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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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

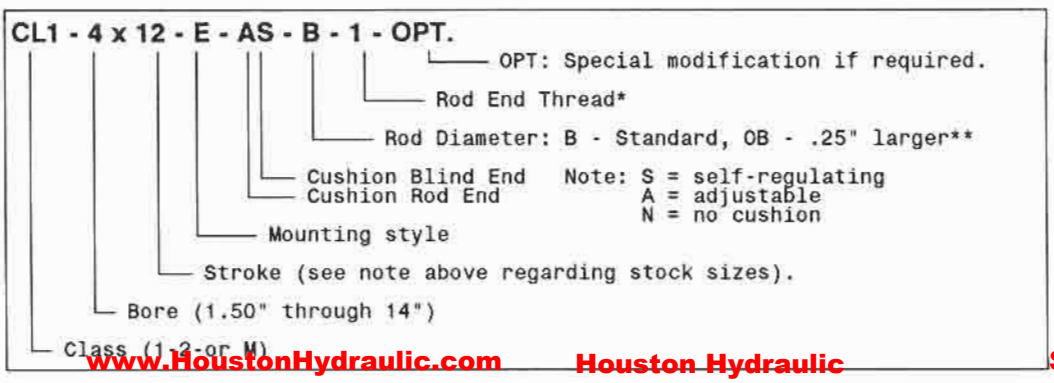
All orders should include the following information:
1. Class of cylinder (1-2- or M).
2. Bore or cylinder diameter size.
3. Stroke length in inches.
4. *Nopak model.*
5. Type of cushioning.
6. Piston rod diameter, B or OB, and type of rod end threading as 1, 2, 3 or special.
7. Operating medium (air,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

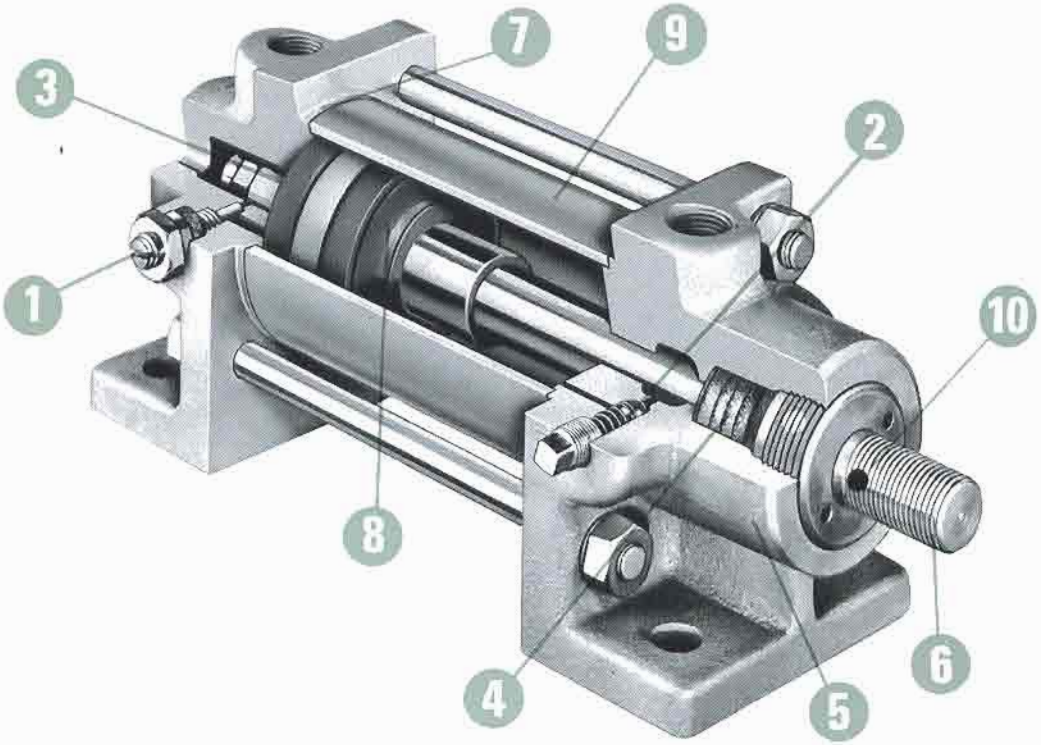


* See respective model charts for details.

