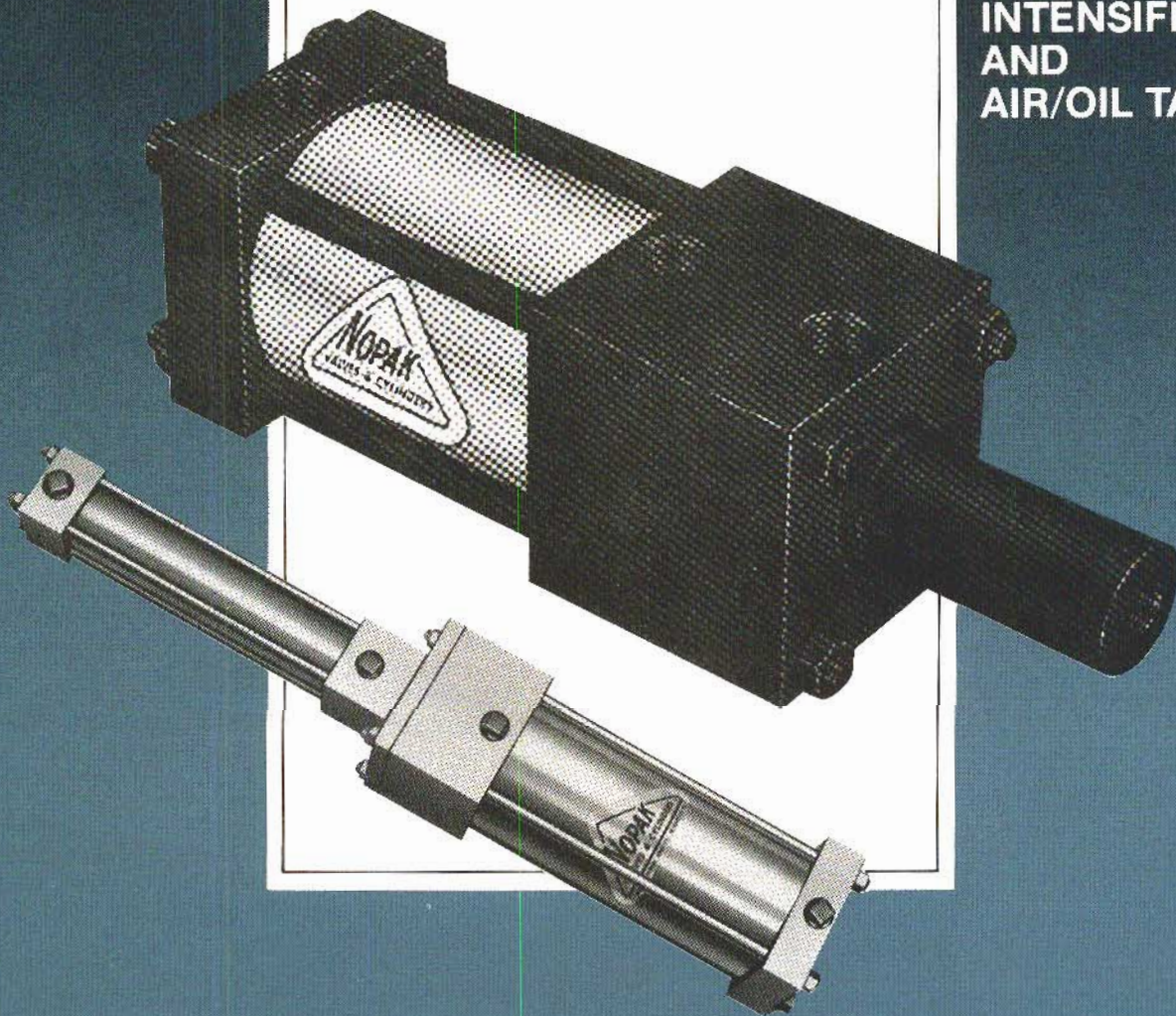


NOPAK[®]

CATALOG 110

BOOSTER
INTENSIFIERS
AND
AIR/OIL TANKS



www.nopak.com • email: sales@nopak.com

GALLAND HENNING NOPAK, Inc.

www.HoustonHydraulic.com with 40th St. Houston, Texas 77002 • Sales@HouHyd.com

P.O. Box 343917 Milwaukee, Wisconsin 53234

PHONE: 414-645-6000 • FAX: 414-645-6048

NOPAK Booster Bits

RAM-TYPE BOOSTERS

A Booster is a device used to convert low pressure shop air to an intensified hydraulic pressure. This is accomplished by applying low pressure air to the full piston area of the low pressure side of the booster. This intensified force is transferred by means of a ram to the high pressure side of the booster. Intensification of pressure is based on the ratio in square inches between the low pressure piston and the high pressure ram.

This method of intensification eliminates costly hydraulic pumps or power pack units. It must be stated that a booster intensifier total output power is limited so that rapid cycling of a booster-cylinder combination is not feasible. Only applications where intermittent high pressure hydraulics required for a limited operation can be achieved with the booster intensifier. The unlimited bore-ram ratios makes the booster a versatile customized device. Whether your requirements are in the low, medium or high pressure range, there is a **Nopak** booster available for your application.

PISTON TYPE BOOSTERS

This type of booster can also be used as an accumulator depending on its location in the circuit. The operating principle is the same as the ram type booster except that intensification in the output cylinder is transmitted to the full area of a piston instead of the ram. The basic assembly consists of two cylinders connected as a unit using a common ram to transfer thrust from the input side of the booster. Parts for both cylinders are standard inventory for Nopak's Class 6 air or medium pressure hydraulic cylinder. The output cylinder is a Nopak Class 3 high pressure hydraulic cylinder. Connection of both cylinders is accomplished by means of an adapter plate. The availability and standardization of adaptable parts makes the NB-3 booster economically priced with faster delivery time. Our engineering personnel can aid and advise you with your booster selection or special applications.

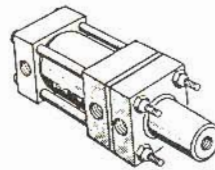
BOOSTERS WITH AIR-OIL TANK COMBINATIONS

The assembly of the air-oil tank to the booster as an integral unit will benefit users with less space required in the circuit and a savings on installation time. Tanks are mounted on the booster with a common plate and tie rods. Tanks are selected with the same diameter bore as the booster. The mounting of the booster must be in a vertical position because of the air over oil function of the tank. Ordering of this unit requires adding "T" (for tank) to booster code combinations. Example of Nopak standard boosters are

NBT-3
NBST-5
NBDT-5

See Page 14 and 15 for air-oil tanks mounted separately in booster circuit.

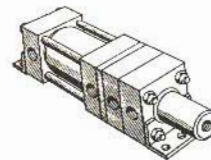
Index of selections



NOPAK NBS-5 SINGLE PRESSURE RAM TYPE BOOSTERS-5000 PSI

PAGE 4

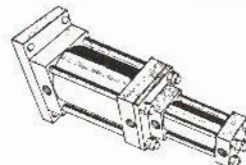
Single pressure boosters are used in applications where an intensified high pressure output is required throughout the full stroke of the work cylinder. Because of the singular ram seal, this type of booster is not self-bleeding or self-filling. Special care must be taken to bleed out air when filling or installing. The NBS-5 booster has an output pressure limitation of 5000 psi maximum.



NOPAK NBD-5 DUAL PRESSURE RAM TYPE BOOSTERS-5000 PSI

PAGE 6

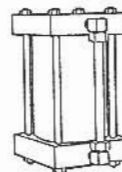
Dual pressure boosters are used in applications where low pressure is adequate for the approach stroke of the work cylinder and high pressure for the remainder of the stroke. The booster ram is only effective after entering the secondary seal of the high pressure side of booster. Therefore a smaller dual booster can be used to do the job that normally it would take for a larger single booster. This type of booster is self-bleeding and self-filling. No external bleed valving is required in inlet line. The NBD-5 booster has an output pressure limitation of 5000 psi maximum.



NOPAK NB-3 PISTON TYPE BOOSTER AND ACCUMULATOR-3000 PSI

PAGE 8

Single acting pressure boosters are used in applications where an intensified high pressure output is required throughout the full stroke of the work cylinder. Piston type boosters can be used in double acting-circuits as well. Intensification is accomplished by use of a piston instead of a ram in the output cylinder of the booster. This then makes the intensification area of the piston a factor in output computations. This type of unit can be used either as a booster or an accumulator, dependent on how it is located in the hydraulic circuit. The fact that it is assembled from stock inventory of available Class 3 and Class 6 components makes the booster economically priced. Modification of two components adapts the high pressure Class 3 to the low pressure Class 6 cylinder as a booster assembly. When applied as a booster, the unit is not self-bleeding, so provisions for this function must be made elsewhere in the hydraulic circuit. Use of stock parts makes the NB-3 booster pressure limitation at 3000 psi maximum.

