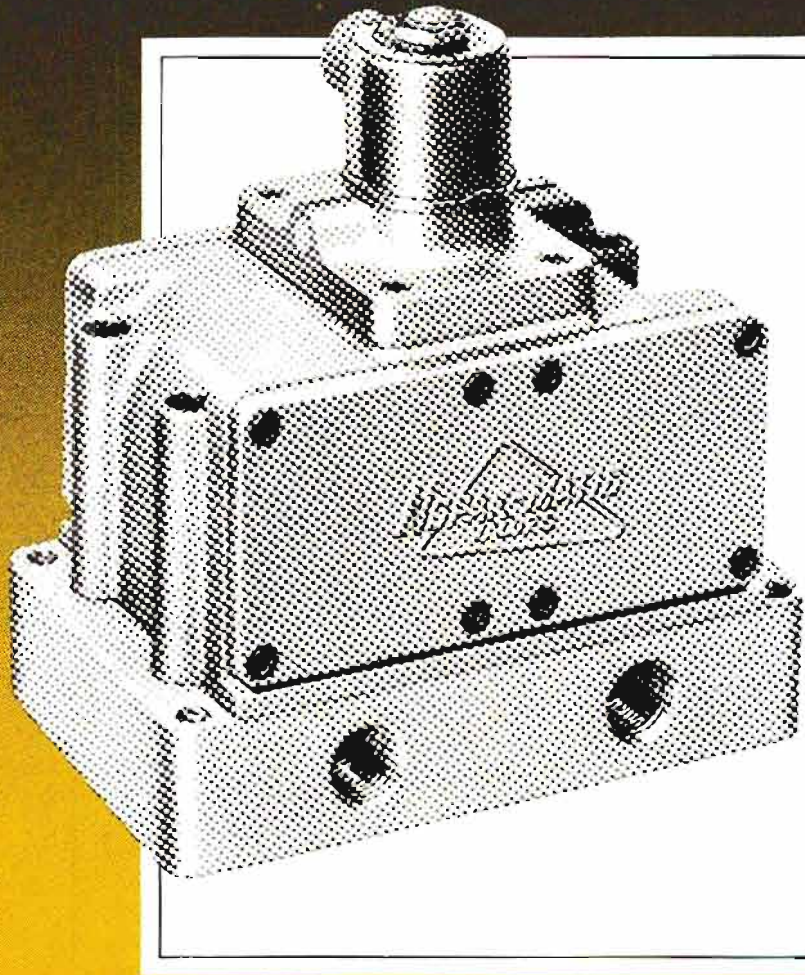


NOPAK[®]

CATALOG 105



POPPET-TYPE
AIR CONTROL
VALVES

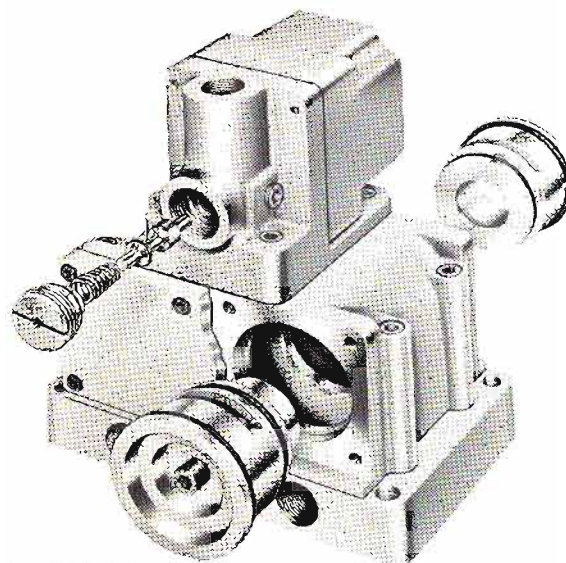
GALLAND HENNING NOPAK, Inc.

1025 South 40th Street • West Milwaukee, Wisconsin 53215
www.HoustonHydraulic.com • Sales@HouHyd.com
P.O. Box 343917 • West Milwaukee, Wisconsin 53234
PHONE: 414-645-6000 • FAX: 414-645-6048

TABLE OF CONTENTS

Nopak-Matic Valve Features and Ordering	2 & 3
Valve Selection and Maintenance	4
Flow Director and Typical Piping	5
3-Way Series 300 Master Valves	6 & 7
3-Way Series 310 PP Special Purpose, Single Solenoid Valves	8 & 9
3-Way Series 310 Single Solenoid Valves	10-13
3-Way Series 320 Double Solenoid Valves	14-17
4-Way Series 400 Master Valves	18 & 19
4-Way Series 410 PP Special Purpose, Single Solenoid Valves	20 & 21
4-Way Series 410 Single Solenoid Valves	22-25
4-Way Series 420 Double Solenoid Valves	26-29
Engineering Section	30-35
Other Nopak Products	36

SERIES 310, 320, 410 & 420 HIGH SPEED, HIGH VOLUME NOPAK-MATIC SINGLE AND DOUBLE SOLENOID VALVES



features and benefits

"Flow Director" Pilot Head — simplifies piping and makes desired valve operation simply by piping to the proper port.

Interchangeable Pilot Heads — any pilot head fits any valve, regardless of type or size.

Solenoids — low amperage, continuously rated industrial-type with hardened plunger faces.

Replaceable, Self-Cleaning Seats — fast and inexpensive replacement of all seats. Poppets do not seat on valve body.

Positive Sealing — resilient, bonded poppet seals ensure leak-proof operation and long life.

Rapid Response — valve shifts in less than .05 of a second.

Full Flow — all passages over-sized for minimum pressure drop through the valve (up to 1").

No Springs — piston-poppets shift with air pressure.

Light Weight, Compact — aluminum used extensively . . . smaller over-all dimensions. Every model has a clean, neat appearance that compliments modern machine design. Base mounting is provided but light weight of valves permits in-line mounting of largest valve.

Corrosion Resistant — all materials corrosion resistant.

Parts Interchangeability — design allows maximum parts interchangeability from one valve to another; and perfect "non-selected" fit of factory shipped maintenance parts.

Simplified Piping — exclusive "Flow-Director" allows piping with fewer fittings . . . makes fewer valves adaptable to more applications. See Page 5.

Manifold Mounting — Multiple valves of the various series or sizes can be mounted on a common manifold requiring only one inlet and exhaust.

additional features

- Subplate mounted
- Splash and dust-proof solenoid covers
- Solenoid inoperative with covers removed
- Manual solenoid push buttons

NOPAK-MATIC POPPET-TYPE AIR CONTROL VALVES

NOW YOU GET THIS

Any Nopak-Matic Valve, of either the 4-Way Series 400 or 3-Way Series 300, is easily changed to other Models of the same Series by exchanging only the pilot heads. Thus any valve can be converted to the operation desired . . . special purpose operation, single solenoid operation, double solenoid operation, or master (air) operation, in a matter of minutes.

In the Nopak-Matic valve you will find this interchangeability carried even further. Only two solenoids are required regardless of valve Series or Model. Only two sizes of piston-poppets, with their matching insert type seats are required . . . only four valve bodies are needed to cover the full range of sizes from 1/4" thru 1 1/4" pipe size and for 2-Way, 3-Way, and 4-Way operation. Gaskets, and plates, seals, etc. are interchangeable among many different valve Models.

WHAT THIS MEANS TO YOU

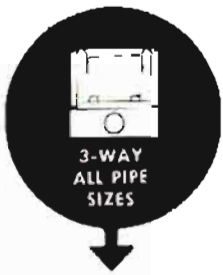
Fewer valves to stock to meet any directional valve control requirements. Fewer parts to stock for quick conversion from one valve to another. Fewer parts to stock for complete maintenance of all valve series, models and sizes. Complete availability of the Series and Model valve you require at the time you need it and with a minimum investment providing the greatest flexibility for satisfying your applications.

Also, all Nopak-Matic valves are available with side or bottom mounting.

www.HoustonHydraulic.com

Houston Hydraulic Sales@HouHyd.com
713-692-4421

SERIES 310PP & 410PP COMPACT, RELIABLE NOPAK-MATIC SINGLE SOLENOID VALVES



SERIES 300



SERIES 400



SERIES 310PP



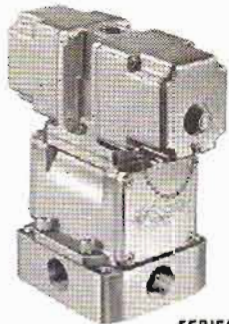
SERIES 410PP



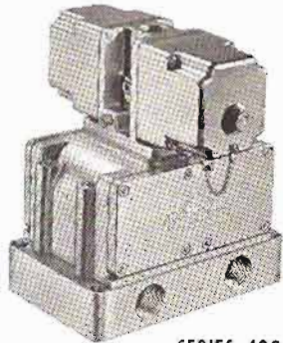
SERIES 310



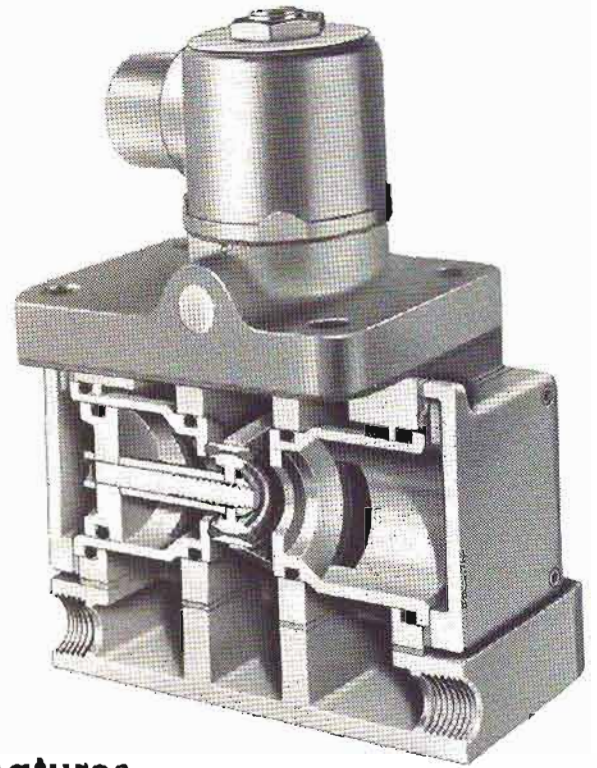
SERIES 410



SERIES 320



SERIES 420



features and benefits

All Purpose – developed especially as a compact, rugged, economically priced valve to solve the most demanding solenoid pilot operated air valve applications.

For All Atmospheric Conditions and Applications – simple pilot head operator is tolerant to dry, unlubricated air and dusty atmospheric conditions. Ideal for heavy duty batching plant, construction, excavation and foundry applications.

Fast Action – produces instantaneous valve response, even after long periods of solenoid energization or de-energization.

Manual Over-ride – solenoid pilot available with manual over-ride.

Single Unit – one pilot head fits all pipe size standard Napak-matic master valves.

Low Wattage – efficient solenoid pilot rated at 10 operating watts in closed position.

Explosion Proof – as well as specially impregnated solenoid coils are available for hazardous, wet or high temperature environment.

Fast Maintenance – complete valve assembly can be replaced in less than 2 minutes, without disturbing piping.

Replaceable, Self-cleaning Seats – fast and inexpensive to replace. Only two seat sizes required to fit all valves and are completely interchangeable within the valve or with other valves.

This valve is available with operating pressures to 125 psi air in the 310PP and 410PP single-solenoid series only. In the case of the 4-way, when the solenoid is energized, pressure is admitted to one cylinder port, the opposite cylinder port being open to exhaust. When the solenoid is de-energized the cycle is reversed.

Seats Replaceable Without Disturbing Plumbing.

ORDERING INFORMATION

WHEN ORDERING VALVES WITHOUT A SOLENOID, BE SURE TO SPECIFY — (1) Model Number and (2) Pipe Size. Unless otherwise specified, all valves shipped are for standard air service. If bottom ported base is desired, add the suffix "M1" to the model number. If the "make-up bleed" feature is required, it must be ordered as such.

WHEN ORDERING VALVES WITH SOLENOID, BE SURE TO SPECIFY — (1) Model Number (2) Pipe Size and (3) Voltage and Cycle. Unless otherwise specified, valves are shipped for standard air services, with 115V/60 solenoids. If bottom ported base is desired, add the suffix "M1" to the model number.

WHEN ORDERING VALVES FOR LOW PRESSURE (BELOW 15 PSI) OR VACUUM OPERATION, BE SURE TO SPECIFY — Remote pilot supply and add suffix "M2" to the model number.

WHEN ORDERING PARTS, BE SURE TO SPECIFY — (1) Model Number (2) Pipe Size (3) Item Number (4) Part Name (5) Part Number and (6) Voltage and Cycle.

www.HoustonHydraulic.com

Houston Hydraulic
713-692-4421

Sales@HouHyd.com

USE 3-WAY NOPAK-MATIC VALVES —

1. To control single acting (spring-return) cylinders.
2. To control double-acting cylinders:
 - a. Piping one 3-Way valve at each end of the cylinder provides both quick exhaust and immediate pressure supply for extremely fast cylinder operation.
 - b. On long-stroke cylinders, using two 3-Way valves eliminates filling and exhausting long

lengths of pipe, thus reducing air consumption and increasing cylinder speed.

3. To provide two pressure operation of a double-acting cylinder. Regulated pressure is directed to one end of cylinder through a 3-Way valve, and line pressure to the other end of cylinder through the other 3-Way valve.
4. To provide directional control. Pressure can be piped to the outlet port and flow directed to either Port "A" or Port "B".

SERIES 300, 310PP, 310 and 320 3-WAY VALVES FOR NORMALLY OPEN OR NORMALLY CLOSED OPERATION	MODEL AND PIPE SIZE						
	¼"	⅜"	½"†	½"	¾"	1"	1 ¼"
Series 300 Master Valves, for remote control	300	301	301 ½	302	303	304	305
Series 310PP Special purpose, single solenoid	310PP	311PP	311 ½ PP	312PP	313PP	314PP	315PP
Series 310 Single solenoid valves, with spring return pilot head	310	311	311 ½	312	313	314	315
Series 320 Double solenoid valves (momentary contact-type)	320	321	321 ½	322	323	324	325

†Models 301½, 311½ and 321½ are ¾" valves modified for ½" ports.

USE 4-WAY NOPAK-MATIC VALVES —

1. To obtain reciprocating action of double-acting cylinders.
2. To operate long-stroke double-acting cylinders when maximum speed is not of prime importance.
3. To obtain fast action and quick reversal of short-stroke cylinders.
4. To provide control of low pressure and vacuum

operation. Valve is modified by the addition of spring loaded piston-poppet valve seat assemblies and may require remote pilot supply. (Also applicable to 3-Ways.) See Engineering Section.

5. To control fluids other than air. In this case, fluid is piped into the valve body and pilot air pressure is brought to the pilot head from a remote source. See Engineering Section.

SERIES 400, 410PP, 410 and 420 4-WAY VALVES	MODEL AND PIPE SIZE						
	¼"	⅜"	½"†	½"	¾"	1"	1 ¼"
Series 400 Master valves for remote control	400	401	401 ½	402	403	404	405
Series 410PP Special purpose, single solenoid	410PP	411PP	411 ½ PP	412PP	413PP	414PP	415PP
Series 410 Single solenoid valves with spring return pilot head	410	411	411 ½	412	413	414	415
Series 420 Double solenoid valves (momentary contact-type)	420	421	421 ½	422	423	424	425

†Models 401½, 411½ and 421½ are ¾" valves modified for ½" ports.

IN-LINE (ON-THE-JOB) MAINTENANCE

"In-line" maintenance is accomplished with small loss of production time. A Nopak-matic valve can be completely serviced in the line in less than fifteen minutes. The cover plates of the valve body, when removed, give immediate access to the piston-poppets and inserted valve seats. These parts are removable as complete assemblies. It is only a matter of minutes to completely replace all moving parts in the main valve. Damage to valve seats machined in the body can never be the cause of a Nopak-matic valve malfunctioning; for all valve seats are inserts and completely interchangeable.

SUB-PLATE MOUNTING

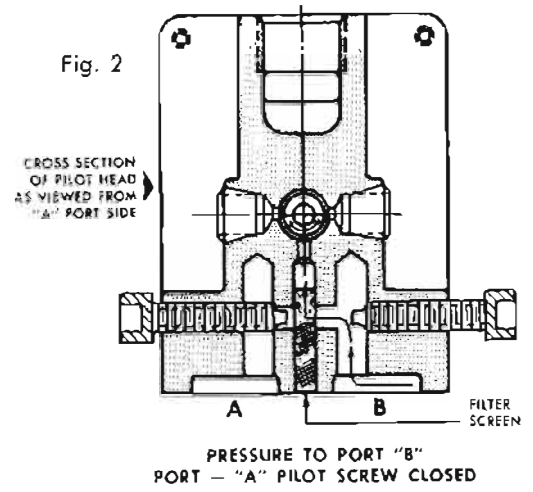
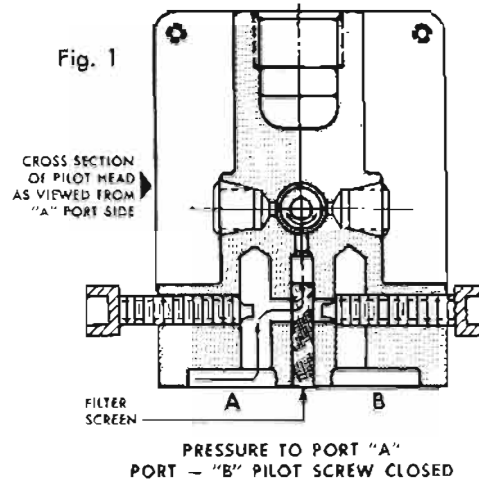
Nopak-matic makes use of subplate mounting of all valves. A

complete valve assembly can be replaced in less than two minutes simply by loosening the four mounting screws that hold the valve body assembly to the subplate. Piping need never be disturbed.

Similarly, pilot heads are quickly replaceable as a unit simply by removing the four screws attaching it to the valve body.

Precision machining of all parts and maximum interchange of parts between valves of different types and sizes allow complete service of more than one-hundred valve combinations with less than twenty-five individual parts. No waiting for special parts is required to get back in operation when you use Nopak-matic. A very small stock of parts is required for complete service of all sizes or types of Nopak-matic valves.

THE FLOW DIRECTOR



The "Flow-Director"^{**}, exclusive with Nopak-matic^{**}, gives you the choice of a normally closed or normally open 3-way valve, without time consuming and complicated reassembly of basic parts; and precludes the expense of buying special valves for each cycle. Also, in 4-way valves, criss-cross piping can be eliminated.

The "Flow-Director", using two manually set pilot screws, permits line pressure to be directed from the optional supply part to the pilot head.

4-WAY SERIES 410 OR 420 SOLENOID VALVES

Unless otherwise specified, all 4-way valves are assembled for pressure supply to port "A" and pilot screws set as in Fig. 1. If line pressure supplied to Port "B" should result in more convenient piping, reverse position of pilot screws (see Fig. 2) as follows: **BACK OUT THE PILOT SCREW ABOVE PORT "B" 6 COMPLETE TURNS**, counter-clockwise. Then turn in clockwise, the opposite pilot screw, (above port "A"), until it

solidly bottoms. Then **FORCE** in 1/2 TURN MORE, to assure tight seating.

3-WAY SERIES 310 OR 320 SOLENOID VALVES

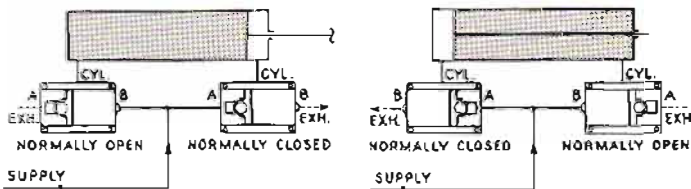
Unless otherwise specified, all 3-way valves are assembled for **NORMALLY CLOSED** operation, with pilot screws set as in Fig. 1: supply to port "A"; CYL. port(s) closed to pressure and connected to port "B" exhaust. For **NORMALLY OPEN** operation, reverse setting of pilot screws as shown in Fig. 2 and connect pressure supply to port "B".

Pilot Head Filter Screen

All Nopak-matic pilot heads are equipped with a filter screen (see Cross-section above) to protect the pilot head seals. If screen collects an excessive amount of foreign matter, valve action may be slower than normal. If this occurs, remove and clean screen.

(*) Registered Patent -- (**) Registered Trademark

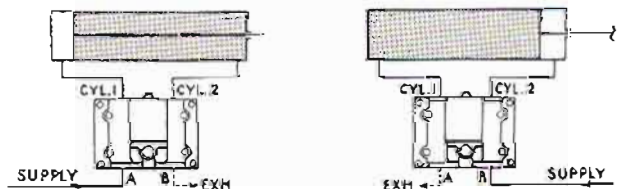
3-WAY NORMALLY OPEN OR NORMALLY CLOSED



Piping supply to Port "A" provides Normally Closed operation — supply to Port "B" Normally Open operation. Rotating the pilot head 180° (PP Models) or closing one "Flow-Director" needle or the other is all that's necessary to change operation. All 3-Way valves have two cylinder outlet ports for further piping convenience.

The exclusive Nopak-matic "Flow-Director" pilot head selects pilot pressure from whichever port is used as inlet. It eliminates special valves for each application or re-assembling parts. Addition of a pipe plug to any Nopak-matic 3-Way valve converts it for 2-Way operation. They can also be used for directional control.

ELIMINATE CRISS-CROSS PIPING



All Nopak-matic 4-Way valves can be piped with pressure to Port "A" or Port "B". Flow through the valve is thus changed to meet the application requirements . . . rod extended or retracted. Criss-cross piping to the cylinder is eliminated. Here again, the "Flow-Director" pilot head selects pilot pressure from the inlet port. There are no extensive changes to make in the valve . . . just reset the needles.

