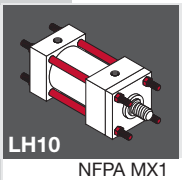
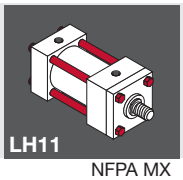
milwaukee *Cylinder*

# Series LH



NFPA MX1



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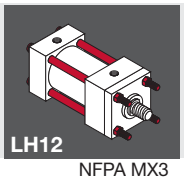

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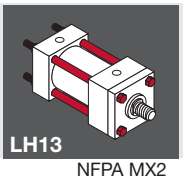

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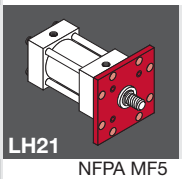

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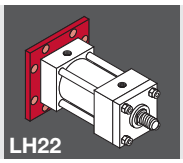

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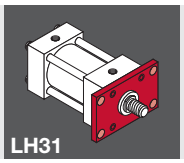

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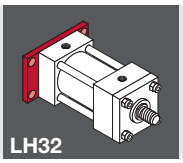

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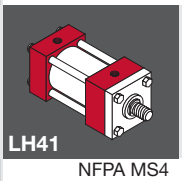

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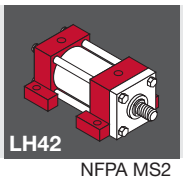

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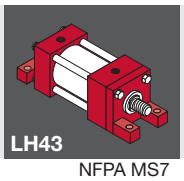
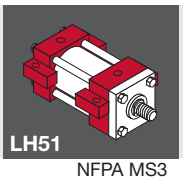


NFPA MS7



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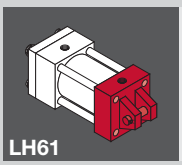

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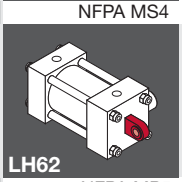

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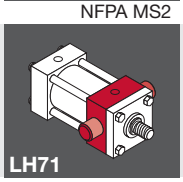

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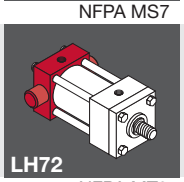

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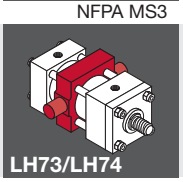

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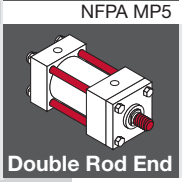
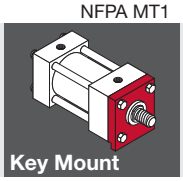


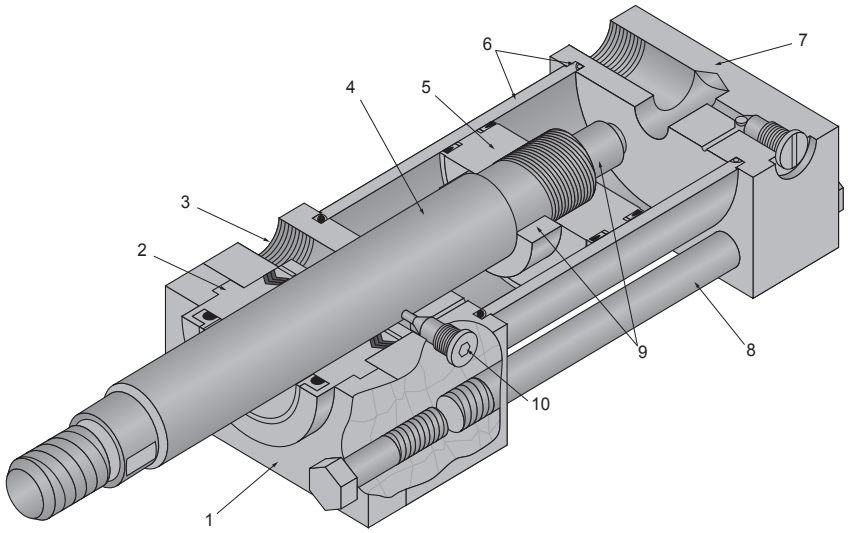
NFPA MDX




***Milwaukee Cylinder* Series LH Low Pressure Hydraulic Cylinders** are built to perform on the toughest applications. The nominal pressure for Series LH ranges from 750 psi to 1500 psi, depending on bore size. Advanced engineering, combined with quality materials and expert workmanship, contribute to the making of a rugged, top quality low-pressure hydraulic cylinder that will provide a long, maintenance-free service life.

## STANDARD SPECIFICATIONS

- Standard construction – square head – tie rod design
- Nominal pressure – 750 psi to 1500 psi (range varies by bore size)
- Standard fluid-hydraulic oil
- Standard temperature – -20° F to +200° F
- Standard bore sizes – 1½" to 6"
- Standard piston rod diameters ⅝" thru 4"
- Standard mounting styles – 17 standard styles plus custom designs to suit your needs
- Strokes – available in any practical stroke length
- Cushions – available at either or both ends of stroke
- Standard 7 rod end styles, plus specials designed to order
- Rod end style $KK_2$ - is studded as standard for ⅝" and 1" diameter rods. Studded rod end style is available for all rod sizes.

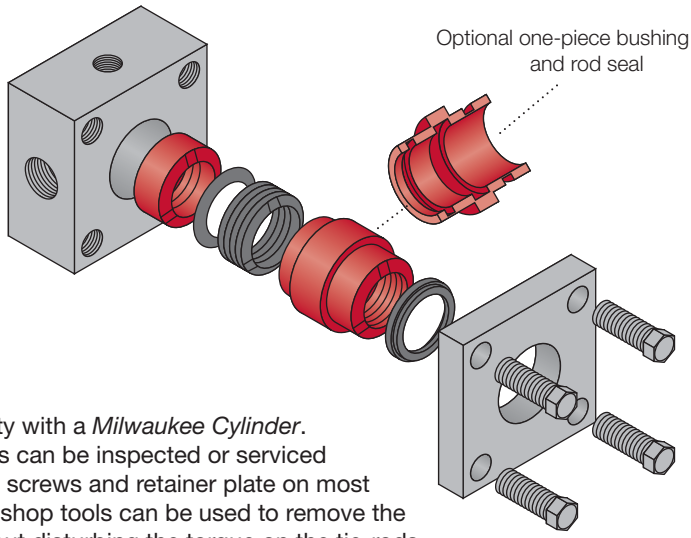



## STANDARD FEATURES

1. **Removable Retainer Plate**
   The retainer plate and rod bushing are externally removable without disassembling the cylinder on most standard models. Four capscrews securely hold and lock the retainer plate in place.
2. **Rod Bushing and Seals**
   A combination of spring loaded multiple lip vee rings with a supporting bronze bushing is standard in *Milwaukee Cylinder* Series LH Cylinders.
3. **Ports**
   Large NPTF cylinder ports are standard and can be located to customer requirements. SAE ports available upon request.
4. **Piston Rod**
   The piston rod is of high strength steel, hardened and plated to resist scoring and corrosion to assure maximum seal life.
5. **Piston**
   The Series LH piston is precision machined from fine grained iron alloy. It is pilot fitted and threaded to the piston rod.
6. **Cylinder Barrel and Seals**
   The barrel is of chrome plated steel tubing, honed to a fine finish to assure superior sealing, minimum friction and maximum seal life. It is step cut on the I.D. of both ends for O-ring seals.
7. **End Caps**
   End caps and mountings are of high quality steel, precision machined for accurate mounting.
8. **Tie-Rods**
   The tie rods are constructed from a high quality medium carbon steel. The threads are accurately rolled for rigid engagement of the nuts.
9. **Cushions**
   Cushions are machined to close tolerance to provide positive, smooth deceleration at the end of stroke. On all bore sizes we provide the longest cushion possible, based on the rod size and blind end caps. Longer cushions are available; for further information, consult factory.
10. **Cushion Needle Adjustment and Ball Check**
    The cushion needle adjustment valve and cushion-check ball retainer screw are specifically designed to provide full cushion adjustment.

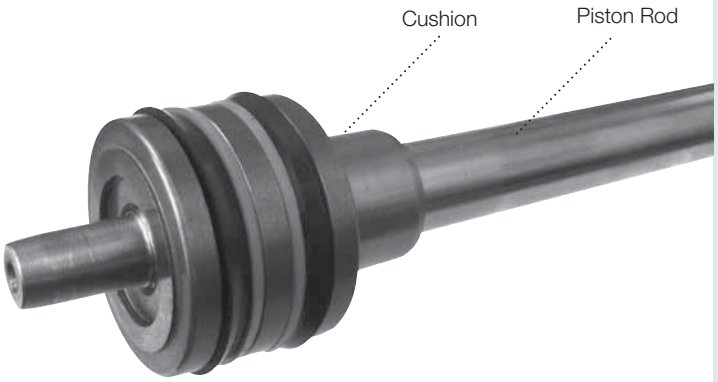
***MilCad* Cylinder Configurator**

Visit **milwaukeecylinder.com** to configure and download CAD files of your cylinders.




## Simple Maintenance…

Simple maintenance is reality with a *Milwaukee Cylinder*. The rod bushing or rod seals can be inspected or serviced by merely removing the cap screws and retainer plate on most models. Standard available shop tools can be used to remove the rod bushing and seals without disturbing the torque on the tie-rods, assuring performance quality with maintenance ease.




## Cushions…

The cushion is of a high grade alloy, precision machined and specially tapered to provide smooth deceleration of the piston at the end of stroke. The rod end cushion bushing is floated with an O-ring to compensate for minor misalignments during normal operation.

## Piston Rod…

The piston rod is hardened, plated high strength steel, machined and processed to resist scoring and corrosion, assuring maximum life. *Milwaukee Cylinder* offers seven rod end styles as standard. **The style #2 rod end with two wrench flats is furnished as standard** unless otherwise specified. Special rod ends and extra wrench flats are also available. They must be specified at the time of order, giving the dimensional requirements and the location of additional wrench flats.

## COMBINATION ROD SEAL DESIGN…

The *Milwaukee Cylinder* Series LH cylinder combines spring loaded multiple lip vee rings with a supporting bronze bushing and a double lip wiper as a secondary seal. This proven rod seal design combination is effective at both high and low pressures. It affords maximum sealing and an extra long bearing support.

As an optional design, a one-piece rod bushing with a double lip rod seal and a double lip wiper is available. Metallic rod scrapers may be supplied on request, in place of the double lip wiper with either rod bushing design.

The unique versatility of the *Milwaukee Cylinder* Series LH design makes available a selection of seals to meet all types of service conditions.

## PISTON AND SEAL COMBINATION

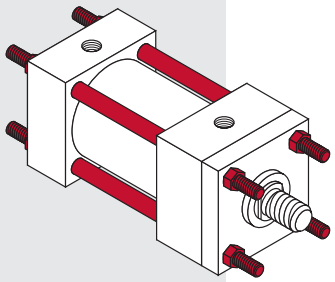
The *Milwaukee Cylinder* Series LH cylinder combines two u-cup seals and a fine grained iron alloy. This proven design combines low friction and smooth break away with the near zero leakage of the block vee seal.

**For Package and Mounting Dimension see Tables 1LH and 2LH.**

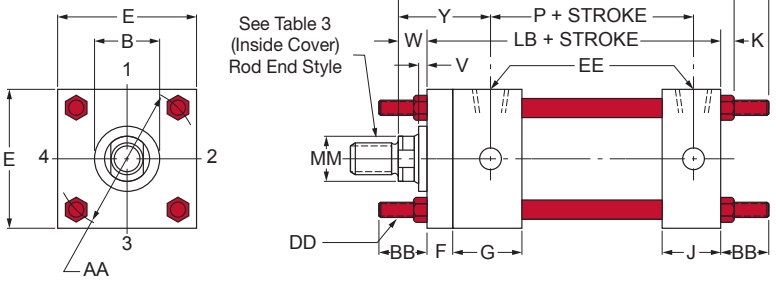
## TIE ROD MOUNTED CYLINDERS

Tie-rod mounts are suited for many applications and are similar to flange mounts, but tie-rod mounts are not as rigid as the flange type of mounting. The best use of tie-rods extended on the blind end is in a thrust load application. When using tie-rods extended on the rod end, the best appllication is a tension load. When long strokes are required, the free end should be supported to prevent misalignment, sagging or possible binding of the cylinder.

