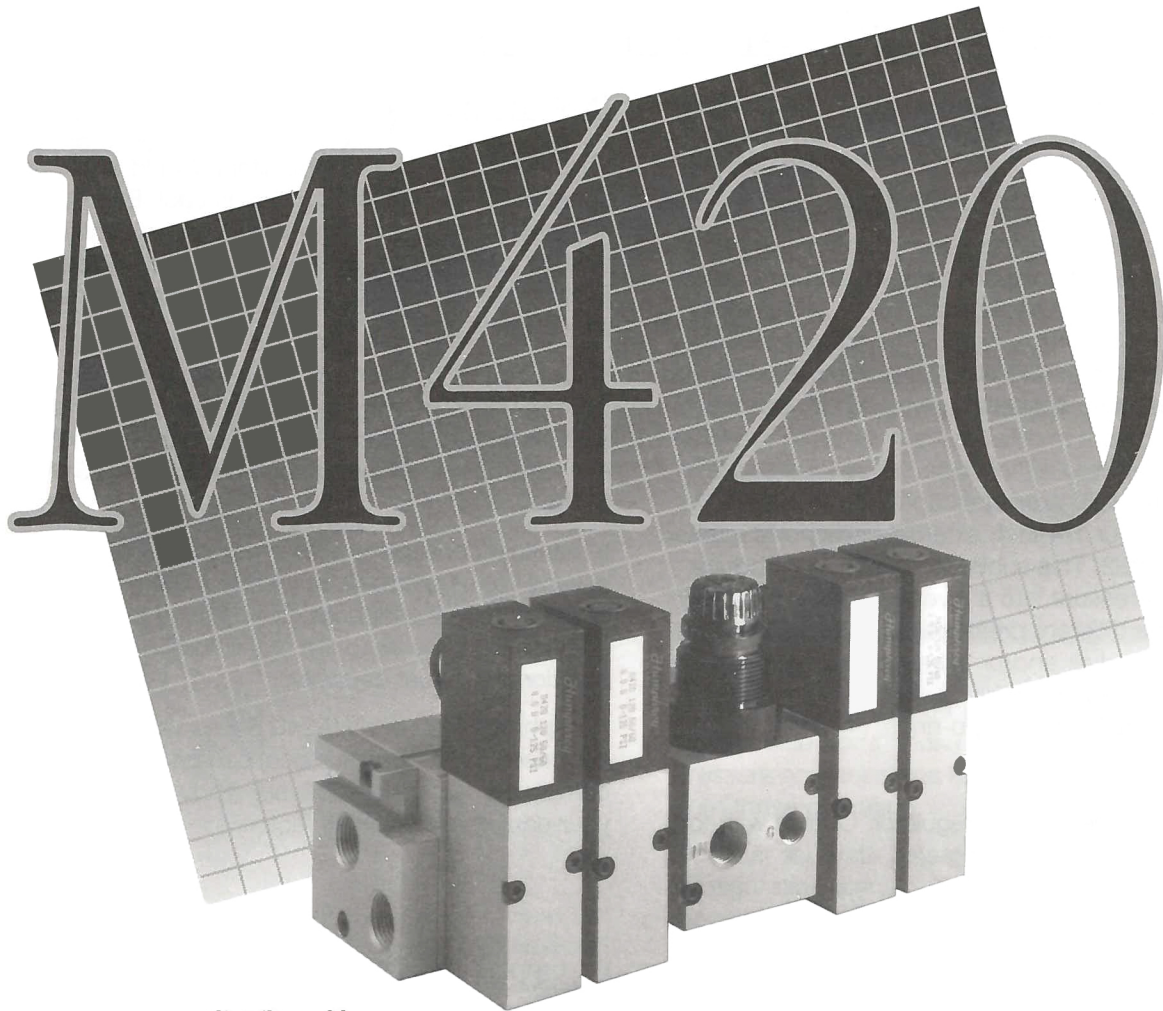


M420 SERIES SOLENOID VALVES



distributed by:

Humphrey[®]

HUMPHREY M420 SERIES

SUBBASE MANIFOLD MOUNTED SOLENOID VALVES

TECHNICAL SECTION GENERAL INFORMATION

DESCRIPTION

M420

A 4-way normally open/normally closed, single solenoid, 2-position/ spring return, general purpose air valve. Comes with two spacer screws and one gasket.

SB-2

Subbase with two 1/4-inch outlet ports, marked 1 and 2. Comes with two spacer screws and two o-rings.

SBMP-2

Subbase with multi-pressure capability. Model SBMP-2 has four 1/4-inch external body ports marked IN, EXH, 1 and 2. This subbase is used to introduce an alternate pressure into a given assembly of valves operating at a different pressure. It is also used to supply additional air and/or exhaust capability to a subbase mounted assembly of valves. Comes with two spacer screws and two o-rings.

SB-2R

Subbase for Model MR420 regulator. Comes with four spacer screws and two o-rings.

SB-2H

Subbase for HA240 series single or double solenoid, 2- or 3-position valves. Subbase has two 1/4-inch outlet ports, marked 1 and 2. Comes with two spacer screws and two o-rings.