Master Valves •

2-Way* and 3-Way •

Normally Open or Normally Closed •

3/8", 3/8", 1/2", 3/4", 1", 1 1/4" Pipe Sizes •

Pressures 15 to 150 Lbs. Air •

3-WAY SERIES 300 MASTER VALVES

OPERATION

NORMALLY CLOSED OPERATION — Supply connected to Port "A" — "CYL" Port closed to pressure — Port "B" exhaust.

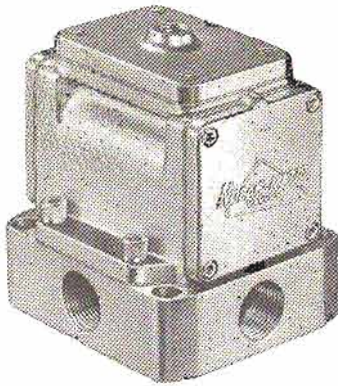
NORMALLY OPEN OPERATION — Supply connected to Port "B" — "CYL" Port open to pressure — Port "A" exhaust.

***2-WAY OPERATION** — "For 2-Way Operation" must be so specified on the order as valve must be modified by insertion of poppet return spring in the master valve.

Plug exhaust port — "B" for Normally Closed operation — "A" for Normally Open operation. Note that two cylinder ports are provided for simplification of piping. A sealing plug is provided for the unused port.

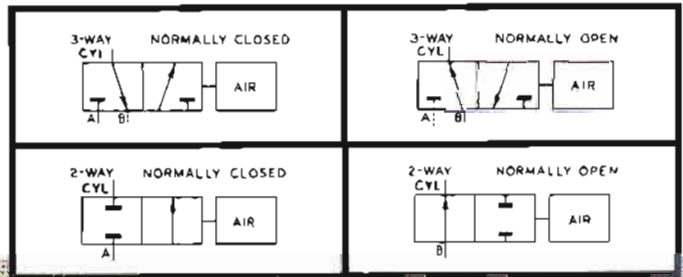
PILOT PRESSURE — Should equal or exceed pressure in valve body.

ACTUATION — Master Valves can be actuated by any 3-Way Valve.

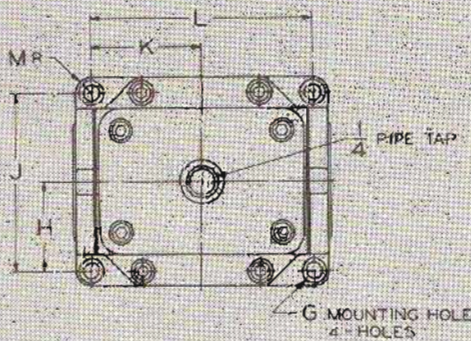


OPTIONAL FEATURES

- Series 300 valves can be modified for lower pressures, vacuum operation or service other than air . . . see Engineering Section. Series 300 valves are available with bottom ported bases at *slight extra cost*. See Engineering Section for dimensions.



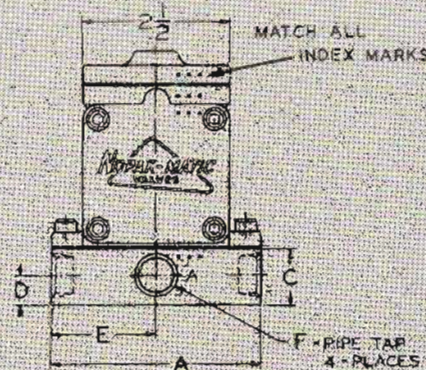
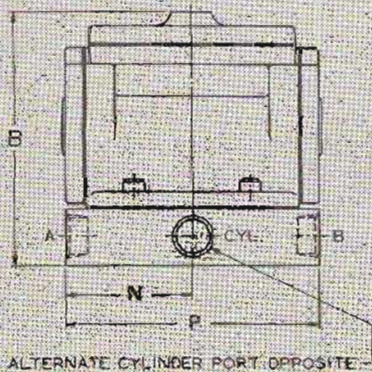
DIMENSIONS AND INSTALLATION DATA



Size	Model Number	DIMENSIONS IN INCHES														
		A	B	C	D	E	F	G	H	J	K	L	M	N	P	
3/8	300															
3/8	301															
1/2	301 1/2	3 3/16	4 1/2	1 3/8	3/16	1 3/32	3/8	1/64	1 11/32	3 1/16	1 23/32	3 13/16	3/4			
1/2	302															
3/4	303	4	5 1/16	1 1/2	3/4	2	3/8	1/64	1 13/16	3 3/8	1 3/4	3 1/2	3/4			
1	304															
1 1/4	305	4 1/4	6 1/8	2 7/16	1 3/8	2 3/8	1 1/4	1/32	1 1/16	3 3/8	2 1/16	5 7/8	3/4	3 5/16	6 5/8	

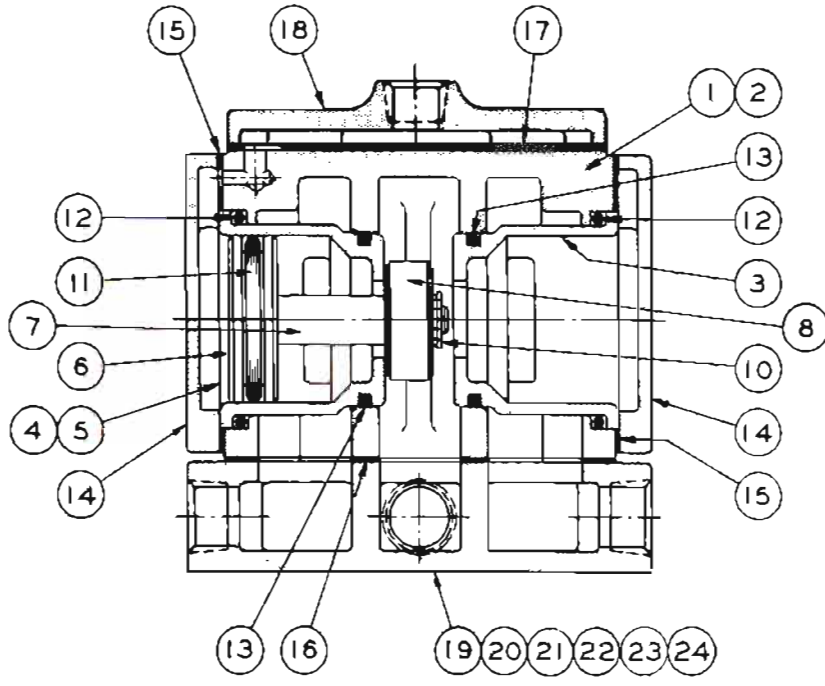
*Model 301 1/2 is the standard 301 valve with 1/2" pipe taps

FULL I.P.S. CAPACITY ALL SIZES (up to 1")



INSTALLATION DATA

- Valve must have **ADEQUATE SUPPLY (VOLUME)** and **UNRESTRICTED EXHAUST**. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the cylinder supply line.
- These valves can be operated Normally Open or Normally Closed to pressure simply by changing the piping. (See OPERATION above).
- Valve will operate mounted in any position.



PILOT HEAD PARTS LIST

Series 300 — 3-way Master Valves

Item	Req.	Description	1/4-3/8-1/2-3/4-1-1 1/4 Part No.
17	1	Master Head Gasket	1057
18	1	Master Valve Head ²	1019

- 1. Item No. 3, Valve Seat, is identical to Item No. 5 except one Valve Seat Unit contains the piston/poppet assembly.
- 2. Not shown on cross section.
- 3. Ports are shipped with gasket or gaskets required.
- 4. Piston/Poppet Seat Assy. Part No.'s for vacuum service are: for 1/4" and 3/8" — No. 1139; for 1/2", 3/4", 1" and 1 1/4" — No. 1127. Assembly Part No.'s for low pressure service are: for 1/4" and 3/8" — No. 1184; for 1/2", 3/4", 1" and 1 1/4" — No. 1185.

VALVE BODY PARTS LIST

Series 300 — 3-way Master Valves

Item	Req.	Description	1/4-3/8	1/2-3/4	1-1 1/4
			Part No.	Part No.	Part No.
1	1	Valve Body Assembly ³	1100	1101	1152
2	1	Valve Body	1000	1001	1001
3	1	Valve Seat ³	1026	1027	1172
4	1	Piston/Poppet Seat Assy. ^{1,4}	1028	1029	1233
5	1	Valve Seat ³	1026	1027	1172
6	1	Piston	1032	1035	1035
7	1	Spacer	1033	1036	1036
8	1	Poppet	1034	1037	1037
9	1	Sec. Head Cap Screw ³	1079	1080	1080
10	1	Flexloc Hex Nut	1081	1082	1082
11	1	Piston "O" Ring	1070	1071	1071
12	2	Valve Seat "O" Ring (Large)	1066	1111	1111
13	2	Valve Seat "O" Ring (Small)	1071	1068	1068
14	2	Valve Body Cover ³	1020	1021	1021
15	2	Valve Body Cover Gasket	1058	1059	1059
16	1	Valve Body Base Gasket	1062	1063	1063
19	1	Valve Base (1/4" Ports) ³	1084		
20	1	Valve Base (3/8" Ports) ³	1005		
21	1	Valve Base (1/2" Ports) ³		1006	
22	1	Valve Base (3/4" Ports) ³		1007	
23	1	Valve Base (1" Ports) ³			1175
24	1	Valve Base (1 1/4" Ports) ³			1176

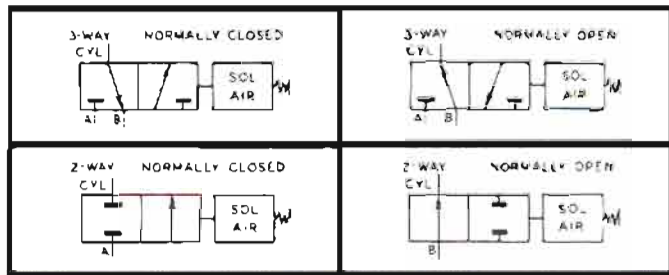
- Solenoid Pilot Controlled
- 2-Way* and 3-Way
- Open or Closed
- Pipe Size 1/4 thru 1 1/4
- Line Pressure to 125 PSI Air



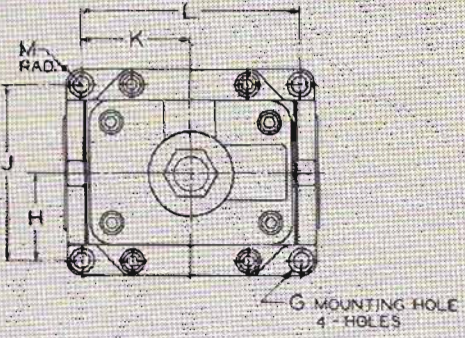
3 WAY SERIES 310PP SPECIAL PURPOSE SINGLE SOLENOID VALVES

FEATURE: Simple pilot head operator — tolerant to dry, unlubricated air and dusty environment — ideal for heavy duty batching plant, construction, excavating and foundry applications. Instantaneous valve response even after long periods of energization or de-energization. Solenoid pilot with manual over-ride. Available for 115, 230, 460 volt A.C.; also D.C.

*2-WAY OPERATION — "For 2-Way Operation" must be so specified on the order as valve must be modified by insertion of poppet return spring in the master valve.

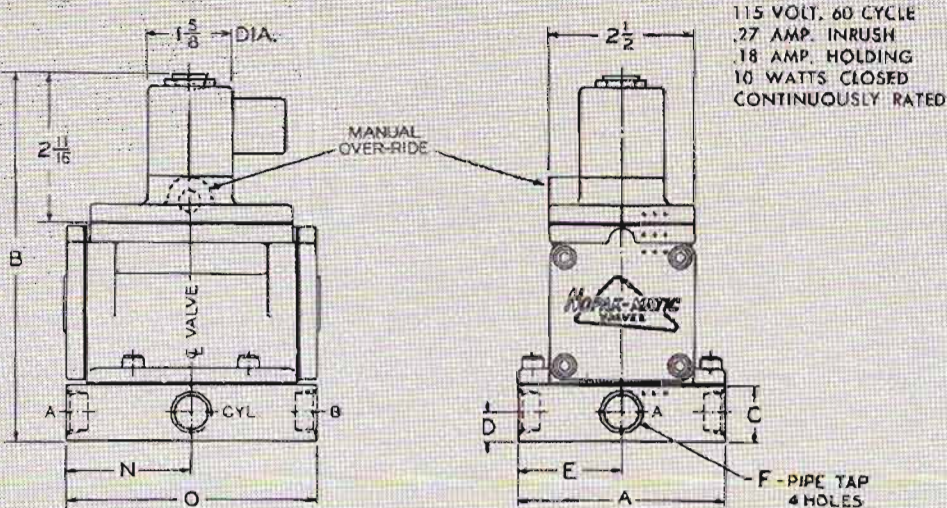


DIMENSIONS AND INSTALLATION DATA



Size	Model Number	DIMENSIONS IN INCHES													
		A	B	C	D	E	F	G	H	J	K	L	M	N	O
1/4	310PP						1/4								
3/8	311PP	3 3/8	6 5/8	1 1/8	3/8	1 1/32	3/8	1 3/8	1 7/32	3 3/8	1 7/32	3 1/4	3/4	2 5/16	4 3/8
1/2	311 1/2 PP						1/2								
3/2	312PP	4	7 3/8	1 1/2	3/4	2	1/2	2 3/8	1 1/8	3 3/8	1 3/4	3 1/2	3/8	2 3/16	4 5/8
3/4	313PP						3/4								
1	314PP	4 1/4	8 1/4	2 1/8	1 3/8	2 3/8	1	1 1/2	1 1/8	3 3/8	2 1/4	5 3/8	3/8	3 5/16	6 3/8
1 1/4	315PP						1 1/4								

*Model 311 1/2 PP is the standard 311 PP with 1/2" ports.

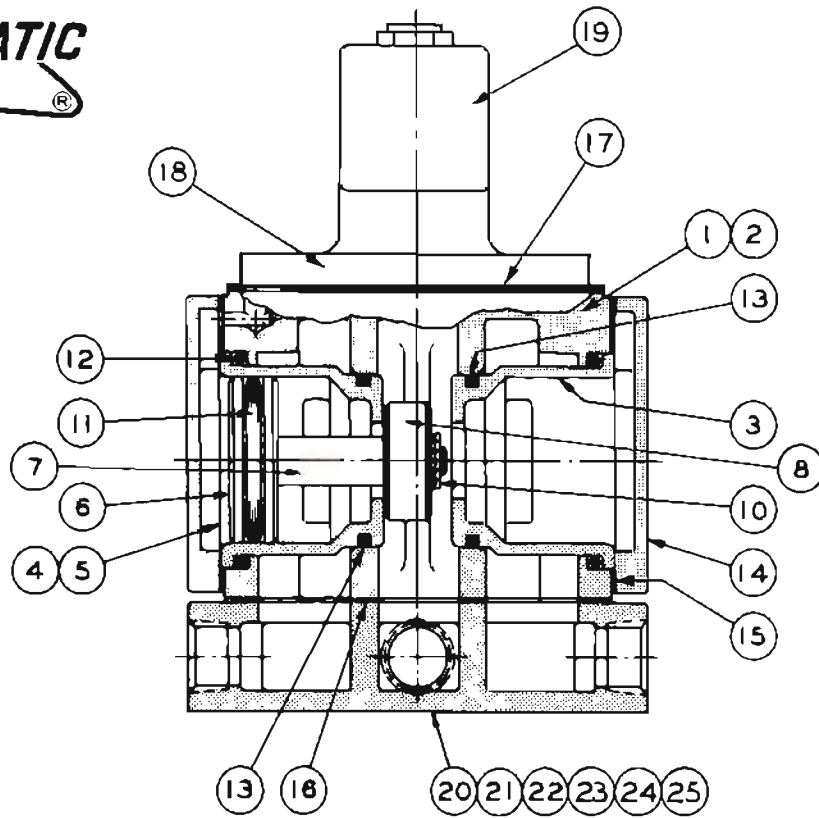


SOLENOID
 115 VOLT, 60 CYCLE
 .27 AMP. INRUSH
 .18 AMP. HOLDING
 10 WATTS CLOSED
 CONTINUOUSLY RATED

INSTALLATION DATA

310 PP valves are assembled as standard for normally closed operation supply to port "A"; "CYL" port blocked port "B" exhaust.

Normally open cycle can be obtained on the 310 PP valves only by rotating the pilot head, but not the gasket, 180°. Inlet to port "B"; "CYL" port open, port "A" to exhaust in energized position.



VALVE PARTS LIST

SERIES 310 PP—3-WAY SINGLE SOLENOID
MAINTAINED CONTACT TYPE

Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.	1-1 1/2 Part No.
1	1	Valve Body Assembly	1100	1101	1152
2	1	Valve Body	1000	1001	1001
3	1	Valve Seat	1026	1027	1172
4	1	Piston Poppet Seat Assembly	1028	1029	1233
5	1	Valve Seat	1026	1027	1172
6	1	Piston	1032	1035	1035
7	1	Spacer	1033	1036	1036
8	1	Poppet	1034	1037	1037
9	1	Soe. Hd. Cap Screw	1079	1080	1080
10	1	Flexloc Hex. Nut	1081	1082	1082
11	1	Piston "O" Ring	1070	1071	1071
12	2	Valve Seat "O" Ring (Large)	1066	1111	1111
13	2	Valve Seat "O" Ring (Small)	1071	1068	1068
14	2	Valve Body Cover	1020	1021	1021
15	2	Valve Body Cover Gasket	1058	1059	1059
16	1	Valve Body Base Gasket	1062	1063	1063
17	1	Pilot Head Gasket	1089	1089	1089
18	1	Pilot Head	1196-1	1196-1	1196-1
19	1	PP Pilot Solenoid	1188	1198	1198
20	1	Valve Base — 1/4" Ports	1004		
21	1	Valve Base — 3/8" Ports	1005		
22	1	Valve Base — 1/2" Ports		1006	
23	1	Valve Base — 3/4" Ports		1007	
24	1	Valve Base — 1" Ports			1175
25	1	Valve Base — 1 1/2" Ports			1176

- Solenoid Pilot Controlled •
- 2-Way* and 3-Way •
- Normally Open or Normally Closed •
- 1/4", 3/8", 1/2", 3/4" Pipe Sizes •
- Pressures 15 to 125 Lbs. Air •

3-WAY SERIES 310 SINGLE SOLENOID VALVES

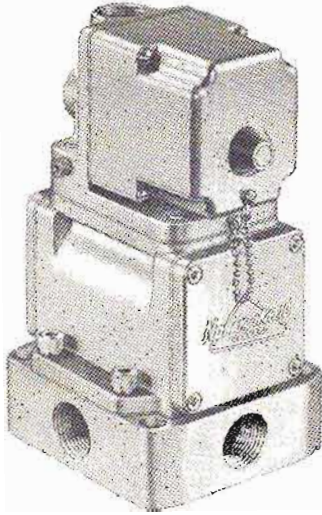
OPERATION

NORMALLY CLOSED OPERATION — Supply connected to Port "A" — "CYL" Port closed to pressure — Port "B" exhaust.

NORMALLY OPEN OPERATION — Supply connected to Port "B" — "CYL" Port open to pressure — Port "A" exhaust.

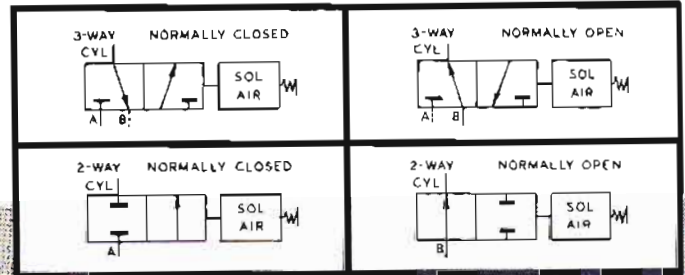
***2-WAY OPERATION** — "For 2-Way Operation" must be so specified on the order as valve must be modified by insertion of poppet return spring in the master valve.

Plug exhaust port — "B" for Normally Closed operation — "A" for Normally Open operation. Note that two cylinder ports are provided for simplification of piping. A sealing plug is provided for the unused port. Also, on all valves with pilot heads, a remote supply must be provided to operate properly.



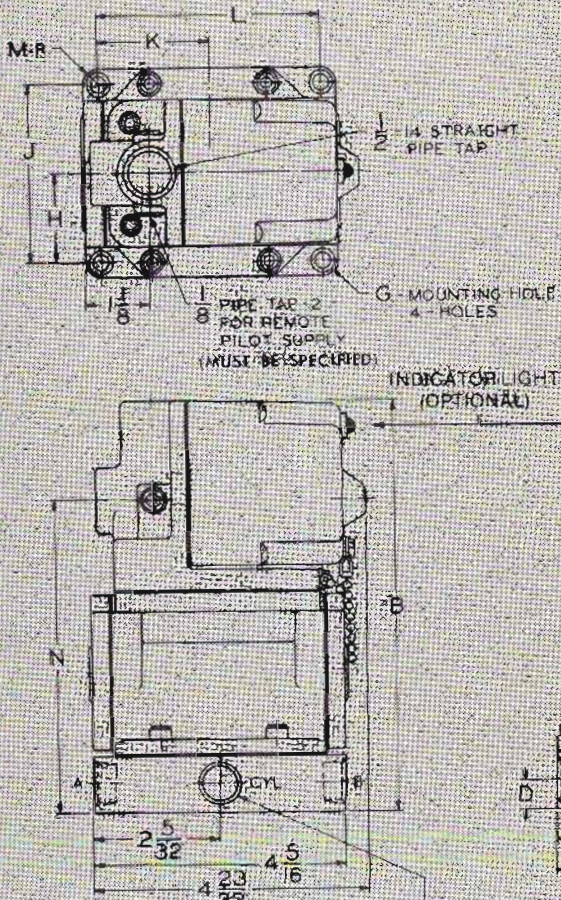
OPTIONAL FEATURES

- Indicator light - a neon pilot light can be provided to indicate the solenoid energizing.
- Solenoids for 115/50, 115/60, 230/50, 230/60, 460/50, 460/60, 550/60 volt A.C. and 12, 16, 24, 32, 50, 90, 125 and 250 volt D.C. are in stock. Special coils, also heavy duty and oil immersed solenoids, available on inquiry.
- Series 310 valves can be modified for lower pressures, vacuum operation or service other than air . . . see Engineering Section.
- Series 310 valves are available with bottom ported bases, at slight extra cost. See Engineering Section for dimensions.