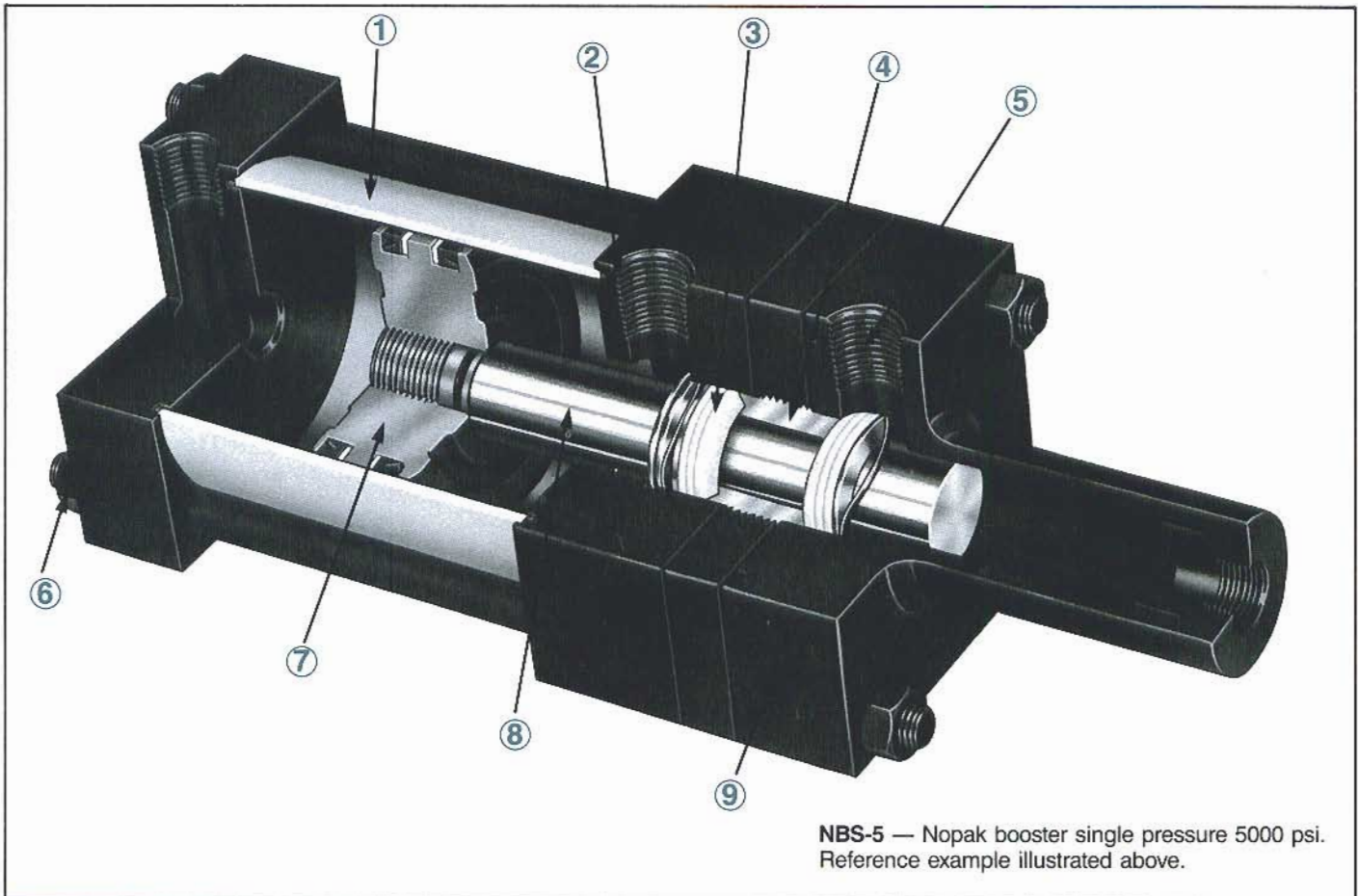


AIR-OIL TANKS

PAGE 14

Air-Oil Tanks offer a means of smooth hydraulic speed control of a cylinder from an air line source. In addition they may be used to prefill a circuit or for low pressure advance of a work cylinder.

NOPAK BOOSTER FEATURES

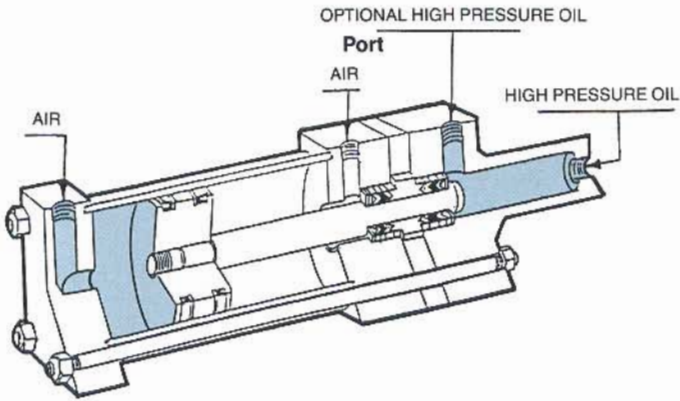


NBS-5 — Nopak booster single pressure 5000 psi.
Reference example illustrated above.

- 1 CYLINDER TUBING** — Hard coated aluminum, incorporating an extremely wear resistant surface, and low friction characteristics. Smooth bore steel tubing standard on H-6 hydraulic cylinders.
- 2 TUBE SEAL** — Positive Controlled Metal Squeeze on Pressure Sealed O-Ring.
- 3 ROD SEALS** — Are self compensating to pressure, multilip vee type packing. Specifically designed for high pressure sealing and minimum leakage.
- 4 ROD BEARING** — Long wearing type bronze is concentrically machined for accurate alignment insuring longer seal life.
- 5 PORTS** — Are machined as a SAE dry seal national pipe thread standard.
- 6 TIE RODS AND LOCKNUTS** — Tie rod material is an alloy steel for maximum strength. Nuts are of high strength steel material and designed for self locking.
- 7 PISTON ASSEMBLY** — A one piece piston, machined from high strength cast iron. Two u-cup seals are of the pressure compensating sealing type backed up by teflon non-extrusion washers.
- 8 PISTON ROD** is hard chrome plated stressproof steel, ground and polished, 125,000 tensile Rockwell 25C.
- 9 END CAPS AND RAM NOZZLE** — Accurately machined from high quality steel plate or bar stock.

NOPAK RAM-TYPE BOOSTERS

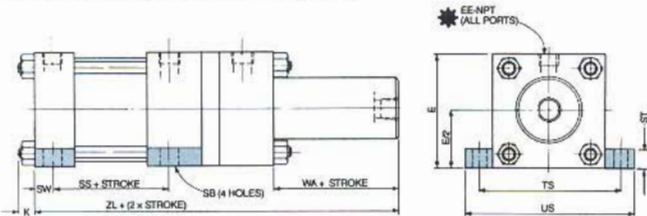
RAM-TYPE NBS-5 SINGLE PRESSURE BOOSTERS Provide Output Pressure Up To 5000 PSI



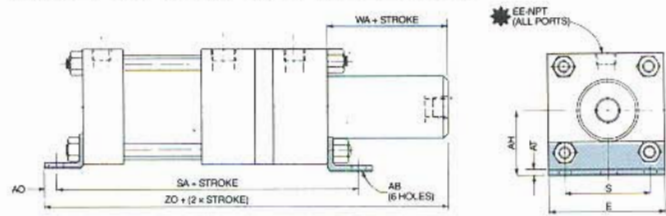
This type booster has a single ram seal so the entire stroke is of intensified high pressure.

Low pressure air is directed to the booster input cylinder port to the cylinder chamber. Making contact with the larger surface of the retracted piston forces the piston with ram, forward, to begin the cylinder stroke. Low pressure oil is intensified in the nozzle chamber by the ram end force created by the larger air piston pushing. The high pressure oil is forced out of the nozzle port into the work cylinder for a high pressure continuous stroke. Oil flows out and back in thru the nozzle port or can be piped in thru the optional port located in the nozzle head. Make up oil is provided from an external replenishing valve. The booster ratio of input and output pressure rated values are charted on page 12.

MODEL A (USA STD. MS2)

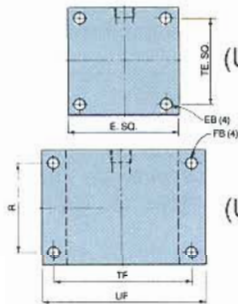


† MODEL AP (USA STD. STYLE MS1)

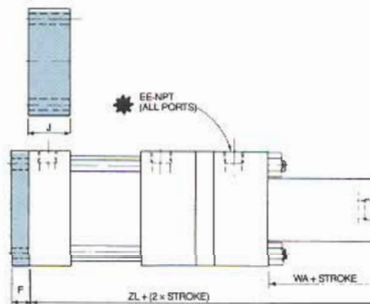


† FOR 2 1/2" DIA. THROUGH 5" DIA. BORE, THIS MODEL IS AVAILABLE FOR SMALL RAM DIA. ONLY.

MODEL CJ (USA STD. STYLE ME4) (8" THRU 14" DIA.)



MODEL C (USA STD. STYLE MF2) (2 1/2" THRU 6" DIA.)



MODEL TB (USA STD. STYLE MX2)



* Large unrestricted ports conforming to NFPA standards are provided. They can be rotated to any 90° position in relation to each other and the booster mounting.

† Dimension refers to bolt dia.

BORE DIA.	INPUT CYL. PSI		MOUNTING DIMENSIONS													
	AIR	HYD.	E	F	K	R	S	AA	†AB	AH	AO	AT	BB	DD	†EB	EE
2 1/2	250	1100	3	3/8	5/16	2.19	2 1/4	3.10	3/8	1 5/8	3/8	1/8	1 1/8	5/16-24	—	3/8
3 1/4	250	1350	3 3/4	5/8	7/16	2.76	2 3/4	4.00	1/2	2	1/2	1/8	1 3/8	7/16-20	—	1/2
4	250	950	4 1/2	5/8	7/16	3.32	3 1/2	4.75	1/2	2 1/4	1/2	1/8	1 3/8	7/16-20	—	1/2
5	250	900	5 1/2	5/8	1/2	4.10	4 1/4	5.80	5/8	2 3/4	5/8	3/16	1 3/4	1/2-20	—	1/2
6	200	750	6 1/2	3/4	9/16	4.88	5 1/4	6.90	3/4	3 1/4	5/8	3/16	1 3/4	9/16-18	—	3/4
8	200	500	8 1/2	3/4	5/8	—	7 1/8	9.10	3/4	4 1/4	1 1/16	1/4	2 1/4	5/8-18	5/8	3/4
10	200	400	10 5/8	3/4	3/4	—	8 7/8	11.31	1	5 5/16	7/8	1/4	2 5/8	3/4-16	3/4	1
12	200	400	12 3/4	3/4	3/4	—	11	13.30	1	6 3/8	7/8	3/8	2 1 1/16	3/4-16	3/4	1
14	200	400	14 3/4	3/4	7/8	—	12 5/8	15.40	1 1/4	7 3/8	1 1/16	3/8	3 3/16	7/8-14	7/8	1 1/4

† Dimension refers to bolt dia.