** 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

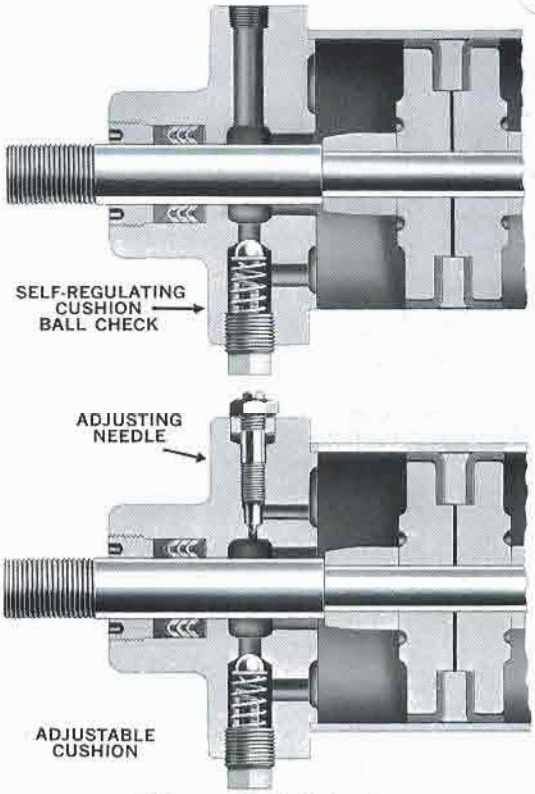
(CLASSES 1 - 2 and M)

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.

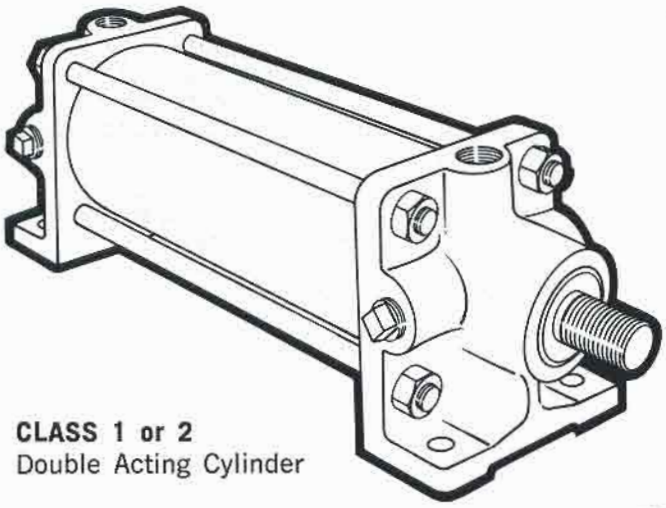
Piston Ring Type:
This type may be specified in low or high hydraulic pressure, honed steel tubing cylinder. Three multiple seal lapped piston rings are precision fitted into the grooves of the cast iron piston. Rings and piston are cast iron for oil; bronze for water.

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

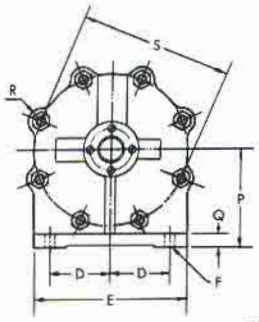
MODEL A



CLASS 1 or 2
Double Acting Cylinder

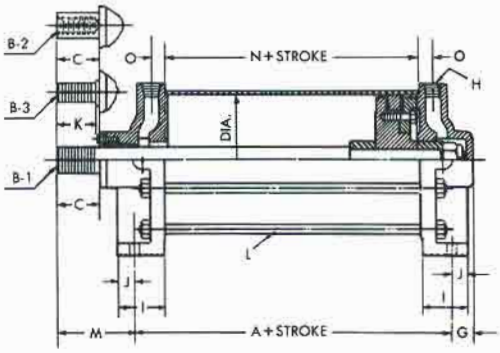
PARALLEL BASE MOUNTING

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	1⅝	3⅞	17/32	¾	⅜	2⅛	⅝	1⅛	4-⅜	2⅝	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 3/16	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.