DIMENSIONS AND INSTALLATION DATA

(D.C. solenoids are longer than A.C. shown here. See Engineering Section for D.C. dimensions.)



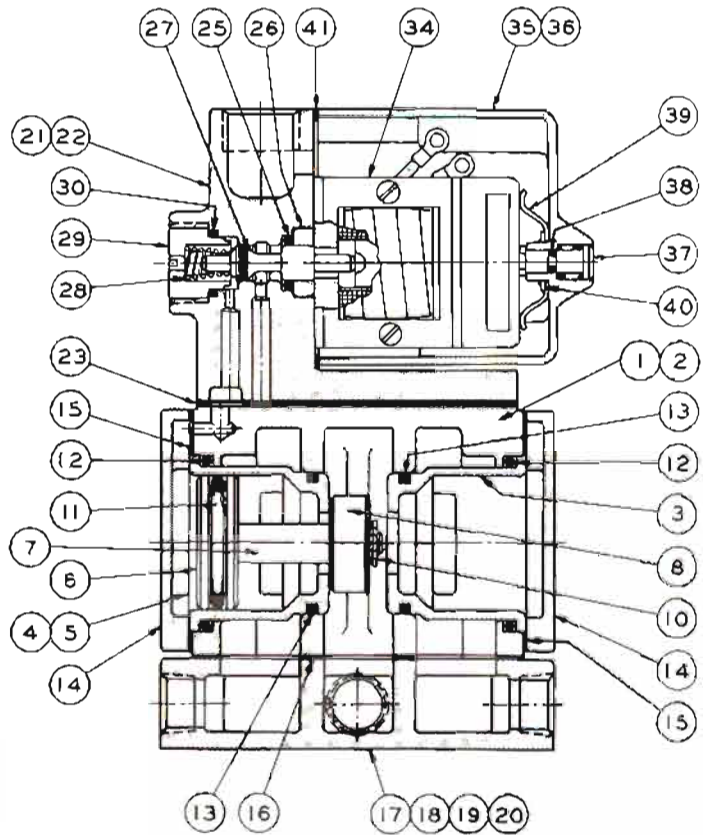
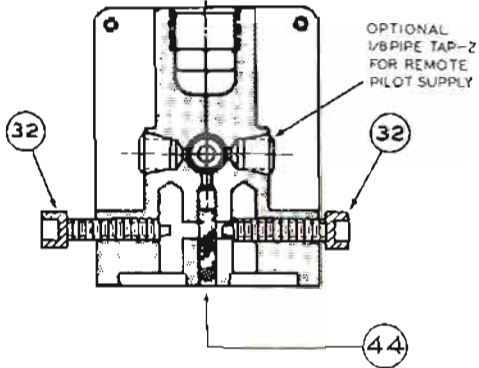
Model Size	Model Number	DIMENSIONS IN INCHES													
		A	B	C	D	E	F	G	H	J	K	L	M	N	
1/4"	310						1/4								
3/8"	311	3 1/16	7 3/4	1 1/8	3/8	1 25/32	3/8	3/16	1 1/2	3/8	1 25/32	3 1/16	1/4	5 1/2	
1/2"	311 1/2						1/2								
3/4"	312						3/4								
1"	313	4	7 25/32	1 1/4	3/8	2	3/4	3/16	1 5/8	3/8	1 3/4	3 1/2	3/8	6 1/8	

*Model 311 1/2 is the standard 311 valve with 1/2" pipe taps

SOLENOID
115 VOLT 60 CYCLE
1.62 AMPS - INRUSH
.385 AMPS - HOLDING
18.5 - CLOSED WATTS
CONTINUOUSLY RATED

INSTALLATION DATA

- Valve must have ADEQUATE SUPPLY (VOLUME) and UNRESTRICTED EXHAUST. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the cylinder supply line.
- Unless otherwise specified, Flow Director in pilot head is set for normally closed operation. (See OPERATION above) For normally open operation, setting must be reversed. (See Engineering Section - Flow Director.)
- If valve must be mounted with solenoid in a vertical position, then valve should be mounted so plunger and pilot stem climb when solenoid is energized. They are returned by spring and gravity.
- These valves should be operated with a remote pilot supply when used for service other than air, or for



For single solenoid pilot head, we recommend the simplified PP design (see page 3) The more expensive "Decco" pilot head is still necessary for double solenoid pilot heads and where "Decco" pilot heads are needed for replacements.

PILOT HEAD PARTS LIST
Series 310 — 3-way Single Solenoid
Maintained Contact Type

VALVE BODY PARTS LIST
Series 310 — 3-way Single Solenoid
Maintained Contact Type

Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.	Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.
21	1	Pilot Head Assembly	1030	1030	1	1	Valve Body Assembly ³	1100	1101
22	1	Pilot Head (Casting Only)	1017	1017	2	1	Valve Body	1000	1001
23	1	Pilot Head Gasket	1089	1089	3	1	Valve Seat ¹	1026	1027
24	2	Solenoid Locating Roll Pins ²	1086	1086	4	1	Piston Poppet Seat Assy. ^{3, 6}	1028	1029
25	1	Pilot Stem "O" Ring	1072	1072	5	1	Valve Seat ¹	1026	1027
26	1	Pilot Stem "O" Ring Retainer	1043	1043	6	1	Piston	1032	1035
27	1	Pilot Stem Assembly	1046	1046	7	1	Spacer	1033	1036
28	1	Pilot Stem Spring	1052	1052	8	1	Poppet	1034	1037
29	1	Pilot Stem Spring Retainer	1044	1044	9	1	Soc. Hd. Cap Screw ²	1079	1080
30	1	Spring Retainer "O" Ring	1073	1073	10	1	Flexloc Hex Nut	1081	1082
32	2	Pilot Screw	1112	1112	11	1	Piston "O" Ring	1070	1071
34	1	Solenoid ⁴	1038	1038	12	2	Valve Seat "O" Ring (Large)	1066	1111
35	1	Solenoid Cover Assembly	1105	1105	13	2	Valve Seat "O" Ring (Small)	1071	1068
36	1	Solenoid Cover	1016	1016	14	2	Valve Body Cover ³	1020	1021
37	1	Manual Operating Button ⁵	1041	1041	15	2	Valve Body Cover Gskt.	1058	1059
38	1	Manual Oper. But. "O" Ring	1074	1074	16	1	Valve Body Base Gskt.	1062	1063
	1	Manual Oper. But. Spring	1110	1110	17	1	Valve Base (1/4" Ports) ³	1004	
	1	Manual Oper. But. Snap Ring	1099	1099	18	1	Valve Base (3/8" Ports) ³	1005	
39	1	Solenoid Retaining Spring	1040	1040	19	1	Valve Base (1/2" Ports) ³		1006
40	1	Solenoid Ret. Sprg. Snap Ring	1087	1087	20	1	Valve Base (3/4" Ports) ³		1007
41	1	Solenoid Cover Gasket	1039	1039					
42	1	Solenoid Cover Chain ²	1088	1088					
	2	Chain Screw ²	1104	1104					
44	1	Screen	1113	1113					

1 Item No. 3, Valve Seat, is identical to Item No. 3 except one Valve Seat unit contains the piston-poppet assembly.
 2 Not shown on cross-section.
 3 Parts are shipped with gasket or gaskets required.
 4 Specify voltage and cycle.
 5 Part No's 1074, 1110 and 1099 shipped with Manual Operating Button.
 6 Piston Poppet Seat Assy. Part No. for valve service are: for 1/4" - No. 1139; for 3/8" & 1/2" - No. 1184; for low pressure service are: for 1/4" & 3/8" - No. 1185; for 1/2" & 3/4" - No. 1185.

- Solenoid Pilot Controlled •
- 2-Way* and 3-Way •
- Normally Open or Normally Closed •
- 1" and 1½" Pipe Sizes •
- Pressures 15 to 125 Lbs. Air •

3-WAY SERIES 310-1" and 1½" PIPE SIZE SINGLE SOLENOID VALVES

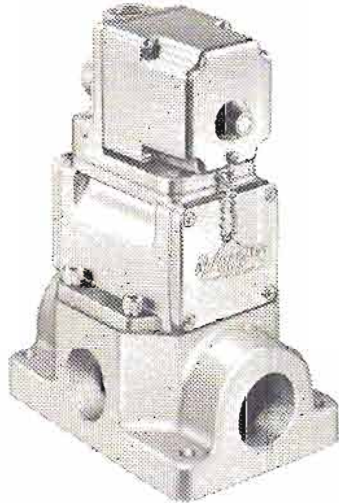
OPERATION

NORMALLY CLOSED OPERATION — Supply connected to Port "A" — "CYL" Port closed to pressure — Port "B" exhaust.

NORMALLY OPEN OPERATION — Supply connected to Port "B" — "CYL" Port open to pressure — Port "A" exhaust.

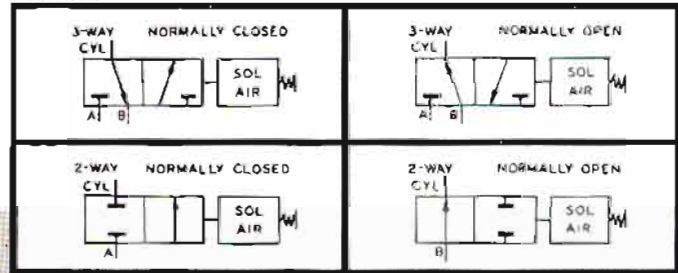
***2-WAY OPERATION** — "For 2-Way Operation" must be so specified on the order as valve must be modified by insertion of poppet return spring in the master valve.

Plug exhaust port — "B" for Normally Closed operation — "A" for Normally Open operation. Note that two cylinder ports are provided for simplification of piping. A sealing plug is provided for the unused port. Also, on all valves with pilot heads, a remote supply must be provided to operate properly.



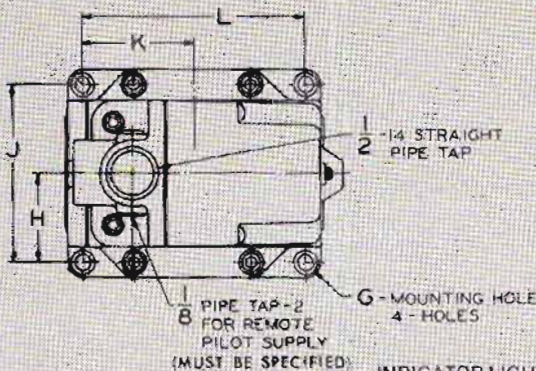
OPTIONAL FEATURES

- Indicator light - a neon pilot light can be provided to indicate the solenoid energizing.
- Solenoids for 115/50, 115/60, 230/50, 230/60, 460/50, 460/60, and 550/60 volt A.C. and 12, 16, 24, 32, 50, 90, 125, and 250 volt D.C. are in stock. Heavy duty 115 volt 60 cycle and oil immersed 115 volt 60 cycle are also in stock. Special coils, also heavy duty and oil immersed solenoids, available on inquiry.
- Series 310 valves can be modified for lower pressures, vacuum operation or service other than air . . . see Engineering Section.
- Series 310 valves are available with bottom ported bases, at slight extra cost. See Engineering Section for dimensions.



DIMENSIONS AND INSTALLATION DATA

(D.C. solenoids are longer than A.C. shown here.
See Engineering Section for D.C. dimensions.)



Size	Model Number	DIMENSIONS IN INCHES											
		A	B	C	D	E	F	G	H	J	K	L	N
1	314	4 3/4	8 3/4	2 1/8	1 3/8	2 1/8	1	7/8	1 1/4	3 3/8	2 1/8	5 3/8	7 3/4
1 1/2	315	4 1/4	8 3/4	2 1/8	1 3/8	2 1/8	1 1/4	1 1/4	1 1/4	3 3/8	2 1/8	5 3/8	7 3/4

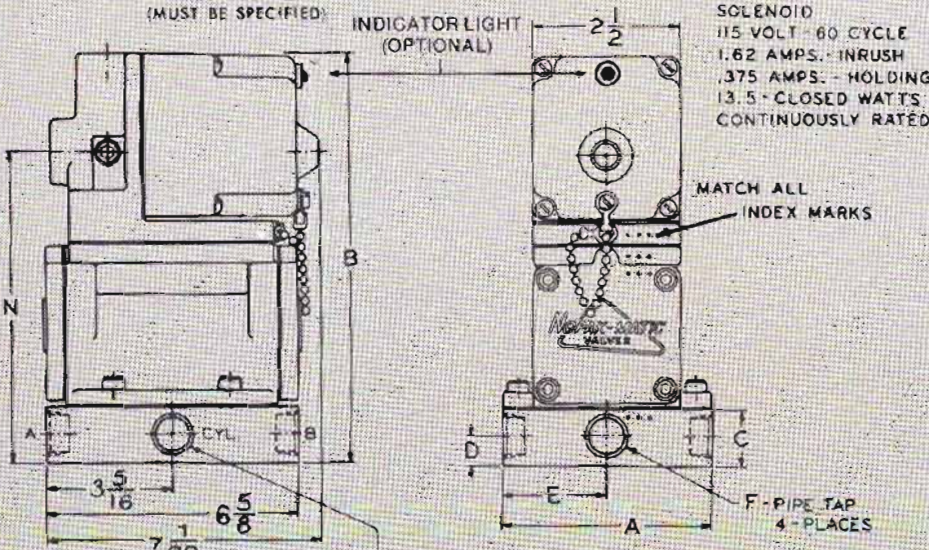
INSTALLATION DATA

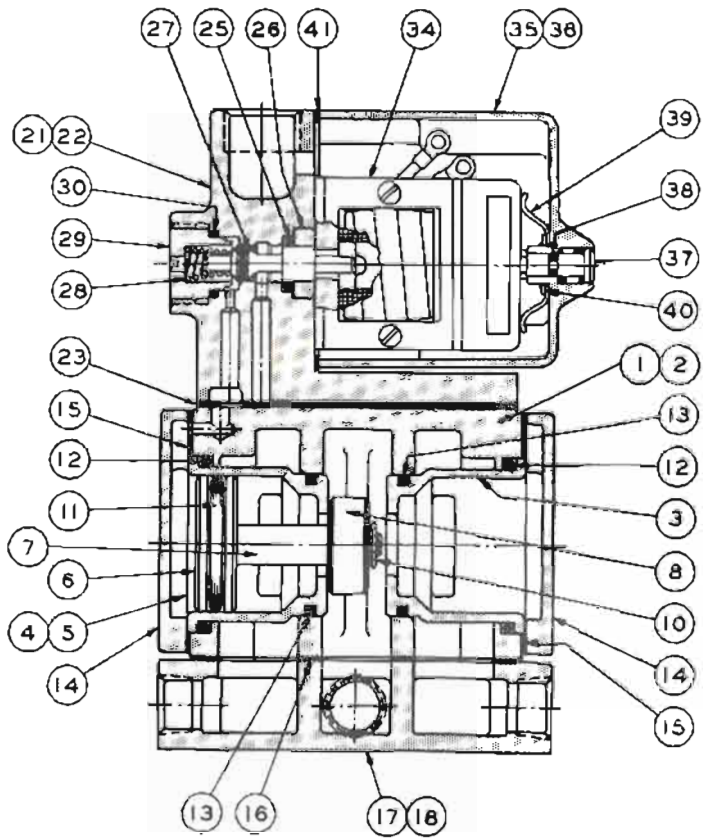
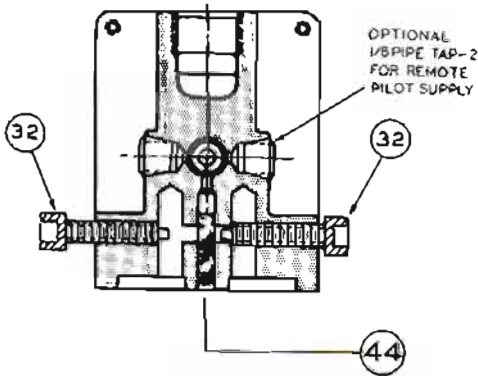
1. Valve must have ADEQUATE SUPPLY (VOLUME) and UNRESTRICTED EXHAUST. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the cylinder supply line.

2. Unless otherwise specified, Flow Director in pilot head is set for normally closed operation. (See OPERATION above.) For normally open operation, setting must be reversed. (See Engineering Section . . . Flow Director.)

3. If valve must be mounted with solenoid in a vertical position, then valve should be mounted so plunger and pilot stem climb when solenoid is energized. They are returned by spring and gravity.

4. These valves should be operated with a remote pilot supply when used for service other than air, or for vacuum operation. See Engineering Section.





For single solenoid pilot head, we recommend the simplified P.P. design (see page 3). The more expensive "Decco" pilot head is still necessary for double solenoid pilot heads and where "Decco" pilot heads are needed for replacements

PILOT HEAD PARTS LIST
Series 310 — 3-way Single Solenoid
Maintained Contact Type

VALVE BODY PARTS LIST
Series 310 — 3-way Single Solenoid
Maintained Contact Type

Item	Req.	Description	1"-1 1/4" Part No.	Item	Req.	Description	1"-1 1/4" Part No.
21	1	Pilot Head Assembly	1030	1	1	Valve Body Assembly ³	1152
22	1	Pilot Head (Casting Only)	1017	2	1	Valve Body	1001
23	1	Pilot Head Gasket	1089	3	1	Valve Seat ³	1172
24	2	Solenoid Locating Roll Pins ²	1086	4	1	Piston Poppet Seat Assy. ^{1, 6}	1233
25	1	Pilot Stem "O" Ring	1072	5	1	Valve Seat ¹	1172
26	1	Pilot Stem "O" Ring Retainer	1043	6	1	Piston	1035
27	1	Pilot Stem Assembly	1046	7	1	Spacer	1036
28	1	Pilot Stem Spring	1052	8	1	Poppet	1037
29	1	Pilot Stem Spring Retainer	1044	9	1	Soc. Hd. Cap Screw ²	1080
30	1	Spring Retainer "O" Ring	1073	10	1	Flexloc Hex Nut	1082
32	2	Pilot Screw	1112	11	1	Piston "O" Ring	1071
34	1	Solenoid ⁴	1038	12	2	Valve Seat "O" Ring (Large)	1111
35	1	Solenoid Cover Assembly	1105	13	2	Valve Seat "O" Ring (Small)	1068
36	1	Solenoid Cover	1016	14	2	Valve Body Cover ³	1021
37	1	Manual Operating Button ⁵	1041	15	2	Valve Body Cover Gskt.	1059
38	1	Manual Oper. But. "O" Ring	1074	16	1	Valve Body Base Gskt.	1063
	1	Manual Oper. But. Spring	1110	17	1	Valve Base (1" Parts) ³	1175
	1	Manual Oper. But. Snap Ring	1099	18	1	Valve Base (1 1/4" Parts) ³	1176
39	1	Solenoid Retaining Spring	1040				
40	1	Solenoid Ret. Sprg. Snap Ring	1087				
41	1	Solenoid Cover Gasket	1039				
42	1	Solenoid Cover Chain ²	1088				
	2	Chain Screw ²	1104				

1 Item No. 3, Valve Seat, is identical to Item No. 5 except one Valve Seat unit contains the piston-poppet assembly.
 2 Not shown on cross-section.
 3 Parts are shipped with gasket or gaskets required.
 4 Specify voltage and cycle.
 5 Part No's. 1074, 1110 and 1099 shipped with Manual Operating Button.
 6 Piston Poppet Seat Assy. Part No. for vacuum service is 1137. Assembly Part No. for low pressure service is 1185.

- Solenoid Pilot Controlled
- Momentary Contact Type
- 2-Way* and 3-Way
- Normally Open or Normally Closed
- 1/4", 3/8", 1/2", 3/4" Pipe Sizes
- Pressures 15 to 150 Lbs. Air

3-WAY SERIES 320 DOUBLE SOLENOID VALVES

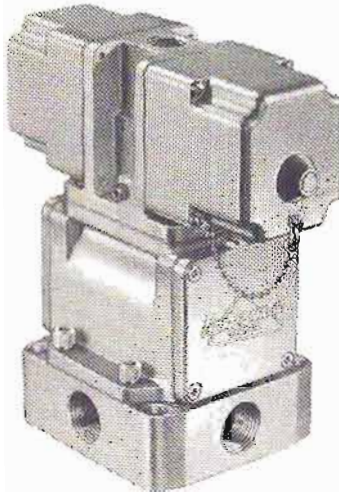
OPERATION

NORMALLY CLOSED OPERATION — Supply connected to Port "A" — "CYL" Port closed to pressure — Port "B" exhaust.

NORMALLY OPEN OPERATION — Supply connected to Port "B" — "CYL" Port open to pressure — Port "A" exhaust.