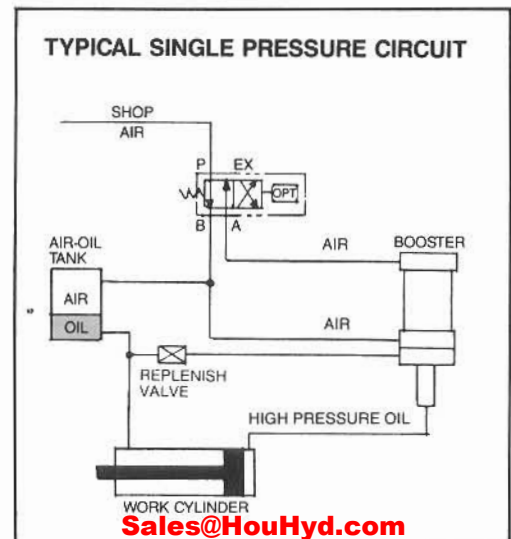
BORE DIA.	INPUT CYL. PSI		MOUNTING DIMENSIONS												
	AIR	HYD.	†FB	SA	†SB	SS	ST	TE	TF	TS	UF	US	WA	ZL	ZO
2 1/2	250	1100	5/16	7 5/8	3/8	3	1/2	—	3 7/8	3 3/4	4 5/8	4 1/2	5/8	6 1/4	7 1/4
3 1/4	250	1350	3/8	9 1/8	1/2	3 1/4	3/4	—	4 1 1/16	4 3/4	5 1/2	5 3/4	5/8	7 1/4	9
4	250	950	3/8	9 1/8	1/2	3 1/4	3/4	—	5 7/16	5 1/2	6 1/4	6 1/2	5/8	7 1/4	9
5	250	900	1/2	9 5/8	3/4	3 1/8	1	—	6 5/8	6 7/8	7 5/8	8 1/4	5/8	7 1/2	9 1/2
6	200	750	1/2	10 1/2	3/4	3 5/8	1	—	7 5/8	7 7/8	8 5/8	9 1/4	7/8	8 5/8	10 5/8
8	200	500	—	11 1/2	3/4	3 3/4	1	7.57	—	9 7/8	—	11 1/4	7/8	8 3/4	11 1/4
10	200	400	—	13 5/8	1	4 5/8	1 1/4	9.40	—	12 3/8	—	14 1/8	1 1/8	10 1/2	13 1/2
12	200	400	—	14 1/8	1	5 1/8	1 1/4	11.10	—	14 1/2	—	16 1/4	1 1/8	11	14
14	200	400	—	16 1/2	1 1/4	5 7/8	1 1/2	12.87	—	17	—	19 1/4	1 5/8	13 1/4	16 3/4

SINGLE PRESSURE RAM TYPE BOOSTER NBS-5

Booster Series NBS is similar to the dual pressure Series NBD except the center head which contains the port and seal for low pressure oil has been eliminated. Therefore, the primary purpose of this design is to provide high pressure oil to the work cylinder during its entire stroke.

Since the booster is neither **self-filling** or **self-venting**, provisions should be made to perform these operations in the external circuit.

See Booster Selector Chart on Page 12 and "How to Select" Information on Page 11.



NOPAK. RAM-TYPE BOOSTERS

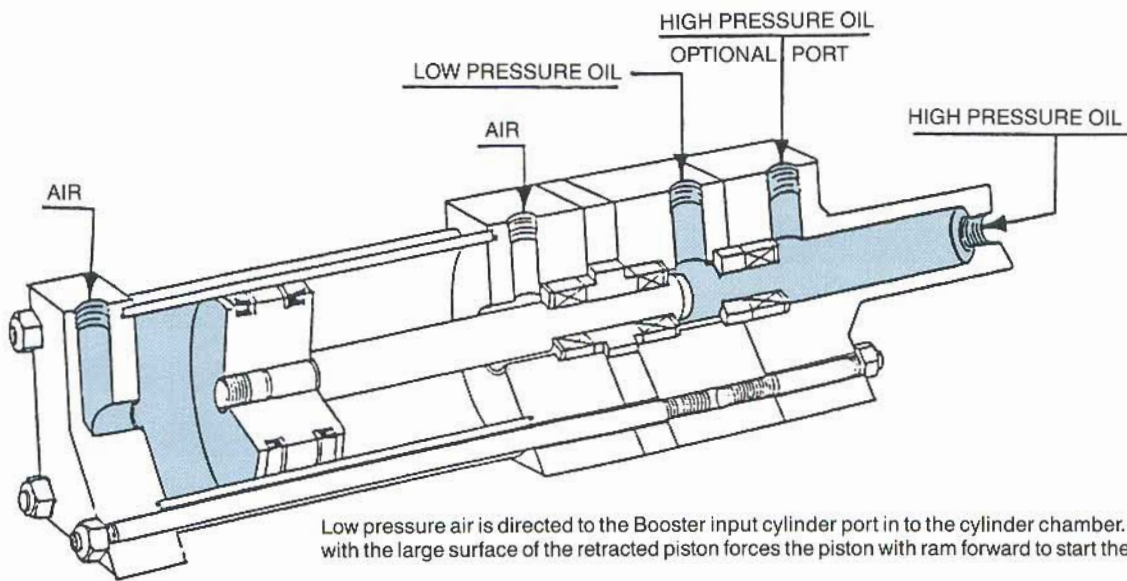
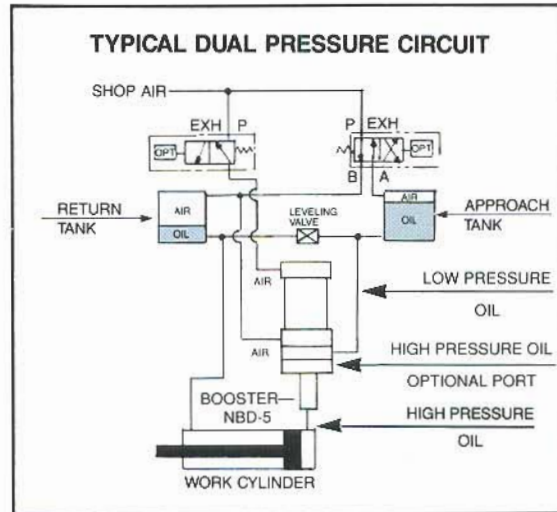
RAM-TYPE NBD-5 DUAL PRESSURE BOOSTERS

Provide Output Pressure Up To 5000 PSI

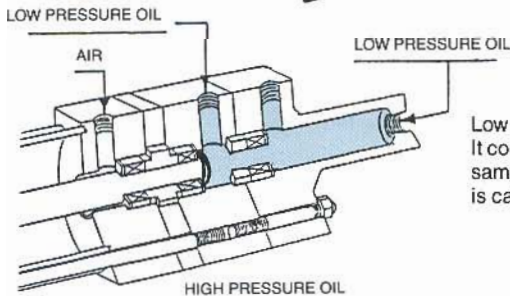
DUAL PRESSURE RAM TYPE BOOSTERS NBD-5

The dual pressure booster is used where the work cylinder is required to travel a short distance at high pressure after a substantial low pressure advance stroke. Because the booster ram operates only during the high pressure portion of the work stroke, a shorter booster stroke is required. In the fully retracted position, the ram is withdrawn from the high pressure ram seal allowing low pressure "approach stroke" oil to pass through to the work cylinder. This design makes the booster both self-filling and self-bleeding.

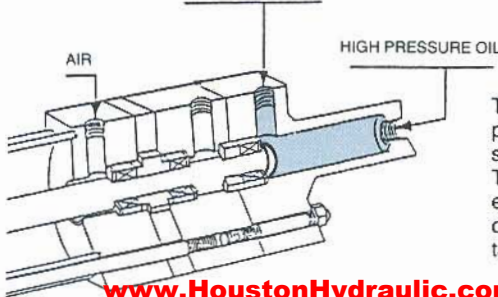
See Booster Selector Chart on Page 12 and "How to Select" Information on Page 11.



Low pressure air is directed to the Booster input cylinder port in to the cylinder chamber. Making contact with the large surface of the retracted piston forces the piston with ram forward to start the cylinder stroke.



Low pressure oil is flowing thru the low pressure port into and thru the high pressure bearing I.D. and seal. It continues thru the nozzle chamber and out the port to the work cylinder. The ram is traveling under the same pressure as the input air. The low pressure oil reaching the work cylinder forces the rod forward which is called "the approach stroke"



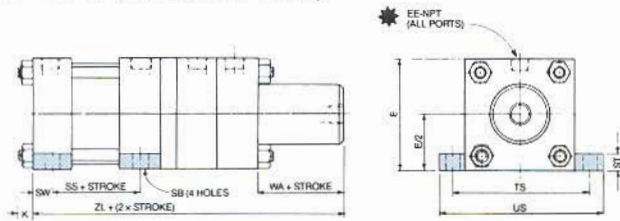
The booster ram traveling forward now enters the high pressure bearing and seal cutting off the low pressure oil supply. The ram end force created by the large air piston now greatly intensifies the oil pressure contained in the nozzle chamber and is pushed out of the high pressure port to the work cylinder. This short stroke of the work cylinder is called the "high pressure stroke" of the work cycle. The booster ratio of input and output pressure rated values are charted on page 12. The input cylinder segment of NBD-5 boosters can be operated either with air or low pressure hydraulics. See the pressure limitations shown on page 12.

