NOPAK®

CATALOG 101

LOW PRESSURE CAST-HEAD CYLINDERS

HYDRAULIC & PNEUMATIC

CLASS 1, 2 OR M PNEUMATIC TO 250 PSI

CLASS 2 HYDRAULIC TO 450 PSI

CLASS M (MILL) HYDRAULIC TO 650 PSI

GALLAND HENNING NOPAK, Inc.

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TABLE OF CONTENTS

NOPAK LOW PRESSURE CAST HEAD CYLINDERS

PRESSURE RATINGS (PSI) RECOMMENDED MAXIMUM			
Air		Hydraulic	
Cyl. Dia.	Class 1-2-M	Class 2	Class M
1½	250	450	650
2	250	450	650
2½	250	450	650
3	250	450	650
4	250	450	650
5	250	450	450
6	250	450	450
8	250	450	450
10	250	450	450
12	250	450	450
14	250	450	450

CLASS 1 CAST HEAD CYLINDERS

For normal applications where low-cost, rugged air cylinders are required. Our exclusive design has been 'user-proven' with over 40 years of experience as the work horse of industry.

CLASS 2 CAST HEAD CYLINDERS

For higher operating air pressures and hydraulic use. These cylinders incorporate recessed gasketed tube seals and piston to rod O-ring seals as standard features.

CLASS M CAST HEAD MILL TYPE CYLINDERS

These cylinders have all the features of NOPAK Class 2 cylinders plus oversize rods and steel tubing with welded flanges and bolted cylinder heads. See page 10.

CL1/SVR CAST HEAD/SEVERE SERVICE CYLINDERS

See our Catalog 101/SVR. These extra-rugged units feature "over-" over-size rods (as compared against competitive models) and extra-heavy duty rod bearing for the most abusive of service.

APPROXIMATE UNCRATED CLASS 1-2-M CAST HEAD CYLINDER WEIGHTS (LBS.)

	Cylinder Bore	1½	2	2½	3	4	5	6	8	10	12	14
	Zero Stroke	4.5	6.8	10.6	13.5	23.4	30.6	52.2	113	175	321	415
Add Per Inch of Stroke	Class 1-2	.38	.44	.65	.75	1.1	1.3	1.6	2.7	4.5	5.9	6.5
	Class M	.45	.45	.75	.75	1.2	1.5	2	2.5	4.5	7.1	8.5

NOPAK CLASS 1-2-M OPTIONS AND MODIFICATIONS

OPTIONS

Bore Size

The bore size of an air cylinder should be selected to supply from 125% to 200% of the required force. The excess of force versus load will result in a faster cylinder speed assuming there is an adequate supply of air into and out of the cylinder.

The bore size of a hydraulic cylinder should be selected to supply sufficient force to exceed the load by approximately 20%. The cylinder speed is the result of flow into and out of the cylinder. Force tables to aid in cylinder sizing are on Page 12.

Mountings

Select the cylinder mounting which will keep the line of force as close as possible to the centerline of the piston rod and free of misalignment. This will maximize seal and bearing life.

Double Rod End

Nopak Class 1-2-M cylinders when ordered as double rod end are designated by prefixing the model with letter "X." Mounting dimensions may vary from standard because two rod end heads are used. The rod sizes or head models may be interchanged.

Cushions

Unless specified otherwise NOPAK Class 1-2-M cylinders are furnished with self-regulating cushions on both ends. Adjustable cushions or non-cushion cylinders are also available. See Page 4.

The purpose of a cushion is to slow up piston speed at the end of the stroke, eliminating shock. The mass to be cushioned should be limited to one half the cylinder force unless other provisions are made for deceleration or special cushioning.

Special Materials and Plating

Special materials, metals and/or platings are available for various applications including AWWA Specifications.

CUSTOM MODIFICATIONS

Stop Tubes

In long cylinders used on push applications, internal stop tubes may be necessary to prevent excessive bearing wear. When stop tubes are required with a cushioned air cylinder, a dual or wider piston or similar arrangement is recommended to reduce the trapped air volume and provide the necessary cushion back pressure.

Oversize Rods

An oversize piston rod, ¼" larger than normal, is available for all Class 1 and Class 2 cylinder diameters except for the 8" which has an oversize rod as standard. Specify an OB style piston rod when ordering. The rod end threading, the rod extension, and related dimensions are shown on Page 11.

The oversize rod is a standard feature on NOPAK Class M mill type cylinders.

Piston Rod Extension and Rod Threading

Longer than standard piston rod extensions may be required to accommodate load fastening.

Depending upon the details of rod engagement to load, special threading on rod end configuration may be required.

Cylinder Ports

To increase cylinder speed, increased fluid volume is necessary. This can be done by using enlarged or additional ports.

Finished machined parts are ready for assembly for all Class 1 cylinder models having the following:

1. Standard bores from 1½" through 8" diameters.
2. Strokes from 1" through 20" in 1" increments.
3. B-1 piston rods.
4. Self-regulating cushions.

HOW TO ORDER

All orders should include the following information:

1. Class of cylinder (1-2- or M).
2. Bore or cylinder diameter size.
3. Stroke length in inches.
4. *Nopak model.*
5. Type of cushioning.
6. Piston rod diameter, B or OB, and type of rod end threading as 1, 2, 3 or special.
7. Operating medium (air, oil or water).

Also specify:

1. Extreme temperatures (below -20° F or above +250° F).
2. Minimum pressure (if less than 20 PSI).
3. Type of fluid (if other than air, oil or water).
4. Unusual operating conditions.

NOTE: Dimensions in inches of ALL Piston Rod Extensions must be taken with the rod retracted. For other than standard piston rod end length dimensions, locate the extreme outboard end of the piston rod in relation to the mounting dimensions of that particular model. Variations in length should be indicated in reference to this dimension. (Related to "C" dimension designation.)

ORDERING CODE

EXAMPLE:

CL1 - 4 x 12 - E - AS - B - 1 - OPT.

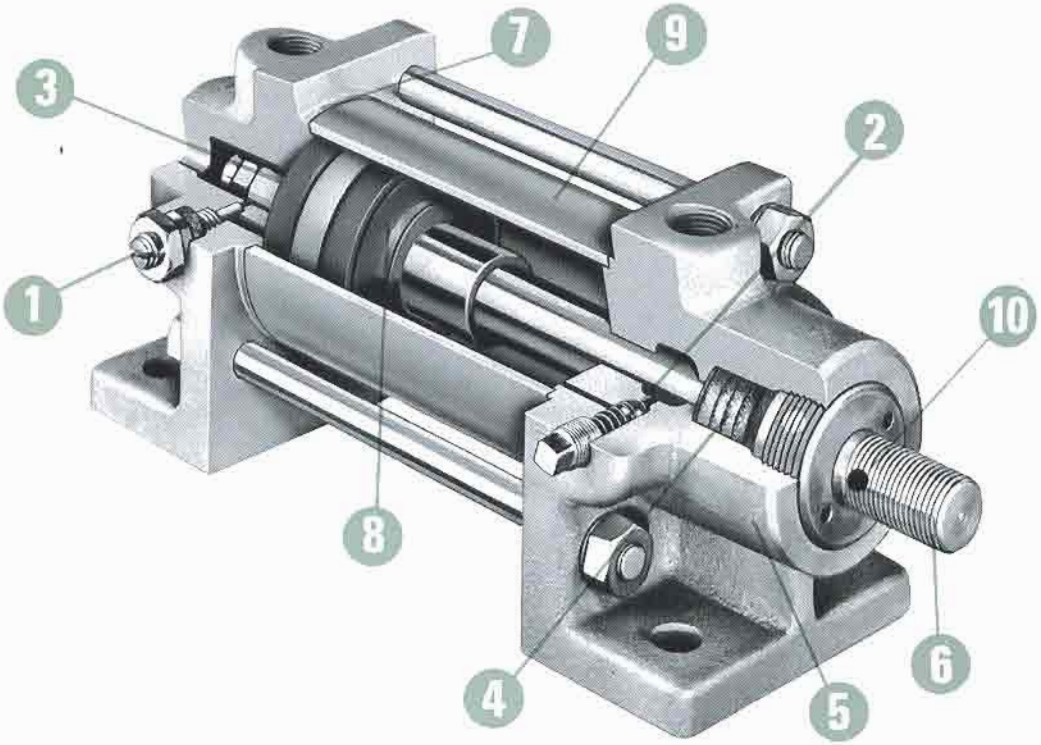
- OPT: Special modification if required.
- Rod End Thread*
- Rod Diameter: B - Standard, OB - .25" larger**
- Cushion Blind End / Cushion Rod End — Note: S = self-regulating, A = adjustable, N = no cushion
- Mounting style
- Stroke (see note above regarding stock sizes).
- Bore (1.50" through 14")
- Class (1-2-or M)

* See respective model charts for details.

** See page 11 for OB rod details.

NOPAK Cylinder Design

PRODUCE DEFINITE OPERATING ADVANTAGES



Sectional view of a NOPAK Double-Acting Cylinder with Built-in, Self-Regulating Cushions. It graphically illustrates 8 other features of NOPAK Cylinder construction which contribute to smooth, efficient performance, under severe operating conditions.

MOUNTINGS Classes 1, 2 and M are available in the five standard mountings designated as Models A, C, D, E and F, illustrated on pages 6 to 11 inclusive.

TYPES OF CUSHIONING ACTION

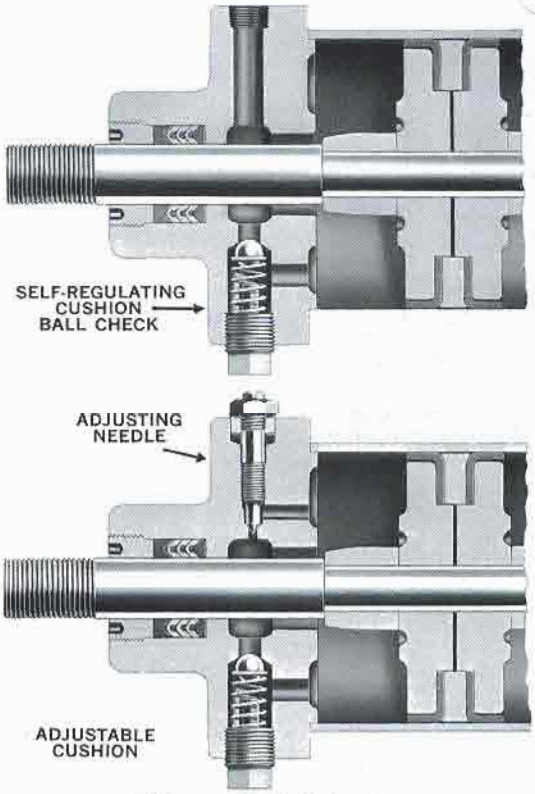
(CLASSES 1 - 2 and M)

Self-Regulating Cushion Type (Operates Automatically)
The self-regulating cylinder head requires no adjustment. Once the cylinder is assembled, its operation is entirely automatic. As the cushion sleeve enters the bore in the cylinder head, the air or fluid is trapped between the piston and the cylinder head, forming a pneumatic or hydraulic cushion.

Pre-determined taper on the cushion sleeve and tolerance between it and bore in the cylinder head provide the self-regulating, positive cushion action. This maximum cushion effect remains constant at all times without needing adjustment.

Adjustable Cushion Type
The adjustable cushion is often desirable where load relations to cylinder capacity are apt to vary a great deal. After the cushion is adjusted, by means of the needle valve, the speed at which the piston continues to the end of its stroke is governed by the foregoing adjustment.

Non-Cushioned Cylinders
NOPAK cylinders can also be furnished with non-cushioned stroke, providing motion at constant speed for full travel. As there is no provision for cushioning, this type is recommended only where the piston speed is very slow, where the stroke is very short, or where the piston is stopped on the work before it reaches the end of full stroke.



Either or Both Ends May be Cushioned

Standardized design and interchangeable components, within each class of construction, permit the cushioning of either or both ends, with either Adjustable or Self-Regulating Cushions.

and Construction Features

1 Adjustable Cushion provides variable cushioning capacity, preventing noisy, damaging metal-to-metal impact of piston against cylinder heads.

2 Quick-opening ball check-valve assures quick starting under full power. Permits line pressure to act on full piston area instantaneously.

3 Special Molded Composition Wide Lip self-sealing cup packings furnished as standard. Hi-Temp Seals are available at extra cost.

4 Positive Seal V-ring Stack-Packing. On cylinders 1½" through 6", three Nylok inserts lock the threaded packing gland in place and maintain proper packing compression. Larger diameters employ a piston rod bushing, packing gland and bolted retainer ring.

5 Iron Alloy Cylinder Heads for durability and long life. Through a large combination of standard and special heads, it is possible to furnish cylinders with mountings for Special Applications. Double rod-end cylinders can also be furnished.

6 Class 1 and 2 cylinders are regularly supplied with hard chrome plated steel piston rods*, threaded in one of three types of rod ends (B-1, B-2, B-3), fine thread series unless otherwise specified. Alternate ¼" oversize diameter rods (OB) can be accommodated in all standard rod head castings. (Oversize diameter rod is standard in 8" bore and in Class M cylinders.) Special alloy piston rods can be furnished to specification. Wrench Flats are NOT standard but are available as an option. Dimension C will increase, consult factory.

7 Leakproof gasket seal between cylinder wall and head on Class 1 cylinders. Recessed gasket on Class 2 and Class M cylinders.

8 Piston Follower and Follower Ring made of aluminum, wherever suitable. Weight is reduced 60% resulting in: (a) Quicker starting and increased power, (b) Longer cup-packing life due to reduced friction in horizontally mounted cylinders, (c) Reduced impact at end of stroke, (d) Less weight per assembly.

9 Cylinder Tubes are of hard coated aluminum material, 1½" diameter thru 8". Honed and chrome plated I.D. steel tubing is furnished for 10" thru 14" diameter cylinders. Class M cylinders have honed steel tubing with welded flanges.

10 NEW: Use drift pinhole to prevent rod rotation when attaching rod end accessories.

* Standard piston rod material is high tensile 100,000 psi minimum yield, ground, polished, and flash chrome plated .0003/.0005 to provide a hard long-wearing surface with low friction. Consult factory for other than air applications.

PISTON ASSEMBLY TYPES

Cup Packing Type:
Cup packings, self-sealing by line pressure, are furnished as standard equipment in Class 1, 2 and Class M Mill Type cylinders. In these assemblies, a wide piston bearing area, plus light metal alloy followers, protect cups from excessive friction and wear. Different types of cups are recommended for different types of service, as follows:

1. Type A – For low pressure, air, oil or water. (Water Glycol Fire Resistant Fluids.) Temperature -20°F to +225°F.
2. Type B – Higher Temperatures -20°F to +325°F oil or air service. (Phosphate Ester Fire Resistant Fluids.)

The above is a simplified statement for general purpose and average conditions. Information on specific media and temperatures exceeding the above ratings should be referred to the Nopak Engineering Department.

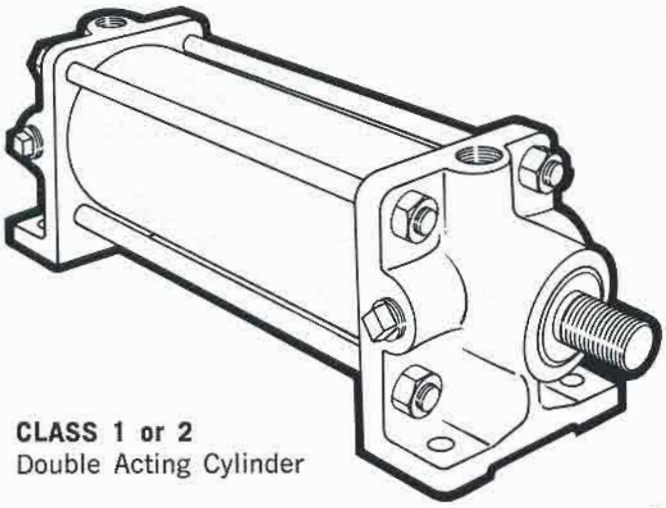
Piston Ring Type:
This type may be specified in low or high hydraulic pressure, honed steel tubing cylinder. Three multiple seal lapped piston rings are precision fitted into the grooves of the cast iron piston. Rings and piston are cast iron for oil; bronze for water.

This type of piston construction is recommended where maximum life is of great importance, providing some piston by-pass is allowable; also for extremely high temperature air or hydraulic applications where heat resistant cup packings might fail.

Optional Piston Designs:
Piston illustrated is U-cup type, one of may types which can be furnished to specifications.

NOPAK

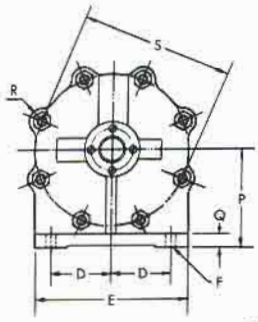
MODEL A



CLASS 1 or 2
Double Acting Cylinder

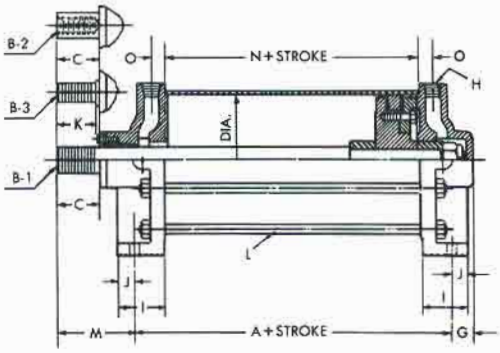
PARALLEL BASE MOUNTING

Model "A" is used primarily in applications requiring straight-line push-pull motion where cylinder can be mounted on a flat surface. Intermediate supports can be furnished in cases where ratio of cylinder stroke to bore is large, to prevent excessive deflection and resulting wear on cups and packings.



End view illustrates 8 tie rod spacing incorporated in the 10", 12" and 14" bore sizes. See dimension L.

1½" thru 4" bore sizes use 4 tie rods, 5" thru 8" bore sizes use 6 tie rods, all evenly spaced and located symmetrically about inlet center line.



FOR FURTHER DETAIL
SEE PAGE 14.

TABLE OF DIMENSIONS — MODEL A — CLASS 1 or 2

Bore	A	Rod* Dia.	B-1*	B-2*	B-3*	C	D	E†	F	G	H	I†	J	K	L	M	N	O	P	Q	R	S
1½	4⅛	⅝	⅝-18	½-20	⅜-24	1⅛	⅞	2¾	13/32	½	¼	1¾	7/16	⅞	4-5/16	1⅞	1⅜	⅝	1¾	⅜	⅜	2⅝
2	4⅜	⅝	⅝-18	½-20	½-20	1⅛	1	3	13/32	½	¼	2	½	⅞	4-5/16	1¾	1⅜	⅝	2⅛	½	½	2⅞
2½	4¾	¾	¾-16	½-20	½-20	1⅜	1⅛	3½	17/32	⅝	⅜	2⅛	⅝	1⅛	4-⅜	2⅝	1¾	⅝	2⅜	½	½	3½
3	4⅞	¾	¾-16	½-20	⅝-18	1⅜	1 5/16	3⅞	17/32	¾	⅜	2⅛	⅝	1⅛	4-⅜	2 6/16	1¾	¾	2½	½	½	3⅞
4	5½	1	1-14	⅝-18	¾-16	1¾	1 15/16	4⅞	17/32	⅞	½	2⅜	⅝	1½	4-½	3⅜	2	1	3	½	⅝	5⅛
5	5¾	1	1-14	⅝-18	¾-16	1¾	2 6/16	5⅝	17/32	⅞	½	2½	⅝	1½	6-½	3¼	2	1	3¾	⅝	½	6⅛
6	5⅝	1¼	1¼-12	¾-16	1-14	2⅛	2 5/16	7⅛	17/32	1⅝	¾	2⅛	⅝	1⅞	6-½	4¼	2⅝	1	4 7/16	⅝	⅝	7⅛
8	7¼	1¾	1¾-12	1-14	1½-12	2 ½	4⅛	9¾	21/32	¾	1	2½	¾	2¼	6-⅝	4 ⅞	3½	1⅛	6⅜	¾	11/16	9½
10	8⅜	2	2-12	1¼-12	1½-12	3¼	4 9/16	11⅝	25/32	1¾	1¼	3⅝	1¼	3	8-¾	5⅞	3⅝	1⅛	7½	1	1	11⅝
12	10	2½	2½-12	1½-12	2-12	4	5¼	14¾	1 1/16	2⅜	1½	5	1⅞	3¾	8-⅞	7⅛	3¾	1⅜	9	1¼	1⅛	14¾
14	10¼	2¾	2¾-12	1¾-12	2½-12	4	6½	17	1 5/16	3	2	5¼	2	3¾	8-⅞	7⅛	3¾	2	10¼	1½	1⅛	17

*A ¼" oversize rod (OB), standard in the 8" bore size, can be furnished using standard head castings. Rod end extension and related dimensions will therefore vary accordingly. See table, page 11. Dimensions shown in this catalog may be altered without notice.

†This is a rough dimension and should not be used for locating purposes.

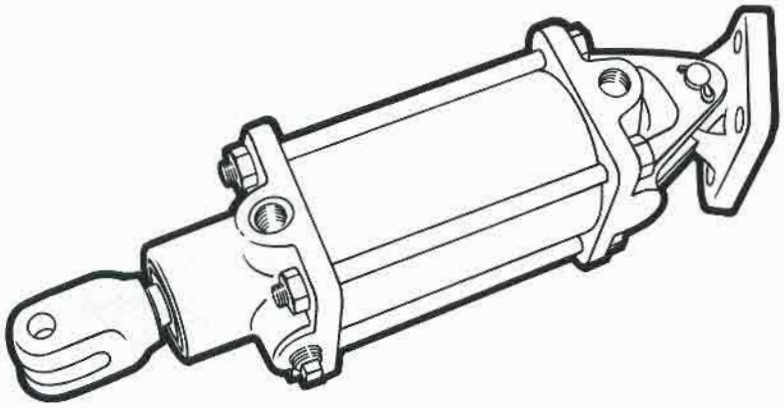
FOR 16" DIAMETER, AND LARGER, REFER TO CATALOG NO. 106.

NOPAK
MODEL E

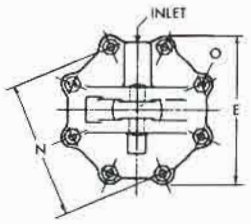
CLEVIS MOUNTING*

Model E is designed expressly for use in hoist service or where articulated or oscillating movement is required. It is often attached to ceiling, beam or other overhead surface, with rod end down, but is also used in the opposite position for upward pushing or tilting operations.

**Mounting Bracket and Rod Clevis as shown are additional. See page 13 for dimensions.*

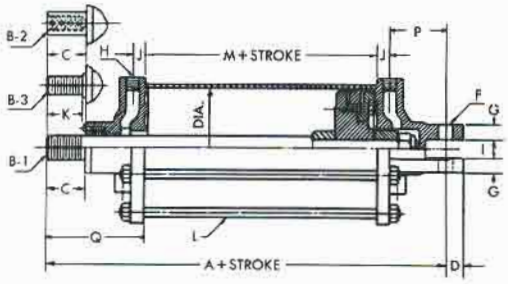


CLASS 1 or 2
Double Acting Cylinder



End view illustrates 8 tie rod spacing incorporated in the 10", 12" and 14" bore sizes. See dimension L.

1½" thru 4" bore sizes use 4 tie rods, 5" thru 8" bore sizes use 6 tie rods, all evenly spaced and located symmetrically about inlet center line.



FOR FURTHER DETAIL
SEE PAGE 14.

TABLE OF DIMENSIONS – MODEL E – CLASS 1 or 2

Bore	A	Rod* Dia.	B-1*	B-2*	B-3*	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1½	6¾	⅝	⅝-18	½-20	⅜-24	1⅛	½	2¾	⅜	⅜	¼	½	⅝	⅞	4-5/16	1⅜	2⅝	⅜	1½	3¼
2	7¼	⅝	⅝-18	½-20	½-20	1⅛	⅝	3	½	½	¼	½	⅝	⅞	4-5/16	1⅜	2⅞	½	2	3¼
2½	8⅝	¾	¾-16	½-20	½-20	1⅜	⅝	3½	½	½	⅜	½	⅝	1⅛	4-⅜	1¾	3½	½	2⅛	4⅛
3	8⅞	¾	¾-16	½-20	⅝-18	1⅜	⅝	3¾	½	½	⅜	½	¾	1⅛	4-⅜	1¾	3⅞	½	2 5/16	4⅛
4	10¾	1	1-14	⅝-18	¾-16	1¾	⅞	4⅞	¾	¾	½	¾	1	1½	4-½	2	5⅛	⅝	2⅝	5⅛
5	10⅞	1	1-14	⅝-18	¾-16	1¾	⅞	6⅜	¾	¾	½	¾	1	1½	6-½	2	6⅛	½	2¾	5⅛
6	12¾	1¼	1¼-12	¾-16	1-14	2⅛	1⅛	7¼	⅞	1	¾	1	1	1⅞	6-½	2⅝	7⅛	⅝	3⅜	5¾
8	14	1¾	1¾-12	1-14	1½-12	2½	1¼	9⅝	1	1	1	1¼	1⅛	2¼	6-⅝	3½	9½	1 1/16	2⅝	6¾
10	17¾	2	2-12	1¼-12	1½-12	3¼	1½	12¾	1¼	1¼	1¼	1½	1⅛	3	8-¾	3⅝	11⅝	1	4¾	8¼
12	21¾	2½	2½-12	1½-12	2-12	4	1¾	15⅞	1½	1½	1½	2	1⅜	3¾	8-⅞	3¾	14¾	1⅛	6⅜	10¼
14	22⅞	2¾	2¾-12	1¾-12	2½-12	4	2	17¾	1¾	1¾	2	2½	2	3¾	8-⅞	3¾	17	1⅛	6¾	10⅜

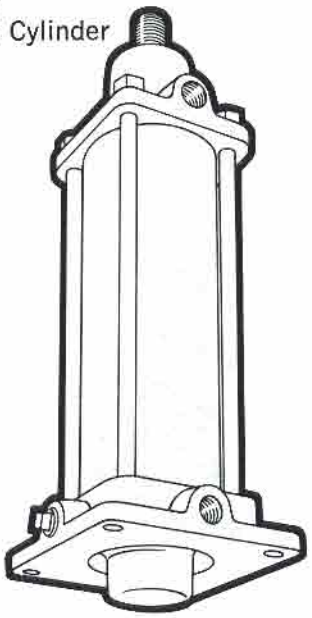
*A ¼" oversize rod (OB) ***standard in the 8" bore size*** can be furnished using standard head castings. Rod end extension and related dimensions will therefore vary accordingly. See table, page 11. Dimensions shown in this catalog may be altered without notice.

FOR 16" DIAMETER, AND LARGER, REFER TO CATALOG NO. 106.

NOPAK

MODEL C

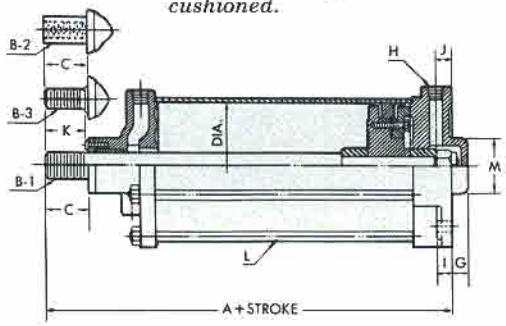
CLASS 1 or 2
Double Acting Cylinder



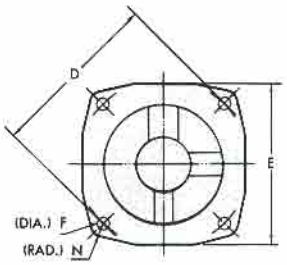
RIGHT ANGLE FLAT BASE MOUNTING – BLANK END

Model C may be mounted on any flat base with provision for protruding cushion boss*. It is used in applications of upward pushing power; also for cantilever action when mounted at right angles to a wall or other vertical surface.

**Flush mounting available at extra charge on blank end, if not cushioned.*



FOR FURTHER DETAIL SEE PAGE 14.



NOTE: 4-Hole Mounting is used on Model C Cylinders from 4" thru 14" in diameter.

NOTE: 2-Hole Mounting is used on Model C Cylinders from 1½" to 3" in diameter.

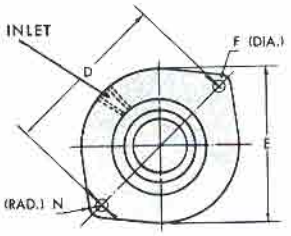


TABLE OF DIMENSIONS – MODEL C – CLASS 1 or 2

Bore	A	Rod* Dia.	B-1*	B-2*	B-3*	C	D	E†	F	G	H	I	J	K	L	M†	N
1½	5¾	⅝	⅝-18	½-20	⅜-24	1⅛	3¼	3⅜	13/32	⅜	¼	½	½	⅞	4-5/16	1½	½
2	5⅞	⅝	⅝-18	½-20	½-20	1⅛	3¾	3⅞	13/32	⅝	¼	⅝	⅝	⅞	4-5/16	1¾	½
2½	7¼	¾	¾-16	½-20	½-20	1⅜	4¾	4½	17/32	⅝	⅜	⅝	¾	1⅛	4-⅜	1⅞	⅝
3	7⅜	¾	¾-16	½-20	⅝-18	1⅜	5¼	4⅞	17/32	¾	⅜	⅝	¾	1⅛	4-⅜	2⅛	⅝
4	8⅞	1	1-14	⅝-18	¾-16	1¾	7¾	6¾	17/32	⅞	½	⅝	¾	1½	4-½	2⅝	⅝
5	8⅞	1	1-14	⅝-18	¾-16	1¾	7¾	7¼	17/32	⅞	½	¾	⅞	1½	6-½	2⅝	⅝
6	10½	1¼	1¼-12	¾-16	1-14	2⅛	9	8⅜	17/32	1⅛	¾	¾	⅞	1⅞	6-½	3	⅝
8	12⅝	1¾	1¾-12	1-14	1½-12	2½	10¾	10⅞	25/32	—	1	⅞	1¼	2¼	6-⅝	—	⅞
10	14¾	2	2-12	1¼-12	1½-12	3¼	13¼	12½	29/32	2	1¼	1⅛	1⅛	3	8-¾	4½	1
12	17⅞	2½	2½-12	1½-12	2-12	4	17½	16	1 1/16	2½	1½	1½	1⅜	3¾	8-⅞	5½	1¼
14	18⅜	2¾	2¾-12	1¾-12	2½-12	4	20	18¾	1 3/16	2¼	2	1¾	2	3¾	8-⅞	5⅞	1½

*A ¼" oversize rod (OB), standard in the 8" bore size, can be furnished using standard head castings. Rod end extension and related dimensions will therefore vary accordingly. See table, page 11. Dimensions shown in this catalog may be altered without notice.

†These are rough dimensions and should not be used for locating purposes. Allow approx. ¼" for clearance. Can be machined at extra charge if specified.

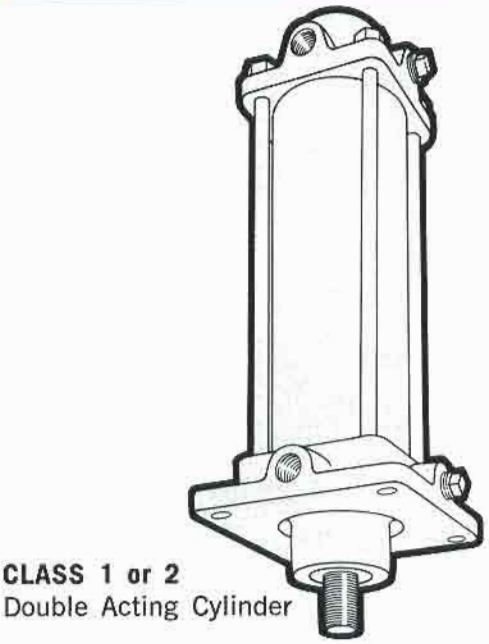
FOR 16" DIAMETER, AND LARGER, REFER TO CATALOG NO. 106.

NOPAK

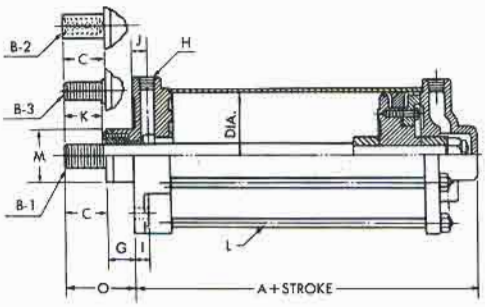
MODEL D

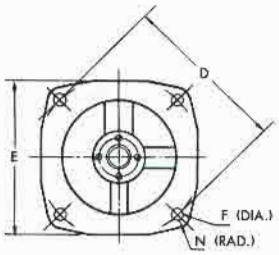
RIGHT ANGLE FLAT BASE MOUNTING – ROD END

Model D is similar in construction to Model C, except that the piston rod is extended through the mounting base. It may be mounted on any flat surface in which an opening can be provided for the protruding cushion boss, and extension of the rod. It is used extensively in applications of inward pulling power.



CLASS 1 or 2
Double Acting Cylinder





NOTE: 4-Hole Mounting is used on Model D Cylinders from 4" thru 14" in diameter.

FOR FURTHER DETAIL SEE PAGE 14.

NOTE: 2-Hole Mounting is used on Model D Cylinders from 1½" to 3" in diameter.

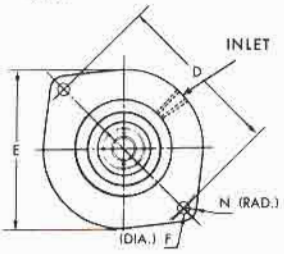


TABLE OF DIMENSIONS – MODEL D – CLASS 1 or 2

Bore	A	Rod* Dia.	B-1*	B-2*	B-3*	C	D	E†	F	G	H	I	J	K	L	M†	N	O
1½	4	⅝	⅝-18	½-20	⅜-24	1⅛	3¼	3⅜	13/32	1	¼	½	½	⅞	4-5/16	2	½	2⅛
2	4½	⅝	⅝-18	½-20	½-20	1⅛	3¾	3⅞	13/32	⅞	¼	⅝	⅝	⅞	4-5/16	2	½	2
2½	5⅛	¾	¾-16	½-20	½-20	1⅜	4¾	4½	17/32	1⅜	⅜	⅝	¾	1⅛	4-⅜	2⅝	⅝	2¾
3	5½	¾	¾-16	½-20	⅝-18	1⅜	5¼	4⅞	17/32	1¼	⅜	⅝	¾	1⅛	4-⅜	2⅝	⅝	2⅝
4	6½	1	1-14	⅝-18	¾-16	1¾	7¾	6¾	17/32	1⅝	½	⅝	¾	1½	4-½	3	⅝	3⅜
5	6⅝	1	1-14	⅝-18	¾-16	1¾	7¾	7¼	17/32	1½	½	¾	⅞	1½	6-½	3	¾	3¼
6	7¾	1¼	1¼-12	¾-16	1-14	2⅛	9	8¼	17/32	1⅝	¾	¾	1	1⅞	6-½	3½	⅝	3¾
8	8⅛	1¾	1¾-12	1-14	1½-12	2½	10¾	10⅞	25/32	1⅞	1	⅞	1¼	2¼	6-⅝	4¼	⅞	4⅜
10	10¾	2	2-12	1¼-12	1½-12	3¼	13¼	12½	29/32	2	1¼	1⅛	1⅛	3	8-¾	4½	1	5¼
12	13⅛	2½	2½-12	1½-12	2-12	4	17½	16	1 1/16	2⅜	1½	1½	1⅜	3¾	8-⅞	5½	1¼	6⅜
14	14¼	2¾	2¾-12	1¾-12	2½-12	4	20	18¾	1 3/16	2⅛	2	1¾	2	3¾	8-⅞	5⅞	1½	6⅛

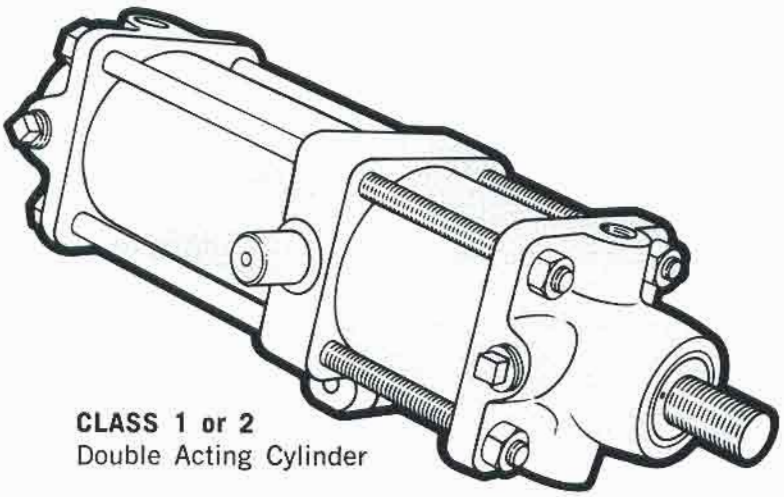
*A ¼" oversize rod (OB), standard in the 8" bore size, can be furnished using standard head castings. Rod end extension and related dimensions will therefore vary accordingly. See table, page 11. Dimensions shown in this catalog may be altered without notice.

†**These are rough dimensions, except on the 8" diameter cylinder. For locating purposes allow approximately ¼" for clearance. Can be machined ¼" smaller than diameter shown at extra charge. The 8" diameter includes a machined hub 4.250 — .005 as standard.**

FOR 16" DIAMETER, AND LARGER, REFER TO CATALOG NO. 106.

NOPAK
MODEL F

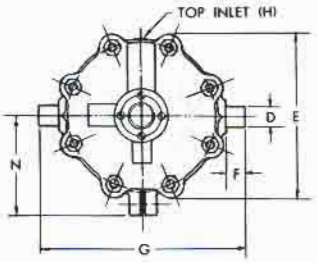
Model F available without trunnion — designated as Model H.



CLASS 1 or 2
Double Acting Cylinder

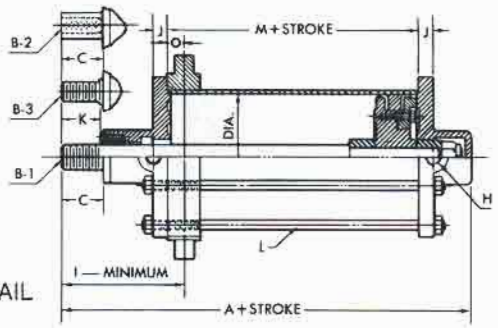
TRUNNION MOUNTING

The Model F Trunnion Mounting provides smooth, dependable cylinder power where oscillating movement is necessary in connection with heavy side thrust. Trunnion location is indicated by dimension "I," which is minimum and furnished as shown unless otherwise specified; may be increased within limits of cylinder tubing length.



End view illustrates 8 tie rod spacing incorporated in the 10", 12" and 14" bore sizes. See dimension L.

1½" thru 4" bore sizes use 4 tie rods, 5" thru 8" bore sizes use 6 evenly spaced tie rods with the inlet located at the one o'clock position. The trunnion clamp is located opposite the inlet.



FOR FURTHER DETAIL SEE PAGE 14.

TABLE OF DIMENSIONS — MODEL F — CLASS 1 or 2

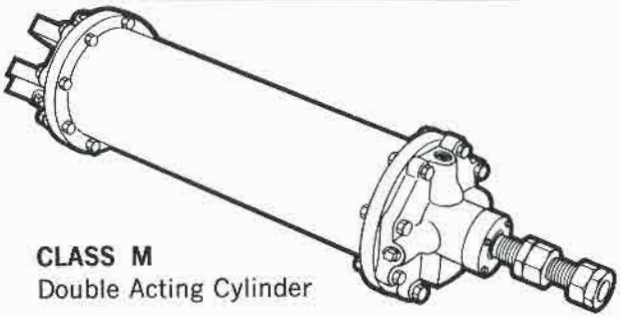
Bore	A	Rod* Dia.	B-1*	B-2*	B-3*	C	D	E	F	G	H	I†	J	K	L	M	N	O
1½	6⅛	⅝	⅝-18	½-20	⅜-24	1⅛	⅝	2¾	⅝	4	¼	3¾	⅝	⅞	4-5/16	1⅜	2 3/16	½
2	6½	⅝	⅝-18	½-20	½-20	1⅛	⅝	3	¾	4⅝	¼	3¾	⅝	⅞	4-5/16	1⅜	2⅜	½
2½	7⅞	¾	¾-16	½-20	½-20	1⅜	¾	3½	1	5¾	⅜	4¾	⅝	1⅛	4-⅜	1¾	2⅞	⅝
3	8⅛	¾	¾-16	½-20	⅝-18	1⅜	¾	3⅞	1⅛	6½	⅜	4¾	¾	1⅛	4-⅜	1¾	3 1/16	⅝
4	9¾	1	1-14	⅝-18	¾-16	1¾	1	4⅞	1¼	7¾	½	5⅞	1	1½	4-½	2	3½	¾
5	9⅞	1	1-14	⅝-18	¾-16	1¾	1	6⅞	1¼	9	½	5⅞	1	1½	6-½	2	4¼	¾
6	11½	1¼	1¼-12	¾-16	1-14	2⅛	1	8⅜	1¼	11	¾	6½	1	1⅞	6-½	2⅝	4⅞	¾
8	12½	1¾	1¾-12	1-14	1½-12	2½	1½	10⅞	1¼	12¾	1	7¾	1⅛	2¼	6-⅝	3½	6⅜	1
10	16	2	2-12	1¼-12	1½-12	3¼	1½	12¾	1½	16¼	1¼	9½	1⅛	3	8-¾	3⅝	7 11/16	1¼
12	19½	2½	2½-12	1½-12	2-12	4	2	15⅞	2	20¼	1½	11⅞	1⅜	3¾	8-⅞	3¾	9½	1⅝
14	20⅜	2¾	2¾-12	1¾-12	2½-12	4	2½	18¼	2½	23½	2	11⅞	2	3¾	8-⅞	3¾	12¼	1½

*A ¼" oversize rod (OB), standard in the 8" bore size, can be furnished using standard head castings. Rod end extension and related dimensions will therefore vary accordingly. See table below. Dimensions shown in this catalog may be altered without notice.

†Dimension "I" will be furnished as shown unless otherwise specified. When ordering, please specify "I" dimension.

FOR 16" DIAMETER, AND LARGER REFER TO CATALOG No. 106

NOPAK
CLASS M



CLASS M
Double Acting Cylinder

NOPAK Class M cylinders are strong and rugged in construction, especially designed for heavy duty applications in mines, quarries, steel mills, and in the heavy construction industries. Maximum system pressure is 650 psi in all diameters to 4" – and 450 psi in diameters of 5" and larger. The Class M construction is available in a full range of sizes and models (mountings) up through 14" in diameter for air, water or oil hydraulic service.

NO TIE RODS – Cylinder flanges are welded to steel cylinder tubing. High tensile alloy iron* heads are bolted to those flanges.

Chrome plated or stainless steel piston rods and chrome plated or brass lined cylinder tubing can be furnished for water hydraulic applications.

**Steel heads are available at extra cost.*

CLASS M — PISTON ROD THREAD DIMENSIONS (Also Class 1 and 2 Standard Oversize) See Clevis Information Page 13

Rod End	CYLINDER DIAMETER										
	1½	2	2½	3	4	5	6	8	10	12	14
Thread	⅞-14	⅞-14	1-14	1-14	1¼-12	1¼-12	1½-12	1¾-12	2¼-12	2¾-12	3-12
OB-1 Dim.-C	1½	1½	1¾	1¾	2⅛	2⅛	2½	2½	3⅝	4⅜	4¾
Dim.-K	1¼	1¼	1½	1½	1⅞	1⅞	2¼	2¼	3⅜	4⅛	4½
Thread	½-20	½-20	½-20	½-20	⅝-18	⅝-18	¾-16	1-14	1¼-12	1½-12	1¾-12
OB-2 Dim.-C	1⅛	1⅛	1⅜	1⅜	1¾	1¾	2⅛	2½	3¼	4	4
Dim.-K	⅞	⅞	⅞	⅞	1⅛	1⅛	1¼	2¼	2	2⅜	2¾
Thread	⅝-18	⅝-18	¾-16	¾-16	1-14	1-14	1¼-12	1½-12	2-12	2½-12	2½-12
OB-3 Dim.-C	1⅛	1⅛	1⅜	1⅜	1¾	1¾	2⅛	2½	3¼	4	4
Dim.-K	⅞	⅞	1⅛	1⅛	1½	1½	1⅞	2¼	3	3¾	3¾

MINIMUM I DIMENSIONS — CLASS M MODEL F CYLINDERS

Bore	1½	2	2½	3	4	5	6	8	10	12	14
I Dimension	5	5	6	6	7⅝	7⅝	8½	10⅜	11⅜	15¼	15⅜

DIMENSIONS

For mounting dimensions of Class M cylinders, use figures from tables of corresponding Class 1, shown on preceding pages, with exception of Piston Rod Diameter and Piston Rod Extension which are shown in tables above. Please note that dimension "I" varies from Class 1 or Class 2 dimension "I" as shown.

SERIES HCM – MILL TYPE

These pragmatic designs, developed and marketed by Midwest Hydraulics Co. during their 30 active years, now enable NOPAK (which acquired Midwest in '93) to produce an endless variety of high pressure hydraulic Mill type cylinders.

The aforesaid designs, evolving from the evermore challenging demands for gigantic Mill types, now place NOPAK in the forefront.

We welcome the opportunity to quote your most challenging applications. Request Catalog HCM-89 for information.

CYLINDER FORCE AND AIR CONSUMPTION TABLE

Cyl. Dia.	Rod Dia.	Theoretical Force @ Fluid Pressure 40	60	80	100	125	200	250	450	650	Cu. Ft. Free Air* Per In. Piston Travel at 80 PSI
1½	PUSH	70.8	106.0	141.4	176.7	220.9	353.4	441.8	795.2	1149	.00658
	PULL 5/8	58.4	87.6	116.8	146.0	182.6	292.1	365.1	657.1	949.2	
	PULL 7/8	46.6	69.9	93.3	116.6	145.7	233.2	291.5	524.6	757.8	
2	PUSH	125.7	188.5	251.3	314.2	392.7	628.3	785.4	1414	2042	.01175
	PULL 5/8	113.4	170.1	226.8	283.5	354.4	567.0	708.7	1276	1843	
	PULL 7/8	101.6	152.4	203.2	254.0	317.5	508.1	635.1	1143	1651	
2½	PUSH	196.3	294.5	392.7	490.9	613.6	981.7	1227	2209	3191	.0183
	PULL 3/4	178.7	268.0	357.3	446.7	558.4	893.4	1117	2010	2903	
	PULL 1	164.9	247.4	329.9	412.3	515.4	824.7	1031	1855	2680	
3	PUSH	282.7	424.1	565.5	706.9	883.6	1414	1767	3181	4595	.0264
	PULL 3/4	265.1	397.7	530.1	662.7	828.4	1325	1657	2982	4307	
	PULL 1	251.3	377.0	502.7	628.3	785.4	1257	1571	2827	4084	
4	PUSH	502.7	754.0	1005	1257	1571	2513	3142	5655	8168	.0469
	PULL 1	471.2	706.9	942.5	1178	1473	2356	2945	5301	7658	
	PULL 1¼	453.6	680.3	907.1	1134	1417	2268	2835	5103	7370	
5	PUSH	785.4	1178	1571	1964	2454	3927	4909	8836		.0731
	PULL 1	754.0	1131	1508	1885	2356	3770	4712	8482		
	PULL 1¼	736.3	1104	1473	1841	2301	3682	4602	8284		
6	PUSH	1131	1696	2262	2827	3534	5655	7069	12723		.1055
	PULL 1¼	1082	1623	2164	2705	3381	5409	6762	12171		
	PULL 1½	1060	1590	2121	2651	3313	5301	6627	11928		
8	PUSH	2011	3016	4021	5027	6283	10053	12566	22619		.188
	PULL 1¾	1914	2872	3829	4786	5982	9572	11965	21537		
10	PUSH	3142	4712	6283	7854	9818	15708	19635	35343		.294
	PULL 2	3016	4524	6032	7540	9425	15080	18850	33929		
	PULL 2¼	2983	4474	5965	7456	9320	14913	18641	33554		
12	PUSH	4524	6786	9048	11310	14138	22620	28275	50895		.423
	PULL 2½	4328	6491	8655	10819	13524	21638	27048	48686		
	PULL 2¾	4286	6430	8573	10716	13395	21432	26790	48222		
14	PUSH	6158	9236	12315	15394	19243	30788	38485	69273		.575
	PULL 2¾	5920	8880	11840	14800	18500	29600	37000	66600		
	PULL 3	5875	8812	11750	14687	18359	29374	36718	66092		

*"Free Air" is normal atmospheric air (sea level) at compressor location. These figures are used in determining size of compressor required. Piston travel in double acting cylinders is twice the stroke. Free Air consumption at other line pressures will vary accordingly.