INSTALLATION

The assembled subbase manifold should be mounted using the slotted mounting hole in each End Cap and 1/4-inch or M6 socket head cap screws or fillister head screws. One threaded 5/16-18 mounting hole is provided in each End Cap for mounting the finished assembly.

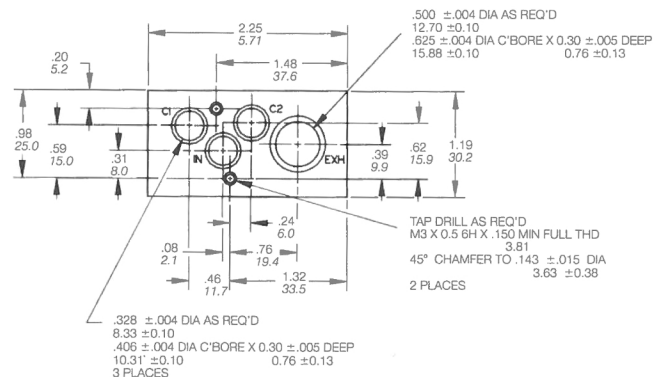
Valves can be mounted in any position in most environments, in keeping with the specifications. All models feature a Class B insulation system and molded coil for ambient temperatures from 32° to 125° F (0° to 50° C).

If manifold consists of a large number of valves or if several valves are to be actuated at the same time, Model SBMP-2 subbases can be used to feed additional supply air to the manifold and to provide additional exhaust capacity.

Humphrey M420 and HA240 Series valves and subbases (or subbases alone) can be ordered completely factory assembled, ready for installation in your equipment. Consult factory for details.

PORTING FOOTPRINT

Humphrey M420 valves can be mounted to your equipment or to special manifolds using the dimensional data shown below.



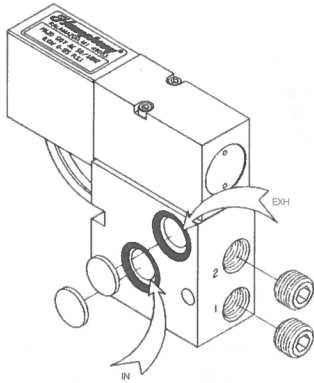
USE AS 3-WAY

The Humphrey 1/4-18 NPT Port Plug # 130-15 can be used to convert the M420 4-way valve to 3-way service:

- Normally closed 3-way: Plug Delivery Port 1.
- Normally open 3-way: Plug Delivery Port 2.

USE AS 2-WAY

The Humphrey #130-15 Port Plug can also be used to convert the M420 to 2-way service:



Normally Closed 2-way: Plug Delivery Port #1. Use a Port Isolator to plug internal subbase EXH port. (Internal EXH port corresponds with EXH port in End Cap.) Also plug external EXH port when using Model SBMP-2 subbase, and the appropriate End Cap EXH port. Connect supply pressure to IN.

Normally Open 2-way: Plug Delivery Port #2. Use a Port Isolator to plug internal subbase IN port. (Internal IN port corresponds with IN port in End Cap.) Also plug external IN port when using Model SBMP-2 subbase, and the appropriate End Cap EXH port. Connect Supply pressure to IN.

MULTI-PRESSURE

Model SBMP-2 subbases can be used to create multiple pressures on a common subbase assembly. Use Port Isolators to isolate the subbase to be used with a separate pressure. Isolate the subbase and connect Supply pressure to the IN port of the subbase.

For simplicity, when mixing valves with different pressures on the same subbase manifold, consider locating valves of one common pressure on one end of the assembly. Use Port Isolators (part number 40-800A) to separate the last valve of a common pressure from other valves in the assembly, then mix/match valves of other pressures at the opposite end of the assembly.

MULTI-PRESSURE, ALTERNATE METHOD

Locate subbase/s for separate pressure on one end of the assembly. Use Port Isolators to plug the internal side ports (those interfacing with the alternate pressure source) of the last subbase to separate it from those operating at another pressure.

Connect separate pressure to End Cap. In this configuration, part of the assembly operates on one pressure, the other part operates on another pressure.

PLUMBING

M420 Series valves are direct acting. When used with vacuum or low pressure, use largest possible tubing size and minimum tubing length for optimum performance.

Before connecting fittings and tubing, blow all foreign material from these components. If a sealant is used, be sure the sealant does not enter the valve as it may cause malfunctions and/or leaks.

LUBRICATION

M420 valves are pre-lubed and can be operated without air line lubrication to an estimated life of 20 million cycles, depending on application. If air pistons/cylinders or other devices require lubrication, ensure that lubrication oils are chemically compatible with Buna N elastomers and are of sufficient viscosity to assure adequate lubrication. Thin or low viscosity oils (spindle oil, machine oil, etc.) do not provide a good residual film of lubrication.

MEDIA/PRESSURE

M420 valves are designed for use with compressed air or inert gases from 28" Hg. vacuum to 125 psig (8.5 bar). Compressed air should be clean and uncontaminated. When in doubt, install an air filter with filtering capacity of 40 microns. Periodically remove and clean or replace filter element. Consult factory if using any other media.