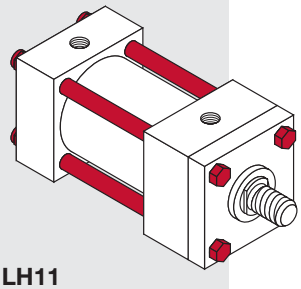
### TIE RODS EXTENDED BOTH ENDS



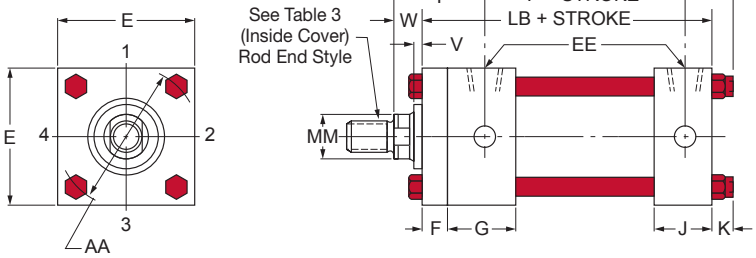
**MODEL LH10**
**NFPA STYLE MX1**



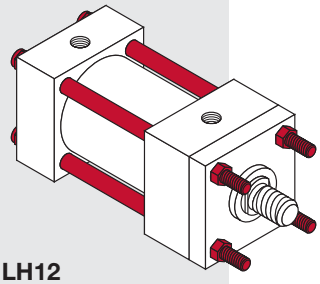

### NO TIE ROD EXTENSION



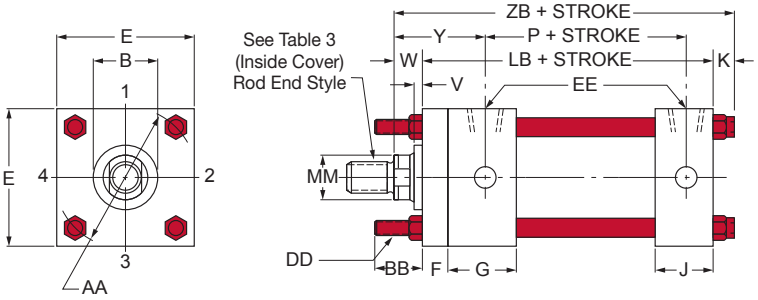
**MODEL LH11**
**NFPA STYLE MX**



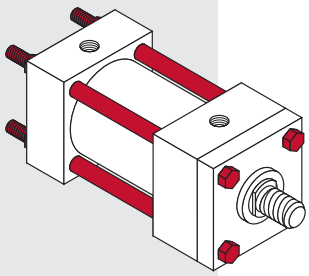

### TIE RODS EXTENDED ROD END



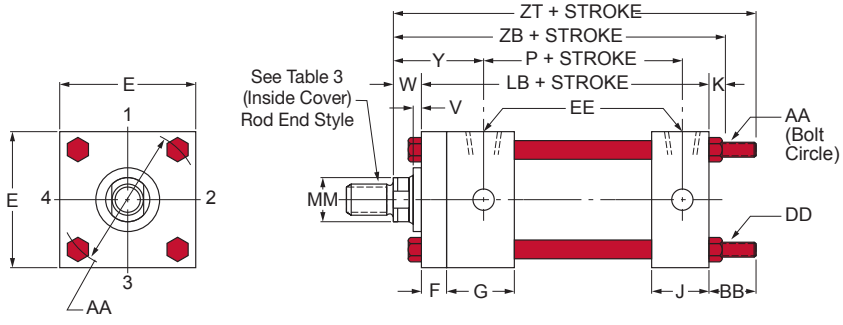
**MODEL LH12**
**NFPA STYLE MX3**




### TIE RODS EXTENDED BLIND END



**MODEL LH13**
**NFPA STYLE MX2**



## ▼ TABLE 1LH

**The dimensions given on this table are affected by the piston rod diameter and the stroke.**

| Bore Ø | Rod MM | Cylinder Code ♦ | B | LB | P | V | W | Y | ZB | ZT |
|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | ⅝ | LH0051 | 1⅛ | 4 | 2¼ | ¼ | ⅝ | 1 15/16 | 5 | 5⅝ |
| | •1 | LH0052 | 1½ | | | ½ | 1 | 2 5/16 | 5⅜ | 6 |
| 2 | ⅝ | LH0510 | 1⅛ | 4 | 2¼ | ¼ | ⅝ | 1 15/16 | 5 1/16 | 5¾ |
| | 1 | LH0511 | 1½ | | | ½ | 1 | 2 5/16 | 5 7/16 | 6⅛ |
| | •1⅜ | LH0512 | 2 | | | ⅝ | 1¼ | 2 9/16 | 5 11/16 | 6⅜ |
| 2½ | ⅝ | LH0520 | 1⅛ | 4⅛ | 2⅜ | ¼ | ⅝ | 1 15/16 | 5 3/16 | 5⅞ |
| | 1 | LH0521 | 1½ | | | ½ | 1 | 2 5/16 | 5 9/16 | 6¼ |
| | 1⅜ | LH0522 | 2 | | | ⅝ | 1¼ | 2 9/16 | 5 13/16 | 6½ |
| | •1¾ | LH0523 | 2⅜ | | | ¾ | 1½ | 2 13/16 | 6 1/16 | 6¾ |
| 3¼ | 1 | LH0530 | 1½ | 4⅞ | 2⅝ | ¼ | ¾ | 2 7/16 | 6⅛ | 7 |
| | 1⅜ | LH0531 | 2 | | | ⅜ | 1 | 2 11/16 | 6⅜ | 7¼ |
| | 1¾ | LH0532 | 2⅜ | | | ½ | 1¼ | 2 15/16 | 6⅝ | 7½ |
| | 2 | LH0533 | 2⅝ | | | ½ | 1⅜ | 3 1/16 | 6¾ | 7⅝ |
| 4 | 1 | LH0540 | 1½ | 4⅞ | 2⅝ | ¼ | ¾ | 2 7/16 | 6⅛ | 7 |
| | 1⅜ | LH0541 | 2 | | | ⅜ | 1 | 2 11/16 | 6⅜ | 7¼ |
| | 1¾ | LH0542 | 2⅜ | | | ½ | 1¼ | 2 15/16 | 6⅝ | 7½ |
| | 2 | LH0543 | 2⅝ | | | ½ | 1⅜ | 3 1/16 | 6¾ | 7⅝ |
| | 2½ | LH0544 | 3⅛ | | | ⅝ | 1⅝ | 3 5/16 | 7 | 7⅞ |
| 5 | 1 | LH0550 | 1½ | 5⅛ | 2⅞ | ¼ | ¾ | 2 7/16 | 6 7/16 | 7 11/16 |
| | 1⅜ | LH0551 | 2 | | | ⅜ | 1 | 2 11/16 | 6 11/16 | 7 15/16 |
| | 1¾ | LH0552 | 2⅜ | | | ½ | 1¼ | 2 15/16 | 6 15/16 | 8 3/16 |
| | 2 | LH0553 | 2⅝ | | | ½ | 1⅜ | 3 1/16 | 7 1/16 | 8 5/16 |
| | 2½ | LH0554 | 3⅛ | | | ⅝ | 1⅝ | 3 5/16 | 7 5/16 | 8 9/16 |
| | 3 | LH0555 | 3¾ | | | ⅝ | 1⅝ | 3 5/16 | 7 5/16 | 8 9/16 |
| | 3½ | LH0556 | 4¼ | | | ⅝ | 1⅝ | 3 5/16 | 7 5/16 | 8 9/16 |
| 6 | 1⅜ | LH0560 | 2 | 5¾ | 3⅛ | ¼ | ⅞ | 2 13/16 | 7 3/16 | 8 7/16 |
| | 1¾ | LH0561 | 2⅜ | | | ⅜ | 1⅛ | 3 1/16 | 7 7/16 | 8 11/16 |
| | 2 | LH0562 | 2⅝ | | | ⅜ | 1¼ | 3 3/16 | 7 9/16 | 8 13/16 |
| | 2½ | LH0563 | 3⅛ | | | ½ | 1½ | 3 7/16 | 7 13/16 | 9 1/16 |
| | 3 | LH0564 | 3¾ | | | ½ | 1½ | 3 7/16 | 7 13/16 | 9 1/16 |
| | 3½ | LH0565 | 4¼ | | | ½ | 1½ | 3 7/16 | 7 13/16 | 9 1/16 |
| | 4 | LH0566 | 4¾ | | | ½ | 1½ | 3 7/16 | 7 13/16 | 9 1/16 |

## ▼ TABLE 2LH

**The dimensions are constant regardless of rod diameter or stroke.**

| Bore Ø | AA | BB | DD | E | EE NPT | EE SAE | F | G | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | 2.02 | 1 | ¼-28 | 2 | ⅜ | #6 | ⅜ | 1½ | 1 | ⅜ |
| 2 | 2.60 | 1⅛ | 5/16-24 | 2½ | ⅜ | #6 | ⅜ | 1½ | 1 | 7/16 |
| 2½ | 3.10 | 1⅛ | 5/16-24 | 3 | ⅜ | #6 | ⅜ | 1½ | 1 | 7/16 |
| 3¼ | 3.90 | 1⅜ | ⅜-24 | 3¾ | ½ | #10 | ⅝ | 1¾ | 1¼ | ½ |
| 4 | 4.70 | 1⅜ | ⅜-24 | 4½ | ½ | #10 | ⅝ | 1¾ | 1¼ | ½ |
| 5 | 5.80 | 1 13/16 | ½-20 | 5½ | ½ | #10 | ⅝ | 1¾ | 1¼ | 9/16 |
| 6 | 6.90 | 1 13/16 | ½-20 | 6½ | ¾ | #12 | ¾ | 2 | 1½ | 9/16 |

### HOW TO ORDER

**For ordering information refer to Page 68.**

**NOTES:**

- ♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DLH0051 (Refer to page 62.)
- • Available with fixed-non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.

**Rod End Styles and Dimensions**

For rod end styles and dimensions see the Table 3 in the inside cover of the catalog.

Page ii

***MilCad* Cylinder Configuator**

Visit **milwaukeecylinder.com** to configure and download CAD files of your cylinders.

**Recommended Pressure Rating**

| Bore Ø | Pressure Rating (psi) |
|---|---|
| 1½ | 1500 |
| 2 | 1500 |
| 2½ | 1500* |
| 3¼ | 1500 |
| 4 | 1000 |
| 5 | 1000* |
| 6 | 750 |

***NOTE:**

2½" Bore, ⅝" Rod, Rating 1000 psi
5" Bore, 1" Rod, Rating 750 psi

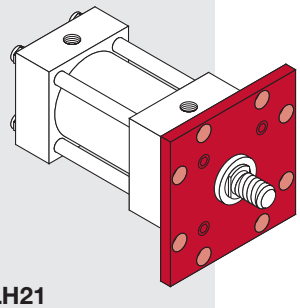
**For Package and Mounting Dimension see Tables 1LH and 2LH.**

## FLANGE MOUNTED CYLINDERS

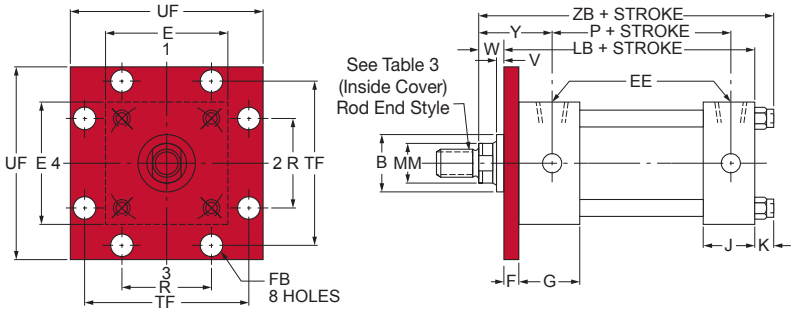
The flange mount is one of the strongest, most rigid methods of mounting. With this type of mount there is little allowance for misalignment, though when long strokes are required, the free end opposite the mounting should be supported to prevent sagging and possible binding of the cylinder.

The best use of a blind end flange is in a thrust load application (rod in compression). Rod end flange mounts are best used in tension applications. When a less rigid mount can be used and the cylinder can be attached to a panel or bulkhead, an extended tie-rod mounting could be considered.