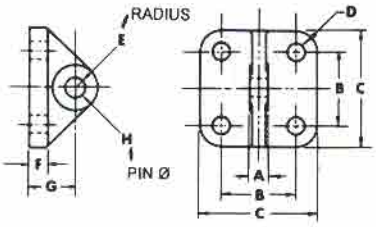
TIE-ROD (OR SOCKET HEAD CAP SCREWS ON CLASS M) TORQUE VALUES

CYLINDER DIA.	TIE ROD DIA. THD.	TIE ROD QTY.	CLASS 1-2 TORQUE — FT. LB.	CLASS M TORQUE — FT. LB.
1.50"	5/16-24 NF	4	7	14
2.00"	5/16-24 NF	4	7	14
2.50"	5/16-24 NF	4	7	14
3.00"	3/8-24 NF	4	14	20
4.00"	3/8-24 NF	4	14	20
5.00"	3/8-24 NF	6	14	20
6.00"	3/8-24 NF	6	14	20
8.00"	1/2-20 NF	6	40	70
10.00"	3/4-16 NF	8	100	200
12.00"	3/4-16 NF	8	100	200
14.00"	7/8-14 NF	8	170	300

CYLINDER ACCESSORIES FOR CLASS 1 - 2 OR M NOPAK CYLINDERS

STANDARD MOUNTING BRACKET AND PIN

CYL. DIA.	A	B	C	D	E	F	G	BRACKET		MTG. PIN "H"	PIN	
								FORMER P/N	CURRENT P/N		FORMER P/N	CURRENT P/N
1-1/2	7/16	1-3/4	2-3/4	13/32	1/2	3/8	1-3/16	1430CY	1801L00	3/8	3253CY-1	3221L46-1
2-2-1/2-3	7/16	2	3-1/4	17/32	5/8	1/2	1-3/8	1630CY	1802L46	1/2	3253CY-3	3221L46-3
4-5	5/8	3-1/4	4-1/2	17/32	7/8	1/2	1-3/4	1796CY	1803L46	3/4	3253CY-4	3221L46-4
6	7/8	4-1/4	5-1/2	17/32	1-1/8	5/8	2	1797CY	1804L06	7/8	3253CY-5	3221L46-5
8	1	5	6-1/2	21/32	1-1/4	3/4	2-1/2	1798CY	1805L07	1	3253CY-6	3221L46-6
10	1-1/4	6	8	25/32	1-1/2	1	3	1799CY	1806L08	1-1/4	3253CY-7	3221L46-7
12	1-3/4	6-3/4	10	1-1/16	2	1-1/4	3-1/2	1800CY	1807L09	1-1/2	3253CY-8	3221L46-8
14	2-1/4	8	10-1/2	1-5/16	2-1/8	1-1/2	3-3/4	2958CY	1767L46	1-3/4	3253CY-9	3221L46-9



Mounting Brackets of high grade malleable iron or steel plate stock are designed to fit the blank end of Model E cylinders or into the slot of the clevises described below. Order by size and part number.

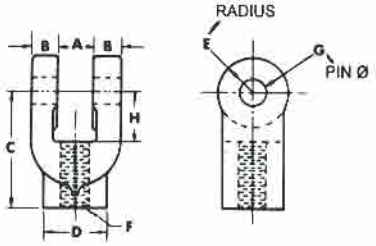
STANDARD FEMALE CLEVIS AND PIN

CYL. DIA.*	THREAD †† "F"	A	B	C	D	E	G	H	CLEVIS		MTG. PIN "G"	PIN	
									FORMER P/N	CURRENT P/N		FORMER P/N	CURRENT P/N
1-1/2-2	5/8-18	17/32	3/8	1-5/8	1	1/2	1/2	3/4	4330CY	1787L46	1/2	3253CY-3	3221L46-3
2-1/2-3	3/4-16	17/32	1/2	2	1-1/4	5/8	1/2	7/8	4331CY	1788L46	1/2	3253CY-3	3221L46-3
4-5	1-14	25/32	3/4	2-5/8	1-1/2	3/4	3/4	1-1/8	4332CY	1789L46	3/4	3253CY-4	3221L46-4
6	1-1/4-12	1-1/32	15/16	3-1/4	1-3/4	1-1/8	7/8	1-3/8	4333CY	1790L06	7/8	3253CY-5	3221L46-5
8	1-3/4-12	1-9/32	1	3-3/4	2-1/2	1-1/4	1	1-1/2	16989CY	1791L07	1	3253CY-6	3221L46-6
10	2-12	1-17/32	1-1/4	4-3/4	3	1-1/2	1-1/4	1-3/4	1373CY	1792L08	1-1/4	3253CY-7	3221L46-7
12-14†	2-1/2-12	2-1/32	1-1/2	5-7/8	3-1/2	1-3/4	1-1/2	2-1/8	1374CY	1793L46	1-1/2	3253CY-8	3221L46-8

*Indicates Class 1 and 2 cylinder diameter with Standard B-1 NF rod end which clevis will fit.

†For B-3 Rod only on 14" diameter.

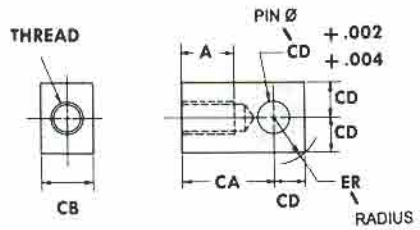
††1-1/2-12 thread clevis 7286L07 (4334CY) available. Dimensions on 1791L07 (18510CY) apply.



Clevises of high grade malleable iron are available for all standard model and size Class 1 and 2 cylinders. Clevises for any diameter cylinder are threaded for that particular standard B-1 rod end. Class 1 and 2 cylinders with oversize rod and Class M cylinders will therefore require a larger clevis unless the rod end is turned down. Be sure to specify when ordering. Special clevises available made to order.

STANDARD ROD EYE AND PIN

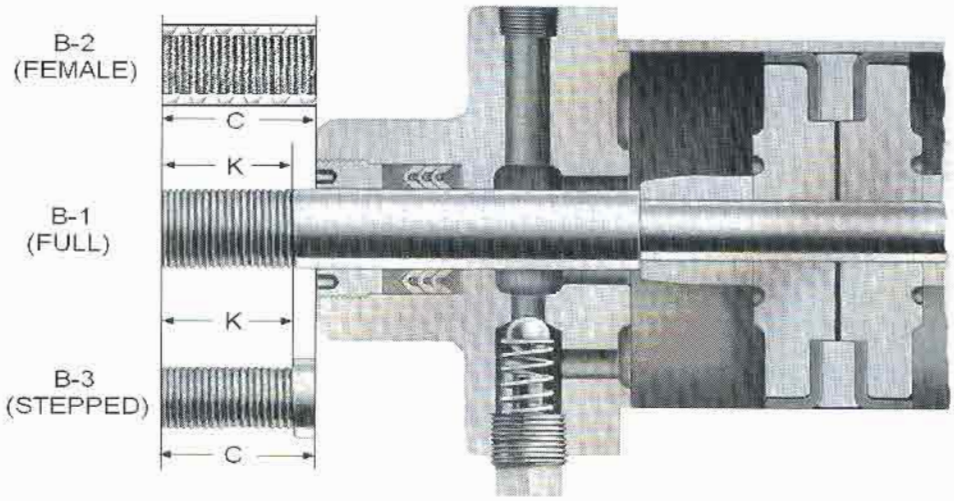
THREAD	A	CA	CB	CD	ER	ROD EYE		PIN	
						FORMER P/N	CURRENT P/N	FORMER P/N	CURRENT P/N
5/8-18	7/8	1-5/8	1	1/2	3/4	21789CY	1811L59	3253CY-3	3221L46-3
3/4-16	1-1/8	2-1/16	1-1/4	3/4	1-1/16	7061CY	1812L59	3253CY-4	3221L46-4
1-14	1-5/8	2-13/16	1-1/2	1	1-7/16	7062CY	1813L59	3253CY-6	3221L46-6
1-1/4-12	2	3-7/16	2	1-3/8	2	7063CY	1814L59	3253CY-4	3221L46-4
1-3/4-12	2-1/4	4	2-1/2	1-3/4	2-1/16	21790CY	1816L59	3253CY-9	3221L46-9
2-12	3	5	2-1/2	2	2-1/4	23464CY	1819L59	3253CY-11	3221L46-11
2-1/2-12	3-1/2	6-1/8	3	3	3-1/4	23465CY	1823L59	3253CY-7	3221L46-7



Rod eyes of mild steel are available for all standard model and size Class 1 and Class 2 cylinders with B-1 rod ends Other sizes of rod eyes are also available Pins for rod eyes are not furnished unless requested.

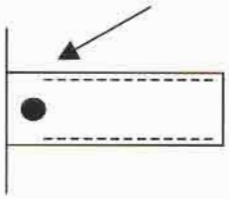
ROD END DETAIL

PISTON ROD & THREAD INFORMATION:



NEW:

Drift pinhole to prevent rod rotation when attaching rod end accessories.



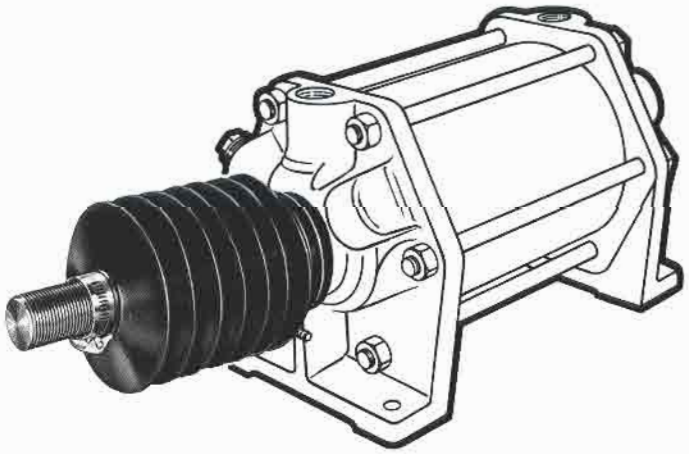
Dim. C = Distance from gland face to rod end.
Dim. K = Thread length, male or female.

PISTON ROD BOOTS

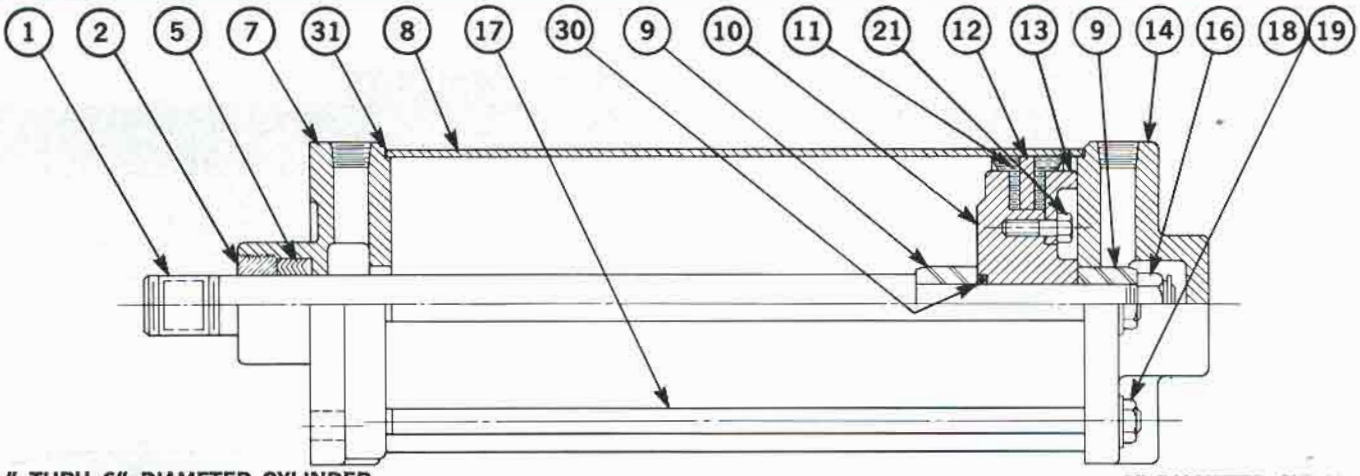
For All Classes of NOPAK Cylinders

These protective sleeves are recommended for cylinders used where there's exposure to chips, grit, dust and other abrasive materials. The expanding sleeve covers the cylinder piston rod at all times, thereby preventing foreign matter from entering the cylinder mechanism through the cylinder head.

NOPAK Cylinders can be equipped with these sleeves at nominal cost. In asking for quotation give full specifications of cylinder. NOTE: It is important that piston rod extension (Dimension C) be longer than standard to accommodate boot in collapsed position. This dimension varies with stroke and is available upon request.

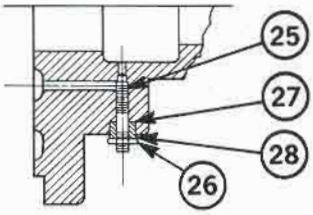


NOPAK CAST HEAD CYLINDER PARTS LIST

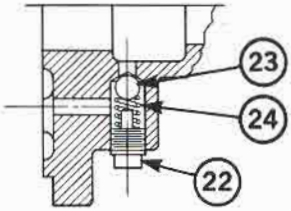


1½" THRU 6" DIAMETER CYLINDER ROD SEAL ASSEMBLY

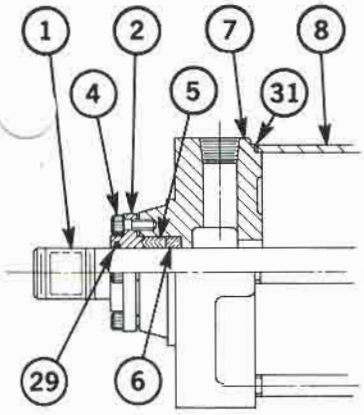
6" DIAMETER CYLINDER PISTON ASSEMBLY



ADJUSTABLE NEEDLE VALVE



BALL CHECK VALVE

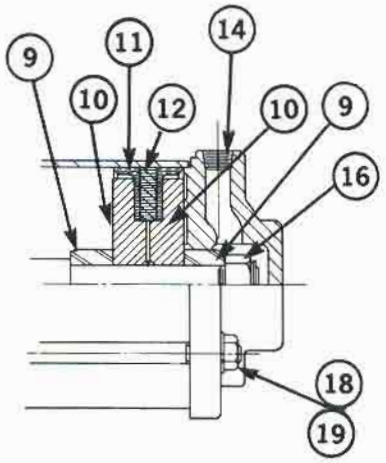


8" DIAMETER CYLINDER ROD SEAL ASSEMBLY

PARTS ORDER INFORMATION

When using this parts list for replacements, be sure to:

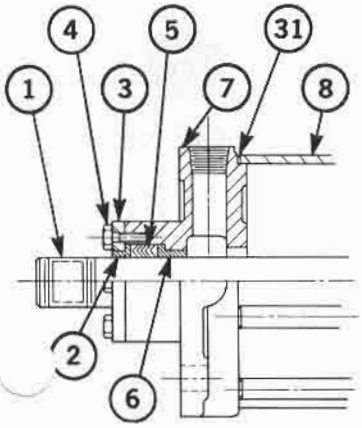
1. Identify part by name and item number;
2. Diameter of cylinder;
3. Model of cylinder;
4. Serial number on NOPAK cylinder label.



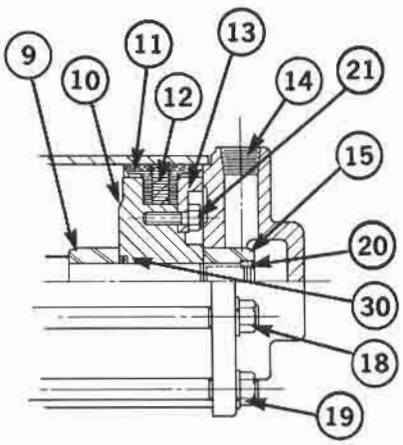
1½" THRU 5" DIAMETER CYLINDER PISTON ASSEMBLY

Parts List

1. Piston Rod
2. Packing Gland
3. Gland Ring
4. Gland Ring Screws
5. V-Ring Packing
6. Piston Rod Bushing
7. Rod End Cylinder Head
8. Cylinder Tube
9. Cushion Sleeve
10. Piston Follower
11. Piston Cups
12. Piston
13. Follower Ring
14. Blank End Cylinder Head
15. Lock Sleeve
16. Piston Lock Nut
17. Tie Rods
18. Tie Rod Nuts
19. Lock Washers
20. Set-Screw
21. Piston Cap Screws
22. Ball Check Plug
23. Ball Check Ball
24. Ball Check Spring
25. Needle Valve
26. Needle Valve Lock Nut
27. Needle Valve Packing
28. Needle Valve Gland Ring
29. Wiper
30. O-Ring
31. Gasket



10" THRU 14" DIAMETER CYLINDER ROD SEAL ASSEMBLY



8" THRU 14" DIAMETER CYLINDER PISTON ASSEMBLY

REPLACEMENT PARTS

REPAIR KITS
FOR CLASS 1, 2 & SVR

ROD SEAL KITS

ROD DIA.	SINGLE ROD a PART NO.
0.63"	RK12M-63
0.75"	RK12M-75
0.88"	RK12M-88
1.00"	RK12M-100
1.25"	RK12M-125
1.50"	RK12M-150
1.75"	RK12M-175
2.00"	RK12M-200
2.25"	RK12M-225
2.50"	RK12M-250
2.75"	RK12M-275
3.00"	RK12M-300

Each Rod Seal Kit consists of:
1 - Set rod "V" packing

① To service DOUBLE ROD END CYLINDER, order one Rod Kit for EACH rod end, and if applicable, one Piston Kit.

PISTON SEAL KITS

BORE SIZE	SINGLE OR DOUBLE ROD PART NO.
1.50"	PK12M-150
2.00"	PK12M-200
2.50"	PK12M-250
3.00"	PK12M-300
4.00"	PK12M-400
5.00"	PK12M-500
6.00"	PK12M-600
8.00"	PK12M-800
10.00"	PK12M-1000
12.00"	PK12M-1200
14.00"	PK12M-1400

Each Piston Seal Kit consists of:
2 - Tube gaskets
2 - Piston cups
1 - Piston "O" ring (3.00" – 14.00" bore)

When ordering, specify Type "A" or Type "B" seal
Type "A" = Buna-N (NITRILE)
Type "B" = Viton

PACKING GLANDS

ROD DIA.	PART NUMBER
0.63	1381G70
0.75	1382G71
0.88	1383G72
1.00	1384G73
1.25	1385G74
1.50	1386G76
1.75	1067G77
2.00	1114G78
2.25	1387G96
2.50	1388G79
2.75	1389G80
3.00	1390G81

NOPAK

National FLUID POWER Association MEMBER

WARRANTY

GALLAND HENNING NOPAK, INC. warrants every product of its manufacture to be of proper materials and first class workmanship. We agree to repair or replace, F.O.B. Factory, but not to remove or install in the field, any perishable "soft goods" such as seals, gaskets, etc., which fail within a six month period after shipment, normal wear excepted. We warrant for one year from date of shipment, all other parts which fail because of defective materials or workmanship. GHN assumes no responsibility for work done or expenses incurred, in the field, pertaining to such repairs or replacements, except upon written authority from our home office. Components not produced by GHN are subject only to the warranty extended to GHN by their respective manufacturer. For a complete statement of terms and warranty, see your NOPAK distributor or the reverse side of any GHN order acknowledgement or invoice.

When orders have been correctly filled, there shall be no returns without GHN's approval. Such returns will be subject to a restocking charge.

"The Bitterness of Poor Workmanship Remains Long After The Sweetness of Low Price is Forgotten"

*Ben Franklin*We are proud to warrant that since 1889 all products manufactured by GALLAND HENNING NOPAK, INC. consist of 99% American material and labor

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Catalog 101 4/04 5K Printed in U.S.A.

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NOPAK®

CATALOG 103

CLASS 3
HYDRAULIC
CYLINDERS
TO 3000 PSI

HIGH
PRESSURE
SQUARE-HEAD
CYLINDERS

GALLAND HENNING NOPAK, Inc.

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NOPAK HIGH PRESSURE SQUARE-HEAD CYLINDERS

TABLE OF CONTENTS

CYL. DIA.	4/1*	RECOMMENDED MAXIMUM CONTINUOUS PRESSURE
1½	2265	3000
2	3209	3000
2½	3209	3000
3¼	2465	3000
4	2288	3000
5	2752	3000
6	2326	3000
7	2632	3000
8	2326	3000
10	3072	3000
12	2710	3000
14	2631	3000
16	2014	3000
18	2099	3000
20	2064	3000

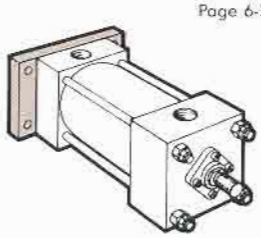
*The 4/1 pressure rating is the lowest calculated value of the various pressure containing elements of a cylinder and is based on ¼th of the minimum tensile strength of the material. While this is a conservative rating method, it does not include factors for type of mounting, length of stroke, method or speed of load application, fluid, temperature, environment, or fatigue. For specific recommendations consult your nearest Nopak field representative or factory application engineer.

APPROXIMATE UNCRATED CLASS 3 HYDRAULIC CYLINDER WEIGHTS (LBS)

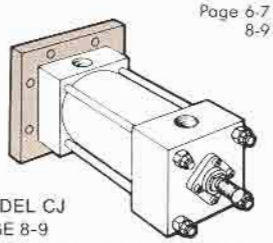
CYLINDER BORE	1½	2	2½	3¼	4	5	6	7	8	10	12	14	16	18	20
BASIC MODELS ZERO STROKE	7.8	12	17.5	33	45	81	137	193	298	532	890	1480	1930	2810	3700
MODELS ME, MF, MP & MT — ADD	2.2	3	3.5	7	8	13	20	27	36	84	130	270	420	540	800
STANDARD ROD PER INCH OF STROKE	.45	.75	1.1	1.6	2.5	4.0	5.2	6.3	8.2	15.5	23	32	38	48	57
LARGE ROD PER INCH OF STROKE	.59	.95	1.6	2.1	3.2	5.8	7.4	9.9	12.2	21.9	30	43	46	52	—

MOUNTING STYLES INDEX

MODEL C
(NFPA MF2)
1½" THROUGH 8" DIA. BORE
Page 6-7

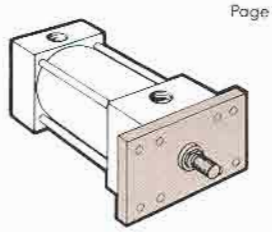


MODEL CC
(NFPA MF6)
1½" THROUGH 12" DIA. BORE
Page 6-7
8-9

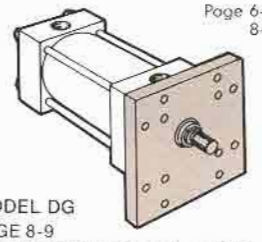


MODEL CJ
PAGE 8-9
14" THROUGH 20" DIA. BORE

MODEL D
(NFPA STD. MF1)
1½" THROUGH 8" DIA. BORE
Page 6-7

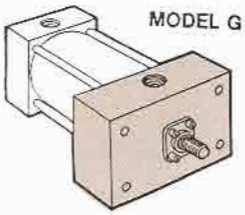


MODEL DD
(NFPA MF5)
1½" THROUGH 12" DIA. BORE
Page 6-7
8-9

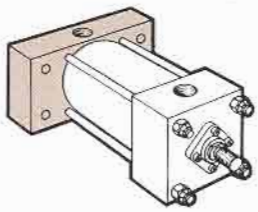


MODEL DG
PAGE 8-9
14" THROUGH 20" DIA. BORE

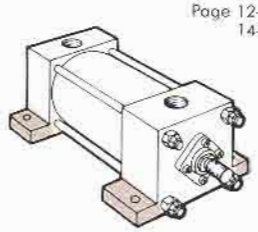
MODEL G
(NFPA STD. ME5)
1½" THROUGH 12" DIA. BORE
Page 10-11



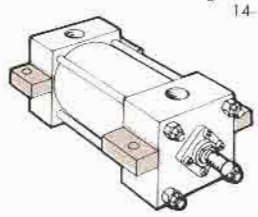
MODEL J
(NFPA STD. ME6)
1½" THROUGH 12" DIA. BORE
Page 10-11



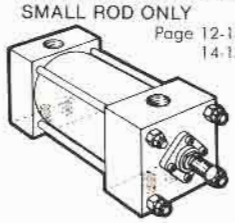
MODEL A
(NFPA STD. MS2)
1½" THROUGH 14" DIA. BORE
Page 12-13
14-15



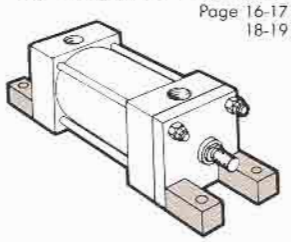
MODEL B
(NFPA STD. MS3)
1½" THROUGH 20" DIA. BORE
Page 12-13
14-15



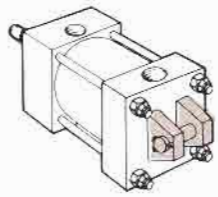
MODEL S
(NFPA STD. MS4)
1½" THROUGH 8" DIA. BORE
SMALL ROD ONLY
Page 12-13
14-15



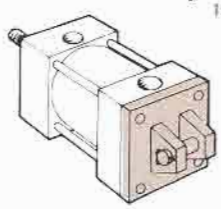
MODEL AL
(NFPA STD. MS7)
1½" THROUGH 8" DIA. BORE
Page 16-17
18-19



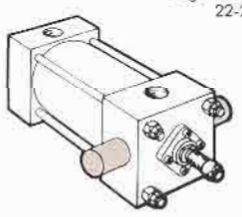
MODEL E
(NFPA STD. MP1)
1½" THROUGH 20" DIA. BORE
Page 16-17
18-19



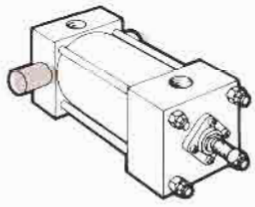
MODEL HE
(NFPA STD. MP2)
1½" THROUGH 8" DIA. BORE
Page 16-17
18-19



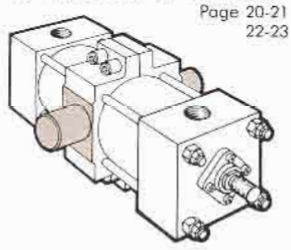
MODEL FR
(NFPA STD. MT1)
1½" THROUGH 14" DIA. BORE
Page 20-21
22-23



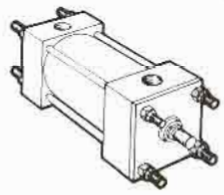
MODEL FB
(NFPA STD. MT2)
1½" THROUGH 14" DIA. BORE
Page 20-21
22-23



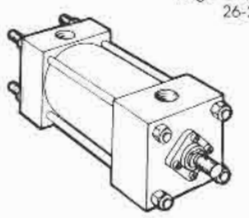
MODEL F
(NFPA STD. MT4)
1½" THROUGH 14" DIA. BORE
Page 20-21
22-23



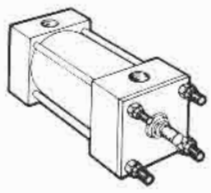
MODEL T
(NFPA STD. MX1)
1½" THROUGH 14" DIA. BORE
Page 24-25
26-27



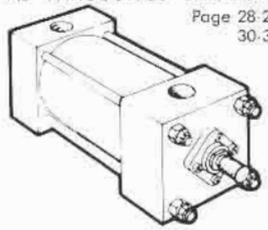
MODEL TB
(NFPA STD. MX2)
1½" THROUGH 14" DIA. BORE
Page 24-25
26-27



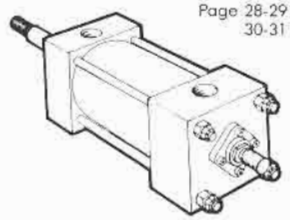
MODEL TR
(NFPA STD. MX3)
1½" THROUGH 14" DIA. BORE
Page 24-25
26-27



MODEL H
(BASIC MODEL)
1½" THROUGH 20" DIA. BORE
Page 28-29
30-31

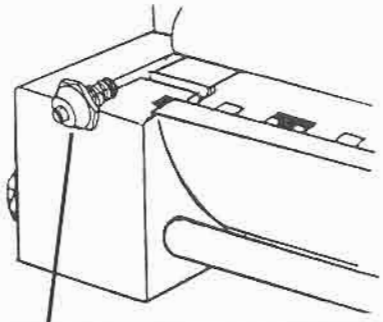


MODEL XH
(DOUBLE ROD)
1½" THROUGH 20" DIA. BORE
AVAILABLE IN MOST MODELS
Page 28-29
30-31



NOPAK HIGH PRESSURE SQUARE-HEAD CLASS 3 HYDRAULIC CYLINDERS

IMPROVED CUSHION ADJUSTMENT – Newly designed needle valve is interchangeable with current design and offers improved sealing characteristics.



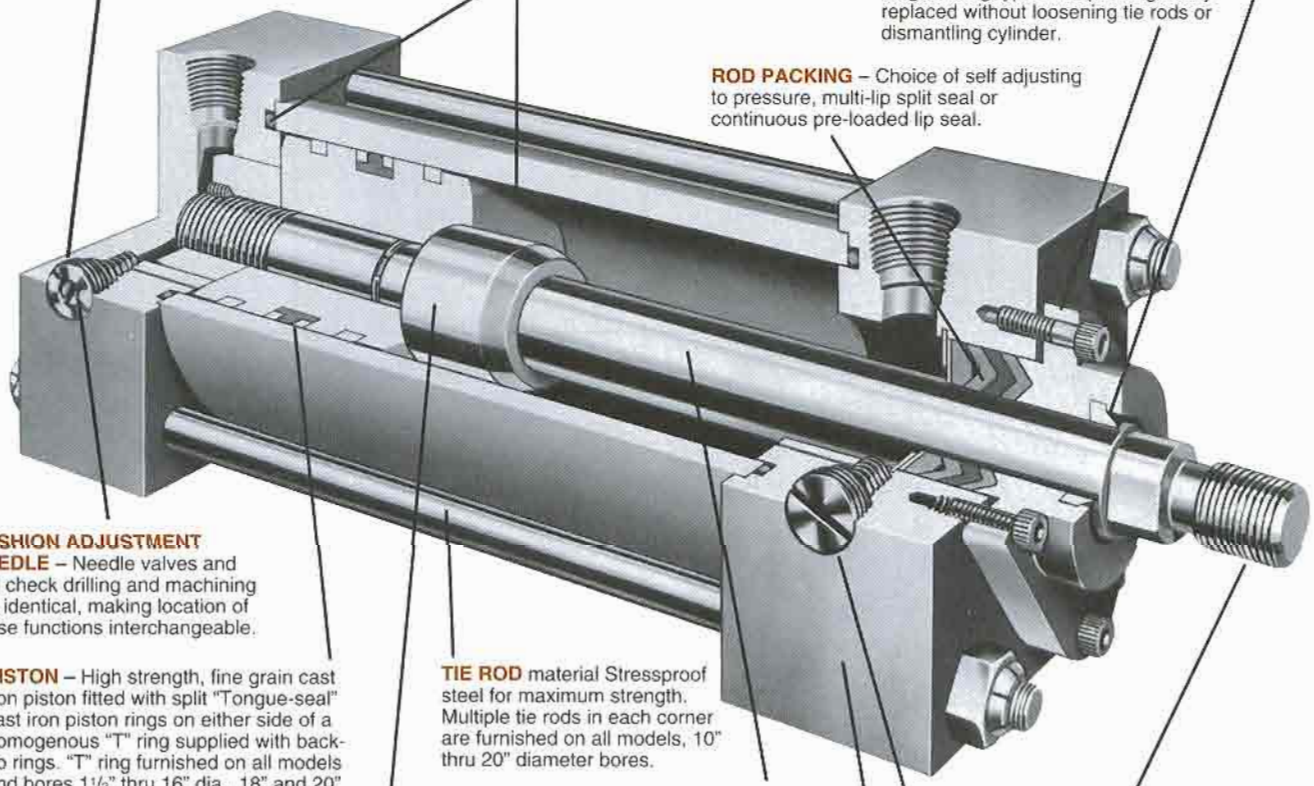
HEAVY WALL steel tubing, precision honed with extra long stones to provide over-lap and eliminate a spiral condition detrimental to long stroke cylinders. The resulting ultra-smooth finish provides maximum seal life.

TUBE SEAL – Two-Step Pilot Recess Grooves afford Positive Controlled Squeeze on Pressure Sealed O-Ring, while Tubing locates concentrically against End Cap.

ROD WIPER – Wipes rod clean and dry. Keeps foreign matter from entering cylinder, extending packing life.

PACKING GLAND – Readily removable long bearing type. Rod packing easily replaced without loosening tie rods or dismantling cylinder.

ROD PACKING – Choice of self adjusting to pressure, multi-lip split seal or continuous pre-loaded lip seal.



CUSHION ADJUSTMENT NEEDLE – Needle valves and ball check drilling and machining are identical, making location of these functions interchangeable.

PISTON – High strength, fine grain cast iron piston fitted with split "Tongue-seal" cast iron piston rings on either side of a homogenous "T" ring supplied with back-up rings. "T" ring furnished on all models and bores 1½" thru 16" dia., 18" and 20" fitted with piston rings. Other designs on application. The outboard piston rings effectively seal off initial shock loads and allow the "T" ring to seal any by-pass fluid to provide a leak-proof piston seal with maximum life.

TIE ROD material Stressproof steel for maximum strength. Multiple tie rods in each corner are furnished on all models, 10" thru 20" diameter bores.

PISTON ROD is high tensile 100,000 psi minimum yield stressproof steel, ground, polished, and flash chrome plated .0003/.0005 to provide a hard, long-wearing surface with low friction, but not corrosion resistant. Consult factory for special applications.

ROD END THREADING – Choice of standard catalog male and female thread types plus standard wrench flats.

CUSHION BALL CHECK assures quick starting under full power; pressure acts on full piston area instantaneously.

CUSHION SLEEVES precision fitted with predetermined taper to provide a gradual deceleration and reduce shock.

END CAPS (Cylinder Heads) – Precision Broached Steel Blocks

NOPAK • OPTIONS • MODIFICATIONS • ORDERING INFORMATION

OPTIONS

Bore Size Selection

Unlike air applications, the output force of a cylinder for hydraulic service need be only slightly greater than the required force. Hydraulic cylinder speed is dependent directly on the relationship of supply flow rate to cylinder volume.

Force tables to aid in cylinder sizing are on page 35.

Mountings

Select the cylinder mounting which will keep the line of force as close as possible to the centerline of the piston rod and free of misalignment. This will maximize seal and bearing life.

CUSTOM MODIFICATIONS

Stop Tubes

In long cylinders used on push applications, internal stop tubes are installed to prevent excessive bearing wear. They are located between the piston and rod end head. See page 37 for instructions.

Oversize Rods

For long, push stroke cylinders, oversize rods may be required. See page 37 for instructions.

HOW TO ORDER NOPAK CLASS 3 CYLINDERS

You can help assure prompt processing of your order by including all of the following requested information:

1. Quantity Required
2. Specify Class 3
3. Bore or cylinder diameter size.
4. Stroke length in inches.
5. Type of mounting (Nopak model or NFPA style.)
6. Type of cushioning:
   non-cushioned-NN — cushioned blind end-NA
   cushioned rod end-AN — cushioned both ends-AA
7. Piston rod diameter, and type of rod end threading as 1, 3, 4, 5, or special (see page 32.)

Double Rod End

Nopak Class 3 cylinders when ordered as double rod end are designated by prefixing the model with the letter "X". Mounting dimensions may vary from standard because two rod end heads are used.

See page 28-30.

Cushions

Nopak Class 3 cylinders are available with adjustable cushions on either or both ends, or non-cushion.

The purpose of a cushion is to slow up piston speed at the end of the stroke, eliminate shock. The mass to be cushioned should be limited to one half the cylinder power unless other provisions are made for deceleration or special cushioning.

Piston Rod Extension and Rod Threading

Longer than standard piston rod extensions may be required to accommodate load fastening.

Depending upon the details of rod engagement to load, special threading or rod end configuration may be required.

Cylinder Ports

Ports are offered as NPTF, SAE O Ring or SAE Flange Type. NPTF ports standard for 1½" thru 8" diameter cylinder bores.

To increase cylinder speed, increased fluid volume is necessary. This can be done by using enlarged or additional ports.

Also Specify:

1. Position of cylinder ports and cushion adjustment screw if other than standard. Normal positions are Cylinder Ports — position 1, Ball Check — position 2, Cushion Adjustment — position 4.
2. Extreme high or low operating or ambient temperatures.
3. Extreme operating pressures.
4. Type of operating fluid if other than standard petroleum base oil.
5. Unusual operating conditions.

ORDERING CODE

EXAMPLE:

Phone: 414-645-6000
Fax No.: 414-645-6048

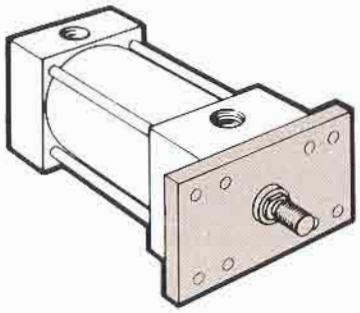
CL3 - 4 x 18 - A - △ △ - 1.75 - 4 - OPT.

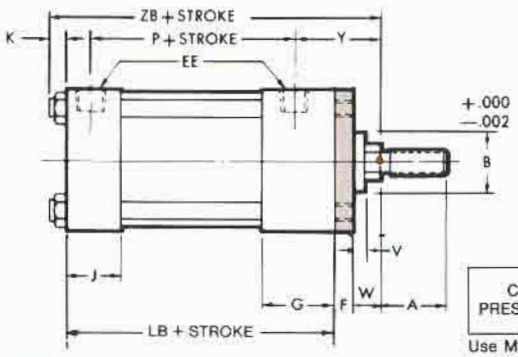
- OPT: Special modification if required.
- Rod End Thread: See chart on page 32.
- Rod Diameter: See chart at respective bore size for rod sizes available in that bore.
- Cushions: See chart below.
- Mounting style: Use either Nopak or NFPA's designation.
  NOTE: If double rod is required, add X before mounting style. (Example: XA, XD, XG, etc.)
- Stroke
- Bore (1.50" through 20")
- Class 3 Hydraulic

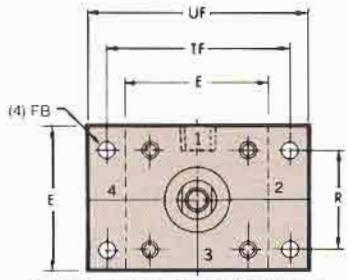
△ △ Two letters required:	NA = No cushion rod end, cushion blind end	OPT = Optional features required such as VITON seals, port position, etc.
NN = No cushions	AN = Cushion rod end, no cushion blind end	
AA = Cushioned both ends		

NOPAK FLANGE MOUNT CYLINDERS

MODEL D (NFPA STD. MF1)





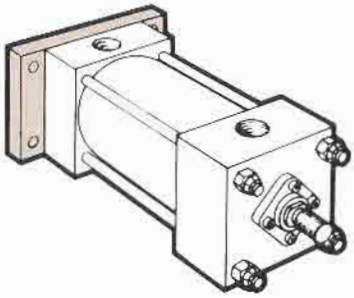


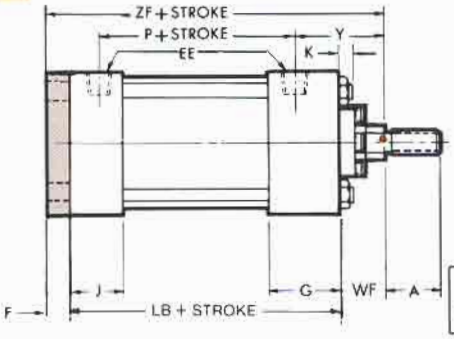
PRESSURE LIMITATIONS (PUSH)

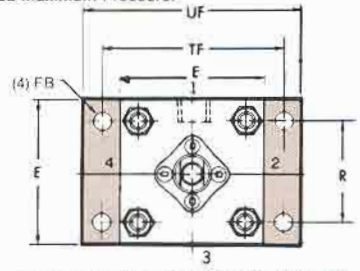
CYL. DIA	5	6	7	8
PRESSURE (PSI)	1800	1500	1000	800

Use Model DD (Below) or Model G (Page 10) for Recommended Maximum Pressure.

MODEL C (NFPA STD. MF2) ▲





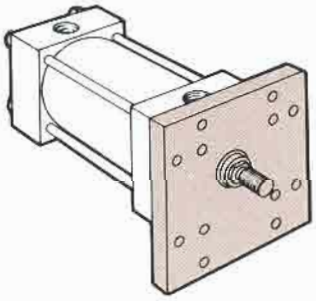


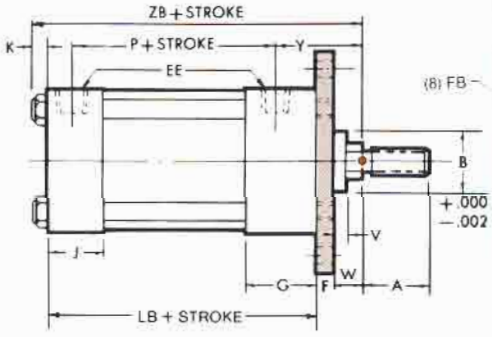
PRESSURE LIMITATIONS (PULL)

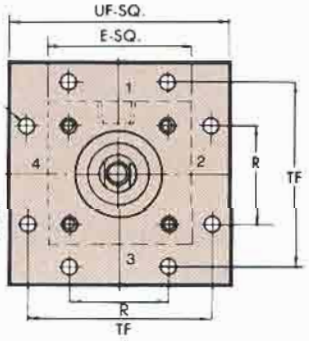
CYL. DIA	5	6	7	8
PRESSURE (PSI)	2000	1600	1200	1000

Use Model CC (Below) or Model J (Page 10) for Recommended Maximum Pressure.

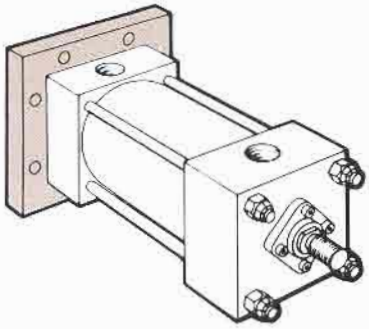
MODEL DD (NFPA STD. MF5)

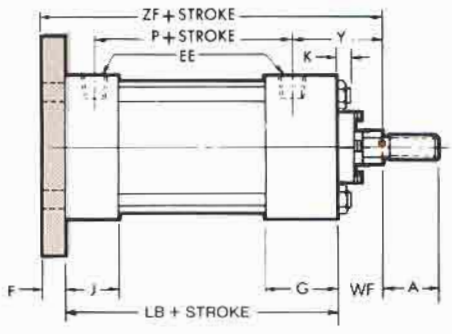


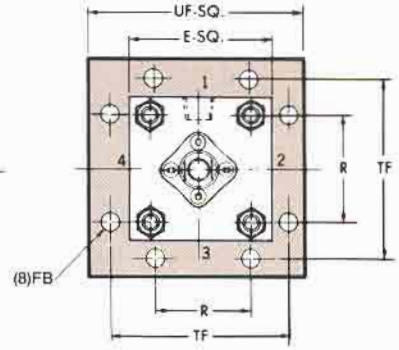




MODEL CC (NFPA STD. MF6)







▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

TABLE 1

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 28.
†Dimensions refer to bolt diameter.

BORE DIA.	E	F	G	J	K	R	EE	FB†	TF	UF
1½	2½	⅜	1¾	1½	½	1.63	½	⅜	3 7/16	4¼
2	3	⅝	1¾	1½	½	2.05	½	½	4⅛	5⅛
2½	3½	⅝	1¾	1½	⅝	2.55	½	½	4⅝	5⅝
3¼	4½	¾	2¼	1¾	¾	3.25	¾	⅝	5⅞	7⅛
4	5	⅞	2¼	1¾	¾	3.82	¾	⅝	6⅜	7⅝
5	6½	⅞	2¼	1¾	1	4.95	¾	⅞	8 3/16	9¾
6	7½	1	2½	2¼	1⅛	5.73	1	1	9 7/16	11¼
7	8½	1	2¾	2¾	1⅛	6.58	1¼	1⅛	10⅝	12⅝
8	9½	1	3	3	1⅜	7.50	1½	1¼	11 13/16	14

TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery.

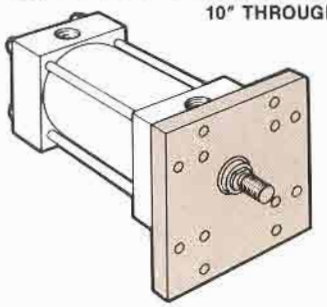
* For piston rod dimensions see page 32.

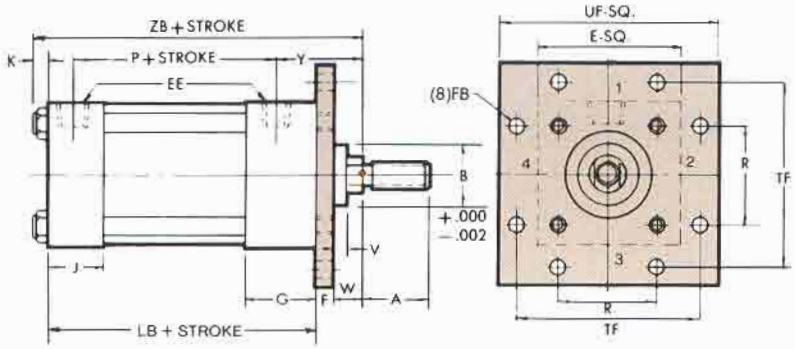
BORE DIA.	*ROD MM	A	B	P	V	W	Y	LB	WF	ZB	ZF
1½	⅝ •	¾	1⅛	2¾	¼	⅝	2 1/16	4⅝	1	6⅛	6
	1 •	1⅛	1½		½	1	2 7/16		1⅜	6½	6⅜
2	1 •	1⅛	1½	2¾	¼	¾	2 7/16	4⅝	1⅜	6½	6⅝
	1⅜ •	1⅝	2		⅜	1	2 11/16		1⅝	6¾	6⅞
2½	1 •	1⅛	1½	2⅞	¼	¾	2 7/16	4¾	1⅜	6¾	6¾
	1⅜ •	1⅝	2		⅜	1	2 11/16		1⅝	7	7
	1¾ •	2	2⅜		½	1¼	2 15/16		1⅞	7¼	7¼
3¼	1⅜ •	1⅝	2	3¼	¼	⅞	3	5½	1⅝	7⅞	7⅞
	1¾ •	2	2⅜		⅜	1⅛	3¼		1⅞	8⅛	8⅛
	2 •	2¼	2⅝		⅜	1¼	3⅜		2	8¼	8¼
4	1¾ •	2	2⅜	3½	¼	1	3¼	5¾	1⅞	8⅜	8½
	2 •	2¼	2⅝		¼	1⅛	3⅜		2	8½	8⅝
	2½ •	3	3⅛		⅜	1⅜	3⅝		2¼	8¾	8⅞
5	2 •	2¼	2⅝	4	¼	1⅛	3⅜	6¼	2	9¼	9⅛
	2½	3	3⅛		⅜	1⅜	3⅝		2¼	9½	9⅜
	3 •	3½	3¾		⅜	1⅜	3⅝		2¼	9½	9⅜
	3½ •	3½	4¼		⅜	1⅜	3⅝		2¼	9½	9⅜
6	2½ •	3	3⅛	4⅝	¼	1¼	3¾	7⅜	2¼	10¾	10⅝
	3	3½	3¾								
	3½	3½	4¼								
	4 •	4	4¾								
7	3 •	3½	3¾	5⅜	¼	1¼	3 13/16	8½	2¼	11⅞	11¾
	3½	3½	4¼								
	4	4	4¾								
	4½	4½	5¼								
	5	5	5¾								
8	3½ •	3½	4¼	6	¼	1¼	4	9½	2¼	13⅛	12¾
	4	4	4¾								
	4½	4½	5¼								
	5	5	5¾								
	5½ •	5½	6¼								

NOPAK FLANGE-MOUNT SQUARE-HEAD MOUNT CYLINDERS

MODEL DD
(ROD END FLANGE MOUNT)

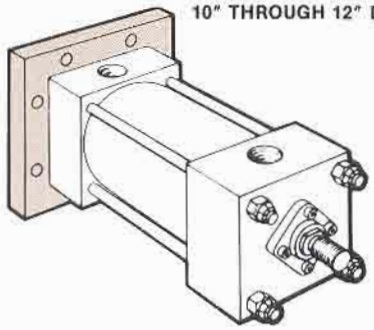
10" THROUGH 12" DIA. BORE

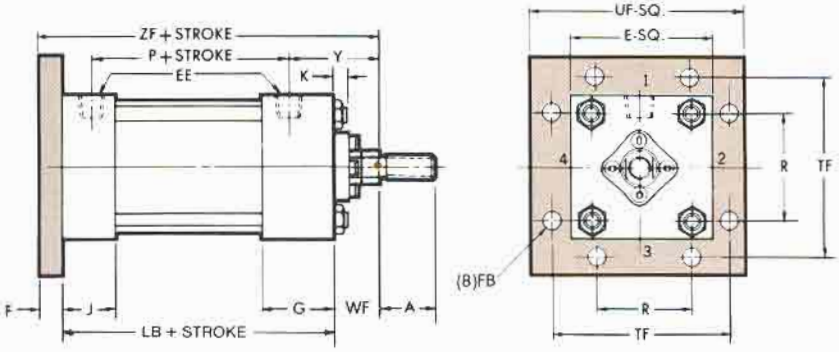




MODEL CC
(BLIND END FLANGE MOUNT)

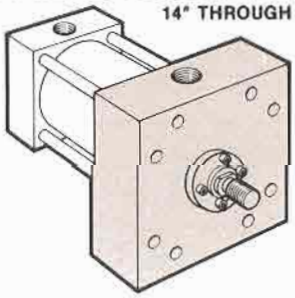
10" THROUGH 12" DIA. BORE

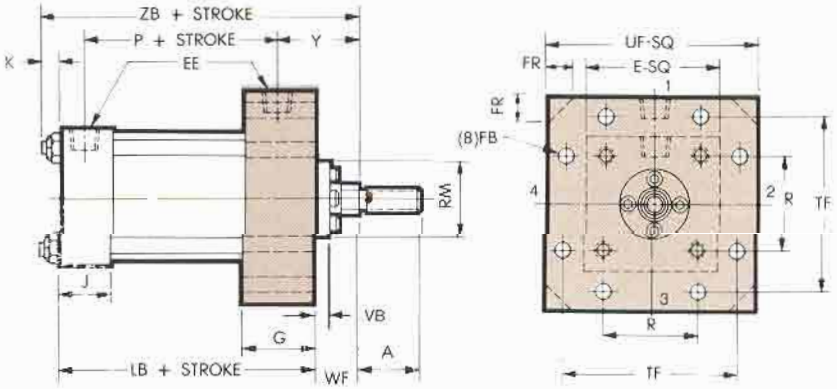




MODEL DG
(ROD HEAD SQUARE MOUNT)

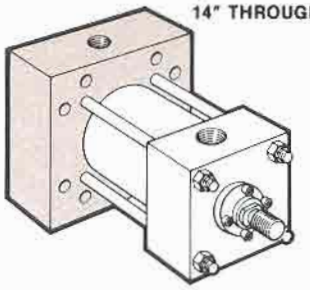
14" THROUGH 20" DIA. BORE





MODEL CJ
(BLIND HEAD SQUARE MOUNT)

14" THROUGH 20" DIA. BORE



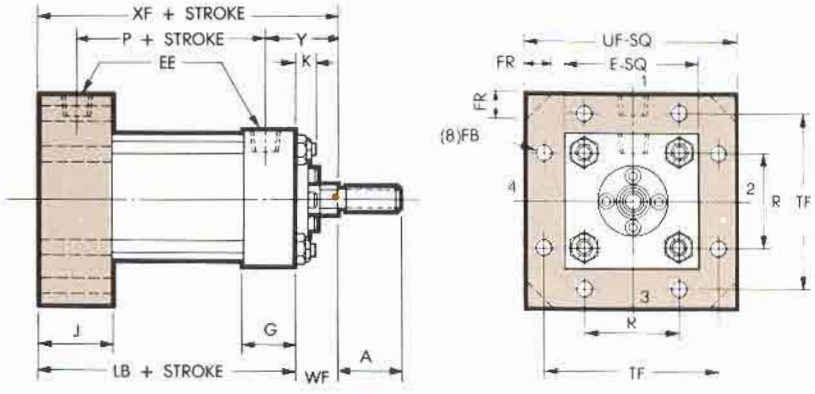


TABLE 1

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 30.
†Dimensions refer to bolt diameter.