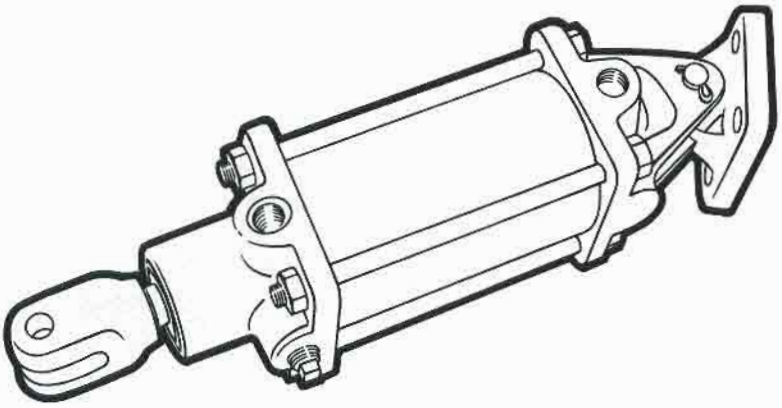
FOR 16" DIAMETER, AND LARGER, REFER TO CATALOG NO. 106.

NOPAK
MODEL E

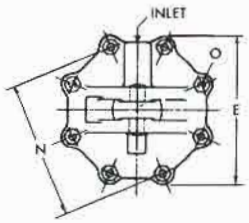
CLEVIS MOUNTING*

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.*

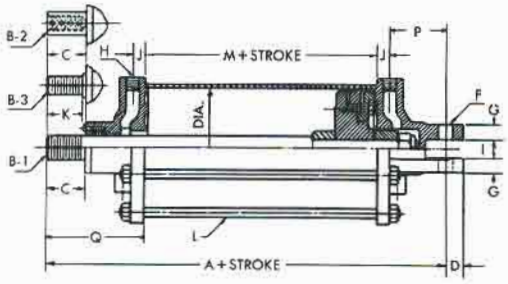


CLASS 1 or 2
Double Acting Cylinder



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

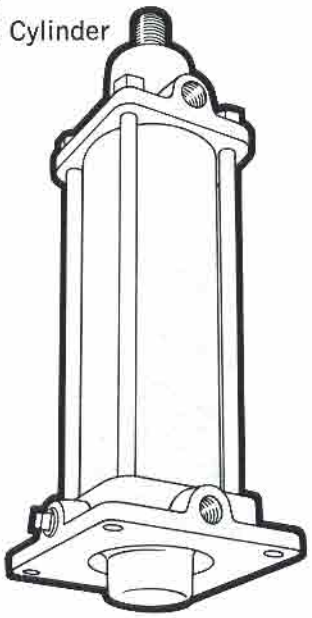
Bore	A	Rod* Dia.	B-1*	B-2*	B-3*	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1½	6¾	⅝	⅝-18	½-20	⅜-24	1⅛	½	2¾	⅜	⅜	¼	½	⅝	⅞	4-5/16	1⅜	2⅝	⅜	1½	3¼
2	7¼	⅝	⅝-18	½-20	½-20	1⅛	⅝	3	½	½	¼	½	⅝	⅞	4-5/16	1⅜	2⅞	½	2	3¼
2½	8⅝	¾	¾-16	½-20	½-20	1⅜	⅝	3½	½	½	⅜	½	⅝	1⅛	4-⅜	1¾	3½	½	2⅛	4⅛
3	8⅞	¾	¾-16	½-20	⅝-18	1⅜	⅝	3¾	½	½	⅜	½	¾	1⅛	4-⅜	1¾	3⅞	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

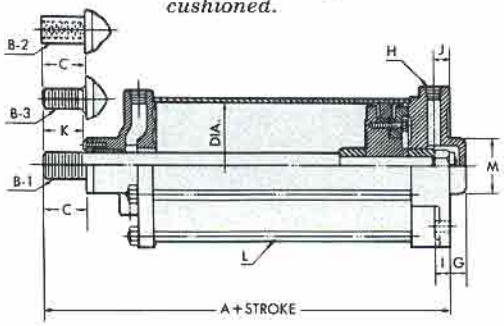
CLASS 1 or 2
Double Acting Cylinder

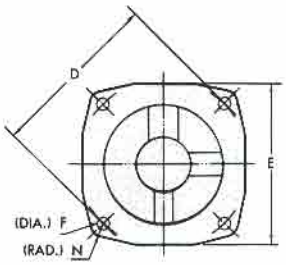


RIGHT ANGLE FLAT BASE MOUNTING – BLANK END

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.*





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

FOR FURTHER DETAIL SEE PAGE 14.