CAUTION: Compressed air is powerful and can be dangerous. Before removing a component from an air line or system, always disconnect the supply air and thoroughly exhaust the line or system. Never attempt to construct, operate or service anything using compressed air unless you have been properly trained to do so. Failure to heed this warning could result in SERIOUS, EVEN FATAL, PERSONAL INJURY.

MANIFOLD PORT IDENTIFICATION

IN	Pressure supply port.
EXH	Exhaust port, vent to atmosphere.
1	Normally open delivery port.
2	Normally closed delivery port.

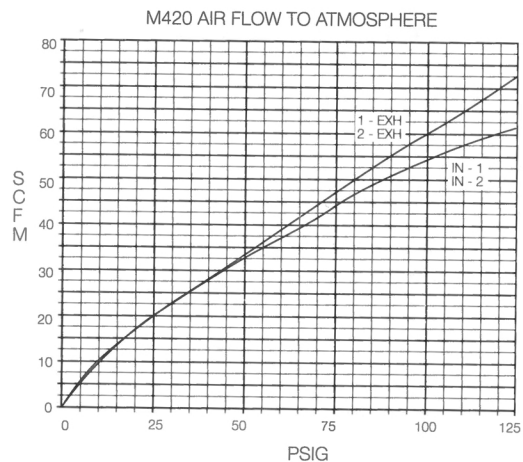
FLOW AND ELECTRICAL DATA

FLOW RATES/C_v

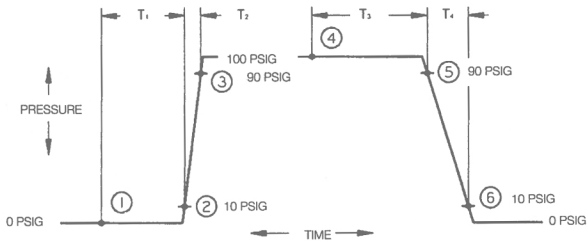
Humphrey recommends "fill/exhaust times," which are related to various chamber sizes, as the easiest method for calculating total valve and actuator response time. Humphrey recognizes the industry's use of flow coefficient C_v as a comparison standard.

Consequently, we offer three types of flow data. The National Fluid Power Association's standards for C_v, the scfm flow rate determined by flowing to atmosphere, and Humphrey's preferred "fill/exhaust times."

Model	C _v	SCFM @100 psig	Fill time (sec) (0 to 80 psig) chamber (cu. in.)			Exhaust time (sec) (100 to 10 psig) chamber (cu. in.)		
			10	100	1000	10	100	1000
M420	.9	54	.037	.37	3.70	.054	.54	5.40



RESPONSE TIMES



IDENTIFICATION OF RESPONSE TIME AREAS

T1 times are measured from point 1 (valve energized) to point 2 (10 percent of supply pressure detected at valve outlet port).

T2 times are measured from point 2 (detection of outlet pressure) to point 3 (90 percent of supply pressure).

T3 times are measured from point 4 (valve de-energized) to point 5 (10 percent of supply pressure exhausted from outlet port).

T4 times are measured from point 5 (detection of pressure drop) to point 6 (90 percent of supply pressure exhausted).

AC/DC VOLTAGES (M420)

Coil voltage	T ₁	T ₂	T ₃	T ₄
DC	0.020 sec.	0.002 sec.	0.005 sec.	0.002 sec.
AC	0.020 sec.	0.002 sec.	0.035 sec.	0.002 sec.

Measured at 70° F (21° C) with 100% voltage and 100 psig supply. Times shown are nominal performance of valves tested.

EXAMPLE OF HOW TO CALCULATE FILL/EXHAUST TIMES

Model 420, 24 VDC
 One Air Line (0.250 I.D. x 24-inch long)
 100 psig supply
 Air Cylinder (2.5-inch bore x 10-inch stroke)
 Volume = 0.785 x Diameter squared x stroke or length

Cylinder Volume	=	49.06 cubic inches
Air Line Volume	=	<u>1.17 cubic inches</u>
Total Circuit Volume	=	50.23 or 50 cubic inches

T ₁ + T ₂	Time to energize valve	= 0.022 sec.
	Time to fill 50 cubic inches	
	50% of .37 sec. for 100 cubic inches	= 0.185 sec.
T ₃ + T ₄	Time to de-energize valve	= 0.007 sec.
	Time to exhaust 50 cubic inches	
	50% of .54 sec. for 100 cubic inches	= <u>0.270 sec.</u>
Total Cycle Time		= 0.484 sec.*

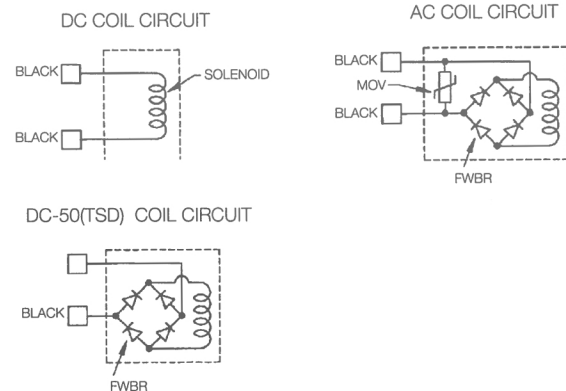
*Although this result is not exact, it is sufficient for most application needs and provides a simple, straight-forward system.