BORE DIA.	E	F	G	J	K	R	EE	FB†	FR	TF	UF
10	12 5/8	1 11/16	3 11/16	3 11/16	1 1/8	9.62	2	1 3/4	—	15 7/8	19
12	14 7/8	1 15/16	4 7/16	4 7/16	1 1/8	11.45	2 1/2	2	—	18 1/2	22
14	17 1/4	—	4 7/8	4 7/8	1 7/16	13.34	2 1/2	2 1/4	—	21	25
16	19 1/4	—	5 7/8	5 7/8	1 7/16	15.10	3	2 1/2	—	23 7/8	28 3/8
18	22	—	6 7/8	6 7/8	1 7/16	16.88	3	2 3/4	4	26 1/4	31
20	23 5/8	—	7 7/8	7 7/8	1 7/16	18.74	3	3	6	29	34 1/2

TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery, Models DD and CC only.
- * For piston rod dimensions see page 32.

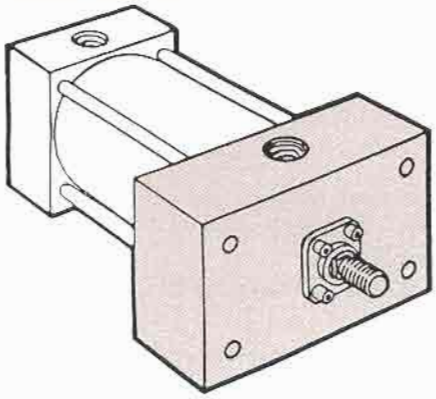
BORE DIA.	*ROD MM	A	B	P	V	W	Y	LB	RM	VB	WF	XF	ZB	ZF
10	4 1/2 •	4 1/2	5 1/4	8	1/4	1 1/4	5	12 1/8	7 1/2		2 15/16	15 1/16	16 3/16	16 3/4
	5	5	5 3/4			1 1/2	5 1/4		8 3/8		3 3/16	15 5/16	16 7/16	17
	5 1/2	5 1/2	6 1/4			1 1/2	5 1/4		9					
	7	7	10 1/4		11/16	1 1/2	5 1/4		10 1/4	2 3/8				
12	5 1/2	5 1/2	6 1/4	9 5/8	1/4	1 1/4	5 5/8	14 1/2	9		3 3/16	17 11/16	18 3/16	19 5/8
	7	7	10 1/4		7/16	1 1/2	5 7/8		10 1/4	2 3/8	3 7/16	17 15/16	19 1/16	19 7/8
	8	8	11 1/4			1 1/2	5 7/8		11 1/4					
14	7	7	—	9 7/8	—	—	6 3/8	15 5/8	10 1/4	2 3/8	3 1/2	19 1/8	20 1/4	21 3/8
	8	8	—				6 3/8		11 1/4					
	10	10	—				6 3/8		14	2 1/2				
16	8	8	—	11 3/8	—	—	7 3/8	18 1/8	11 1/4	2 3/8	4	22 1/4	23 9/16	24 7/8
	9	9	—				7 3/8		12 1/2	2 1/2				
	10	10	—				7 3/8		14					
18	9	9	—	12 3/8	—	—	8 5/8	21 1/8	12 1/2	2 1/2	4 1/4	25 3/8	26 13/16	28 3/8
	10	10	—				8 5/8		14					
20	10	10	—	13 3/8	—	—	9 5/8	23 5/8	14	2 1/2	4 1/2	28 1/8	29 9/16	31 3/8

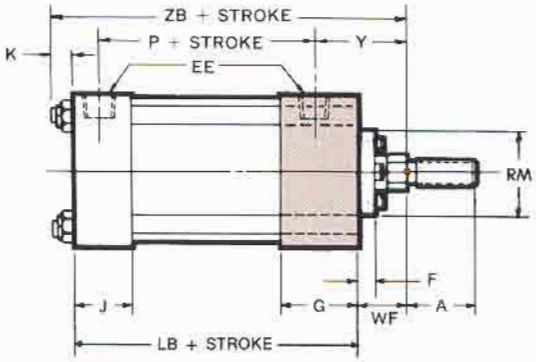
NOPAK

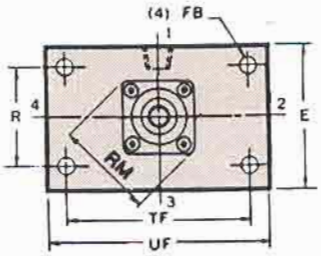
- ROD HEAD RECTANGULAR MOUNT
- BLIND HEAD RECTANGULAR MOUNT

1½" THROUGH 12" BORE

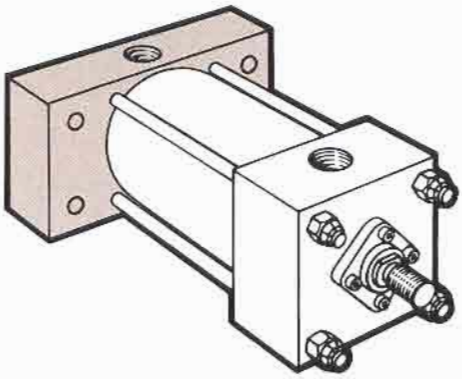
MODEL G (NFPA STD. ME5)

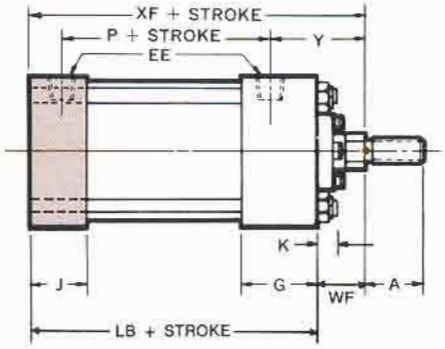






MODEL J (NFPA STD. ME6) ▲





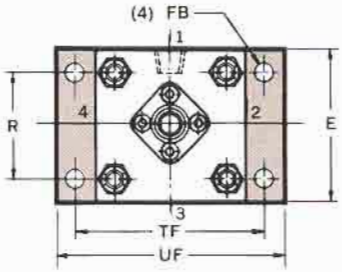


TABLE 1

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 30.
†Dimensions refer to bolt diameter.

BORE DIA.	E	G	J	K	R	EE	†FB	TF	UF
1½	2½	1¾	1½	½	1.63	½	⅜	3 7/16	4¼
2	3	1¾	1½	½	2.05	½	½	4⅛	5⅛
2½	3½	1¾	1½	⅝	2.55	½	½	4⅝	5⅝
3¼	4½	2¼	1¾	¾	3.25	¾	⅝	5⅞	7⅛
4	5	2¼	1¾	¾	3.82	¾	⅝	6⅜	7⅝
5	6½	2¼	1¾	1	4.95	¾	⅞	8 3/16	9¾
6	7½	2½	2¼	1⅛	5.73	1	1	9 7/16	11¼
7	8½	2¾	2¾	1¼	6.58	1¼	1⅛	10⅝	12⅝
8	9½	3	3	1½	7.50	1½	1¼	11 13/16	14
10	12⅝	3 11/16	3 11/16	1⅛	9.62	2	1¾	15⅞	19
12	14⅞	4 7/16	4 7/16	1⅛	11.45	2½	2	18½	22

▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

TABLE 2

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

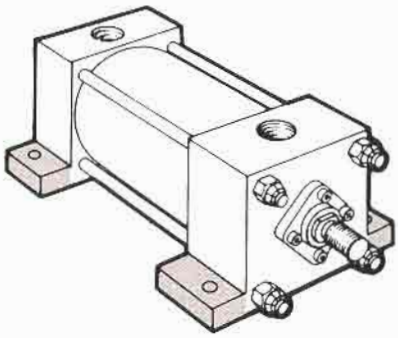
- Heads bored for these rod sizes are normally in stock– thus faster delivery. ■ Model J only.
- * For piston rod dimensions see page 32.

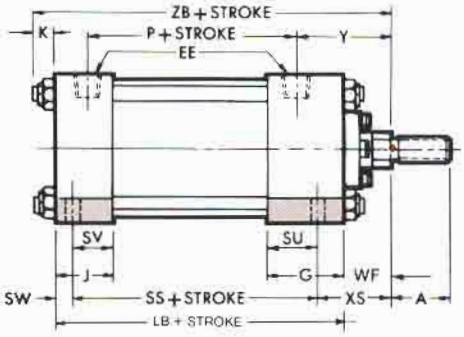
BORE DIA.	*ROD MM	A	F	P	Y	LB	RM	WF	XF	ZB
1½	⅝ •	¾	⅜	2¾	2 1/16	4⅝	2⅛	1	5⅝	6⅛
	1 •■	1⅛	½		2 7/16		2⅜	1⅜	6	6½
2	1 •	1⅛	½	2¾	2 7/16	4⅝	2⅜	1⅜	6	6½
	1⅜ •■	1⅝	9/16		2 11/16		3	1⅝	6¼	6¾
2½	1 •	1⅛	½	2⅞	2 7/16	4¾	2⅜	1⅜	6⅛	6¾
	1⅜ •■	1⅝	9/16		2 11/16		3	1⅝	6⅜	7
	1¾ •■	2	9/16		2 15/16		3½	1⅞	6⅝	7¼
3¼	1⅜ •	1⅝	9/16	3¼	3	5½	3	1⅝	7⅛	7⅞
	1¾ •■	2	9/16		3¼		3½	1⅞	7⅜	8⅛
	2 •■	2¼	9/16		3⅜		4⅛	2	7½	8¼
4	1¾ •	2	9/16	3½	3¼	5¾	3½	1⅞	7⅝	8⅜
	2 •■	2¼	9/16		3⅜		4⅛	2	7¾	8½
	2½ •■	3	¾		3⅝		4⅝	2¼	8	8¾
5	2 •	2¼	9/16	4	3⅜	6¼	4⅛	2	8¼	9¼
	2½	3	¾		3⅝		4⅝	2¼	8½	9½
	3 •■	3½	¾		3⅝		5⅜	2¼	8½	9½
	3½ •■	3½	¾		3⅝		6⅛	2¼	8½	9½
6	2½ •	3	¾	4⅝	3¾	7⅜	4⅝	2¼	9⅝	10¾
	3	3½	¾				5⅜		9⅝	10¾
	3½	3½	¾				6⅛		9⅝	10¾
	4 •■	4	13/16				6⅞		9⅝	10¾
7	3 •	3½	¾	5⅜	3 13/16	8½	5⅜	2¼	10¾	11⅞
	3½	3½	¾				6⅛		10¾	11⅞
	4	4	13/16				6⅞		10¾	11⅞
	4½	4½	13/16				7½		10¾	11⅞
	5	5	15/16				8⅜		10¾	11⅞
8	3½ •	3½	¾	6	4	9½	6⅛	2¼	11¾	13⅛
	4	4	13/16				6⅞		11¾	13⅛
	4½	4½	13/16				7½		11¾	13⅛
	5	5	15/16				8⅜		11¾	13⅛
	5½ •■	5½	15/16				9		11¾	13⅛
10	4½	4½	13/16	8	5	12⅛	7½	2 15/16	15 1/16	16 3/16
	5	5	15/16		5¼		8⅜	3 3/16	15 5/16	16 7/16
	5½	5½	15/16		5¼		9		15 5/16	16 7/16
	7	7	2 3/16		5¼		10¼		15 5/16	16 7/16
12	5½	5½	15/16	9⅝	5⅝	14½	9	3 3/16	17 11/16	18 13/16
	7	7	2 3/16		5⅞		10¼	3 7/16	17 15/16	19 1/16
	8	8	2 7/16		5⅞		11¼		17 15/16	19 1/16

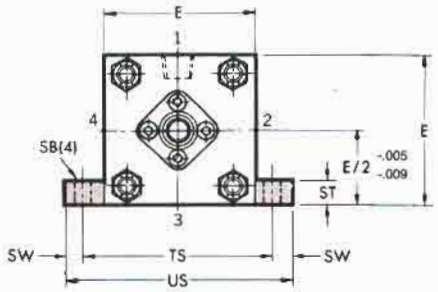
NOPAK SIDE AND LUG MOUNT CYLINDERS

1½" THROUGH 7" BORE

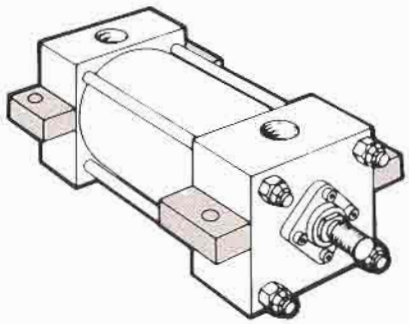
MODEL A (NFPA STD. MS2) ▲

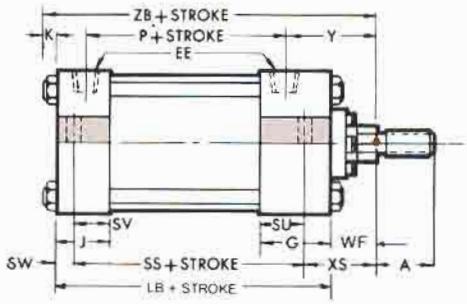


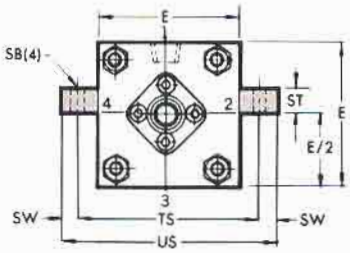




MODEL B (NFPA STD. MS3) ▲







For double rod end cylinders Model A and B — subtract dimension SV from SU and add the difference to dimension SS + stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 28.

†Dimensions refer to bolt diameter.

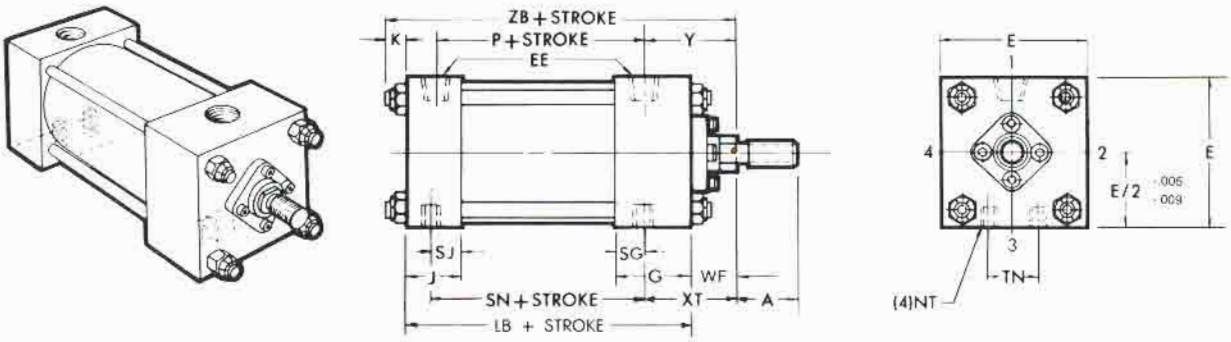
TABLE 1

These dimensions are constant regardless of rod diameter or stroke.

BORE DIA.	E	G	J	K	EE	NT	SB†	SG	SJ	ST	SU	SV	SW	TN	TS	US
1½	2½	1¾	1½	½	½	⅜-16	⅜	¾	¾	½	1⅜	1⅛	⅜	¾	3¼	4
2	3	1¾	1½	½	½	½-13	½	¾	¾	¾	1¼	1	½	15/16	4	5
2½	3½	1¾	1½	⅝	½	⅝-11	¾	¾	¾	1	1 1/16	13/16	11/16	1 5/16	4⅞	6¼
3¼	4½	2¼	1¾	¾	¾	¾-10	¾	1⅛	⅞	1	1 9/16	1 1/16	11/16	1½	5⅞	7¼
4	5	2¼	1¾	¾	¾	1-8	1	1⅛	⅞	1¼	1⅜	⅞	⅞	2 1/16	6¾	8½
5	6½	2¼	1¾	1	¾	1-8	1	1⅛	⅞	1¼	1⅜	⅞	⅞	2 15/16	8¼	10
6	7½	2½	2¼	1⅛	1	1¼-7	1¼	1¼	1¼	1½	1⅜	1⅛	1⅛	3 5/16	9¾	12
7	8½	2¾	2¾	1⅛	1¼	1½-6	1½	1 13/16	1 11/16	1¾	1⅜	1⅜	1⅜	3¾	11¼	14

▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

MODEL S (USA STD. MS4)



For double rod end cylinders Model S — In place of dimension SN + stroke, multiply dimension XT times 2 and to this total add the cylinder stroke. From this figure, subtract the ZM + double stroke (See Page 29-31).

TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery. NOTE: MODEL B EXCLUDED.

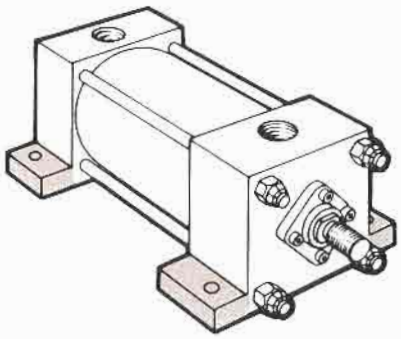
* For piston rod dimensions see page 32.

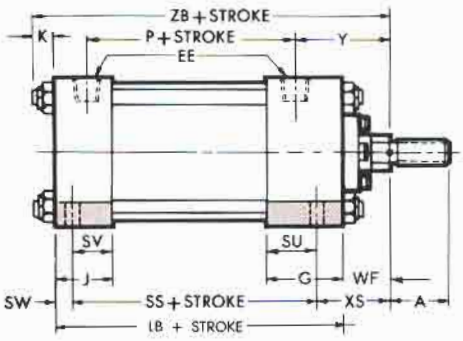
BORE DIA.	*ROD MM	A	P	Y	LB	SN	SS	WF	XS	XT	ZB
1 1/2	5/8 •	3/4	2 3/4	2 1/16	4 5/8	2 7/8	3 7/8	1	1 3/8	2	6 1/8
	1 •	1 1/8		2 7/16				1 3/8	1 3/4		6 1/2
2	1 •	1 1/8	2 3/4	2 7/16	4 5/8	2 7/8	3 5/8	1 3/8	1 7/8	2 3/8	6 1/2
	1 3/8 •	1 5/8		2 11/16				1 5/8	2 1/8		6 3/4
2 1/2	1 •	1 1/8	2 7/8	2 7/16	4 3/4	3	3 3/8	1 3/8	2 1/16	2 3/8	6 3/4
	1 3/8 •	1 5/8		2 11/16				1 5/8	2 5/16		7
	1 3/4 •	2		2 15/16				1 7/8	2 9/16		7 1/4
3 1/4	1 3/8 •	1 5/8	3 1/4	3	5 1/2	3 1/2	4 1/8	1 5/8	2 5/16	2 3/4	7 7/8
	1 3/4 •	2		3 1/4				1 7/8	2 9/16		8 1/8
	2 •	2 1/4		3 3/8				2	2 11/16		8 1/4
4	1 3/4 •	2	3 1/2	3 1/4	5 3/4	3 3/4	4	1 7/8	2 3/4	3	8 3/8
	2 •	2 1/4		3 3/8				2	2 7/8		8 1/2
	2 1/2 •	3		3 5/8				2 1/4	3 1/8		8 3/4
5	2 •	2 1/4	4	3 3/8	6 1/4	4 1/4	4 1/2	2	2 7/8	3 1/8	9 1/4
	2 1/2	3		3 5/8				2 1/4	3 1/8		9 1/2
	3 •	3 1/2		3 5/8				2 1/4	3 1/8		9 1/2
	3 1/2 •	3 1/2		3 5/8				2 1/4	3 1/8		9 1/2
6	2 1/2 •	3	4 5/8	3 3/4	7 3/8	5 1/8	5 1/8	2 1/4	3 3/8	3 1/2	10 3/4
	3	3 1/2		3 3/4				2 1/4	3 3/8		10 3/4
	3 1/2	3 1/2		3 3/4				2 1/4	3 3/8		10 3/4
	4 •	4		3 3/4				2 1/4	3 3/8		10 3/4
7	3 •	3 1/2	5 3/8	3 13/16	8 1/2	5 7/8	5 3/4	2 1/4	3 5/8	3 13/16	11 7/8
	3 1/2	3 1/2		3 13/16				2 1/4	3 5/8		11 7/8
	4	4		3 13/16				2 1/4	3 5/8		11 7/8
	4 1/2	4 1/2		3 13/16				2 1/4	3 5/8		11 7/8
	5	5		3 13/16				2 1/4	3 5/8		11 7/8

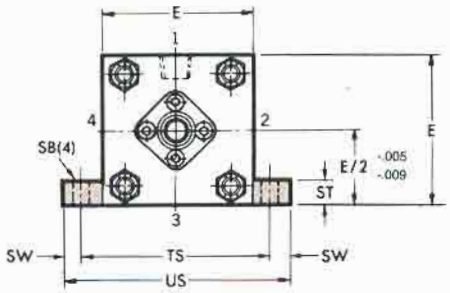
NOPAK SIDE AND LUG MOUNT CYLINDERS

MODEL A (NFPA STD. MS2)

8" THROUGH 14" DIA. BORE

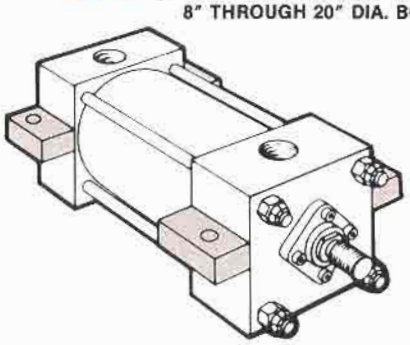


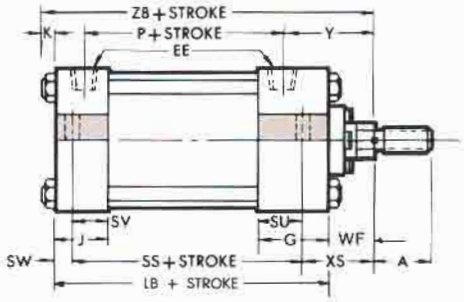


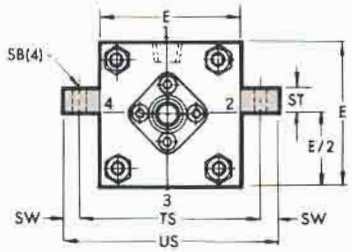


MODEL B (NFPA STD. MS3)

8" THROUGH 20" DIA. BORE







For double rod end cylinders Model A and B — subtract dimension SV from SU and add the difference to dimension SS + stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 30.

†Dimensions refer to bolt diameter.

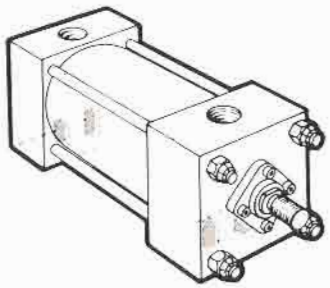
TABLE 1

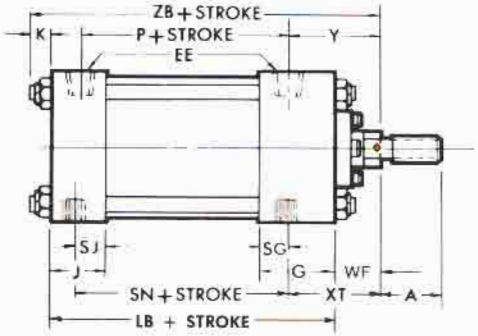
These dimensions are constant regardless of rod diameter or stroke.

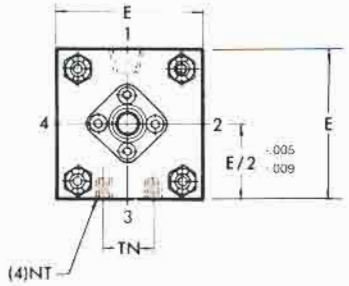
BORE DIA.	E	G	J	K	EE	NT	SB†	SG	SJ	ST	SU	SV	SW	TN	TS	US
8	9 1/2	3	3	1 3/8	1 1/2	1 1/2-6	1 1/2	1 5/16	1 13/16	1 3/4	1 5/8	1 5/8	1 3/8	4 1/4	12 1/4	15
10	12 5/8	3 11/16	3 11/16	1 1/8	2	—	1 1/2	—	—	2 1/4	2 1/16	2 1/16	1 5/8	—	15 7/8	19 1/8
12	14 7/8	4 7/16	4 7/16	1 1/8	2 1/2	—	1 1/2	—	—	3	2 7/16	2 7/16	2	—	18 7/8	22 7/8
14	17 1/4	4 7/8	4 7/8	1 7/16	2 1/2	—	2 1/4	—	—	4	2 5/8	2 5/8	2 1/4	—	21 3/4	26 1/4
16	19 1/4	5 7/8	5 7/8	1 7/16	3	—	2 1/2	—	—	4 1/2	3 1/8	3 1/8	2 1/2	—	24 1/4	29 1/4
18	22	6 7/8	6 7/8	1 7/16	3	—	2 3/4	—	—	5 1/4	3 5/8	3 5/8	2 3/4	—	27 1/2	33
20	23 5/8	7 7/8	7 7/8	1 7/16	3	—	3	—	—	6 1/2	4	4	3 1/4	—	30 1/8	36 5/8

MODEL S (NFPA STD. MS4)

8" DIA. BORE







THIS MODEL AVAILABLE IN SMALL ROD ONLY

TABLE 2

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

For double rod end cylinders Model S — In place of dimension SN + stroke, multiply dimension XT times 2 and to this total add the cylinder stroke. From this figure, subtract the ZM + double stroke (See Page 29-31).

- Heads bored for these rod sizes are normally in stock– thus faster delivery. Models A and S only.

* For piston rod dimensions see page 32.

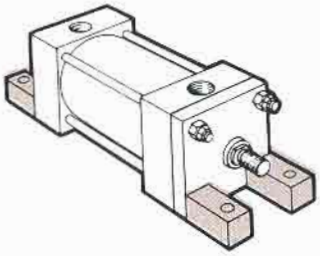
BORE DIA.	*ROD MM	A	P	Y	LB	SN	SS	WF	XS	XT	ZB
8	3½ •	3½	6	4	9½	6⅝	6¾	2¼	3⅝	3 15/16	13⅛
	4	4				—				—	
	4½	4½									
	5	5									
	5½	5½									
10	4½	4½	8	5	12⅛	—	8⅞	2 15/16	4 9/16	—	16 3/16
	5	5		5¼				3 3/16	4 13/16		16 7/16
	5½	5½									
	7	7									
12	5½	5½	9⅝	5⅝	14½	—	10½	3 3/16	5 3/16	—	18 13/16
	7	7		5⅞				3 7/16	5 7/16		19 1/16
	8	8									
14	7	7	9⅞	6⅜	15⅝	—	11⅛	3½	5¾	—	20¼
	8	8									
	10	10									
16	8	8	11⅜	7⅜	18⅛	—	12⅝	4	6¾	—	23 9/16
	9	9									
	10	10									
18	9	9	12⅜	8⅝	21⅛	—	14⅝	4¼	7½	—	26 13/16
	10	10									
20	10	10	13⅜	9⅝	23⅝	—	15⅞	4½	8⅜	—	29 9/16

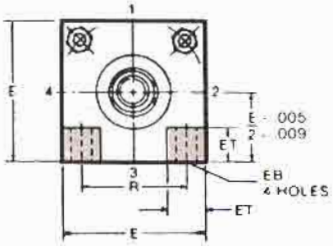
NOPAK

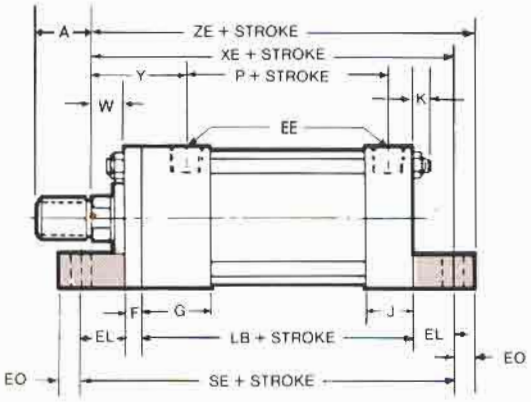
END LUG
FIXED CLEVIS
DETACHABLE CLEVIS
MOUNT CYLINDERS

1½" THROUGH 7" DIA.

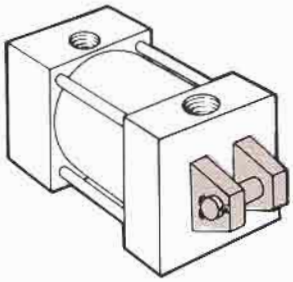
MODEL AL (NFPA STD. MS7)

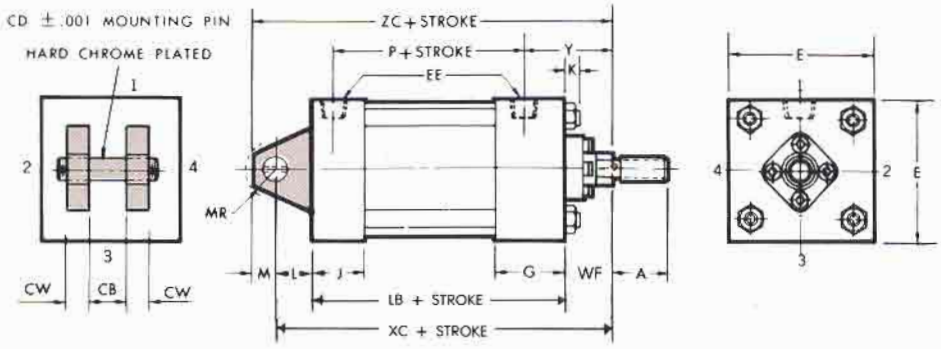






MODEL E (NFPA STD. MP1) ▲





Note: Pin Ø is CD.
Swing radius is MR.

For double rod end cylinders Model AL — subtract dimension J from G and add to dimension SE + stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 28.

†Dimensions refer to bolt diameter.

TABLE 1

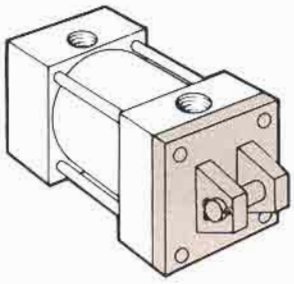
These dimensions are constant regardless of rod diameter or stroke.

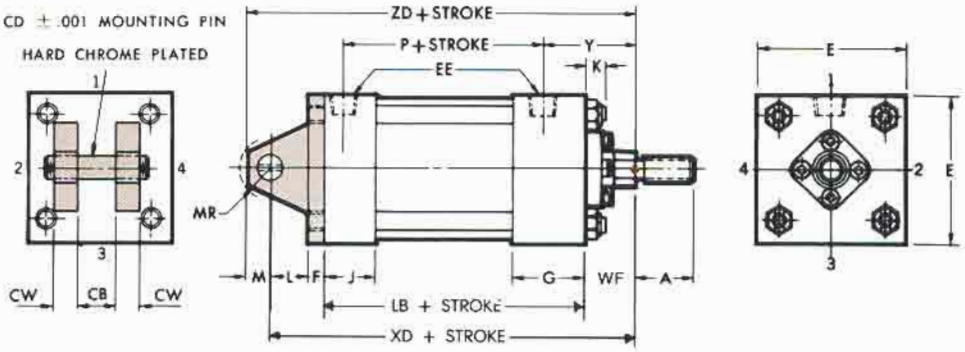
BORE DIA.	E	F AL	F HE	G	J	K	L	M	R	CB	CD	CW	EB†	EE	EL	EO	ET	MR
1½	2½	⅜	⅜	1¾	1½	½	¾	½	1.81	¾	½	½	⅜	½	⅞	⅜	11/16	⅝
2	3	⅝	⅝	1¾	1½	½	1¼	¾	2.19	1¼	¾	⅝	½	½	15/16	½	13/16	⅞
2½	3½	⅝	⅝	1¾	1½	⅝	1¼	¾	2.55	1¼	¾	⅝	½	½	15/16	½	15/16	⅞
3¼	4½	¾	⅞	2¼	1¾	¾	1½	1	3.25	1½	1	¾	⅝	¾	1⅛	⅝	1¼	1¼
4	5	⅞	⅞	2¼	1¾	¾	2⅛	1⅜	3.82	2	1⅜	1	⅝	¾	1⅛	⅝	1⅜16	1⅝
5	6½	⅞	1⅛	2¼	1¾	1	2¼	1¾	4.95	2½	1¾	1¼	⅞	¾	1½	¾	1⅝16	2
6	7½	1	17/16	2½	2¼	1⅛	2½	2	5.73	2½	2	1¼	1	1	111/16	⅞	1¾	2⅜
7	8½	1	15/8	2¾	2¾	1⅛	3	2½	6.58	3	2½	1½	1⅛	1¼	113/16	1	1⅞	3

▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

MODEL HE (NFPA STD. MP2) ▲

(1½" THROUGH 7" DIA.)





Note: Pin Ø is CD.
Swing radius is MR.

TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery. NOTE: MODEL AL EXCLUDED.

* For piston rod dimensions see page 32.

BORE DIA.	*ROD MM	A	P	W	Y	LB	SE	WF	XC	XD	XE	ZC	ZD	ZE
1½	5/8 •	3/4	2¾	5/8	2 1/16	4⅝	6¾	1	6⅜	6¾	6½	6⅞	7¼	6⅞
	1 •	1⅛		1	2 7/16			1⅜	6¾	7⅛	6⅞	7¼	7⅝	7¼
2	1 •	1⅛	2¾	¾	2 7/16	4⅝	7⅛	1⅜	7¼	7⅞	6 15/16	8	8⅝	7 7/16
	1⅜ •	1⅝		1	2 11/16			1⅝	7½	8⅛	7 3/16	8¼	8⅞	7 11/16
2½	1 •	1⅛	2⅞	¾	2 7/16	4¾	7¼	1⅜	7⅜	8	7 1/16	8⅛	8¾	7 9/16
	1⅜ •	1⅝		1	2 11/16			1⅝	7⅝	8¼	7 5/16	8⅜	9	7 13/16
	1¾ •	2		1¼	2 15/16			1⅞	7⅞	8½	7 9/16	8⅝	9¼	8 1/16
3¼	1⅜ •	1⅝	3¼	⅞	3	5½	8½	1⅝	8⅝	9½	8¼	9⅝	10½	8⅞
	1¾ •	2		1⅛	3¼			1⅞	8⅞	9¾	8½	9⅞	10¾	9⅛
	2 •	2¼		1¼	3⅜			2	9	9⅞	8⅝	10	10⅞	9¼
4	1¾ •	2	3½	1	3¼	5¾	8⅞	1⅞	9¾	10⅝	8¾	11⅛	12	9⅜
	2 •	2¼		1⅛	3⅜			2	9⅞	10¾	8⅞	11¼	12⅛	9½
	2½ •	3		1⅜	3⅝			2¼	10⅛	11	9⅛	11½	12⅜	9¾
5	2 •	2¼	4	1⅛	3⅜	6¼	10⅛	2	10½	11⅝	9¾	12¼	13⅜	10½
	2½	3		1⅜	3⅝			2¼	10¾	11⅞	10	12½	13⅝	10¾
	3 •	3½		1⅜				2¼						
	3½ •	3½		1⅜				2¼						
6	2½ •	3	4⅝	1¼	3¾	7⅜	11¾	2¼	12⅛	13 9/16	11 5/16	14⅛	15 9/16	12½
	3	3½												
	3½	3½												
	4 •	4												
7	3 •	3½	5⅜	1¼	3 13/16	8½	13⅛	2¼	13¾	15⅜	12 9/16	16¼	17⅞	13 9/16
	3½	3½												
	4	4												
	4½	4½												
	5	5												

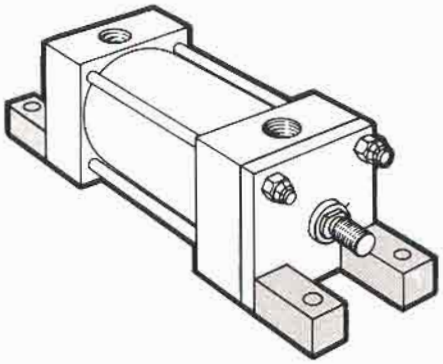
▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

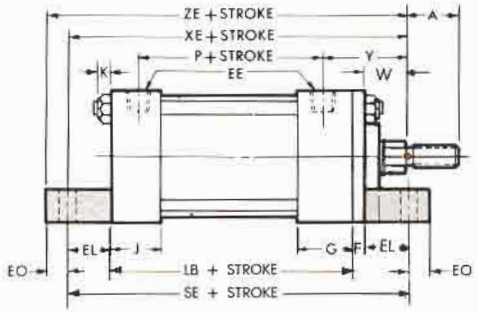
NOPAK

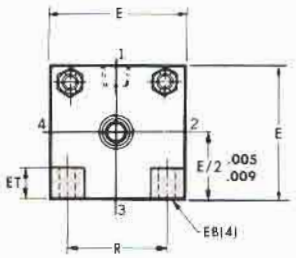
END LUG
FIXED CLEVIS
DETACHABLE CLEVIS
MOUNT CYLINDERS

MODEL AL (NFPA STD. MS7)

8" DIA. BORE

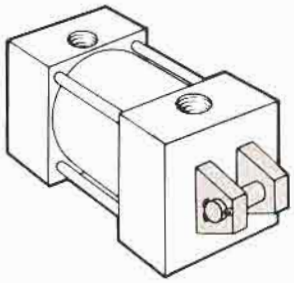


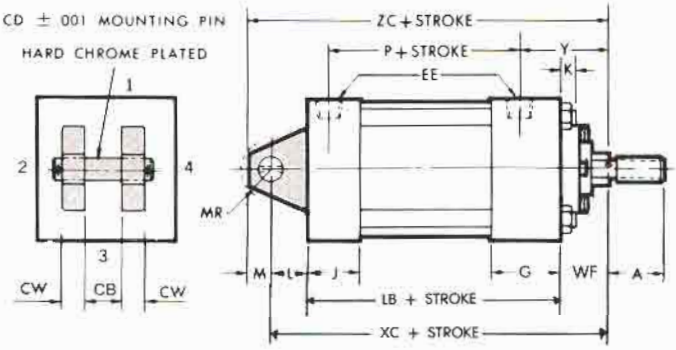


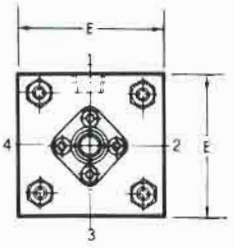


MODEL E (NFPA STD. MP1)

8" THROUGH 20" DIA. BORE







Note: Pin Ø is CD.
Swing radius is MR.

For double rod end cylinders Model AL — subtract dimension J from G and add to dimension SE + stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 30.

†Dimensions refer to bolt diameter.

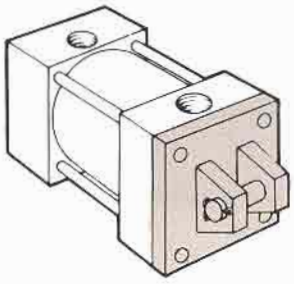
TABLE 1

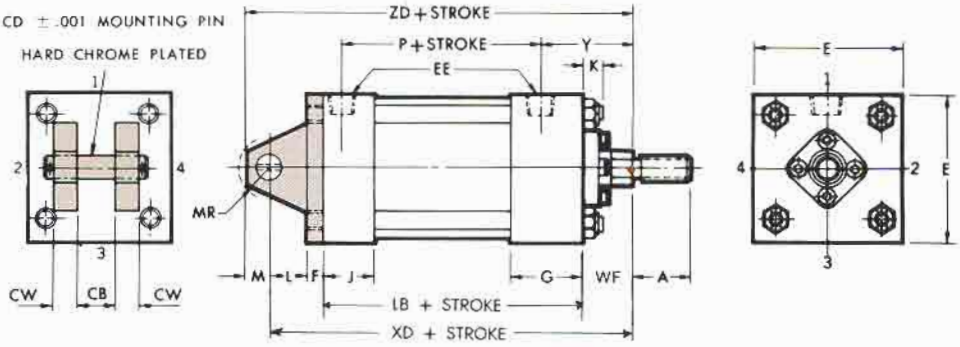
These dimensions are constant regardless of rod diameter or stroke.

BORE DIA.	E	F AL	F HE	G	J	K	L	M	R	CB	CD	CW	EB†	EE	EL	EO	ET	MR
8	9½	1	2	3	3	1⅜	3¼	2¾	7.50	3	3	1½	1¼	1½	2	1⅛	2	3¼
10	12⅝	—		3 11/16	3 11/16	1⅛	4	3½	—	4	3½	2	—	2	—	—	—	3½
12	14⅞	—		4 7/16	4 7/16	1⅛	4⅝	4	—	4½	4	2¼	—	2½	—	—	—	4
14	17¼	—		4⅞	4⅞	1 7/16	5⅝	5	—	6	5	3	—	2½	—	—	—	5
16	19¼	—		5⅞	5⅞	1 7/16	7	6	—	7	6	3½	—	3	—	—	—	6
18	22	—		6⅞	6⅞	1 7/16	7⅝	6½	—	8	6½	4	—	3	—	—	—	6½
20	23⅝	—		7⅞	7⅞	1 7/16	8¾	7½	—	9	7½	4½	—	3	—	—	—	7½

MODEL HE (NFPA STD. MP2)

8" DIA. BORE





Note: Pin Ø is CD.
Swing radius is MR.

TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery. NOTE: MODEL AL EXCLUDED.

* For piston rod dimensions see page 32.

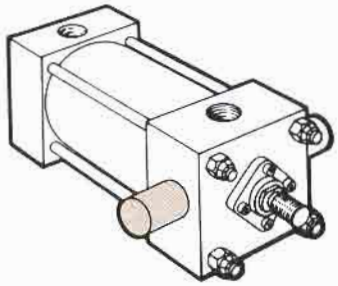
BORE DIA.	*ROD MM	A	P	W	Y	LB	SE	WF	XC	XD	XE	ZC	ZD	ZE
8	3½ •	3½	6	1¼	4	9½	14½	2¼	15	17	13¾	17¾	19¾	14⅞
	4	4												
	4½	4½												
	5	5												
	5½ •	5½												
10	4½ •	4½	8	—	5	12⅛	—	2 15/16	19 1/16	—	—	22 9/16	—	—
	5	5			5¼			3 3/16	19 5/16			22 13/16		
	5½	5½												
	7	7												
12	5½	5½	9⅝	—	5⅝	14½	—	3 3/16	22 5/16	—	—	26 5/16	—	—
	7	7			5⅞			3 7/16	22 9/16			26 9/16		
	8	8												
14	7	7	9⅞	—	6⅜	15⅝	—	3½	24¾	—	—	29¾	—	—
	8	8												
	10	10												
16	8	8	11⅜	—	7⅜	18⅛	—	4	29⅛	—	—	35⅛	—	—
	9	9												
	10	10												
18	9	9	12⅜	—	8⅝	21⅛	—	4¼	33	—	—	39½	—	—
	10	10												
20	10	10	13⅜	—	9⅝	23⅝	—	4½	36⅞	—	—	44⅜	—	—

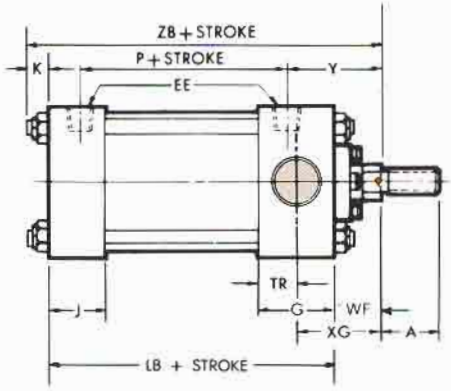
NOPAK TRUNNION MOUNT CYLINDERS

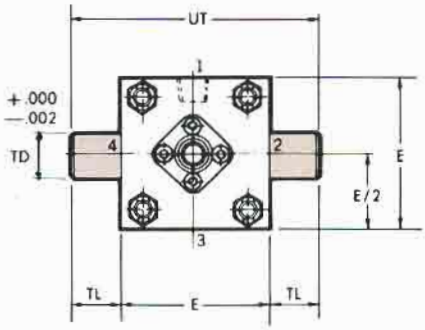
1½" THROUGH 7" DIA.

MODEL FR (NFPA STD. MT1) ▲

Integral trunnion pins are designed for shear, not bending, loads.

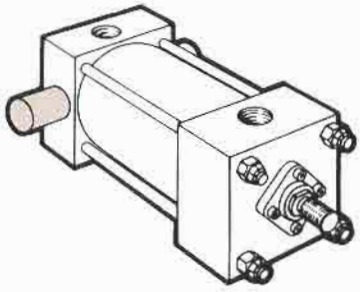


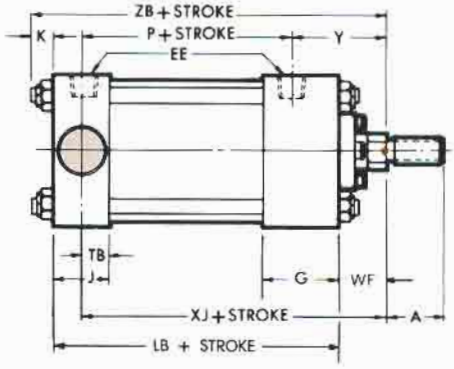




MODEL FB (NFPA STD. MT2) ▲

Integral trunnion pins are designed for shear, not bending, loads.





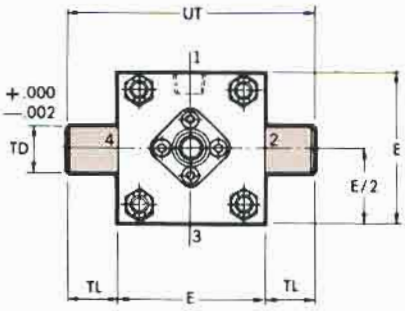


TABLE 1

These dimensions are constant regardless of rod diameter or stroke.