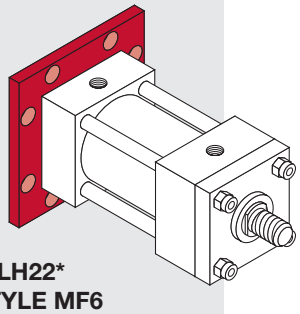
### ROD SQUARE FLANGE MOUNTING



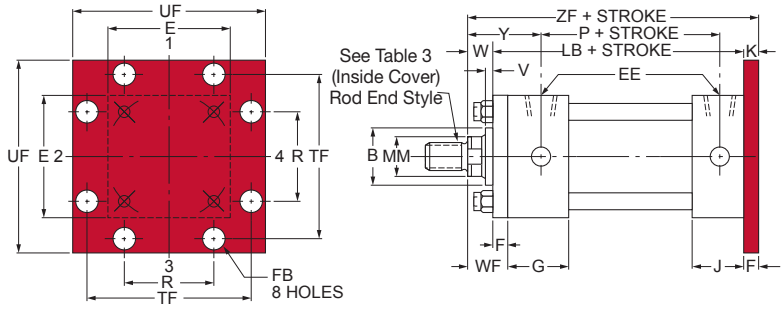
**MODEL LH21**
**NFPA STYLE MF5**



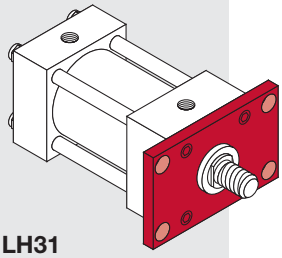

### BLIND SQUARE FLANGE MOUNTING



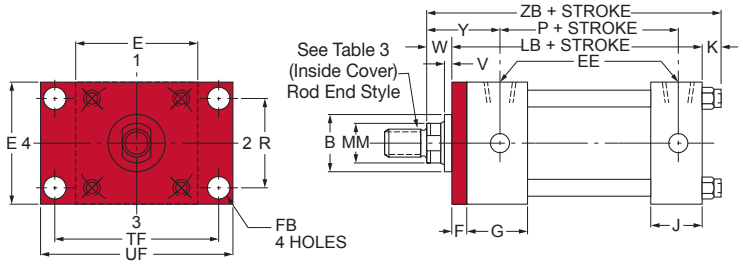
**MODEL LH22***
**NFPA STYLE MF6**



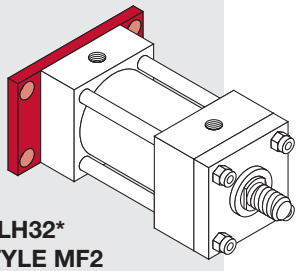

### ROD RECTANGULAR FLANGE MOUNTING



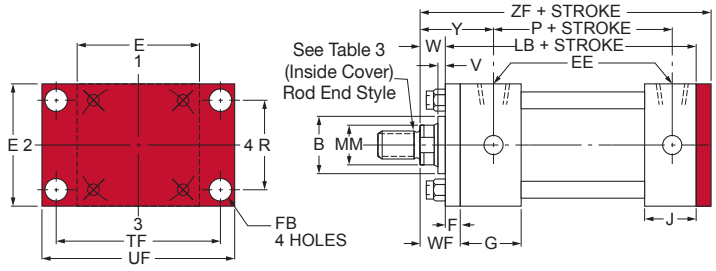
**MODEL LH31**
**NFPA STYLE MF1**




### BLIND RECTANGULAR FLANGE MOUNTING



**MODEL LH32***
**NFPA STYLE MF2**



## ▼ TABLE 1LH

**The dimensions given on this table are affected by the piston rod diameter and the stroke.**

| Bore Ø | Rod MM | Cylinder Code ♦ | B | LB | P | V | W | Y | ZB | ZF |
|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | ⅝ | LH0051 | 1⅛ | 4 | 2¼ | ¼ | ⅝ | 1 15/16 | 5 | 5 |
| | •1* | LH0052 | 1½ | | | ½ | 1 | 2 5/16 | 5⅜ | 5⅜ |
| 2 | ⅝ | LH0510 | 1⅛ | 4 | 2¼ | ¼ | ⅝ | 1 15/16 | 5 1/16 | 5 |
| | 1 | LH0511 | 1½ | | | ½ | 1 | 2 5/16 | 5 7/16 | 5⅜ |
| | •1⅜* | LH0512 | 2 | | | ⅝ | 1¼ | 2 9/16 | 5 11/16 | 5⅝ |
| 2½ | ⅝ | LH0520 | 1⅛ | 4⅛ | 2⅜ | ¼ | ⅝ | 1 15/16 | 5 3/16 | 5⅛ |
| | 1 | LH0521 | 1½ | | | ½ | 1 | 2 5/16 | 5 9/16 | 5½ |
| | 1⅜ | LH0522 | 2 | | | ⅝ | 1¼ | 2 9/16 | 5 13/16 | 5¾ |
| | •1¾* | LH0523 | 2⅜ | | | ¾ | 1½ | 2 13/16 | 6 1/16 | 6 |
| 3¼ | 1 | LH0530 | 1½ | 4⅞ | 2⅝ | ¼ | ¾ | 2 7/16 | 6⅛ | 6¼ |
| | 1⅜ | LH0531 | 2 | | | ⅜ | 1 | 2 11/16 | 6⅜ | 6½ |
| | 1¾ | LH0532 | 2⅜ | | | ½ | 1¼ | 2 15/16 | 6⅝ | 6¾ |
| | 2* | LH0533 | 2⅝ | | | ½ | 1⅜ | 3 1/16 | 6¾ | 6⅞ |
| 4 | 1 | LH0540 | 1½ | 4⅞ | 2⅝ | ¼ | ¾ | 2 7/16 | 6⅛ | 6¼ |
| | 1⅜ | LH0541 | 2 | | | ⅜ | 1 | 2 11/16 | 6⅜ | 6½ |
| | 1¾ | LH0542 | 2⅜ | | | ½ | 1¼ | 2 15/16 | 6⅝ | 6¾ |
| | 2 | LH0543 | 2⅝ | | | ½ | 1⅜ | 3 1/16 | 6¾ | 6⅞ |
| | 2½* | LH0544 | 3⅛ | | | ⅝ | 1⅝ | 3 5/16 | 7 | 7⅛ |
| 5 | 1 | LH0550 | 1½ | 5⅛ | 2⅞ | ¼ | ¾ | 2 7/16 | 6 7/16 | 6½ |
| | 1⅜ | LH0551 | 2 | | | ⅜ | 1 | 2 11/16 | 6 11/16 | 6¾ |
| | 1¾ | LH0552 | 2⅜ | | | ½ | 1¼ | 2 15/16 | 6 15/16 | 7 |
| | 2 | LH0553 | 2⅝ | | | ½ | 1⅜ | 3 1/16 | 7 1/16 | 7⅛ |
| | 2½ | LH0554 | 3⅛ | | | ⅝ | 1⅝ | 3 5/16 | 7 5/16 | 7⅜ |
| | 3 | LH0555 | 3¾ | | | ⅝ | 1⅝ | 3 5/16 | 7 5/16 | 7⅜ |
| | 3½* | LH0556 | 4¼ | | | ⅝ | 1⅝ | 3 5/16 | 7 5/16 | 7⅜ |
| 6 | 1⅜ | LH0560 | 2 | 5¾ | 3⅛ | ¼ | ⅞ | 2 13/16 | 7 3/16 | 7⅜ |
| | 1¾ | LH0561 | 2⅜ | | | ⅜ | 1⅛ | 3 1/16 | 7 7/16 | 7⅝ |
| | 2 | LH0562 | 2⅝ | | | ⅜ | 1¼ | 3 3/16 | 7 9/16 | 7¾ |
| | 2½ | LH0563 | 3⅛ | | | ½ | 1½ | 3 7/16 | 7 13/16 | 8 |
| | 3 | LH0564 | 3¾ | | | ½ | 1½ | 3 7/16 | 7 13/16 | 8 |
| | 3½ | LH0565 | 4¼ | | | ½ | 1½ | 3 7/16 | 7 13/16 | 8 |
| | 4 | LH0566 | 4¾ | | | ½ | 1½ | 3 7/16 | 7 13/16 | 8 |

## ▼ TABLE 2LH

**The dimensions are constant regardless of rod diameter or stroke.**

| Bore Ø | E | EE NPT | EE SAE | F | FB | G | J | K | R | TF | UF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | 2 | ⅜ | #6 | ⅜ | 5/16 | 1½ | 1 | ⅜ | 1.43 | 2¾ | 3⅜ |
| 2 | 2½ | ⅜ | #6 | ⅜ | ⅜ | 1½ | 1 | 7/16 | 1.84 | 3⅜ | 4⅛ |
| 2½ | 3 | ⅜ | #6 | ⅜ | ⅜ | 1½ | 1 | 7/16 | 2.19 | 3⅞ | 4⅝ |
| 3¼ | 3¾ | ½ | #10 | ⅝ | 7/16 | 1¾ | 1¼ | ½ | 2.76 | 4 11/16 | 5½ |
| 4 | 4½ | ½ | #10 | ⅝ | 7/16 | 1¾ | 1¼ | ½ | 3.32 | 5 7/16 | 6¼ |
| 5 | 5½ | ½ | #10 | ⅝ | 9/16 | 1¾ | 1¼ | 9/16 | 4.10 | 6⅝ | 7⅝ |
| 6 | 6½ | ¾ | #12 | ¾ | 9/16 | 2 | 1½ | 9/16 | 4.88 | 7⅝ | 8⅝ |

### HOW TO ORDER

**For ordering information refer to Page 68.**

**NOTES:**

♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DLH0051 (Refer to page 62.)

• Available with fixed-non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.

* Removable retainer not available for these bore and rod combinations in the LH22 and LH32 mounting styles.

**Rod End Styles and Dimensions**

For rod end styles and dimensions see the Table 3 in the inside cover of the catalog.

Page ii

***MilCad* Cylinder Configurator**

Visit **milwaukeecylinder.com** to configure and download CAD files of your cylinders.

**Recommended Pressure Rating**

| Bore Ø | Pressure Rating (psi) |
|---|---|
| 1½ | 1500 |
| 2 | 1500 |
| 2½ | 1500* |
| 3¼ | 1500 |
| 4 | 1000 |
| 5 | 1000* |
| 6 | 750 |

***NOTE:**

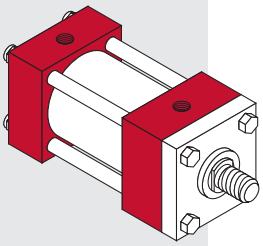
2½" Bore, ⅝" Rod, Rating 1000 psi
5" Bore, 1" Rod, Rating 750 psi

**For Package and Mounting Dimension see Tables 1LH and 2LH.**

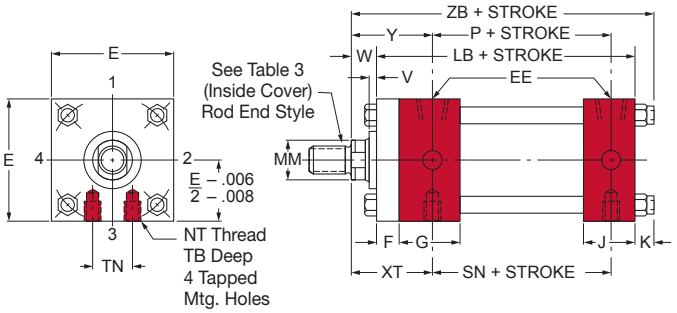
## SIDE OR LUG MOUNTED CYLINDERS

The side or lug mounted cylinder provides a fairly rigid mount. These types of cylinders can tolerate a slight amount of misalignment when the cylinder is at full stroke, but as the piston moves toward the blind end, the tolerance for misalignment decreases. It is important to note that if the cylinder is used properly (without misalignment), the mounting bolts are either in simple shear or tension without any compound stresses.