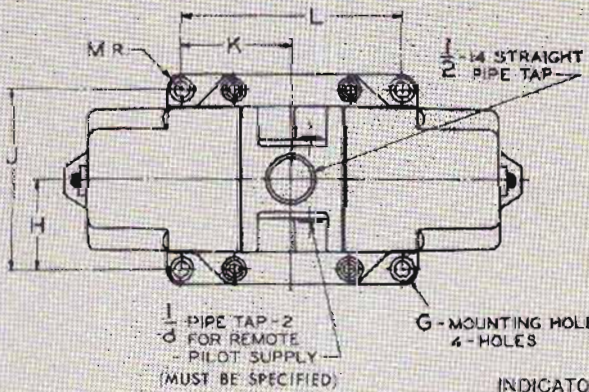
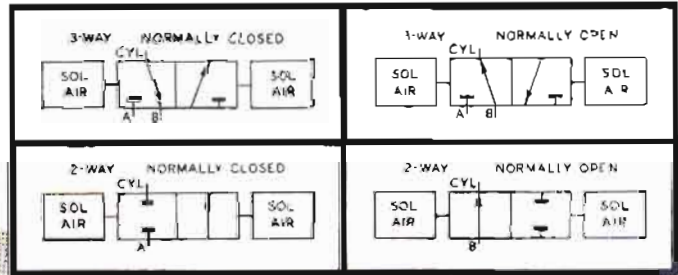
***2-WAY OPERATION** — "For 2-Way Operation" must be so specified on the order as valve must be modified by insertion of poppet return spring in the master valve.

Plug exhaust port — "B" for Normally Closed operation — "A" for Normally Open operation. Note that two cylinder ports are provided for simplification of piping. A sealing plug is provided for the unused port. Also, on all valves with pilot heads, a remote supply must be provided to operate properly.



OPTIONAL FEATURES

- Indicator light - a neon pilot light can be provided to indicate the solenoid energizing.
- Solenoids for 115/50, 115/60, 230/50, 230/60, 460/50, 460/60, and 550/60 volt A.C. and 12, 16, 24, 32, 50, 90, 125, and 250 volt D.C. are in stock. Heavy duty 115 volt 60 cycle and oil immersed 115 volt 60 cycle are also in stock. Special coils, also heavy duty and oil immersed solenoids, available on inquiry.
- Series 320 valves can be modified for lower pressures, vacuum operation or service other than air . . . see Engineering Section.
- Series 320 valves are available with bottom ported bases, at slight extra cost. See Engineering Section for dimensions.

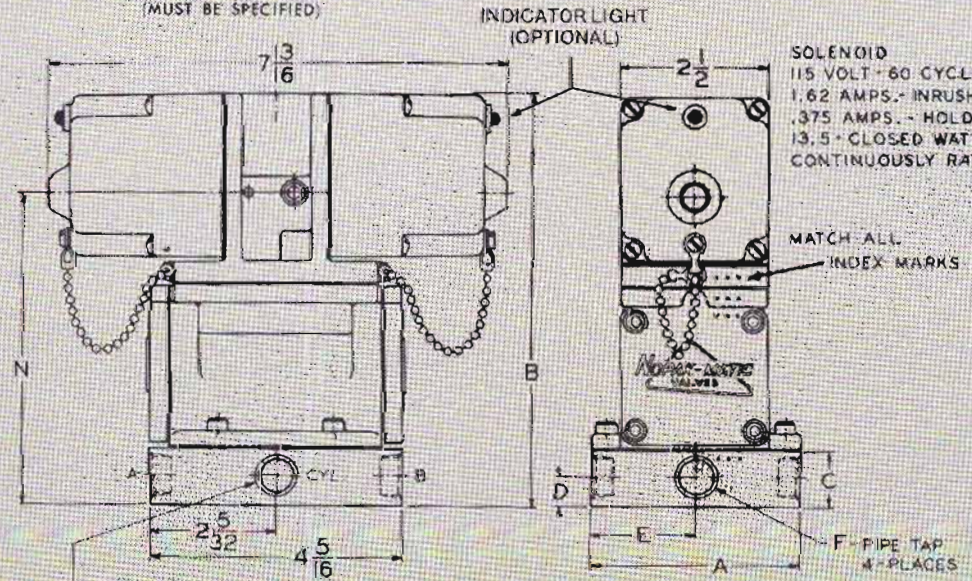


DIMENSIONS AND INSTALLATION DATA

(D.C. solenoids are longer than A.C. shown here. See Engineering Section for D.C. dimensions.)

Size	Model Number	DIMENSIONS IN INCHES													
		A	B	C	D	E	F	G	H	J	K	L	M	N	
1/4"	320						3/4								
3/8"	321	3 3/4	7 1/4	13 1/8	3/8	1 7/8	3/8	1 1/4	1 1/2	3 1/8	1 3/8	3 3/8	1/2	5 1/2	
1/2"	321 1/2						1 1/2								
1/2"	322						1 1/2								
3/4"	323	4	7 3/8	1 1/2	3/4	2	3/4	2 3/4	1 1/4	3 3/8	1 3/4	3 3/8	3/8	6 7/8	

*Model 321 1/2 is the standard 322 valve with 1/2" pipe taps.



INSTALLATION DATA

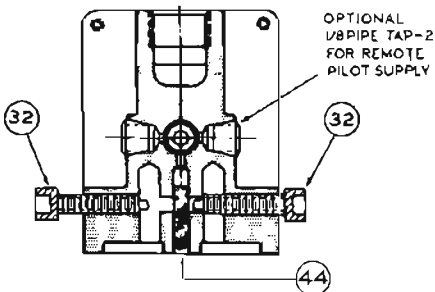
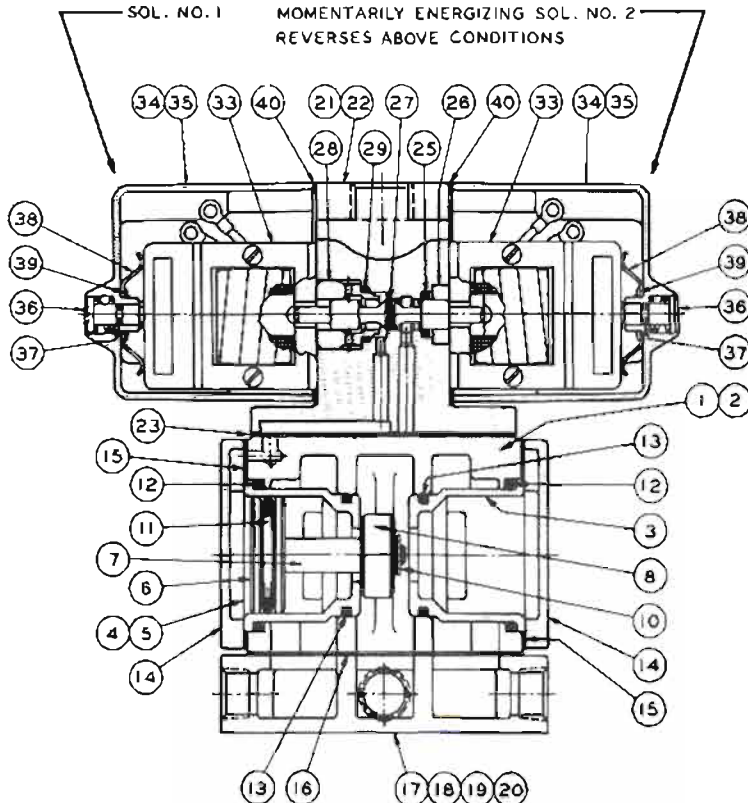
1. Valves must have ADEQUATE SUPPLY (VOLUME) and UNRESTRICTED EXHAUST. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the supply line.
2. Unless otherwise specified, Flow Director in pilot head is set for normally closed operation. (See OPERATION above.) For normally open operation, setting must be reversed. (See Engineering Section . . . Flow Director.)
3. Valves will operate mounted in any position that results in the solenoids being placed in a horizontal position.
4. These valves should be operated with a remote pilot supply when used for service other than air, or for vacuum operation . . . See Engineering Section.



SOL. NO. 1 IN ENERGIZED POSITION
 - SUPPLY CONNECTED TO PORT "A"
 - PORT "CYL" NORMALLY CLOSED
 TO PRESSURE - PORT "B" EXH.

SOL. NO. 1 IN ENERGIZED POSITION
 - SUPPLY CONNECTED TO PORT "B"
 - PORT "CYL" NORMALLY OPEN
 TO PRESSURE - PORT "A" EXH.

SOL. NO. 1 MOMENTARILY ENERGIZING SOL. NO. 2
 REVERSES ABOVE CONDITIONS



OPTIONAL
 1/8" PIPE TAP-2
 FOR REMOTE
 PILOT SUPPLY

PILOT HEAD PARTS LIST

Series 320—3-way Double Solenoid
 Momentary Contact Type

Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.
21	1	Pilot Head Assembly	1031	1031
22	1	Pilot Head (Casting Only)	1018	1018
23	1	Pilot Head Gasket	1089	1089
24	4	Solenoid Locating Rail Pins ²	1086	1086
25	1	Pilot Stem "O" Ring	1072	1072
26	1	Pilot Stem "O" Ring Retainer	1043	1043
27	1	Pilot Stem Assembly	1047	1047
28	1	Pilot Stem Retainer	1045	1045
29	1	Pilot Stem Ret. "O" Ring	1073	1073
32	2	Pilot Screw	1112	1112
33	2	Solenoid ⁴	1038	1038
34	2	Solenoid Cover Assembly	1105	1105
35	2	Solenoid Cover	1016	1016
36	2	Manual Operating Button ⁵	1041	1041
37	2	Manual Oper. But. "O" Ring	1074	1074
	2	Manual Oper. But. Spring	1110	1110
	2	Manual Oper. But. Snap Ring	1099	1099
38	2	Solenoid Retaining Spring	1040	1040
39	2	Solenoid Ret. Sprg. Ring	1087	1087
40	2	Solenoid Cover Gasket	1039	1039
41	2	Solenoid Cover Chain ²	1088	1088
	4	Chain Screw ²	1104	1104
44	1	Screen	1113	1113

VALVE BODY PARTS LIST

Series 320—3-way Double Solenoid
 Momentary Contact Type

Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.
1	1	Valve Body Assembly ³	1100	1101
2	1	Valve Body	1000	1001
3	1	Valve Seat ¹	1026	1027
4	1	Piston Poppet Seat Assy. ⁴	1028	1029
5	1	Valve Seat ¹	1026	1027
6	1	Piston	1032	1035
7	1	Spacer	1033	1036
8	1	Poppet	1034	1037
9	1	Spec. Hd. Cap Screw ²	1079	1080
10	1	Flexloc Hex Nut	1081	1082
11	1	Piston "O" Ring	1070	1071
12	4	Valve Seat "O" Ring (Large)	1066	1111
13	4	Valve Seat "O" Ring (Small)	1071	1066
14	2	Valve Body Cover ³	1020	1021
15	2	Valve Body Cover Gskt.	1058	1059
16	1	Valve Body Base Gskt.	1062	1063
17	1	Valve Base (1/4" Ports) ³	1004	
18	1	Valve Base (3/8" Ports) ³	1005	
19	1	Valve Base (1/2" Ports) ³		1006
20	1	Valve Base (3/4" Ports) ³		1007

1 Item No. 3, Valve Seat, is identical to Item No. 5 except one Valve Seat unit contains the piston-poppet assembly.
 2 Not shown on cross section.
 3 Parts are shipped with gasket or gaskets required.
 4 Specify voltage and cycle.
 5 Part No's. 1074, 1110 and 1099 shipped with Manual Operating Button.
 6 Piston-Poppet Seat Assy. Part No. 1028 & 1029 - No. 1139; for 3/8" & 1/2" - No. 1137; Assembly Part No. 1028 & 1029 for low pressure service are for 1/4" & 3/8" - No. 1184; for 1/2" & 3/4" - No. 1185.

- Solenoid Pilot Controlled
- Momentary Contact Type
- 2-Way* and 3-Way
- Normally Open or Normally Closed
- 1" and 1 1/4" Pipe Sizes
- Pressures 15 to 150 Lbs. Air

3-WAY SERIES 320-1" and 1 1/4" PIPE SIZE DOUBLE SOLENOID VALVES

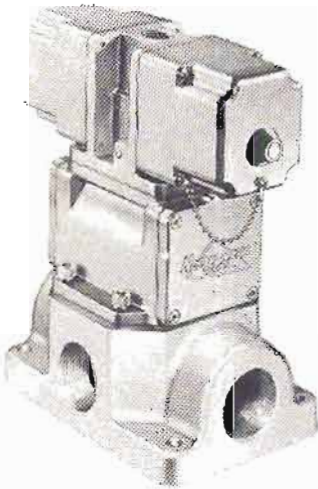
OPERATION

NORMALLY CLOSED OPERATION — Supply connected to Port "A" — "CYL" Port closed to pressure — Port "B" exhaust.

NORMALLY OPEN OPERATION — Supply connected to Port "B" — "CYL" Port open to pressure — Port "A" exhaust.

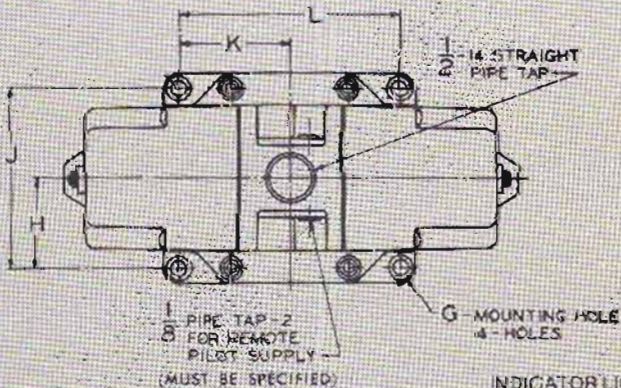
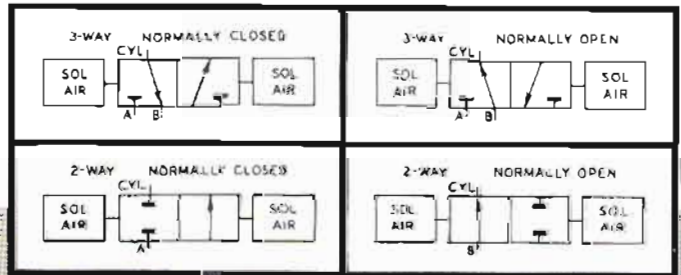
***2-WAY OPERATION** — "For 2-Way Operation" must be so specified on the order as valve must be modified by insertion of poppet return spring in the master valve.

Plug exhaust port — "B" for Normally Closed operation — "A" for Normally Open operation. Note that two cylinder ports are provided for simplification of piping. A sealing plug is provided for the unused port. Also, on all valves with pilot heads, a remote supply must be provided to operate properly.



OPTIONAL FEATURES

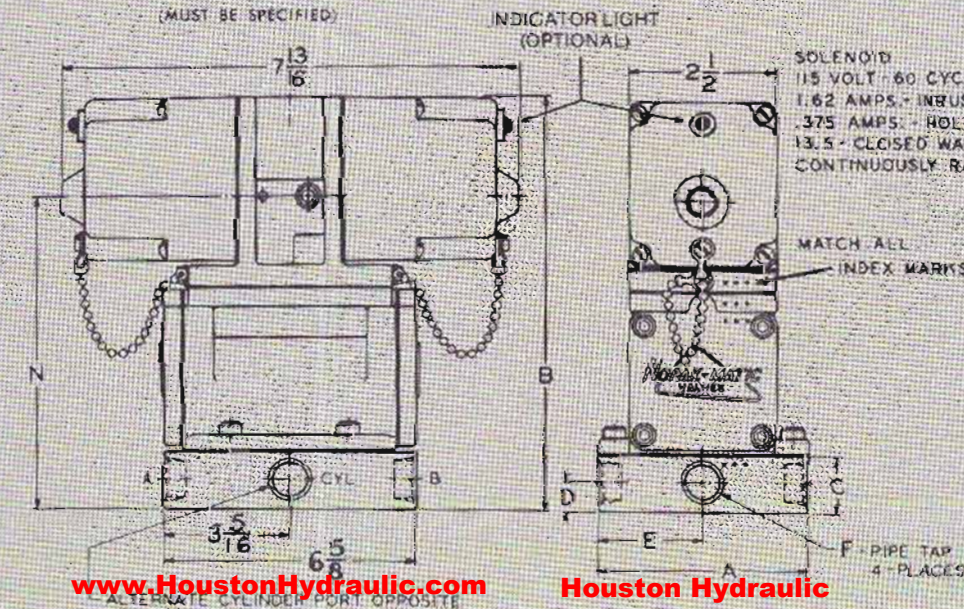
- Indicator light - a neon pilot light can be provided to indicate the solenoid energizing.
- Solenoids for 115/50, 115/60, 230/50, 230/60, 460/50, 460/60, 550/60 volt A.C. and 12, 16, 24, 32, 50, 90, 125, and 250 volt D.C. are in stock. Heavy duty 115 volt 60 cycle and oil immersed 115 volt 60 cycle are also in stock. Special coils, also heavy duty and oil immersed solenoids, available on inquiry.
- Series 310 valves can be modified for lower pressures, vacuum operation or service other than air... see Engineering Section.
- Series 320 valves are available with bottom ported bases, at slight extra cost. See Engineering Section for dimensions.



DIMENSIONS AND INSTALLATION DATA

(D.C. solenoids are longer than A.C. shown here. See Engineering Section for D.C. dimensions.)

Size	Model Number	DIMENSIONS IN INCHES											
		A	B	C	D	E	F	G	H	J	K	L	N
1	324	4 3/4	8 3/4	2 1/2	1 1/4	2 1/2	1	2 3/4	1 1/2	3 3/8	2 3/4	5 3/8	7 3/4
1 1/4	325	4 3/4	8 3/4	2 1/2	1 1/4	2 1/2	1 1/4	2 3/4	1 1/2	3 3/8	2 3/4	5 3/8	7 3/4



INSTALLATION DATA

1. Valves must have ADEQUATE SUPPLY (VOLUME) and UNRESTRICTED EXHAUST. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the supply line.
2. Unless otherwise specified, Flow Director in pilot head is set for normally closed operation. (See OPERATION above.) For normally open operation, setting must be reversed. (See Engineering Section - Flow Director.)
3. Valves will operate mounted in any position that results in the solenoids being placed in a horizontal position.
4. These valves should be operated with a remote pilot supply when used for service other than air, or for vacuum operation. See Engineering Section.

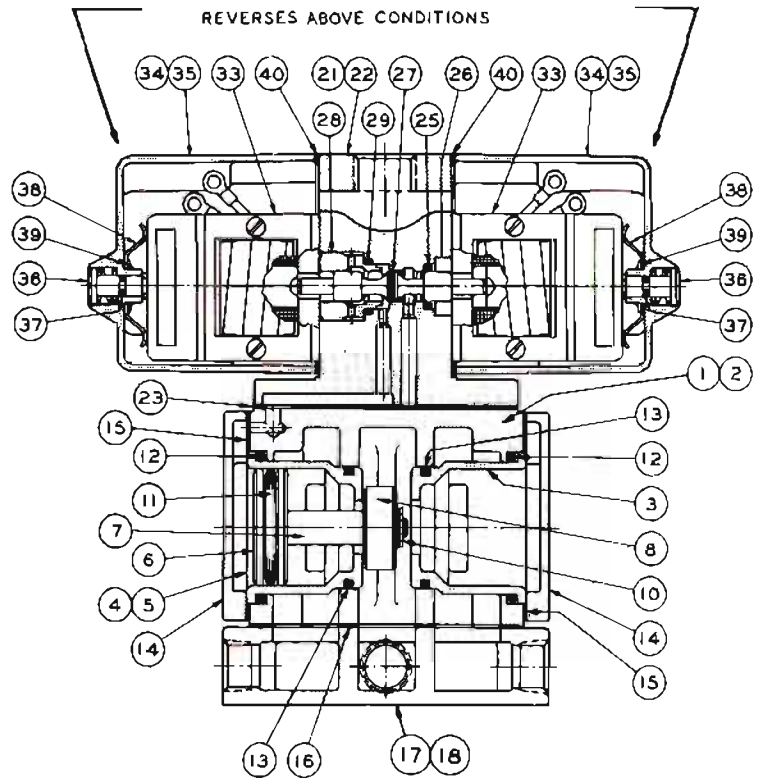
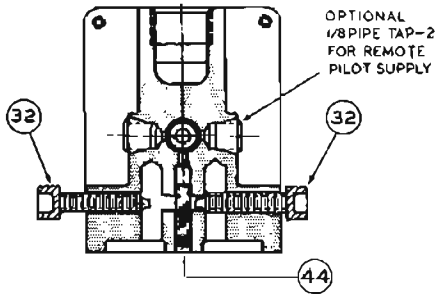


SOL. NO. 1 IN ENERGIZED POSITION
 - SUPPLY CONNECTED TO PORT "A"
 - PORT "CYL" NORMALLY CLOSED TO PRESSURE - PORT "B" EXH.

SOL. NO. 1 IN ENERGIZED POSITION
 - SUPPLY CONNECTED TO PORT "B"
 - PORT "CYL" NORMALLY OPEN TO PRESSURE - PORT "A" EXH.