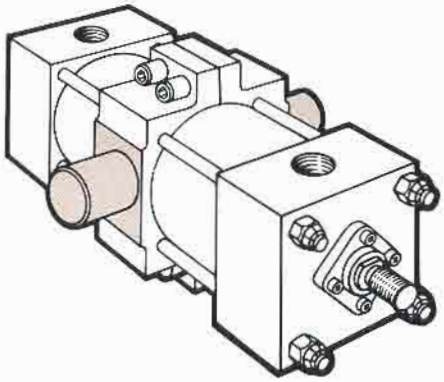
Double rod end models are designated by letter "X" preceding the model identification. See page 28.

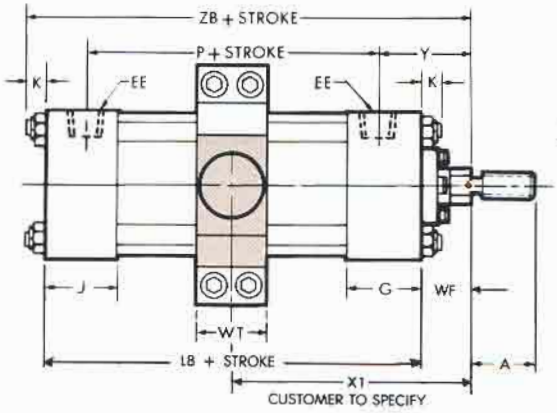
BORE DIA.	E	G	J	K	EE	TB	TD	TL	TM	TR	UM	UT	UV	WT
1½	2½	1¾	1½	½	½	¾	1	1	3	⅞	5	4½	4	1¼
2	3	1¾	1½	½	½	¾	1⅜	1⅜	3½	⅞	6¼	5¾	4¾	1½
2½	3½	1¾	1½	⅝	½	¾	1⅜	1⅜	4	⅞	6¾	6¼	5¼	1½
3¼	4½	2¼	1¾	¾	¾	⅞	1¾	1¾	5	1¼	8½	8	6¾	2
4	5	2¼	1¾	¾	¾	⅞	1¾	1¾	5½	1¼	9	8½	7¼	2
5	6½	2¼	1¾	1	¾	⅞	1¾	1¾	7	1¼	10½	10	9	2
6	7½	2½	2¼	1⅛	1	1	2	2	8	1⅜	12	11½	10¼	2½
7	8½	2¾	2¾	1⅛	1¼	1⅜	2½	2½	9	1⅜	14	13½	11¼	2¾

▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

MODEL F (NFPA STD. MT4) ▲

Integral trunnion pins are designed for shear, not bending loads. The intermediate trunnion pin mounting location, being non-adjustable, is determined by the "XI" dimension which should be specified by the customer. It can be located at any point between the heads of the cylinder.





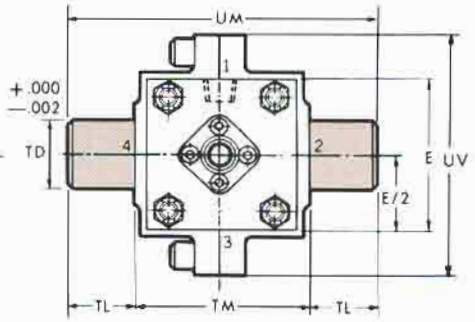


TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery.
- ■ Models F and FB only.
- * For piston rod dimensions see page 32.

BORE DIA.	*ROD MM	A	P	Y	LB	WF	XG	(MIN.) XI	XJ	ZB
1½	5/8 •	3/4	2¾	2 1/16	4⅝	1	1⅞	3 7/16	4⅞	6⅛
	1 •■	1⅛		2 7/16		1⅜	2¼	3 13/16	5¼	6½
2	1 •	1⅛	2¾	2 7/16	4⅝	1⅜	2¼	3 15/16	5¼	6½
	1⅜ •■	1⅝		2 11/16		1⅝	2½	4 3/16	5½	6¾
2½	1 •	1⅛	2⅞	2 7/16	4¾	1⅜	2¼	3 15/16	5⅜	6¾
	1⅜ •	1⅝		2 11/16		1⅝	2½	4 3/16	5⅝	7
	1¾ •■	2		2 15/16		1⅞	2¾	4 7/16	5⅞	7¼
3¼	1⅜ •	1⅝	3¼	3	5½	1⅝	2⅝	4 15/16	6¼	7⅞
	1¾ •■	2		3¼		1⅞	2⅞	5 3/16	6½	8⅛
	2 •■	2¼		3⅜		2	3	5 5/16	6⅝	8¼
4	1¾ •	2	3½	3¼	5¾	1⅞	2⅞	5 3/16	6¾	8⅜
	2 •■	2¼		3⅜		2	3	5 5/16	6⅞	8½
	2½ •■	3		3⅝		2¼	3¼	5 9/16	7⅛	8¾
5	2 •	2¼	4	3⅜	6¼	2	3	5 5/16	7⅜	9¼
	2½	3		3⅝		2¼	3¼	5 9/16	7⅝	9½
	3 •■	3½								
	3½ •■	3½								
6	2½ •	3	4⅝	3¾	7⅜	2¼	3⅜	6 1/16	8⅜	10¾
	3	3½								
	3½	3½								
	4 •■	4								
7	3 •	3½	5⅜	3 13/16	8½	2¼	3⅝	6 7/16	9⅜	11⅞
	3½	3½								
	4	4								
	4½	4½								
	5	5								

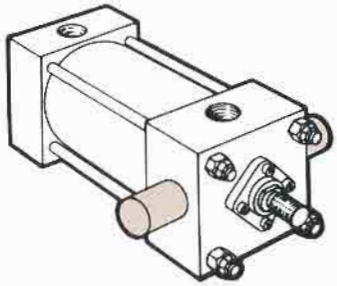
▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

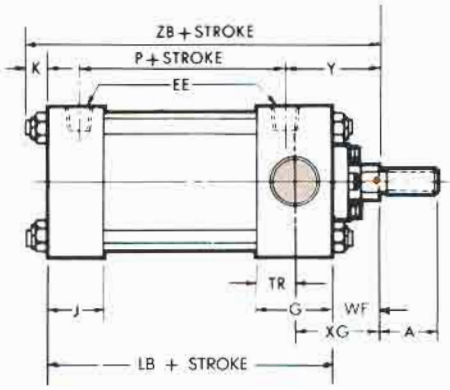
NOPAK TRUNNION MOUNT CYLINDERS

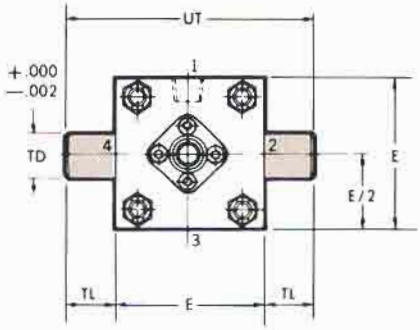
8" THROUGH 14" DIA.

MODEL FR (NFPA STD. MT1)

Integral trunnion pins are designed for shear, not bending, loads.

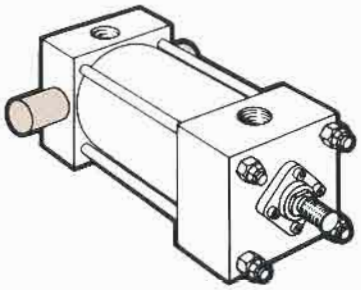


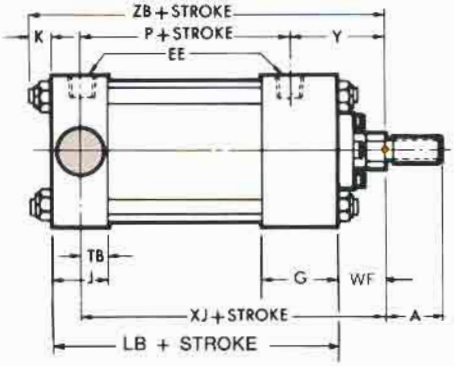




MODEL FB (NFPA STD. MT2)

Integral trunnion pins are designed for shear, not bending, loads.





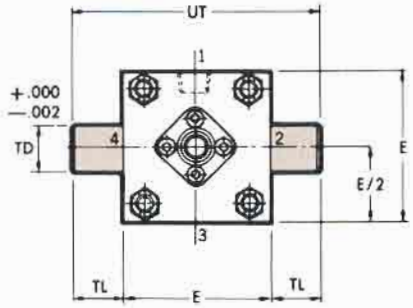


TABLE 1

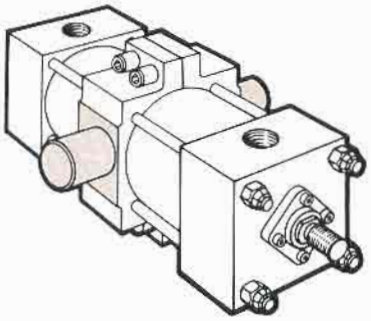
These dimensions are constant regardless of rod diameter or stroke.

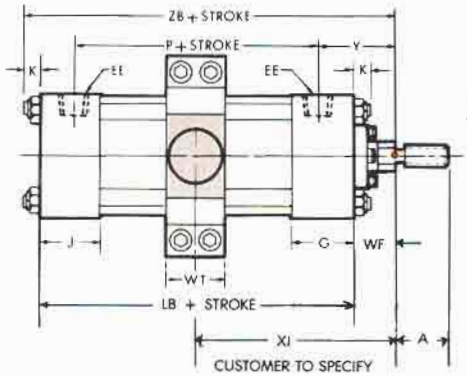
Double rod end models are designated by letter "X" preceding the model identification. See page 30.

BORE DIA.	E	G	J	K	EE	TB	TD	TL	TM	TR	UM	UT	UV	WT
8	9½	3	3	1⅜	1½	1½	3	3	10	1½	16	15½	12½	3¼
10	12⅝	3 11/16	3 11/16	1⅛	2	1⅞	3½	3½	14	1⅞	21	19⅝	16½	4½
12	14⅞	4 7/16	4 7/16	1⅛	2½	2¼	4	4	16½	2¼	24½	22⅞	19¼	5½
14	17¼	4⅞	4⅞	1 7/16	2½	2 7/16	4½	4½	19⅝	2½	28⅝	26⅛	22½	5½

MODEL F (NFPA STD. MT4)

Integral trunnion pins are designed for shear, not bending loads. The intermediate trunnion pin mounting location, being non-adjustable, is determined by the "XI" dimension which should be specified by the customer. It can be located at any point between the heads of the cylinder.





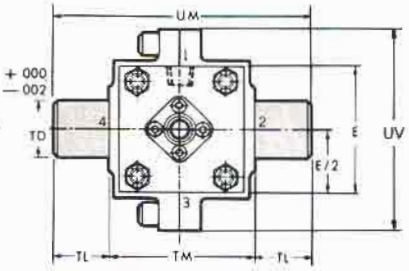


TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery.
- ■ Models F and FB only.

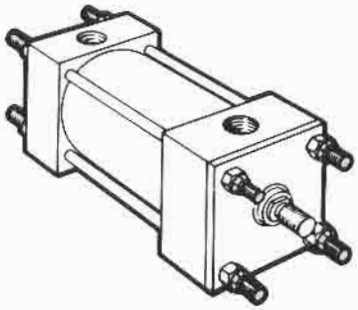
* For piston rod dimensions see page 32.

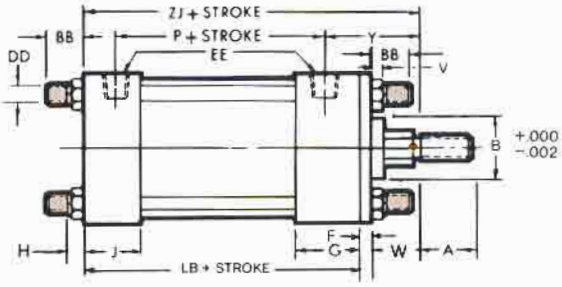
BORE DIA.	ROD MM	A	P	Y	LB	WF	XG	(MIN.) XI	XJ	ZB
8	3½ •	3½	6	4	9½	2¼	3¾	6 15/16	10¼	13⅛
	4	4								
	4½	4½								
	5	5								
	5½ • ■	5½								
10	4½ • ■	4½	8	5	12⅛	2 15/16	4¾	8⅞	13¼	16 3/16
	5	5		5¼		3 3/16	5	9⅛	13½	16 7/16
	5½	5½								
	7	7								
12	5½	5½	9⅝	5⅝	14½	3 3/16	5⅜	10⅜	15½	18 3/16
	7	7		5⅞		3 7/16	5⅝	10⅝	15¾	19 1/16
	8	8								
14	7	7	9⅞	6⅜	15⅝	3½	5⅞	11⅛	16¾	20¼
	8	8								
	10	10								

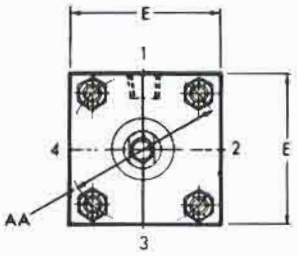
NOPAK TIE-ROD MOUNT CYLINDERS

1½" THROUGH 8" DIA.

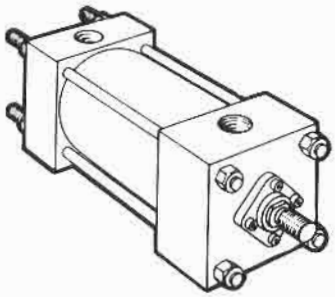
MODEL T (NFPA STD. MX1)

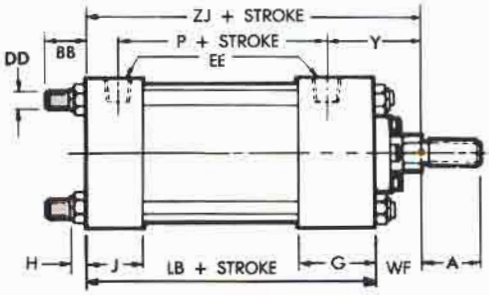






MODEL TB (NFPA STD. MX2) ▲





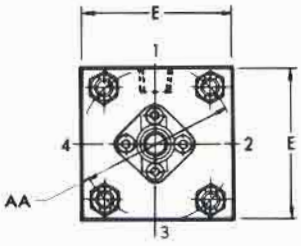


TABLE 1

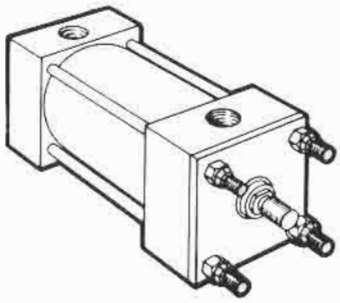
These dimensions are constant regardless of rod diameter or stroke.

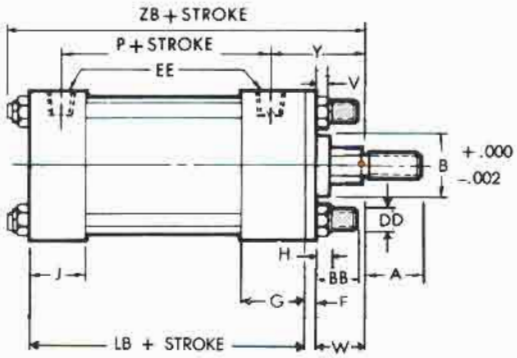
Double rod end models are designated by letter "X" preceding the model identification. See page 28.

BORE DIA.	E	F	G	H	J	AA	BB	DD	EE
1½	2½	3/8	1¾	11/32	1½	2.56	1⅜	3/8-24	½
2	3	5/8	1¾	3/8	1½	3.10	1⅝	7/16-20	½
2½	3½	5/8	1¾	15/32	1½	3.61	1⅞	½-20	½
3¼	4½	¾	2¼	9/16	1¾	4.60	2⅜	5/8-18	¾
4	5	⅞	2¼	9/16	1¾	5.40	2⅜	5/8-18	¾
5	6½	⅞	2¼	25/32	1¾	7.00	3¼	⅞-14	¾
6	7½	1	2½	⅞	2¼	8.10	3⅝	1-14	1
7	8½	1	2¾	1	2¾	9.30	4⅛	1⅛-12	1¼
8	9½	1	3	1⅛	3	10.61	4½	1¼-12	1½

▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

MODEL TR (NFPA STD. MX3)





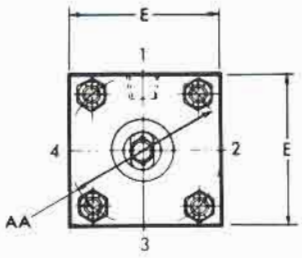


TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery.

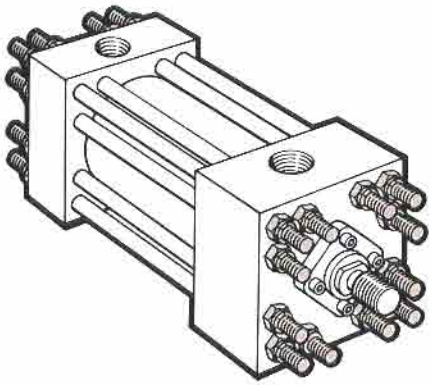
* For piston rod dimensions see page 32.

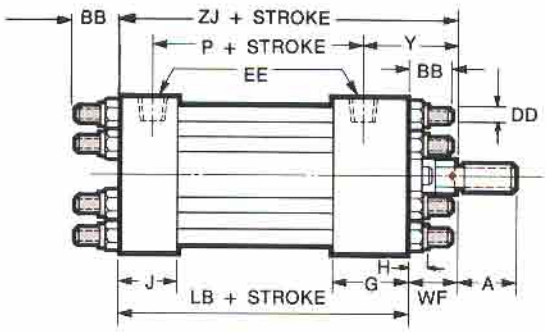
BORE DIA.	ROD MM	A	B	P	V	W	Y	LB	WF	ZB	ZJ
1½	5/8 •	3/4	1 1/8	2 3/4	1/4	5/8	2 1/16	4 5/8	1	6 1/8	5 5/8
	1 •	1 1/8	1 1/2		1/2	1	2 7/16		1 3/8	6 1/2	6
2	1 •	1 1/8	1 1/2	2 3/4	1/4	3/4	2 7/16	4 5/8	1 3/8	6 1/2	6
	1 3/8 •	1 5/8	2		3/8	1	2 11/16		1 5/8	6 3/4	6 1/4
2½	1 •	1 1/8	1 1/2	2 7/8	1/4	3/4	2 7/16	4 3/4	1 3/8	6 3/4	6 1/8
	1 3/8 •	1 5/8	2		3/8	1	2 11/16		1 5/8	7	6 3/8
	1 3/4 •	2	2 3/8		1/2	1 1/4	2 15/16		1 7/8	7 1/4	6 5/8
3¼	1 3/8 •	1 5/8	2	3 1/4	1/4	7/8	3	5 1/2	1 5/8	7 7/8	7 1/8
	1 3/4 •	2	2 3/8		3/8	1 1/8	3 1/4		1 7/8	8 1/8	7 3/8
	2 •	2 1/4	2 5/8		3/8	1 1/4	3 3/8		2	8 1/4	7 1/2
4	1 3/4 •	2	2 3/8	3 1/2	1/4	1	3 1/4	5 3/4	1 7/8	8 3/8	7 5/8
	2 •	2 1/4	2 5/8		1/4	1 1/8	3 3/8		2	8 1/2	7 3/4
	2 1/2 •	3	3 1/8		3/8	1 3/8	3 5/8		2 1/4	8 3/4	8
5	2 •	2 1/4	2 5/8	4	1/4	1 1/8	3 3/8	6 1/4	2	9 1/4	8 1/4
	2 1/2	3	3 1/8		3/8	1 3/8	3 5/8		2 1/4	9 1/2	8 1/2
	3 •	3 1/2	3 3/4		3/8	1 3/8	3 5/8		2 1/4	9 1/2	8 1/2
	3 1/2 •	3 1/2	4 1/4		3/8	1 3/8	3 5/8		2 1/4	9 1/2	8 1/2
6	2 1/2 •	3	3 1/8	4 5/8	1/4	1 1/4	3 3/4	7 3/8	2 1/4	10 3/4	9 5/8
	3	3 1/2	3 3/4								
	3 1/2	3 1/2	4 1/4								
	4 •	4	4 3/4								
7	3 •	3 1/2	3 3/4	5 3/8	1/4	1 1/4	3 13/16	8 1/2	2 1/4	11 7/8	10 3/4
	3 1/2	3 1/2	4 1/4								
	4	4	4 3/4								
	4 1/2	4 1/2	5 1/4								
	5	5	5 3/4								
8	3 1/2 •	3 1/2	4 1/4	6	1/4	1 1/4	4	9 1/2	2 1/4	13 1/8	11 3/4
	4	4	4 3/4								
	4 1/2	4 1/2	5 1/4								
	5	5	5 3/4								
	5 1/2 •	5 1/2	6 1/4								

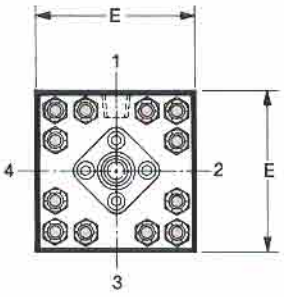
NOPAK TIE-ROD MOUNT CYLINDERS

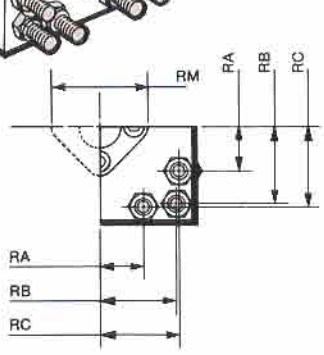
10" THROUGH 14" DIA.

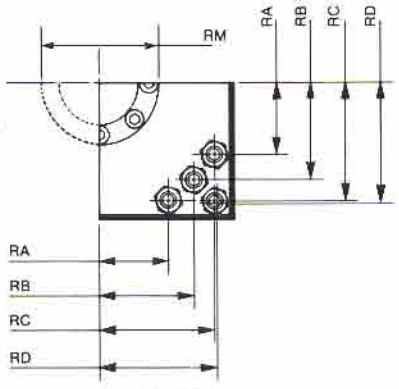
MODEL T (NFPA STD. MX1)

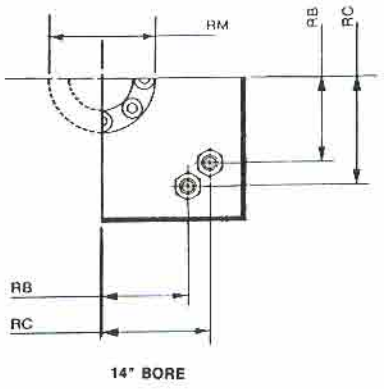




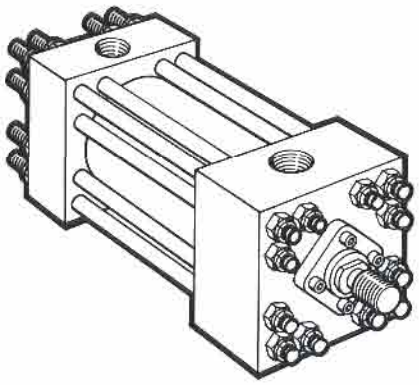


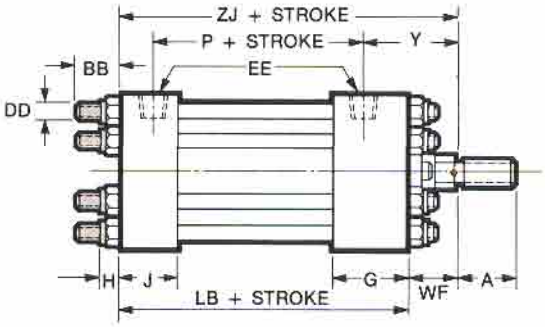






MODEL TB (NFPA STD. MX2)





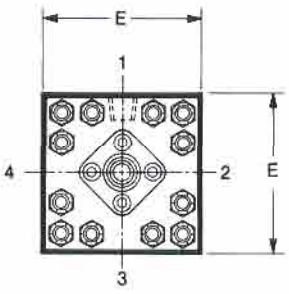


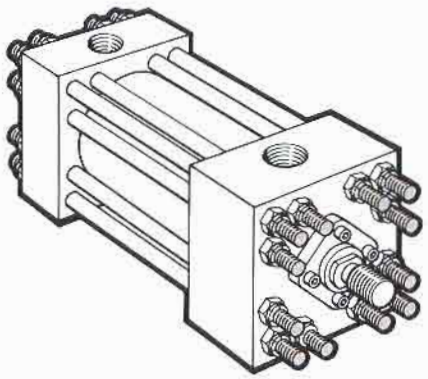
TABLE 1

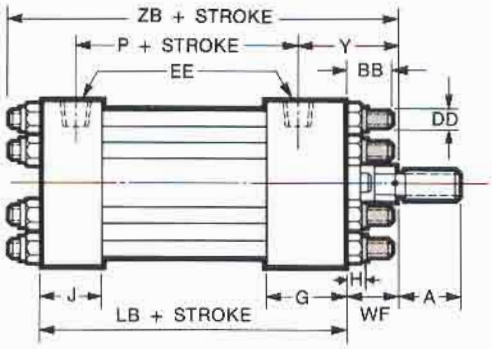
These dimensions are constant regardless of rod diameter or stroke.

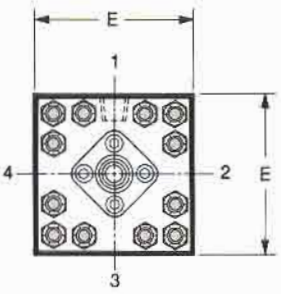
Double rod end models are designated by letter "X" preceding the model identification. See page 30.

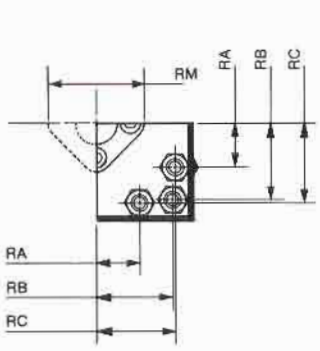
BORE DIA.	E	G	H	J	BB	DD	EE	RA	RB	RC	RD	RE
10	12 5/8	3 11/16	7/8	3 11/16	6	1-14	2	3.312	5.438	5.531	—	—
12	14 7/8	4 7/16	7/8	4 7/16	7	1-14	2 1/2	3.718	5.344	6.593	6.656	—
14	17 1/4	4 7/8	1 9/32	4 7/8	8	1 1/2-12	2 1/2	—	5.000	7.313	—	—

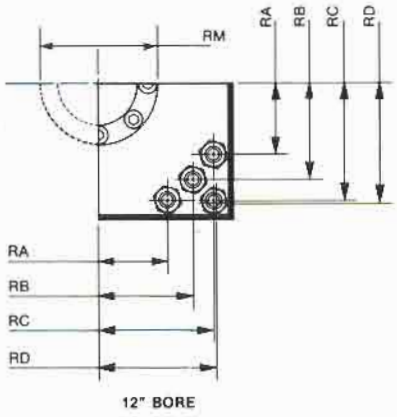
MODEL TR (NFPA STD. MX3)











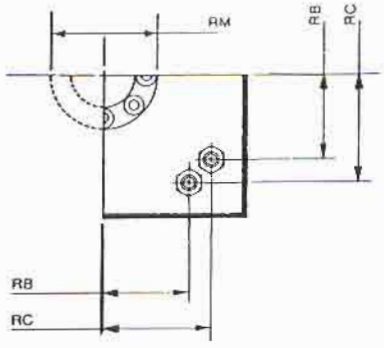


TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery.

* For piston rod dimensions see page 32.

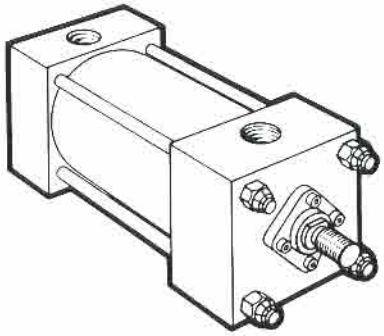
BORE DIA.	ROD MM	A	P	Y	LB	RM	WF	ZB	ZJ
10	4½ •	4½	8	5	12⅛	7½	2 15/16	16 3/16	15 1/16
	5	5		5¼		8⅜	3 3/16	16 7/16	15 5/16
	5½	5½				9			
	7	7				10¼			
12	5½	5½	9⅝	5⅝	14½	9	3 3/16	18 13/16	17 11/16
	7	7		5⅞		10¼	3 7/16	19 1/16	17 15/16
	8	8				11¼			
14	7	7	9⅞	6⅜	15⅝	10¼	3½	20¼	19⅛
	8	8				11¼			
	10	10				14			

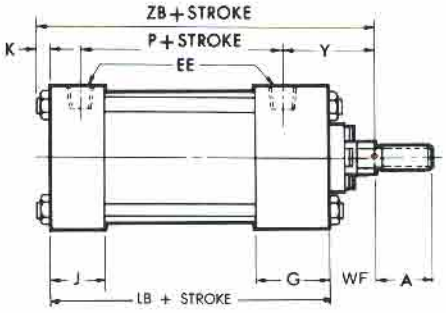
NOPAK

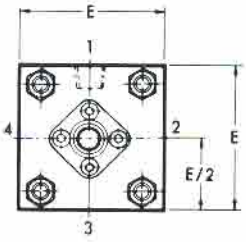
BASIC MODEL NO MOUNT CYLINDERS DOUBLE-ROD CYLINDER

1½" THROUGH 6" DIA.

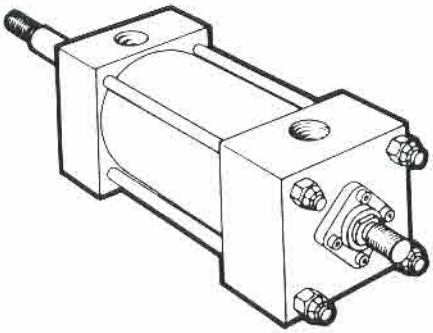
MODEL H-BASIC CYLINDER NO MOUNT ▲

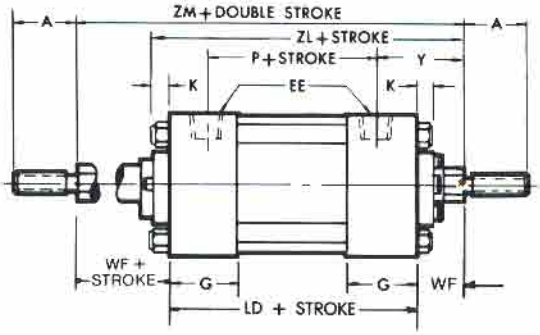






MODEL XH-BASIC CYLINDER DOUBLE ROD END ▲





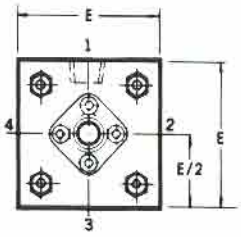


TABLE 1

These dimensions are constant regardless of rod diameter or stroke.

BORE DIA.	E	F	G	J	K
1 1/2	2 1/2	3/8	1 3/4	1 1/2	1/2
2	3	5/8	1 3/4	1 1/2	1/2
2 1/2	3 1/2	5/8	1 3/4	1 1/2	5/8
3 1/4	4 1/2	3/4	2 1/4	1 3/4	3/4
4	5	7/8	2 1/4	1 3/4	3/4
5	6 1/2	7/8	2 1/4	1 3/4	1
6	7 1/2	1	2 1/2	2 1/4	1 1/8

▲See Table A on page 29 for bore and rod combinations using head plates with threaded bronze gland.

NOPAK H & XH CYLINDER DIMENSIONAL DATA

TABLE 2

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

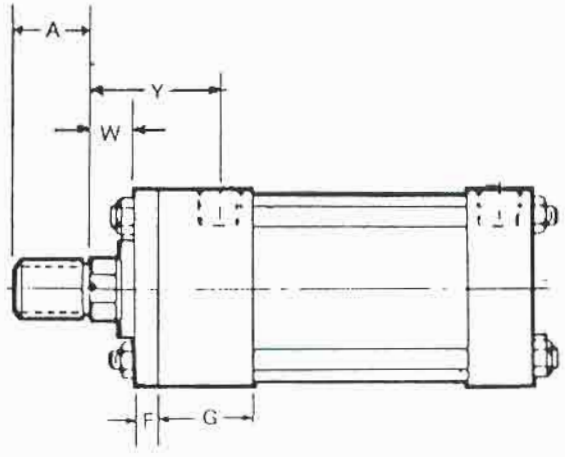
- Heads bored for these rod sizes are normally in stock– thus faster delivery.
- * For piston rod dimensions see page 32.

BORE DIA.	*ROD MM	A	P	Y	LB	LD	W	WF	ZB	ZL	ZM
1 1/2	5/8 •	3/4	2 3/4	2 1/16	4 5/8	4 7/8	5/8	1	6 1/8	6 3/8	6 7/8
	1 •	1 1/8		2 7/16			1	1 3/8	6 1/2	6 3/4	7 5/8
2	1 •	1 1/8	2 3/4	2 7/16	4 5/8	4 7/8	3/4	1 3/8	6 1/2	6 3/4	7 5/8
	1 3/8 •	1 5/8		2 11/16			1	1 5/8	6 3/4	7	8 1/8
2 1/2	1 •	1 1/8	2 7/8	2 7/16	4 3/4	5	3/4	1 3/8	6 3/4	7	7 3/4
	1 3/8 •	1 5/8		2 11/16			1	1 5/8	7	7 1/4	8 1/4
	1 3/4 •	2		2 15/16			1 1/4	1 7/8	7 1/4	7 1/2	8 3/4
3 1/4	1 3/8 •	1 5/8	3 1/4	3	5 1/2	6	7/8	1 5/8	7 7/8	8 3/8	9 1/4
	1 3/4 •	2		3 1/4			1 1/8	1 7/8	8 1/8	8 5/8	9 3/4
	2 •	2 1/4		3 3/8			1 1/4	2	8 1/4	8 3/4	10
4	1 3/4 •	2	3 1/2	3 1/4	5 3/4	6 1/4	1	1 7/8	8 3/8	8 7/8	10
	2 •	2 1/4		3 3/8			1 1/8	2	8 1/2	9	10 1/4
	2 1/2 •	3		3 5/8			1 3/8	2 1/4	8 3/4	9 1/4	10 3/4
5	2 •	2 1/4	4	3 3/8	6 1/4	6 3/4	1 1/8	2	9 1/4	9 3/4	10 3/4
	2 1/2	3		3 5/8			1 3/8	2 1/4	9 1/2	10	11 1/4
	3 •	3 1/2					1 3/8				
	3 1/2 •	3 1/2					1 3/8				
6	2 1/2 •	3	4 5/8	3 3/4	7 3/8	7 5/8	1 1/4	2 1/4	10 3/4	11	12 1/8
	3	3 1/2					1 1/4				
	3 1/2	3 1/2					1 1/4				
	4 •	4					1 1/4				

NOTE: CYLINDER MOUNTINGS, ROD SIZES AND THREAD TYPES ARE INTERCHANGEABLE ON EITHER END OF DOUBLE ROD END CYLINDER ASSEMBLY.

THE FOLLOWING BORE/ROD COMBINATIONS USE HEAD PLATE AND BRONZE GLANDS AS SHOWN AT RIGHT.	
BORE	ROD DIAMETER (MM)
1.50"	1.00"
2.00"	1.38"
2.50"	1.75"

Note: Threaded Bronze Gland used on all Model D and DD Cylinders. Bolt-on Gland used on all Model G and DG Cylinders.

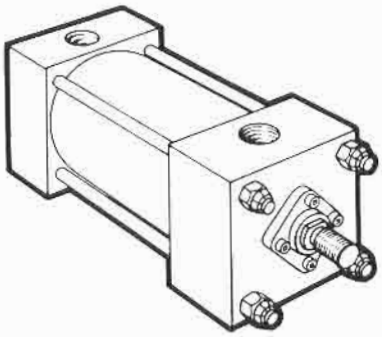


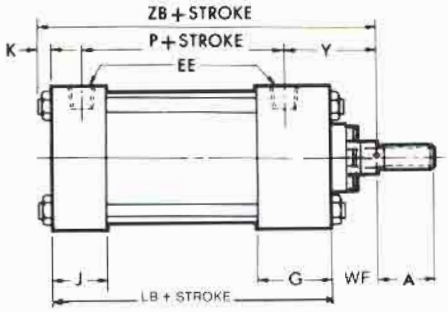
NOPAK

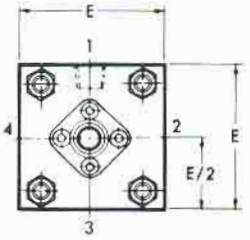
BASIC MODEL NO MOUNT CYLINDERS DOUBLE-ROD CYLINDER

7" THROUGH 20" DIA.

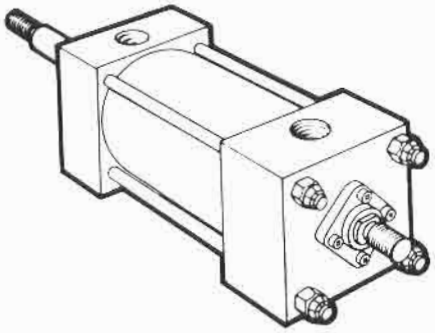
MODEL H BASIC CYLINDER NO MOUNT

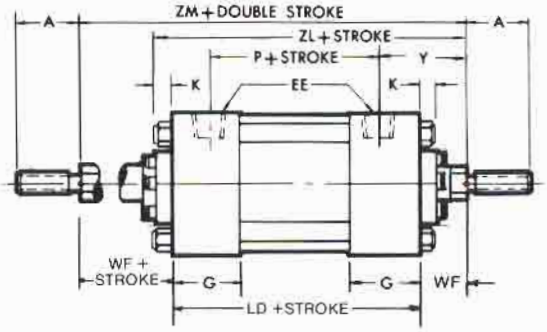






MODEL XH BASIC CYLINDER DOUBLE ROD END





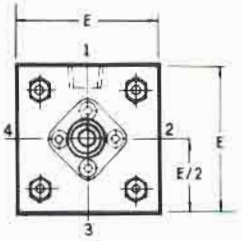


TABLE 1

These dimensions are constant regardless of rod diameter or stroke.

BORE DIA.	E	G	J	K	EE
7	8 1/2	2 3/4	2 3/4	1 1/8	1 1/4
8	9 1/2	3	3	1 3/8	1 1/2
10	12 5/8	3 11/16	3 11/16	1 1/8	2
12	14 7/8	4 7/16	4 7/16	1 1/8	2 1/2
14	17 1/4	4 7/8	4 7/8	1 1/4	2 1/2
16	19 1/4	5 7/8	5 7/8	1 7/16	3
18	22	6 7/8	6 7/8	1 7/16	3
20	23 5/8	7 7/8	7 7/8	1 7/16	3

NOPAK H & XH CYLINDER DIMENSIONAL DATA

TABLE 2

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

- Heads bored for these rod sizes are normally in stock– thus faster delivery.

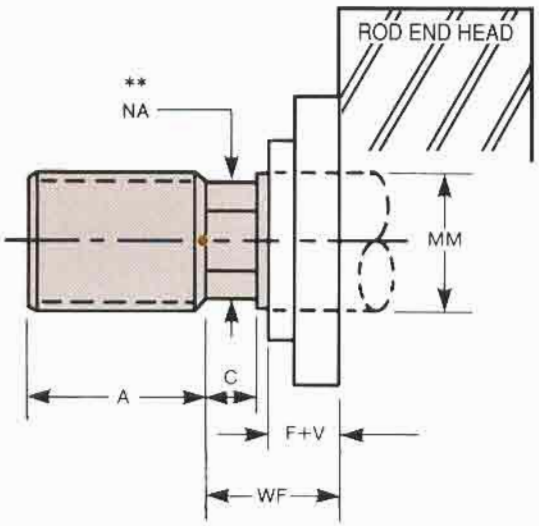
* For piston rod dimensions see page 32.

BORE DIA.	*ROD MM	A	P	Y	LB	LD	WF	ZB	ZL	ZM
7	3 •	3½	5⅜	3 13/16	8½	8½	2¼	11⅞	11⅞	13
	3½	3½								
	4	4								
	4½	4½								
	5	5								
8	3½ •	3½	6	4	9½	9½	2¼	13⅛	13⅛	14
	4	4								
	4½	4½								
	5	5								
	5½ •	5½								
10	4½ •	4½	8	5	12⅛	12⅛	2 15/16	16 3/16	16 3/16	18
	5	5		5¼			3 3/16	16 7/16	16 7/16	18½
	5½	5½								
	7	7								
12	5½	5½	9⅝	5⅝	14½	14½	3 3/16	18 13/16	18 13/16	20⅞
	7	7		5⅞			3 7/16	19 1/16	19 1/16	21⅜
	8	8								
14	7	7	9⅞	6⅜	15⅝	15⅝	3½	20¼	20¼	22⅝
	8	8								
	10	10								
16	8	8	11⅜	7⅜	18⅛	18⅛	4	23 9/16	23 9/16	26⅛
	9	9								
	10	10								
18	9	9	12⅜	8⅝	21⅛	21⅛	4¼	26 13/16	26 13/16	29⅝
	10	10								
20	10	10	13⅜	9⅝	23⅝	23⅝	4½	29 9/16	29 9/16	32⅝

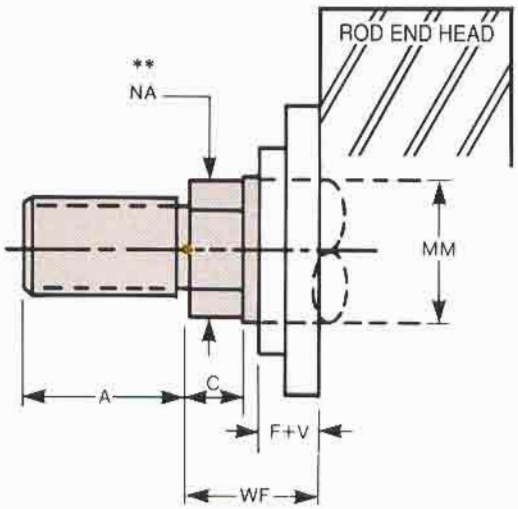
NOTE: CYLINDER MOUNTINGS, ROD SIZES AND THREAD TYPES ARE INTERCHANGEABLE ON EITHER END OF DOUBLE ROD END CYLINDER ASSEMBLY.

NOPAK CLASS 3 CYLINDER PISTON ROD ENDS DIMENSIONAL DATA

ROD TYPE NO. 1

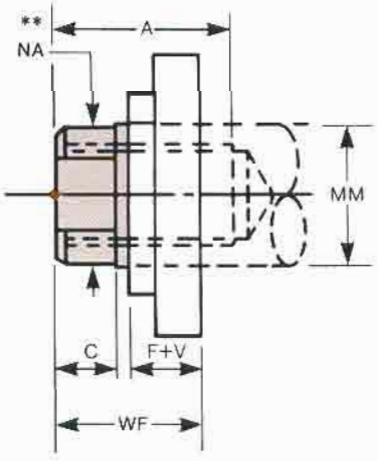


ROD END TYPE NO. 3 *NO. 4



*TYPE NO. 4 THREAD IS SIZED FOR ROD CLEVIS AND EYE

ROD END TYPE NO. 5



DIA. ROD MM	ROD END TYPE NO. 1	NO. 3	NO. 4*	NO. 5	A	C	D †	F + V	WF
5/8	5/8-18	1/2-20	7/16-20	7/16-20	3/4	3/8	1/2	5/8	See the respective charts covering model (mount), bore, and rod diameter.
1	1-14	7/8-14	3/4-16	3/4-16	1 1/8	1/2	7/8	3/4	
1 3/8	1 3/8-12	1 1/4-12	1-14	1-14	1 5/8	5/8	1 1/8	1	
1 3/4	1 3/4-12	1 1/2-12	1 1/4-12	1 1/4-12	2	3/4	1 1/2	3/4	
2	2-12	1 3/4-12	1 1/2-12	1 1/2-12	2 1/4	7/8	1 11/16	7/8	
2 1/2	2 1/2-12	2 1/4-12	1 7/8-12	1 7/8-12	3	1	2 1/16	1 1/16	
3	3-12	2 3/4-12	2 1/4-12	2 1/4-12	3 1/2	1	2 5/8	1 1/8	
3 1/2	3 1/2-12	3 1/4-12	2 1/2-12	2 1/2-12	3 1/2	1	3	1 1/8	
4	4-12	3 3/4-12	3-12	3-12	4	1	3 3/8	1 1/4	
4 1/2	4 1/2-12	4 1/4-12	3 1/4-12	3 1/4-12	4 1/2	1	3 7/8	1 1/4	
5	5-12	4 3/4-12	3 1/2-12	3 1/2-12	5	1	4 1/4	1 1/4	
5 1/2	5 1/2-12	5 1/4-12	4-12	4-12	5 1/2	1	4 5/8	1 1/4	
7	7-12	6 1/2-12	5 1/2-12	5 1/2-12	7	1	–	2 3/8	
8	8-12	7 1/2-12	5 3/4-12	5 3/4-12	8	1	–	2 3/8	
9	9-12	8 1/2-12	6 1/2-12	6 1/2-12	9	1	–	2 1/2	
10	10-12	9 1/2-12	7 1/4-12	7 1/4-12	10	1	–	2 1/2	

**Dimension NA is .060 under MM dia. dimension

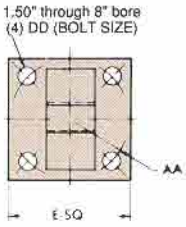
† Dimension D is size across wrench flats

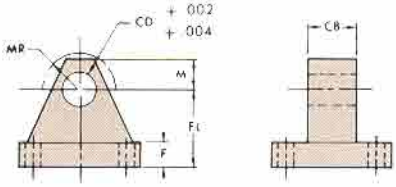
(4) 1/2 Dia. Spanner Holes Furnished in all rods 7" thru 10" Dia. all types.

NOTE: Rod Threads are Class UNF-2A or 2B unless specifically quoted otherwise.

CYLINDER ACCESSORIES

EYE BRACKET



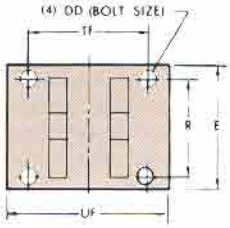


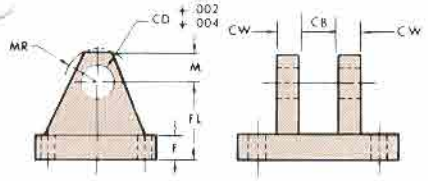
CYL. DIA.	E	F	M	AA	CB	CD	DD	FL	MR	(FORMER) PART NO.	(PRESENT) PART NO.
1½	2½	⅜	½	2.30	¾	½	⅜	1⅛	⅝	A-12008CY	2716 L47
2-2½	3½	⅜	¾	3.61	1¼	¾	½	1⅞	⅞	A-26139CY	2719 L32
3¼	4½	⅞	1	4.60	1½	1	⅝	2⅜	1¼	A-26140CY	2720 L33
4	5	⅞	1⅜	5.40	2	1⅜	⅝	3	1⅜	A-26141CY	2721 L34
5	6½	1⅛	1¾	7.00	2½	1¾	⅞	3⅜	2	A-26142CY	2722 L35
6	7½	1 7/16	2	8.10	2½	2	1	3 15/16	2⅜	A-26143CY	2723 L36
7	8½	1⅝	2½	9.30	3	2½	1⅛	4⅜	3	A-26144CY	2724 L37
8	9½	2	2¾	10.61	3	3	1¼	5¼	3¼	A-26145CY	2725 L38
10	12⅝	2⅜	3½	*	4	3½	1	6⅜	3½	A-26146CY	2726 L39
12	14⅞	2⅞	4	*	4½	4	1	7½	4	A-26147CY	2727 L40
14	17¼	3⅜	5	*	6	5	1	9	5	A-26148CY	2728 L41

FOR CLEVIS BRACKET REFERENCE SEE PAGE 17 & 19

*See page 26 for bolt hole location.