NOPAK RAM-TYPE BOOSTERS

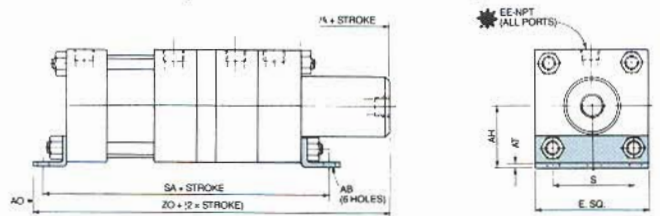
RAM-TYPE NBD-5 DUAL PRESSURE BOOSTERS

Provide Output Pressure Up To 5000 PSI

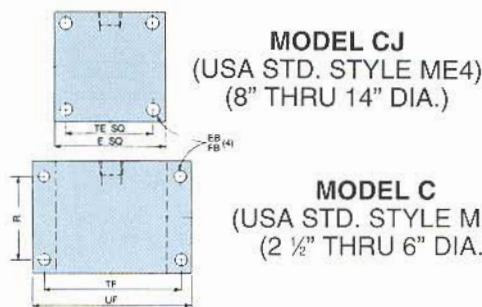
MODEL A (USA STD. MS2)



† MODEL AP (USA STD. STYLE MS1)



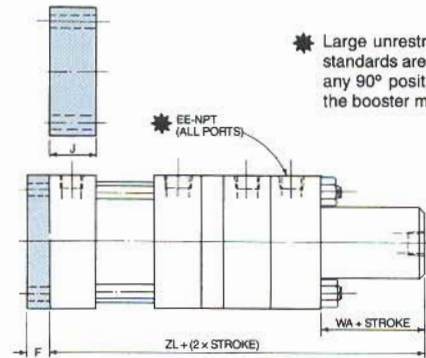
† FOR 2 1/2" DIA. THROUGH 5" DIA. BORE, THIS MODEL IS AVAILABLE FOR SMALL RAM DIA. ONLY.



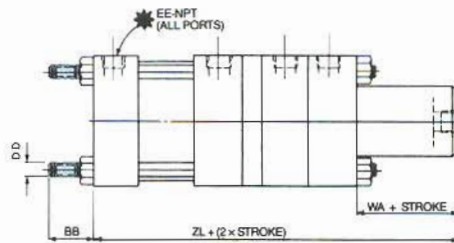
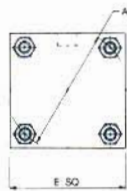
MODEL CJ
(USA STD. STYLE ME4)
(8" THRU 14" DIA.)

MODEL C
(USA STD. STYLE MF2)
(2 1/2" THRU 6" DIA.)

★ Large unrestricted ports conforming to NFPA standards are provided. They can be rotated to any 90° position in relation to each other and the booster mounting.



MODEL TB (USA STD. STYLE MX2)



† Dimension Refers To Bolt Dia.

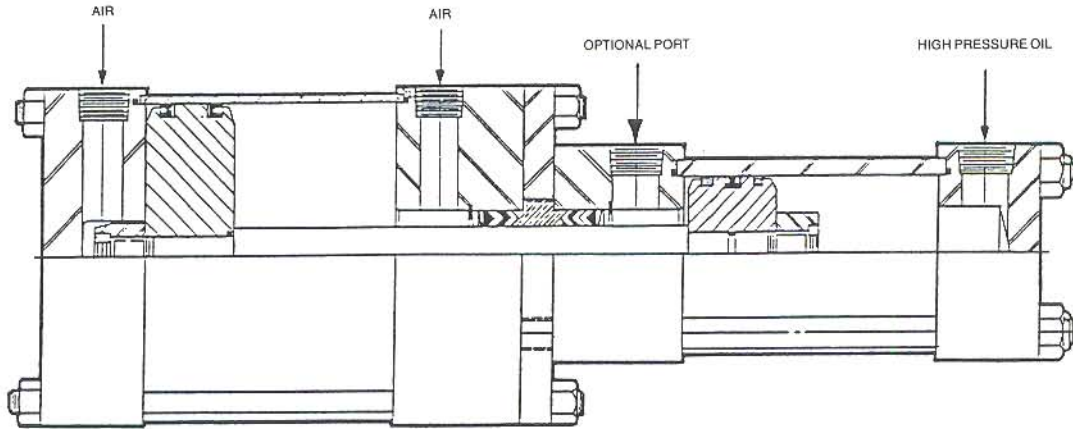
BORE DIA.	INPUT CYL. PSI		MOUNTING DIMENSIONS														
	AIR	HYD.	E	F	J	K	R	S	AA	†AB	AH	AO	AT	BB	DD	†EB	EE
2 1/2	250	1100	3	3/8	1 1/8	5/16	2.19	2 1/4	3.10	3/8	1 1/8	3/8	1/8	1 1/8	5/16-24	—	3/8
3 1/4	250	1350	3 3/4	5/8	1 1/4	7/16	2.76	2 3/4	4.00	1/2	2	1/2	1/8	1 3/8	7/16-20	—	1/2
4	250	950	4 1/2	5/8	1 1/4	7/16	3.32	3 1/2	4.75	1/2	2 1/4	1/2	1/8	1 3/8	7/16-20	—	1/2
5	250	900	5 1/2	5/8	1 1/4	1/2	4.10	4 1/4	5.80	5/8	2 3/4	5/8	3/16	1 3/4	1/2-20	—	1/2
6	200	750	6 1/2	3/4	1 1/2	9/16	4.88	5 1/4	6.90	3/4	3 1/4	5/8	3/16	1 3/4	9/16-18	—	3/4
8	200	500	8 1/2	3/4	1 1/2	3/8	—	7 1/8	9.10	3/4	4 1/4	1 1/16	1/4	2 1/4	5/8-18	5/8	3/4
10	200	400	10 3/8	3/4	2	3/4	—	8 7/8	11.31	1	5 5/16	7/8	1/4	2 5/8	3/4-16	3/4	1
12	200	400	12 3/4	3/4	2	3/4	—	11	13.30	1	6 3/8	7/8	3/8	2 1 1/16	3/4-16	3/4	1
14	200	400	14 3/4	3/4	2 1/4	7/8	—	12 5/8	15.40	1 1/4	7 3/8	1 1/16	3/8	3 3/16	7/8-14	7/8	1 1/4

BORE DIA.	INPUT CYL. PSI		MOUNTING DIMENSIONS														
	AIR	HYD.	†FB	SA	†SB	SS	ST	SW	TE	TF	TS	UF	US	WA	ZL	ZO	
2 1/2	250	1100	5/16	9 1/8	3/8	3	1/2	3/8	—	3 3/8	3 3/4	4 5/8	4 1/2	5/8	7 3/4	9 1/8	
3 1/4	250	1350	3/8	10 7/8	1/2	3 1/4	3/4	1/2	—	4 1 1/16	4 3/4	5 1/2	5 3/4	5/8	9	10 3/4	
4	250	950	3/8	10 7/8	1/2	3 1/4	3/4	1/2	—	5 7/16	5 1/2	6 1/4	6 1/2	5/8	9	10 3/4	
5	250	900	1/2	11 3/8	3/4	3 3/8	1	1 1/16	—	6 5/8	6 3/8	7 3/8	8 1/4	5/8	9 1/4	11 1/4	
6	200	750	1/2	12 1/2	3/4	3 3/8	1	1 1/16	—	7 5/8	7 3/8	8 3/8	9 1/4	7/8	10 5/8	12 5/8	
8	200	500	—	13 1/2	3/4	3 3/4	1	1 1/16	7.57	—	9 3/8	—	11 1/4	7/8	10 3/4	13 1/4	
10	200	400	—	15 7/8	1	4 5/8	1 1/4	7/8	9.40	—	12 3/8	—	14 3/8	1 1/8	12 3/4	15 3/4	
12	200	400	—	16 3/8	1	5 1/8	1 1/4	7/8	11.10	—	14 1/2	—	16 1/4	1 1/8	13 1/4	16 1/4	
14	200	400	—	19 1/4	1 1/4	5 3/8	1 1/2	1 1/8	12.87	—	17	—	19 1/4	1 1/8	16	19 1/2	

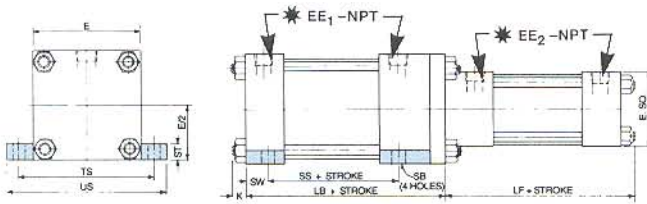
NOPAK. PISTON TYPE BOOSTERS AND ACCUMULATORS

PISTON TYPE NB3 BOOSTERS AND ACCUMULATORS

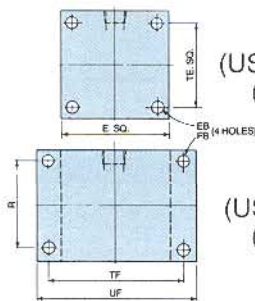
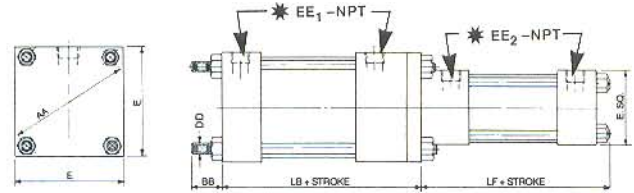
Provide Output Pressure Up To 3000 PSI



MODEL A (USA STD. MS2)



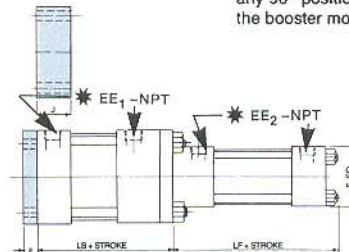
MODEL TB (USA STD. STYLE MX2)



MODEL CJ
(USA STD. STYLE ME4)
(8" THRU 14" DIA.)

