | Solid State | NPN / DC | 5 m, 3 Conductor | JC1HDN-5 | — | — |
| | | | .3 m, M8 3-Pin | JC1HDN-K | 63549-02 | 63549-05 |
| | | PNP / DC | 5 m, 3 Conductor | JC1HDP-5 | — | — |
| | | | .3 m, M8 3-Pin | JC1HDP-K | 63549-02 | 63549-05 |
| -M [Axial] | Reed | PNP or NPN / AC | .3 m, M12 4-Pin | JC1ADU-K | 81284-1-010 | — |
| | | PNP or NPN / DC | 5 m, 3 Conductor | JC1RDU-5 | — | — |
| | | | .3 m, M8 3-Pin | JC1RDU-K | 63549-02 | 63549-05 |
| | Solid State | PNP / DC Two Position Teachable | 2 m, 4 Conductor | JC1STP-2 | — | — |
| | | | 2 m, M8 4-Pin | JC1STP-K | — | 81284-1-001 |

### SWITCH MOUNTING BRACKET

| CYLINDER SIZE | BRACKET NO. |
|---|---|
| 1-3/8 | 92101 |

**NOTE:** Brackets are ordered separately.




## 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.

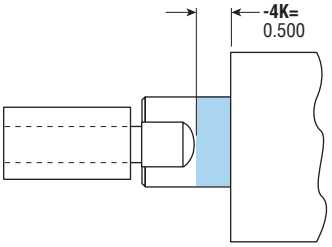
Maximum stroke for cylinders with close tolerance is 18".

**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.** ⊕

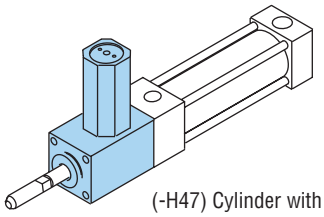
PHD's Rodlok is ideal for locking the piston rod while in a static/ stationary position. When the pressure is removed from the port of the Rodlok, the mechanism will grip the rod and prevent it from moving. The loads are held indefinitely without power. Rodlok performance is application and environment 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.

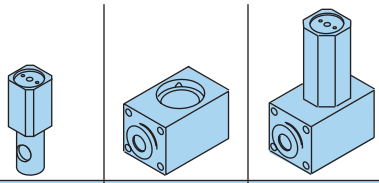


(-H47) Cylinder with rod locking device and adaptor preassembled

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

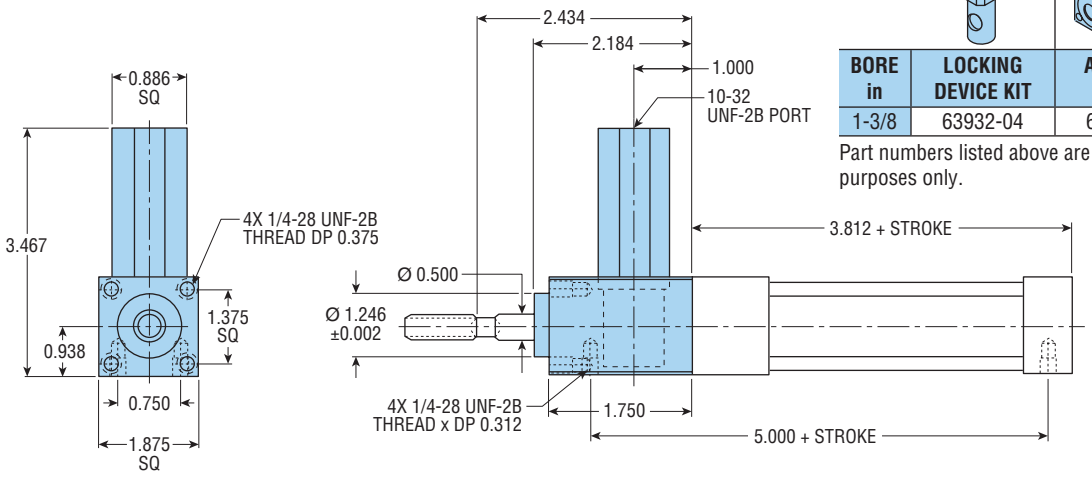
**NOTE:** *Locking force given is the actual locking force with a dry, clean rod and does not include any safety factor.