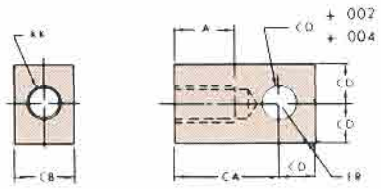
MOUNTING BRACKET





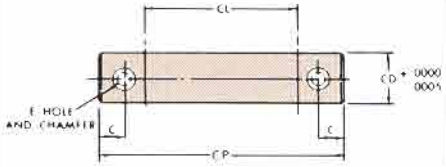
CYL. DIA.	E	F	M	R	CB	CD	CW	DD	FL	MR	TF	UF	(FORMER) PART NO.	(PRESENT) PART NO.
1½	2½	⅜	½	1.63	¾	½	½	⅜	1⅛	⅝	2¾	3½	A-8496CY	2683 L47
2-2½	3½	⅝	¾	2.55	1¼	¾	⅜	½	1⅞	⅞	3¾	4¾	A-8497CY	2684 L47
3¼	4½	⅞	1	3.25	1½	1	¾	⅝	2⅜	1¼	4½	5¾	A-26157CY	2685 L47
4	5	⅞	1⅜	3.82	2	1⅜	1	⅝	3	1⅝	5½	6¾	A-8499CY	2686 L47
5	6½	1⅛	1¾	4.95	2½	1¾	1¼	⅞	3⅜	2	7	8½	A-26158CY	2687 L47
6	7½	1 7/16	2	5.73	2½	2	1¼	1	3 15/16	2⅜	7½	9¼	A-26159CY	2688 L47
7	8½	1⅝	2½	6.58	3	2½	1½	1⅛	4⅜	3	8½	10½	A-26160CY	2689 L47
8	9½	2	2¾	7.50	3	3	1½	1¼	5¼	3¼	8¾	10¾	A-26161CY	2690 L47
10	12⅝	2⅜	3½	9.62	4⅛	3½	2	1¾	6⅜	3½	12	15	B-26162CY	2691 L47
12	14⅞	2⅞	4	11.45	4⅝	4	2¼	2	7½	4	14	18	B-26163CY	2692 L47
14	17¼	3⅜	5	13.36	6⅛	5	3	2¼	9	5	17¾	22½	B-26164CY	2693 L47

EYE (FEMALE)

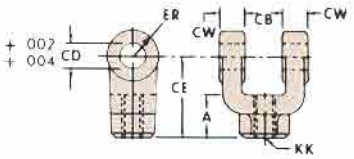


KK	A	CA	CB	CD	ER	PART NO.
7/16-20	¾	1½	¾	½	⅝	1810L59
¾-16	1⅛	2 1/16	1¼	¾	1 1/16	1812 L59
1-14	1⅝	2 13/16	1½	1	1 7/16	1813 L59
1¼-12	2	3 7/16	2	1⅜	2	1814 L59
1½-12	2¼	4	2½	1¾	2 1/16	1815 L59
1⅞-12	3	5	2½	2	2¼	1817 L59
2¼-12	3½	5 13/16	3	2½	2⅞	1820 L59
2½-12	3½	6⅛	3	3	3⅛	1821 L59
3¼-12	4½	7⅝	4	3½	3⅞	1824 L59
4-12	5½	9⅛	4½	4	4 7/16	1825 L59
5½-12	7	11⅞	6	5	5	1826 L59

PIVOT — PIN



CLEVIS (FEMALE)



CYL. DIA.	C	E	CD	CP	CL	PART NO.
1½	3/16	⅛	½	2⅜	1.8	3222 L47-1
2-2½	¼	3/16	¾	3¼	2.6	3222 L47-2
3¼	¼	3/16	1	3¾	3.1	3222 L47-3
4	¼	3/16	1⅜	4⅞	4.1	3222 L47-4
5	¼	3/16	1¾	5⅞	5.1	3222 L47-5
6	5/16	¼	2	6⅛	5.2	3222 L47-6
7	5/16	¼	2½	7⅛	6.3	3222 L47-8
8	5/16	¼	3	7⅛	6.3	3222 L47-7
10	⅜	¼	3½	9¼	8.0	3222 L47-9
12	⅜	¼	4	10¼	9.0	3222 L47-10
14	⅜	¼	5	13½	12.3	3222 L47-11

KK	A	CB	CD	CE	CW	ER	PART NO.
7/16-20	¾	¾	½	1½	½	½	2834 L59
¾-16	1⅛	1¼	¾	2⅜	⅝	¾	2835 L59
1-14	1⅝	1½	1	3⅛	¾	1	2836 L59
1¼-12	2	2	1⅜	4⅛	1	1⅜	2837 L59
1½-12	2¼	2½	1¾	4½	1¼	1¾	2838 L59
1⅞-12	3	2½	2	5½	1¼	2	2839 L59
2¼-12	3½	3	2½	6½	1½	2½	2840 L59
2½-12	3½	3	3	6¾	1½	3	2841 L59
3¼-12	4½	4	3½	8½	2	3½	2842 L59
4-12	5½	4½	4	10	2¼	4	2843 L59
5½-12	7	6	5	12¾	3	5	2844 L59

NOPAK CLASS 3 ENGINEERING INFORMATION

ENGINEERING INFORMATION

NOPAK Class 3 pressure-rated cylinders are designed for hydraulic service. For reference to basic pressure ratings, see table page 2. Cylinders 1½" through 8" diameter bore are assembled from standard inventory components. Special design and large diameter Class 3 cylinders are available. Send us your specifications.

OPERATING TEMPERATURES AND MEDIA

Class 3 hydraulic cylinders equipped with standard Type A packings may be operated at temperatures from -40°F to 225°F air, water* or oil. The following chart relates in a simplified general purpose manner the limitations and uses of available piston and rod packings.

PACKING TYPE	
A = Nitrile (Buna-N)	B = Viton
-40°F to +225°F Std. Hyd. Oil Air Water (not steam) Water Glycol fire resistant fluid	-20°F to +325°F Std. Hyd. Oil Air Phosphate Ester fire resistant fluid

For specific media and temperature or conditions exceeding the chart ratings, consult NOPAK Engineering Department.

Applications involving Fire Resistant Fluids must be so specified for compatible component materials. When considering temperature, remember that as the temperature increases (within the rated limits) the packing life decreases.

INTERCHANGEABILITY

Class 3 cylinders are dimensionally interchangeable with other square-head cylinders of the same pressure classification. Construction and performance are in conformance with applicable recommended NFPA Standards.

CUSHIONS

NOPAK Class 3 cylinders are available with adjustable cushions on either or both ends, or non-cushion.

The purpose of a cushion is to slow up piston speed at the end of the stroke, eliminating hammer and shock.

Cushion adjusting screws serve to by-pass the fluid from the trapped section between the piston and the cylinder head when the cushion sleeve has entered the bore. Turning the needle inward against the seat results in maximum cushion intensity. Backing up on the needle decreases the effect.

Where standard cushions are inadequate for unusual requirements, special cushions possibly requiring longer-than-standard heads can be furnished at additional charge. Very rapid cushioning of high speed movement may require deceleration valves.

The purpose of the ball check in the cushion mechanism is to allow fluid to pass to the piston face without obstruction (while the cushion sleeve is still within the bore in the head). This results in essential quick starting of the piston.

CYLINDER PORT TYPES & LOCATION

Standard ports are NPT. SAE O-ring boss ports are available at extra charge. SAE 4-bolt flange ports are offered at extra charge. Specify Code 61 or Code 62.

Inlet ports are located in Position 1 as standard (see rod end view on dimension drawings). They can however, be located at other numbered locations on application. Extra inlets furnished at additional charge. Oversize and special inlets require dimensions and quotation on application.

*WATER SERVICE

Special cylinders can be built for water service. Due to the uncertainty of action of water supply on some materials, responsibility for premature failure due to corrosion, mineral deposits or electrolysis cannot be accepted.

NOPAK CLASS 3 ENGINEERING DATA

PRE-STRESSING TIE-RODS

Some of the tie-rod torque values shown in Table 1 may be impractical to obtain with an ordinary torque wrench. If so, another method for prestressing the tie-rods may be used. Lightly tighten opposite tie-rods alternately to a 100 ft.-lb. torque value. Measure the stressed length of the tie-rod (the distance between the nut faces of thread engaged surfaces) and multiply this length by the proper "N" factor as specified in Table A. This will indicate the amount of turn or turns required. Scribe a reference mark on each nut and the adjacent bolted surface to assist in determining the amount of rotation. Slowly and evenly heat the exposed center length of the tie-rod using caution not to overheat the tie-rod or nearby cylinder or head surfaces. (If desired, use a fireproof heat shield for insulation of the cylinder barrel). When the tie-rod is sufficiently heated the nut can be turned to the proper location. This procedure may be followed for the other tie-rods in the alternate fashion until all the tie-rods have been tightened the desired amount. After they have cooled, the tie-rods will be stressed to the proper torque value.

TABLE A • TIE ROD TORQUE

Cyl. Dia.	1½	2	2½	3¼	4	5	6	7	8	10	12	14	16	18	20
No. of Tie Rod	4	4	4	4	4	4	4	4	4	12	16	8	8	12	12
Tie Rod Size	3/8	7/16	1/2	5/8	5/8	7/8	1	1⅛	1¼	1	1	1½	1½	1½	1½
Torque Ft. Lbs.	20	45	60	150	150	400	600	850	1000	600	600	2500	2500	2500	2500
N. Factor							.043	.036	.040	.044	.044	.044	.043	.044	.043

TABLE B — DEDUCTIONS FOR PULL STROKE FORCE AND DISPLACEMENT

Rod Size	Rod Area Sq. In.	ROD DIAMETER FORCE IN POUNDS FOR VARIOUS LINE PRESSURES							DISPLACEMENT Per Inch of Stroke	
		500	750	1000	1250	1500	2000	3000	Cu. Inch	Gallons
5/8	.307	154	230	307	384	461	614	921	.307	.0013
1	.785	393	589	785	981	1,178	1,570	2,355	.785	.0034
1⅜	1.485	743	1114	1,485	1856	2228	2970	4455	1.485	.0064
1¾	2.405	1203	1804	2405	3006	3608	4810	7215	2.405	.0104
2	3.142	1571	2357	3142	3928	4713	6284	9426	3.142	.0136
2½	4.909	2455	3682	4909	6137	7364	9818	14,727	4.909	.0213
3	7.069	3535	5302	7069	8836	10,604	14,138	21,207	7.069	.0306
3½	9.621	4811	7216	9621	12,026	14,432	19,242	28,863	9.621	.0416
4	12.566	6283	9425	12,566	15,708	18,849	25,132	37,698	12.566	.0544
4½	15.904	7952	11,928	15,904	19,880	23,856	31,808	47,712	15.904	.0688
5	19.635	9818	14,726	19,635	24,544	29,452	39,270	58,905	19.635	.0850
5½	23.758	11,879	17,819	23,758	29,698	35,637	47,516	71,274	23.758	.1028
7	38.484	19,242	28,863	38,484	48,105	57,726	76,968	115,452	38.484	.1666
8	50.265	25,133	37,699	50,265	62,831	75,398	100,530	150,795	50.265	.2176
9	63.617	31,809	47,713	63,617	79,521	95,426	127,234	190,851	63.617	.2754
10	78.539	39,270	58,904	78,539	98,174	117,809	157,079	235,617	78.539	.3400

NOTE:

To determine cylinder pull stroke force or displacement, deduct force or displacement corresponding to rod size in Table B from force or displacement corresponding to bore size shown in Table C.

1 gallon = 231 Cu. In.

Area of Circle = $.7854\ d^2$

$$\text{Piston Speed (In./Min)} = \frac{\text{Pressure Source Delivery (GPM)}}{\text{Cylinder Displacement (Gal./In.)}}$$

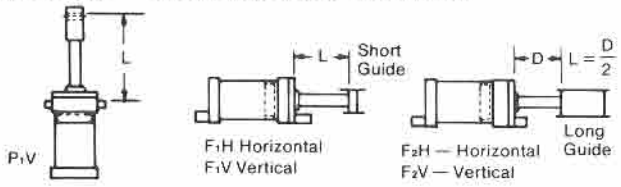
TABLE C — THRUST FORCE AND DISPLACEMENT

Bore Size	Piston Area Sq. In.	CYLINDER THRUST FORCE IN POUNDS FOR VARIOUS LINE PRESSURES							DISPLACEMENT Per Inch of Stroke	
		500	750	1000	1250	1500	2000	3000	Cu. Inch	Gallons
1½	1.767	884	1,325	1,767	2,209	2,650	3,534	5,301	1.767	.00765
2	3.142	1,571	2,357	3,142	3,928	4,713	6,284	9,426	3.142	.0136
2½	4.909	2,455	3,682	4,909	6,137	7,364	9,818	14,727	4.909	.0213
3¼	8.296	4,148	6,222	8,296	10,370	12,444	16,592	24,888	8.296	.0359
4	12.566	6,283	9,425	12,566	15,708	18,849	25,132	37,698	12.566	.0544
5	19.635	9,818	14,726	19,635	24,544	29,452	39,270	58,905	19.365	.0850
6	28.274	14,137	21,206	28,274	35,342	42,411	56,548	84,822	28.274	.1224
7	38.485	19,242	28,864	38,485	48,106	57,727	76,970	115,455	38.485	.1666
8	50.265	25,133	37,699	50,265	62,832	75,398	100,530	150,795	50.265	.2176
10	78.54	39,270	58,905	78,540	98,175	117,810	157,080	235,620	78.54	.3400
12	113.10	56,550	84,825	113,100	141,375	169,650	226,200	339,300	113.10	.4896
14	153.94	76,970	115,455	153,940	192,425	230,910	307,880	461,820	153.94	0.666
16	201.06	100,530	150,795	201,060	251,325	301,590	402,120	603,180	201.06	0.870
18	254.47	127,235	190,853	254,470	318,088	381,705	508,940	763,410	254.47	1.102
20	314.16	157,080	235,620	314,160	392,700	471,240	628,320	942,480	314.16	1.360

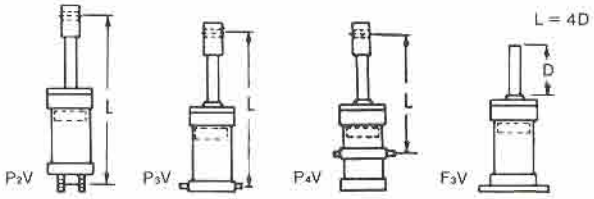
ENGINEERING DATA

INFORMATION TO PREVENT EXCESSIVE BEARING WEAR AND PISTON ROD COLUMN FAILURES

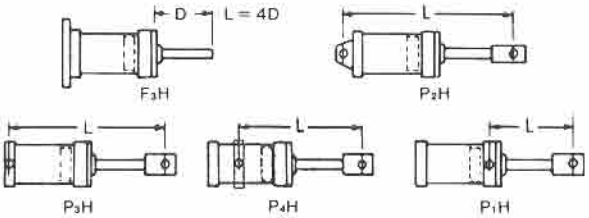
GROUP A — With piston rods extended.



GROUP B — To be checked for buckling or jack-knifing with piston rods extended and vertically mounted.



GROUP C — To be checked for load on bearing with piston rods extended and horizontally mounted.



STEP 1 – Find drawing in one of three groups above that fits your cylinder application, and follow instructions listed for that group.

Instructions: Stop tubes are used on log push stroke cylinders to prevent jack-knifing or buckling. They are placed between the piston and cylinder head to restrict the extended position of the piston rod so that the lengthened space between piston and bushing provides additional piston rod guide support.
The best choice for a cylinder with an exceptionally long stop tube requirement is the DOUBLE PISTON WITH SPACER. Note that the piston effective bearing area is doubled in addition to gaining the normal increased minimum distance between bearing points.

To determine whether a stop tube is required on a push stroke cylinder, proceed as follows:

a. Using above drawings, determine value of "L" from stroke length, rod and cylinder dimensions.
b. Refer to Table 1 for stop tube recommendation. A cylinder having an "L" value 45 requires a minimum of 1" stop tube and a maximum of 5" stop tube. Specifications for more than the maximum stop tube will usually adversely increase the cylinder weight.

Example: In a P_2V type application requiring 32" of stroke, "L" = 32" + 32" + approximately 10" for head and cap thickness = 74". A stop tube 4" long is required. (when a fraction of an inch of stop tube is calculated, use the next full inch.) Adjusted value of "L" is 74" + 4" or 78". Use of up to 8" of stop tube will further reduce bearing loads.

Instructions: Stop tubing is recommended for reducing piston and bushing/bearing loads on long stroke cylinders of the types shown. To determine length of stop tube required for this type of application, resolve the turning moments and loads between the piston and rod bushing. Include the weight of the fluid especially on large bore cylinders. It is ideal to keep projected bearing area loads lower than 200 PSI.

Caution: Do not use oversize rods to lessen bearing loads. Stop tubes are more economical and effective; oversize rods are heavier, cost more than stop tubing and if misalignment occurs, bearing loads are considerably increased due to stiffness of the oversize rod.

If your drawing is F_3H, P_2H, P_3H, or P_4H, in Group C, check for stop tube requirements from instructions in Group B.

Use whichever stop tube is longer. Determine value of "L" and proceed to Step 2.

STEP 2 – Find Rod Diameter for Column Strength.

Standard diameter piston rods are recommended on all installations except where column strength, piston rod sag, or return rate of hydraulic cylinders requires larger diameter rods.

Bushing/bearing loads caused by unavoidable misalignment are minimized when piston rods of correct diameter instead of unnecessarily large diameter piston rods are used. Correct (usually standard) piston rod diameters decrease and absorb shock loads to a greater extend than unnecessarily large oversize rods.

To determine the minimum piston rod diameter on push stroke cylinders:

a. Determine your push stroke thrust from table on page 35.
b. Find your push stroke thrust "T" in Table 2. If exact thrust isn't shown, use next larger shown.
c. In the horizontal column in line with your thrust, find value of "L" determined in Step 1.
d. Find minimum piston rod diameter required by following the same vertical line where your value of "L" is located, toward the top of the table.

TABLE 1

"L" INCHES	MINIMUM STOP TUBE LENGTH (INCHES)	*MAXIMUM STOP TUBE LENGTH (INCHES)	"L" INCHES	MINIMUM STOP TUBE LENGTH (INCHES)	*MAXIMUM STOP TUBE LENGTH (INCHES)
5-10		1	161-170	13	17
11-20		2	171-180	14	18
21-30		3	181-190	15	19
31-40		4	191-200	16	20
41-50	1	5	201-210	17	21
51-60	2	6	211-220	18	22
61-70	3	7	221-230	19	23
71-80	4	8	231-240	20	24
81-90	5	9	241-250	21	25
91-100	6	10	251-260	22	26
101-110	7	11	261-270	23	27
111-120	8	12	271-280	24	28
121-130	9	13	281-290	25	29
131-140	10	14	291-300	26	30
141-150	11	15	301-310	27	31
151-160	12	16			

***NOTE:** USING STOP TUBE LENGTHS GREATER THAN "MAXIMUM STOP TUBE" HAS DIMINISHING EFFECT ON REDUCING BEARING LOADS.

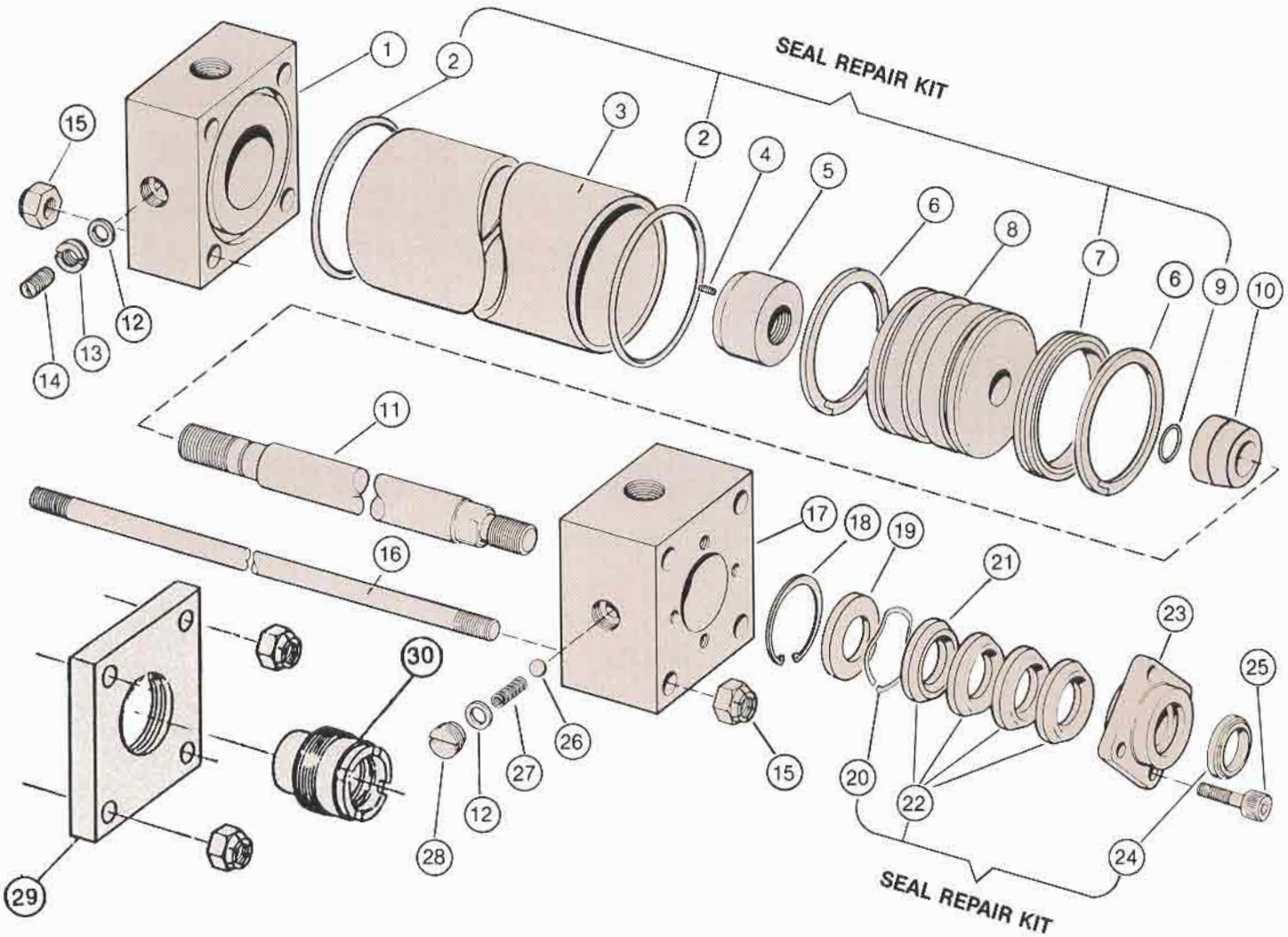
TABLE 2
VALUE OF "L" IN INCHES

Value of "T" in Lbs. in This Column	PISTON ROD DIAMETERS															
	0.63	1.00	1.38	1.75	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	7.00	8.00	9.00	10.00
1,000	27	60	105	155	190	257	330									
1,400	24	53	92	142	174	244	308	385								
1,800	23	48	82	127	160	230	296	366	440							
2,400	19	45	75	114	145	213	281	347	415	488						
3,200	16	41	67	103	130	194	261	329	400	461						
4,000	13	38	63	94	119	175	240	310	378	446						
5,000	9	34	60	87	110	163	225	289	360	426	494					
6,000		30	56	82	102	152	208	274	342	410	476					
8,000		26	50	76	93	137	188	245	310	375	447					
10,000		21	45	70	89	125	172	222	279	349	412	482				
12,000		17	41	65	84	118	155	210	269	326	388	454				
16,000			34	57	75	110	142	188	235	292	350	420				
20,000			28	52	68	103	136	172	218	270	326	385				
30,000				39	55	87	120	156	189	230	285	330				
40,000				22	43	74	108	142	177	210	248	294				
50,000					*30*	*66*	*96*	*130*	*165*	*200*	*234*	*269*	*408*			
60,000						57	88	119	154	190	225	256	384			
80,000						36	71	104	137	170	204	240	336			
100,000							57	90	120	154	189	222	324	400		
120,000							45	77	108	140	175	207	313	377		
140,000								64	98	128	160	194	301	365		
160,000								47	86	118	148	182	279	350	421	
200,000									67	98	131	161	260	330	402	
250,000										72	109	141	236	301	375	
300,000											86	120	212	281	351	420
350,000											52	100	195	261	328	396
400,000												77	182	241	309	374
500,000													152	212	274	341
600,000													114	183	247	310
700,000													70	162	221	280
800,000														118	197	260
900,000														82	168	237
1,000,000															115	212

Values of "L" less than those shown have a slenderness ratio (length ÷ radius of gyration which is length ÷ ¼ diameter of piston rod) of less than 50. Thus, the compressive strength formula (s = thrust ÷ rod area) is used rather than the column strength formula on which Table 2 is based. For very low slenderness ratios (below 20), compressive strength formulae with a 2 to 1 factor of safety are satisfactory. For slenderness ratios between 20 and 50, use compressive strength formulae with proportionate factors between 2 to 1 and 5 to 1.

IMPROVED CUSHION ADJUSTMENT —
Newly designed needle valve is interchangeable with current design and offers improved sealing characteristics.

REPLACEMENT PARTS



1. Blind End Head
2. Tube Seal★
3. Tube
4. Lock Screw
5. Lock Sleeve
6. Piston Ring
7. "T" Seal and Back-Ups★††
8. Piston
9. Piston O-Ring★
10. Cushion Sleeve – Rod End
11. Piston Rod
12. Seal
13. Cushion Adjusting Screw Gland
14. Cushion Adjusting Screw
15. Tie Rod Nut
16. Tie Rod
17. Rod End Head
18. Snap Ring††
19. Packing Spacer††
20. Wave Spring★††
21. Bottom Adapter Ring★☆††
22. Rod Packing★††
23. Packing Gland††
24. Rod Wiper★
25. Packing Gland Cap Screw
26. Check Ball
27. Ball Check Spring
28. Ball Check Plug

IF APPLICABLE:
29. Head Plate
30. Screw Gland

† "T" Seal used thru 16" dia. bore 18" and 20" fitted with piston rings.
†† For 7" dia. rods and larger.
Parts 18, 19, 20, and 21 are eliminated
Part 22 replaced by a U-cup style seal
Part 23 replaced by a rod bearing and a multi-bolt gland retainer.

★ Items are included in seal repair kits.
See page 5 for ordering information.
☆ Item 21 is metallic for high temp applications.

When ordering replacement parts be sure to specify:
– Part by name and item number
– Bore, stroke, mounting, and Serial number shown on Nopak label

NOTE: Isometric view of DOUBLE ROD cylinders available at N/C.
Consult factory or our authorized distributor.

REPAIR KITS
CLASS 3

ROD SEAL KITS

SINGLE ROD •	
ROD DIA.	PART NO.*
0.63"	RK3-63
1.00"	RK3-100
1.38"	RK3-138
1.75"	RK3-175
2.00"	RK3-200
2.50"	RK3-250
3.00"	RK3-300
3.50"	RK3-350
4.00"	RK3-400
4.50"	RK3-450
5.00"	RK3-500
5.50"	RK3-550
7.00"	RK3-700

Each Rod Seal Kit consists of:
- 1 - "V" ring rod packing
- 1 - Rod wiper
- 1 - Wave spring

• To service DOUBLE ROD END CYLINDER, order one Rod Kit for EACH rod end, and if applicable, one Piston Kit.

PISTON SEAL KITS

SINGLE OR DOUBLE ROD	
BORE SIZE	PART NO.*
1.50"	PK3-150
2.00"	PK3-200
2.50"	PK3-250
3.25"	PK3-325
4.00"	PK3-400
5.00"	PK3-500
6.00"	PK3-600
7.00"	PK3-700
8.00"	PK3-800
10.00"	PK3-1000
12.00"	PK3-1200
14.00"	PK3-1400

Each Piston Seal Kit consists of:
- 2 - Tube "O" rings
- 1 - G. T. ring (piston seal)
- 1 - Piston "O" ring

NOTE: Cast Iron Rings NOT included.

***When ordering, specify Type "A" or Type "B" seals**
Type "A" = Buna-N (NITRILE)
Type "B" = Viton

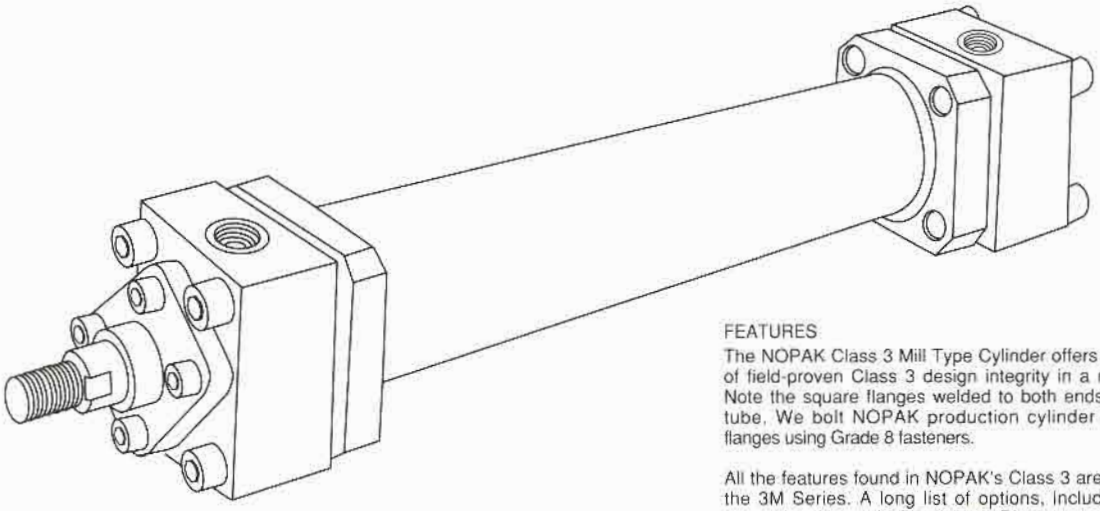
PACKING GLANDS

ROD DIA.	PACKING GLANDS	
	ALL MODELS EXCEPT D & DD •	MODELS D & DD ONLY
	PART NUMBER	PART NUMBER
0.63"	1069G70	1071G70
1.00" *	1068G73	2859G73
1.38" *	1066G75	2858G75
1.75" *	1067G77	2857G77
2.00"	1065G78	2856G78
2.50"	1064G79	2855G79
3.00"	1063G81	2854G81
3.50"	1062G82	2853G82
4.00"	1061G83	2852G83
4.50"	1060G84	C/F
5.00"	1070G85	C/F
5.50"	1059G86	C/F
7.00"	C/F	C/F

* Use pkg. gland 2859G73 for 1.50" cyl. with 1.00" Ø rod.
Use pkg. gland 2858G75 for 2.00" cyl. with 1.38" Ø rod.
Use pkg. gland 2857G77 for 2.50" cyl. with 1.75" Ø rod.
• For Models AL, T, and TR, consult factory.

NOPAK

CLASS 3M NON-TIE-ROD MILL TYPE CYLINDER



FEATURES

The NOPAK Class 3 Mill Type Cylinder offers the advantages of field-proven Class 3 design integrity in a non-tie-rod unit. Note the square flanges welded to both ends of the cylinder tube. We bolt NOPAK production cylinder heads to these flanges using Grade 8 fasteners.

All the features found in NOPAK's Class 3 are incorporated in the 3M Series. A long list of options, including dual piston stop tube, integral LDT (Linear Displacement Transducer), servo or proportional valve footprint in cylinder head and multiple mounting styles are available.

WARRANTY

GALLAND HENNING NOPAK, INC. warrants every product of its manufacture to be of proper materials and first class workmanship. We agree to repair or replace, F.O.B. Factory, but not to remove or install in the field, any perishable "soft goods" such as seals, gaskets, etc., which fail within a six-month period after shipment, normal wear excepted. We warrant for one year from date of shipment, all other parts which fail because of defective materials or workmanship. GHN assumes no responsibility for work done or expenses incurred, in the field, pertaining to such repairs or replacements, except upon written authority from our home office. Components not produced by GHN are subject only to the warranty extended to GHN by their respective manufacturer. For a complete statement of terms and warranty, see your NOPAK distributor or the reverse side of any GHN invoice.

When orders have been correctly filled, there shall be no returns without GHN's approval. Such returns will be subject to a restocking charge.

NATIONAL FLUID POWER ASSOCIATION MEMBER

PREFERRED NOPAK DISTRIBUTOR

GALLAND HENNING NOPAK, Inc.

1025 South 40th Street ▪ West Milwaukee, Wisconsin 53215
PHONE: 414-645-6000 ▪ FAX: 414-645-6048
www.NOPAK.com ▪ Email: sales@nopak.com

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Catalog 103 7/05 10K Printed in U.S.A.

NOPAK®

CATALOG 106

CLASS P6
AIR CYLINDERS
TO 250 PSI

CLASS H6
HYDRAULIC
CYLINDERS
BORE RATED
(SEE PAGE 2)

INTERMEDIATE
PRESSURE
SQUARE-HEAD
CYLINDERS

HYDRAULIC &
PNEUMATIC

GALLAND HENNING NOPAK, Inc.

1025 South 40th Street ■ West Milwaukee, Wisconsin 53215
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www.nopak.com ■ Email: sales@nopak.com

NOPAK INTERMEDIATE PRESSURE SQUARE HEAD CLASS P6-AIR & H6-HYDRAULIC CYLINDERS

TABLE OF CONTENTS

PRESSURE RATINGS (PSI)

Nopak intermediate pressure square-head cylinders are designed as class P6 for pneumatic (air) services to 250 PSI class H6 for hydraulic service to 1500 PSI.

CYL. BORE	P-6 (Air) (See Note 2)		H-6 (Hyd.)	
	Recommended Continuous Duty Operating Pressure	Maximum Non-Continuous Pressure Rating	Recommended Continuous Duty Operating Pressure	Maximum Non-Continuous Pressure Rating
1½	250	750	1500	2500
2	250	750	1500	2500
2½	250	500	1100	1600
3¼	250	650	1050	1550
4	250	400	750	1000
5	250	400	900	1200
6	200	250	500	700
8	200	250	500	800
10	200	250	400 Steel Tube	800 Steel Tube
			400 Brass Tube	450 Brass Tube
12	200	250	400	800
14	200	250	400	800
16	200	250	200	500
18	200	250	200	500
20	200	250	200	500

Note 1 — In addition to the pressure ratings proper choice and application of a cylinder are dependent on mounting type, stroke, method of load application, fluid, temperature, environment, and other such conditions. For specific recommendations consult your nearest Nopak field representative or factory application engineer.

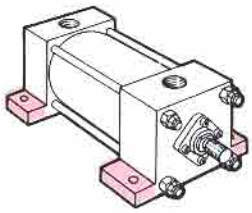
Note 2 — While P6 cylinders are designed primarily for air service as noted, they are also suitable for limited range low-pressure hydraulic service. Unless otherwise specified any order received for a hydraulic cylinder will be entered as Class H6.

Note 3 — Maximum non-continuous ratings should be used only when all operating conditions are accurately known and *only* on applications intended for intermittent duty. For specific recommendations consult your nearest Nopak field representative or factory application engineer.

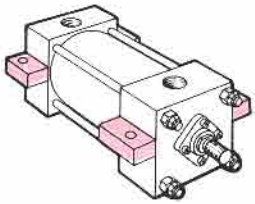
Note 4 — For pressures above these ratings refer to Nopak Class 3 High Pressure Hydraulic Cylinders. Catalog 103.

MOUNTING STYLES INDEX

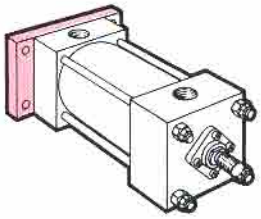
MODEL A
(USA STD. MS2)
1½" THROUGH 20" DIA. BORE
PAGE 10-11-12-13



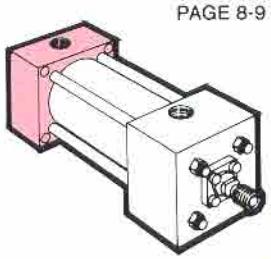
MODEL B
(USA STD. MS3)
1½" THROUGH 20" DIA. BORE
PAGE 10-11-12-13



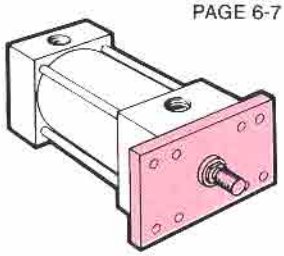
MODEL C
(USA STD. MF2)
1½" THROUGH 6" DIA. BORE
PAGE 6-7



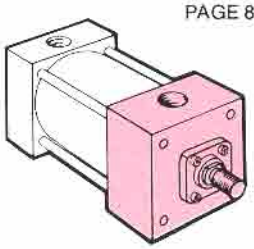
MODEL CJ
(USA STD. ME4)
8" THROUGH 20" DIA. BORE
PAGE 8-9



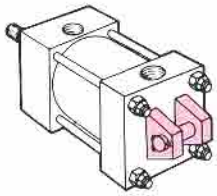
MODEL D
(USA STD. MF1)
1½" THROUGH 6" DIA. BORE
PAGE 6-7



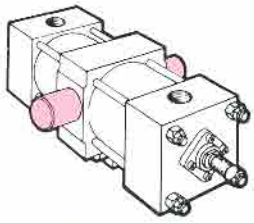
MODEL DG
(USA STD. ME3)
8" THROUGH 20" DIA. BORE
PAGE 8-9



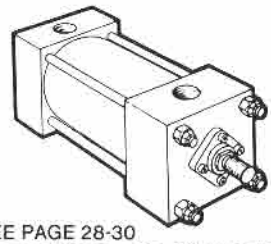
MODEL E
(USA STD. MP1)
1½" THROUGH 20" DIA. BORE
PAGE 14-15-16-17



MODEL F
(USA STD. MT4)
1½" THROUGH 14" DIA. BORE
PAGE 18-19-20-21

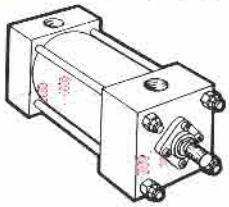


MODEL H
1½" THROUGH 20" DIA. BORE
PAGE 28-29-30-31

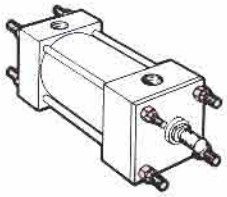


SEE PAGE 28-30
FOR DOUBLE ROD CYLINDER

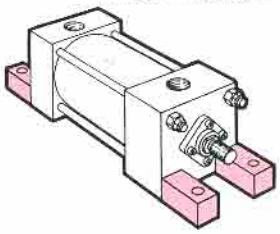
MODEL S
(USA STD. MS4)
1½" THROUGH 20" DIA. BORE
PAGE 10-11-12-13



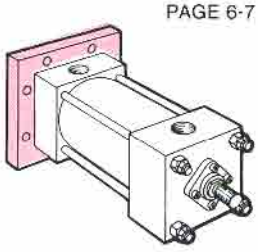
MODEL T
(USA STD. MX1)
1½" THROUGH 20" DIA. BORE
PAGE 22-23-24-25



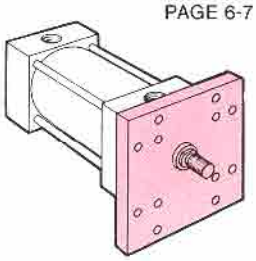
MODEL AL
(USA STD. MS7)
1½" THROUGH 14" DIA. BORE
PAGE 14-15-16-17



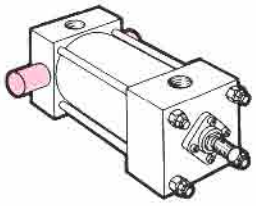
MODEL CC
(USA STD. MF6)
1½" THROUGH 6" DIA. BORE
PAGE 6-7



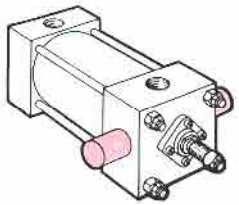
MODEL DD
(USA STD. MF5)
1½" THROUGH 6" DIA. BORE
PAGE 6-7



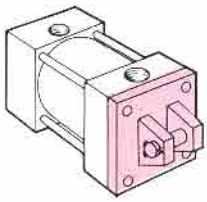
MODEL FB
(USA STD. MT2)
1½" THROUGH 20" DIA. BORE
PAGE 18-19-20-21



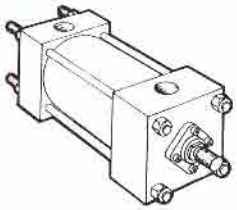
MODEL FR
(USA STD. MT1)
1½" THROUGH 20" DIA. BORE
PAGE 18-19-20-21



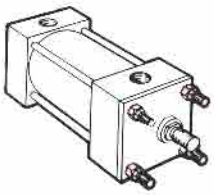
MODEL HE
(USA STD. MP2)
1½" THROUGH 10" DIA. BORE
PAGE 14-15-16-17



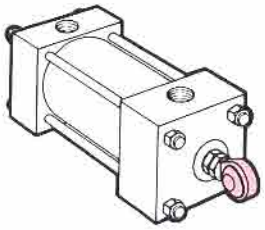
MODEL TB
(USA STD. MX2)
1½" THROUGH 20" DIA. BORE
PAGE 22-23-24-25



MODEL TR
(USA STD. MX3)
1½" THROUGH 20" DIA. BORE
PAGE 22-23-24-25

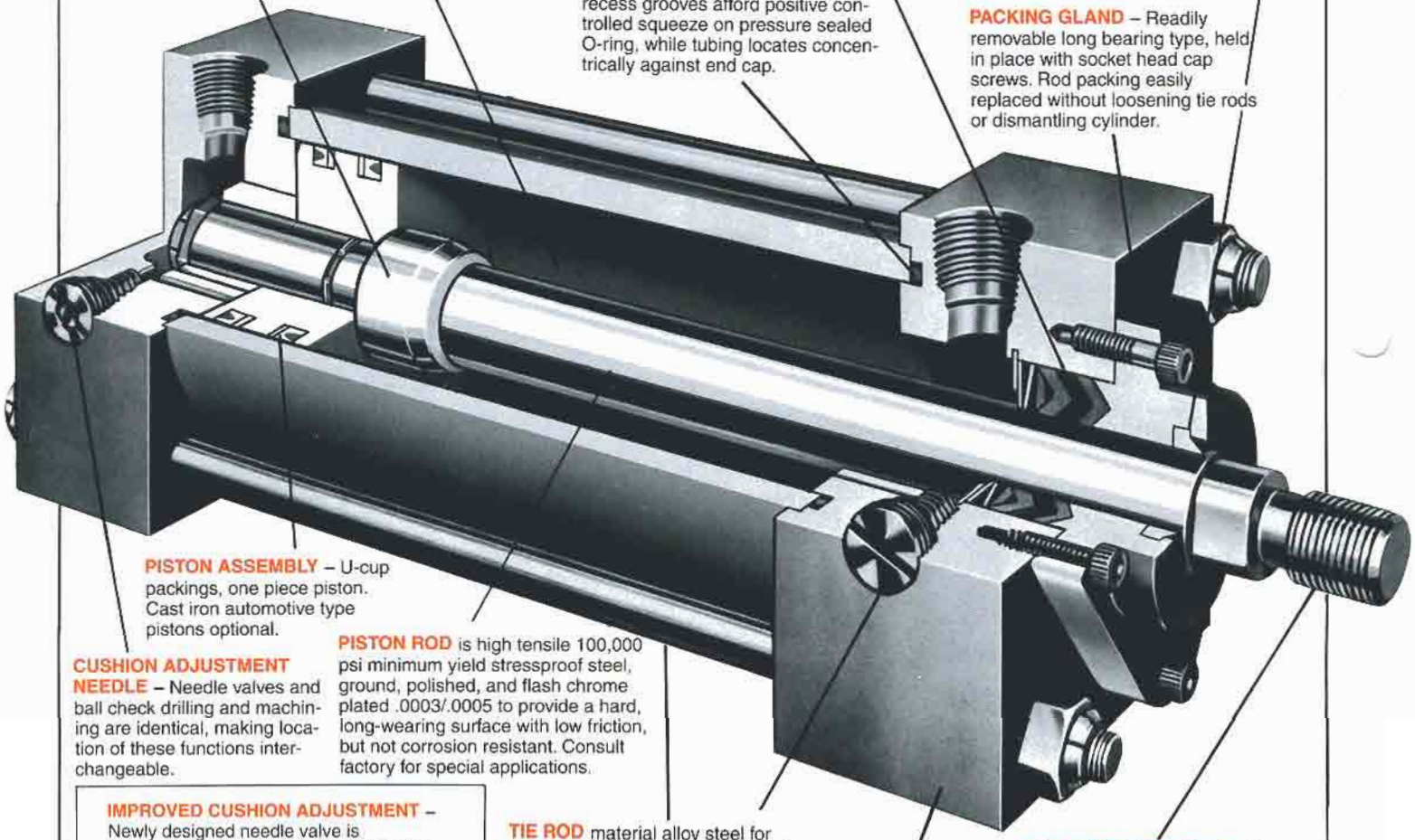


MODEL UE
1½" THROUGH 6" DIA. BORE
PAGE 26-27



NOTE: NFPA MS1 (NOPAK Model AP) not shown, but available. Consult Factory.
ME5 (NOPAK MODEL G)
ME6 (NOPAK MODEL J)

NOPAK INTERMEDIATE PRESSURE SQUARE HEAD CLASS P6-AIR & H6-HYDRAULIC CYLINDERS



CYLINDER TUBING – AIR: Hard coated aluminum, or honed, non-corrosive steel, providing an extremely wear-resistant surface and low friction characteristics. HYDRAULIC: Honed steel tubing standard (H6).

CUSHION SLEEVES precision fitted with predetermined taper to provide gradual deceleration and reduce shock.

ROD PACKING – Choice of self adjusting to pressure, multi-lip split seal or continuous pre-loaded lip seal.

ROD WIPER – Wipes rod clean and dry. Keeps foreign matter from entering cylinder, extending packing life.

TUBE SEAL – Two-step pilot recess grooves afford positive controlled squeeze on pressure sealed O-ring, while tubing locates concentrically against end cap.

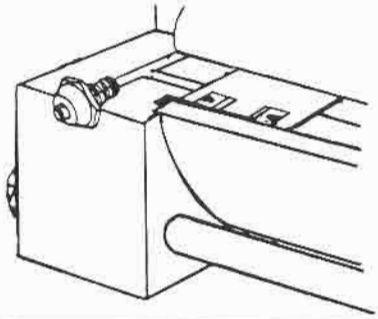
PACKING GLAND – Readily removable long bearing type, held in place with socket head cap screws. Rod packing easily replaced without loosening tie rods or dismantling cylinder.

PISTON ASSEMBLY – U-cup packings, one piece piston. Cast iron automotive type pistons optional.

CUSHION ADJUSTMENT NEEDLE – Needle valves and ball check drilling and machining are identical, making location of these functions interchangeable.

PISTON ROD is high tensile 100,000 psi minimum yield stressproof steel, ground, polished, and flash chrome plated .0003/.0005 to provide a hard, long-wearing surface with low friction, but not corrosion resistant. Consult factory for special applications.

IMPROVED CUSHION ADJUSTMENT – Newly designed needle valve is interchangeable with current design and offers improved sealing characteristics.



TIE ROD material alloy steel for maximum strength. Multiple tie rods in each corner are furnished on all 16" through 20" diameter cylinders.

CUSHION BALL CHECK assures quick starting under full power; pressure acts on full piston area instantaneously.

END CAPS (Cylinder Heads) Precision steel blocks

ROD END THREADING – Choice of standard catalog male and female thread types plus standard wrench flats.

NOPAK ORDERING INFORMATION AND WARRANTY

WHEN ORDERING NOPAK CLASS-6 CYLINDERS . . . PLEASE TELL US . . .

1. Quantity Required.
2. Operating medium — Series P-6 or H-6. P for pneumatic and H for hydraulic.
   Class P6 cylinders are fabricated in shelf stock strokes with standard (smallest) rod diameter.
3. Bore Size.
4. Stroke Length (inches).
5. Type of Mounting (Nopak Model or USA STD. style).
6. Type of Cushioning:
   Non-Cushioned NN
   Cushioned Rod End AN
   Cushioned Blind End NA
   Cushioned Both Ends AA
7. Piston rod diameter and type of rod threading — specify type No. 1 - 3 - 4 - 5.

NOPAK CLASS-6 STOCKING PROGRAM

Consists of all finished Class P6 machined parts ready for assembly 1½" bore thru 6" bore inclusive. Stock size stroke lengths from 1" to 20" inclusive (1" increments).

YOU SHOULD ALSO SPECIFY . . .

1. Position of cylinder ports and cushion adjustment screws, if other than standard. National pipe thread inlets position-1, ball check position-2, cushion adjustment position-4, are standard.
2. Extreme high-or-low operating or ambient temperatures.
3. Type of Hydraulic fluid if other than standard petroleum base oil.
4. Any unusual operating conditions.

Piston rods carried in stock are machined for type No. 4 threading (see page 32 for dimensions).

Mountings carried in shelf stock inventory:

NOPAK MODEL	USA STD. STYLE	PAGE	NOPAK MODEL	USA STD. STYLE	PAGE
A	MS2	10	DD	MF5	6
S *	MS4	10	CJ	ME4	8
E	MP1	14	DG	ME3	8
H	NONE	28	T	MX1	22
C	MF2	6	TB	MX2	22
D	MF1	6	TR	MX3	22
CC	MF6	6			

*MS4 mount machined per order.

ORDERING CODE

Phone: 414-645-6000 Fax No.: 414-645-6048

EXAMPLE:

CLP6 - 8 x 18 - A - △△ - 1⅜ - 4

Any special requirements should be described IN WORDS below model number.