ELECTRICAL SPECIFICATION CHART

Voltage	Resistance (Ohms)	Current (Milliamps)
12VDC	18.0	667
12VDC-50	13.8	760
24VDC	72.0	333
24VDC-50	58.0	370
24VAC	50.0	400
100VAC	1051.0	87
120VAC	1512.0	73
200VAC	4200.0	44
240VAC	6050.0	36

- All coils are standard with 24-inch black lead wires. Optional 72-inch lead wires are available.
- All AC coils are rated for 50/60 Hertz.
- All coils conform to Class B insulation systems.
- Resistance and current are nominal values.
- Valve assemblies are “hi-pot” tested at 1750 VAC for one second.
- Ensure proper voltage supply per voltage label rating, +10%, -15% for AC or DC voltages.

SOLENOID CIRCUIT SCHEMATICS



Transient Suppression Diode (TSD), Order code -50, is available for DC voltages to protect circuits from DC voltage spikes generated by the valve.

If operating the valve with a reed switch, the TSD will enhance the life of switch contacts.

If operating the valve with a programmable controller, the TSD will eliminate voltage spikes which could cause erratic operation of the controller.

The TSD option will increase T3 response times to that of the DC coils.

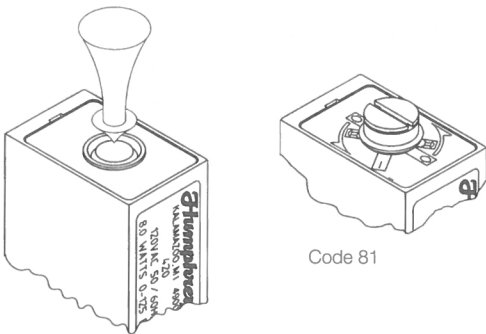
MANUAL OVERRIDE

Push button/spring return manual override is standard. Manual override is located on top of coil.

Pushing red button shifts armature which actuates the main stem of valve. Release of manual force permits valve spring to return valve to normal position.

M420 valves are available without manual override by specifying Code 87 (example is M420-87 24VDC). On valves without manual override, a solid cover is installed on the coil. This replaces the punched disk which is used on valves with manual override.

A locking manual override is optional; specify Code 81 (example is M420-81 24VDC). In the non-actuated position the override is locked "Off" and will not operate the valve. Clockwise rotation of slotted screw approximately 30 degrees provides operation like the standard manual override: pushing center portion actuates the main stem of the valve; release of manual pressure permits spring to return valve to the normal position. Rotating an additional 90 degrees locks override and valve in the "On" position.



Code 81

METRIC PORTS/DIMENSIONS

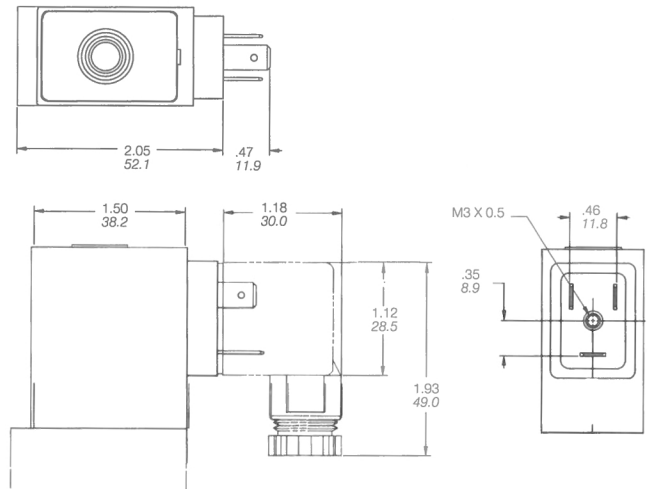
Although these subbases are produced using the inch system, all drawings show the metric equivalent in millimeters (indicated by slanted numbers).

All port connections are available in metric sizes. The 1/4-18 NPSF pipe ports are available in ISO 7/1-Rp 1/4. The 3/8-18 ports in the End Caps are available in ISO 7/1-Rp 3/8.

Specify metric port threads by using letter E as a model number prefix. Example: ESB2 has metric ports.

CODE 39

Humphrey Code 39 is an optional plug-in DIN-type connector base that conforms to international standards. It provides simplicity, convenience, and fast, easy electrical installation. The connector base accepts DIN 43 650/ISO 4400 connectors which form a secure, solderless electrical connection.



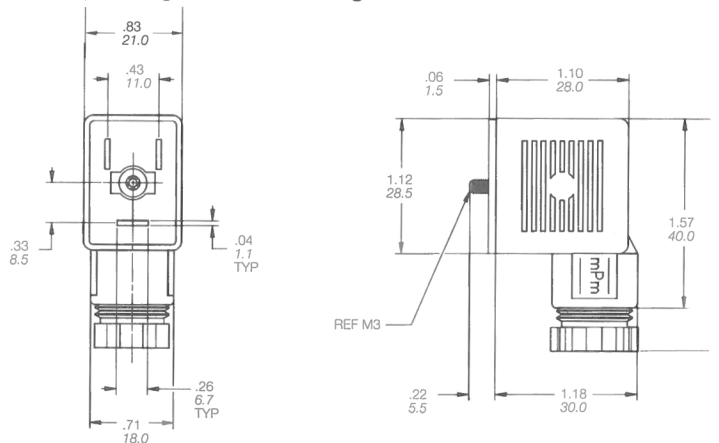
CONNECTORS (Order Separately)

Model HS-3.