SOL. NO. 1 MOMENTARILY ENERGIZING SOL. NO. 2 REVERSES ABOVE CONDITIONS

SOL. NO. 2



PILOT HEAD PARTS LIST

Series 320 — 3-way Double Solenoid Momentary Contact Type

Item	Qty	Description	1" - 1 1/4" Part No.
21	1	Pilot Head Assembly	1031
22	1	Pilot Head (Casting Only)	1018
23	1	Pilot Head Gasket	1089
24	4	Solenoid Locking Roll Pins ²	1086
25	1	Pilot Stem "O" Ring	1072
26	1	Pilot Stem "O" Ring Retainer	1043
27	1	Pilot Stem Assembly	1047
28	1	Pilot Stem Retainer	1045
29	1	Pilot Stem Ret. "O" Ring	1073
32	2	Pilot Screw	1112
33	2	Solenoid ¹	1038
34	2	Solenoid Cover Assembly	1105
35	2	Solenoid Cover	1016
36	2	Manual Operating Button ³	1041
37	2	Manual Oper. But. "O" Ring	1074
	2	Manual Oper. But. Spring	1110
	2	Manual Oper. But. Seal Ring	1099
38	2	Solenoid Retaining Spring	1040
39	2	Solenoid Ret. Sprg. Ring	1087
40	2	Solenoid Cover Gasket	1049
41	2	Solenoid Cover Chain ⁴	1088
	4	Chain Screw ⁵	1104
44	1	Screen	1113

VALVE BODY PARTS LIST

Series 320 — 3-way Double Solenoid Momentary Contact Type

Item	Qty	Description	1" - 1 1/4" Part No.
1	1	Valve Body Assembly ³	1152
2	1	Valve Body	1001
3	1	Valve Seat ¹	1122
4	1	Piston Poppet Seat Assy. ⁶	1233
5	1	Valve Seat ¹	1172
6	1	Piston	1035
7	1	Spacer	1036
8	1	Poppet	1037
9	1	Sec. Hd. Cap Screw ⁵	1080
10	1	Flexloc Hex Nut	1082
11	1	Piston "O" Ring	1071
12	2	Valve Seat "O" Ring (Large)	1011
13	2	Valve Seat "O" Ring (Small)	1068
14	2	Valve Body Cover ³	1021
15	2	Valve Body Cover Gskt.	1059
16	1	Valve Body Base Gskt.	1063
17	1	Valve Base (1" Parts) ³	1175
18	1	Valve Base (1 1/4" Parts) ³	1176

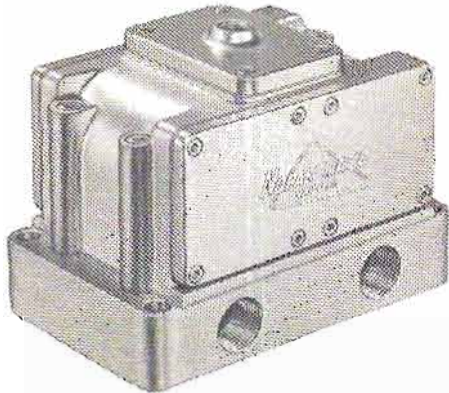
1 Item No. 3, Valve Seat, is identical to Item No. 5 except one Valve Seat unit contains the piston poppet assembly.
 2 Not shown on cross-section.
 3 Parts are shipped with gasket or gaskets required.
 4 Specify voltage and cycle.
 5 Part No's. 1074, 1110 and 1099 shipped with Manual Operating Button.
 6 Piston Poppet Seat Assy. Part No. for vacuum service is 1137, Assembly Part No. for low pressure service is 1188.

Master Valves •

Four-Way •

1/4", 3/8", 1/2", 3/4", 1", 1 1/4" Pipe Sizes •

Pressures 15 to 150 Lbs. Air •



4-WAY SERIES 400 MASTER VALVES

OPERATION

PORT "A" INLET — Supply connected to Port "A" — "CYL 2" Port open to pressure — "CYL 1" Port open to exhaust through Port "B".

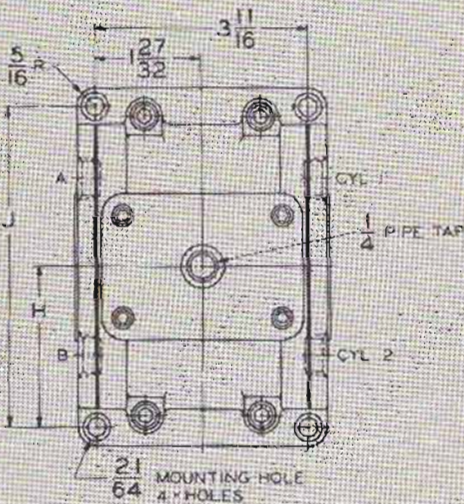
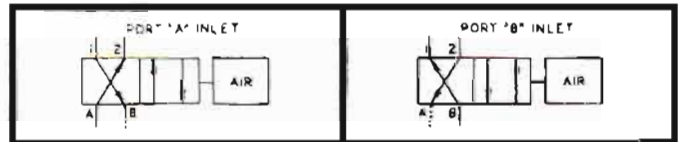
PORT "B" INLET — Supply connected to Port "B" — "CYL 1" Port open to pressure — "CYL 2" Port open to exhaust through Port "A".

PILOT PRESSURE — Should equal or exceed pressure in valve body.

ACTUATION — Master Valves can be actuated by any 3-Way Valve.

OPTIONAL FEATURES

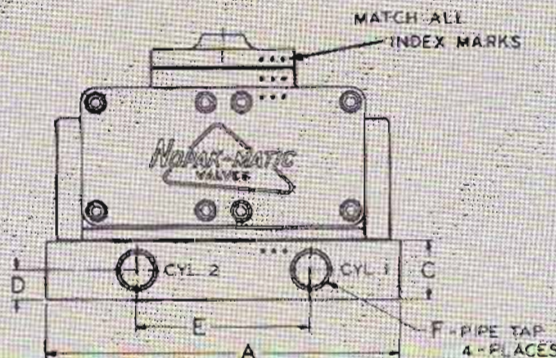
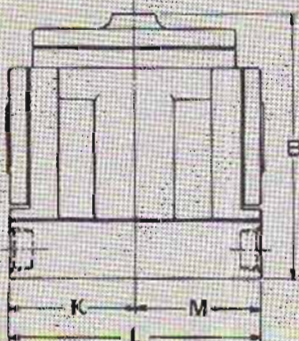
- Series 400 valves are available with bottom ported bases, at slight extra costs. See Engineering Section for dimensions.
- Series 400 valves can be modified for lower pressures, vacuum operation or service other than air . . . see Engineering Section.



DIMENSIONS AND INSTALLATION DATA

Size	Model Number	DIMENSIONS IN INCHES										
		A	B	C	D	E	F	H	J	K	L	M
1/4	400	6 1/2	4 1/16	1 3/8	1/2	2 1/16	3/8	2 3/8	5 1/2			
3/8	401						1/2					
1/2	401 1/2						3/4			2 3/32	4 5/8	
3/4	402	7	5 1/16	1 1/8	3/4	3	1/2	3 1/8	6 3/8			2 3/32
1	403						3/4					
1 1/4	404	7 3/4	6 3/8	2	1	2 1/16	1	3 3/8	6 3/8	2 1/32	5	
	405						1 1/8					

*Model 401 1/2 is the standard 401 valve with 1/2" pipe taps

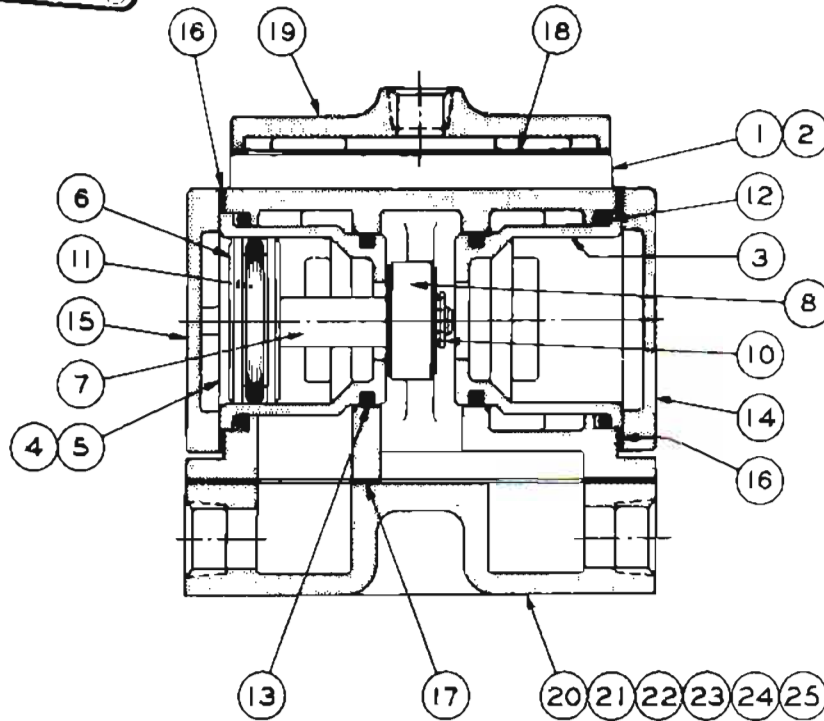


INSTALLATION DATA

1. Valves must have ADEQUATE SUPPLY (VOLUME) and UNRESTRICTED EXHAUST. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the cylinder supply lines.

2. These valves can be piped with either Port "A" or Port "B" as inlet. (See OPERATION ABOVE).

3. Valve will operate mounted in any position.



PILOT HEAD PARTS LIST

Series 400 — 4-way Master Valves

Item	Req.	Description	1/4-3/8-1/2-3/4-1-1 1/4 Part No.
18	1	Master Head Gasket	1057
19	1	Master Valve Head ¹	1019

1. Item No. 3 Valve Seat, is identical to Item No. 5 except one Valve Seat Unit contains the piston-poppet assembly.
2. Not shown on cross-section.
3. Parts are shipped with gasket or gaskets required.
4. Piston Poppet Seat Assy. Part No's. for vacuum service are for 1/4" and 3/8" — No. 1139; for 1/2", 3/4", 1" and 1 1/4" — No. 1137. Assembly Part No's. for low pressure service are for 1/2" and 3/4" — No. 1134; for 1/4", 3/8", 1" and 1 1/4" — No. 1135.

VALVE BODY PARTS LIST

Series 400 — 4-way Master Valves

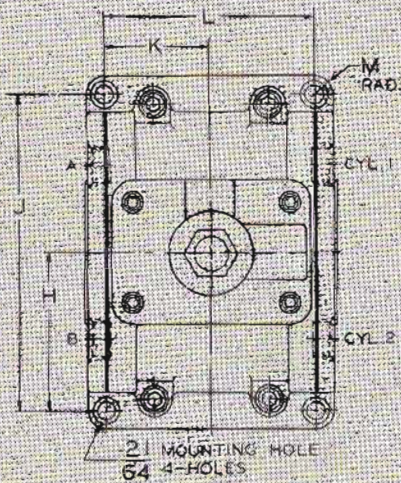
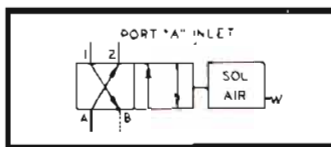
Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.	1-1 1/4 Part No.
1	1	Valve Body Assembly ²	1102	1105	1153
2	1	Valve Body	1002	1003	1003
3	2	Valve Seat ¹	1026	1027	1172
4	2	Piston Poppet Seat Assy. ⁴	1020	1029	1233
5	2	Valve Seat ¹	1026	1027	1172
6	2	Piston	1032	1035	1035
7	2	Spacer	1033	1036	1036
8	2	Poppet	1034	1037	1037
9	2	Sec. Head Cap Screw ²	1079	1080	1080
10	2	Flexloc Hex Nut	1081	1082	1082
11	2	Piston "O" Ring	1070	1071	1071
12	4	Valve Seat "O" Ring (Large)	1066	1111	1111
13	4	Valve Seat "O" Ring (Small)	1071	1068	1068
14	1	Valve Body Cover (Poppet End) ²	1022	1024	1024
15	1	Valve Body Cover (Piston End) ²	1023	1025	1025
16	2	Valve Body Cover Gasket	1060	1061	1061
17	1	Valve Body Base Gasket	1064	1065	1065
20	1	Valve Base (1/4" Ports) ²	1008		
21	1	Valve Base (3/8" Ports) ²	1009		
22	1	Valve Base (1/2" ports) ²		1010	
23	1	Valve Base (3/4" Ports) ²		1011	
24	1	Valve Base (1" Ports) ²			1170
25	1	Valve Base (1 1/4" Ports) ²			1171

- Solenoid Pilot Controlled
- Maintained Contact Type
- 4-Way
- Pipe Sizes 1/4 thru 1 1/4
- Line Pressure to 125 PSI Air



4 WAY SERIES 410PP SPECIAL PURPOSE SINGLE SOLENOID VALVES

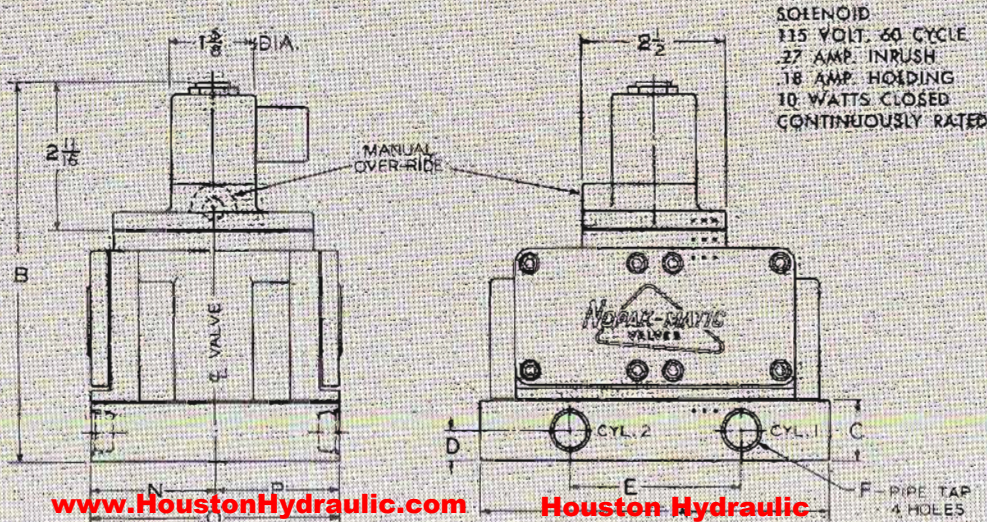
FEATURE: Simple pilot head operator — tolerant to dry, unlubricated air and dusty environment. Ideal for heavy duty batching plant, construction, excavating and foundry applications. Instantaneous valve response even after long periods of energization or de-energization. Pilot with manual over-ride. Available for 115, 230, 460 volt A.C.; also D.C.



DIMENSIONS AND INSTALLATION DATA

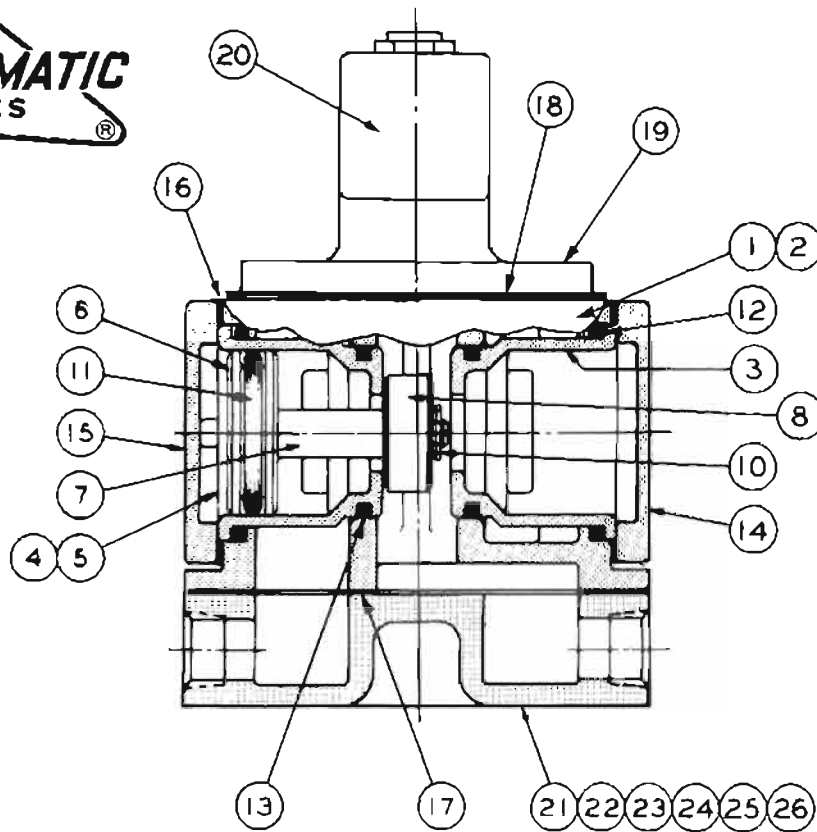
Size	Model Number	DIMENSIONS IN INCHES													
		A	B	C	D	E	F	H	J	K	L	M	N	O	P
1/4	410PP						3/4								
3/8	411PP	6 1/8	6 3/8	1 3/8	1/2	2 1/8	3/4	2 3/4	5 1/2	12 3/32	8 1/16	1/4	2 3/32	4 3/8	2 3/32
1/2	411 1/2 PP						1/2								
3/4	412PP	7	7 5/16	1 3/8	3/4	3	1/2	3 1/16	6 5/8	1 3/4	3 3/2	3/4	2 3/32	4 3/8	2 3/32
1	413PP						3/4								
1 1/4	414PP	7 1/4	9	2	1	2 1/4	1 1/8	3 3/8	6 3/4	2 1/8	5 7/8	3/4	2 1/32	5	2 3/32
1 1/2	415PP						1 3/8								

*Model 411 1/2 PP is the standard 411 PP with 1/2" ports.



INSTALLATION DATA

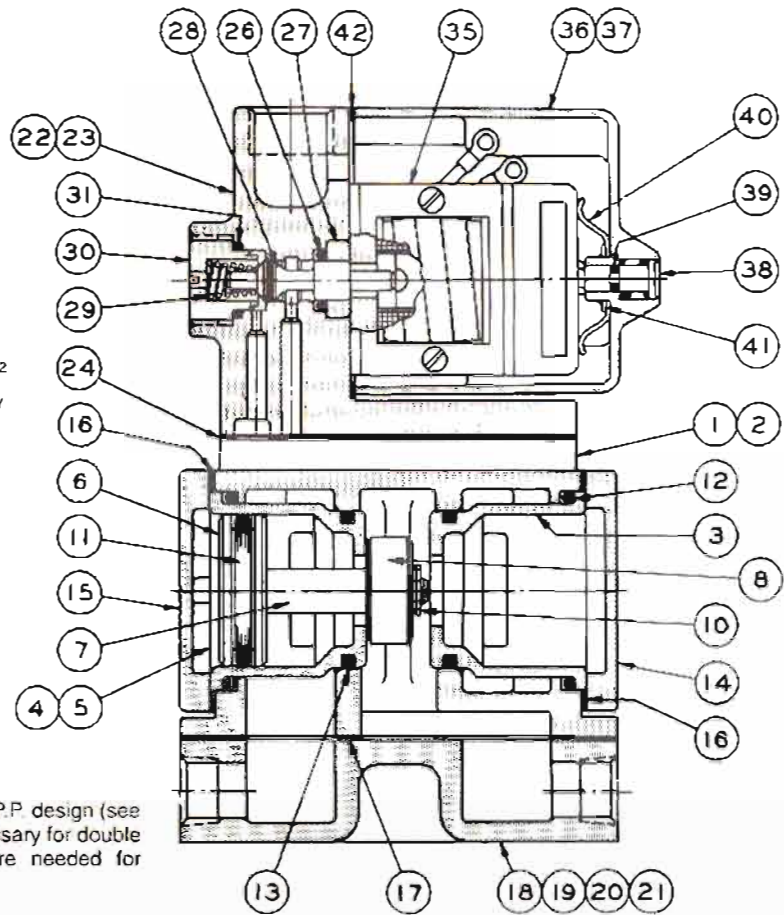
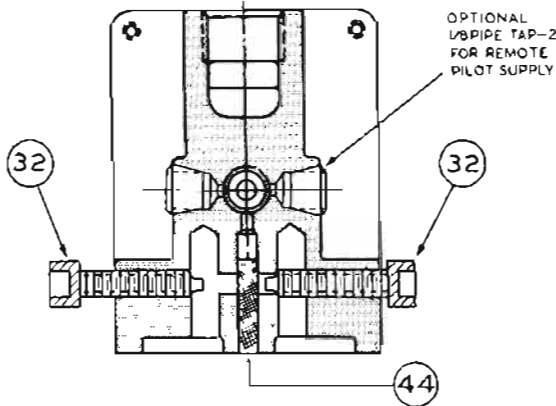
410 PP valves are assembled as standard with port "A" as pressure port. Energizing the solenoid pressurizes "CYL" part 1 with "CYL" part 2 open to exhaust. When the solenoid is de-energized, the cycle is reversed.



VALVE PARTS LIST

SERIES 410 PP — 4-WAY SINGLE SOLENOID
MAINTAINED CONTACT TYPE

Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.	1-1 1/4 Part No.
1	1	Valve Body Assembly	1102	1103	1153
2	1	Valve Body	1002	1003	1003
3	2	Valve Seat	1026	1027	1172
4	2	Piston Poppet Seat Assembly	1028	1029	1233
5	2	Valve Seat	1026	1027	1172
6	2	Piston	1032	1035	1035
7	2	Spacer	1033	1036	1036
8	2	Poppet	1034	1037	1037
9	2	Soc. Hd. Cap Screw	1079	1080	1080
10	2	Flexloc Hex Nut	1081	1082	1082
11	2	Piston "O" Ring	1070	1071	1071
12	4	Valve Seat "O" Ring (Large)	1071	1068	1068
13	4	Valve Seat "O" Ring (Small)	1066	1111	1111
14	1	Valve Body Cover (Poppet End)	1022	1024	1024
15	1	Valve Body Cover (Piston End)	1023	1025	1025
16	2	Valve Body Cover Gasket	1060	1061	1061
17	1	Valve Body Base Gasket	1064	1065	1065
18	1	Pilot Head Gasket	1089	1089	1089
19	1	Pilot Head	1196-1	1196-1	1196-1
20	1	PP Pilot Solenoid	1198	1198	1198
21	1	Valve Base — 1/4" Ports	1008		
22	1	Valve Base — 3/8" Ports	1009		
23	1	Valve Base — 1/2" Ports		1010	
24	1	Valve Base — 3/4" Ports		1011	
25	1	Valve Base — 1" Ports			1170
26	1	Valve Base — 1 1/4" Ports			1171



For single solenoid pilot head, we recommend the simplified P.P. design (see page 3). The more expensive "Decco" pilot head is still necessary for double solenoid pilot heads and where "Decco" pilot heads are needed for replacements.