### 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.



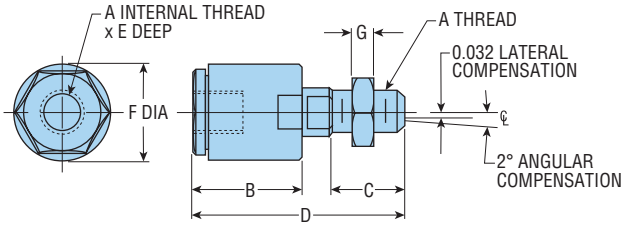

**NOTE:**
BREAKAWAY FORCE ON CYLINDERS WITH RODLOK APPROXIMATELY 30 psi.

# ACCESSORIES: Series AV & HV Cylinders - 1-3/8" Bore

## 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.



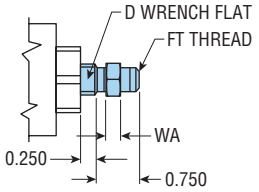

| MODEL NO. | LETTER DIMENSION | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G |
| 375 | 3/8-24 | 1.000 | 0.625 | 1.875 | 0.500 | 0.875 | 0.219 |
| 437 | 7/16-20 | 1.125 | 0.650 | 2.187 | 0.500 | 1.000 | 0.250 |
| 500 | 1/2-20 | 1.125 | 0.650 | 2.187 | 0.500 | 1.000 | 0.312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

To order, specify the model number.

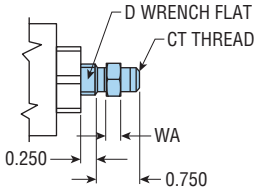
All dimensions are reference only unless specifically toleranced.

## 1-3/8" BORE CYLINDERS

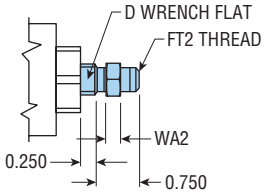
### G
### ROD END STYLE #2
### STANDARD ON:
### (1-3/8" BORE)



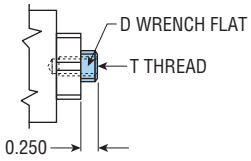

### L
### COARSE THREAD ROD END



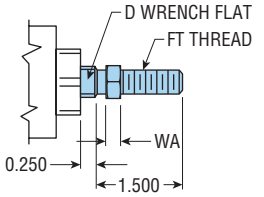

### F
### ROD END STYLE #1



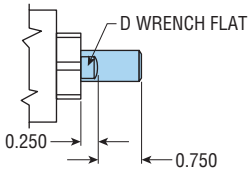

### I
### ROD END STYLE #4




### J
### ROD END STYLE #2X




### N
### PLAIN ROD END

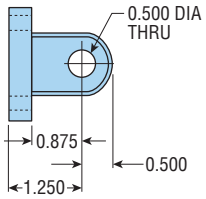


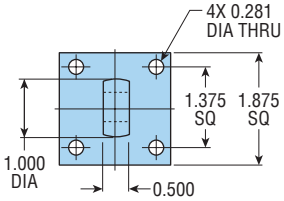

All standard rod ends have four wrench flats (two wrench flats with "I" option).

| 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.

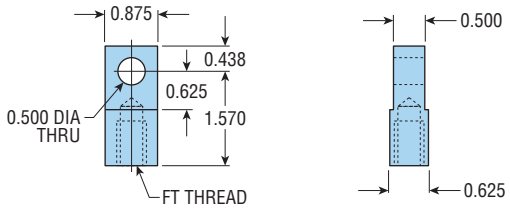
### EYE BRACKET KIT



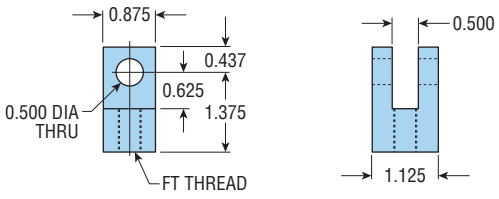

| BORE SIZE | PART NO. |
|---|---|
| 1-3/8 | 1330 |

### 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.