This connector has an internal socket for screw-type wire termination contained within a black housing. The housing is capable of being rotated 180 degrees with respect to the socket for flexibility of cable placement.

Model HS-3L.

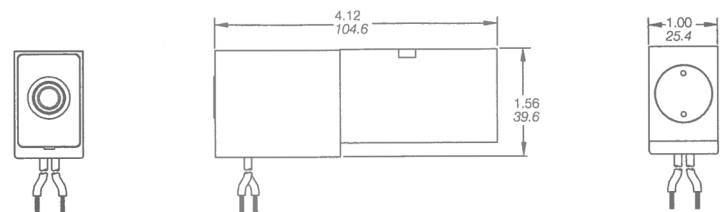
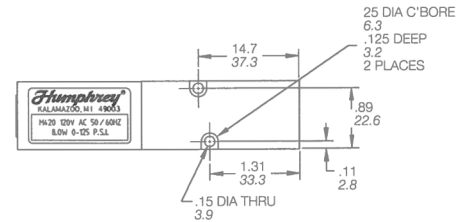
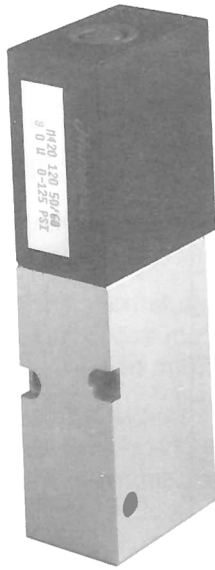
This connector has a built-in AC/DC LED that can be ordered for 12V, 24V, 120V, or 240V coils. It has an internal socket for screw-type wire termination. The transparent housing can be rotated 180 degrees with respect to the socket for flexibility of cable placement. Specify voltage when ordering.



SPECIFICATIONS

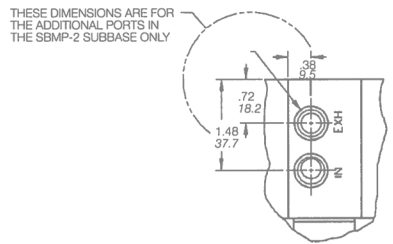
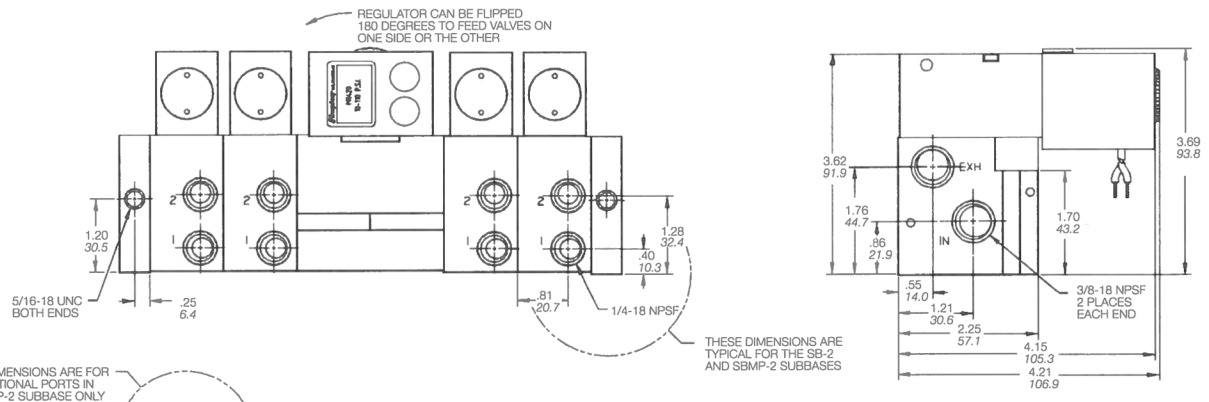
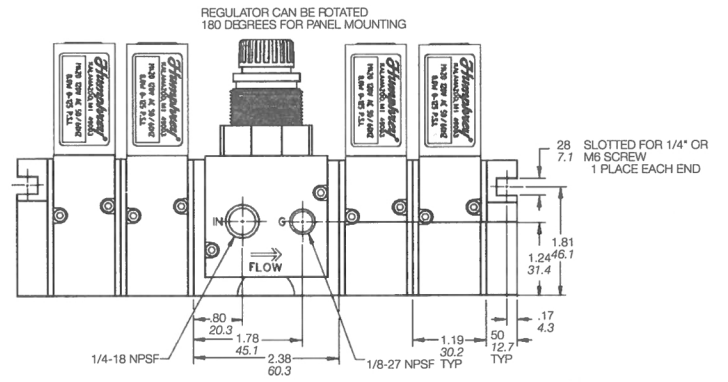
	M420 Valves		
Media	Air, vacuum or inert gases		
Pressure range	28" Hg (vacuum) to 125 psig (8.5 bar)		
Ambient temperature range	32 to 125° F (0 to 50° C)		
Coil temperature rise (any voltage)	108° F (60° C)		
Power consumption (AC/DC)	8.0 watts		
Response time (on/off)	.022/.007 (DC), .022/.037 (AC)		
Voltage tolerance	Plus 10%, minus 15% of rated voltage		
Coil voltages	12VDC, 24VDC, 24VAC, 100VAC, 120VAC, 200VAC, 240VAC, 12VDC-50, 24VDC-50		
SCFM @ 100 psig	54		
C _v	.9		
Fill time (sec.) 0 to 80 psig	10 cu. in. .037	100 cu. in. .37	1000 cu. in. 3.7
Exhaust time (sec.) 100 to 20 psig	.054	.54	5.4
Leak rate (max. allowed)	4cc/minute @ 100 psig		
Type of operation	Direct solenoid		
Effective area	.045 Inch ²		
Stroke	.032-inch		
Typ. cycle rate (cycles/min.)	1500 (DC), 725 (AC)		
Lubrication	None required, factory pre-lubed		
Filtration	40 Micron recommended		
Weight	M420 .73 lbs. (322 gms.)		
Materials (wetted)	Brass, Buna N, aluminum, stainless steel, acetal		