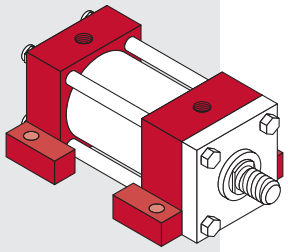
### TAPPED HOLES IN CAPS FLUSH MOUNTING



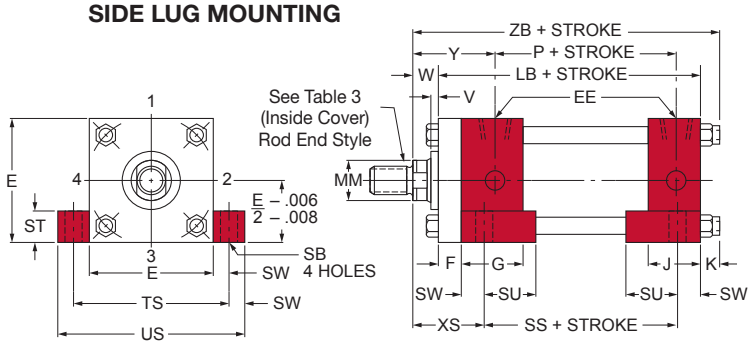
**MODEL LH41**
**NFPA STYLE MS4**




### SIDE LUG MOUNTING

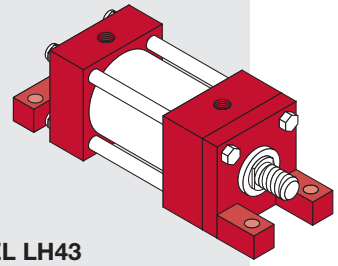


**MODEL LH42**
**NFPA STYLE MS2**

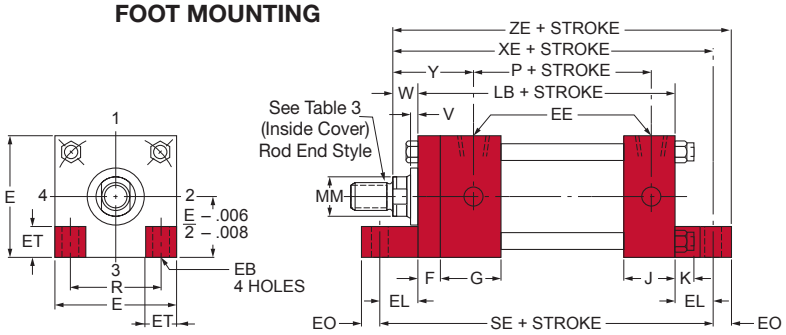



**Not Available With Removable Retainers.**

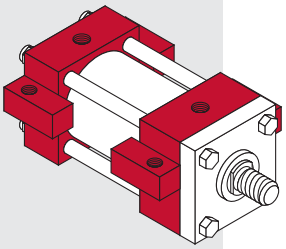
### FOOT MOUNTING



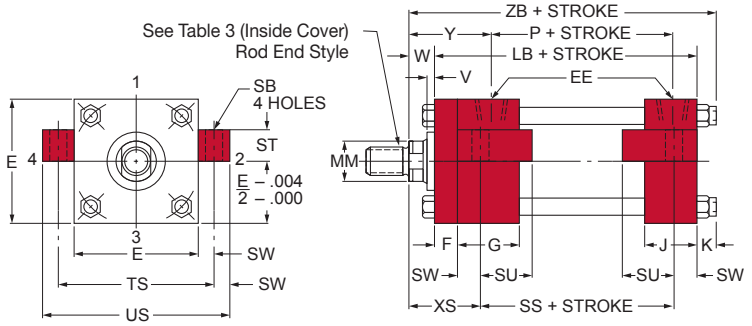
**MODEL LH43**
**NFPA STYLE MS7**




### CENTERLINE LUG MOUNTING



**MODEL LH51**
**NFPA STYLE MS3**



## ▼ TABLE 1LH

**The dimensions given on this table are affected by the piston rod diameter and the stroke.**

| Bore Ø | Rod MM | Cylinder Code ♦ | LB | P | SE ▲ | SN | SS ■ | V | W | XE | XS | XT | Y | ZB | ZE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | 5/8 | LH0051 | 4 | 2 1/4 | 5 1/2 | 2 1/4 | 2 7/8 | 1/4 | 5/8 | 5 3/8 | 1 3/8 | 1 15/16 | 1 15/16 | 5 | 5 3/8 |
| | •1* | LH0052 | | | | | | 1/2 | 1 | 5 3/4 | 1 3/4 | 2 5/16 | 2 5/16 | 5 3/8 | 6 |
| 2 | 5/8 | LH0510 | 4 | 2 1/4 | 5 7/8 | 2 1/4 | 2 7/8 | 1/4 | 5/8 | 5 9/16 | 1 3/8 | 1 15/16 | 1 15/16 | 5 1/16 | 5 7/8 |
| | †1* | LH0511 | | | | | | 1/2 | 1 | 5 15/16 | 1 3/4 | 2 5/16 | 2 5/16 | 5 7/16 | 6 1/4 |
| | •1 3/8* | LH0512 | | | | | | 5/8 | 1 1/4 | 6 3/16 | 2 | 2 9/16 | 2 9/16 | 5 11/16 | 6 1/2 |
| 2½ | 5/8 | LH0520 | 4 1/8 | 2 3/8 | 6 1/4 | 2 3/8 | 3 | 1/4 | 5/8 | 5 13/16 | 1 3/8 | 1 15/16 | 1 15/16 | 5 3/16 | 6 1/8 |
| | 1 | LH0521 | | | | | | 1/2 | 1 | 6 3/16 | 1 3/4 | 2 5/16 | 2 5/16 | 5 9/16 | 6 1/2 |
| | †1 3/8* | LH0522 | | | | | | 5/8 | 1 1/4 | 6 7/16 | 2 | 2 9/16 | 2 9/16 | 5 13/16 | 6 3/4 |
| | •1 3/4* | LH0523 | | | | | | 3/4 | 1 1/2 | 6 11/16 | 2 1/4 | 2 13/16 | 2 13/16 | 6 1/16 | 7 |
| 3¼ | 1 | LH0530 | 4 7/8 | 2 5/8 | 6 5/8 | 2 5/8 | 3 1/4 | 1/4 | 3/4 | 6 1/2 | 1 7/8 | 2 7/16 | 2 7/16 | 6 1/8 | 6 7/8 |
| | 1 3/8 | LH0531 | | | | | | 3/8 | 1 | 6 3/4 | 2 1/8 | 2 11/16 | 2 11/16 | 6 3/8 | 7 1/8 |
| | 1 3/4* | LH0532 | | | | | | 1/2 | 1 1/4 | 7 | 2 3/8 | 2 15/16 | 2 15/16 | 6 5/8 | 7 3/8 |
| | 2* | LH0533 | | | | | | 1/2 | 1 3/8 | 7 1/8 | 2 1/2 | 3 1/16 | 3 1/16 | 6 3/4 | 7 1/2 |
| 4 | 1 | LH0540 | 4 7/8 | 2 5/8 | 6 7/8 | 2 5/8 | 3 1/4 | 1/4 | 3/4 | 6 5/8 | 1 7/8 | 2 7/16 | 2 7/16 | 6 1/8 | 7 |
| | 1 3/8 | LH0541 | | | | | | 3/8 | 1 | 6 7/8 | 2 1/8 | 2 11/16 | 2 11/16 | 6 3/8 | 7 1/4 |
| | 1 3/4 | LH0542 | | | | | | 1/2 | 1 1/4 | 7 1/8 | 2 3/8 | 2 15/16 | 2 15/16 | 6 5/8 | 7 1/2 |
| | 2 | LH0543 | | | | | | 1/2 | 1 3/8 | 7 1/4 | 2 1/2 | 3 1/16 | 3 1/16 | 6 3/4 | 7 5/8 |
| | 2 1/2* | LH0544 | | | | | | 5/8 | 1 5/8 | 7 1/2 | 2 3/4 | 3 5/16 | 3 5/16 | 7 | 7 7/8 |
| 5 | 1 | LH0550 | 5 1/8 | 2 7/8 | 7 1/4 | 2 7/8 | 3 1/8 | 1/4 | 3/4 | 6 15/16 | 2 1/16 | 2 7/16 | 2 7/16 | 6 7/16 | 7 7/16 |
| | 1 3/8 | LH0551 | | | | | | 3/8 | 1 | 7 3/16 | 2 5/16 | 2 11/16 | 2 11/16 | 6 11/16 | 7 11/16 |
| | 1 3/4 | LH0552 | | | | | | 1/2 | 1 1/4 | 7 7/16 | 2 9/16 | 2 15/16 | 2 15/16 | 6 15/16 | 7 15/16 |
| | 2 | LH0553 | | | | | | 1/2 | 1 3/8 | 7 9/16 | 2 11/16 | 3 1/16 | 3 1/16 | 7 1/16 | 8 1/16 |
| | 2 1/2 | LH0554 | | | | | | 5/8 | 1 5/8 | 7 13/16 | 2 15/16 | 3 5/16 | 3 5/16 | 7 5/16 | 8 5/16 |
| | 3 | LH0555 | | | | | | 5/8 | 1 5/8 | 7 13/16 | 2 15/16 | 3 5/16 | 3 5/16 | 7 5/16 | 8 5/16 |
| | 3 1/2* | LH0556 | | | | | | 5/8 | 1 5/8 | 7 13/16 | 2 15/16 | 3 5/16 | 3 5/16 | 7 5/16 | 8 5/16 |
| 6 | 1 3/8 | LH0560 | 5 3/4 | 3 1/8 | 7 3/4 | 3 1/8 | 3 5/8 | 1/4 | 7/8 | 7 5/8 | 2 5/16 | 2 13/16 | 2 13/16 | 7 3/16 | 8 1/8 |
| | 1 3/4 | LH0561 | | | | | | 3/8 | 1 1/8 | 7 7/8 | 2 9/16 | 3 1/16 | 3 1/16 | 7 7/16 | 8 3/8 |
| | 2 | LH0562 | | | | | | 3/8 | 1 1/4 | 8 | 2 11/16 | 3 3/16 | 3 3/16 | 7 9/16 | 8 1/2 |
| | 2 1/2 | LH0563 | | | | | | 1/2 | 1 1/2 | 8 1/4 | 2 15/16 | 3 7/16 | 3 7/16 | 7 13/16 | 8 3/4 |
| | 3 | LH0564 | | | | | | 1/2 | 1 1/2 | 8 1/4 | 2 15/16 | 3 7/16 | 3 7/16 | 7 13/16 | 8 3/4 |
| | 3 1/2 | LH0565 | | | | | | 1/2 | 1 1/2 | 8 1/4 | 2 15/16 | 3 7/16 | 3 7/16 | 7 13/16 | 8 3/4 |
| | 4* | LH0566 | | | | | | 1/2 | 1 1/2 | 8 1/4 | 2 15/16 | 3 7/16 | 3 7/16 | 7 13/16 | 8 3/4 |

### HOW TO ORDER

**For ordering information refer to Page 68.**

**NOTES:**

♦ For double rod end cylinders, add prefix letter D to cylinder code. (Example: DLH0051 (Refer to page 62.)

* Model LH41 is not available in these sizes.

† The standard rod eye or rod clevis will interfere with foot lugs on Model LH43. When these rod end accessories are required, use additional rod extension.

▲ For double rod end cylinders from 1½" thru 6" bore, add ½ + F to this dimension.

■ For double rod end cylinders from 1½" thru 6" bore, add ½ to this dimension.

• Available with fixed non-adjustable cushions on rod end and standard adjustable cushions on the blind end only

**Rod End Styles and Dimensions**

For rod end styles and dimensions see the Table 3 in the inside cover of the catalog.

Page ii

**Recommended Pressure Rating**

| Bore Ø | Pressure Rating (psi) |
|---|---|
| 1½ | 1500 |
| 2 | 1500 |
| 2½ | 1500* |
| 3¼ | 1500 |
| 4 | 1000 |
| 5 | 1000* |
| 6 | 750 |

***NOTE:**

2½" Bore, 5/8" Rod, Rating 1000 psi
5" Bore, 1" Rod, Rating 750 psi

## ▼ TABLE 2LH

**The dimensions are constant regardless of rod diameter or stroke.**

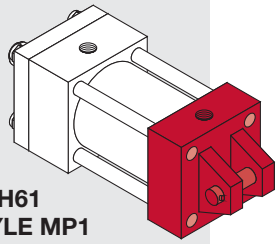
| Bore Ø | E | EB | EE NPT | EE SAE | EL | EO | ET | F | G | J | K | NT | R | SB | ST | SU | SW | TB | TN | TS | US |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | 2 | 5/16 | 3/8 | #6 | 3/4 | 1/4 | 1/2 | 3/8 | 1 1/2 | 1 | 3/8 | 1/4-20 | 1.43 | 7/16 | 1/2 | 15/16 | 3/8 | 3/8 | 5/8 | 2 3/4 | 3 1/2 |
| 2 | 2 1/2 | 3/8 | 3/8 | #6 | 15/16 | 5/16 | 19/32 | 3/8 | 1 1/2 | 1 | 7/16 | 5/16-18 | 1.84 | 7/16 | 1/2 | 15/16 | 3/8 | 9/16 | 7/8 | 3 1/4 | 4 |
| 2½ | 3 | 3/8 | 3/8 | #6 | 1 1/16 | 5/16 | 3/4 | 3/8 | 1 1/2 | 1 | 7/16 | 3/8-16 | 2.19 | 7/16 | 1/2 | 15/16 | 3/8 | 5/8 | 1 1/4 | 3 3/4 | 4 1/2 |
| 3¼ | 3 3/4 | 7/16 | 1/2 | #10 | 7/8 | 3/8 | 29/32 | 5/8 | 1 3/4 | 1 1/4 | 1/2 | 1/2-13 | 2.76 | 9/16 | 3/4 | 1 1/4 | 1/2 | 3/4 | 1 1/2 | 4 3/4 | 5 3/4 |
| 4 | 4 1/2 | 7/16 | 1/2 | #10 | 1 | 3/8 | 1 1/8 | 5/8 | 1 3/4 | 1 1/4 | 1/2 | 1/2-13 | 3.32 | 9/16 | 3/4 | 1 1/4 | 1/2 | 1 | 2 1/16 | 5 1/2 | 6 1/2 |
| 5 | 5 1/2 | 9/16 | 1/2 | #10 | 1 1/16 | 1/2 | 1 11/32 | 5/8 | 1 3/4 | 1 1/4 | 9/16 | 5/8-11 | 4.10 | 13/16 | 1 | 1 9/16 | 1 1/16 | 1 | 2 11/16 | 6 7/8 | 8 1/4 |
| 6 | 6 1/2 | 9/16 | 3/4 | #12 | 1 | 1/2 | 1 9/16 | 3/4 | 2 | 1 1/2 | 9/16 | 3/4-10 | 4.88 | 13/16 | 1 | 1 9/16 | 1 1/16 | 1 1/8 | 3 1/4 | 7 7/8 | 9 1/4 |

**For Package and Mounting Dimension see Tables 1LH and 2LH.**

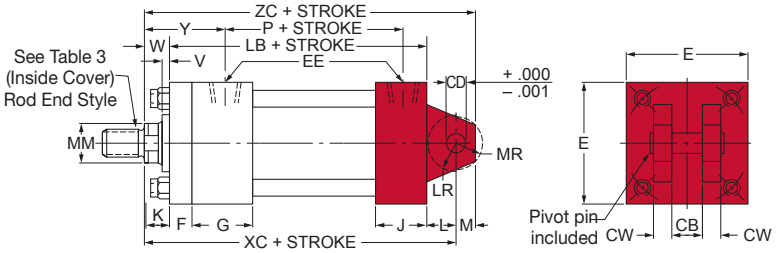
## PIN AND TRUNNION MOUNTED CYLINDERS

All pin and trunnion cylinders need a provision on both ends for pivoting. These types of cylinders are designed to carry shear loads and the trunnion and pivot pins should be carried by bearings that are rigidly held and closely fit for the entire length of the pin.