PILOT HEAD PARTS LIST

Series 410 — 4-way Single Solenoid Maintained Contact Type

Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.
22	1	Pilot Head Assembly	1030	1030
23	1	Pilot Head (Casting Only)	1017	1017
24	1	Pilot Head Gasket	1089	1089
25	2	Solenoid Locating Roll Pins ²	1086	1086
26	1	Pilot Stem "O" Ring	1072	1072
27	1	Pilot Stem "O" Ring Retainer	1043	1043
28	1	Pilot Stem Assembly	1046	1046
29	1	Pilot Stem Spring	1052	1052
30	1	Pilot Stem Spring Retainer	1044	1044
31	1	Spring Retainer "O" Ring	1073	1073
32	2	Pilot Screw	1112	1112
35	1	Solenoid ⁴	1038	1038
36	1	Solenoid Cover Assembly	1105	1105
37	1	Solenoid Cover	1016	1016
38	1	Manual Operating Button	1041	1041
39	1	Manual Oper. But. "O" Ring	1074	1074
	1	Manual Oper. But. Spring	1110	1110
	1	Manual Oper. But. Snap Ring	1099	1099
40	1	Solenoid Retaining Spring	1040	1040
41	1	Solenoid Ret. Spring Ring	1087	1087
42	1	Solenoid Cover Gasket	1039	1039
43	1	Solenoid Cover Chain ²	1088	1088
44	2	Chain Screw ²	1104	1104

VALVE BODY PARTS LIST

Series 410 — 4-way Single Solenoid Maintained Contact Type

Item	Req.	Description	1/4-3/8 Part No.	1/2-3/4 Part No.
1	1	Valve Body Assembly ³	1102	1103
2	1	Valve Body	1002	1003
3	2	Valve Seat ¹	1026	1027
4	2	Piston Poppet Seat Assy. ^{1, 5}	1028	1029
5	2	Valve Seat ¹	1026	1027
6	2	Piston	1032	1035
7	2	Spacer	1033	1036
8	2	Poppet	1034	1037
9	2	Soc. Hd. Cap Screw ²	1079	1080
10	2	Flexloc Hex Nut	1081	1082
11	2	Piston "O" Ring	1070	1071
12	4	Valve Seat "O" Ring (Large)	1066	1111
13	4	Valve Seat "O" Ring (Small)	1071	1068
14	1	Valve Body Cover (Poppet End) ³	1022	1024
15	1	Valve Body Cover ((Piston End) ³	1023	1025
16	2	Valve Body Cover Gasket	1060	1061
17	1	Valve Body Base Gskt.	1064	1065
18	1	Valve Base (1/4" Ports) ³	1008	
19	1	Valve Base (3/8" Ports) ³	1009	
20	1	Valve Base (1/2" Ports) ³		1010
21	1	Valve Base (3/4" Ports) ³		1011

² Not shown on cross-section.

³ Parts are shipped with gasket or gaskets required.

⁴ Specify voltage and cycle.

⁵ Piston Poppet Seat Assy. Part No. 1028 for 1/4" & 1/2" ports; Part No. 1029 for 3/8" & 3/4" ports.

- Solenoid Pilot Controlled
- Maintained Contact Type
- Four-Way
- 1" and 1½" Pipe Sizes
- Pressures 15 to 125 Lbs. Air

4-WAY SERIES 410-1" and 1½" PIPE SIZE SINGLE SOLENOID VALVES

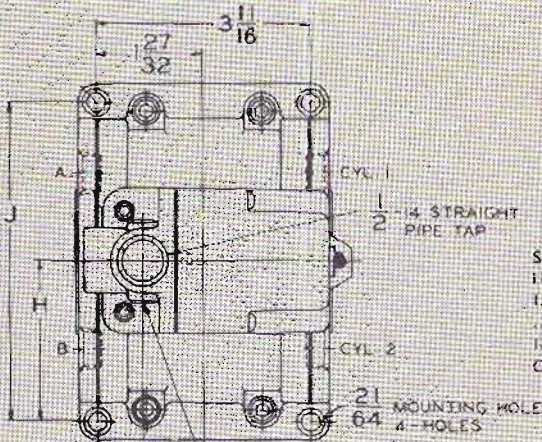
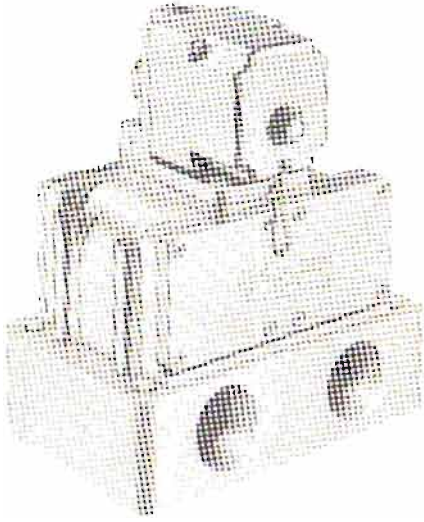
OPERATION

PORT "A" INLET — Supply connected to Port "A" — "CYL 2" Port open to pressure — "CYL 1" Port open to exhaust through Port "B".

PORT "B" INLET — Supply connected to Port "B" — "CYL 1" Port open to pressure — "CYL 2" Port open to exhaust through Port "A".

OPTIONAL FEATURES

- Indicator light - a neon pilot light can be provided to indicate the solenoid energizing.
- 1" and 1½" valves are available with bottom ported bases, at slight extra cost. See Engineering Section for dimensions.
- Solenoids for 115/50, 115/60, 230/50, 230/60, 460/50, 460/60, and 550/60 volt A.C. and 12, 16, 24, 32, 50, 90, 125, and 250 volt D.C. are in stock. Special coils, also heavy duty and oil immersed solenoids, available on inquiry.
- 1" and 1½" valves can be modified for lower pressures, vacuum operation or service other than air. See Engineering Section.



SOLENOID
115 VOLT - 60 CYCLE
1.62 AMPS. - INRUSH
.375 AMPS. - HOLDING
13.5 - CLOSED WATTS
CONTINUOUSLY RATED

DIMENSIONS AND INSTALLATION DATA

(D.C. solenoids are longer than A.C. shown here.
See Engineering Section for D.C. dimensions.)

Model Size	Model Number	DIMENSIONS IN INCHES								
		A	B	C	D	E	F	H	J	N
1"	414	7 3/8	8 3/8	2	1	2 15/16	1	3 3/8	6 3/8	8 3/4
1 1/2"	415	7 3/8	8 3/8	2	1	2 15/16	1 3/4	3 3/8	6 3/8	6 3/4

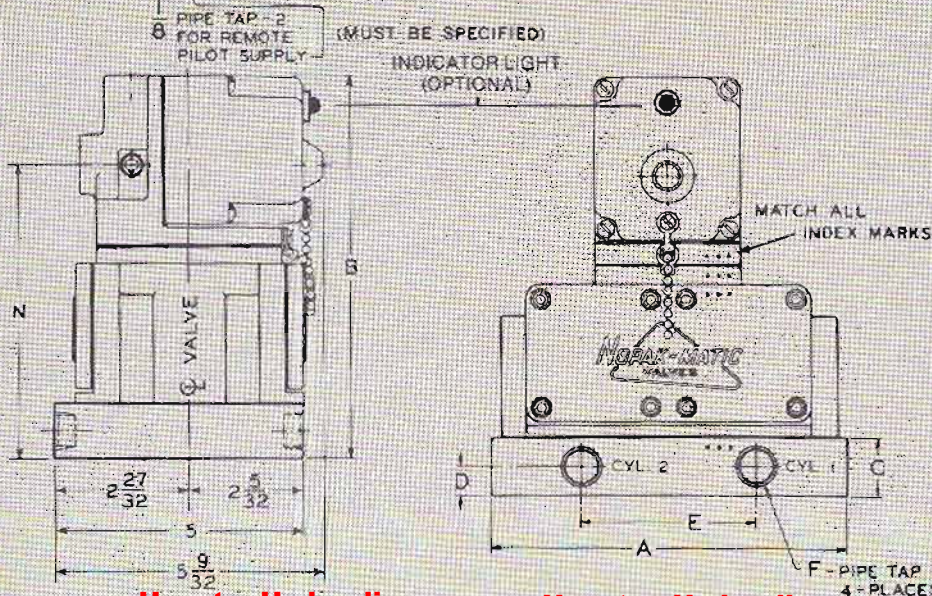
INSTALLATION DATA

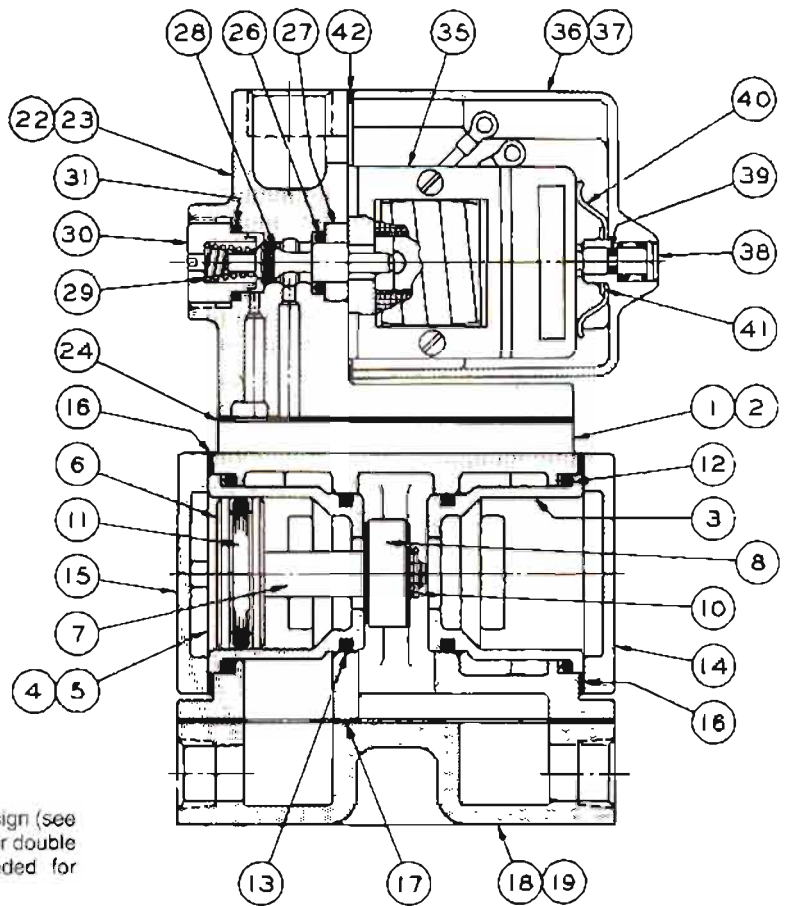
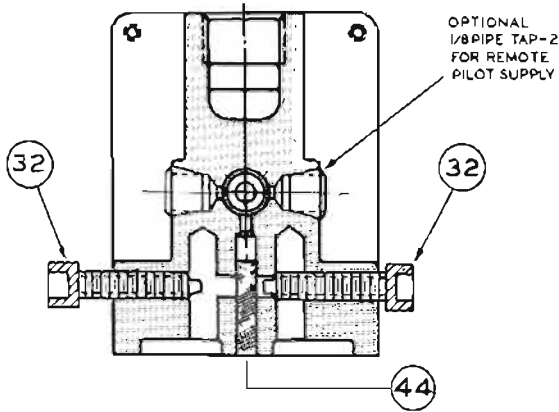
1. Valves must have ADEQUATE SUPPLY (VOLUME) and UNRESTRICTED EXHAUST. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the cylinder supply lines.

2. Unless otherwise specified, Flow Director in pilot head is set for Port "A" inlet. (See OPERATION above.) For Port "B" inlet, setting must be reversed. (See Engineering Section for Flow Director.)

3. If valve must be mounted with solenoid in a vertical position, then valve should be mounted so plunger and pilot stem climb when solenoid is energized. They are returned by spring and gravity.

4. These valves should be operated with a remote pilot supply when used for service other than air, or for vacuum operation. See Engineering Section.





For single solenoid pilot head, we recommend the simplified P.P. design (see page 3). The more expensive "Decco" pilot head is still necessary for double solenoid pilot heads and where "Decco" pilot heads are needed for replacements.

PILOT HEAD PARTS LIST

Series 410—4-way Single Solenoid Maintained Contact Type

VALVE BODY PARTS LIST

Series 410—4-way Single Solenoid Maintained Contact Type

Item	Req.	Description	1"-1 1/4" Part No.	Item	Req.	Description	1"-1 1/4" Part No.
22	1	Pilot Head Assembly	1030	1	1	Valve Body Assembly ³	1153
23	1	Pilot Head (Casting Only)	1017	2	1	Valve Body	1003
24	1	Pilot Head Gasket	1089	3	2	Valve Seat ¹	1172
25	2	Solenoid Locating Roll Pins ²	1086	4	2	Piston Poppet Seat Assy. ^{1,5}	1238
26	1	Pilot Stem "O" Ring	1072	5	2	Valve Seat ¹	1172
27	1	Pilot Stem "O" Ring Retainer	1043	6	2	Piston	1035
28	1	Pilot Stem Assembly	1046	7	2	Spacer	1036
29	1	Pilot Stem Spring	1052	8	2	Poppet	1037
30	1	Pilot Stem Spring Retainer	1044	9	2	Soc. Hd. Cap Screw ²	1090
31	1	Spring Retainer "O" Ring	1073	10	2	Flexloc Hex Nut	1082
32	2	Pilot Screw	1112	11	2	Piston "O" Ring	1071
35	1	Solenoid ⁴	1038	12	4	Valve Seat "O" Ring (Large)	1111
36	1	Solenoid Cover Assembly	1105	13	4	Valve Seat "O" Ring (Small)	1068
37	1	Solenoid Cover	1016	14	1	Valve Body Cover (Poppet End) ³	1024
38	1	Manual Operating Button	1041	15	1	Valve Body Cover (Piston End) ³	1025
39	1	Manual Oper. But. "O" Ring	1074	16	2	Valve Body Cover Gasket	1061
	1	Manual Oper. But. Spring	1110	17	1	Valve Body Base Gskt.	1065
	1	Manual Oper. But. Snap Ring	1099	18	1	Valve Base (1" Parts) ³	1170
40	1	Solenoid Retaining Spring	1040	19	1	Valve Base (1 1/4" Parts) ³	1171
41	1	Solenoid Ret. Spring Ring	1087				
42	1	Solenoid Cover Gasket	1039				
43	1	Solenoid Cover Chain ²	1088				
	2	Chain Screw ²	1104				

1 Item No. 3, Valve Seat, is identical to Item No. 5 except one Valve Seat unit contains the piston-poppet assembly.
 2 Not shown on cross-section.
 3 Parts are shipped with gasket or gaskets required.
 4 Specify voltage and cycle.
 5 Piston Poppet Seat Assy. Part No. for vacuum service is 1137. Assembly Part No. for low pressure service is 1185.

- Solenoid Pilot Controlled
- Momentary Contact Type
- Four-Way
- 1/4", 3/8", 1/2", 3/4" Pipe Sizes
- Pressures 15 to 150 Lbs. Air

4-WAY SERIES 420 DOUBLE SOLENOID VALVES

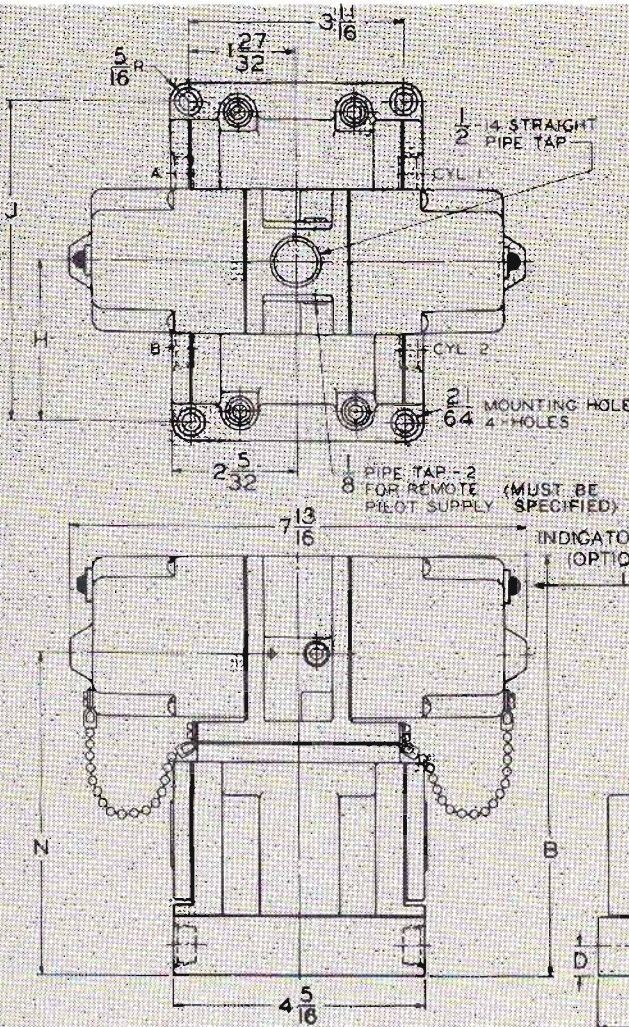
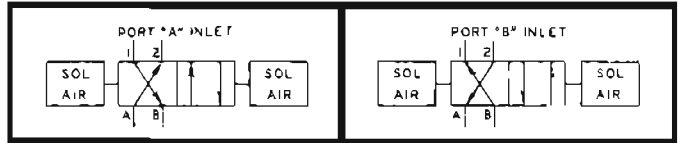
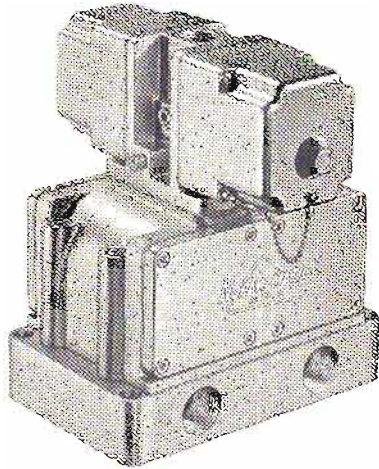
OPERATION

PORT "A" INLET — Supply connected to Port "A" — "CYL 2"
Port open to pressure — "CYL 1" Port open to exhaust through
Port "B".

PORT "B" INLET — Supply connected to Port "B" — "CYL 1"
Port open to pressure — "CYL 2" Port open to exhaust through
Port "A".

OPTIONAL FEATURES

- Indicator light - a neon pilot light can be provided to indicate the solenoid energizing.
- 1" and 1 1/4" valves are available with bottom ported bases, at slight extra cost. See Engineering Section for dimensions.
- Solenoids for 115/50, 115/60, 230/50, 230/60, 460/50, 460/60, and 550/60 volt A.C. and 12, 16, 24, 32, 50, 90, 125, and 250 volt D.C. are in stock. Heavy duty 115 volt 60 cycle and oil immersed 115 volt 60 cycle are also in stock. Special coils, also heavy duty and oil immersed solenoids, available on inquiry.
- 1" and 1 1/4" valves can be modified for lower pressures, vacuum operation or service other than air . . . see Engineering Section.



DIMENSIONS AND INSTALLATION DATA

(D.C. solenoids are longer than A.C. shown here.
See Engineering Section for D.C. dimensions.)

Size	Model Number	DIMENSIONS IN INCHES								
		A	B	C	D	E	F	H	J	N
1/4"	420						1/4			
3/8"	421	6 1/8	7 1/8	1 1/8	1 1/2	2 3/8	3/8	2 3/8	5 1/2	5 3/4
1/2"	421 1/2						1/2			
3/4"	422						3/4			
1"	423	7	7 1/4	1 3/8	3/4	3	3/4	3 3/8	6	6 1/4

*Model 421 1/2 is the standard 421 valve with 1/2" pipe taps

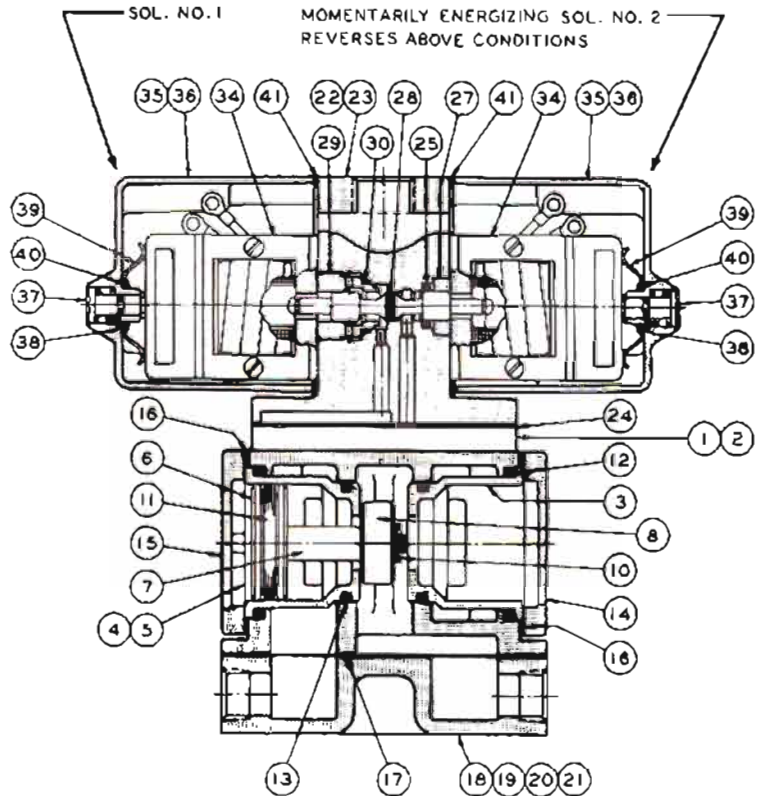
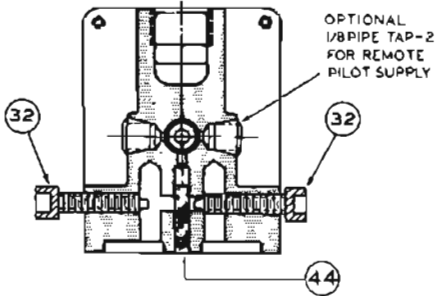
INSTALLATION DATA

1. Valves must have ADEQUATE SUPPLY (VOLUME) and UNRESTRICTED EXHAUST. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the cylinder supply lines.
2. Unless otherwise specified, Flow Director in pilot head is set for Port "A" inlet. (See OPERATION above.) For Port "B" inlet, setting must be reversed. (See Engineering Section Flow Director.)
3. Valves will operate mounted in any position that results in the solenoids being placed in a horizontal position.
4. These valves should be operated with a remote pilot supply when used for service other than air, or for vacuum operation . . . See Engineering Section.