M420 SOLENOID VALVE

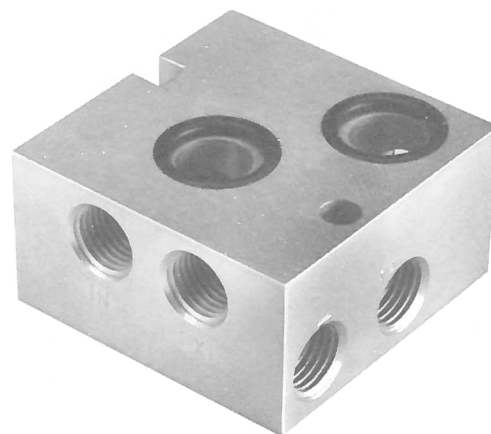
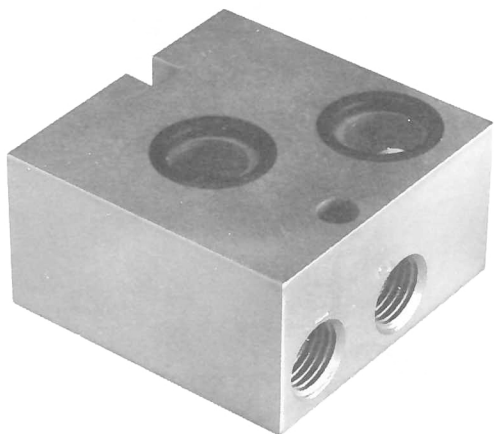


M420

- 4-way, Normally Open/Normally Closed
- 2-position, spring return
- Direct acting, single solenoid
- Continuous duty coil
- Four internal ports: In, Delivery ports 1 & 2, Exhaust
- Non-locking manual override
- (Optional locking override, specify order code -81)
- Two spacer screws and one gasket



SUBBASES, MANIFOLD END PLATE ASSEMBLIES AND REGULATOR

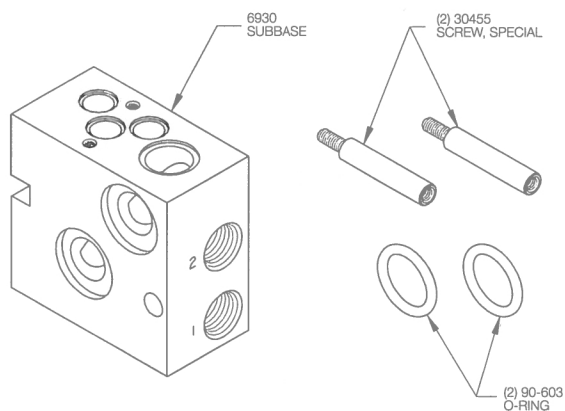
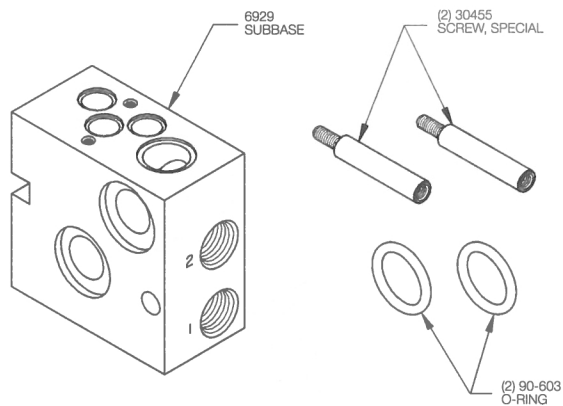


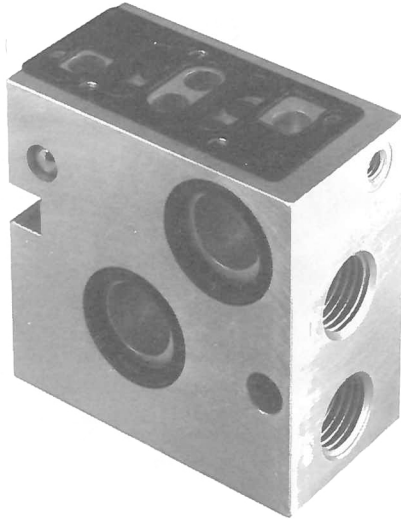
SB-2

- Subbase for M420 valve
- Two delivery ports, marked 1 and 2
Port 1 is normally open, Port 2 is normally closed
- Two spacer screws and two o-rings for inter-subbase seal