MODEL C
(USA STD. STYLE MF2)
(2 1/2" THRU 6" DIA.)

* Large unrestricted ports conforming to NFPA standards are provided. They can be rotated to any 90° position in relation to each other and the booster mounting.

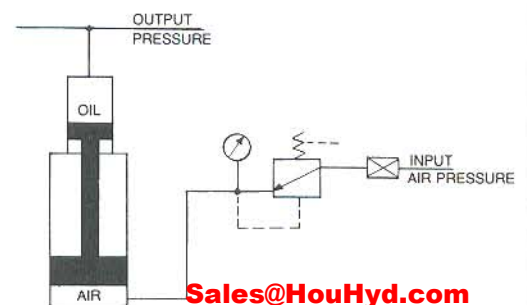


PISTON TYPE BOOSTERS AND ACCUMULATORS NB3

Piston type boosters and accumulators consist of two cylinders with a common ram, joined together as an integral unit. This unit may be used as a booster or accumulator depending on how it is located in hydraulic circuit. When used as a booster, it is not self-bleeding so provisions must be made in the external circuit to bleed the system after each operation and before refilling.

See Booster Selector Chart on Page 13 and "How to Select" Information on Page 11.

TYPICAL ACCUMULATOR CIRCUIT



NOPAK. PISTON TYPE BOOSTERS AND ACCUMULATORS

PISTON TYPE NB3 BOOSTERS AND ACCUMULATORS

Provide Output Pressure Up To 3000 PSI

† Dimension refers to bolt dia.

		INPUT CYLINDER DIMENSIONS								A/L††	
BORE		2 1/2	3 1/4	4	5	6	8	10	12	14	
PSI	A††	250	250	250	250	200	200	200	200	200	
	L††	1100	1350	950	900	750	500	400	400	400	
E		3	3 3/4	4 1/2	5 1/2	6 1/2	8 1/2	10 5/8	12 3/4	14 3/4	
F		3/8	5/8	5/8	5/8	3/4	3/4	3/4	3/4	3/4	
J		1 1/8	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	2	2	2 1/4	
K		5/16	7/16	7/16	1/2	9/16	5/8	3/4	3/4	7/8	
R		2.19	2.76	3.32	4.10	4.88	—	—	—	—	
AA		3.10	4.00	4.75	5.80	6.90	9.10	11.31	13.30	15.40	
BB		1 1/8	1 3/8	1 3/8	1 3/4	1 3/4	2 1/4	2 5/8	2 11/16	3 3/16	
DD		5/16-24	7/16-20	7/16-20	1/2-20	9/16-18	5/8-18	3/4-16	3/4-16	7/8-14	
†EB		—	—	—	—	—	5/8	3/4	3/4	7/8	
* EE ₁		3/8	1/2	1/2	1/2	3/4	3/4	1	1	1 1/4	
†FB		5/16	3/8	3/8	1/2	1/2	—	—	—	—	
LB		4 1/8	4 7/8	4 7/8	5 1/8	5 3/4	5 7/8	7 1/8	7 5/8	8 7/8	
†SB		3/8	1/2	1/2	3/4	3/4	3/4	1	1	1 1/4	
SS		3	3 1/4	3 1/4	3 1/8	3 5/8	3 3/4	4 5/8	5 1/8	5 7/8	
ST		1/2	3/4	3/4	1	1	1	1 1/4	1 1/4	1 1/2	
SW		3/8	1/2	1/2	1 1/16	1 1/16	1 1/16	7/8	7/8	1 1/8	
TE		—	—	—	—	—	7.57	9.40	11.10	12.87	
TF		3 7/8	4 11/16	5 7/16	6 5/8	7 5/8	—	—	—	—	
TS		3 3/4	4 3/4	5 1/2	6 7/8	7 7/8	9 7/8	12 3/8	14 1/2	17	
UF		4 5/8	5 1/2	6 1/4	7 5/8	8 5/8	—	—	—	—	
US		4 1/2	5 3/4	6 1/2	8 1/4	9 1/4	11 1/4	14 1/8	16 1/4	19 1/4	

		OUTPUT CYLINDER DIMENSIONS							A/L††	
BORE		1 1/2	2	2 1/2	3 1/4	4	5	6	8	
PSI	A††	250	250	250	250	250	250	200	200	
	L††	1500	1500	1100	1350	950	900	750	500	
E		2	2 1/2	3	3 3/4	4 1/2	5 1/2	6 1/2	8 1/2	
* EE ₂		3/8	3/8	3/8	1/2	1/2	1/2	3/4	3/4	
LF		3 7/8	4 1/8	4 1/8	4 11/16	4 11/16	5	5 3/8	5 3/4	

		OUTPUT CYLINDER DIMENSIONS							H††	
BORE		1 1/2	2	2 1/2	3 1/4	4	5	6	8	
PSI	H††	3000	3000	3000	3000	3000	3000	3000	3000	
E		2 1/2	3	3 1/2	4 1/2	5	6 1/2	7 1/2	9 1/2	
* EE ₂		1/2	1/2	1/2	3/4	3/4	3/4	1	1 1/2	
LF		5 1/8	5 1/8	5 3/8	6 1/4	6 1/2	7 1/4	8 1/2	10 7/8	