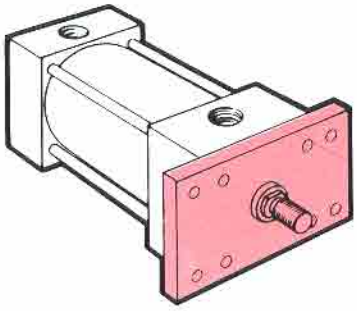
- 4 — Rod End Thread: See chart on page 32.
- 1⅜ — Rod Diameter: See chart at respective bore size for rod sizes available in that bore.
- △△ — Cushions: See chart below.
- A — Mounting style: Use either Nopak or NFPA's designation.
- 18 — Stroke (stocked in 1" increments up to 20", through 6" bore).
- 8 — Bore (1½" through 20")
- CLP6 — Class (P6 or H6)

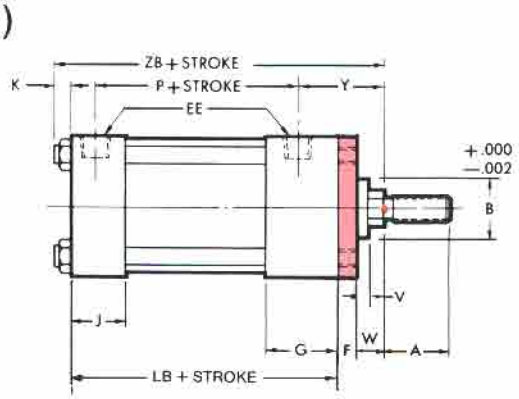
△△ Two letters required in model number:
NN = No cushions
AA = Cushioned both ends
NA = No cushion rod end, cushion bind end
AN = Cushion rod end, no cushion blind end

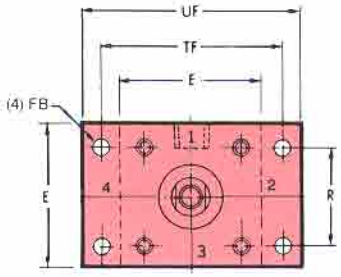
NOPAK FLANGE MOUNT CYLINDERS

1½" THROUGH 6" BORE

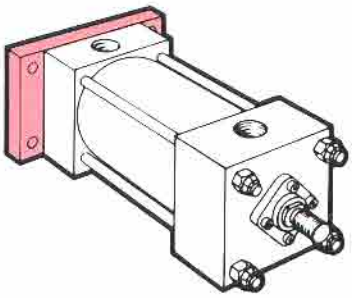
MODEL D (USA STD. MF1)

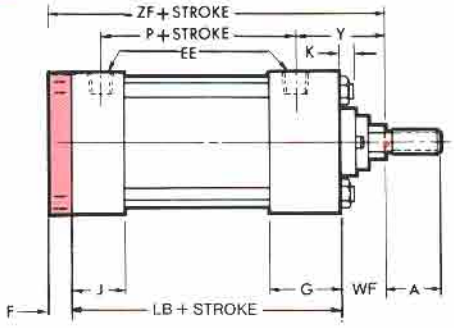


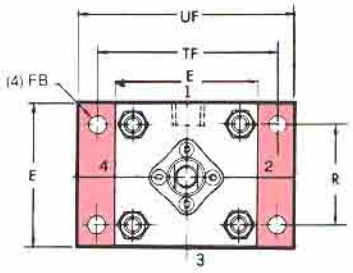




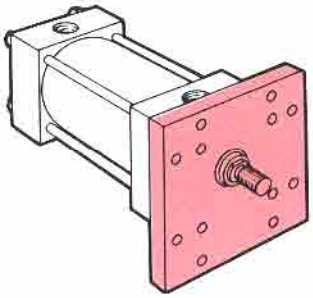
MODEL C (USA STD. MF2) ▲

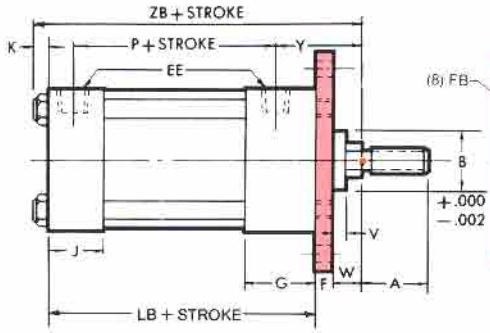


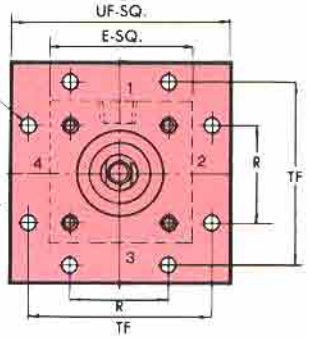




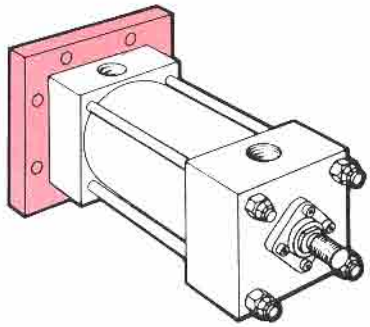
MODEL DD (USA STD. MF5)

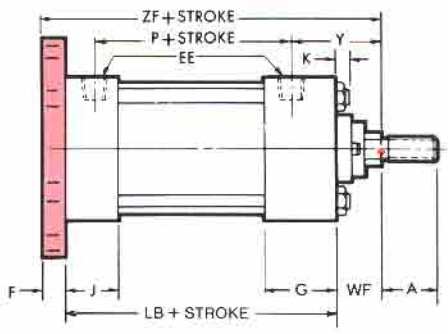






MODEL CC (USA STD. MF6) ▲





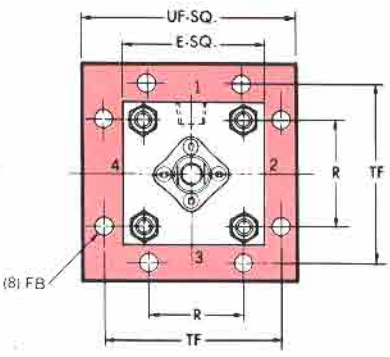


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 28.
†Dimensions refer to bolt diameter.

BORE DIA.	E	F	G	J	K	R	EE	FB †	TF	UF
1½	2	⅜	1½	1⅛	¼	1.43	⅜	¼	2¾	3⅜
2	2½	⅜	1½	1⅛	7/16	1.84	⅜	5/16	3⅜	4⅛
2½	3	⅜	1½	1⅛	5/16	2.19	⅜	5/16	3⅞	4⅝
3¼	3¾	⅝	1¾	1¼	7/16	2.76	½	⅜	4 11/16	5½
4	4½	⅝	1¾	1¼	7/16	3.32	½	⅜	5 7/16	6¼
5	5½	⅝	1¾	1¼	½	4.10	½	½	6⅝	7⅝
6	6½	¾	2	1½	9/16	4.88	¾	½	7⅝	8⅝

TABLE 1

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

- • Heads bored for these rod sizes are normally in stock — thus faster delivery.
- * For piston rod dimensions see page 32.

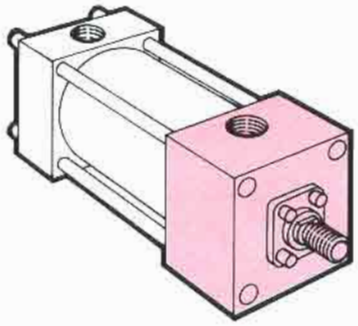
BORE DIA.	*ROD MM	A	B	P	V	W	Y	LB	WF	ZB	ZF
1½	5/8 •	¾	1⅛	2⅛	¼	5/8	1 15/16	3⅝	1	4⅞	5
	1 •	1⅛	1½		½	1	2 5/16		1⅜	5¼	5⅜
2	5/8 •	¾	1⅛	2⅛	¼	5/8	1 15/16	3⅝	1	5 1/16	5
	1 •	1⅛	1½		½	1	2 5/16		1⅜	5 7/16	5⅜
	1⅜	1⅝	2		⅝	1¼	2 9/16		1⅝	5 11/16	5⅝
2½	5/8 •	¾	1⅛	2¼	¼	5/8	1 15/16	3¾	1	5 1/16	5⅛
	1 •	1⅛	1½		½	1	2 5/16		1⅜	5 7/16	5½
	1⅜	1⅝	2		⅝	1¼	2 9/16		1⅝	5 11/16	5¾
	1¾	2	2⅜		¾	1½	2 13/16		1⅞	5 15/16	6
3¼	1 •	1⅛	1½	2½	¼	¾	2½	4¼	1⅜	6 1/16	6¼
	1⅜ •	1⅝	2		⅜	1	2¾		1⅝	6 5/16	6½
	1¾	2	2⅜		½	1¼	3		1⅞	6 9/16	6¾
	2	2¼	2⅝		½	1⅜	3⅛		2	6 11/16	6⅞
4	1 •	1⅛	1½	2½	¼	¾	2½	4¼	1⅜	6 1/16	6¼
	1⅜ •	1⅝	2		⅜	1	2¾		1⅝	6 5/16	6½
	1¾ •	2	2⅜		½	1¼	3		1⅞	6 9/16	6¾
	2	2¼	2⅝		½	1⅜	3⅛		2	6 11/16	6⅞
	2½	3	3⅛		⅝	1⅝	3⅜		2¼	6 15/16	7⅛
5	1 •	1⅛	1½	2¾	¼	¾	2½	4½	1⅜	6⅜	6½
	1⅜ •	1⅝	2		⅜	1	2¾		1⅝	6⅝	6¾
	1¾	2	2⅜		½	1¼	3		1⅞	6⅞	7
	2	2¼	2⅝		½	1⅜	3⅛		2	7	7⅛
	2½	3	3⅛		⅝	1⅝	3⅜		2¼	7¼	7⅜
	3	3½	3¾		⅝	1⅝	3⅜		2¼	7¼	7⅜
	3½	3½	4¼		⅝	1⅝	3⅜		2¼	7¼	7⅜
6	1⅜ •	1⅝	2	3⅛	¼	⅞	2 13/16	5	1⅝	7 3/16	7⅜
	1¾ •	2	2⅜		⅜	1⅛	3 1/16		1⅞	7 7/16	7⅝
	2 •	2¼	2⅝		⅜	1¼	3 3/16		2	7 9/16	7¾
	2½	3	3⅛		½	1½	3 7/16		2¼	7 13/16	8
	3	3½	3¾		½	1½	3 3/16		2¼	7 13/16	8
	3½	3½	4¼		½	1½	3 7/16		2¼	7 13/16	8
	4	4	4¾		½	1½	3 7/16		2¼	7 13/16	8

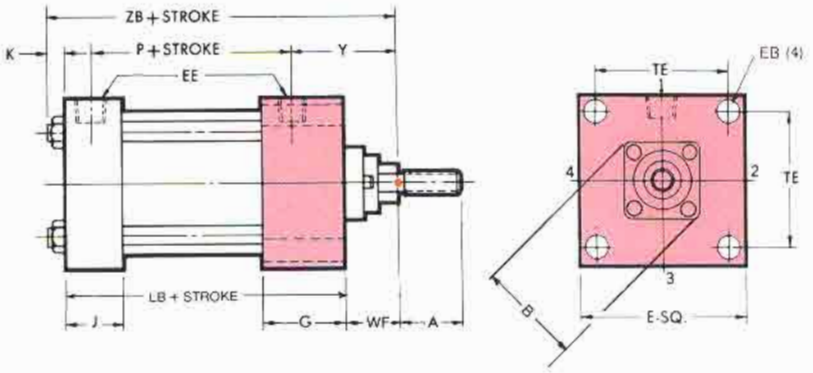
▲ See Table A on page 27 for bore and rod combinations using head plates with threaded bronze glands.

NOPAK FLANGE MOUNT CYLINDERS

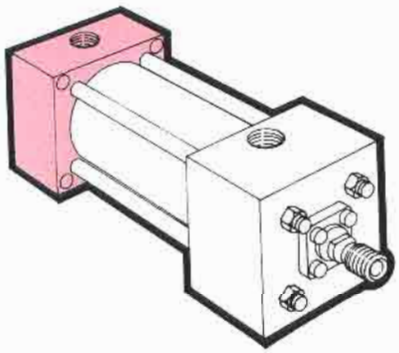
8" THROUGH 20" BORE

MODEL DG (USA STD. ME3)





MODEL CJ (USA STD. ME4)



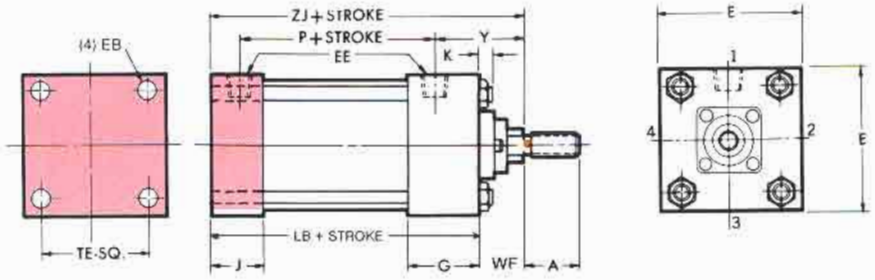


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 30.

† Dimensions refer to bolt diameter.

BORE DIA.	E	G	J	K	EB†	EE	TE
8	8½	2	1½	⅝	⅝	¾	7.57
10	10⅝	2¼	2	¾	¾	1	9.40
12	12¾	2¼	2	¾	¾	1	11.10
14	14¾	2¾	2¼	⅞	⅞	1¼	12.87
16	17½	3	3	1	1¼	1½	14.75
18	19½	3 7/16	3 7/16	1⅛	1½	1½	16.50
20	21¾	3 15/16	3 15/16	1¼	1¾	2	18.25

TABLE 1

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

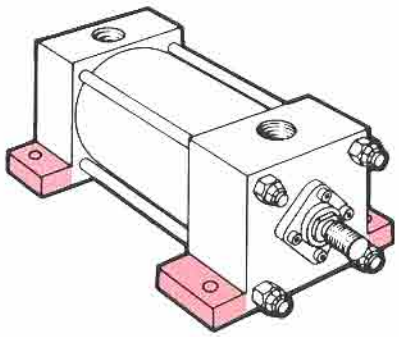
- • Heads bored for these rod sizes are normally in stock — thus faster delivery.
- ■ Model DG only.
- * For piston rod dimensions see page 32.

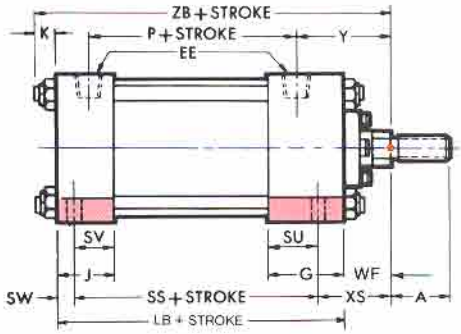
BORE DIA.	*ROD MM	A	B	P	Y	LB	WF	ZB	ZJ
8	1⅜ •	1⅝	3⅛	3¼	2 13/16	5⅛	1⅝	7⅜	6¾
	1¾	2	3⅝		3 1/16		1⅞	7⅝	7
	2	2¼	4¼		3 3/16		2	7¾	7⅛
	2½	3	4¾		3 7/16		2¼	8	7⅜
	3	3½	5½						
	3½	3½	6¼						
	4	4	7¼						
	4½	4½	7¾						
	5	5	8⅝						
	5½	5½	9¼						
10	1¾ •	2	3⅝	4	3 3/16	6⅜	1⅞	9	8¼
	2	2¼	4¼		3 5/16		2	9⅛	8⅜
	2½	3	4¾		3 9/16		2¼	9⅜	8⅝
	3	3½	5½						
	3½	3½	6¼						
	4	4	7¼						
	4½	4½	7¾						
	5	5	8⅝						
	5½	5½	9¼						
12	2 •■	2¼	4¼	4½	3 5/16	6⅞	2	9⅝	8⅞
	2½	3	4¾		3 9/16		2¼	9⅞	9⅛
	3	3½	5½						
	3½	3½	6¼						
	4	4	7¼						
	4½	4½	7¾						
	5	5	8⅝						
	5½	5½	9¼						
14	2½	3	4¾	5½	3 13/16	8⅛	2¼	11¼	10⅜
	3	3½	5½						
	3½	3½	6¼						
	4	4	7¼						
	4½	4½	7¾						
	5	5	8⅝						
	5½	5½	9¼						
16	2½	3	4¾	5⅞	3 15/16	9¼	2¼	12½	11½
	3	3½	5½						
	3½	3½	6¼						
	4	4	7¼						
	4½	4½	7¾						
	5	5	8⅝						
	5½	5½	9¼						
18	3½	3½	6¼	6	4⅜	10¼	2¼	13⅝	12½
	4	4	7¼						
	4½	4½	7¾						
	5	5	8⅝						
	5½	5½	9¼						
20	4	4	7¼	7⅛	4 9/16	11¾	2¼	15¼	14
	4½	4½	7¾						
	5	5	8⅝						
	5½	5½	9¼						

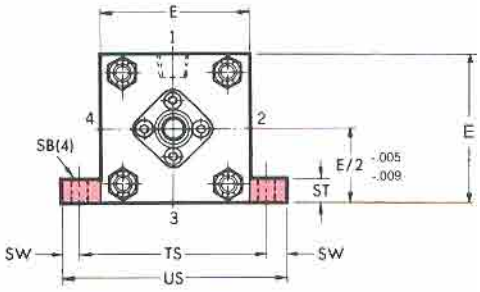
NOPAK SIDE AND LUG MOUNT CYLINDERS

1½" THROUGH 6" BORE

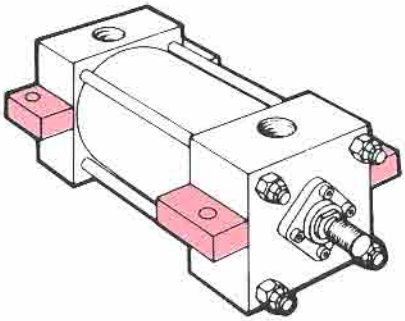
MODEL A (USA STD. MS2) ▲

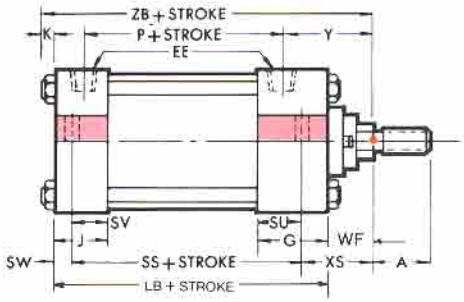


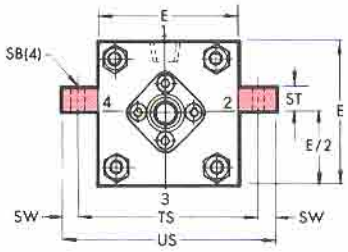




MODEL B (USA STD. MS3) ▲







For double rod end cylinders Model A and B 1.50" through 6.00" bore, add 0.50" to Dimension SS. Also see pages 28-29.

Double rod end models are designated by letter "X" preceding the model identification. See page 28.

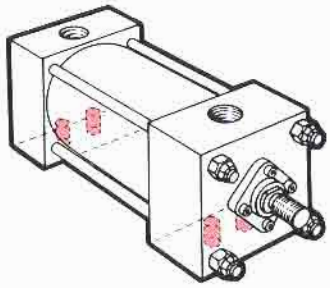
†Dimensions refer to bolt diameter.

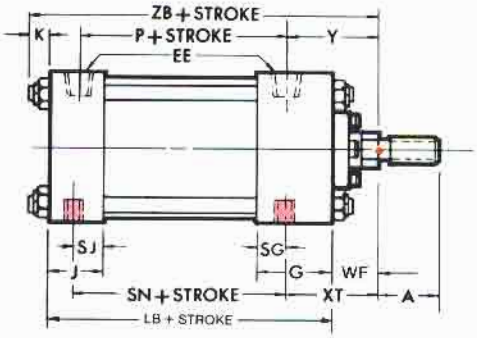
TABLE 2

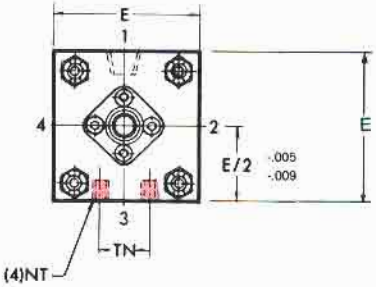
These dimensions are constant regardless of rod diameter or stroke.

BORE DIA.	E	G	J	K	EE	NT	SB†	SG	SJ	ST	SU	SV	SW	TN	TS	US
1½	2	1½	1⅛	¼	⅜	¼-20	⅜	9/16	11/16	½	1⅛	¾	⅜	⅝	2¾	3½
2	2½	1½	1⅛	⅜	⅜	5/16-18	⅜	9/16	11/16	½	1⅛	¾	⅜	⅞	3¼	4
2½	3	1½	1⅛	5/16	⅜	⅜-16	⅜	9/16	11/16	½	1⅛	¾	⅜	1¼	3¾	4½
3¼	3¾	1¾	1¼	7/16	½	½-13	½	11/16	11/16	¾	1¼	¾	½	1½	4¾	5¾
4	4½	1¾	1¼	7/16	½	½-13	½	11/16	11/16	¾	1¼	¾	½	2 1/16	5½	6½
5	5½	1¾	1¼	½	½	⅝-11	¾	11/16	11/16	1	1 1/16	9/16	11/16	2 11/16	6⅞	8¼
6	6½	2	1½	9/16	¾	¾-10	¾	13/16	13/16	1	1 5/16	13/16	11/16	3¼	7⅞	9¼

MODEL S (USA STD. MS4) ▲







• Heads bored for these rod sizes are normally in stock — thus faster delivery, Model A only.

For double rod end cylinders Model S 1.50" through 2.50" bore, add 0.13" to Dimension SN. Also see pages 28-29.

TABLE 1

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

*For piston rod end dimensions see page 32.
Double rod end models are designated by letter "X" preceding the model identification. See page 28.

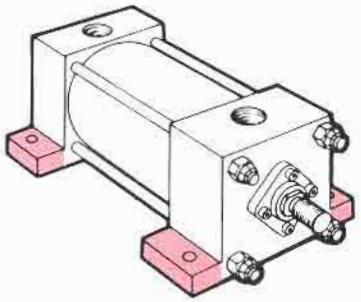
BORE DIA.	*ROD MM	A	P	Y	LB	SN	SS	WF	XS	XT	ZB
1½	5/8 •	3/4	2 1/8	1 15/16	3 5/8	2 1/4	2 7/8	1	1 3/8	1 15/16	4 7/8
	1 •	1 1/8		2 5/16				1 3/8	1 3/4	2 5/16	5 1/4
2	5/8 •	3/4	2 1/8	1 15/16	3 5/8	2 1/4	2 7/8	1	1 3/8	1 15/16	5
	1 •	1 1/8		2 5/16				1 3/8	1 3/4	2 5/16	5 3/8
	1 3/8	1 5/8		2 9/16				1 5/8	2	2 9/16	5 11/16
2½	5/8 •	3/4	2 1/4	1 15/16	3 3/4	2 3/8	3	1	1 3/8	1 15/16	5 1/16
	1 •	1 1/8		2 5/16				1 3/8	1 3/4	2 5/16	5 7/16
	1 3/8	1 5/8		2 9/16				1 5/8	2	2 9/16	5 11/16
	1 3/4	2		2 13/16				1 7/8	2 1/4	2 13/16	5 15/16
3¼	1 •	1 1/8	2½	2½	4¼	2 5/8	3¼	1 3/8	1 7/8	2 7/16	6 1/16
	1 3/8 •	1 5/8		2 3/4				1 5/8	2 1/8	2 11/16	6 5/16
	1 3/4	2		3				1 7/8	2 3/8	2 15/16	6 9/16
	2	2 1/4		3 1/8				2	2½	3 1/16	6 11/16
4	1 •	1 1/8	2½	2½	4¼	2 5/8	3¼	1 3/8	1 7/8	2 7/16	6 1/16
	1 3/8	1 5/8		2 3/4				1 5/8	2 1/8	2 11/16	6 5/16
	1 3/4	2		3				1 7/8	2 3/8	2 15/16	6 9/16
	2	2 1/4		3 1/8				2	2½	3 1/16	6 11/16
	2½	3		3 3/8				2 1/4	2 3/4	3 5/16	6 15/16
5	1 •	1 1/8	2 3/4	2½	4½	2 7/8	3 1/8	1 3/8	2 1/16	2 7/16	6 3/8
	1 3/8	1 5/8		2 3/4				1 5/8	2 5/16	2 11/16	6 5/8
	1 3/4	2		3				1 7/8	2 9/16	2 15/16	6 7/8
	2	2 1/4		3 1/8				2	2 11/16	3 1/16	7
	2½	3		3 3/8				2 1/4	2 15/16	3 5/16	7 1/4
	3	3½		3 3/8				2 1/4	2 15/16	3 5/16	7 1/4
	3½	3½		3 3/8				2 1/4	2 15/16	3 5/16	7 1/4
6	1 3/8 •	1 5/8	3 1/8	2 13/16	5	3 1/8	3 5/8	1 5/8	2 5/16	2 13/16	7 3/16
	1 3/4	2		3 1/16				1 7/8	2 9/16	3 1/16	7 7/16
	2	2 1/4		3 3/16				2	2 11/16	3 3/16	7 9/16
	2½	3		3 7/16				2 1/4	2 15/16	3 7/16	7 13/16
	3	3½		3 7/16				2 1/4	2 15/16	3 7/16	7 13/16
	3½	3½		3 7/16				2 1/4	2 15/16	3 7/16	7 13/16
	4	4		3 7/16				2 1/4	2 15/16	3 7/16	7 13/16

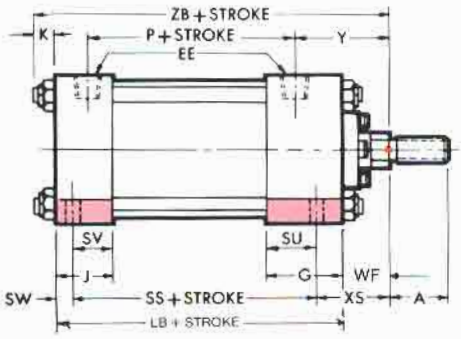
▲ See Table A on page 27 for bore and rod combinations using head plates with threaded bronze glands.

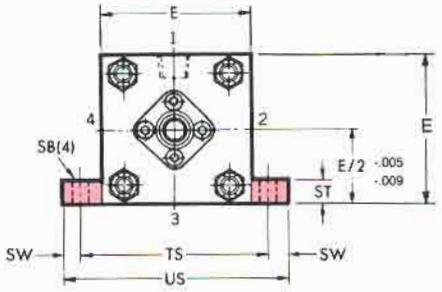
NOPAK SIDE AND LUG MOUNT CYLINDERS

8" THROUGH 20" BORE

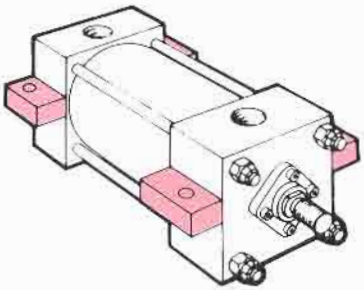
MODEL A (USA STD. MS2)

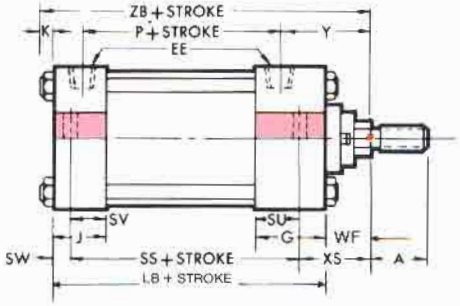


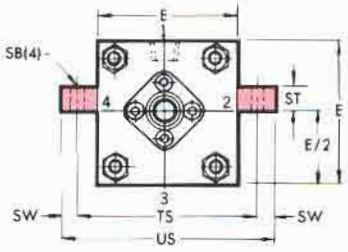




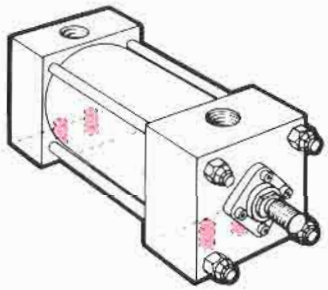
MODEL B (USA STD. MS3)

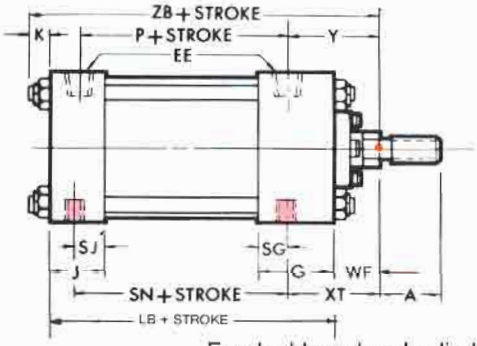


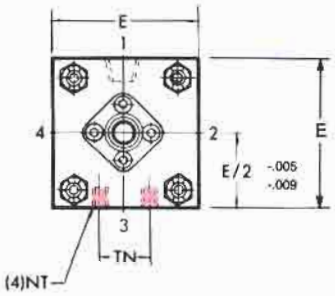




MODEL S (USA STD. MS4)







For double rod end cylinders Model A and B 8.00" through 14.00" bore, subtract SV from SS dimension and add SU. Also see pages 30-31.

Double rod end models are designated by letter "X" preceding the model identification. See page 30.

†Dimensions refer to bolt diameter.

TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

BORE DIA.	E	G	J	K	EE	NT	SB†	SG	SJ	ST	SU	SV	SW	TN	TS	US
8	8½	2	1½	⅝	¾	¾-10	¾	13/16	13/16	1	1 5/16	13/16	1 1/16	4½	9⅞	11¼
10	10⅝	2¼	2	¾	1	1-8	1	1	1	1¼	1⅜	1⅛	⅞	5½	12⅜	14⅛
12	12¾	2¼	2	¾	1	1-8	1	1	1	1¼	1⅜	1⅛	⅞	7¼	14½	16¼
14	14¾	2¾	2¼	⅞	1¼	1¼-7	1¼	1 3/16	1 3/16	1½	1⅝	1⅛	1⅛	8⅜	17	19¼
16	17½	3	3	1	1½	1¾-12	1¾	1 9/16	1 11/16	2	1¼	1¼	1⅝	7	21	24¼
18	19½	3 7/16	3 7/16	1⅛	1½	2-12	2	1¾	1⅞	2½	1 7/16	1 7/16	2	8	23½	27½
20	21¾	3 15/16	3 15/16	1¼	2	2¼-12	2¼	2	1⅞	3	1 9/16	1 9/16	2⅜	8½	26½	31¼

TABLE 1

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

For double rod end cylinders Model S 16.00" through 20.00" bore, subtract SJ from SN dimension and add SG. Also see pages 30-31.

* For piston rod dimensions see page 32.

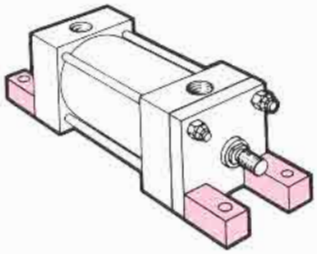
BORE DIA.	*ROD MM	A	P	Y	LB	SN	SS	WF	XS	XT	ZB
8	1 3/8	1 5/8	3 1/4	2 13/16	5 1/8	3 1/4	3 3/4	1 5/8	2 5/16	2 13/16	7 3/8
	1 3/4	2		3 1/16				1 7/8	2 9/16	3 1/16	7 5/8
	2	2 1/4		3 3/16				2	2 11/16	3 3/16	7 3/4
	2 1/2	3		3 7/16				2 1/4	2 15/16	3 7/16	8
	3	3 1/2									
	3 1/2	3 1/2									
	4	4									
	4 1/2	4 1/2									
	5	5									
	5 1/2	5 1/2									
10	1 3/4	2	4	3 3/16	6 3/8	4 1/8	4 5/8	1 7/8	2 3/4	3 1/8	9
	2	2 1/4		3 5/16				2	2 7/8	3 1/4	9 1/8
	2 1/2	3		3 9/16				2 1/4	3 1/8	3 1/2	9 3/8
	3	3 1/2									
	3 1/2	3 1/2									
	4	4									
	4 1/2	4 1/2									
	5	5									
	5 1/2	5 1/2									
12	2	2 1/4	4 1/2	3 5/16	6 7/8	4 5/8	5 1/8	2	2 7/8	3 1/4	9 5/8
	2 1/2	3		3 9/16				2 1/4	3 1/8	3 1/2	9 7/8
	3	3 1/2									
	3 1/2	3 1/2									
	4	4									
	4 1/2	4 1/2									
	5	5									
	5 1/2	5 1/2									
14	2 1/2	3	5 1/2	3 13/16	8 1/8	5 1/2	5 7/8	2 1/4	3 3/8	3 13/16	11 1/4
	3	3 1/2									
	3 1/2	3 1/2									
	4	4									
	4 1/2	4 1/2									
	5	5									
	5 1/2	5 1/2									
16	2 1/2	3	5 7/8	3 15/16	9 1/4	6 1/2	5 3/4	2 1/4	4	3 11/16	12 1/2
	3	3 1/2									
	3 1/2	3 1/2									
	4	4									
	4 1/2	4 1/2									
	5	5									
	5 1/2	5 1/2									
18	3 1/2	3 1/2	6	4 3/8	10 1/4	7	6 1/4	2 1/4	4 1/4	3 15/16	13 5/8
	4	4									
	4 1/2	4 1/2									
	5	5									
	5 1/2	5 1/2									
20	4	4	7 1/8	4 9/16	11 3/4	7 3/4	7	2 1/4	4 5/8	4 3/16	15 1/4
	4 1/2	4 1/2									
	5	5									
	5 1/2	5 1/2									

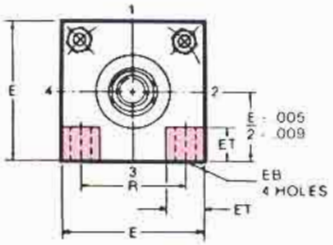
NOPAK

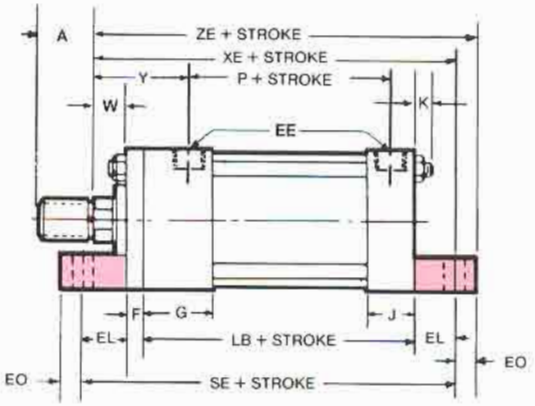
END LUG
FIXED CLEVIS
DETACHABLE CLEVIS
MOUNT CYLINDERS

1½" THROUGH 8" DIA.

MODEL AL (USA STD. MS7)

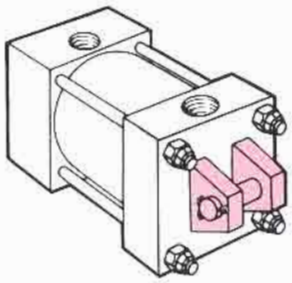






Model AL-1½ dia. through 6" dia. cylinders furnished with head plates. 8" dia. through 14" dia. cylinders use (4) bolt glands as shown on page 16.

MODEL E (USA STD. MP1) ▲



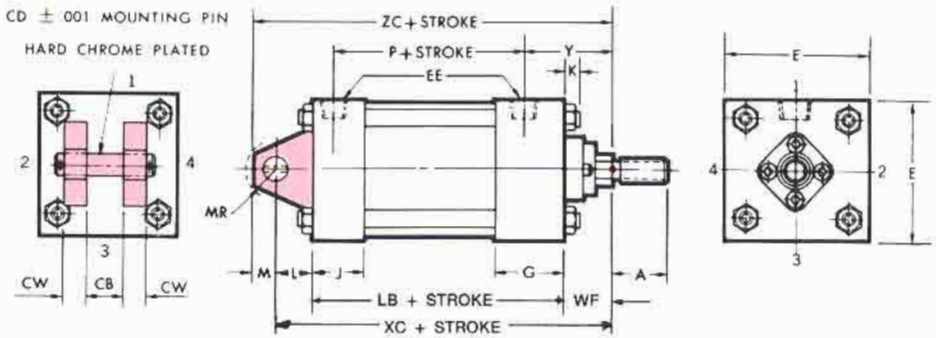


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

For double rod end cylinders Model AL – subtract Dimension J from G and add to Dimension SE + stroke. 1.50" through 6.00" bore also add Dimension F.

Double rod end models are designated by letter "X" preceding the model identification. See page 28.

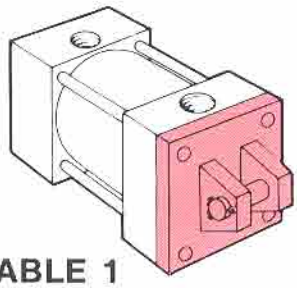
†Dimensions refer to bolt diameter.

BORE DIA.	E	F AL	F HE	G	J	K	L	M	R	CB	CD	CW	EB†	EE	EL	EO	ET	MR
1½	2	⅜	⅜	1½	1⅛	¼	¾	½	1.43	¾	½	½	¼	⅜	¾	¼	½	⅝
2	2½	⅜	⅜	1½	1⅛	⅜	¾	½	1.84	¾	½	½	5/16	⅜	15/16	5/16	19/32	⅝
2½	3	⅜	⅜	1½	1⅛	5/16	¾	½	2.19	¾	½	½	5/16	⅜	1 1/16	5/16	¾	⅝
3¼	3¾	⅝	⅝	1¾	1¼	7/16	1¼	¾	2.76	1¼	¾	⅝	⅜	½	⅞	⅜	29/32	⅞
4	4½	⅝	⅝	1¾	1¼	7/16	1¼	¾	3.32	1¼	¾	⅝	⅜	½	1	⅜	1⅛	⅞
5	5½	⅝	⅝	1¾	1¼	½	1¼	¾	4.10	1¼	¾	⅝	½	½	1 1/16	½	1 11/32	⅞
6	6½	¾	⅞	2	1½	9/16	1½	1	4.88	1½	1	¾	½	¾	1	½	1 9/16	1¼
8	8½	¾	⅞	2	1½	⅝	1½	1	6.44	1½	1	¾	⅝	¾	1⅛	⅝	2	1¼

▲ See Table A on page 27 for bore and rod combinations using head plates with threaded bronze glands.

MODEL HE (USA STD. MP2)▲

• Heads bored for these rod sizes are normally in stock — thus faster delivery, Models E and HE only.



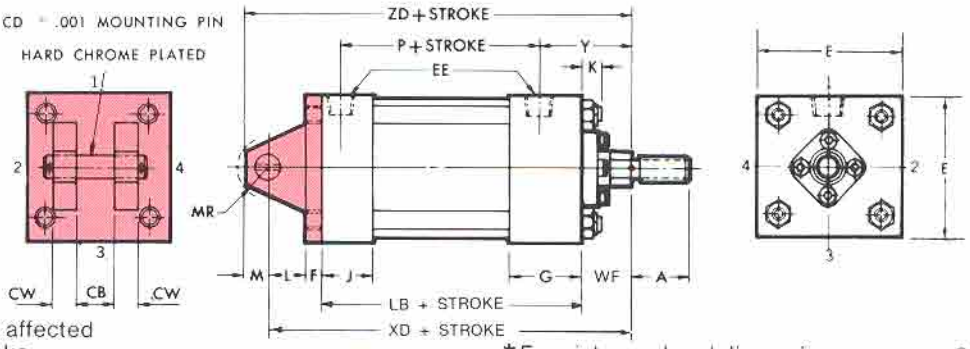


TABLE 1

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

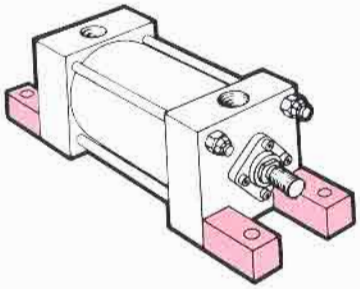
*For piston rod end dimensions see page 32.

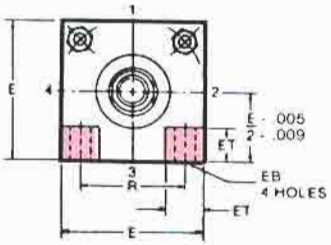
BORE DIA.	*ROD MM	A	P	W	Y	LB	SE	WF	XC	XD	XE	ZC	ZD	ZE
1½	5/8 •	3/4	2 1/8	5/8	1 15/16	3 5/8	5 1/2	1	5 3/8	5 3/4	5 3/8	5 7/8	6 1/4	5 5/8
	1 •	1 1/8		1	2 5/16			1 3/8	5 3/4	6 1/8	5 3/4	6 1/4	6 5/8	6
2	5/8 •	3/4	2 1/8	5/8	1 15/16	3 5/8	5 7/8	1	5 3/8	5 3/4	5 9/16	5 7/8	6 1/4	5 7/8
	1 •	1 1/8		1	2 5/16			1 3/8	5 3/4	6 1/8	5 15/16	6 1/4	6 5/8	6 1/4
	1 3/8	1 5/8		1 1/4	2 9/16			1 5/8	6	6 3/8	6 3/16	6 1/2	6 7/8	6 1/2
2½	5/8 •	3/4	2 1/4	5/8	1 15/16	3 3/4	6 1/4	1	5 1/2	5 7/8	5 13/16	6	6 3/8	6 1/8
	1 •	1 1/8		1	2 5/16			1 3/8	5 7/8	6 1/4	6 3/16	6 3/8	6 3/4	6 1/2
	1 3/8	1 5/8		1 1/4	2 9/16			1 5/8	6 1/8	6 1/2	6 7/16	6 5/8	7	6 3/4
	1 3/4	2		1 1/2	2 13/16			1 7/8	6 3/8	6 3/4	6 11/16	6 7/8	7 1/4	7
3¼	1 •	1 1/8	2 1/2	3/4	2 1/2	4 1/4	6 5/8	1 3/8	6 7/8	7 1/2	6 1/2	7 5/8	8 1/4	6 7/8
	1 3/8 •	1 5/8		1	2 3/4			1 5/8	7 1/8	7 3/4	6 3/4	7 7/8	8 1/2	7 1/8
	1 3/4 •	2		1 1/4	3			1 7/8	7 3/8	8	7	8 1/8	8 3/4	7 3/8
	2	2 1/4		1 3/8	3 1/8			2	7 1/2	8 1/8	7 1/8	8 1/4	8 7/8	7 1/2
4	1 •	1 1/8	2 1/2	3/4	2 1/2	4 1/4	6 7/8	1 3/8	6 7/8	7 1/2	6 5/8	7 5/8	8 1/4	7
	1 3/8 •	1 5/8		1	2 3/4			1 5/8	7 1/8	7 3/4	6 7/8	7 7/8	8 1/2	7 1/4
	1 3/4 •	2		1 1/4	3			1 7/8	7 3/8	8	7 1/8	8 1/8	8 3/4	7 1/2
	2	2 1/4		1 3/8	3 1/8			2	7 1/2	8 1/8	7 1/4	8 1/4	8 7/8	7 5/8
	2 1/2	3		1 5/8	3 3/8			2 1/4	7 3/4	8 3/8	7 1/2	8 1/2	9 1/8	7 7/8
5	1 •	1 1/8	2 3/4	3/4	2 1/2	4 1/2	7 1/4	1 3/8	7 1/8	7 3/4	6 15/16	7 7/8	8 1/2	7 7/16
	1 3/8 •	1 5/8		1	2 3/4			1 5/8	7 3/8	8	7 3/16	8 1/8	8 3/4	7 11/16
	1 3/4	2		1 1/4	3			1 7/8	7 5/8	8 1/4	7 7/16	8 3/8	9	7 15/16
	2	2 1/4		1 3/8	3 1/8			2	7 3/4	8 3/8	7 9/16	8 1/2	9 1/8	8 1/16
	2 1/2	3		1 5/8	3 3/8			2 1/4	8	8 5/8	7 13/16	8 3/4	9 3/8	8 5/16
	3	3 1/2		1 5/8	3 3/8			2 1/4	8	8 5/8	7 13/16	8 3/4	9 3/8	8 5/16
	3 1/2	3 1/2		1 5/8	3 3/8			2 1/4	8	8 5/8	7 13/16	8 3/4	9 3/8	8 5/16
6	1 3/8 •	1 5/8	3 1/8	7/8	2 13/16	5	7 3/4	1 5/8	8 1/8	9	7 5/8	9 1/8	10	8 1/8
	1 3/4 •	2		1 1/8	3 1/16			1 7/8	8 3/8	9 1/4	7 7/8	9 3/8	10 1/4	8 3/8
	2 •	2 1/4		1 1/4	3 3/16			2	8 1/2	9 3/8	8	9 1/2	10 3/8	8 1/2
	2 1/2	3		1 1/2	3 7/16			2 1/4	8 3/4	9 5/8	8 1/4	9 3/4	10 5/8	8 3/4
	3	3 1/2		1 1/2	3 7/16			2 1/4	8 3/4	9 5/8	8 1/4	9 3/4	10 5/8	8 3/4
	3 1/2	3 1/2		1 1/2	3 7/16			2 1/4	8 3/4	9 5/8	8 1/4	9 3/4	10 5/8	8 3/4
	4	4		1 1/2	3 7/16			2 1/4	8 3/4	9 5/8	8 1/4	9 3/4	10 5/8	8 3/4
8	1 3/8 •	1 5/8	3 1/4	—	2 13/16	5 1/8	7 3/8	1 5/8	8 1/4	9 1/8	7 7/8	9 1/4	10 1/8	8 1/2
	1 3/4	2		—	3 1/16			1 7/8	8 1/2	9 3/8	8 1/8	9 1/2	10 3/8	8 3/4
	2	2 1/4		—	3 3/16			2	8 5/8	9 1/2	8 1/4	9 5/8	10 1/2	8 7/8
	2 1/2	3		—	3 7/16			2 1/4	8 7/8	9 3/4	8 1/2	9 7/8	10 3/4	9 1/8
	3	3 1/2		—	3 7/16				8 7/8	9 3/4	8 1/2	9 7/8	10 3/4	9 1/8
	3 1/2	3 1/2		—	3 7/16				8 7/8	9 3/4	8 1/2	9 7/8	10 3/4	9 1/8
	4	4		—	3 7/16				8 7/8	9 3/4	8 1/2	9 7/8	10 3/4	9 1/8
	4 1/2	4 1/2		—	3 7/16				8 7/8	9 3/4	8 1/2	9 7/8	10 3/4	9 1/8
	5	5		—	3 7/16				8 7/8	9 3/4	8 1/2	9 7/8	10 3/4	9 1/8
	5 1/2	5 1/2		—	3 7/16				8 7/8	9 3/4	8 1/2	9 7/8	10 3/4	9 1/8

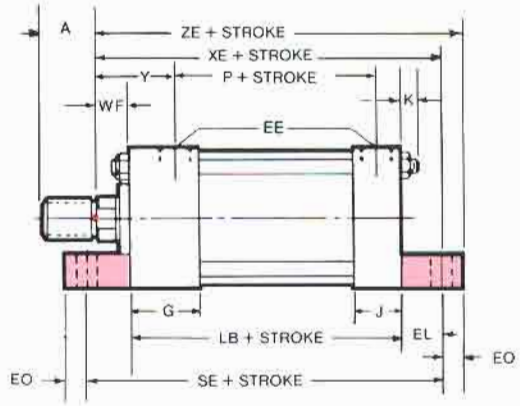
NOPAK

END LUG
FIXED CLEVIS
DETACHABLE CLEVIS
MOUNT CYLINDERS

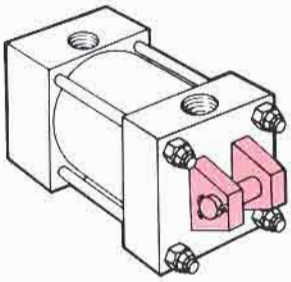
MODEL AL (USA STD. MS7)
10" THROUGH 14" DIA.







MODEL E (USA STD. MP1)
10" THROUGH 20" DIA.



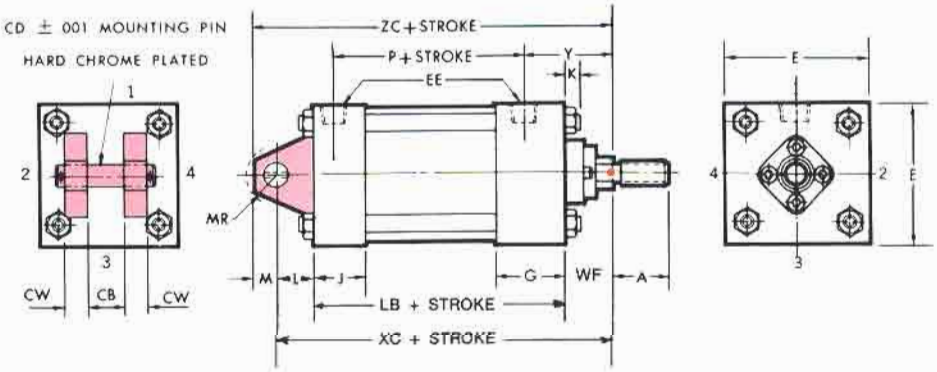


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

For double rod end cylinders Model AL — subtract dimension J from G and add to dimension SE + stroke.

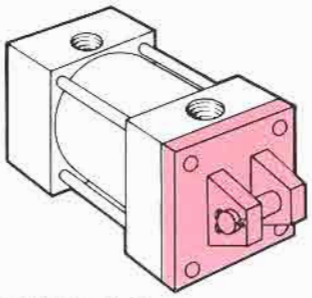
Double rod end models are designated by letter "X" preceding the model identification. See page 30.