SBMP-2

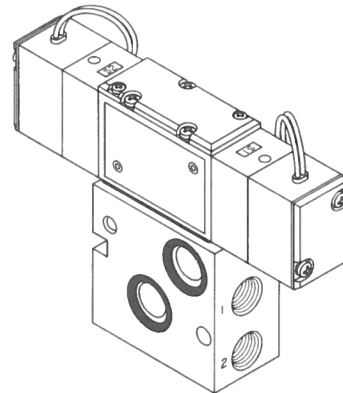
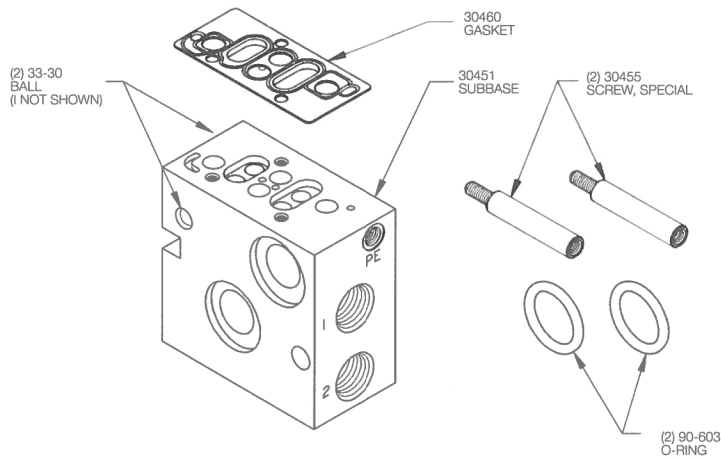
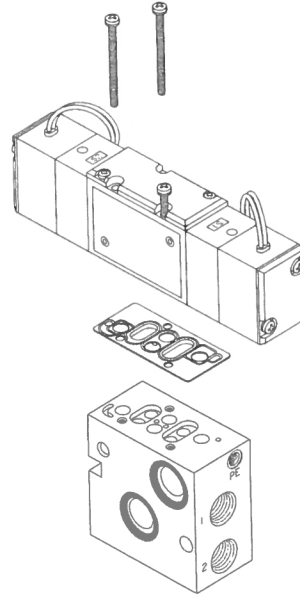
- Subbase for M420 valve
- Four ports: Two delivery ports marked 1 and 2
(Port 1 is normally open, Port 2 is normally closed);
plus one separate IN and one separate EXH port
- Two spacer screws, and two o-rings for inter-subbase seal

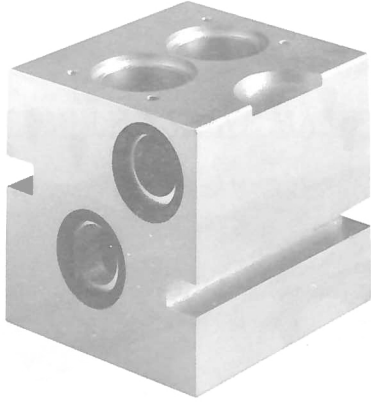




SB-2H

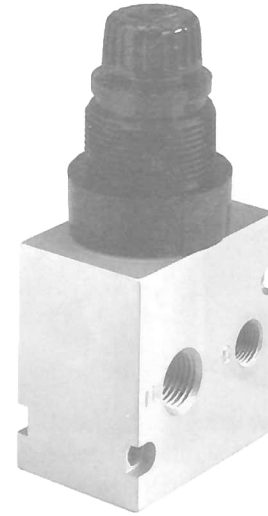
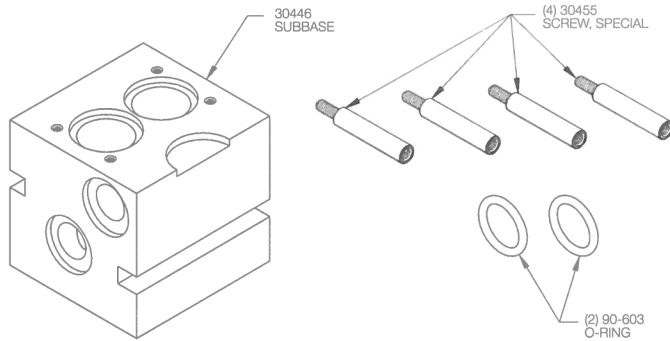
- Subbase for HA240 Series valves
- H240 valves are available as single or double solenoid. Double solenoid models are offered as either 2- or 3-position valves.
- Complete details on HA240 Series valves are given in the complete Humphrey valve catalog. This catalog is available from your Humphrey distributor or from the factory.
- Two spacer screws, gasket and two o-rings.