SOL. NO. 1 IN ENERGIZED POSITION
 - SUPPLY CONNECTED TO PORT "A"
 - PORT CYL 1" OPEN TO EXHAUST
 - PORT CYL 2" OPEN TO PRESSURE
 - PORT "B" EXH.

SOL. NO. 1 IN ENERGIZED POSITION
 - SUPPLY CONNECTED TO PORT "B"
 - PORT CYL 1" OPEN TO PRESSURE
 - PORT CYL 2" OPEN TO EXHAUST
 - PORT "A" EXH.



PILOT HEAD PARTS LIST
 Series 420—4-way Double Solenoid
 Momentary Contact Type

Item	Req.	Description	1/4-3/8	1/2-3/4
			Part No.	Part No.
22	1	Pilot Head Assembly	1031	1031
23	1	Pilot Head (Casting Only)	1018	1018
24	1	Pilot Head Gasket	1089	1089
25	1	Pilot Stem "O" Ring	1072	1072
26	4	Solenoid Locating Roll Pins ²	1086	1086
27	1	Pilot Stem "O" Ring Retainer	1043	1043
28	1	Pilot Stem Assembly	1047	1047
29	1	Pilot Stem Retainer	1045	1045
30	1	Pilot Stem Ret. "O" Ring	1073	1073
32	2	Pilot Screw	1112	1112
34	2	Solenoid ⁴	1038	1038
35	2	Solenoid Cover Assembly	1105	1105
36	2	Solenoid Cover	1016	1016
37	2	Manual Operating Button	1041	1041
38	2	Manual Oper. But. "O" Ring	1074	1074
	1	Manual Oper. But. Spring	1110	1110
	1	Manual Oper. But. Snap Ring	1099	1099
39	2	Solenoid Retaining Spring	1040	1040
40	2	Solenoid Ret. Spring Ring	1087	1087
41	2	Solenoid Cover Gasket	1039	1039
42	2	Solenoid Cover Chain ²	1088	1088
	4	Chain Screw ²	1104	1104
44	1	Screen	1113	1113

VALVE BODY PARTS LIST
 Series 420—4-way Double Solenoid
 Momentary Contact Type

Item	Req.	Description	1/4-3/8	1/2-3/4
			Part No.	Part No.
1	1	Valve Body Assembly ³	1102	1103
2	1	Valve Body	1002	1003
3	2	Valve Seat ¹	1026	1027
4	2	Piston Poppet Seat Assy. ^{2, 5}	1028	1029
5	2	Valve Seat ¹	1026	1027
6	2	Piston	1032	1035
7	2	Spacer	1033	1036
8	2	Poppet	1034	1037
9	2	Soc. Hd. Cap Screw ²	1079	1080
10	2	Flexloc Hex Nut	1081	1082
11	2	Piston "O" Ring	1070	1071
12	4	Valve Seat "O" Ring (Large)	1066	1111
13	4	Valve Seat "O" Ring (Small)	1071	1068
14	1	Valve Body Cover (Poppet End) ³	1022	1024
15	1	Valve Body Cover (Piston End) ³	1023	1025
16	2	Valve Body Cover Gskt.	1060	1061
17	1	Valve Body Base Gskt.	1064	1065
18	1	Valve Base (1/4" Ports) ³	1008	
19	1	Valve Base (3/8" Ports) ³	1009	
20	1	Valve Base (1/2" Ports) ³		1010
21	1	Valve Base (3/4" Ports) ³		1011

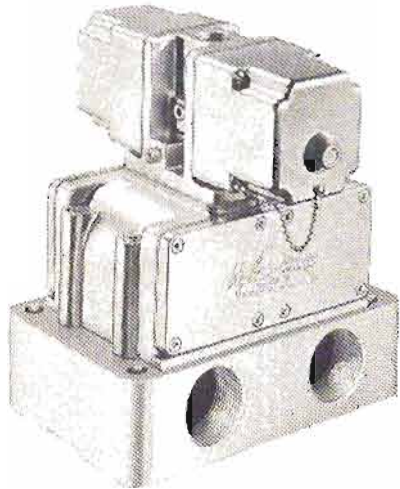
² Not shown on cross-section.

³ Parts are shipped with gasket or gaskets required.

⁴ Specify voltage and cycle.

⁵ Piston Poppet Seat Assy. Part No. 1139 for 1/2" & 3/4" - No. 1139; for 1/4" & 3/8" - No. 1137. Assembly Part for low pressure service are: for 1/4" & 3/8" - No. 1184; for 1/2" & 3/4" - No. 1185.

- Solenoid Pilot Controlled
- Momentary Contact Type
- Four-Way
- 1" and 1 1/4" Pipe Sizes
- Pressures 15 to 150 Lbs. Air



4-WAY SERIES 420-1" and 1 1/4" PIPE SIZE DOUBLE SOLENOID VALVES

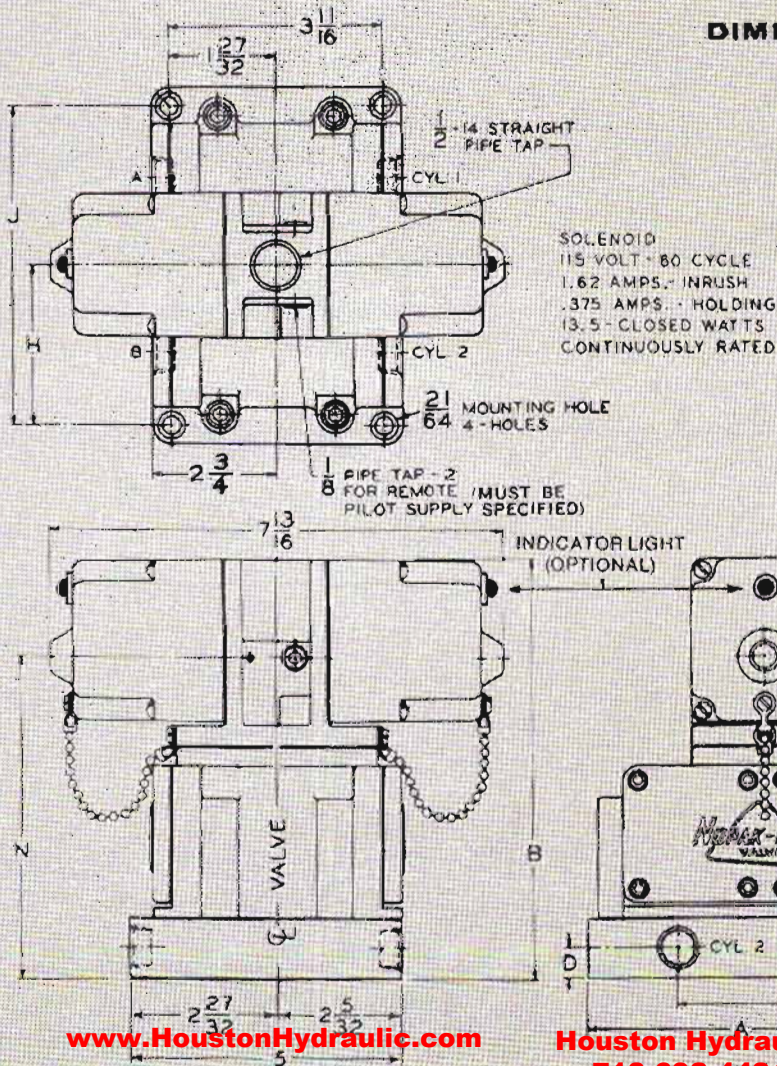
OPERATION

PORT "A" INLET — Supply connected to Port "A" — "CYL 2" Port open to pressure — "CYL 1" Port open to exhaust through Port "B".

PORT "B" INLET — Supply connected to Port "B" — "CYL 1" Port open to pressure — "CYL 2" Port open to exhaust through Port "A".

OPTIONAL FEATURES

- Indicator light - a neon pilot light can be provided to indicate the solenoid energizing.
- 1" and 1 1/4" valves are available with bottom ported bases, at slight extra cost. See Engineering Section for dimensions.
- Solenoids for 115/50, 115/60, 230/50, 230/60, 460/50, 460/60, and 550/60 volt A.C. and 12, 16, 24, 32, 50, 90, 125, and 250 volt D.C. are in stock. Heavy duty 115 volt 60 cycle and oil immersed 115 volt 60 cycle are also in stock. Special coils, also heavy duty and oil immersed solenoids, available on inquiry.
- 1" and 1 1/4" valves can be modified for lower pressures, vacuum operation or service other than air . . . see Engineering Section.



DIMENSIONS AND INSTALLATION DATA

(D.C. solenoids are longer than A.C. shown here.
See Engineering Section for D.C. dimensions.)

Size	Model Number	DIMENSIONS IN INCHES								
		A	B	C	D	E	F	H	J	N
1	424	7 3/4	8 3/8	2	1	2 3/8	1	3 3/8	6 3/8	6 3/8
1 1/4	425	7 3/4	8 3/8	2	1	2 3/8	1 1/4	3 3/8	6 3/8	6 3/8

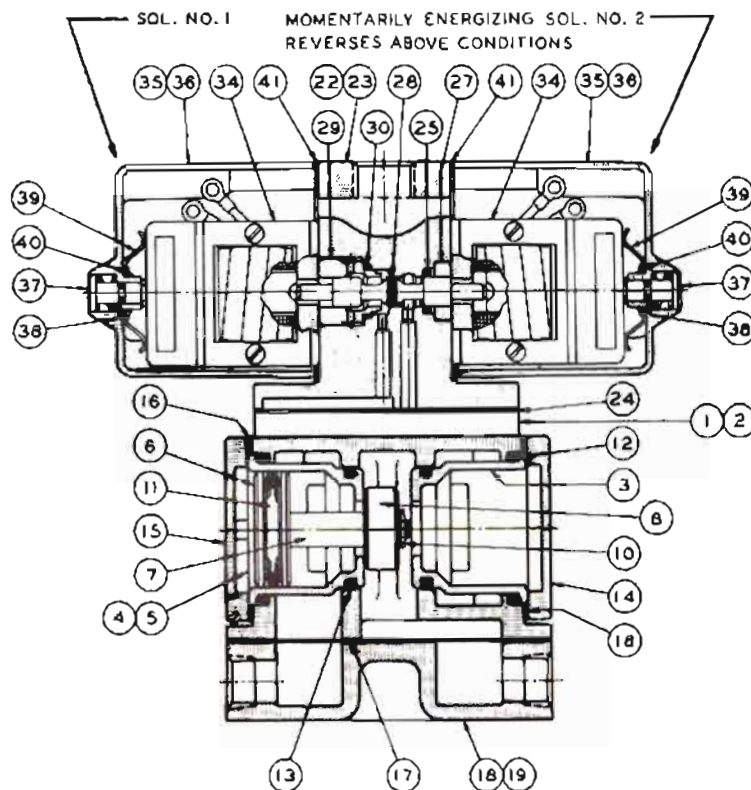
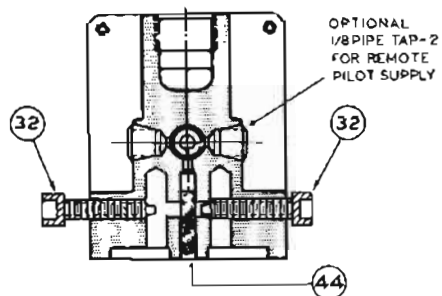
INSTALLATION DATA

1. Valves must have ADEQUATE SUPPLY (VOLUME) and UNRESTRICTED EXHAUST. Supply or exhaust lines should not be reduced more than one pipe size. Speed control valves or other restrictions can be placed in the cylinder supply lines.
2. Unless otherwise specified, Flow Director in pilot head is set for Port "A" inlet. (See OPERATION above.) For Port "B" inlet, setting must be reversed. (See Engineering Section . . . Flow Director.)
3. Valves will operate mounted in any position that results in the solenoids being placed in a horizontal position.
4. These valves should be operated with a remote pilot supply when used for service other than air, or for vacuum operation. See Engineering Section.



SOL. NO. 1 IN ENERGIZED POSITION
 - SUPPLY CONNECTED TO PORT "A"
 - PORT CYL #1" OPEN TO EXHAUST
 - PORT "CYL 2" OPEN TO PRESSURE
 - PORT "B" EXH.

SOL. NO. 1 IN ENERGIZED POSITION
 - SUPPLY CONNECTED TO PORT "B"
 - PORT "CYL 1" OPEN TO PRESSURE
 - PORT "CYL 2" OPEN TO EXHAUST
 - PORT "A" EXH.



PILOT HEAD PARTS LIST

Series 420—4-way Double Solenoid
Momentary Contact Type

VALVE BODY PARTS LIST

Series 420—4-way Double Solenoid
Momentary Contact Type

Item	Req.	Description	1"-1 1/4" Part No.	Item	Req.	Description	1"-1 1/4" Part No.
22	1	Pilot Head Assembly	1031	1	1	Valve Body Assembly ²	1153
23	1	Pilot Head (Casting Only)	1018	2	1	Valve Body	1003
24	1	Pilot Head Gasket	1089	3	2	Valve Seat ¹	1172
25	1	Pilot Stem "O" Ring	1072	4	2	Piston Poppet Seat Assy. ^{1, 5}	1233
26	4	Solenoid Locating Roll Pins ²	1086	5	2	Valve Seat ¹	1172
27	1	Pilot Stem "O" Ring Retainer	1043	6	2	Piston	1035
28	1	Pilot Stem Assembly	1047	7	2	Spacer	1036
29	1	Pilot Stem Retainer	1045	8	2	Poppet	1037
30	1	Pilot Stem Ret. "O" Ring	1073	9	2	Soc. Hd. Cap Screw ²	1080
32	2	Pilot Screw	1112	10	2	Flexloc Hex Nut	1082
34	2	Solenoid ⁴	1038	11	2	Piston "O" Ring	1071
35	2	Solenoid Cover Assembly	1105	12	4	Valve Seat "O" Ring (Large)	1111
36	2	Solenoid Cover	1016	13	4	Valve Seat "O" Ring (Small)	1068
37	2	Manual Operating Button	1041	14	1	Valve Body Cover (Poppet End) ³	1024
38	2	Manual Oper. But. "O" Ring	1074	15	1	Valve Body Cover (Piston End) ³	1025
	1	Manual Oper. But. Spring	1110	16	2	Valve Body Cover Gskt.	1061
	1	Manual Oper. But. Snap Ring	1099	17	1	Valve Body Base Gskt.	1065
39	2	Solenoid Retaining Spring	1040	18	1	Valve Base (1" Ports) ³	1170
40	2	Solenoid Ret. Spring Ring	1087	19	1	Valve Base (1 1/4" Ports) ³	1171
41	2	Solenoid Cover Gasket	1039				
42	2	Solenoid Cover Chain ²	1088				
	4	Chain Screw ²	1104				
44	1	Screen	1113				

¹ Item No. 3, Valve Seat, is identical to Item No. 5 except one Valve Seat unit contains the piston-poppet assembly.

² Not shown on cross-section.

³ Parts are shipped with gasket or gaskets required for storage and cycle.

⁴ Piston Poppet Seat Assy. Part No. for vacuum service is 1137. Assembly Part No. for low pressure service is 1185.

ENGINEERING
Bottom Ported Subplates •
Disassembly – Assembly •
Remote Pilot Supply •



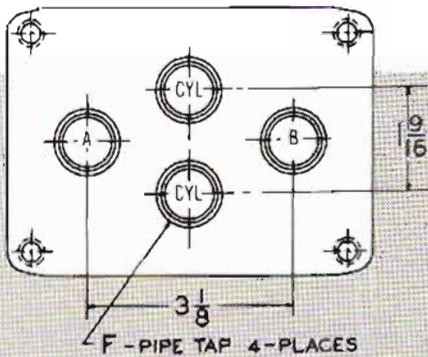
**BOTTOM PORTED SUBPLATES FOR
 SERIES 300, 310PP, 310 AND
 320 VALVES**

All 3-Way Valves are available with bottom ported bases at no extra cost.

The drawing below indicates port location dimensions for bottom ported bases.

Dimension "B" is for over-all valve height, when supplied with bottom ported base, and dimension "C" is for thickness of base.

All other dimensions remain as shown on catalog sheets covering standard models.



NOTE: Bottom ported subplates for 3-way valves, 1" and 1 1/4" pipe sizes have one "cyl" port which is in line with A and B port.

F PIPE SIZE	3-WAY MASTER VALVE		3-WAY SPECIAL PURPOSE VALVE		3-WAY SINGLE SOLENOID VALVE		3-WAY DOUBLE SOLENOID VALVE		BASE PART NO.
	MODEL	B	MODEL	B	MODEL	B	MODEL	C	
1/4"	300M1	4 7/8	310PPM1	7	310M1	7 17/32	320M1	1 1/2	1006-1
3/8"	301M1	4 7/8	311PPM1	7	311M1	7 17/32	321M1	1 1/2	1006-2
1/2"	302M1	5 1/8	312PPM1	7 3/16	312M1	7 13/32	322M1	1 1/2	1006-3
3/4"	303M1	5 1/8	313PPM1	7 3/16	313M1	7 13/32	323M1	1 1/2	1006-4
1 "	304M1	6 1/8	314PPM1	8 1/4	314M1	8 3/4	324M1	2 1/8	1176-1
1 1/4"	305M1	6 1/8	315PPM1	8 1/4	315M1	8 3/4	325M1	2 1/8	1176-2

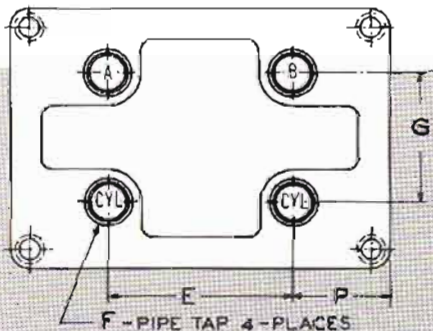
**BOTTOM PORTED SUBPLATES FOR
 SERIES 400, 410PP, 410 AND
 420 VALVES**

All 4-Way Valves are available with bottom ported bases, at no extra cost.

The drawing below indicates port location dimensions for bottom ported bases.

Dimension "B" is for over-all valve height, when supplied with bottom ported base, and dimension "C" is for thickness of base.

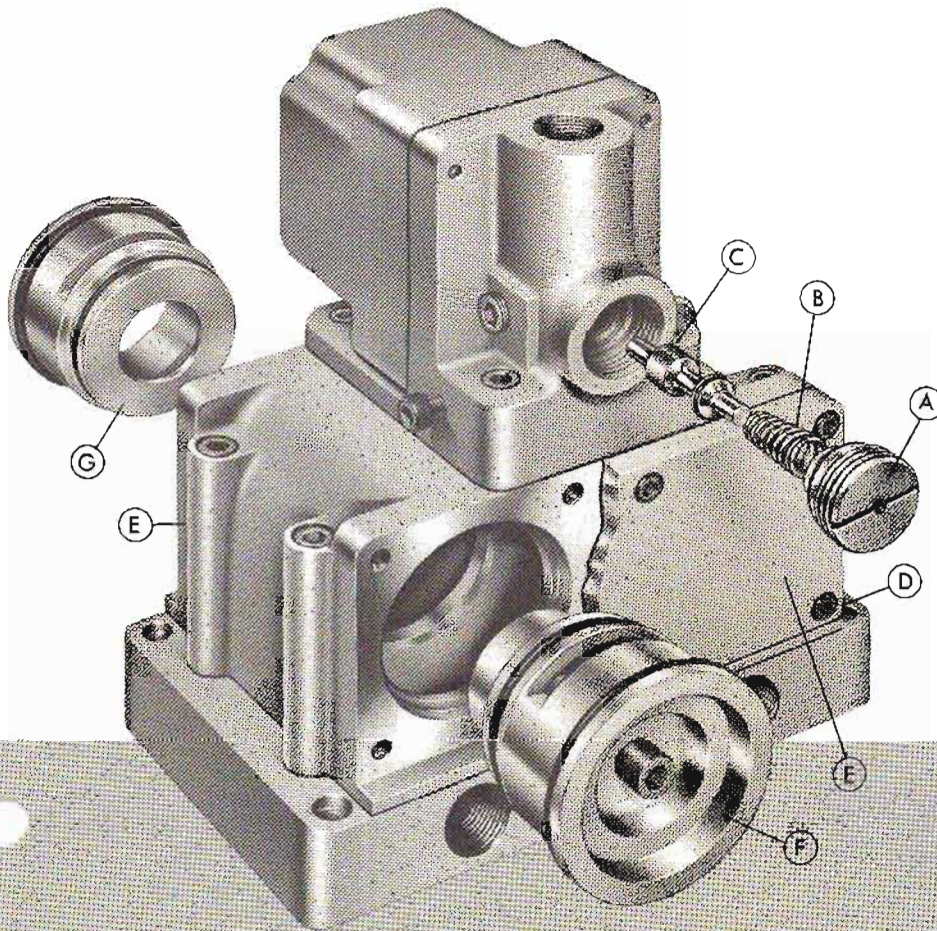
All other valve dimensions remain as shown on catalog sheets covering standard models.