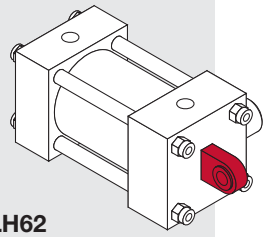
### CLEVIS MOUNT



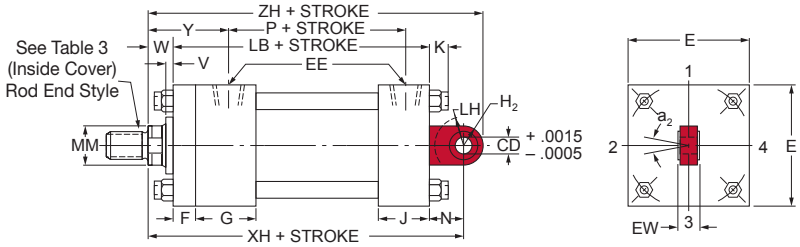
**MODEL LH61**
**NFPA STYLE MP1**



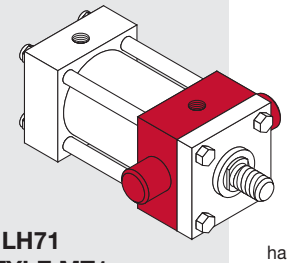

### FIXED EYE MOUNT



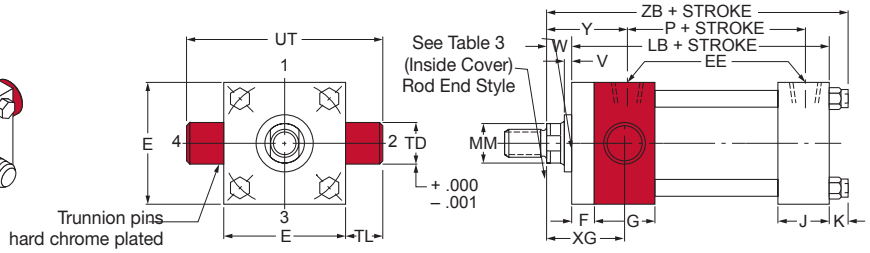
**MODEL LH62**
**NFPA STYLE MP5**



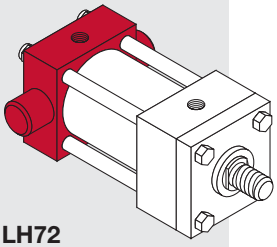

### ROD END TRUNNION MOUNT



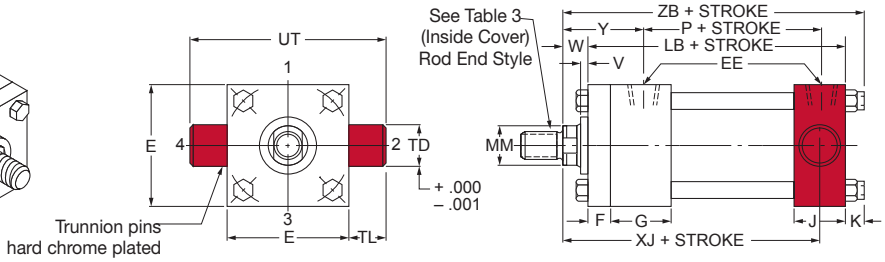
**MODEL LH71**
**NFPA STYLE MT1**



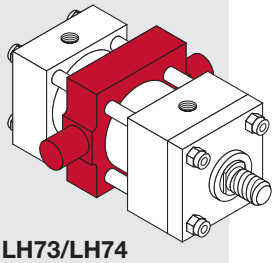

### BLIND END TRUNNION MOUNT



**MODEL LH72**
**NFPA STYLE MT2**

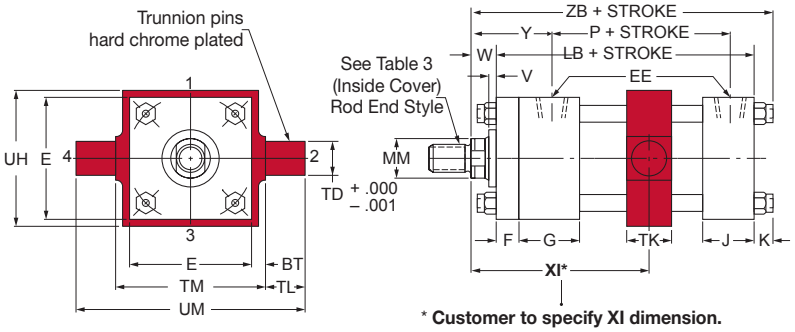



### CENTER TRUNNION MOUNT



**MODEL LH73/LH74**
**NFPA STYLE MT4**

LH73 is an exclusive Milwaukee Cylinder design.
LH74 is the Industry "Standard" design.




* Customer to specify XI dimension.

## ▼ TABLE 1LH

**The dimensions given on this table are affected by the piston rod diameter and the stroke.**

| Bore Ø | Rod MM | Cylinder Code ♦ | LB | P | V | W | XC | XG | XH | XJ | Y | ZB | ZC | ZH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | 5/8 | LH0051 | 4 | 2¼ | ¼ | 5/8 | 5⅜ | 1¾ | 5½ | 4⅛ | 1 15/16 | 5 | 5⅞ | 6¼ |
| | •1* | LH0052 | | | ½ | 1 | 5¾ | 2⅛ | 5⅞ | 4½ | 2 5/16 | 5⅜ | 6¼ | 6⅝ |
| 2 | 5/8 | LH0510 | 4 | 2¼ | ¼ | 5/8 | 5⅜ | 1¾ | 5½ | 4⅛ | 1 15/16 | 5 1/16 | 5⅞ | 6¼ |
| | 1* | LH0511 | | | ½ | 1 | 5¾ | 2⅛ | 5⅞ | 4½ | 2 5/16 | 5 7/16 | 6¼ | 6⅝ |
| | •1⅜* | LH0512 | | | 5/8 | 1¼ | 6 | 2⅜ | 6⅛ | 4¾ | 2 9/16 | 5 11/16 | 6½ | 6⅞ |
| 2½ | 5/8 | LH0520 | 4⅛ | 2⅜ | ¼ | 5/8 | 5½ | 1¾ | 5⅝ | 4¼ | 1 15/16 | 5 3/16 | 6 | 6⅜ |
| | 1 | LH0521 | | | ½ | 1 | 5⅞ | 2⅛ | 6 | 4⅝ | 2 5/16 | 5 9/16 | 6⅜ | 6¾ |
| | 1⅜ | LH0522 | | | 5/8 | 1¼ | 6⅛ | 2⅜ | 6¼ | 4⅞ | 2 9/16 | 5 13/16 | 6⅝ | 7 |
| | •1¾* | LH0523 | | | ¾ | 1½ | 6⅜ | 2⅝ | 6⅜ | 5⅛ | 2 13/16 | 6 1/16 | 6⅞ | 7⅛ |
| 3¼ | 1 | LH0530 | 4⅞ | 2⅝ | ¼ | ¾ | 6⅞ | 2¼ | 6⅞ | 5 | 2 7/16 | 6⅛ | 7⅝ | 8⅛ |
| | 1⅜ | LH0531 | | | ⅜ | 1 | 7⅛ | 2½ | 7⅛ | 5¼ | 2 11/16 | 6⅜ | 7⅞ | 8⅜ |
| | 1¾ | LH0532 | | | ½ | 1¼ | 7⅜ | 2¾ | 7⅜ | 5½ | 2 15/16 | 6⅝ | 8⅛ | 8⅝ |
| | 2* | LH0533 | | | ½ | 1⅜ | 7½ | 2⅞ | 7½ | 5⅝ | 3 1/16 | 6¾ | 8¼ | 8¾ |
| 4 | 1 | LH0540 | 4⅞ | 2⅝ | ¼ | ¾ | 6⅞ | 2¼ | 6⅞ | 5 | 2 7/16 | 6⅛ | 7⅝ | 8⅛ |
| | 1⅜ | LH0541 | | | ⅜ | 1 | 7⅛ | 2½ | 7⅛ | 5¼ | 2 11/16 | 6⅜ | 7⅞ | 8⅜ |
| | 1¾ | LH0542 | | | ½ | 1¼ | 7⅜ | 2¾ | 7⅜ | 5½ | 2 15/16 | 6⅝ | 8⅛ | 8⅝ |
| | 2 | LH0543 | | | ½ | 1⅜ | 7½ | 2⅞ | 7½ | 5⅝ | 3 1/16 | 6¾ | 8¼ | 8¾ |
| | 2½* | LH0544 | | | 5/8 | 1⅝ | 7¾ | 3⅛ | 7¾ | 5⅞ | 3 5/16 | 7 | 8½ | 9 |
| 5 | 1 | LH0550 | 5⅛ | 2⅞ | ¼ | ¾ | 7⅛ | 2¼ | 7⅛ | 5¼ | 2 7/16 | 6 7/16 | 7⅞ | 8⅜ |
| | 1⅜ | LH0551 | | | ⅜ | 1 | 7⅜ | 2½ | 7⅜ | 5½ | 2 11/16 | 6 11/16 | 8⅛ | 8⅝ |
| | 1¾ | LH0552 | | | ½ | 1¼ | 7⅝ | 2¾ | 7⅝ | 5¾ | 2 15/16 | 6 15/16 | 8⅜ | 8⅞ |
| | 2 | LH0553 | | | ½ | 1⅜ | 7¾ | 2⅞ | 7¾ | 5⅞ | 3 1/16 | 7 1/16 | 8½ | 9 |
| | 2½ | LH0554 | | | 5/8 | 1⅝ | 8 | 3⅛ | 8 | 6⅛ | 3 5/16 | 7 5/16 | 8¾ | 9¼ |
| | 3 | LH0555 | | | 5/8 | 1⅝ | 8 | 3⅛ | 8 | 6⅛ | 3 5/16 | 7 5/16 | 8¾ | 9¼ |
| | 3½* | LH0556 | | | 5/8 | 1⅝ | 8 | 3⅛ | 8 | 6⅛ | 3 5/16 | 7 5/16 | 8¾ | 9¼ |
| 6 | 1⅜ | LH0560 | 5¾ | 3⅛ | ¼ | ⅞ | 8⅛ | 2⅝ | 8¼ | 5⅞ | 2 13/16 | 7 3/16 | 9⅛ | 10 |
| | 1¾ | LH0561 | | | ⅜ | 1⅛ | 8⅜ | 2⅞ | 8½ | 6⅛ | 3 1/16 | 7 7/16 | 9⅜ | 10¼ |
| | 2 | LH0562 | | | ⅜ | 1¼ | 8½ | 3 | 8⅝ | 6¼ | 3 3/16 | 7 9/16 | 9½ | 10⅜ |
| | 2½ | LH0563 | | | ½ | 1½ | 8¾ | 3¼ | 8⅞ | 6½ | 3 7/16 | 7 13/16 | 9¾ | 10⅝ |
| | 3 | LH0564 | | | ½ | 1½ | 8¾ | 3¼ | 8⅞ | 6½ | 3 7/16 | 7 13/16 | 9¾ | 10⅝ |
| | 3½ | LH0565 | | | ½ | 1½ | 8¾ | 3¼ | 8⅞ | 6½ | 3 7/16 | 7 13/16 | 9¾ | 10⅝ |
| | 4 | LH0566 | | | ½ | 1½ | 8¾ | 3¼ | 8⅞ | 6½ | 3 7/16 | 7 13/16 | 9¾ | 10⅝ |

### HOW TO ORDER

**For ordering information refer to Page 68.**

**NOTES:**

♦ For double rod end cylinders, add prefix letter D to cylinder code. Example: DLH0051 (Refer to page 62.) Double rod ends are not available on LH61 or LH62 mount styles of Series LH cylinders.

• Available with fixed non-adjustable cushions on rod end and standard adjustable cushions on the blind end only.

* Removable retainer not available for these bore and rod combinations: LH61 and LH73/LH74 mounting styles.

**Rod End Styles and Dimensions**

**Rod End Styles and Dimensions**

For rod end styles and dimensions see the Table 3 in the inside cover of the catalog.

Page ii

***MilCad* Cylinder Configurator**

Visit **milwaukeecylinder.com** to configure and download CAD files of your cylinders.

**Recommended Pressure Rating**

| Bore Ø | Pressure Rating (psi) |
|---|---|
| 1½ | 1500 |
| 2 | 1500 |
| 2½ | 1500* |
| 3¼ | 1500 |
| 4 | 1000 |
| 5 | 1000* |
| 6 | 750 |

***NOTE:**

2½" Bore, 5/8" Rod, Rating 1000 psi
5" Bore, 1" Rod, Rating 750 psi

## ▼ TABLE 2LH

**The dimensions are constant regardless of rod diameter or stroke.**

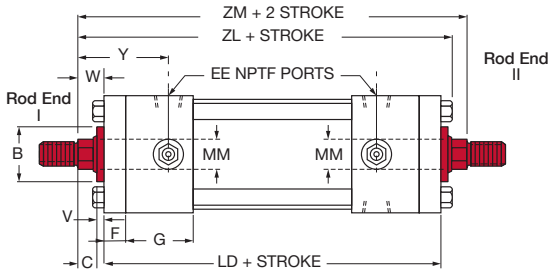
| Bore Ø | $a_2$ | BT | CB | CD | CW | E | EE NPT | EE SAE | EW | F | G | $H_2$ | J | K | L | LH | LR | M | MR | N | TD | TL | LH73 TK | LH73 TM | LH73 UH | LH73 UM | LH74 TK | LH74 TM | LH74 UH | LH74 UM | UT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1½ | 13° | ¾ | ¾ | ½ | ½ | 2 | ⅜ | #6 | 5/8 | ⅜ | 1½ | 13/16 | 1 | ⅜ | ¾ | 5/8 | 5/8 | ½ | 21/32 | ⅞ | 1 | 1 | 1⅛ | 3½ | 2⅜ | 5½ | 1¼ | 2½ | 2½ | 4½ | 4 |
| 2 | 13° | ¾ | ¾ | ½ | ½ | 2½ | ⅜ | #6 | 5/8 | ⅜ | 1½ | 13/16 | 1 | 7/16 | ¾ | 5/8 | 5/8 | ½ | 11/16 | ⅞ | 1 | 1 | 1⅛ | 4 | 2⅞ | 6 | 1½ | 3 | 3 | 5 | 4½ |
| 2½ | 13° | ¾ | ¾ | ½ | ½ | 3 | ⅜ | #6 | 5/8 | ⅜ | 1½ | 13/16 | 1 | 7/16 | ¾ | 5/8 | 5/8 | ½ | 11/16 | ⅞ | 1 | 1 | 1⅛ | 4½ | 3⅜ | 6½ | 1½ | 3½ | 3½ | 5½ | 5 |
| 3¼ | 13° | ¾ | 1¼ | ¾ | 5/8 | 3¾ | ½ | #10 | ⅞ | 5/8 | 1¾ | 1¼ | 1¼ | ½ | 1¼ | 1 | 1 1/16 | ¾ | 15/16 | 1¼ | 1 | 1 | 1¼ | 5¼ | 4⅛ | 7¼ | 2 | 4½ | 4½ | 6½ | 5¾ |
| 4 | 13° | ¾ | 1¼ | ¾ | 5/8 | 4½ | ½ | #10 | ⅞ | 5/8 | 1¾ | 1¼ | 1¼ | ½ | 1¼ | 1 | 1 1/16 | ¾ | 15/16 | 1¼ | 1 | 1 | 1¼ | 6 | 5 | 8 | 2 | 5¼ | 5 | 7¼ | 6½ |
| 5 | 13° | ¾ | 1¼ | ¾ | 5/8 | 5½ | ½ | #10 | ⅞ | 5/8 | 1¾ | 1¼ | 1¼ | 9/16 | 1¼ | 1 | 1 1/16 | ¾ | 15/16 | 1¼ | 1 | 1 | 1¼ | 7 | 6 | 9 | 2 | 6¼ | 6 | 8¼ | 7½ |
| 6 | 12½° | 1 | 1½ | 1 | ¾ | 6½ | ¾ | #12 | 1⅜ | ¾ | 2 | 1¾ | 1½ | 9/16 | 1½ | 1¼ | 1¼ | 1 | 1 3/16 | 1⅝ | 1⅜ | 1⅜ | 1½ | 8½ | 7 | 11¼ | 2½ | 7⅝ | 7 | 10⅜ | 9¼ |

## DOUBLE ROD END CYLINDERS

*Milwaukee Cylinder's* Double Rod End Cylinders are available with all the standard types of mountings, except LH61 and LH62 mount styles of Series LH cylinders.