††A = Air

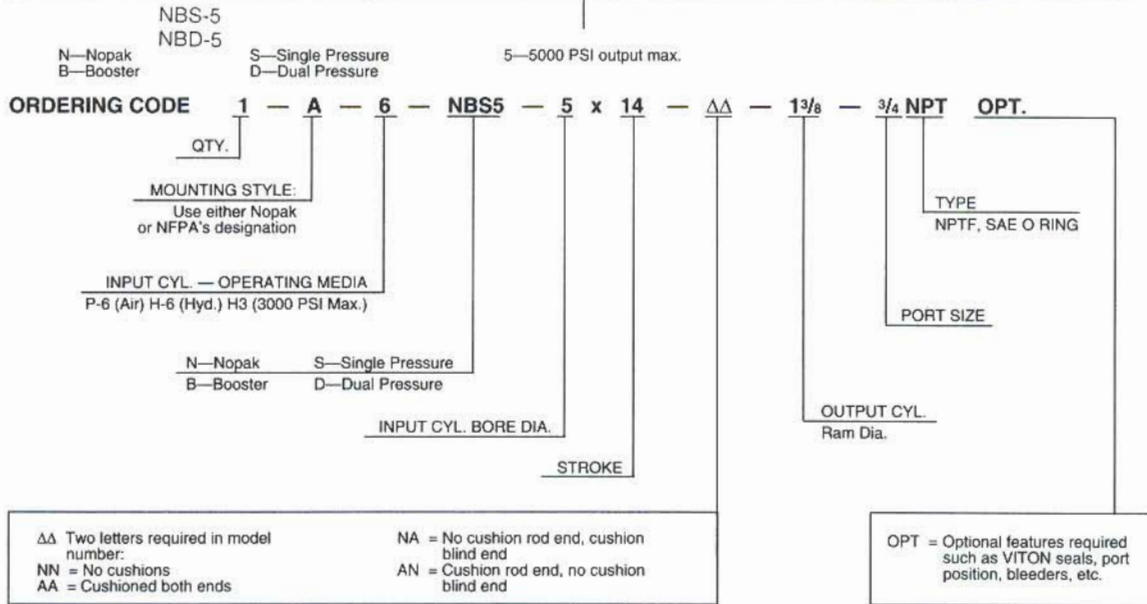
††L = L.P. Hydraulics

††H = H.P. Hydraulics 3000 PSI

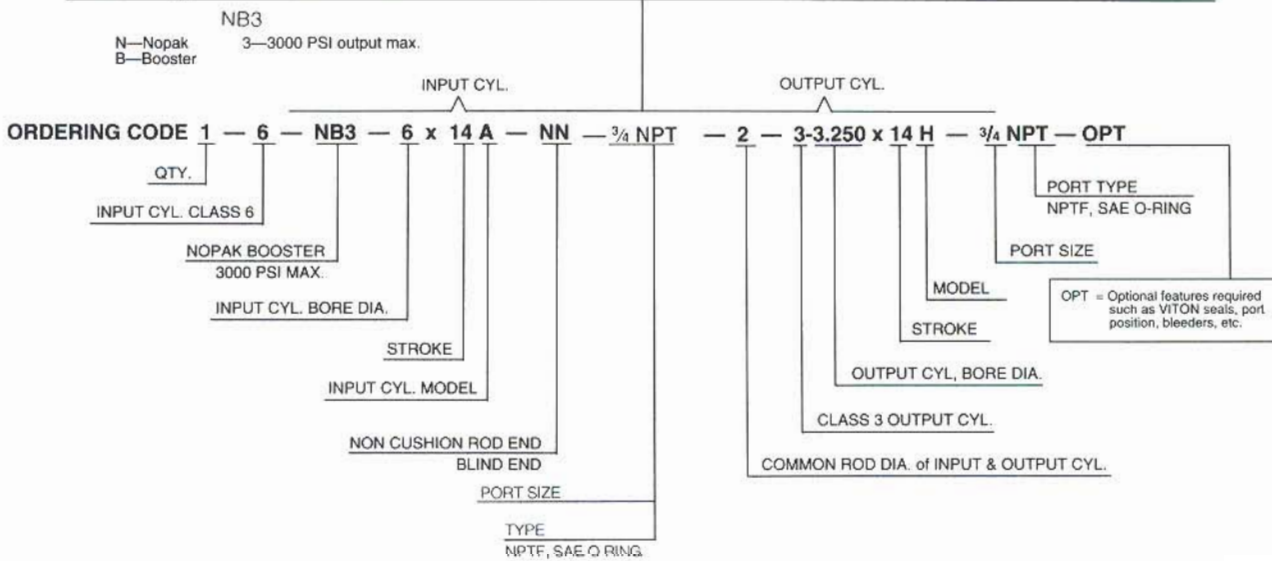
NOPAK

ORDERING INFORMATION

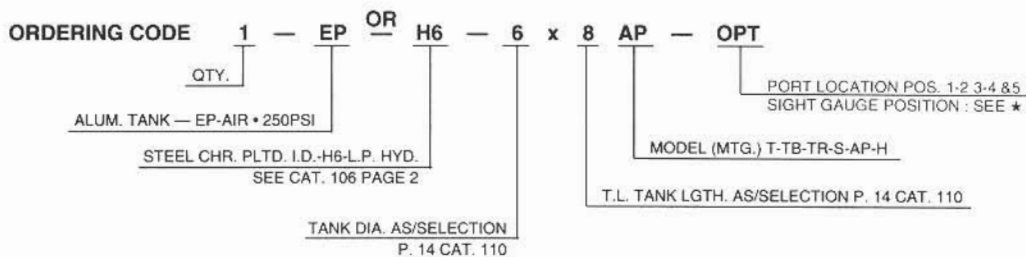
Ram Type Booster Code



Piston Type Booster Code



AIR-OIL TANKS



MATERIAL NOTE: ALUMINUM HEADS (CLASS EP STOCK)
FOR TANK DIA. 3/4" DIA. THRU 8" DIA.
STEEL HEADS (CLASS H6 STOCK) FOR TANK DIA. 10-12-14

Note: Unless specified, Air-Oil Tanks shall be a separate unit in
the www.HoustonHydraulic.com 14 and 15

★ Sight gauge is considered to
be in position 1 in all cases
unless specifically called out
otherwise. See page 15.

HOW TO SELECT THE MOST EFFICIENT BOOSTER

STEP 1. SELECTING A SINGLE PRESSURE BOOSTER

Preliminary information needed:

- Thrust force or load required from work cylinder for application.
- Bore diameter of work cylinder and stroke length required to do the job. (Select a force greater than that required as a margin of safety.)
- Input psi pressure of work cylinder needed to obtain force selected.
- Available input psi pressure to operate booster.
- Booster ratio.

Example:

Your application requires a thrust or force of **4400 lbs.** for **4 inch** length.

From Catalog 103 Page 35 Table C you read 4909 lbs. for a 2 1/2" dia. cylinder which requires an input pressure of 1000 psi to obtain this force. This allows a 500# force margin of safety.

Your available input pressure at site is 80 psi shop air. Booster ratio can now be determined.

$$\text{ratio} = \frac{\text{output pressure}}{\text{input pressure}} = \frac{1000}{80} = 12.5$$

You have now established that:

- | | |
|-----------------------------|-------------------|
| A. Work cylinder force | = 4900 lbs. |
| B. Work cylinder diameter | = 2 1/2" bore |
| Work cylinder stroke | = 4" length |
| C. Booster output pressure | = 1000 psi |
| D. Available input pressure | = 80 psi shop air |
| E. Booster ratio | = 12.5 |

STEP 2. SELECT BOOSTER BORE AND RAM SIZE

Using ratio from above Item E, select from Booster Selector Table Page 12, the bore and ram size that reads closest to ratio. If exact ratio is not shown then select next larger ratio. Next check if input psi corresponds to application availability Item D above.

Read down input psi column to output psi that is equal or greater than Item C above. If table output is larger than needed then the ratio can be recalculated.

Now with your recalculated ratio, input pressure and closest output pressure, you can now read the booster bore diameter and ram size needed.

STEP 3. DETERMINE BOOSTER STROKE:

Calculate the booster stroke using formula

$$S = \frac{V + VcL}{Ra}$$

S = Booster stroke

V = Volume cubic inch of 2 1/2" bore work cylinder times 4" stroke or 19.6 cu. in.

VcL = Volume cubic inch plus oil volume cu. in. in circuit lines (20 cu. in. FOR THIS EXAMPLE) TIMES 1% PER 1000 PSI OR .01

Ra = Area of 1 3/8 dia. ram or 1.485 sq. in.

Note: Substitute Pa (piston area) for Ra (ram area) in the above formula when calculating a piston type booster or accumulator.

$$S = \frac{19.6 + (19.6 + 20) .01}{1.485}$$

$$S = \frac{19.996}{1.485} = 13.46 \text{ or } 14" \text{ stroke}$$

*NOTE: TO ACCOUNT FOR LEAKAGE (HYDRAULIC SLIP) OR ANY OTHER UNCERTAINTIES, A FACTOR OF SAFETY OF 20% SHOULD BE ADDED

$$S = 14" \times 1.20 = 16.8 \text{ OR } 17" \text{ STROKE}$$

From the following determining selection you would then order:

A 5" diameter single pressure NBS-5 booster with a 17" stroke using a 1 3/8 dia. ram. With an input pressure of 80 psi air to be intensified to 1058 psi for full 4" stroke of 2 1/2" bore work cylinder with a recalculated ratio of 13.22.

SELECTING A DUAL PRESSURE BOOSTER

Step No. 1 and 2 are the same as a single pressure booster. Proceed with step No. 3.

STEP 3. DETERMINE BOOSTER STROKE:

Calculate the booster stroke using formula.

$$S = \frac{V + VcL}{Ra} + 2 \text{ inch stroke required to close H.P. Seal}$$

(FOR LARGER BOOSTERS W/3" DIA. ROD AND OVER, USE 3" PLUS CALCULATED BOOSTER STROKE)

S = Booster stroke

V = Volume cubic inch of 2 1/2" bore work cylinder times H.P. stroke length or 4.9 sq. in. x 1" = 4.9 cu." of H.P. stroke

VcL = Volume cubic inch plus oil volume cu. in. in circuit lines or 20 cu. in. times 1% per 1000 psi or .01

Ra = Area of 1 3/8 dia. ram or 1.485 sq. in.

Note: Substitute Pa (piston area) for Ra (ram area) in the above formula when calculating a piston type booster or accumulator.

$$S = \frac{4.9 + (19.6 + 20) .01}{1.485} + 2$$

$$S = \frac{5.30}{1.485} + 2$$

S = 5.56 or 6" Booster stroke

$$S = 6 \times 1.20 = 7.2 \text{ OR } 8" \text{ STROKE (SEE NOTE ABOVE)}$$

From the following determining selection you would then order:

A 5" diameter dual pressure NBD-5 booster with a 8" stroke using a 1 3/8 dia. ram. With an input pressure of 80 psi air to be intensified to 1058 psi for last 1" stroke of 2 1/2" bore work cylinder with recalculated ratio of 13.22.

RAM TYPE BOOSTER

BOOSTER SELECTION CHART FOR SINGLE PRESSURE NBS-5 AND DUAL PRESSURE NBD-5 5000 PSI

†††

DRIVING CYLINDER		PRESS. RATING	OUTPUT RAM		BOOSTER RATIO	INTENSIFIED OUTPUT HYDRAULIC PRESSURE (PSI) AT INPUT PRESSURE												
BORE	AREA	AIR HYD.	DIA.	AREA		60	80	100	200	250	400	500	750	900	950	1100	1350	
2 1/2	4.90	250	5/8	.307	15.84	958	1277	1596	3192	3990	6384	7980	11971	14365	15163	17757		
			1	.785	6.29	375	499	624	1248	1561	2497	3121	4682	5618	5930	6866		
		1100	1 3/8	1.485	3.30	198	264	330	660	825	1320	1650	2475	2970	3135	3630		
			1 3/4	2.405	2.04	122	163	204	408	509	815	1019	1528	1834	1936	2241		
3 1/4	8.296	250	1	.785	10.57	634	846	1057	2114	2642	4227	5285	7926	9511	10039	11625	14268	
			1 3/8	1.485	5.59	335	447	559	1118	1397	2234	2795	4190	5028	5307	6145	7542	
		1350	1 3/4	2.405	3.45	207	276	345	690	862	1380	1725	2587	3104	3277	3795	4657	
			2	3.142	2.64	158	211	264	528	660	1056	1320	1980	2376	2508	2905	3565	
4	12.566	250	1	.785	16.00	960	1280	1601	3202	4002	6403	8000	12005	14406	15206			
			1 3/8	1.485	8.46	508	677	846	1692	2116	3385	4230	6346	7615	8038			
		950	1 3/4	2.405	5.23	313	418	523	1046	1306	2090	2615	3919	4702	4963			
			2	3.142	4.00	240	320	400	800	1000	1600	2000	3000	3599	3799			
5	19.635	250	1	.785	25.01	1500	2000	2500	5000	6253	10005	12505	18759	22512				
			1 3/8	1.485	13.22	793	1058	1323	2646	3306	5289	6610	9917	11900				
		900	1 3/4	2.405	8.16	489	653	817	1634	2041	3266	4080	6123	7348				
			2	3.142	6.25	375	500	625	1250	1562	2500	3125	4687	5624				
6	28.274	200	1 3/8	1.485	19.05	1143	1524	1903	3806	4760	7616	9525	14279					
			1 3/4	2.405	11.76	706	941	1175	2351	2939	4703	5880	8817					
		750	2	3.142	9.00	540	720	900	1800	2250	3600	4500	6749					
			2 1/2	4.909	5.76	345	461	576	1152	1440	2304	2880	4320					
8	50.265	200	1 3/8	1.485	33.85	2031	2708	3385	6770	8462	13539	16925						
			1 3/4	2.405	20.90	1254	1672	2090	4180	5225	8360	10450						
		500	2	3.142	16.00	960	1280	1600	3200	3999	6399	8000						
			2 1/2	4.909	10.24	614	819	1024	2048	2560	4096	5120						
10	78.54	200	3	7.069	7.11	426	569	711	1414	1778	2845	3555						
			3 1/2	9.621	5.23	313	418	523	1045	1306	2090	2615						
		400	4	12.566	4.00	240	320	400	800	1000	1600	2000						
			4 1/2	15.904	3.16	190	253	316	632	790	1264	1580						
12	113.10	200	5	19.635	2.56	154	205	256	512	640	1023	1280						
			5 1/2	23.758	2.12	127	170	212	423	529	846	1060						
		400	1 3/4	2.405	32.66	1959	2613	3266	6531	8164	13063							
			2	3.142	25.00	1500	2000	2500	5000	6249	9999							
14	154.94	200	2 1/2	4.909	16.00	960	1280	1600	3200	4000	6400							
			3	7.069	11.11	666	886	1111	2222	2778	4444							
		400	3 1/2	9.621	8.16	489	653	816	1633	2041	3265	2500						
			4	12.566	6.25	375	500	625	1250	1563	2500							

When output pressures are in the gray shaded area—the output pressure has exceeded the rating for the output cylinder and then Boosters NBS-5 - NBD-5 should not be used. For output pressures greater than 5000 psi, please consult the factory.