NOTE: Special dual-access subplates, combining both side and bottom porting, are also carried in stock.

F PIPE SIZE	4-WAY MASTER VALVE		4-WAY SPECIAL PURPOSE VALVE		4-WAY SINGLE SOLENOID VALVE		4-WAY DOUBLE SOLENOID VALVE			BASE PART NO.	
	MODEL	B	MODEL	B	MODEL	B	MODEL	C	E		G
1/4"	400M1	4 1/8	410PPM1	6 1/16	410M1	6 27/32	420M1	1	3 1/2	2	1012
3/8"	401M1	4 1/8	411PPM1	6 1/16	411M1	6 27/32	421M1	1	3 1/2	2	1013
1/2"	402M1	5 1/8	412PPM1	7	412M1	7 3/32	422M1	1 3/8	4 1/4	2 1/8	1014
3/4"	403M1	5 1/8	413PPM1	7	413M1	7 3/32	423M1	1 3/8	4 1/4	2 1/8	1015
1 "	404M1	5 13/16	414PPM1	9	414M1	8 3/8	424M1	2	3	3 1/2	1182-1
1 1/4"	405M1	5 13/16	415PPM1	9	415M1	8 3/8	425M1	2	3	3 1/2	1182-2

NOPAK-MATIC VALVES



DISASSEMBLY

CAUTION! Always shut off electrical and pressure supply and bleed all lines before any disassembly.

REMOVAL OF PILOT STEM:

1. Unscrew pilot stem spring retainer nut A.
2. Remove spring B.
3. Push manual operating button. Then carefully pull out exposed pilot stem C.

REMOVAL OF PISTON POPPET ASSEMBLIES

1. Remove socket head cap screws D on both sides of valve.
2. Drop valve body cover plates E.
3. Push out poppet assembly cartridge F by nudging with wooden dowel inserted through hole in valve seat cartridge G. Then push out cartridge G by inserting dowel into opening exposed by removal of cartridge F. (A wooden dowel should be used to prevent damage to sealing surfaces.)

ASSEMBLY

1. All parts should be carefully cleaned so that foreign particles are removed. Be sure to also check pilot head filter screen.
2. Moving parts must be lightly oiled with recommended lubricant—see list in Engineering section.
3. Damaged gaskets should be replaced.
4. Assemble parts in a reverse order of disassembly.
5. Tighten all screws systematically to obtain an even pull-down. Do not over-tighten.

REMOTE PILOT SUPPLY

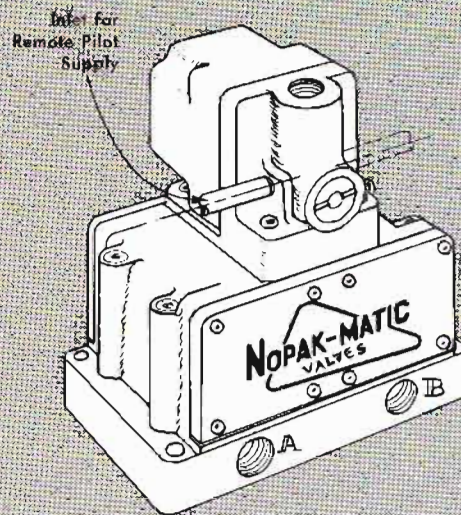
All Nopak-matic 2, 3, & 4 way solenoid operated valves can be adapted for low pressure (below 15 psi) vacuum service.

To accomplish this it is necessary to remotely supply the pilot section with at least 15 psi air in order to shift the main poppets. Two special 1/8" NPT inlets are tapped into the pilot section, as shown right, to bring the pilot air supply into either pilot inlet port. (One inlet is sufficient, but two are supplied for convenience of piping. Unused port is plugged.) Both pilot selector screws must be fully closed to assure isolation of pilot section from master section of valve.

When using other media (oil for example), even at standard operating pressures, it is still necessary to bring air pressure to the pilot section, via the remote pilot supply feature. Pilot pressure must meet or exceed main inlet pressure.

When ordering, please specify "Remote Pilot Supply." Also indicate:

1. Vacuum: specify maximum vacuum in HQ or equivalent. Special return spring will be furnished in piston poppet assembly (see opposite page).



2. Low pressure (below 15 psi): special return spring furnished in piston poppet assembly (see opposite page).
3. Other media—
 - A. Type, description and specifications.
 - B. Pressure.
 - C. Temperature.
4. Voltage and cycle.

ENGINEERING

- Make-Up Bleed
- Spring Loaded Piston-Poppet
- Flow Director
- Proper Lubricants

MAKE-UP BLEED

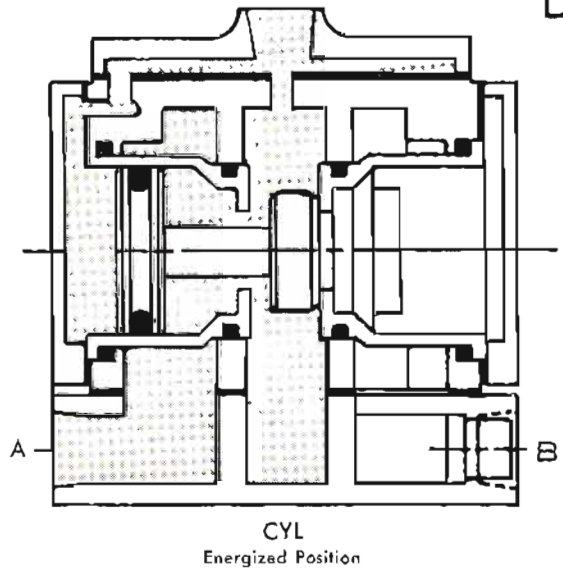
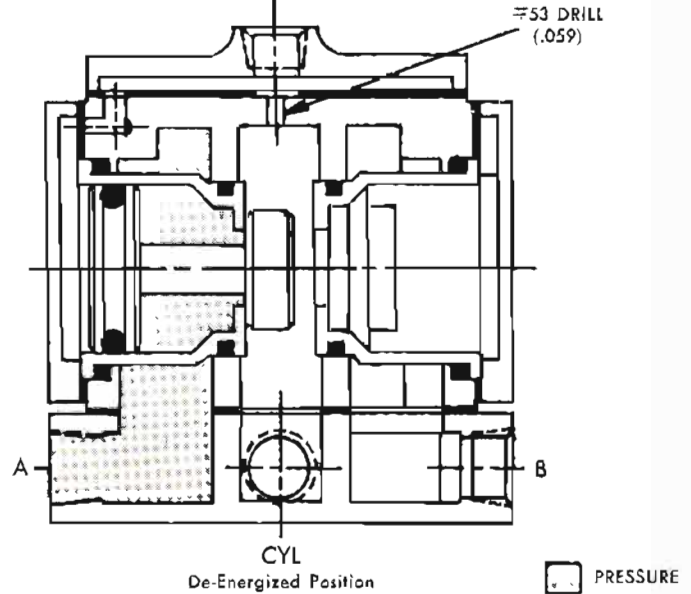
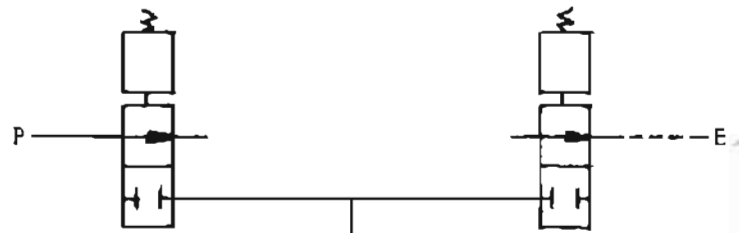
Nopak-matic master 3-way or 4-way valves, supplied with a "Make-up bleed" feature, eliminate the need of maintaining constant pilot pressure to hold the master valve in the energized position.

Normally, a 3-way valve is required to pilot the Nopak-matic master valve. With "Make-up bleed", two 2-way normally closed pilot valves can be used as follows: the first directs pressure into pilot head, the second exhausts pilot head to atmosphere.

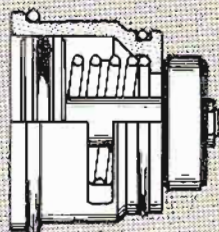
As shown in the sketch below, a small orifice is drilled in the master valve body connecting the center chamber to the master valve head. When the valve is de-energized, the center chamber as well as the master valve head is exhausted.

A momentary actuation of the first 2-way pilot valve puts an impulse of air into the master valve head and moves the piston poppet(s) over to the energized position. This pressurizes the center chamber and make-up bleed continues to supply pressure to master valve head to compensate for any leakage through fittings, elbows, pipes, etc., after the first 2-way pilot valve has been closed. When the second 2-way pilot valve is momentarily actuated, air from the master valve head exhausts faster than the make-up bleed orifice can replenish the supply, resulting in the piston poppet(s) shifting back to the de-energized position.

Customer must specify "Make-up bleed" when ordering this valve.



**NOPAK-MATIC
VALVES FOR
LOW PRESSURE
OR VACUUM
OPERATION**



PISTON-POPPET
SEAT ASSEMBLY
WITH RETURN
SPRING

Nopak-matic valves can be adapted to low-pressure (below 15 p.s.i.) or vacuum operation by the addition of a spring(s) in the piston-poppet seat assembly.

High pressure from the pilot head shifts the piston-poppet in one direction, spring pressure returns it to seat. Supply pressure from the pilot head must be 15 p.s.i. or more.

When ordering, specify modification desired: "M2" — Low Pressure; or "M2" — Vacuum.

See bottom of page 31 for remote pilot supply operation.

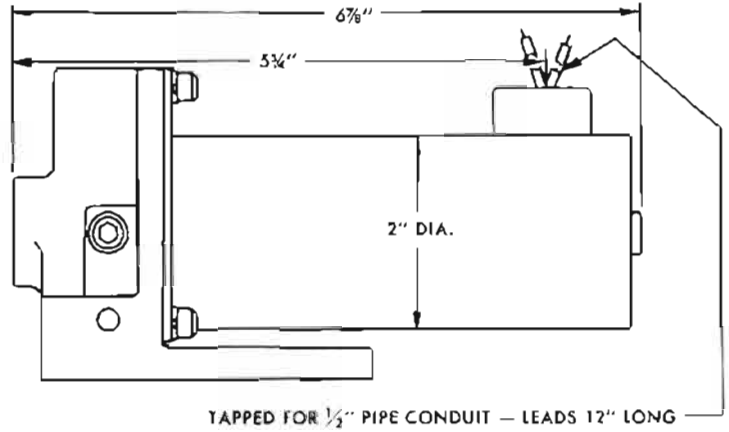
ENGINEERING

- Direct Current Solenoids •
- Ambient Temperatures •
- Pressure Drop vs. Air Flow •

DIRECT CURRENT SOLENOIDS

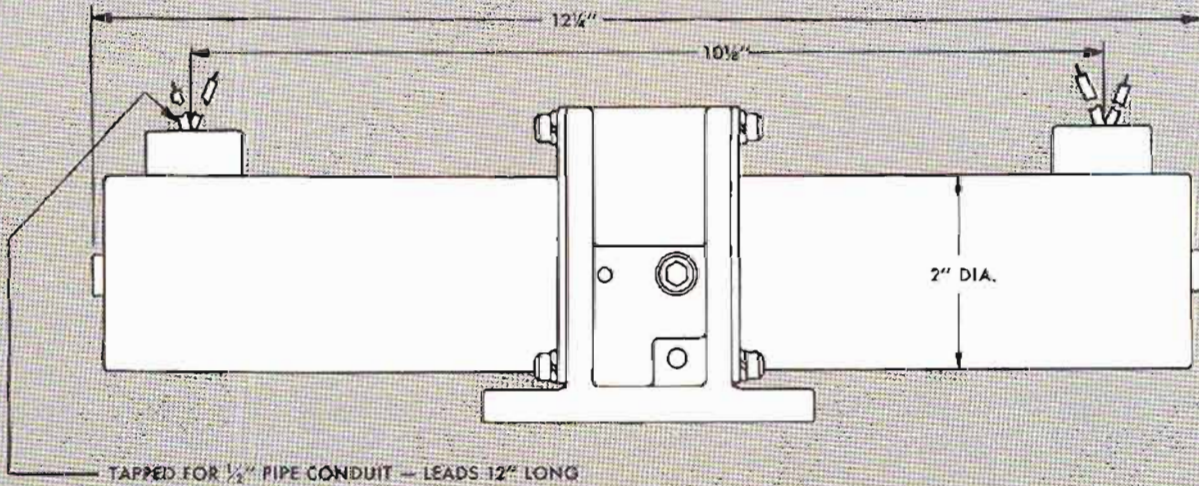
Drawings below give dimensions of D.C. solenoids mounted on standard Nopak-matic pilot heads. All other valve dimensions are the same as shown on each catalog sheet. Solenoids for 12, 16, 24, 32, 50, 90, 125 and 250 D.C. are in stock. Other voltages are available on request. For complete cost data, see price sheet.

SINGLE SOLENOID PILOT HEAD FOR SERIES 310 and 410 VALVES



NOTE — Both single and double solenoid valves use No. 24-80 solenoids with coils No. 9-27 (watts = 36) inrush amps = holding amps then for 25 volts D.C., $A = \frac{36}{24} = 1.5$ amps

DOUBLE SOLENOID PILOT HEAD FOR SERIES 320 and 420 VALVES



AMBIENT TEMPERATURES — Nopak-matic valves with solenoids will function trouble-free in temperatures to 140° F. Check with Nopak for special solenoids for temperatures in excess of 140° F.

USE AIR LINE FILTER, PROPER LUBRICANTS

TO INSURE maximum performance, Nopak-matic Valves should be supplied with CLEAN LUBRICATED air. We recommend use of an air line filter and lubricator, BOTH OF AMPLE FLOW CAPACITY, installed as close as possible ahead of the valve and cylinder. DO NOT USE oils having any detergent additives. Following is a representative list of oil refiners and their particular brands:

- Cities Service Oil Co. North Star #2
- Esso Standard Oil Tarasso #43 or Terasstic #43
- Gulf Oil Co. Harmony #44 or Security #44
- N. Y. & N. J. Lubricant Co. A-#88/HNR
- Shell Oil Co. Tellus #27 or Turbo #27
- Sinclair Refining Co. Rubilene-Extra Light
- Socony-Mobile Oil Co. D.T.E. Light
- Standard Oil of Calif. Chevron GST Oil #32
- Texaco Regal A.R. & O.
- Union Oil of Calif. Red Line Turbine Oil #150

Chemical composition, however may vary somewhat due to geographical areas in which these lubricants are produced.

C_v FACTORS FOR NOPAK-MATIC VALVES

C_v FACTORS FOR NOPAK-MATIC VALVES

To assist in the selection of Nopak-matic valves, the following flow coefficients of the various models and pipe sizes have been determined in accordance with the standard air flow equation:

$$C_v = \frac{Q \times 60}{1360} \sqrt{\frac{G \times T_u}{\Delta P \times P_u}}$$

in which

- C_v = flow coefficient
- Q = air flow in standard units, scfm (14.7 psi, 68°F)
- G = specific gravity, air @ 68°F
- T_u = absolute temp. (deg. F + 460)
- ΔP = press. drop, psi
- P_u = press. in absolute units (subscript "u" = upstream)

then

$$C_v = \frac{Q \times 60}{1360} \sqrt{\frac{.932 \times (68 + 460)}{\Delta P \times (100 + 14.7)}}$$

for values of C_v and Press. drops
at 100 psi entering air press.

For our Nopak-matic valves the following C_v factors apply:

3-WAY			
MODEL	NPTF SIZE	C _v	
		ΔP = .15	ΔP = 40.
300 310 320	¼	5.66	5.13
301 311 321	⅜	6.28	5.63
301½ 311½ 321½	½	7.37	6.60
302 312 322	½	7.74	6.93
303 313 323	¾	8.33	7.58
304 314 324	1	11.3	10.1
305 315 325	1¼	12.0	10.8

4-WAY			
MODEL	NPTF SIZE	C _v	
		ΔP = .15	ΔP = 40.
400 410 420	¼	2.83	2.74
401 411 421	⅜	3.42	3.32
401½ 411½ 421½	½	4.21	4.13
402 412 422	½	4.48	4.41
403 413 423	¾	4.72	4.62
404 414 424	1	6.42	6.28
405 415 425	1¼	6.72	6.50

To determine the C_v factor for supply pressures at other than 100 psig, calculate ΔP and Q in accordance with the information given in the Pressure Drop vs. Air Flow Graph and then substitute these new values in the above equation.

PRESSURE DROP Vs. AIR FLOW AT 100 PSIG ENTERING PRESSURE

TO DETERMINE PRESSURE DROP AT
OTHER ENTERING AIR PRESSURES
FOR A SPECIFIED FLOW:

$$\Delta P_2 = \frac{\Delta P_1 \times 114.7}{P_2 + 14.7}$$

Where ΔP_2 = Pressure Drop (Unknown)

ΔP_1 = Pressure Drop for Correct Valve at
specified flow (read along bottom of
chart where flow and valve curve
intersect)

P_2 = Entering air pressure (Desired)

TO DETERMINE FLOW RATE AT OTHER
ENTERING AIR PRESSURES FOR A
SPECIFIED PRESSURE DROP:

$$Q_2 = \frac{Q_1}{\sqrt{\frac{P_2 + 14.7}{P_1 + 14.7}}}$$

Where Q_2 = Flow Rate CFM (Unknown)

Q_1 = Flow Rate for correct valve at specified
pressure drop (read along left side of
chart where pressure drop and valve
curve intersect)

P_1 = Entering Air Pressure (Desired)

PRESSURE DROP P.S.I.G.

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

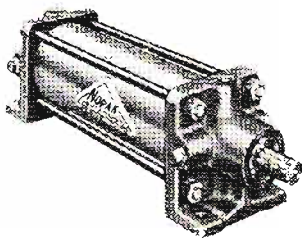
We are proud to warrant that since 1889 all products manufactured by GALLAND HENNING NOPAK, INC. consist of 99% American materials and labor.



National
FLUID POWER
Association

MLMBER

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™ NFFPA AIR OR HYDRAULIC CYLINDER



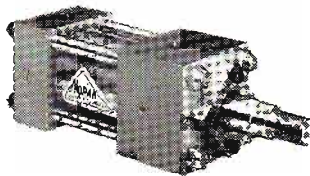
100% performance at 40% less cost! Economical, light weight. Quality built for tough use. Corrosion resistant aluminum barrel and heads. Chrome plated steel piston rod. Bronze rod bearing. Eight (8) interchangeable NFFPA mountings. Pressures to 250 psi. Eight (8) bore sizes 1-1/2" to 8" diameter.

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

Also no lube option. See Catalog 109.

SQUARE HEAD, TIE-ROD

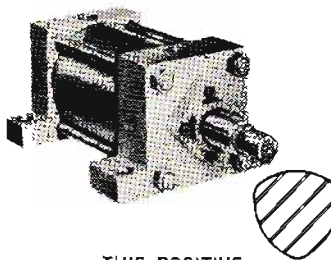
(Interchangeable)



Class 3: Square head, steel plate, honed steel tubing and tie-rod construction. Choice of cushioned or non-cushioned heads. 18 standard mountings. Completely interchangeable with other NFFPA square head hydraulic cylinders. Pressures to 3,000 PSI. See Catalog 103.

Class 6: These Bore-Rated Air and Hydraulic cylinders are similar to Class 3 in construction. Available with either steel, brass, aluminum or Plastic tubing. For air pressures to 250 PSI; hydraulic to 1,500 PSI. Meet or exceed all NFFPA requirements. See Catalog 106.

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.

SPECIAL CYLINDERS



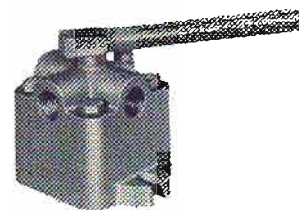
NOPAK has a wealth of experience with special cylinders of varying bores, strokes and pressures. Hydraulic cylinders with diameters up to 33 inches and capable of generating 1500 tons of force have been designed and built by NOPAK.

MILL TYPE CYLINDER



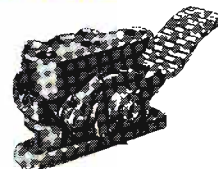
Made of heavy, honed steel tubing. Lock-ring flange construction permits head rotation for most convenient mounting. Cylinder head design provides four inlet port locations spaced at 90 degrees. Designed for oil or water hydraulic service at pressures up to 2000 PSI. Consult factory.

HAND VALVE



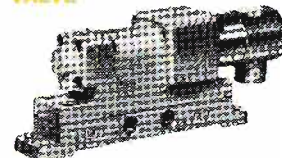
NOPAK 3 and 4-Way Hand Valve, 250 PSI, to actuate single or double acting cylinders. Sealing at right angle to stream flow permits gradual throttling or immediate full opening. See Catalog 102.

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.

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.