To obtain dimensional information on a double rod end cylinder, first select the desired mounting style and refer to the corresponding single rod end cylinder model shown on the preceding pages. After you have determined all necessary dimensions from the previous page covering the desired mounting, turn back to this page. Supplement those dimensions with additional ones from the drawings below and the table at the right. These added dimensions differ from, or are in addition to, those shown on the preceding pages and provide the additional information needed to completely dimension a double rod end cylinder model.

On a double rod end cylinder where two different rod ends are required, or two different rod sizes are required, or cushions on one end are required, be sure to state clearly which rod is to go at which end of the cylinder. When two types of mounting styles are required, be sure to specify their relationship to the piston rods, if they are not the same.




## ▼ DOUBLE ROD END CYLINDERS

| Bore Ø | Rod MM | Cylinder Code | LD* | SE* | SS* | ZL | ZM |
|---|---|---|---|---|---|---|---|
| 1½ | ⅝ | DLH051 | 4⅞ | 6⅜ | 3⅜ | 5⅞ | 6⅛ |
| | 1 | DLH052 | | | | 6¼ | 6⅞ |
| 2 | ⅝ | DLH510 | 4⅞ | 6¾ | 3⅜ | 5 15/16 | 6⅛ |
| | 1 | DLH511 | | | | 6 5/16 | 6⅞ |
| | 1⅜ | DLH512 | | | | 6 9/16 | 7⅜ |
| 2½ | ⅝ | DLH520 | 5 | 7⅛ | 3½ | 6 1/16 | 6¼ |
| | 1 | DLH521 | | | | 6 7/16 | 7 |
| | 1⅜ | DLH522 | | | | 6 11/16 | 7½ |
| | 1¾ | DLH523 | | | | 6 15/16 | 8 |
| 3¼ | 1 | DLH530 | 6 | 7¾ | 3¾ | 7¼ | 7½ |
| | 1⅜ | DLH531 | | | | 7½ | 8 |
| | 1¾ | DLH532 | | | | 7¾ | 8½ |
| | 2 | DLH533 | | | | 7⅞ | 8¾ |
| 4 | 1 | DLH540 | 6 | 8 | 3¾ | 7¼ | 7½ |
| | 1⅜ | DLH541 | | | | 7½ | 8 |
| | 1¾ | DLH542 | | | | 7¾ | 8½ |
| | 2 | DLH543 | | | | 7⅞ | 8¾ |
| | 2½ | DLH544 | | | | 8⅛ | 9¼ |
| 5 | 1 | DLH550 | 6¼ | 8⅜ | 3⅝ | 7 9/16 | 7¾ |
| | 1⅜ | DLH551 | | | | 7 13/16 | 8¼ |
| | 1¾ | DLH552 | | | | 8 1/16 | 8¾ |
| | 2 | DLH553 | | | | 8 3/16 | 9 |
| | 2½ | DLH554 | | | | 8 7/16 | 9½ |
| | 3 | DLH555 | | | | | |
| | 3½ | DLH556 | | | | | |
| 6 | 1⅜ | DLH560 | 7 | 8⅞ | 4⅛ | 8 7/16 | 8¾ |
| | 1¾ | DLH561 | | | | 9 11/16 | 9¼ |
| | 2 | DLH562 | | | | 8 13/16 | 9½ |
| | 2½ | DLH563 | | | | 9 1/16 | 10 |
| | 3 | DLH564 | | | | | |
| | 3½ | DLH565 | | | | | |
| | 4 | DLH566 | | | | | |

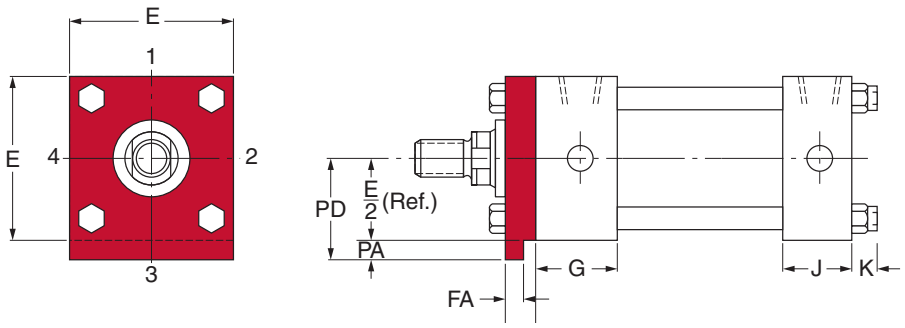
* NOTE: These dimensions are to be substituted for the related mounting dimensions given on the preceding pages. All dimensions given on this table are plus stroke.

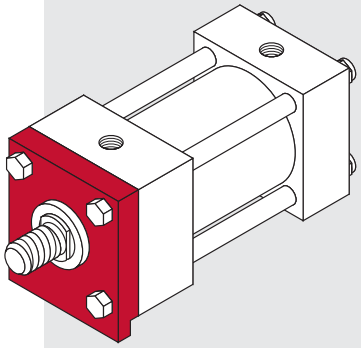
## KEY MOUNT CYLINDERS

The *Milwaukee Cylinder* Key Mount retainer plate is a mounting option designed to add rugged stability to foot and side mount cylinders. The retainer plate is extended below the mounting surface of the cylinder. This extension may be fitted into a milled keyway in your mounting pad, eliminating the need for welded keys or locator pins.

**HOW TO ORDER**

**For ordering information refer to Page 68.**



## ▼ KEY MOUNT CYLINDERS

| Bore Ø | E | F | FA | G | PA | PD |
|---|---|---|---|---|---|---|
| **1½** | 2 | ⅜ | .312/.310 | 1½ | 3/16 | 1 3/16 |
| **2** | 2½ | ⅜ | .312/.310 | 1½ | 3/16 | 1 7/16 |
| **2½** | 3 | ⅜ | .312/.310 | 1½ | 3/16 | 1 11/16 |
| **3¼** | 3¾ | ⅝ | .562/.560 | 1¾ | 5/16 | 2 3/16 |
| **4** | 4½ | ⅝ | .562/.560 | 1¾ | 5/16 | 2 9/16 |
| **5** | 5½ | ⅝ | .562/.560 | 1¾ | 5/16 | 3 1/16 |
| **6** | 6½ | ¾ | .687/.684 | 2 | ⅜ | 3⅝ |

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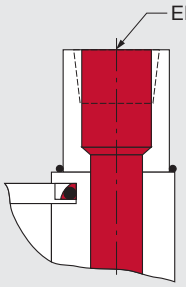
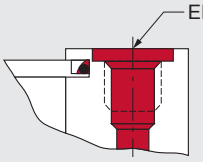
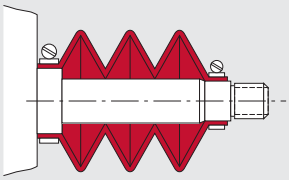


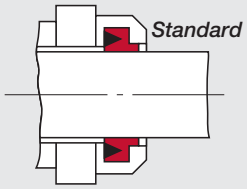

*Oversize Port Welded Boss*

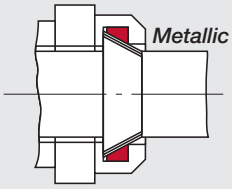



*SAE Straight Thread O-ring Port*



*Rod Boots*




*Metallic Rod Wipers*

## STANDARD DESIGN OPTIONS

**Standard Ports**

The *Milwaukee Cylinder* Series LH Cylinders are manufactured as standard, with the largest NPTF tapered thread ports that will fit in both the rod and blind ends of a given bore size. Upon request, extra ports can be provided on the sides of the end caps not occupied by mountings or cushion adjusters.

**Oversize Ports**

On most bore sizes, welded bosses may be provided for oversize NPTF ports. These bosses protrude from the sides of the end caps. For information as to the boss height in relation to your bore and port requirements, contact your local *Milwaukee Cylinder* Representative. Also, special heavier end caps can be provided so that oversize ports can be accommodated without the use of a welded boss.

**Straight Thread Ports**

On request, *Milwaukee Cylinder* will furnish an SAE straight thread O-Ring port on the Series LH Cylinders. In addition to the standard oversize NPTF ports, welded bosses may also be used for oversize SAE straight thread O-Ring ports. For further information on oversize SAE ports, contact the factory.

**Note:**
Flange and manifold style ports are available from *Milwaukee Cylinder*.

**Rod Boots**

When cylinders are used in areas of high contamination or where contaminants have an air hardening property, the exposed piston rod should be covered with a rod boot to protect the rod bearing and seals. A rod boot is simply a collapsible cover. It is of sewn construction made from a neoprene coated fabric. The rod boots are impervious to oil, grease and water. They will operate effectively from 0° F to +200° F without cracking. For additional details on Rod Boots, please see page 186.

**Metallic Rod Wipers**

If requested, metallic rod wipers will be supplied in place of the standard synthetic rubber wiper. This type of seal is recommended for applications where contaminants would tend to cling to the rod and damage a standard synthetic rubber rod wiper.

## ▼ PORT SIZES

| Bore Ø | Standard NPTF Port EE | Oversized NPTF Port $EE_1$ | SAE Straight O-Ring Port | |
|---|---|---|---|---|
| | | | $EE_2$ | SAE Standard Thread Series |
| 1½ | ⅜ | ½ | #6 | 9/16-18 |
| 2 | ⅜ | ½ | #6 | 9/16-18 |
| 2½ | ⅜ | ½ | #6 | 9/16-18 |
| 3¼ | ½ | ¾ | #10 | 7/8-14 |
| 4 | ½ | ¾ | #10 | 7/8-14 |
| 5 | ½ | ¾ | #10 | 7/8-14 |
| 6 | ¾ | 1 | #12 | 1 1/16-12 |

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## DESIGN OPTIONS FOR SPECIAL CYLINDERS

### Special Rod Ends

Modifications of standard or entirely special rod ends are available from *Milwaukee Cylinder*. When your requirements call for a special rod end style, your order should include a sketch if it is to be an entirely special rod end or note reference as to which letter dimensions you wish to have modified (see inside front cover).

### Special Assemblies from Standard Parts

Each style of the various standard cylinder mountings is illustrated, using the commonly recognized cylinder dimensional symbols of the National Fluid Power Association. Each side of the end views are numbered to aid in communication when referring to the relationship between the ports and the mountings. When requesting information or placing an order that requires a dimension other than standard, always make reference to the given dimensional symbol in the catalog and then give your requirements.

### Cushion Adjustment Locations

A ball check and a cushion adjustment needle are supplied as standard in position #2 on most models. The cushion needle and ball check are interchangeable as far as location and may be put in any side not occupied by a port or mounting.

### Port Locations

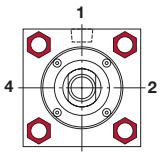
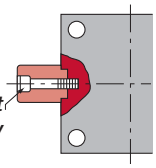


*Figure 1*

Ports are located in position #1 as standard unless otherwise specified. By using the position numbers given with the end views in the dimensional data section of this catalog, ports can be arranged in any one of four 90° positions in relation to the cylinder mounting. When ports are relocated on a cushioned cylinder, the cushion needle and ball check are automatically relocated to hold their relationship to the port as on a standard cylinder, unless otherwise specified at the time of the order.

### Removable Trunnion Pins


*Self-Locking Socket Head Capscrew*

Removable trunnion pins are available on models LH71 and LH72. They can be used on all bore and rod combinations, except on the largest oversize rods offered with each bore size on all model LH71 cylinders.

### Single-Acting Cylinders

The *Milwaukee Cylinder's* Series LH cylinders are designed for either single or double action. When used as a single acting cylinder, hydraulic power drives the piston in one direction, only relying on either the load or an external force to return the piston after the pressure is exhausted.

### Single-Acting Spring Cylinders

Single-acting spring return cylinders normally have a spring inside of the cylinder to return the piston to its original position. The application load and friction conditions must be specified when placing an order to properly size the spring. Also specify whether the spring is to return or advance the piston. A spring return cylinder is designed with a stop tube to act as spring guide, which prevents binding of the cylinder due to misalignment of the spring. To accurately determine the cylinder length and mounting dimensions for your application, contact your local *Milwaukee Cylinder* representative or the factory.

### Water Service Cylinders

*Milwaukee Cylinder's* Series LH Cylinders can be used with water as an operating fluid with some standard modifications to the types of material and the manufacturing processes used. These modifications will include, at some additional cost, bronze piston, nickel plated end caps, a hard chrome plated cylinder barrel and a chrome plated piston or stainless steel piston rod at extra cost. Due to the increased factors of corrosion, electrolysis and mineral deposits acting within a water fitted cylinder, *Milwaukee Cylinder* cannot warrant or make any guarantees other than a water service cylinder will be free of defects in workmanship or materials.

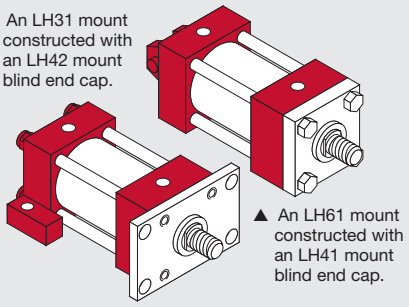
### Proximity Switches

**End of Stroke Limit Switches:**

We provide inductive proximity switches for end of stroke sensing. These non-contact switches detect the presence of the spud/cushion bushing. See page 185 for more information.