NOTE: When output pressures are not shown - either output pressure has exceeded rating of output cylinder or input pressure has exceeded rating of input cylinder.

††† CL3 series not shown in this ratio combination.

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PISTON TYPE BOOSTER AND ACCUMULATORS

BOOSTER SELECTION CHART FOR NB-3-3000 PSI

INPUT CYLINDER				OUTPUT CYLINDER						BOOSTER RATIO	OUTPUT PRESSURE (PSI) AT INPUT PRESSURE OF										
BORE	AREA	MAXIMUM INPUT PRESSURE		BORE	AREA	MAXIMUM OUTPUT PRESSURE USING			60		80	100	200	250	400	500	750	900	950	1100	
		A.	L.			A.	L.	H.													
2 1/2	4.90	250	1100	1 1/2	1.767	250	1500	3000	2.77	166	221	277	555	693	1109	1387	2080	2496	2634	—	
3 1/4	8.296	250	1350	1 1/2	1.767	250	1500	3000	4.69	281	375	469	939	1172	1877	2345	—	—	—	—	
				2	3.142	250	1500	3000	2.64	158	211	264	528	660	1056	1320	1980	2376	2508	—	
4	12.566	250	950	1 1/2	1.767	250	1500	3000	7.11	426	565	711	1422	1777	2844	—	—	—	—	—	
				2	3.142	250	1500	3000	4.00	240	320	400	800	1000	1600	2000	3000	—	—	—	—
				2 1/2	4.909	250	1100	3000	2.56	153	205	256	512	640	1023	1280	1920	2304	2432	—	—
5	19.635	250	900	1 1/2	1.767	250	1500	3000	11.11	666	889	1111	2222	2775	—	—	—	—	—	—	
				2	3.142	250	1500	3000	6.25	375	500	625	1250	1562	2499	—	—	—	—	—	—
				2 1/2	4.909	250	1100	3000	4.00	240	320	400	800	1000	1600	2000	3000	—	—	—	—
6	28.274	200	750	3 1/4	8.296	250	1350	3000	2.37	142	190	237	473	592	946	1185	1775	2130	—	—	
				2	3.142	250	1500	3000	9.00	540	720	900	1800	2250	—	—	—	—	—	—	
				2 1/2	4.909	250	1100	3000	5.76	345	461	576	1152	1440	2304	2880	—	—	—	—	
8	50.265	200	500	3 1/4	8.296	250	1350	3000	3.41	204	273	341	682	852	1364	1705	2556	—	—		
				4	12.566	250	950	3000	2.25	135	180	225	450	562	900	1125	1688	—	—	—	
				2	3.142	250	1500	3000	16.00	960	1280	1600	—	—	—	—	—	—	—	—	
10	78.540	200	400	2 1/2	4.909	250	1100	3000	10.24	614	819	1024	2048	2560	—	—	—	—	—		
				3 1/4	8.296	250	1350	3000	6.06	363	485	606	1212	1515	2423	—	—	—	—	—	
				4	12.566	250	950	3000	4.00	240	320	400	800	1000	1600	2000	—	—	—	—	
12	113.10	200	400	5	19.635	250	900	3000	2.56	153	205	256	512	640	1024	1280	—	—	—		
				2 1/2	4.909	250	1100	3000	16.00	960	1280	1600	—	—	—	—	—	—	—		
				3 1/4	8.296	250	1350	3000	9.47	568	758	947	1893	2367	—	—	—	—	—		
14	153.94	200	400	4	12.566	250	950	3000	6.25	375	500	625	1250	1562	2500	—	—	—	—		
				5	19.635	250	900	3000	4.00	240	320	400	800	1000	1600	—	—	—	—		
				6	28.274	250	750	3000	2.78	166	223	278	556	695	1111	—	—	—	—		

Note: When output pressures are not shown — either output pressure has exceeded rating of 3000 PSI at output cylinder or input pressure has exceeded rating of input cylinder.

A = AIR
 L = LOW PRESSURE HYDRAULIC
 H = HIGH PRESSURE HYDRAULIC

NOPAK

AIR-OIL TANKS

GENERAL INFORMATION

Nopak air-oil tanks are used as a simple economical method to supply a make up source of oil to any hydraulic circuit. Mounting the tank in a vertical position above the circuit that is being supplied, automatically bleeds the entire circuit system. The air supply to the air over oil tank is supplied by the same shop air source that provides low pressure power to the booster. In addition, air-oil tanks offer a means of smooth hydraulic speed control.

Design Features:

* Baffles on either end of the tank to reduce turbulence caused by rapid intake of air and discharge of oil causing aeration, whirlpooling and foaming.

* Replaceable sight gauge mounted in heads on the tank side. The transparent plastic sight tube clearly shows oil levels in the tank and is compatible with most hydraulic fluids.

* Large pipe ports enable the quick filling or draining of the tank.

Aluminum heads are standard for tank diameters of 3 1/4" dia. thru 8" diameter. Otherwise steel class 6 inventoried stock of 3 1/4" dia. thru 14" diameters modified for added ports plus aluminum tubes are standard stock.

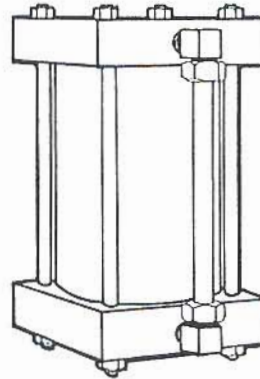
NOTE:

Tanks are also available with glass wound filament fiberglass tubing. Because it is translucent, it provides a visual oil level indication. This eliminates the use of a sight gauge. Fiberglass tubing has the highest strength to weight ratio commercially available. It has a higher resistance for high impact and dents than brass or aluminum tubing. Corrosion resistant to a wide range of chemicals, acids, high moisture and other severe conditions make for a trouble-free operation in most environments. Nopak can economically supply you with either tank depending on your choice preference or specification.

How to select the correct sized air-oil tank.

1. Determine the bore diameter and stroke of the work cylinder.
2. Calculate the cubic inch oil displacement of work cylinder by multiplying the piston square inch times the stroke in

inches. (Use Catalog 106, Page 35, Table B, Blind End Displacement for piston square inch area for ready reference.) Your determination will result in the cubic inch displacement volume requirement needed to select an air-oil tank.



Example: Work cylinder has a 4 inch diameter bore with 15 inch long stroke.

From Cat. 106 P. 35

12.56 sq. in. area 4" bore
x 15 Stroke Length

188.4 Cubic inch displacement volume needed.

See the tank selector chart below to select proper choice. Select a bore-height combination that has a capacity closest to, but larger than 188.4 cu. ". Your options are the 4 inch diameter bore with a 21 inch long tank length or the 5 inch bore with a 14 inch tank length or a 6 inch bore with an 11 inch tank length.

Economics recommends that your selection be the smaller 4 inch diameter bore with the 21 inch long tank length. This of course is predicated on available space. The smaller bore tanks are generally less costly than larger bores. Exceptions to this are the booster-tank combination which then makes your selection to be that the tank diameter be the same diameter as the booster. Next selection would be the type of mount applicable to your requirements. See the chart on opposite page for selection and dimensions. Nopak offers Models H, S, T, TB, and AP as a standard. However other mounting styles can be selected from Catalog 106. When boosters and air-oil tanks are ordered, specify whether air-oil tanks should be separate or integral. It is assumed that air-oil tanks are to be separate unless specified.

Please consult the Nopak Sales office or your nearest Nopak representative for additional information.