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

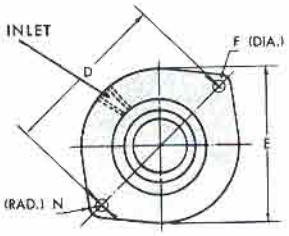


TABLE OF DIMENSIONS – MODEL C – CLASS 1 or 2

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.

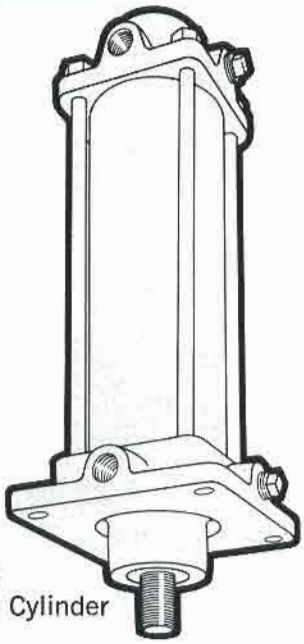
FOR 16" DIAMETER, AND LARGER, REFER TO CATALOG NO. 106.

NOPAK

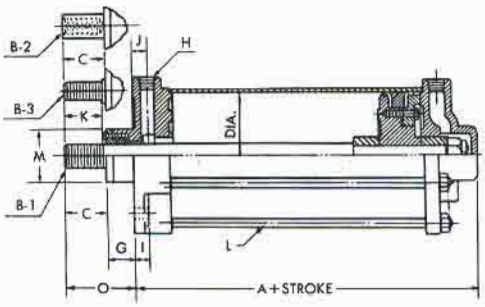
MODEL D

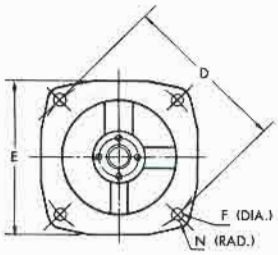
RIGHT ANGLE FLAT BASE MOUNTING – ROD END

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.

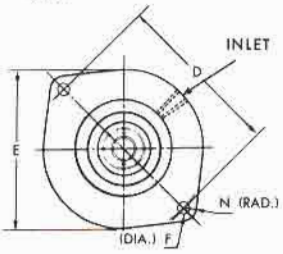


TABLE OF DIMENSIONS – MODEL D – CLASS 1 or 2

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

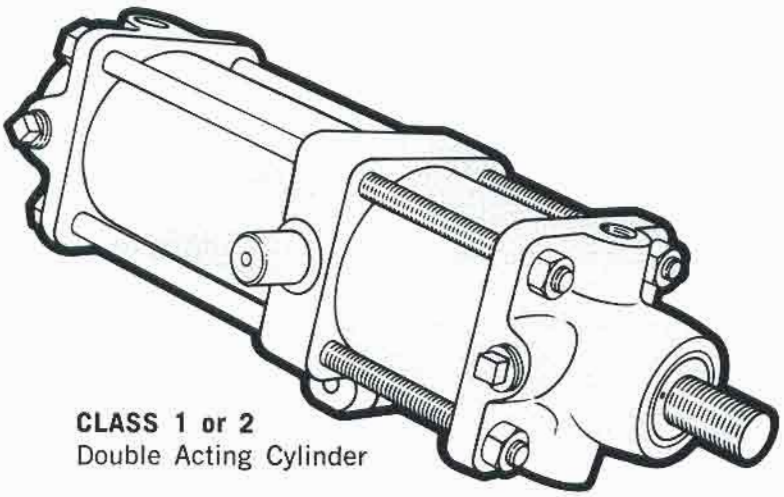
*A ¼" oversize rod (OB), standard in the 8" bore size, can be furnished using standard head castings. Rod end extension and related dimensions will therefore vary accordingly. See table, page 11. Dimensions shown in this catalog may be altered without notice.

†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

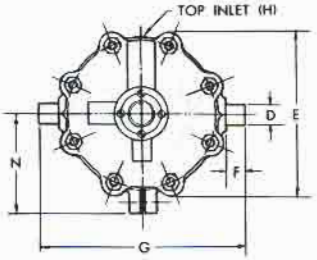
Model F available without trunnion — designated as Model H.