† Dimensions refer to bolt diameter.

BORE DIA.	E	F	G	J	K	L	M	R	CB	CD	CW	EB†	EE	EL	EO	ET	MR
10	10 5/8	7/8	2 1/4	2	3/4	2 1/8	1 3/8	7.92	2	1 3/8	1	3/4	1	1 5/16	1 5/16	2 5/8	1 5/8
12	12 3/4	—	2 1/4	2	3/4	2 1/4	1 3/4	9.40	2 1/2	1 3/4	1 1/4	3/4	1	1 5/16	1 11/16	3 3/8	2
14	14 3/4	—	2 3/4	2 1/4	7/8	2 1/2	2	10.90	2 1/2	2	1 1/4	7/8	1 1/4	1 1/2	2	3 7/8	2 3/8
16	17 1/2	—	3	3	1	2 1/2	2	—	2 1/2	2	1 1/4	—	1 1/2	—	—	—	2 3/8
18	19 1/2	—	3 7/16	3 7/16	1 1/8	3	2 3/4	—	3	2 1/2	1 1/2	—	1 1/2	—	—	—	3
20	21 3/4	—	3 15/16	3 15/16	1 1/4	3 1/4	2 3/4	—	3	3	1 1/2	—	2	—	—	—	3 1/4

MODEL HE (USA STD. MP2) 10" DIA.

- Heads bored for these rod sizes are normally in stock — thus faster delivery, Model E only.



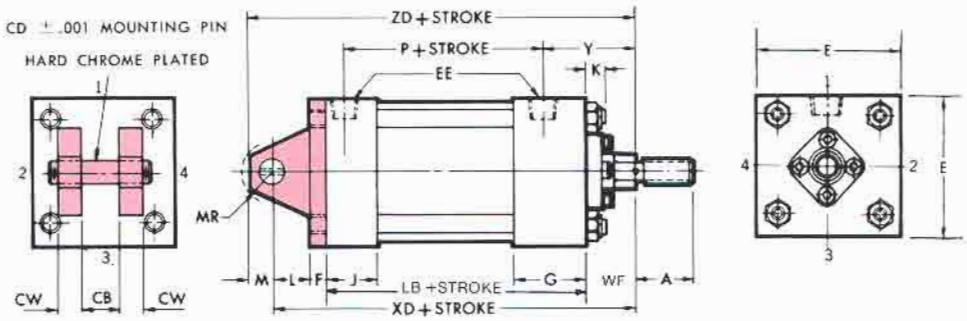


TABLE 1

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

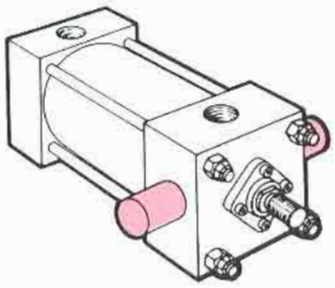
*For piston rod dimensions see page 32.

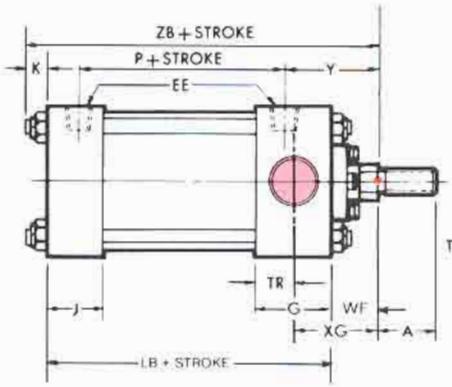
BORE DIA.	*ROD MM	A	P	Y	LB	SE	WF	XC	XD	XE	ZC	ZD	ZE
10	1¾ •	2	4	3 3/16	6⅜	9	1⅞	10⅜	11¼	9 9/16	11¾	12⅝	10⅞
	2	2¼		3 5/16			2	10½	11⅜	9 11/16	11⅞	12¾	11
	2½	3		3 9/16			2¼	10¾	11⅝	9 15/16	12⅛	13	11¼
	3	3½											
	3½	3½											
	4	4											
	4½	4½											
	5	5											
	5½	5½											
12	2	2¼	4½	3 5/16	6⅞	9½	2	11⅛	—	10 3/16	12⅞	—	11⅞
	2½	3		3 9/16			2¼	11⅜	—	10 7/16	13⅛	—	12⅛
	3	3½											
	3½	3½											
	4	4											
	4½	4½											
	5	5											
	5½	5½											
14	2½	3	5½	3 13/16	8⅛	11⅛	2¼	12⅞	—	11⅞	14⅞	—	13⅞
	3	3½											
	3½	3½											
	4	4											
	4½	4½											
	5	5											
	5½	5½											
16	2½	3	5⅞	3 15/16	9¼	—	2¼	14	—	—	16	—	—
	3	3½											
	3½	3½											
	4	4											
	4½	4½											
	5	5											
	5½	5½											
18	3½	3½	6	4⅜	10¼	—	2¼	15½	—	—	18	—	—
	4	4											
	4½	4½											
	5	5											
	5½	5½											
20	4	4	7⅛	4 9/16	11¾	—	2¼	17¼	—	—	20	—	—
	4½	4½											
	5	5											
	5½	5½											

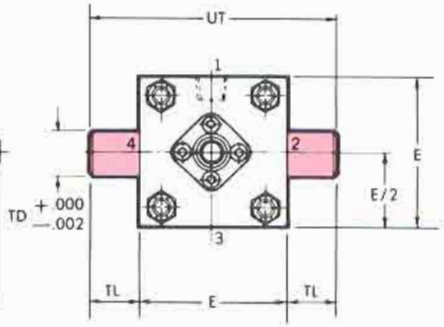
NOPAK TRUNNION MOUNT CYLINDERS

1½" THROUGH 6" DIA.

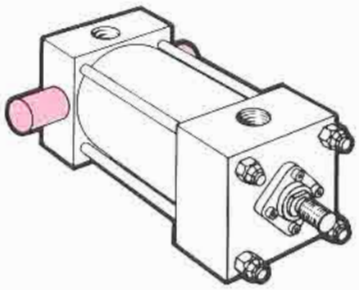
MODEL FR (USA STD. MT1) ▲

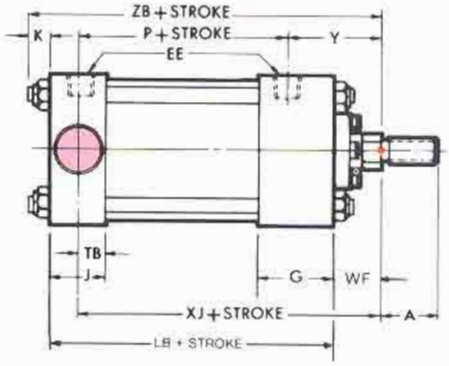






MODEL FB (USA STD. MT2) ▲





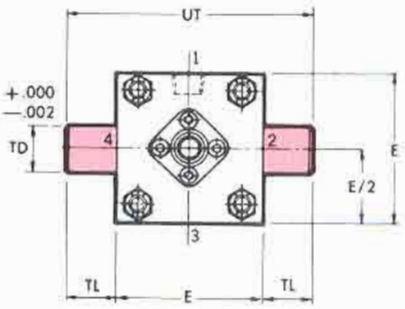


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

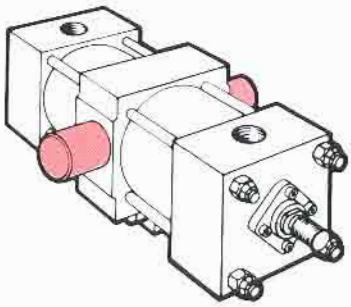
Double rod end models are designated by letter "X" preceding the model identification. See page 28.

BORE DIA.	E	G	J	K	EE	TB	TD	TL	TM	TR	UM	UT	UV	WT
1½	2	1½	1⅛	¼	⅜	9/16	1	1	2½	¾	4½	4	2½	1½
2	2½	1½	1⅛	⅜	⅜	9/16	1	1	3	¾	5	4½	3	1½
2½	3	1½	1⅛	5/16	⅜	9/16	1	1	3½	¾	5½	5	3½	1½
3¼	3¾	1¾	1¼	7/16	½	⅝	1	1	4½	⅞	6½	5¾	4½	2
4	4½	1¾	1¼	7/16	½	⅝	1	1	5¼	⅞	7¼	6½	5	2
5	5½	1¾	1¼	½	½	⅝	1	1	6¼	⅞	8¼	7½	6	2
6	6½	2	1½	9/16	¾	¾	1⅜	1⅜	7⅝	1	10⅜	9¼	7	2½

▲ See Table A on page 27 for bore and rod combinations using head plates with threaded bronze glands.

MODEL F (USA STD. MT4) ▲

- Heads bored for these rod sizes are normally in stock — thus faster delivery.
- ■ Models F and FB only.



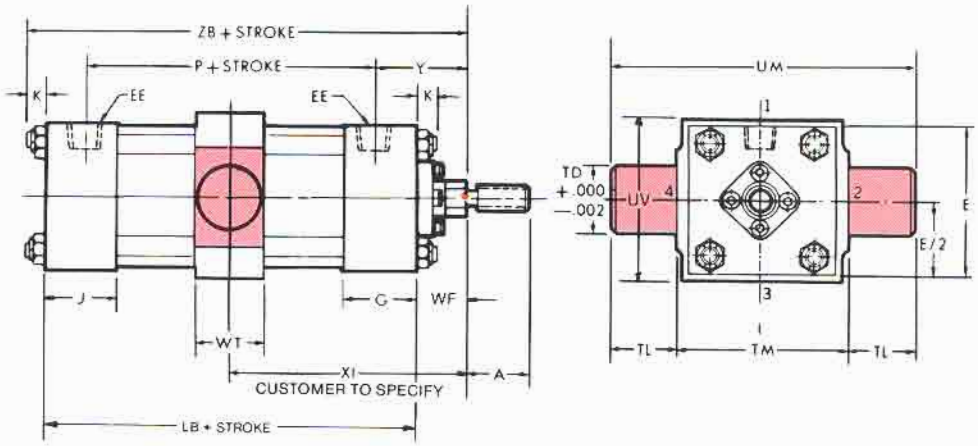


TABLE 1

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

Double rod end models are designated by letter "X" preceding the model identification. See page 28.

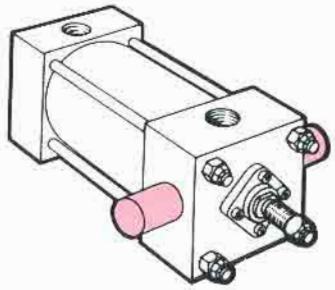
*For piston rod end dimensions see page 32.

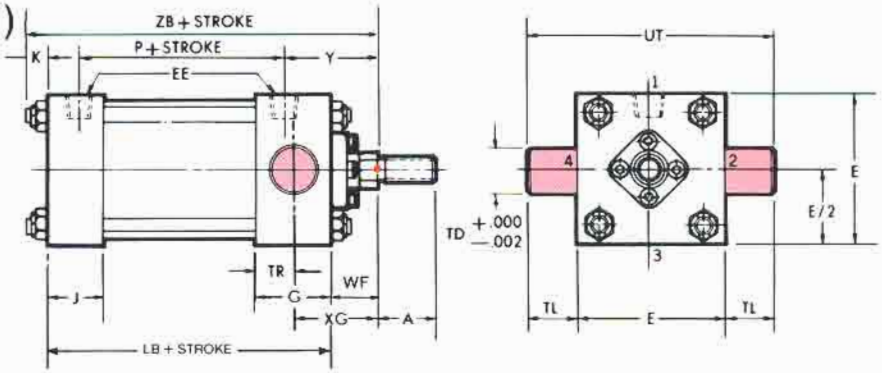
BORE DIA.	*ROD MM	A	P	Y	LB	WF	XG	XI (MIN.)	XJ	ZB
1½	⅝ •	¾	2⅛	1 15/16	3⅝	1	1¾	3¼	4 1/16	4⅞
	1 •■	1⅛		2 5/16		1⅜	2⅛	3⅝	4 7/16	5¼
2	⅝ •	¾	2⅛	1 15/16	3⅝	1	1¾	3¼	4 1/16	5
	1 •■	1⅛		2 5/16		1⅜	2⅛	3⅝	4 7/16	5⅜
	1⅜	1⅝		2 9/16		1⅝	2⅜	3⅞	4 11/16	5 11/16
2½	⅝ •	¾	2¼	1 15/16	3¾	1	1¾	3¼	4 3/16	5 1/16
	1 •■	1⅛		2 5/16		1⅜	2⅛	3⅝	4 9/16	5 7/16
	1⅜	1⅝		2 9/16		1⅝	2⅜	3⅞	4 13/16	5 11/16
	1¾	2		2 13/16		1⅞	2⅝	4⅛	5 1/16	5 15/16
3¼	1 •	1⅛	2½	2½	4¼	1⅜	2¼	4⅛	5	6 1/16
	1⅜•■	1⅝		2¾		1⅝	2½	4⅜	5¼	6 5/16
	1¾•■	2		3		1⅞	2¾	4⅝	5½	6 9/16
	2	2¼		3⅛		2	2⅞	4¾	5⅝	6 11/16
4	1 •	1⅛	2½	2½	4¼	1⅜	2¼	4⅛	5	6 1/16
	1⅜•■	1⅝		2¾		1⅝	2½	4⅜	5¼	6 5/16
	1¾•■	2		3		1⅞	2¾	4⅝	5½	6 9/16
	2	2¼		3⅛		2	2⅞	4¾	5⅝	6 11/16
	2½	3		3⅜		2¼	3⅛	5	5⅞	6 15/16
5	1 •	1⅛	2¾	2½	4½	1⅜	2¼	4⅛	5¼	6⅜
	1⅜•■	1⅝		2¾		1⅝	2½	4⅜	5½	6⅝
	1¾	2		3		1⅞	2¾	4⅝	5¾	6⅞
	2	2¼		3⅛		2	2⅞	4¾	5⅞	7
	2½	3		3⅜		2¼	3⅛	5	6⅛	7¼
	3	3½		3⅜		2¼	3⅛	5	6⅛	7¼
	3½	3½		3⅜		2¼	3⅛	5	6⅛	7¼
6	1⅜ •	1⅝	3⅛	2 13/16	5	1⅝	2⅝	4⅞	5⅞	7 3/16
	1¾•■	2		3 1/16		1⅞	2⅞	5⅛	6⅛	7 7/16
	2 •■	2¼		3 3/16		2	3	5¼	6¼	7 9/16
	2½	3		3 7/16		2¼	3¼	5½	6½	7 13/16
	3	3½		3 7/16		2¼	3¼	5½	6½	7 13/16
	3½	3½		3 7/16		2¼	3¼	5½	6½	7 13/16
	4	4		3 7/16		2¼	3¼	5½	6½	7 13/16

NOPAK TRUNNION MOUNT CYLINDERS

MODEL FR (USA STD. MT1)

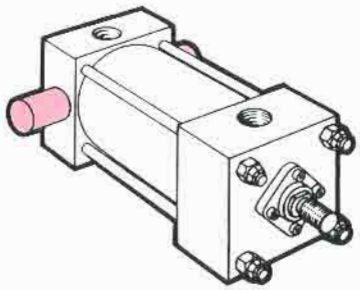
8" THROUGH 20" DIA.

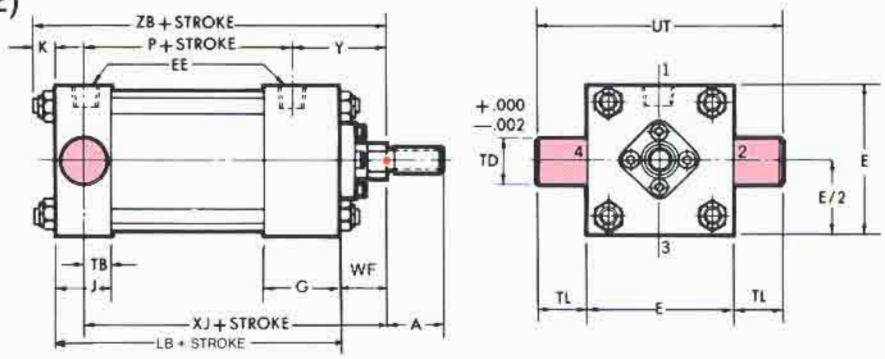




MODEL FB (USA STD. MT2)

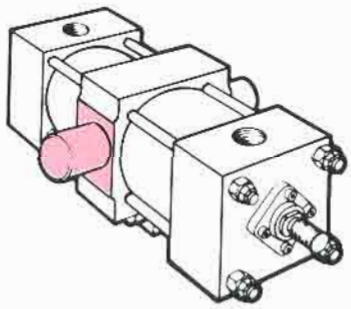
8" THROUGH 20" DIA.





MODEL F (USA STD. MT4)

8" THROUGH 14" DIA.



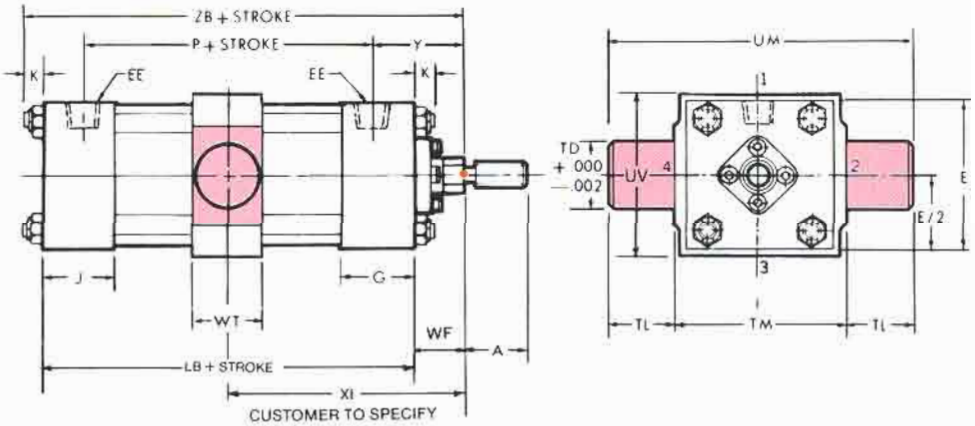


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 30.

BORE DIA.	E	G	J	K	EE	TB	TD	TL	TM	TR	UM	UT	UV	WT
8	8½	2	1½	⅝	¾	¾	1⅜	1⅜	9¾	1	12½	11¼	9½	2½
10	10⅝	2¼	2	¾	1	1	1¾	1¾	12	1⅛	15½	14⅛	11¾	3
12	12¾	2¼	2	¾	1	1	1¾	1¾	14	1⅛	17½	16¼	13¾	3
14	14¾	2¾	2¼	⅞	1¼	1⅛	2	2	16¼	1⅜	20¼	18¾	16	3½
16	17½	3	3	1	1½	1½	2¾	2¾	—	1½	—	23	—	—
18	19½	3 7/16	3 7/16	1⅛	1½	1 11/16	3	3	—	1 11/16	—	25½	—	—
20	21¾	3 15/16	3 15/16	1¼	2	1 15/16	3½	3½	—	1 15/16	—	28¾	—	—

TABLE 1

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

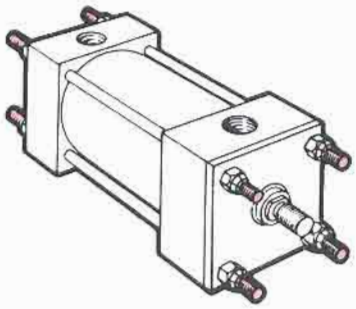
- Heads bored for these rod sizes are normally in stock — thus faster delivery.
- * For piston rod dimensions see page 32.

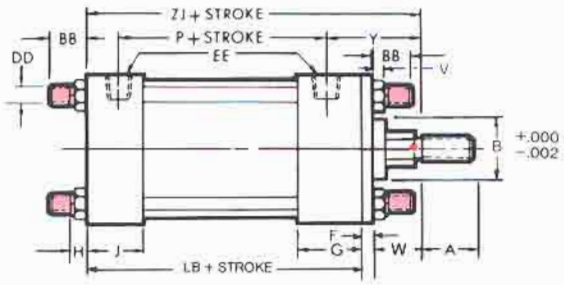
BORE DIA.	*ROD MM	A	P	Y	LB	WF	XG	XI (MIN)	XJ	ZB
8	1⅜ •	1⅝	3¼	2 13/16	5⅛	1⅝	2⅝	4⅞	6	7⅜
	1¾	2		3 1/16		1⅞	2⅞	5⅛	6¼	7⅝
	2	2¼		3 3/16		2	3	5¼	6⅜	7¾
	2½	3		3 7/16		2¼	3¼	5½	6⅝	8
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
10	1¾ •	2	4	3 3/16	6⅜	1⅞	3	5⅝	7¼	9
	2	2¼		3 5/16		2	3⅛	5¾	7⅜	9⅛
	2½	3		3 9/16		2¼	3⅜	6	7⅝	9⅜
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
12	2	2¼	4½	3 5/16	6⅞	2	3⅛	5¾	7⅞	9⅝
	2½	3		3 9/16		2¼	3⅜	6	8⅛	9⅞
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
14	2½	3	5½	3 13/16	8⅛	2¼	3⅝	6	9¼	11¼
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
16	2½	3	5⅞	3 15/16	9¼	2¼	3¾	—	10	12½
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
18	3½	3½	6	4⅜	10¼	2¼	4	—	10¾	13⅝
	4	4								
	4½	4½								
	5	5								
	5½	5½								
20	4	4	7⅛	4 9/16	11¾	2¼	4¼	—	12	15¼
	4½	4½								
	5	5								
	5½	5½								

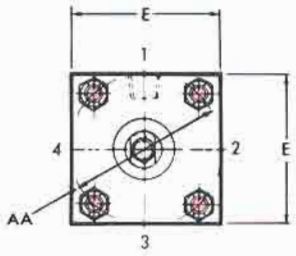
NOPAK TIE-ROD MOUNT CYLINDERS

1½" THROUGH 6" DIA.

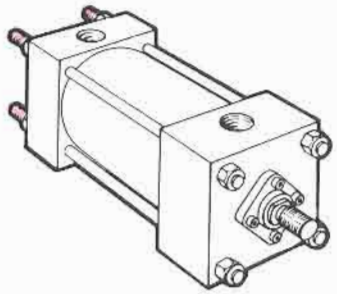
MODEL T (USA STD. MX1)

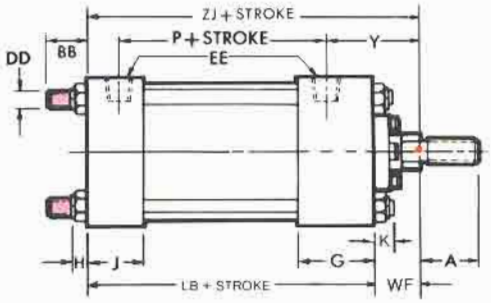






MODEL TB (USA STD. MX2) ▲





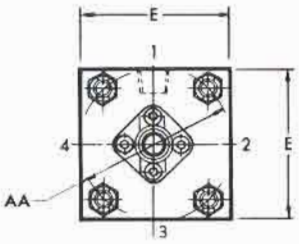


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

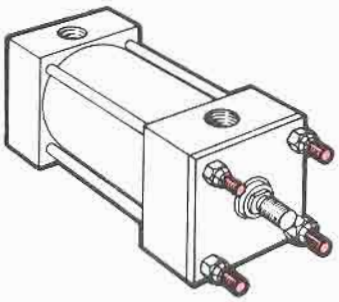
Double rod end models are designated by letter "X" preceding the model identification. See page 28.

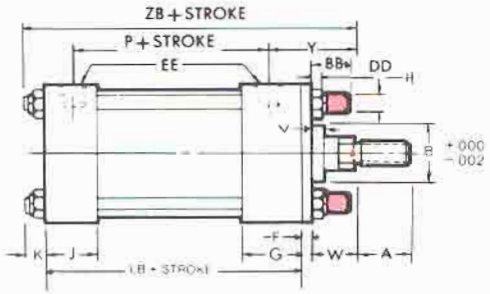
BORE DIA.	E	F	G	H	J	K	AA	BB	DD	EE
1½	2	⅜	1½	7/32	1⅛	¼	2.02	⅞	¼-28	⅜
2	2½	⅜	1½	9/32	1⅛	7/16	2.60	1 3/16	5/16-24	⅜
2½	3	⅜	1½	9/32	1⅛	5/16	3.10	1⅛	5/16-24	⅜
3¼	3¾	⅝	1¾	⅜	1¼	7/16	4.00	1⅜	⅜-24	½
4	4½	⅝	1¾	⅜	1¼	7/16	4.75	1⅜	⅜-24	½
5	5½	⅝	1¾	7/16	1¼	½	5.80	1¾	½-20	½
6	6½	¾	2	½	1½	9/16	6.90	1¾	½-20	¾

▲ See Table A on page 27 for bore and rod combinations using head plates with threaded bronze glands.

MODEL TR (USA STD. MX3)

- Heads bored for these rod sizes are normally in stock — thus faster delivery.
- ■ Model TB only.





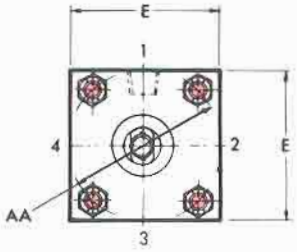


TABLE 1

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

Double rod end models are designated by letter "X" preceding the model identification. See page 28.

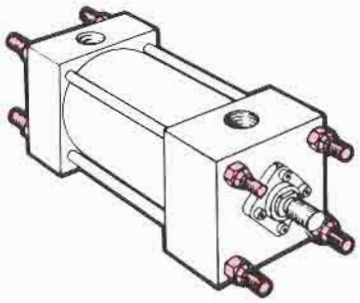
* For piston rod end dimensions see page 32.

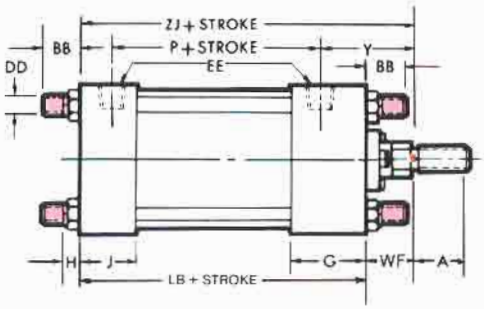
BORE DIA.	*ROD MM	A	B	P	V	W	Y	LB	WF	ZB	ZJ
1½	5/8 •	3/4	1 1/8	2 1/8	1/4	5/8	1 15/16	3 5/8	1	4 7/8	4 5/8
	1 •	1 1/8	1 1/2		1/2	1	2 5/16		1 3/8	5 1/4	5
2	5/8 •	3/4	1 1/8	2 1/8	1/4	5/8	1 15/16	3 5/8	1	5	4 5/8
	1 •	1 1/8	1 1/2		1/2	1	2 5/16		1 3/8	5 3/8	5
	1 3/8	1 5/8	2		5/8	1 1/4	2 9/16		1 5/8	5 11/16	5 1/4
2½	5/8 •	3/4	1 1/8	2 1/4	1/4	5/8	1 15/16	3 3/4	1	5 1/16	4 3/4
	1 •	1 1/8	1 1/2		1/2	1	2 5/16		1 3/8	5 7/16	5 1/8
	1 3/8	1 5/8	2		5/8	1 1/4	2 9/16		1 5/8	5 11/16	5 3/8
	1 3/4	2	2 3/8		3/4	1 1/2	2 13/16		1 7/8	5 15/16	5 5/8
3¼	1 •	1 1/8	1 1/2	2 1/2	1/4	3/4	2 1/2	4 1/4	1 3/8	6 1/16	5 5/8
	1 3/8 •	1 5/8	2		3/8	1	2 3/4		1 5/8	6 5/16	5 7/8
	1 3/4	2	2 3/8		1/2	1 1/4	3		1 7/8	6 9/16	6 1/8
	2	2 1/4	2 5/8		1/2	1 3/8	3 1/8		2	6 11/16	6 1/4
4	1 •	1 1/8	1 1/2	2 1/2	1/4	3/4	2 1/2	4 1/4	1 3/8	6 1/16	5 5/8
	1 3/8 •	1 5/8	2		3/8	1	2 3/4		1 5/8	6 5/16	5 7/8
	1 3/4 •	2	2 3/8		1/2	1 1/4	3		1 7/8	6 9/16	6 1/8
	2	2 1/4	2 5/8		1/2	1 3/8	3 1/8		2	6 11/16	6 1/4
	2½	3	3 1/8		5/8	1 5/8	3 3/8		2 1/4	6 15/16	6 1/2
5	1 •	1 1/8	1 1/2	2 3/4	1/4	3/4	2 1/2	4 1/2	1 3/8	6 3/8	5 7/8
	1 3/8 • ■	1 5/8	2		3/8	1	2 3/4		1 5/8	6 5/8	6 1/8
	1 3/4	2	2 3/8		1/2	1 1/4	3		1 7/8	6 7/8	6 3/8
	2	2 1/4	2 5/8		1/2	1 3/8	3 1/8		2	7	6 1/2
	2½	3	3 1/8		5/8	1 5/8	3 3/8		2 1/4	7 1/4	6 3/4
	3	3 1/2	3 3/4		5/8	1 5/8	3 3/8		2 1/4	7 1/4	6 3/4
	3 1/2	3 1/2	4 1/4		5/8	1 5/8	3 3/8		2 1/4	7 1/4	6 3/4
6	1 3/8 •	1 5/8	2	3 1/8	1/4	7/8	2 13/16	5	1 5/8	7 3/16	6 5/8
	1 3/4 • ■	2	2 3/8		3/8	1 1/8	3 1/16		1 7/8	7 7/16	6 7/8
	2 • ■	2 1/4	2 5/8		3/8	1 1/4	3 3/16		2	7 9/16	7
	2½	3	3 1/8		1/2	1 1/2	3 7/16		2 1/4	7 13/16	7 1/4
	3	3 1/2	3 3/4		1/2	1 1/2	3 7/16		2 1/4	7 13/16	7 1/4
	3 1/2	3 1/2	4 1/4		1/2	1 1/2	3 7/16		2 1/4	7 13/16	7 1/4
	4	4	4 3/4		1/2	1 1/2	3 7/16		2 1/4	7 13/16	7 1/4

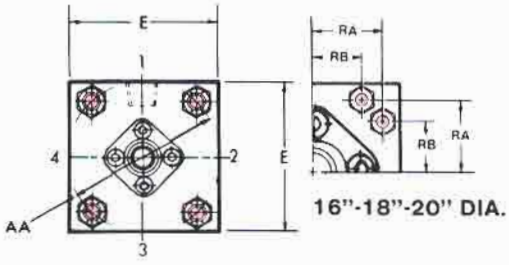
NOPAK TIE-ROD MOUNT CYLINDERS

8" THROUGH 20" DIA.

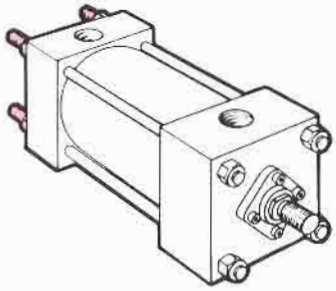
MODEL T (USA STD. MX1)

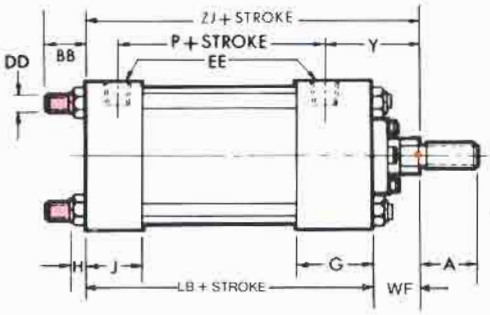


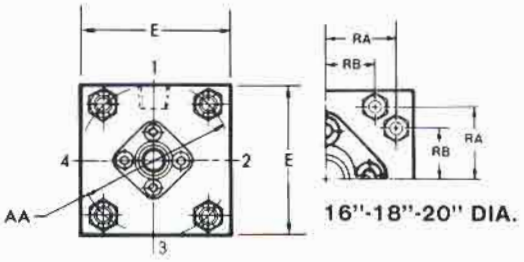




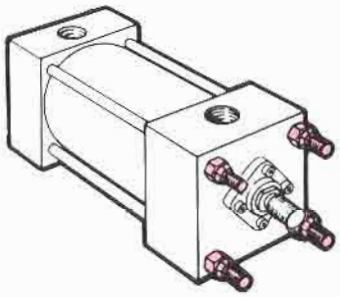
MODEL TB (USA STD. MX2)

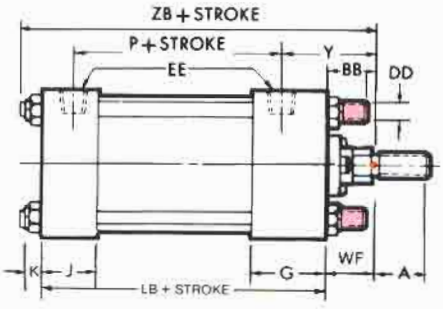






MODEL TR (USA STD. MX3)





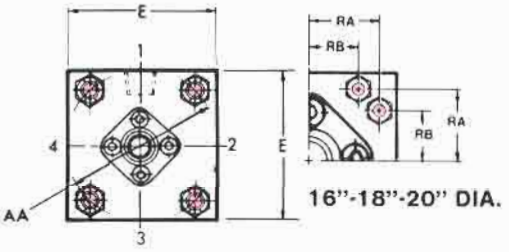


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification. See page 30.

BORE DIA.	E	G	H	J	K	AA	BB	DD	EE	RA	RB
8	8½	2	9/16	1½	5/8	9.10	2¼	5/8-18	¾	—	—
10	10⅝	2¼	5/8	2	¾	11.31	2⅝	¾-16	1	—	—
12	12¾	2¼	5/8	2	¾	13.30	2 11/16	¾-16	1	—	—
14	14¾	2¾	¾	2¼	⅞	15.40	3 3/16	⅞-14	1¼	—	—
16	17½	3	⅞	3	1	18.25	3⅝	1-14	1½	7.48	5.23
18	19½	3 7/16	1	3 7/16	1⅛	20.50	4⅛	1⅛-12	1½	8.40	5.88
20	21¾	3 15/16	1⅛	3 15/16	1¼	22.62	4½	1¼-12	2	9.27	6.49

TABLE 1

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

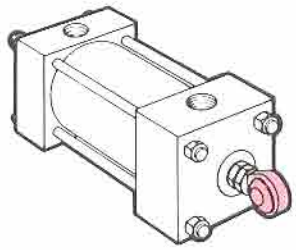
- Heads bored for these rod sizes are normally in stock — thus faster delivery.
- * For piston rod dimensions see page 32.

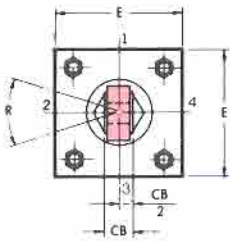
BORE DIA.	*ROD MM	A	P	Y	LB	WF	ZB	ZJ
8	1 3/8 •	1 5/8	3 1/4	2 13/16	5 1/8	1 5/8	7 3/8	6 3/4
	1 3/4	2		3 1/16		1 7/8	7 5/8	7
	2	2 1/4		3 3/16		2	7 3/4	7 1/8
	2 1/2	3		3 7/16		2 1/4	8	7 3/8
	3	3 1/2						
	3 1/2	3 1/2						
	4	4						
	4 1/2	4 1/2						
	5	5						
	5 1/2	5 1/2						
10	1 3/4 •	2	4	3 3/16	6 3/8	1 7/8	9	8 1/4
	2	2 1/4		3 5/16		2	9 1/8	8 3/8
	2 1/2	3		3 9/16		2 1/4	9 3/8	8 5/8
	3	3 1/2						
	3 1/2	3 1/2						
	4	4						
	4 1/2	4 1/2						
	5	5						
	5 1/2	5 1/2						
12	2 •	2 1/4	4 1/2	3 5/16	6 7/8	2	9 5/8	8 7/8
	2 1/2	3		3 9/16		2 1/4	9 7/8	9 1/8
	3	3 1/2						
	3 1/2	3 1/2						
	4	4						
	4 1/2	4 1/2						
	5	5						
	5 1/2	5 1/2						
14	2 1/2	3	5 1/2	3 13/16	8 1/8	2 1/4	11 1/4	10 3/8
	3	3 1/2						
	3 1/2	3 1/2						
	4	4						
	4 1/2	4 1/2						
	5	5						
	5 1/2	5 1/2						
16	2 1/2	3	5 7/8	3 15/16	9 1/4	2 1/4	12 1/2	11 1/2
	3	3 1/2						
	3 1/2	3 1/2						
	4	4						
	4 1/2	4 1/2						
	5	5						
	5 1/2	5 1/2						
18	3 1/2	3 1/2	6	4 3/8	10 1/4	2 1/4	13 5/8	12 1/2
	4	4						
	4 1/2	4 1/2						
	5	5						
	5 1/2	5 1/2						
20	4	4	7 1/8	4 9/16	11 3/4	2 1/4	15 1/4	14
	4 1/2	4 1/2						
	5	5						
	5 1/2	5 1/2						

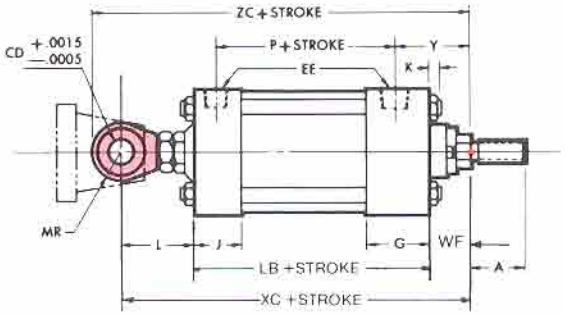
NOPAK SPHERICAL EYE PIN MOUNT CYLINDERS

1½" THROUGH 6" DIA.

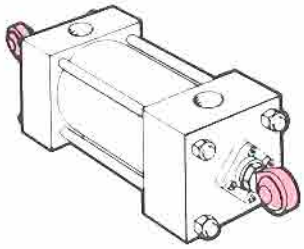
MODEL UE (USA STD. NONE) ▲

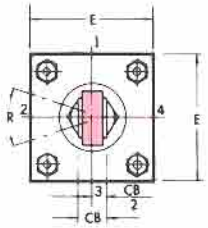






MODEL UUE (USA STD. NONE) ▲





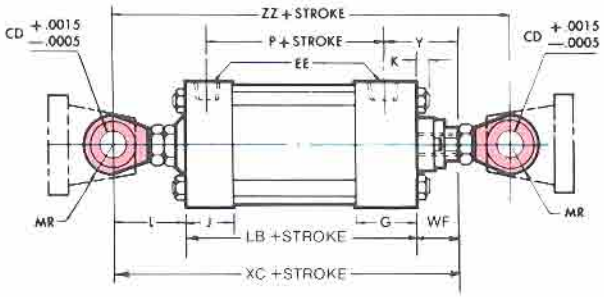


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

BORE DIA.	E	F	G	K	L	R	CB	CD	EE	MR
1½	2	⅜	1½	¼	1⅞	12°	⅝	½	⅜	11/16
2	2½	⅜	1½	⅜	1⅞	12°	⅝	½	⅜	11/16
2½	3	⅜	1½	5/16	1⅞	12°	⅝	½	⅜	11/16
3¼	3¾	⅝	1¾	7/16	2⅞	13½°	⅞	¾	½	⅞
4	4½	⅝	1¾	7/16	2⅞	13½°	⅞	¾	½	⅞
5	5½	⅝	1¾	½	2⅞	13½°	⅞	¾	½	⅞
6	6½	¾	2	9/16	4⅛	14°	1⅜	1	¾	1⅜

▲ See Table A on page 27 for bore and rod combinations using head plates with threaded bronze glands.

MODEL UE & UUE CYLINDER DIMENSIONAL DATA

TABLE 1

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

- • Heads bored for these rod sizes are normally in stock — thus faster delivery.
- * For piston rod dimensions see page 32.

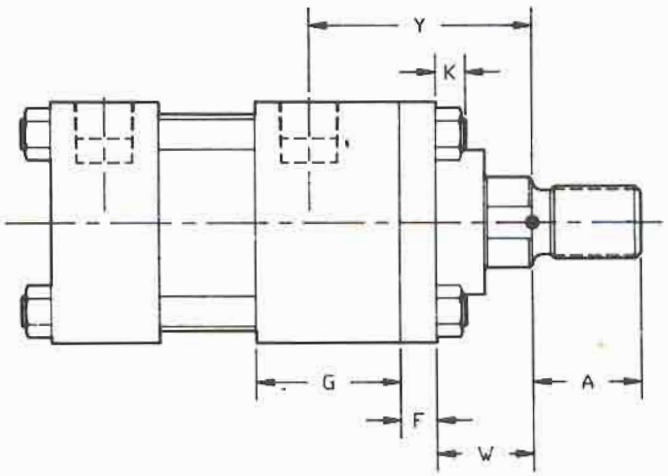
BORE DIA.	* ROD MM	A	P	Y	LB	W	WF	XC	ZC	ZZ
1 1/2	5/8 •	3/4	2 1/8	1 15/16	3 5/8	5/8	1	6 1/2	7 3/16	7 11/16
	1 •	1 1/8		2 5/16		1	1 3/8	6 7/8	7 9/16	8 1/16
2	5/8 •	3/4	2 1/8	1 15/16	3 5/8		1	6 1/2	7 3/16	7 11/16
	1 •	1 1/8		2 5/16		1	1 3/8	6 7/8	7 9/16	8 1/16
	1 3/8	1 5/8		2 9/16		1 1/4	1 5/8	7 1/8	7 13/16	8 5/16
2 1/2	5/8 •	3/4	2 1/4	1 15/16	3 3/4		1	6 5/8	7 5/16	7 13/16
	1 •	1 1/8		2 5/16			1 3/8	7	7 11/16	8 3/16
	1 3/8 •	1 5/8		2 9/16			1 5/8	7 1/4	7 15/16	8 7/16
	1 3/4	2		2 13/16		1 1/2	1 7/8	7 1/2	8 3/16	8 11/16
3 1/4	1 •	1 1/8	2 1/2	2 1/2	4 1/4		1 3/8	8 1/2	9 3/8	10 1/16
	1 3/8 •	1 5/8		2 3/4			1 5/8	8 3/4	9 5/8	10 5/16
	1 3/4 •	2		3			1 7/8	9	9 7/8	10 9/16
	2	2 1/4		3 1/8		1 3/8	2	9 1/8	10	10 11/16
4	1 •	1 1/8	2 1/2	2 1/2	4 1/4		1 3/8	8 1/2	9 3/8	10 1/16
	1 3/8 •	1 5/8		2 3/4			1 5/8	8 3/4	9 5/8	10 5/16
	1 3/4 •	2		3			1 7/8	9	9 7/8	10 9/16
	2	2 1/4		3 1/8			2	9 1/8	10	10 11/16
	2 1/2	3		3 3/8		1 5/8	2 1/4	9 3/8	10 1/4	10 15/16
5	1 •	1 1/8	2 3/4	2 1/2	4 1/2		1 3/8	8 3/4	9 5/8	10 5/16
	1 3/8 •	1 5/8		2 3/4			1 5/8	9	9 7/8	10 9/16
	1 3/4	2		3			1 7/8	9 1/4	10 1/8	10 13/16
	2	2 1/4		3 1/8			2	9 3/8	10 1/4	10 15/16
	2 1/2	3		3 3/8			2 1/4	9 5/8	10 1/2	11 3/16
	3	3 1/2		3 3/8			2 1/4	9 5/8	10 1/2	11 3/16
	3 1/2	3 1/2		3 3/8		1 5/8	2 1/4	9 5/8	10 1/2	11 3/16
6	1 3/8 •	1 5/8	3 1/8	2 13/16	5		1 5/8	10 3/4	12 1/8	13 5/16
	1 3/4 •	2		3 1/16			1 7/8	11	12 3/8	13 9/16
	2 •	2 1/4		3 3/16			2	11 1/8	12 1/2	13 11/16
	2 1/2	3		3 7/16			2 1/4	11 3/8	12 3/4	13 15/16
	3	3 1/2		3 7/16			2 1/4	11 3/8	12 3/4	13 15/16
	3 1/2	3 1/2		3 7/16			2 1/4	11 3/8	12 3/4	13 15/16
	4	4		3 7/16		1 1/2	2 1/4	11 3/8	12 3/4	13 15/16

TABLE A

THE FOLLOWING BORE/ROD COMBINATIONS USE HEAD PLATE AND BRONZE GLANDS AS SHOWN AT RIGHT.	
BORE	ROD DIAMETER (MM)
1 1/2	5/8 & 1
2	1 & 1 3/8
2 1/2	1 3/4
3 1/4	2
4	2 1/2
5	3 1/2
6	4

Bolt-on glands not available on these combinations.

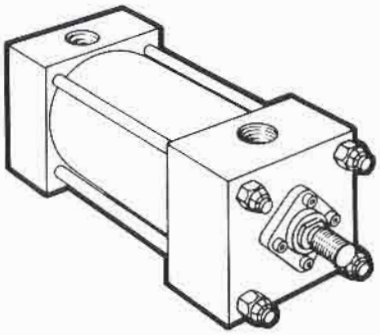
Note: Threaded Bronze Gland used on all Model D Cylinders. Bolt-on Gland used on all Model DG Cylinders.

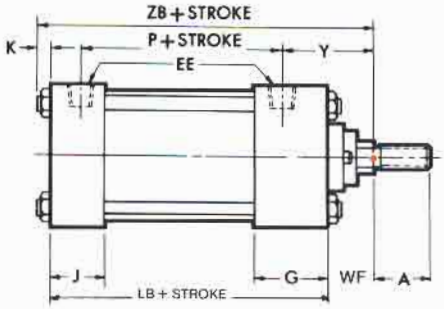


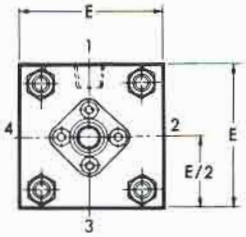
NOPAK BASIC MODEL NO MOUNT CYLINDERS

1½" THROUGH 6" DIA.

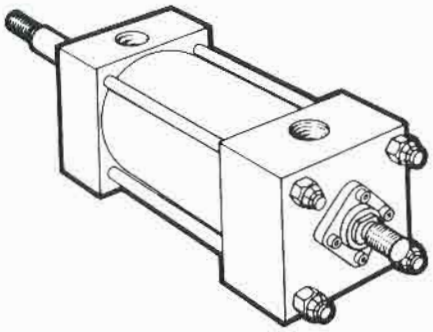
MODEL H (USA STD. NONE)▲

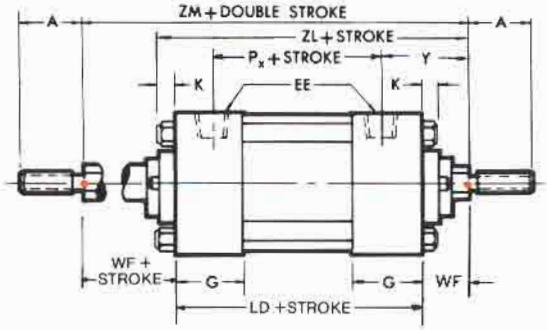






MODEL XH (USA STD. NONE)▲





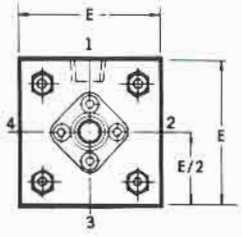


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification.

BORE DIA.	E	G	J	K	EE
1½	2	1½	1⅛	¼	⅜
2	2½	1½	1⅛	⅜	⅜
2½	3	1½	1⅛	5/16	⅜
3¼	3¾	1¾	1¼	7/16	½
4	4½	1¾	1¼	7/16	½
5	5½	1¾	1¼	½	½
6	6½	2	1½	9/16	¾

H & XH CYLINDER DIMENSIONAL DATA

TABLE 1

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

- Heads bored for these rod sizes are normally in stock — thus faster delivery, Model H only.
- * For piston rod dimensions see page 32.