### Combined Mountings

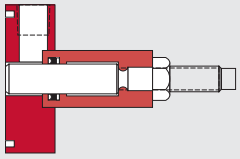
Standard mountings may be combined when specified by the customer. Some examples of this are:


▼ An LH31 mount constructed with an LH42 mount blind end cap.

▲ An LH61 mount constructed with an LH41 mount blind end cap.

These and other combinations can be readily made from standard parts. If you are unsure of a possible combination or if it will suit your particular needs, consult with your local *Milwaukee Cylinder* representative or contact the factory.

### Adjustable Stroke Cylinders

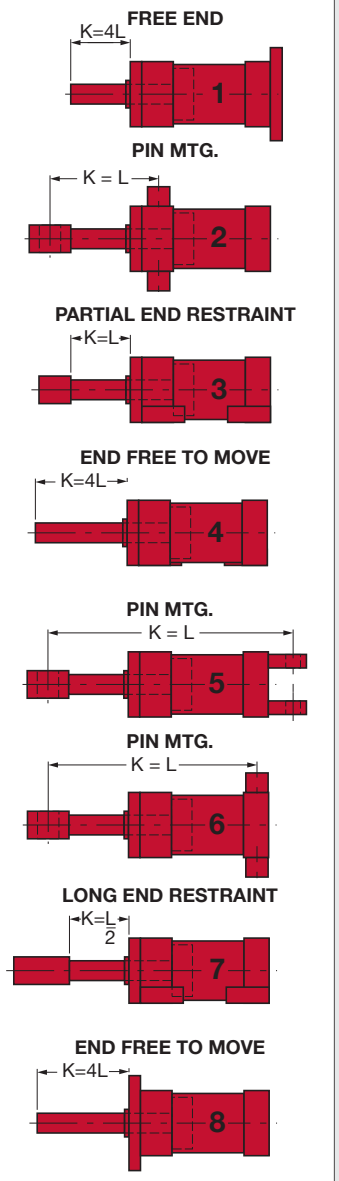


When a cylinder application requires stroke adjustment, *Milwaukee Cylinder* offers a number of designs, the most common of which is illustrated below. This particular design is externally adjustable, incorporating a threaded rod (of piston rod quality) with the standard hydraulic rod end multiple lip vee seal and bushing design. This provides a proven-effective high and low pressure seal, affording maximum sealing on the stroke adjustment rod.

Further information concerning design limitations, cushioning or alternate designs can be obtained by contacting the factory.

**CAUTION!**
Cylinders with removable trunnion pins will have a reduced pressure rating. Consult the factory.

## FIGURE 1




**Stop Tubes**
For more information on Stop Tubes, see page 181 in the Design Engineer's Guide.

## STOP TUBES

Stop tubes are used to maintain bearing pressure within acceptable limits and are recommended on cylinders with long strokes or poorly guided rods.

The stop tube is a spacer between the rod end cap and the piston, which provides separation between the piston and the rod bearing. This separation reduces the moment forces developed between the rod bearing and piston when the rod is extended.

To determine if stop tube is necessary for your cylinder requirements, you have to solve for "K" (refer to Figure 1). If your required cylinder has a "K" dimension in excess of 40 inches, stop tube is required. For each 10 inch increment or fraction thereof in excess of 40 inches, one inch of stop tube is recommended. When stop tube is required, the overall length of the cylinder will be increased by the length of the stop tube to be used.

To determine "K" (see to Figure 1)
*Note: W = the rod stick out
(refer to pages 54-63)

**Cylinder #1, #4, #8 – see Figure 1**

K = 4L= 4 (stroke + W*)

**Cylinder #2 - see Figure 1**

K = L = (CA or CE) + XG + Stroke

Note:
CA = rod eye dimension (back inside cover)
CE = rod clevis dimension (back inside cover)
XG = mounting dimension page 60

**Cylinder #3 – see Figure 1**

K = L = W* + Stroke

**Cylinder #5 – see Figure 1**

K = L = (CA or CE) + XC + (2 x Stroke)

Note:
CA = rod eye dimension (back inside cover)
CE = rod clevis dimension (back inside cover)
XC = mounting dimension page 60

**Cylinder #6 – see Figure 1**

K = L = (CA or CE) + XJ + (2 x Stroke)

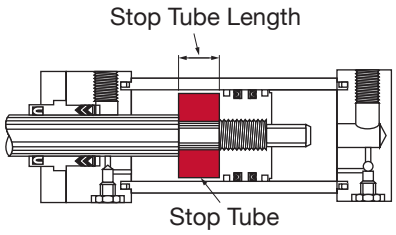
Note:
CA = rod eye dimension (back inside cover)
CE = rod clevis dimension (back inside cover)
XJ = mounting dimension page 60

**Cylinder #7 – see Figure 1**

K = L/2 =(W* + Stroke)/2

When mounting long stroke cylinders, care should be taken to assure cylinder alignment over the entire length of stroke. The use of external guides or swivel bushings is recommended to reduce side load conditions and prolong the cylinder's service life.

Note: Stop tube length must be added to "K" factor before making final selection of rod size. This is primarily true in No. 5 long stroke applications.




*The stop tube is located between the piston and the rod end cap. It limits the extended stroke of the cylinder, providing additional strength for less cost and reduced weight than the use of an oversize rod.*

## ▼ TABLE 1 - VALUE OF "K" IN INCHES

| Thrust Force (in-lbs) | Piston Rod Diameter (in) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ⅝ | 1 | 1⅜ | 1¾ | 2 | 2½ | 3 | 3½ | 4 | 4½ | 5 | 5½ | 7 |
| 400 | 35 | 84 | 134 | – | – | – | – | – | – | – | – | – | – |
| 700 | 30 | 68 | 119 | – | – | – | – | – | – | – | – | – | – |
| 1,000 | 26 | 60 | 105 | 156 | 190 | – | – | – | – | – | – | – | – |
| 1,400 | 24 | 54 | 93 | 144 | 175 | 244 | 308 | – | – | – | – | – | – |
| 1,800 | 23 | 48 | 84 | 127 | 160 | 230 | 294 | 366 | – | – | – | – | – |
| 2,400 | 18 | 45 | 75 | 114 | 145 | 214 | 281 | 347 | – | – | – | – | – |
| 3,200 | 16 | 40 | 68 | 103 | 131 | 196 | 262 | 329 | 398 | – | – | – | – |
| 4,000 | 12 | 38 | 63 | 93 | 119 | 174 | 240 | 310 | 373 | 446 | – | – | – |
| 5,000 | 9 | 36 | 60 | 87 | 112 | 163 | 225 | 289 | 359 | 426 | – | – | – |
| 6,000 | – | 30 | 56 | 82 | 102 | 152 | 209 | 274 | 342 | 411 | 476 | – | – |
| 8,000 | – | 25 | 51 | 76 | 93 | 136 | 186 | 244 | 310 | 375 | 448 | – | – |
| 10,000 | – | 21 | 45 | 70 | 89 | 125 | 172 | 221 | 279 | 349 | 412 | – | – |
| 12,000 | – | 17 | 41 | 64 | 85 | 117 | 155 | 210 | 270 | 326 | 388 | 455 | – |
| 16,000 | – | – | 35 | 57 | 75 | 110 | 141 | 188 | 233 | 291 | 350 | 421 | – |
| 20,000 | – | – | 28 | 52 | 66 | 103 | 136 | 173 | 218 | 270 | 325 | 385 | – |
| 30,000 | – | – | – | 39 | 56 | 87 | 120 | 156 | 190 | 232 | 285 | 330 | – |
| 40,000 | – | – | – | 24 | 43 | 75 | 108 | 142 | 177 | 210 | 248 | 293 | – |
| 50,000 | – | – | – | – | 30 | 66 | 97 | 131 | 165 | 201 | 234 | 268 | 408 |
| 60,000 | – | – | – | – | – | 57 | 88 | 119 | 154 | 190 | 226 | 256 | 384 |
| 80,000 | – | – | – | – | – | 36 | 71 | 104 | 136 | 170 | 204 | 240 | 336 |
| 100,000 | – | – | – | – | – | – | 56 | 91 | 120 | 154 | 199 | 224 | 324 |
| 120,000 | – | – | – | – | – | – | 45 | 76 | 108 | 146 | 174 | 207 | 313 |
| 140,000 | – | – | – | – | – | – | – | 64 | 98 | 129 | 162 | 194 | 301 |
| 160,000 | – | – | – | – | – | – | – | 47 | 87 | 118 | 149 | 182 | 279 |
| 200,000 | – | – | – | – | – | – | – | – | 65 | 98 | 131 | 160 | 260 |
| 250,000 | – | – | – | – | – | – | – | – | – | 72 | 109 | 143 | 236 |
| 300,000 | – | – | – | – | – | – | – | – | – | – | 85 | 120 | 212 |
| 350,000 | – | – | – | – | – | – | – | – | – | – | 53 | 100 | 195 |
| 400,000 | – | – | – | – | – | – | – | – | – | – | – | 72 | 182 |
| 500,000 | – | – | – | – | – | – | – | – | – | – | – | – | 152 |
| 600,000 | – | – | – | – | – | – | – | – | – | – | – | – | 114 |
| 700,000 | – | – | – | – | – | – | – | – | – | – | – | – | 70 |

## ▼ TABLE 2 - DEDUCTIONS FOR PULL STROKE FORCE & DISPLACEMENT

| Piston Rod Ø | Piston Rod Area | Cylinder Force in Pounds for Various Pressures | | | | | | | | Displacement /in of Stroke |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 psi | 200 psi | 250 psi | 500 psi | 750 psi | 1000 psi | 1250 psi | 1500 psi | Gallons Oil Displaced |
| ⅝ | .307 | 31 | 61 | 77 | 154 | 230 | 307 | 384 | 461 | .00133 |
| 1 | .785 | 79 | 157 | 196 | 393 | 589 | 785 | 981 | 1178 | .00340 |
| 1⅜ | 1.485 | 149 | 297 | 371 | 743 | 1114 | 1485 | 1856 | 2228 | .00643 |
| 1¾ | 2.405 | 241 | 481 | 601 | 1203 | 1804 | 2405 | 3006 | 3608 | .01041 |
| 2 | 3.142 | 314 | 628 | 786 | 1571 | 2357 | 3142 | 3928 | 4713 | .01360 |
| 2½ | 4.909 | 491 | 982 | 1227 | 2455 | 3682 | 4909 | 6137 | 7364 | .02125 |
| 3 | 7.069 | 707 | 1414 | 1767 | 3535 | 5302 | 7069 | 8836 | 10600 | .03060 |
| 3½ | 9.621 | 962 | 1924 | 2405 | 4811 | 7216 | 9621 | 12026 | 14430 | .04165 |
| 4 | 12.57 | 1257 | 2514 | 3143 | 6285 | 9428 | 12570 | 15708 | 18860 | .05442 |

## ▼ TABLE 3 - THRUST FORCE AND DISPLACEMENT

| Cylinder Bore Ø | Piston Area | Cylinder Force in Pounds for Various Pressures | | | | | | | | Displacement /in of Stroke |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 psi | 200 psi | 250 psi | 500 psi | 750 psi | 1000 psi | 1250 psi | 1500 psi | Gallons Oil Displaced |
| 1½ | 1.767 | 177 | 353 | 442 | 884 | 1325 | 1767 | 2209 | 2651 | .00765 |
| 2 | 3.142 | 314 | 628 | 786 | 1571 | 2357 | 3142 | 3928 | 4713 | .01360 |
| 2½ | 4.909 | 491 | 982 | 1227 | 2455 | 3682 | 4909 | 6137 | 7364 | .02125 |
| 3¼ | 8.296 | 830 | 1659 | 2074 | 4148 | 6222 | 8296 | 10370 | 12440 | .03591 |
| 4 | 12.57 | 1257 | 2514 | 3143 | 6285 | 9428 | 12570 | 15708 | 18860 | .05442 |
| 5 | 19.64 | 1964 | 3928 | 4910 | 9820 | 14730 | 19640 | 24544 | 29460 | .08502 |
| 6 | 28.27 | 2827 | 5654 | 7068 | 14140 | 21200 | 28270 | 35342 | 42400 | .12230 |

## CYLINDER SIZING

The selection of the correct rod size is one of the most important factors in sizing a cylinder. The standard rod for each bore size that *Milwaukee Cylinder* manufactures is sufficient to handle the maximum tension force that the cylinder is capable of producing. It is primarily in compression and long stroke, high thrust applications that the column strength needs to be considered.

The following steps should be used to determine the proper rod size for an application:

1. Select the cylinder bore size required from Table 3 based on the required cylinder thrust force and the operating line pressure at the cylinder.
2. Determine the length between mounting points or "L" as shown on Figure 1, page 66.
3. Based on the distance between mounting points ("L"), determine the value of "K" as shown on Figure 1, page 66.
4. Using the thrust force and the developed "K" dimension, refer to Table 1 to select the proper rod size.
5. If an oversized rod is required, re-check the overall length dimension ("K") in Step 1 and confirm your previous rod size selection.