CLASS 1 or 2
Double Acting Cylinder

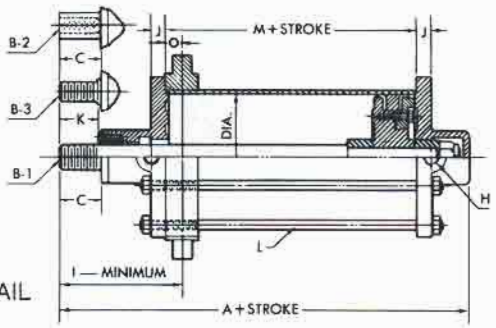
TRUNNION MOUNTING

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

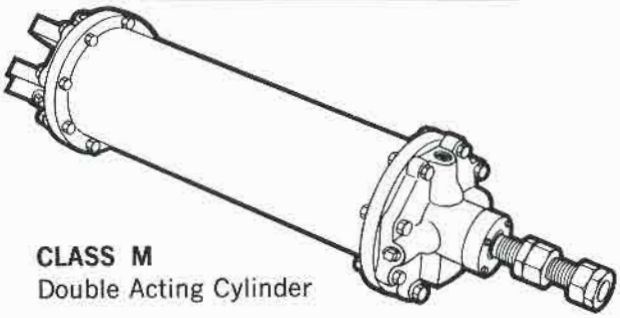
Bore	A	Rod* Dia.	B-1*	B-2*	B-3*	C	D	E	F	G	H	I†	J	K	L	M	N	O
1½	6⅛	⅝	⅝-18	½-20	⅜-24	1⅛	⅝	2¾	⅝	4	¼	3¾	⅝	⅞	4-5/16	1⅜	2 3/16	½
2	6½	⅝	⅝-18	½-20	½-20	1⅛	⅝	3	¾	4⅝	¼	3¾	⅝	⅞	4-5/16	1⅜	2⅜	½
2½	7⅞	¾	¾-16	½-20	½-20	1⅜	¾	3½	1	5¾	⅜	4¾	⅝	1⅛	4-⅜	1¾	2⅞	⅝
3	8⅛	¾	¾-16	½-20	⅝-18	1⅜	¾	3⅞	1⅛	6½	⅜	4¾	¾	1⅛	4-⅜	1¾	3 1/16	⅝
4	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.

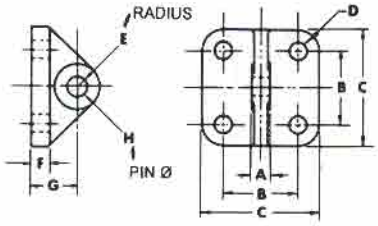
TIE-ROD (OR SOCKET HEAD CAP SCREWS ON CLASS M) TORQUE VALUES

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.

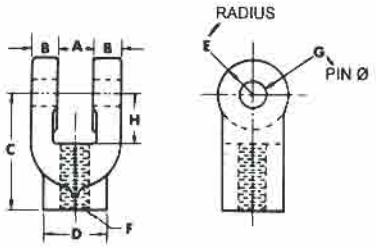
STANDARD FEMALE CLEVIS AND PIN

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.

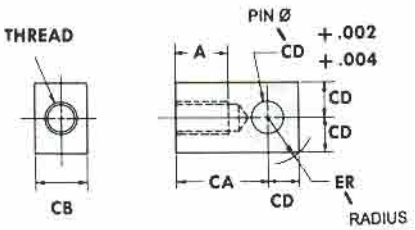
††1-1/2-12 thread clevis 7286L07 (4334CY) available. Dimensions on 1791L07 (18510CY) apply.