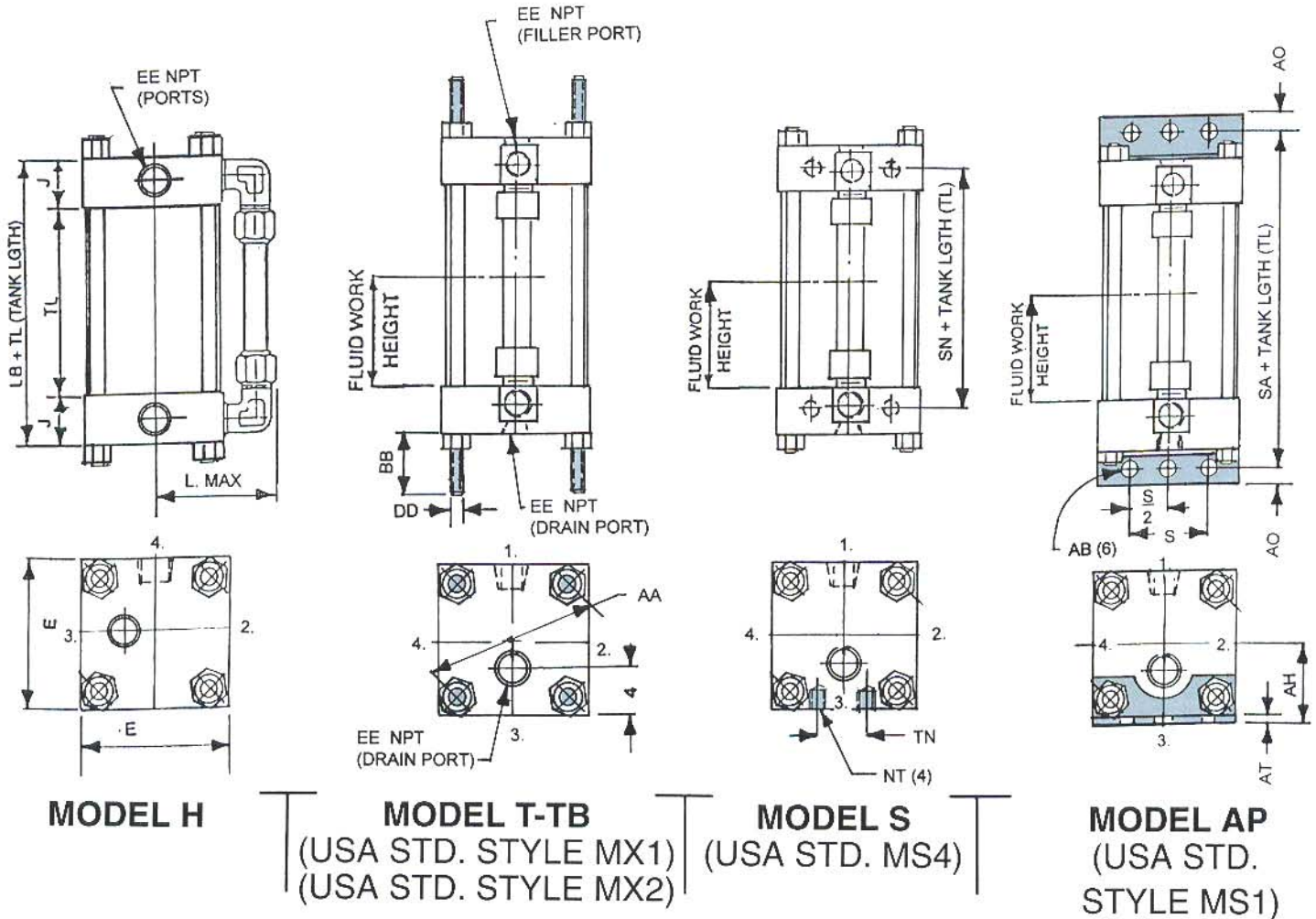
TANK SELECTOR CHART

TANK BORE (INCHES)	TANK VOLUME IN CUBIC INCHES																				
	TL — TANK LENGTH IN INCHES																				
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
3 1/4	21	25	32	35	44	51	58	66	73	80	88	95	102	109	116	124	131	139	146	153	160
4	31	38	48	56	67	78	88	100	111	122	133	144	155	166	176	188	199	210	221	232	242
5	49	59	76	88	105	122	137	157	174	191	208	225	243	260	273	294	311	328	346	363	378
6	70	85	109	127	152	176	198	226	250	275	300	325	349	374	396	424	448	473	498	523	544
8	126	151	195	226	270	314	352	402	446	490	534	578	622	666	704	754	798	841	885	929	968
10	196	236	304	353	422	490	550	628	697	765	834	903	971	1040	1100	1178	1246	1315	1384	1453	1512
12	283	339	438	509	607	706	792	904	1003	1102	1201	1300	1399	1498	1583	1696	1795	1894	1993	2092	2177
14	385	462	597	692	827	962	1078	1231	1366	1500	1635	1770	1905	2039	2155	2309	2443	2578	2713	2847	2963
Fluid Working Height In.	2 1/2	3	3 7/8	4 1/2	5 3/8	6 1/4	7	8	8 7/8	9 3/4	10 3/8	11 1/2	12 3/8	13 1/4	14	15	15 7/8	16 3/4	17 3/8	18 1/2	19 1/4

NOPAK

AIR-OIL TANKS

DIMENSIONS



†Dimension refers to bolt dia.

TANK BORE (INCHES)	DIMENSION CHART																		
	E	J	U	S	L	AA	†AB	AT	AH	AO	BB	DD	EE	LB	NT	SA	SN	TN	
3¼	3¼	1¼	1⅝	2¾	3¼	4.00	½	2	½	⅛	1⅝	7/16-20	½	2½	½-13	5	1⅝	1½	
4	4½	1¼	1⅝	3½	3⅝	4.75	½	2¼	½	⅛	1⅝	7/16-20	½	2½	½-13	5	1⅝	2⅛	
5	5½	1¼	2	4¼	4⅝	5.80	⅝	2¾	⅝	⅜	1¾	½-20	½	2½	⅝-11	5¼	1⅝	2⅛	
6	6½	1½	2¼	5¼	4⅝	6.90	¾	3¼	⅝	⅜	1¾	⅝-18	¾	3	¾-10	5¼	1⅝	3¼	
8	8½	1½	3	7⅞	5⅝	9.10	¾	4¼	1⅞	¼	2¼	⅝-18	¾	3	¾-10	6⅝	1⅝	4½	
10	10⅝	2	3¼	8⅞	6¾	11.30	1	5⅞	⅞	¼	2⅝	¾-16	1	4	1-8	8¼	2	5½	
12	12¾	2	3¾	11	7¾	13.31	1	6⅝	⅞	⅜	2⅞	¾-16	1	4	1-8	8¼	2	7¼	
14	14¾	2¼	3⅞	12⅝	8¾	15.40	1¼	7⅞	1⅞	⅜	3⅞	⅞-14	1¼	4½	1¼-7	9⅞	2⅝	8⅝	

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.

"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 materials and labor.



National
FLUID POWER
Association

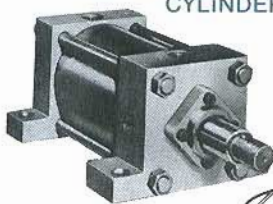
MEMBER

GALLAND HENNING NOPAK, Inc.

www.HoustonHydraulic.com

Houston Hydraulic
713-692-4421

NON-ROUND ROD CYLINDERS



THIS POSITIVE NON-ROTATING CYLINDER: Eliminates Outrigger Rods - Eliminates Internal Splines - Highest Torque Carrying Capacity - Incorporates Conventional Components Including Rod Packing. Available in 2" to 10" Bore Square Head Cylinders with 1" and 2" Nominal Non-Round Rods, Up to 14" Stroke.

MILL TYPE CYLINDER



Made of heavy, honed steel tubing. Lock-ring flange construction permits head rotation for most convenient mounting. Cylinder head design provides four inlet port locations spaced at 90 degrees. Designed for oil or water hydraulic service at pressures up to 2000 PSI. Consult factory.

SPECIAL CYLINDERS



NOPAK has a wealth of experience with special cylinders of varying bores, strokes and pressures. Hydraulic cylinders with diameters up to 33 inches and capable of generating 1500 tons of force have been designed and built by NOPAK.

HAND VALVE



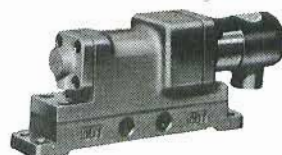
NOPAK 3 and 4-Way Hand Valve, 250 PSI, to actuate single or double acting cylinders. Sealing at right angle to stream flow permits gradual throttling or immediate full opening. See Catalog 102.

FOOT VALVE



MODEL "R" 4-way foot valve has oscillating disc with no neutral position and can be used as a 3-way valve, for single acting cylinder by plugging one port. It can also be used as a spring return shut-off valve by plugging one cylinder port and the exhaust port. See Catalog 102.

PILOT OPERATED VALVE



NOPAK MODEL V, Type AR, 4-Way Pilot-Operated Slide Valve. Unbalanced piston, under constant internal pressure, is shifted by admitting pressure to large end by energizing a normally closed 3-way solenoid pilot. Air 25 to 100 PSI. See Catalog 102.

POPPET TYPE AIR VALVE



NOPAK-MATIC 4-Way valves, master (air), single or double solenoid pilot controlled. Pipe sizes 1/4" through 1 1/4". Pressures to 150 PSIG. Side or bottom ports available. See Catalog 105.

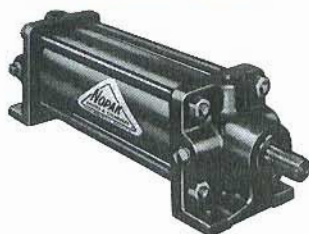
SPEED CONTROL

Adjustable Orifice Speed Control Valves



NOPAK FLOTROL valves provide uniform speed control of cylinders. Pipe sizes 1/4" thru 1". See Catalog 102.

CAST HEAD, TIE-ROD



Class 1: For air, oil or service at line pressures up to 250 PSI. Diameters up to and including 8" with 20" maximum stroke, available from Shelf-Stock for air and oil service. See Catalog 101.

Class 2: Identical to Class 1, except that the tubing (cylinder wall) is recessed into the cylinder heads, and the joint sealed by fibre gaskets. Class 2 is recommended for air, oil or water line pressures to 450 PSI. See Catalog 101.

ECONOPAK™ NFPA AIR OR HYDRAULIC CYLINDER



100% performance at 40% less cost! Economical, light weight. Quality built for tough use. Corrosion resistant aluminum barrel and heads. Chrome plated steel piston rod. Bronze rod bearing. Eight (8) interchangeable NFPA mountings. Pressures to 250 psi. Eight (8) bore sizes 1-1/2" to 8" diameter.

Special Option: Tie rod mounted, proximity switch stroke position indicator.

Also no lube option. See Catalog 109.