To determine the cylinder pull (tension), stroke force, or displacement, deduct the force or displacement corresponding to the rod size in Table 2 from the force or displacement corresponding to the bore size shown in Table 3.

| Feature | Description | Page Number | Code Number |
|---|---|---|---|
| Double Rod End | | 62 | D |
| Cylinder Code | Refer to Table 1LH | 55, 57, 59, and 61 | — |
| Mounting Style | Model Number Only | 54, 56, 58, and 60 | — |
| Rod End Style | Code Number | inside front cover (ii) | — |
| Cushions | None<br>Rod End<br>Blind End<br>Both Ends | —<br>—<br>—<br>— | 1<br>2<br>3<br>4 |
| Cylinder Modifications | Special | | S |
| Seals | BUNA-N (-20° to 200° F)<br>Viton (-15° to 350° F)<br>Special | | 7<br>8<br>S |
| Stroke | Specify in Inches Including Fractional Requirements | | — |

Example: LH0542 – 31 – 1 4 ___ – 7 × 14 3/4

If Standard Leave Blank

*If Special Describe Requirements

*__NOTE:__ Use “S” if any special design features or seals are required, describe in detail on your order.

__EXAMPLE:__ The code for a hydraulic cylinder 4" bore, rod end rectangular flange mounting, 1¾" rod, style No. 1 rod end, cushion both ends, standard seals with a 14¾" stroke is **LH0542-31-14-7x14¾.**

**DUPLICATE CYLINDERS**

**Duplicate cylinders can be ordered by giving the serial number from the nameplate of the original cylinder. Factory records supply a quick, positive identification.**

## HOW TO ORDER

### Series LH Cylinders

Standard Series LH Cylinders can be completely and accurately described by a model number. If your requirements are completely standard, select the alphanumeric codes from above that represent your cylinder and place them in the sequence indicated by the example. Use of the cylinder model number will eliminate untimely delays in handling your order.

### General Order Data

1. Bore & Rod Size or the Cylinder Code: (refer to pages 54-63)
2. Mounting Style: (refer to page 54-63)
3. Rod End Style: (refer to Inside Cover, page ii)
4. Cushion Requirements
5. Length of Stroke

### Application Data

1. **Port Requirements**: refer to page 64.
2. **Operating Fluid or Medium:** Series LH Cylinders are equipped with seals for use with hydraulic oil. If other than a quality grade hydraulic oil will be used, specify the type of fluid in your order. See page 184 for more details.
3. **Temperature Range:** Series LH Hydraulic Cylinders contain seals of Nitrile (Buna-N) suitable to -20° F to +200° F. Specify your operating temperature if your application does not fall within this temperature range.
4. **Operating Pressure:** Series LH Cylinders are rated for 750-1500 PSI. If your requirements are in excess of the rated pressure, describe your application in your order.
5. **Accessories**: Specify any accessories you require, using the part numbers given on the inside back cover.
6. **Special Requirements:** If you require special seals, rod material, stop tube, center support, adjustable stroke or any other special requirements not covered, specify in detail on your order.

***MilCad* Cylinder Configurator**

Visit **milwaukeecylinder.com** to configure and download CAD files of your cylinders.

## REPLACEMENT SEALS OR CYLINDER PARTS

For replacement seals or cylinder parts, the serial number of your cylinder, the cylinder model number and the item number of the part you require (below) should appear on your order. To order entire seal kits for your cylinder, simply specify the serial number and the cylinder model number from page 68 on your request for service parts.

## HOW TO ORDER COMPLETE SEAL KITS

When ordering complete seal kits, specify the following information on your order:

1. The serial number of the cylinder the seals will be used on.
2. The bore and rod size.
3. If the cylinder is cushioned.

To eliminate untimely delays in the handling of your order, please use the seal kit code as shown in the example below:

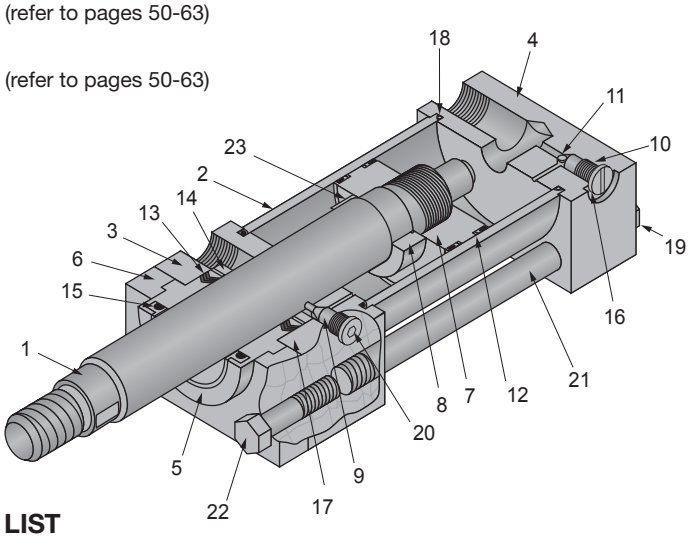
Example:

**Buna-N Kit No.** XXXXX-7-50

- cylinder code number (refer to pages 50-63)

**Viton Kit No.** XXXXX-8-50

- cylinder code number (refer to pages 50-63)




## ▼ STANDARD PARTS LIST

| Item No. | Description |
|---|---|
| 1 | Piston Rod |
| 2 | Cylinder Barrel |
| 3 | Head End Cap |
| 4 | Cap End Cap |
| 5 | Rod Bushing |
| 6 | Retainer Plate |
| 7 | Piston |
| 8 | Cushion Plunger |
| 9 | Cushion Adj. Plunger |
| 10 | Ball Check Retainer |
| 11 | Ball Check |
| 12 | U-Cup Seal & Backup Washer for Piston |
| 13 | Rod Vee Ring Set |
| 14 | Rear Bearing Ring |
| 15 | Rod Wiper |
| 16 | O-Ring Seal for Ball Check Retainer |
| 17 | Wave Spring |
| 18 | Cylinder Barrel O-Ring |
| 19 | Tie Rod Flex Lock Nut |
| 20 | O-Ring Seal for Cushion Adj. Needle |
| 21 | Tie Rod |
| 22 | Self-Locking Cap Screw |
| 23 | O-Ring for Floating Cushion |

## Retainer Plate Cap Screw Torques

### ▼ For Square Retainers

| Bore Ø | Torque (Ft-lbs) |
|---|---|
| 1½ | 10 |
| 2 | 20 |
| 2½ | 20 |
| 3¼ | 30 |
| 4 | 30 |
| 5 | 50 |
| 6 | 50 |

## Tie-rod Nut Torques

### ▼ Nut Torque Specifications

| Bore Ø | Torque (Ft-lbs) |
|---|---|
| 1½ | 8 |
| 2 | 18 |
| 2½ | 18 |
| 3¼ | 35 |
| 4 | 35 |
| 5 | 60 |
| 6 | 60 |

When it is necessary to remove the tie-rod nuts on a cylinder, they must be reassembled to the torque specifications given above. To prevent the tie-rods from twisting when tightened, use a vice grip or locking clamp. Note that the torque specification is based on lubricated threads.

## INSTALLATION FOR SERIES LH

### General Information

**Cleanliness**

The most important consideration when installing the cylinder. When cylinders are shipped from *Milwaukee Cylinder*, the ports are securely plugged with plastic plugs which should not be removed until the piping is to be installed. All piping should be thoroughly clean, to include the removal of all threading and flaring burrs or chips, before making the connection to the cylinder ports. One chip can cause premature failure of the cylinder or other hydraulic system components.

**Alignment**

Improper alignment will result in excessive cylinder wear. Check to assure rod alignment between the cylinder and its mating component on your machine in both the extended and retracted positions.

**Environment**

Cylinders operating in areas where there is weld splatter, fast drying chemicals, paint, excessive heat or other hazardous conditions, should have covers or shields to prevent damage to the rod and rod seals.

**Bleeding**

Air within the cylinder or system will cause erratic operation of the cylinder. Our cylinders generally do not require bleed ports if the cylinder ports are mounted in an upright position. Several full strokes of the cylinder will purge air from the cylinder into the circuit piping, where it can be bled off. Bleeder ports are available for applications where the cylinder is the high point of the circuit or where the cylinder does not complete a full stroke during its normal cycle.

## MOUNTING RECOMMENDATIONS

**Foot Mounted Cylinders**

The use of high strength alloy steel mounting bolts 1/16" smaller than the hole size is recommended. After final alignment, foot mounted cylinders should be dowel pinned in place.

**Trunnion Mounted Cylinders**

Lubricated pillow blocks designed for close tolerance applications should be used. It is important to rigidly mount and align the pillow blocks so that the trunnion pins will not be subjected to any extreme bending moments The rod end should be pivoted with the pivot pin in line and parallel to the axis of the trunnion pins.

**Flush Mount Cylinders**

The use of high strength alloy steel mounting bolts is recommended. Shear keys should be used to reduce the stress on the mounting bolts created by the normal push and pull forces created by the cylinder cycle.

**Flange Mount Cylinders**

The controlled diameter rod bushing extension can be used as a pilot to locate the flange mount. Dowel pins should be used after the cylinder is mounted and aligned to prevent shifting.

**Clevis Mount Cylinders**

This type of cylinder must be pivoted at both ends and the pins must be in line and parallel to each other. After the cylinder is mounted, the customer should check to assure that the cylinder is free to swing through its working arc without interference from other machined parts.

## STORAGE

Often times, cylinders are delivered before a customer is prepared to install them and must be stored for a period of time. When storage is required:

1. Select an area indoors for storage, which has dry and non-corrosive atmosphere. Take caution to protect the cylinder from both internal and external corrosion.
2. Cylinders to be stored should be kept in a vertical position (piston rod up) whenever possible.
3. Port protector plugs should be kept in the cylinder ports until the time of installation.

## CYLINDER TROUBLE SHOOTING

1. **External leakage**

   If leaking occurs between the end cap and barrel, check tie-rod torque. Do not over torque. If the torque is correct, then replace the barrel seal. When leakage occurs in the rod bushing area, replace the rod seals. If leakage continues or reoccurs in short period of operation, check items 2 thru 5, page 69.

2. **Cylinder misalignment**

   Side load is a common problem which occurs when the cylinder application does not allow the piston rod to work in line during the extend and retract motions of the cylinder. Evidence of this is excessive seal failure, bushing wear or galling of the piston rod. Often, bending of the piston rod or complete failure (breakage) of the rod occurs.

3. **Contamination on the piston rod**

   Dirt and other material is often picked up when the piston rod is extended. When the rod is retracted in an excessive dirty application, it often carries the dirt back into the rod seal cavity of the cylinder, causing damage to the seals. With a slight modification of the cylinder rod end, a rod boot can be added to protect the rod bushing and seals for most applications.

4. **Bad mountings**

   Due to wear of pivot pins or mounting bolts working loose, a cylinder may have side load, even though the rod was in line when the cylinder was first installed. All cylinder mountings should be checked periodically.

5. **Damaged piston rod**

   An extended piston rod can be damaged by the impact of a hard object which could burr the rod. If this occurs, the rod should be checked immediately to prevent seal damage.

6. **Internal leakage**

   Inside the cylinder, leakage past the piston seals can cause sluggish movement or settling of the cylinder under load conditions. This occurs due to leakage of worn piston seals or rings.

7. **Creeping cylinder**

   When a cylinder is stopped in midstroke and it creeps, check for internal leakage. Creeping can also be caused by a worn control valve and this should be checked, even if the cylinder is found to have internal leakage.

8. **Erratic operation**

   When a cylinder is erratic or sluggish in operation, this may be caused by a number of problems. The most common cause of sluggish operation is air in the system. Internal leakage could also be a cause. If the system starts out sluggishly and, as it warms, speeds up, the oil may be of too high viscosity. The whole system should be checked for worn components if after these checks, the cylinder is still operating in a sluggish manner.

## CYLINDER MAINTENANCE

### Rod Seal Replacement

When changing rod seals, extend the piston rod 3" or more if possible, being sure to support the rod at all times. Remove the retainer plate screws (if tie-rod nuts have to be removed, refer to the nut torque specification on this page when reassembling the cylinder), retainer plate and outer bushing. Using an eye hook or thin screwdriver, pry the vees from the end cap cavity (if low pressure air is applied to the rod end port, this will help to force the vees from the cavity). The new set of vees should be assembled into the cavity separately and lubed with the soft vee in the center. Replace the rod wiper in the bushing and reassemble the cylinder.

### Piston Seal Replacement

When changing piston seals, extend the piston rod 3" or more if possible, being sure to support the piston rod and the piston at all times. *Remove the tie-rod nuts, blind end cap, the barrel and then the piston seals. A light grease, compatible with the system fluid, should be used on the rings and block vee seals for smooth assembly. Install the block vee piston seals, scarf cutting on only the back-up washers. Then install the cast iron rings with the joints in opposite directions. To reassemble, start the piston into the tube, compressing the cast iron rings using twine or a ring compressor. When the piston block vee seal is to the edge of the barrel, use a thin rounded blade to start the lip of the block vee, making sure the entire lip is started before moving the piston further into the tube.

***Note:** When a cylinder has been disassembled this far, the barrel seals should at least be inspected, if not replaced.

### Barrel Seal Replacement

When replacing barrel seals, use the same method of disassembling the cylinder as used when replacing piston seals. The barrel seal consists of a backup washer and O-Ring, which is assembled on the first step of both ends of the tube, with the backup washer going on first. The outer diameter of the tube groove on the end caps must be checked for nicks or burrs and then greased. Position the end caps squarely on the tube (check to make sure port location is correct) and firmly force or tap the end cap over the tube until it bottoms. Check to make sure the O-Ring did not shear and then finish assembling the cylinder.

### ▼ Nut Torque Specifications

| Bore Ø | Torque (Ft-lbs) |
|---|---|
| 1½ | 8 |
| 2 | 18 |
| 2½ | 18 |
| 3¼ | 35 |
| 4 | 35 |
| 5 | 60 |
| 6 | 60 |

When it is necessary to remove the tie-rod nuts on a cylinder, they must be reassembled to the torque specifications given above. To prevent the tie-rods from twisting when tightened, use a vice grip or locking clamp. Note that the torque specification is based on lubricated threads.