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

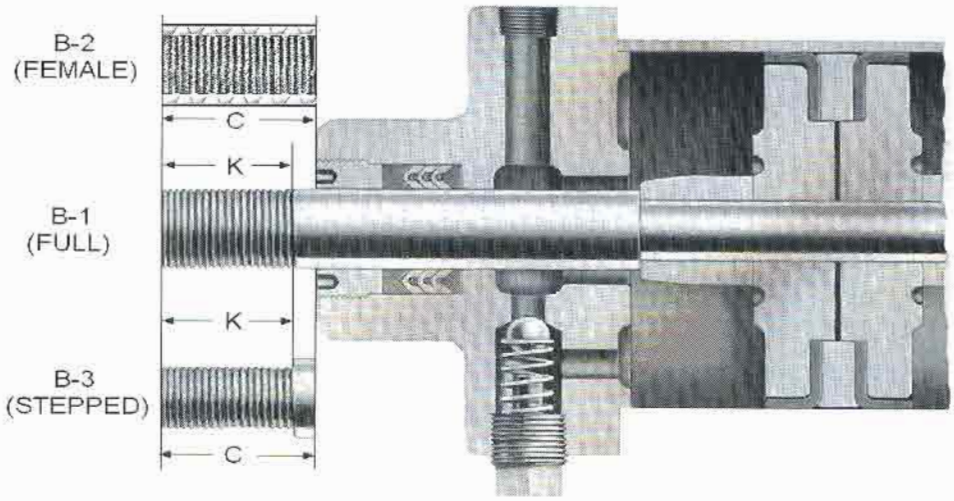
THREAD	A	CA	CB	CD	ER	ROD EYE		PIN	
						FORMER P/N	CURRENT P/N	FORMER P/N	CURRENT P/N
5/8-18	7/8	1-5/8	1	1/2	3/4	21789CY	1811L59	3253CY-3	3221L46-3
3/4-16	1-1/8	2-1/16	1-1/4	3/4	1-1/16	7061CY	1812L59	3253CY-4	3221L46-4
1-14	1-5/8	2-13/16	1-1/2	1	1-7/16	7062CY	1813L59	3253CY-6	3221L46-6
1-1/4-12	2	3-7/16	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.

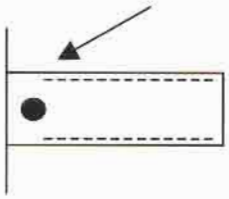
ROD END DETAIL

PISTON ROD & THREAD INFORMATION:



NEW:

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



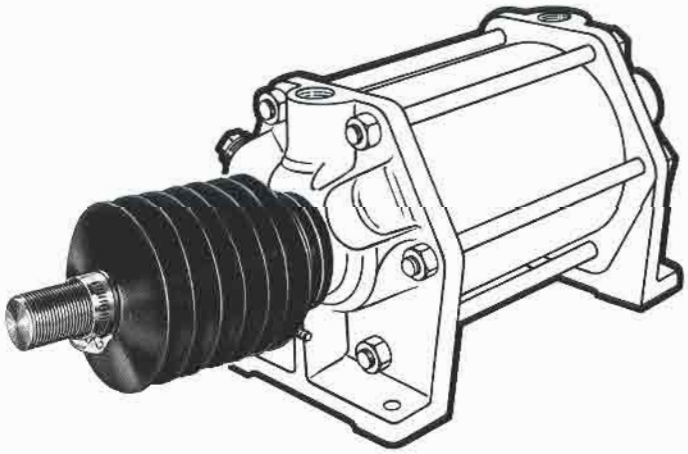
Dim. C = Distance from gland face to rod end.
Dim. K = Thread length, male or female.