BORE DIA.	*ROD MM	A	P	P_X	Y	LB	LD	WF	ZB	ZL	ZM
1½	5/8 •	¾	2⅛	2¼	1 15/16	3⅝	4⅛	1	4⅞	5⅜	6⅛
	1 •	1⅛			2 5/16			1⅜	5¼	5¾	6⅞
2	5/8 •	¾	2⅛	2¼	1 15/16	3⅝	4⅛	1	5	5½	6⅛
	1 •	1⅛			2 5/16			1⅜	5⅜	5⅞	6⅞
	1⅜	1⅝			2 9/16			1⅝	5 11/16	6⅛	7⅜
2½	5/8 •	¾	2¼	2⅜	1 15/16	3¾	4¼	1	5 1/16	5 9/16	6¼
	1 •	1⅛			2 5/16			1⅜	5 7/16	5 15/16	7
	1⅜	1⅝			2 9/16			1⅝	5 11/16	6 3/16	7½
	1¾	2			2 13/16			1⅞	5 15/16	6 7/16	8
3¼	1 •	1⅛	2½		2½	4¼	4¾	1⅜	6 1/16	6 9/16	7½
	1⅜ •	1⅝			2¾			1⅝	6 5/16	6 13/16	8
	1¾ •	2			3			1⅞	6 9/16	7 1/16	8½
	2	2¼			3⅛			2	6 11/16	7 3/16	8¾
4	1 •	1⅛	2½		2½	4¼	4¾	1⅜	6 1/16	6 9/16	7½
	1⅜ •	1⅝			2¾			1⅝	6 5/16	6 13/16	8
	1¾ •	2			3			1⅞	6 9/16	7 1/16	8½
	2	2¼			3⅛			2	6 11/16	7 3/16	8¾
	2½	3			3⅜			2¼	6 15/16	7 7/16	9¼
5	1 •	1⅛	2¾		2½	4½	5	1⅜	6⅜	6⅞	7¾
	1⅜ •	1⅝			2¾			1⅝	6⅝	7⅛	8¼
	1¾	2			3			1⅞	6⅞	7⅜	8¾
	2	2¼			3⅛			2	7	7½	9
	2½	3			3⅜			2¼	7¼	7¾	9½
	3	3½			3⅜			2¼	7¼	7¾	9½
	3½	3½			3⅜			2¼	7¼	7¾	9½
6	1⅜ •	1⅝	3⅛		2 13/16	5	5½	1⅝	7 3/16	7 11/16	8¾
	1¾ •	2			3 1/16			1⅞	7 7/16	7 15/16	9¼
	2 •	2¼			3 3/16			2	7 9/16	8 1/16	9½
	2½	3			3 7/16			2¼	7 13/16	8 5/16	10
	3	3½			3 7/16			2¼	7 13/16	8 5/16	10
	3½	3½			3 7/16			2¼	7 13/16	8 5/16	10
	4	4			3 7/16			2¼	7 13/16	9 5/16	10

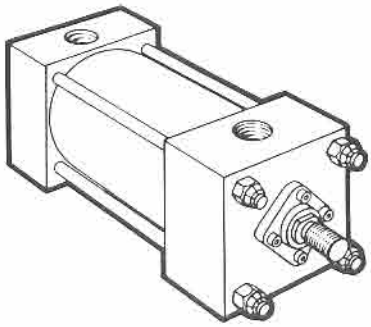
▲ See Table A on page 27 for bore and rod combinations using head plates with threaded bronze glands.

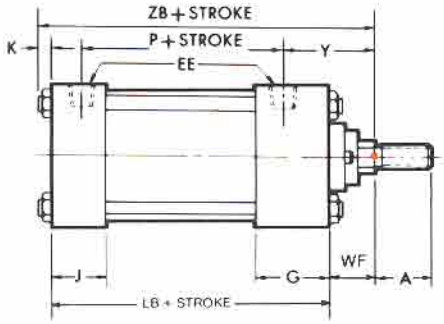
NOPAK

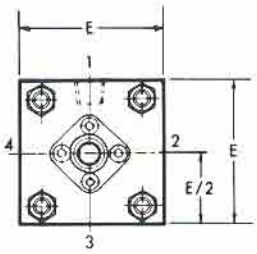
BASIC MODEL NO MOUNT CYLINDER

8" THROUGH 20" DIA.

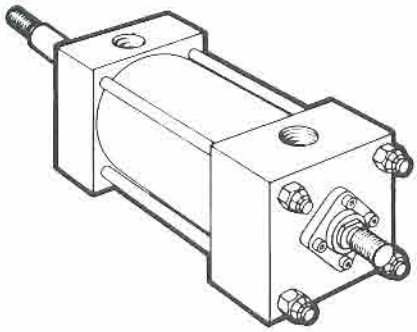
MODEL H (USA STD. NONE)

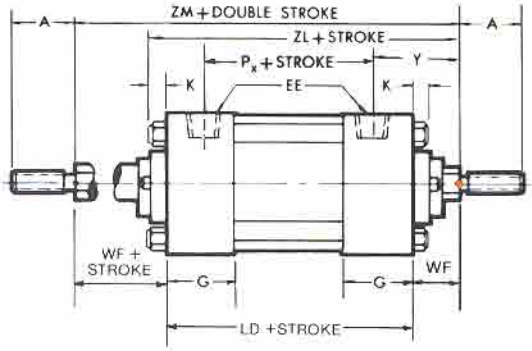






MODEL XH (USA STD. NONE)





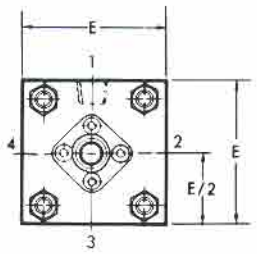


TABLE 2

These dimensions are constant regardless of rod diameter or stroke.

Double rod end models are designated by letter "X" preceding the model identification.

BORE DIA.	E	G	J	K	EE
8	8½	2	1½	5/8	3/4
10	10⅝	2¼	2	3/4	1
12	12¾	2¼	2	3/4	1
14	14¾	2¾	2¼	7/8	1¼
16	17½	3	3	1	1¼
18	19½	3 7/16	3 7/16	1⅛	1½
20	21¾	3 15/16	3 15/16	1¼	2

TABLE 1

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

- Heads bored for these rod sizes are normally in stock — thus faster delivery, Model H only.
- * For piston rod dimensions see page 32.

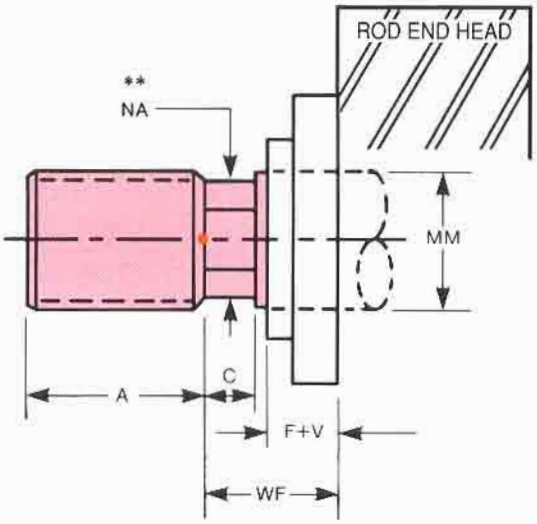
BORE DIA.	*ROD MM	A	P	Y	LB	LD	WF	ZB	ZL	ZM
8	1⅜ •	1⅝	3¼	2 13/16	5⅛	5⅝	1⅝	7⅜	7⅞	8⅞
	1¾	2		3 1/16			1⅞	7⅝	8⅛	9⅜
	2	2¼		3 3/16			2	7¾	8¼	9⅝
	2½	3		3 7/16			2¼	8	8½	10⅛
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
10	1¾ •	2	4	3 3/16	6⅜	6⅝	1⅞	9	9¼	10⅜
	2	2¼		3 5/16			2	9⅛	9⅜	10⅝
	2½	3		3 9/16			2¼	9⅜	9⅝	11⅛
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
12	2 •	2¼	4½	3 5/16	6⅞	7⅛	2	9⅝	9⅞	11⅛
	2½	3		3 9/16			2¼	9⅞	10⅛	11⅝
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
14	2½	3	5½	3 13/16	8⅛	8⅝	2¼	11¼	11¾	13⅛
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
16	2½	3	5⅞	3 15/16	9¼	9¼	2¼	12½	12½	13¾
	3	3½								
	3½	3½								
	4	4								
	4½	4½								
	5	5								
	5½	5½								
18	3½	3½	6	4⅜	10¼	10¼	2¼	13⅝	13⅝	14¾
	4	4								
	4½	4½								
	5	5								
	5½	5½								
20	4	4	7⅛	4 9/16	11¾	11¾	2¼	15¼	15¼	16¼
	4½	4½								
	5	5								
	5½	5½								

NOPAK CLASS 6 CYLINDERS PISTON ROD END DIMENSIONAL DATA

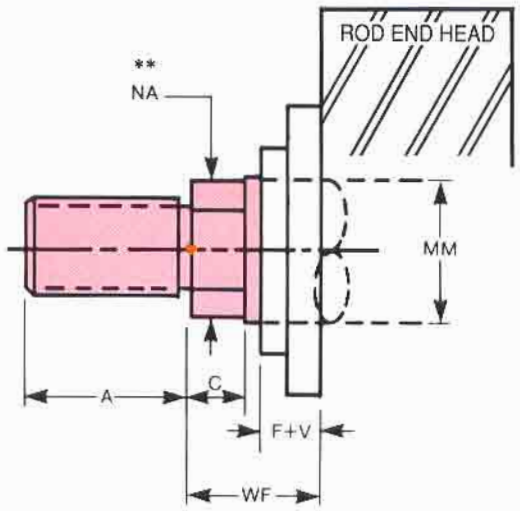
NOTE: Standard (smallest) diameter rods in each bore size with standard (#4) thread are **STOCKED** in even-inch stroke increments 1" through 20". Cushioned and non-cushioned.

This translates to MUCH QUICKER delivery.

ROD TYPE NO. 1

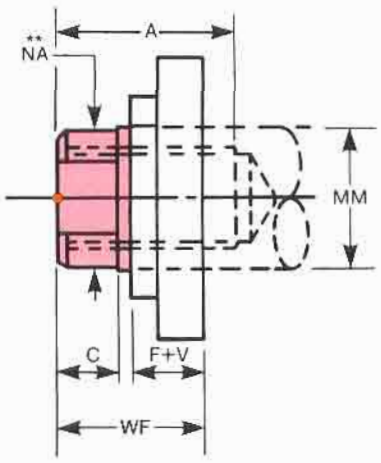


ROD END TYPE NO. 3 *NO. 4



***TYPE NO. 4 THREAD IS SIZED FOR ROD CLEVIS AND EYE**

ROD END TYPE NO. 5



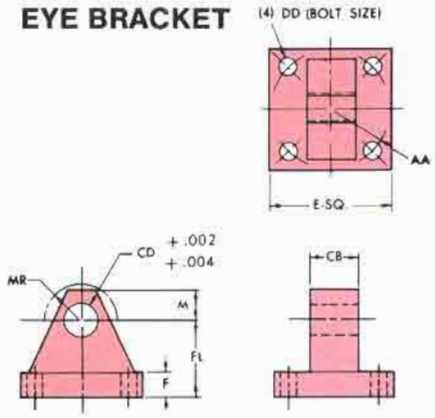
*Type 4 thread sized for clevis & rod eye accessories
**Dimension NA is .060 under MM dia. dimension
† Dimension D is size across wrench flats

DIA. ROD MM	ROD END TYPE NO. 1	NO. 3	NO. 4*	NO. 5	A	C	D †	F + V	WF
5/8	5/8-18	1/2-20	7/16-20	7/16-20	3/4	3/8	1/2	5/8	1
1	1-14	7/8-14	3/4-16	3/4-16	1 1/8	1/2	7/8	3/4	1 3/8
1 3/8	1 3/8-12	1 1/4-12	1-14	1-14	1 5/8	5/8	1 1/8	1	1 5/8
1 3/4	1 3/4-12	1 1/2-12	1 1/4-12	1 1/4-12	2	3/4	1 1/2	3/4	1 7/8
2	2-12	1 3/4-12	1 1/2-12	1 1/2-12	2 1/4	7/8	1 11/16	7/8	2
2 1/2	2 1/2-12	2 1/4-12	1 7/8-12	1 7/8-12	3	1	2 1/16	1 1/16	2 1/4
3	3-12	2 3/4-12	2 1/4-12	2 1/4-12	3 1/2	1	2 5/8	1 1/8	2 1/4
3 1/2	3 1/2-12	3 1/4-12	2 1/2-12	2 1/2-12	3 1/2	1	3	1 1/8	2 1/4
4	4-12	3 3/4-12	3-12	3-12	4	1	3 3/8	1 1/4	2 1/4
4 1/2	4 1/2-12	4 1/4-12	3 1/4-12	3 1/4-12	4 1/2	1	3 7/8	1 1/4	2 1/4
5	5-12	4 3/4-12	3 1/2-12	3 1/2-12	5	1	4 1/4	1 1/4	2 1/4
5 1/2	5 1/2-12	5 1/4-12	4-12	4-12	5 1/2	1	4 5/8	1 1/4	2 1/4

NOTE: Rod Threads are Class UNF-2A or 2B unless specifically quoted otherwise. For Plain Rod End (no threads, no wrench flats, etc.), consult factory for ordering information.

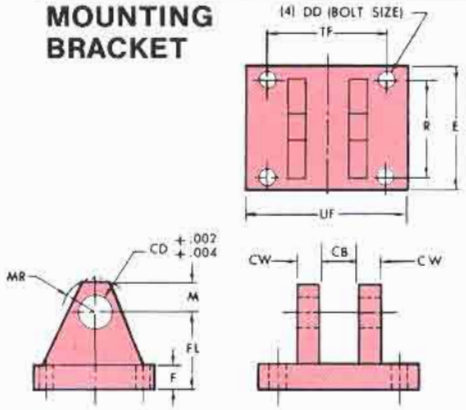
CYLINDER ACCESSORIES

EYE BRACKET



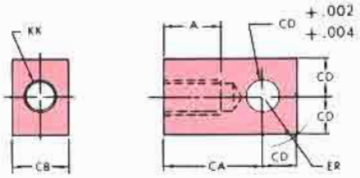
CYL. DIA.	E	F	M	AA	CB	CD	DD	FL	MR	(FORMER) PART NO.	(PRESENT) PART NO.
1½-2-2½	2½	⅜	½	2.30	¾	½	⅜	1⅛	⅝	A-12008CY	2716 L47
3¼-4-5	3½	⅝	¾	3.61	1¼	¾	½	1⅞	⅞	A-26139CY	2719 L32
6-8	4½	⅞	1	4.60	1½	1	⅝	2⅜	1¼	A-26140CY	2720 L33
10	5	⅞	1⅜	5.40	2	1⅜	⅝	3	1⅝	A-26141CY	2721 L34
12	6½	1⅛	1¾	7.00	2½	1¾	⅞	3⅜	2	A-26142CY	2722 L35
14-16	7½	1 7/16	2	8.10	2½	2	1	3 15/16	2⅜	A-26143CY	2723 L36
18	8½	1⅝	2½	9.30	3	2½	1⅛	4⅝	3	A-26144CY	2724 L37
20	9½	2	2¾	10.61	3	3	1¼	5¼	3¼	A-26145CY	2725 L38

MOUNTING BRACKET

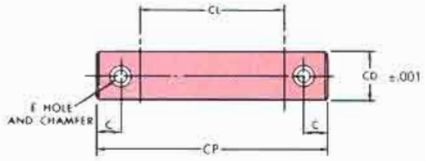


CYL. DIA.	E	F	M	R	CB	CD	CW	DD	FL	MR	TF	UF	(FORMER) PART NO.	(PRESENT) PART NO.
1½-2-2½	2½	⅜	½	1.63	¾	½	½	⅜	1⅛	⅝	2¾	3½	A-8496CY	2683 L47
3¼-4-5	3½	⅝	¾	2.55	1¼	¾	⅝	½	1⅞	⅞	3¾	4¾	A-8497CY	2684 L47
6-8	4½	⅞	1	3.25	1½	1	¾	⅝	2⅜	1¼	4½	5¾	A-26157CY	2685 L47
10	5	⅞	1⅜	3.82	2	1⅜	1	⅝	3	1⅝	5½	6¾	A-8499CY	2686 L47
12	6½	1⅛	1¾	4.95	2½	1¾	1¼	⅞	3⅜	2	7	8½	A-26158CY	2687 L47
14-16	7½	1 7/16	2	5.73	2½	2	1¼	1	3 15/16	2⅜	7½	9¼	A-26159CY	2688 L47
18	8½	1⅝	2½	6.58	3	2½	1½	1⅛	4⅝	3	8½	10½	A-26160CY	2689 L47
20	9½	2	2¾	7.50	3	3	1½	1¼	5¼	3¼	8¾	10¾	A-26161CY	2690 L47

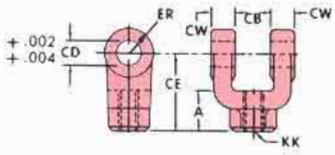
EYE (FEMALE)



PIVOT—PIN

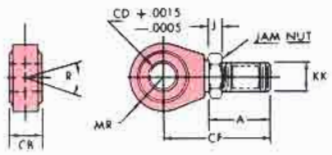


CLEVIS (FEMALE)



KK	A	CA	CB	CD	ER	(FORMER) PART NO.	(PRESENT) PART NO.	CYL. DIA.	C	E	CD	CP	CL	(FORMER) PART NO.	(PRESENT) PART NO.	KK	A	CB	CD	CE	CW	ER	(FORMER) PART NO.	(PRESENT) PART NO.
7/16-20	¾	1½	¾	½	⅝	A-7060CY	1810 L59	1½-2-2½	3/16	⅛	½	2⅜	1¾	A-7110CY-1	3222 L47-1	7/16-20	¾	¾	½	1½	½	½	A-15078CY	2834 L59
¾-16	1⅛	2 1/16	1¼	¾	1 1/16	A-7061CY	1812 L59	3¼-4-5	¼	3/16	¾	3⅛	2½	A-7110CY-2	3222 L47-2	¾-16	1⅛	1¼	¾	2⅜	⅝	¾	A-15079CY	2835 L59
1-14	1⅝	2 13/16	1½	1	1 7/16	A-7062CY	1813 L59	6-8	¼	3/16	1	3⅝	3	A-7110CY-3	3222 L47-3	1-14	1⅝	1½	1	3⅛	¾	1	A-15080CY	2836 L59
1¼-12	2	3 7/16	2	1⅜	2	A-7063CY	1814 L59	10	¼	3/16	1⅜	4¾	4	A-7110CY-4	3222 L47-4	1¼-12	2	2	1⅜	4⅛	1	1⅜	A-15081CY	2837 L59
1½-12	2¼	4	2½	1¾	2 1/16	A-7064CY	1815 L59	12	¼	3/16	1¾	5 13/16	5	A-7110CY-5	3222 L47-5	1½-12	2¼	2½	1¾	4½	1¼	1¾	A-15082CY	2838 L59
1⅞-12	3½	5	2½	2	2¼	A-7065CY	1817 L59	14	5/16	¼	2	5 13/16	5	A-7110CY-6	3222 L47-6	1⅞-12	3	2½	2	5½	1¼	2	A-15083CY	2839 L59
2¼-12	3½	5 13/16	3	2½	2⅞	A-17196CY	1820 L59	16	5/16	¼	2½	6⅞	6	A-7110CY-8	3222 L47-8	2¼-12	3½	3	2½	6½	1½	2½	A-17197CY	2840 L59
2½-12	3½	6⅛	3	3	3⅛	A-7066CY	1821 L59	18-20	5/16	¼	3	6⅞	6	A-7110CY-7	3222 L47-7	2½-12	3½	3	3	6¾	1½	2¾	A-15084CY	2841 L59
3¼-12	4½	7⅜	4	3½	3⅞	A-20453CY	1824 L59	ROD EYE & CLEVIS	⅜	¼	3½	9¼	8	A-7110CY-9	3222 L47-9	3¼-12	4½	4	3½	8½	2	3½	A-19947CY	2842 L59

SPHERICAL ROD EYE



CYL. DIA.	A	J	R	CB	CD	CF	KK	MR	THRUST RATING (PROX.)	PART NO.	
1½-2-2½	1½	¼	12°	⅝	½	2 7/16	7/16-20	11/16	5,500#	2825 L48-1	
1½-2-2½	15/16	⅛	12°	⅝	½	1⅞	7/16-20	11/16	5,500#	2825 L48-2	BLIND END ONLY
3¼-4-5	1¾	7/16	13½°	⅞	¾	2⅛	¾-16	⅞	10,000#	2825 L48-3	
6-8	2⅛	9/16	14°	1⅜	1	4⅛	1-14	1 7/16	12,000#	2825 L48-4	
8*	2⅛	9/16	14°	1⅜	1	4⅛	1-14	1 7/16	19,000#	2825 L48-5	

*For 8" Cyl. Diameter — Hydraulics Only.

NOPAK CLASS 6 ENGINEERING INFORMATION

NOPAK Class 6 bore-rated cylinders are identified as P-6 for air and H-6 for hydraulic service. Please refer to basic pressure ratings, see table page 2. Cylinders 1½" through 10" bore are assembled from standard inventory components. Special design and large diameter Class 6 cylinders are available. Send us your specifications.

OPERATING TEMPERATURES AND MEDIA

Class P-6 air and H-6 hydraulic cylinders equipped with standard Type A packings may be operated at temperatures from -20° F to 250° F air, water or oil. The following chart relates in a simplified general purpose manner the limitations and uses of available piston and rod packings.

PACKING TYPE		
A	B	C
—20°F to+250°F Std. Hyd. Oil Air Water (not steam) Water Glycol Fire Resistant Fluid	−20°F to +375°F Std. Hyd. Oil Air Phosphate Ester Fire Resistant Fluid	to +350°F Steam

For specific media and temperature or conditions exceeding the chart ratings, consult NOPAK Engineering Department.

Applications involving Fire Resistant Fluids must be so specified for compatible component materials. When considering temperature, remember that as the temperature increases (within the rated limits) the packing life decreases.

INTERCHANGEABILITY

Class 6 cylinders are dimensionally interchangeable with other square-head cylinders of the same pressure classification. Construction and performance are in conformance with applicable N.F.P.A. recommended standards.

P6 (pneumatic) cylinders with Integral Limit Switch(es), see Catalog NEPF.

CUSHIONS

NOPAK Class 6 cylinders are available with adjustable cushions on either or both ends, or non-cushion.

The purpose of a cushion is to slow up piston speed at the end of the stroke, eliminating hammer and noise. Where standard cushions are inadequate for unusual requirements, special cushions possibly requiring longer-than-standard heads can be furnished at additional charge. Very rapid cushioning of high speed movement may require deceleration valves.

The purpose of the ball check in the cushion mechanism is to allow fluid to pass to the piston face without obstruction (while the cushion sleeve is still within the bore in the head). This results in essential quick starting of the piston. Cushion adjusting screws serve to by-pass the fluid from the trapped section between the piston and the cylinder head when the cushion sleeve has entered the bore. Turning the needle inward against the seat results in maximum cushion intensity. Backing up on the needle decreases the effect.

CYLINDER PORT LOCATION

Inlet ports are located in Position 1 as standard (see rod end view on dimension drawings). They can however, be located at other numbered locations on application. Extra inlets furnished at additional charge. Oversize and special inlets require dimensions and quotation on application.

WATER SERVICE

Special cylinders can be built for water service. Due to the uncertainty of action of water supply on some materials, responsibility for premature failure due to corrosion, mineral deposits or electrolysis cannot be accepted.

TABLE A — TIE ROD TORQUE CHART CLASS P-6 AIR AND H-6 HYD. CYL.

Cylinder Diameter	No. of Tie Rods	Tie Rod Size	P-6 Cylinder Torque Ft. Lbs.	H-6 Cylinder Torque Ft. Lbs.
1½	4	¼	3	7
2	4	5/16	7	14
2½	4	5/16	7	14
3¼	4	⅜	15	30
4	4	⅜	15	30
5	4	½	30	60
6	4	½	30	60
8	4	⅝	60	150
10	4	¾	100	260
12	4	¾	100	260
14	4	⅞	170	400
16	8	1	260	600
18	8	1⅛	300	850
20	8	1¼	450	1000

TABLE B — VOLUME OF OIL PER 12" OF STROKE

Cyl. Bore	BLIND END DISPLACEMENT		ROD END DISPLACEMENT			
	Area (Sq. In.)	Gals./Foot of Stroke	Net Area (Sq. In.) with R Rod	Gals./Foot of Stroke	Net Area (Sq. In.) with HR Rod	Gals./Foot of Stroke
1½	1.767	.0918	1.460	.0758	.982	.0510
2	3.142	.1632	2.835	.1473	1.656	.0852
2½	4.909	.2550	4.602	.2390	2.503	.1301
3¼	8.296	.4309	7.511	.3902	5.154	.2700
4	12.566	.6528	11.781	.6120	7.658	.4010
5	19.635	1.020	18.850	.9792	10.014	.5210
6	28.274	1.468	26.789	1.392	15.708	.8201
8	50.266	2.611	48.781	2.534	26.507	1.380
10	78.540	4.080	76.135	3.956	54.780	2.850
12	113.10	5.918	109.96	5.712	89.337	4.640
14	153.94	7.997	149.04	7.309	130.178	6.760
16	201.06	10.444	196.16	10.190	178.302	9.260
18	254.47	13.219	244.85	12.715	230.709	11.980
20	314.16	16.320	301.60	15.667	291.400	15.140

TABLE B chart covers the smallest and the largest rod available per cylinder diameter. Intermediate rod end displacements can be calculated.

TABLE C — CYLINDER PUSH AND PULL FORCES

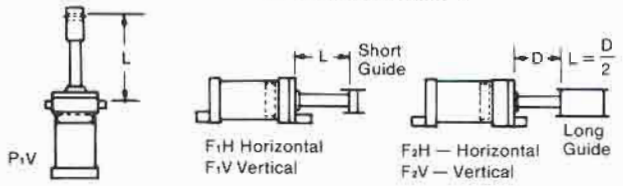
BORE	ROD	THEORETICAL FORCE @ FLUID PRESSURE									
		100	250	300	500	800	1000	1200	1500	2250	2500
1½	PUSH	176.7	441.8	530.1	883.5	1414	1767	2120	2650	3976	4418
	PULL — ⅝ ROD	146.0	365.0	438.0	730.0	1168	1460	1752	2190	3285	3650
	PULL — 1 ROD	98.0	245	294	490	783	980	1175	1470	2200	2450
2	PUSH	314.2	785.5	942.6	1571	2514	3142	3770	4713	7070	7855
	PULL — ⅝ ROD	283.5	708.7	850.5	1417	2268	2835	3402	4252	6379	7087
	PULL — 1⅜ ROD	165.6	414	496.8	828	1324.8	1656	1987.2	2484	3726	4140
2½	PUSH	490.9	1227	1473	2454	3927	4909	5891	7364	—	—
	PULL — ⅝ ROD	460.2	1150	1381	2301	3682	4602	5522	6903	—	—
	PULL — 1¾ ROD	250.3	625.8	751	1251	2002	2503	3004	3755	—	—
3¼	PUSH	829.6	2074	2489	4148	6637	8296	9955	12444	18670	—
	PULL — 1 ROD	751.1	1878	2253	3756	6009	7511	9013	11270	16900	—
	PULL — 2 ROD	515.4	1288	1546	2577	4123	5154	6185	7731	11596	—
4	PUSH	1257	3142	3770	6283	10050	12566	15079	18850	—	—
	PULL — 1 ROD	1178	2945	3534	5890	9425	11781	14137	17671	—	—
	PULL — 2½ ROD	765.7	1914	2297	3828	6126	7657	9189	11486	—	—
5	PUSH	1963	4908	5890	9817	15708	19635	23562	—	—	—
	PULL — 1 ROD	1885	4712	5655	9425	15080	18850	22620	—	—	—
	PULL — 3½ ROD	1001	2503	3004	5006	8011	10013	12016	—	—	—
6	PUSH	2827	7078	8482	14137	22619	28274	33928	—	—	—
	PULL — 1⅜ ROD	2679	6697	8037	13394	21431	26789	32147	—	—	—
	PULL — 4 ROD	1570	3926	4712	7853	12566	15707	18850	—	—	—
8	PUSH	5027	12566	15079	25133	40213	50266	—	—	—	—
	PULL — 1⅜ ROD	4878	12195	14634	24390	39025	48781	—	—	—	—
	PULL — 5½ ROD	2650	6626	7952	13253	21205	26507	—	—	—	—
10	PUSH	7854	19635	23562	39270	62832	—	—	—	—	—
	PULL — 1¾ ROD	7614	19034	22840	38068	60908	—	—	—	—	—
	PULL — 5½ ROD	5478	13695	16434	27390	43825	—	—	—	—	—
12	PUSH	11130	28275	33930	56550	90480	—	—	—	—	—
	PULL — 2 ROD	10995	27486	32985	54975	87948	—	—	—	—	—
	PULL — 5½ ROD	8933	22334	26801	44670	71471	—	—	—	—	—
14	PUSH	15394	38485	46182	76970	123152	—	—	—	—	—
	PULL — 2½ ROD	14900	37250	44700	74500	119232	—	—	—	—	—
	PULL — 5½ ROD	13018	32545	39054	65090	104152	—	—	—	—	—
16	PUSH	20106	50265	60318	100530	—	—	—	—	—	—
	PULL — 2½ ROD	19616	49040	58480	98080	—	—	—	—	—	—
	PULL — 5½ ROD	17730	44325	53190	88650	—	—	—	—	—	—
18	PUSH	25447	63617	76341	127235	—	—	—	—	—	—
	PULL — 3½ ROD	24485	61213	73445	122425	—	—	—	—	—	—
	PULL — 5½ ROD	23072	57680	69216	115360	—	—	—	—	—	—
20	PUSH	31416	78640	94248	157080	—	—	—	—	—	—
	PULL — 4 ROD	30160	75400	90480	150800	—	—	—	—	—	—
	PULL — 5½ ROD	29041	72603	87123	145205	—	—	—	—	—	—

TABLE C chart covers the smallest and the largest rod available per cylinder diameter. Intermediate rod pull force can be calculated.

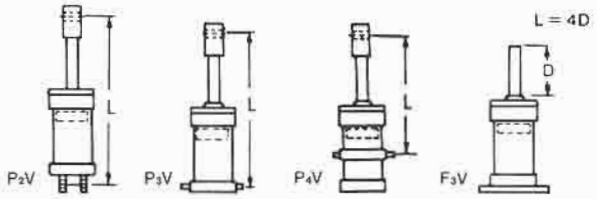
ENGINEERING DATA

INFORMATION TO PREVENT EXCESSIVE BEARING WEAR AND PISTON ROD COLUMN FAILURES

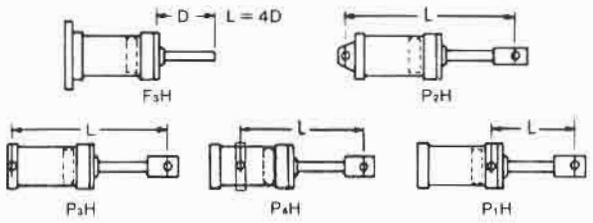
GROUP A — With piston rods extended.



GROUP B — To be checked for buckling or jack-knifing with piston rods extended and vertically mounted.



GROUP C — To be checked for load on bearing with piston rods extended and horizontally mounted.



STEP 1 – Find drawing in one of three groups above that fits your cylinder application, and follow instructions listed for that group.

Instructions: Stop tubes are used on log push stroke cylinders to prevent jack-knifing or buckling. They are placed between the piston and cylinder head to restrict the extended position of the piston rod so that the lengthened space between piston and bushing provides additional piston rod guide support.
The best choice for a cylinder with an exceptionally long stop tube requirement is the DOUBLE PISTON WITH SPACER. Note that the piston effective bearing area is doubled in addition to gaining the normal increased minimum distance between bearing points.

To determine whether a stop tube is required on a push stroke cylinder, proceed as follows:

a. Using above drawings, determine value of "L" from stroke length, rod and cylinder dimensions.
b. Refer to Table 1 for stop tube recommendation. A cylinder having an "L" value 45 requires a minimum of 1" stop tube and a maximum of 5" stop tube. Specifications for more than the maximum stop tube will usually adversely increase the cylinder weight.

Example: In a P_2V type application requiring 32" of stroke, "L" = 32" + 32" + approximately 10" for head and cap thickness = 74". A stop tube 4" long is required. (when a fraction of an inch of stop tube is calculated, use the next full inch.) Adjusted value of "L" is 74" + 4" or 78". Use of up to 8" of stop tube will further reduce bearing loads.

Instructions: Stop tubing is recommended for reducing piston and bushing/bearing loads on long stroke cylinders of the types shown. To determine length of stop tube required for this type of application, resolve the turning moments and loads between the piston and rod bushing. Include the weight of the fluid especially on large bore cylinders. It is ideal to keep projected bearing area loads lower than 200 PSI.

Caution: Do not use oversize rods to lessen bearing loads. Stop tubes are more economical and effective; oversize rods are heavier, cost more than stop tubing and if misalignment occurs, bearing loads are considerably increased due to stiffness of the oversize rod.

If your drawing is F_3H, P_2H, P_3H, or P_4H, in Group C, check for stop tube requirements from instructions in Group B.

Use whichever stop tube is longer. Determine value of "L" and proceed to Step 2.

STEP 2 – Find Rod Diameter for Column Strength.

Standard diameter piston rods are recommended on all installations except where column strength, piston rod sag, or return rate of hydraulic cylinders requires larger diameter rods.

Bushing/bearing loads caused by unavoidable misalignment are minimized when piston rods of correct diameter instead of unnecessarily large diameter piston rods are used. Correct (usually standard) piston rod diameters decrease and absorb shock loads to a greater extend than unnecessarily large oversize rods.

To determine the minimum piston rod diameter on push stroke cylinders:

a. Determine your push stroke thrust from table on page 35.
b. Find your push stroke thrust "T" in Table 2. If exact thrust isn't shown, use next larger shown.
c. In the horizontal column in line with your thrust, find value of "L" determined in Step 1.
d. Find minimum piston rod diameter required by following the same vertical line where your value of "L" is located, toward the top of the table.

TABLE 1

"L" INCHES	MINIMUM STOP TUBE LENGTH (INCHES)	*MAXIMUM STOP TUBE LENGTH (INCHES)	"L" INCHES	MINIMUM STOP TUBE LENGTH (INCHES)	*MAXIMUM STOP TUBE LENGTH (INCHES)
5-10		1	161-170	13	17
11-20		2	171-180	14	18
21-30		3	181-190	15	19
31-40		4	191-200	16	20
41-50	1	5	201-210	17	21
51-60	2	6	211-220	18	22
61-70	3	7	221-230	19	23
71-80	4	8	231-240	20	24
81-90	5	9	241-250	21	25
91-100	6	10	251-260	22	26
101-110	7	11	261-270	23	27
111-120	8	12	271-280	24	28
121-130	9	13	281-290	25	29
131-140	10	14	291-300	26	30
141-150	11	15	301-310	27	31
151-160	12	16			

***NOTE:** USING STOP TUBE LENGTHS GREATER THAN "MAXIMUM STOP TUBE" HAS DIMINISHING EFFECT ON REDUCING BEARING LOADS.

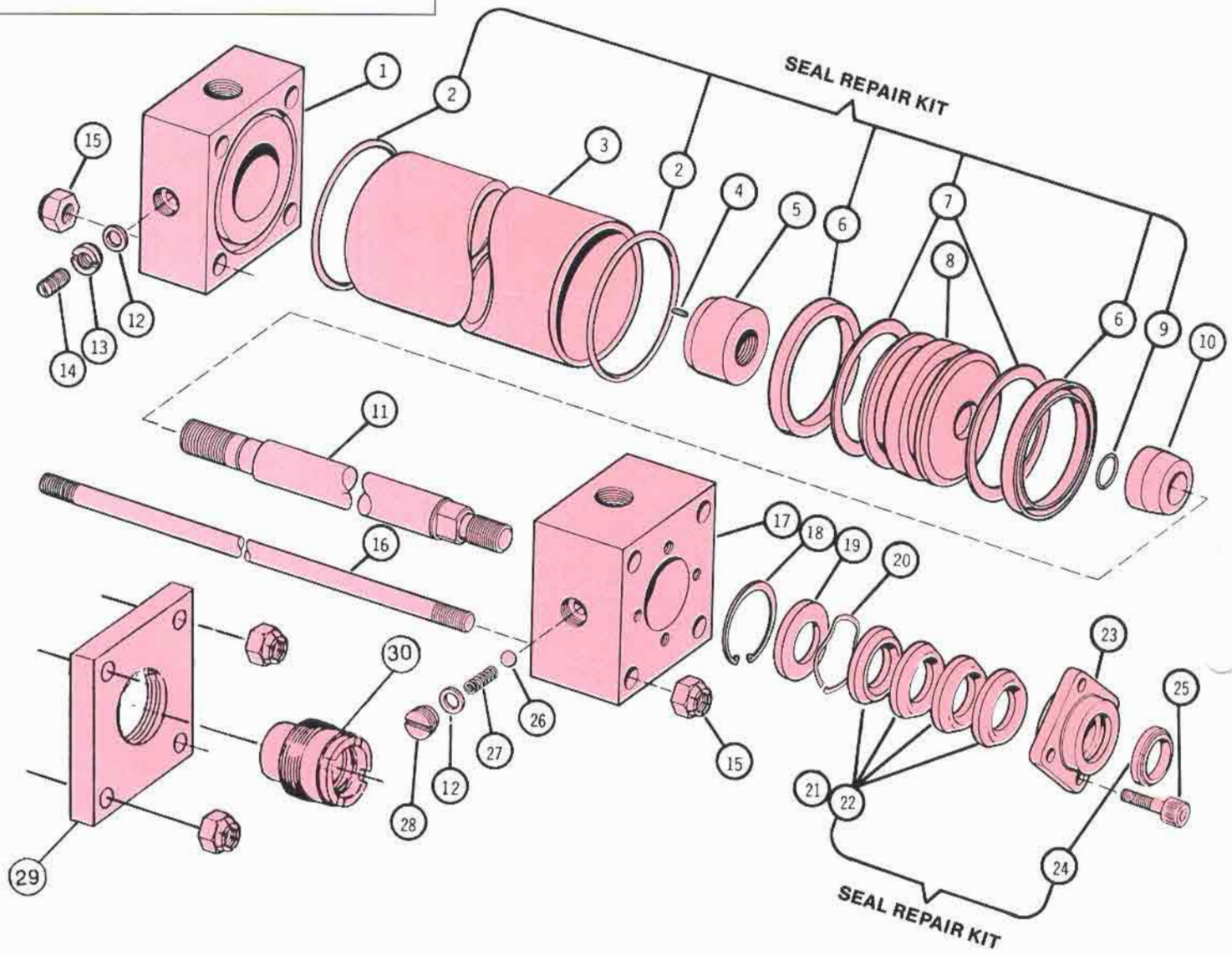
TABLE 2
VALUE OF "L" IN INCHES

Axial Thrust "T" Against Rod End in Lbs. Force	MINIMUM PISTON ROD DIAMETER											
	0.63	1.00	1.38	1.75	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50
50	67											
100	59	110										
150	53	103										
250	43	94										
400	37	83	134	186								
700	30	68	118	168	202	275						
1,000	27	60	105	155	190	257						
1,400	24	53	92	142	174	244	308	385				
1,800	23	48	82	127	160	230	294	366	440			
2,400	19	45	75	114	145	213	281	347	415	488		
3,200	16	41	67	103	130	194	262	329	400	461		
4,000	13	38	63	94	119	175	240	310	378	446		
5,000	9	34	60	87	110	163	225	289	360	426	494	
6,000		30	56	82	102	152	209	274	342	411	476	
8,000		26	50	76	93	137	186	245	310	375	447	
10,000		21	45	70	89	125	172	222	279	349	412	482
12,000		17	41	65	84	118	155	210	269	326	388	455
16,000			34	57	75	110	141	188	235	291	350	421
20,000			28	52	68	103	136	172	218	270	326	384
30,000				39	55	87	120	156	189	232	285	330
40,000				22	43	74	108	142	177	210	248	294
50,000					30	66	97	130	165	201	234	269
60,000						57	88	119	154	190	225	256
80,000						36	71	104	137	170	204	240
100,000							56	90	120	154	189	224
120,000							45	77	108	140	175	207
140,000								64	98	129	160	194
160,000								47	86	118	148	182
200,000									67	98	131	160
250,000										72	109	143
300,000											86	120
350,000											52	100
400,000												71

Values of "L" less than those shown have a slenderness ratio (length ÷ radius of gyration which is length ÷ ¼ diameter of piston rod) of less than 50. Thus, the compressive strength formula (s = thrust ÷ rod area) is used rather than the column strength formula on which Table 2 is based. For very low slenderness ratios (below 20), compressive strength formulae with a 2 to 1 factor of safety are satisfactory. For slenderness ratios between 20 and 50, use compressive strength formulae with proportionate factors between 2 to 1 and 5 to 1.

IMPROVED CUSHION ADJUSTMENT —
Newly designed needle valve is interchangeable with current design and offers improved sealing characteristics.

REPLACEMENT PARTS



1. Blind end head
2. Tube seal★
3. Tube
4. Lock screw
5. Lock sleeve ▲
6. U-cup★
7. Back-up ring★
8. Piston
9. Piston O-ring★
10. Cushion sleeve – rod end
11. Piston rod
12. Seal
13. Cushion adjusting screw gland
14. Cushion adjusting screw
15. Tie rod nut
16. Tie rod
17. Rod end head
18. Snap ring
19. Packing spacer
20. Wave spring★
21. Bottom adapter ring★☆
22. Rod packing★
23. Packing gland
24. Rod wiper★
25. Packing gland cap screw
26. Check ball
27. Ball check spring
28. Ball check plug

IF APPLICABLE:
29. Head Plate
30. Screw Gland

★ Items are included in seal repair kits. See page 5 for ordering information.
☆ Item 21 is metallic for high temp. applications.
Note: Head and Screw Gland Option Available in all Models except DG (ME-3)
▲ Use lock nut or threaded piston on 1.50"-8.00" bore with or without cushion, or cushion nose.

When ordering replacement parts be sure to specify:

- Part by name and item number
- Bore, stroke and mounting
- Serial number shown on Nopak label

NOTE: Isometric view of DOUBLE ROD cylinders available at N/C. Consult factory or our authorized distributor.

REPLACEMENT PARTS

REPAIR KITS

CLASS P6
CLASS H6

For Current Design Cylinders
Manufactured After March 1982

ROD KITS

SINGLE ROD *	
ROD DIA.	PART NO.•
0.63"	RK6-63
1.00"	RK6-100
1.38"	RK6-138
1.75"	RK6-175
2.00"	RK6-200
2.50"	RK6-250
3.00"	RK6-300
3.50"	RK6-350
4.00"	RK6-400
4.50"	RK6-450
5.00"	RK6-500
5.50"	RK6-550

Each Rod Kit consists of:

1 - "V" ring rod packing
1 - Rod wiper
1 - Wave spring

* To service DOUBLE ROD END CYLINDER, order one Rod Kit for EACH rod end, and if applicable, one Piston Kit.

PISTON KITS

SINGLE OR DOUBLE ROD	
BORE SIZE	PART NO.•
1.50"	PK6-150
2.00"	PK6-200
2.50"	PK6-250
3.25"	PK6-325
4.00"	PK6-400
5.00"	PK6-500
6.00"	PK6-600
8.00"	PK6-800
10.00"	PK6-1000
12.00"	PK6-1200
14.00"	PK6-1400

Each Piston Kit consists of:

2 - Tube "O" rings
2 - Piston U-cups
2 - Back-up washers
1 - Piston "O" ring

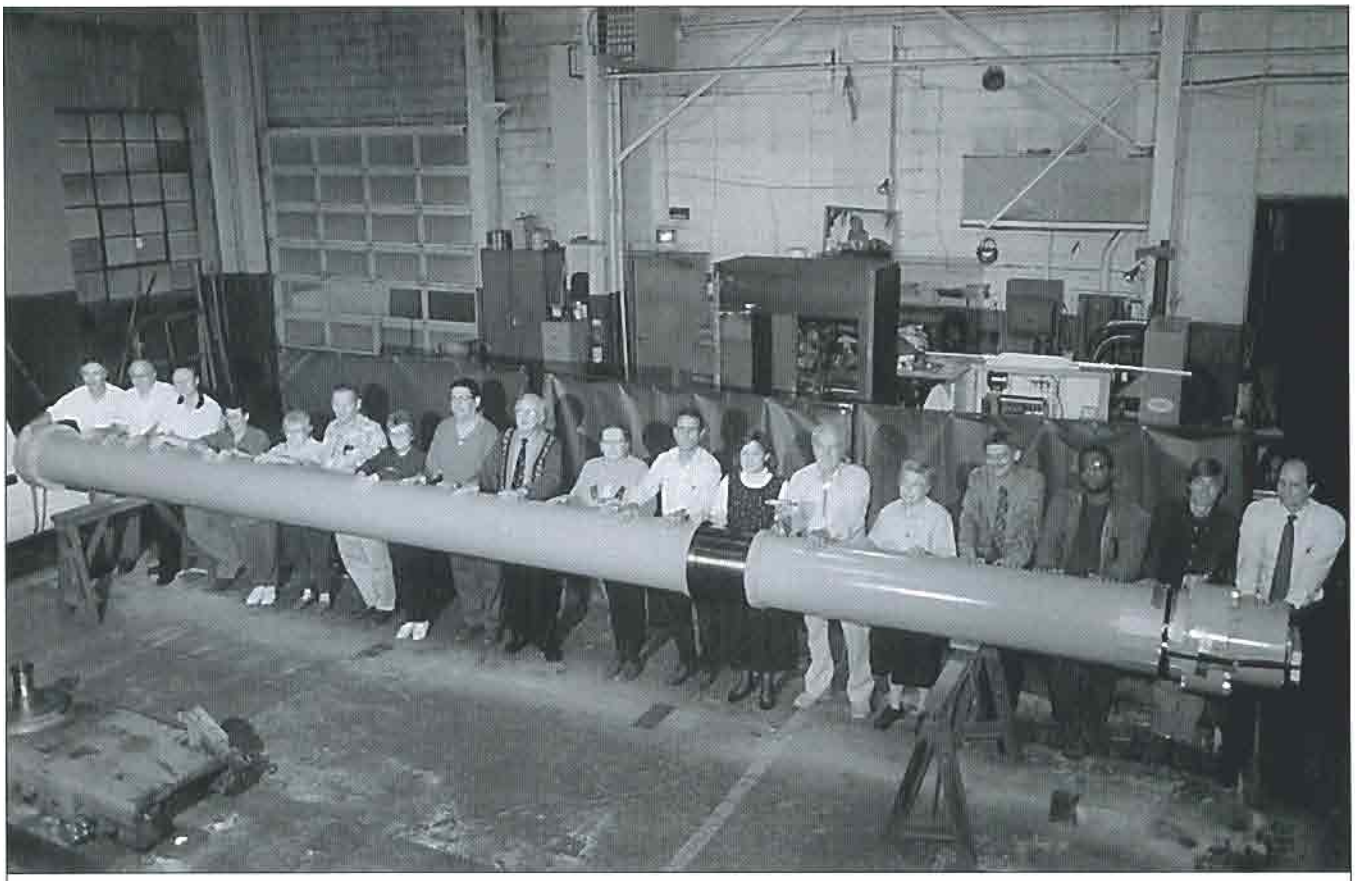
• **When ordering, specify Type "A" or Type "B" seals.**
Type "A" = Buna-N (NITRILE)
Type "B" = Viton

PACKING GLANDS

CLASS P6 and H6

ROD DIA.	ALL MODELS EXCEPT D & DD ②	MODELS D & DD ONLY
	PART NUMBER	PART NUMBER
0.63" ①	1069G70	1071G70
1.00" ①	1068G73	2859G73
1.38" ①	1066G75	2858G75
1.75" ①	1067G77	2857G77
2.00" ①	1065G78	2856G78
2.50" ①	1064G79	2855G79
3.00"	1063G81	2854G81
3.50" ①	1062G82	2853G82
4.00" ①	1061G83	2852G83
4.50"	1060G84	2851G84
5.00"	1070G85	2850G85
5.50"	1059G86	C/F

① Use pkg. gland 1071G70 for 1.50" cyl. w/ 0.63" Ø rod.
Use pkg. gland 2859G73 for 1.50" & 2.00" cyls. w/ 1.00" Ø rod.
Use pkg. gland 2858G75 for 2.00" cyl. w/ 1.38" Ø rod.
Use pkg. gland 2857G77 for 2.50" cyl. w/ 1.75" Ø rod.
Use pkg. gland 2856G78 for 3.25" cyl. w/ 2.00" Ø rod.
Use pkg. gland 2855G79 for 4.00" cyl. w/ 2.50" Ø rod.
Use pkg. gland 2853G82 for 5.00" cyl. w/ 3.50" Ø rod.
Use pkg. gland 2852G83 for 6.00" cyl. w/ 4.00" Ø rod.
② For Models AL, T, and TR, consult factory.



Above: 14" bore x 300" stroke cylinder with hollow piston rod and mid trunnion mount. Designed and manufactured by Galland Henning Nopak in 1999. Now in service in dredge duty in one of the world's largest canals. Request Catalog HCM for information.

WARRANTY

GALLAND HENNING NOPAK, INC. warrants every product of its manufacture to be of proper materials and first class workmanship. We agree to repair or replace, F.O.B. Factory, but not to remove or install in the field, any perishable "soft goods" such as seals, gaskets, etc., which fail within a six-month period after shipment, normal wear excepted. We warrant for one year from date of shipment, all other parts which fail because of defective materials or workmanship. GHN assumes no responsibility for work done or expenses incurred, in the field, pertaining to such repairs or replacements, except upon written authority from our home office. Components not produced by GHN are subject only to the warranty extended to GHN by their respective manufacturer. For a complete statement of terms and warranty, see your NOPAK distributor or the reverse side of any GHN invoice.

When orders have been correctly filled, there shall be no returns without GHN's approval. Such returns will be subject to a restocking charge.

PREFERRED NOPAK DISTRIBUTOR

NATIONAL FLUID POWER ASSOCIATION MEMBER

GALLAND HENNING NOPAK, Inc.

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