PISTON ROD BOOTS

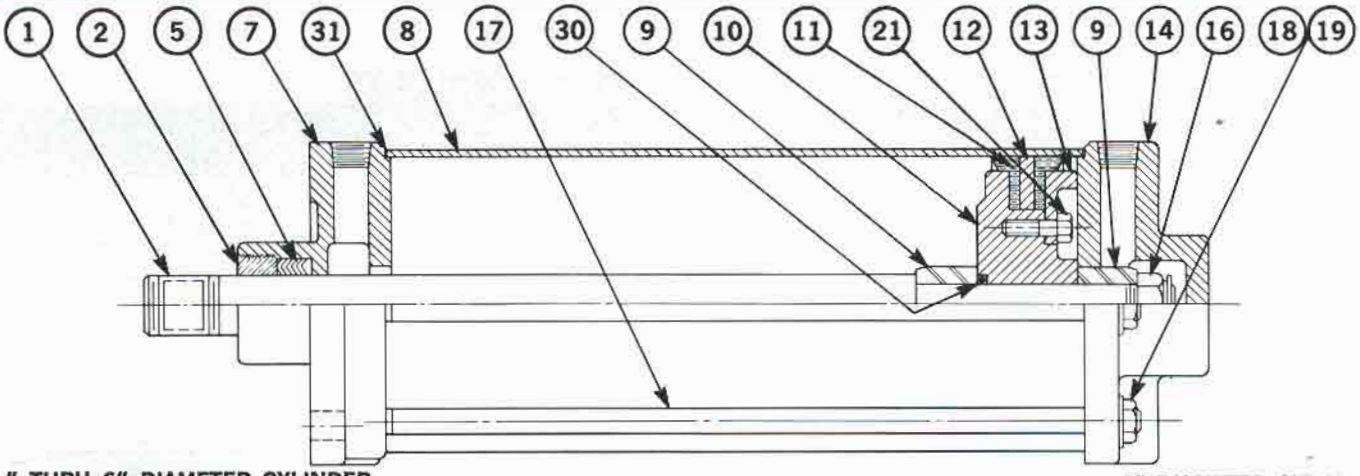
For All Classes of NOPAK Cylinders

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.

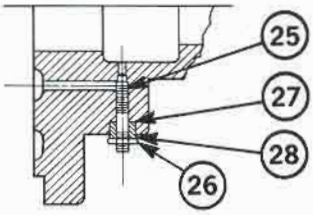


NOPAK CAST HEAD CYLINDER PARTS LIST

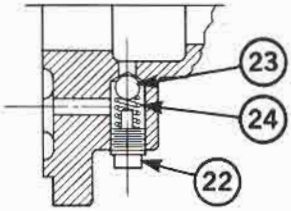


1½" THRU 6" DIAMETER CYLINDER ROD SEAL ASSEMBLY

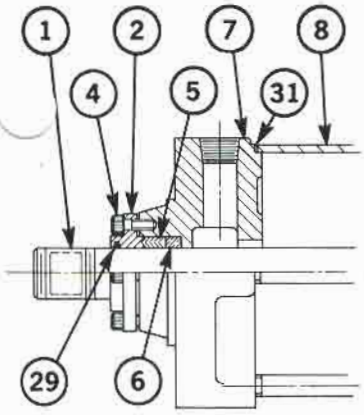
6" DIAMETER CYLINDER PISTON ASSEMBLY



ADJUSTABLE NEEDLE VALVE



BALL CHECK VALVE

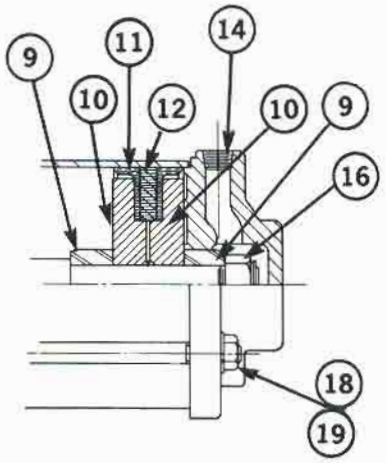


8" DIAMETER CYLINDER ROD SEAL ASSEMBLY

PARTS ORDER INFORMATION

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

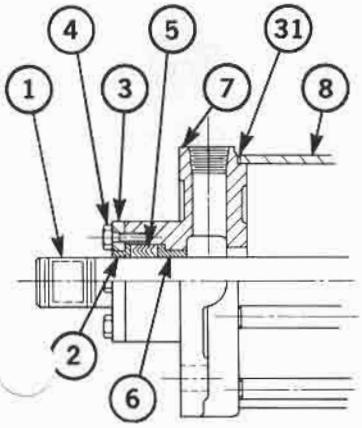
1. Identify part by name and item number;
2. Diameter of cylinder;
3. Model of cylinder;
4. Serial number on NOPAK cylinder label.



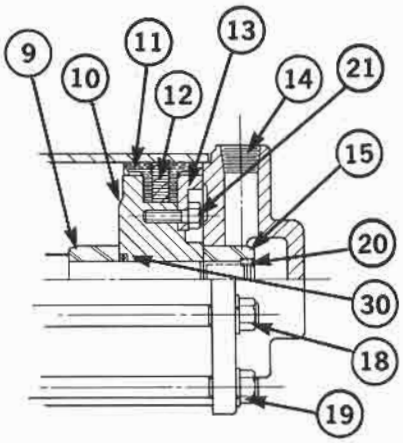
1½" THRU 5" DIAMETER CYLINDER PISTON ASSEMBLY

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

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.

National FLUID POWER Association MEMBER

"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

GALLAND HENNING NOPAK, Inc.

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