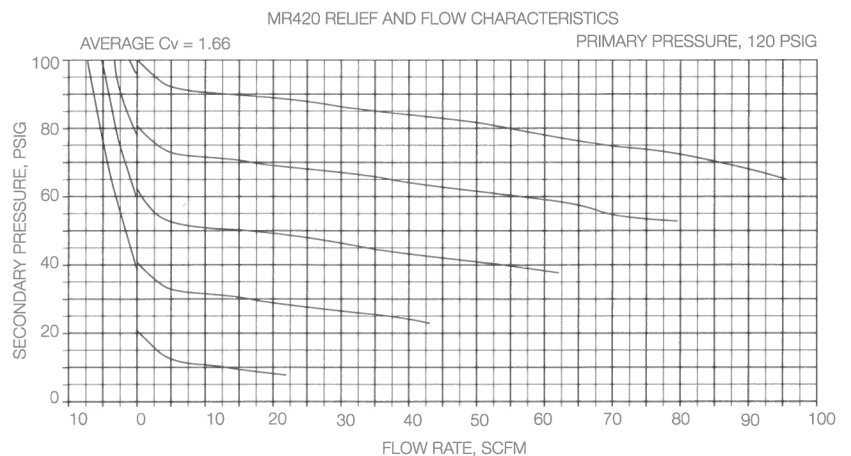
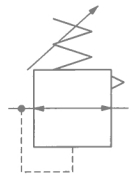
SB-2R

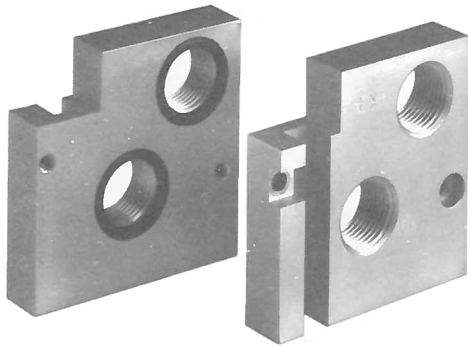
- Subbase for Model MR420 pressure regulator.
- Four spacer screws, two o-rings.



MR420

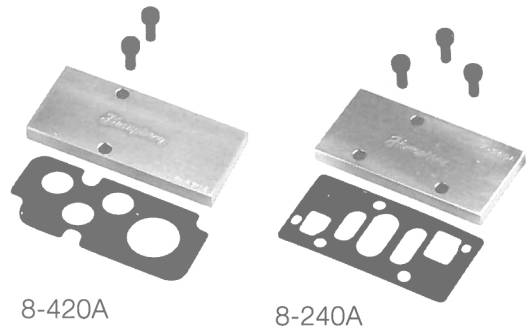
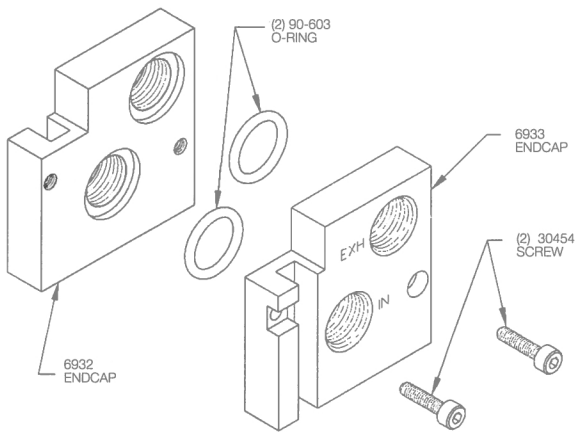
- Relieving type pressure regulator for manifold mounting alongside valves.
- Has a trim fingertip control knob (non- rising) and an adjustment locking ring.
- Can be rotated 180° in two different directions depending on application requirements.
- Eliminates need for piping between components.
- Makes systems more efficient and compact.
- Two mounting screws and two o-rings.
- One 130-15 and one 130-31 pipe plug; plug visible ports if not needed. (Has separate supply port and gauge port.)
- Whereas the MR420 regulator can regulate pressure to any number of valves, cycle rates and flow requirements are factors to be considered.





END PLATE ASSEMBLY
PART NUMBER 7-200A

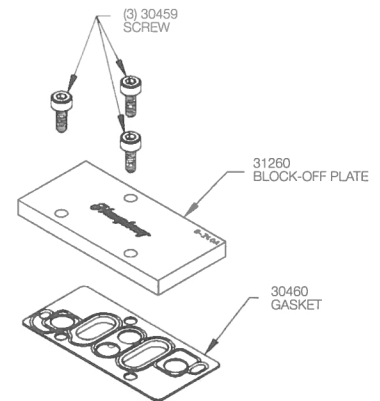
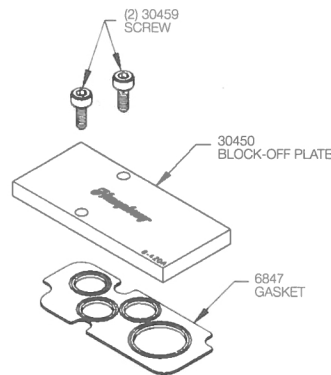
The End Plate Assembly consists of two subbase end caps and fastening accessories. One End Plate is mounted to each end of a completed subbase assembly. Tighten screws to 50 lb.·in. of torque, maximum. Two slotted holes provide a method of mounting a subbase assembly. Includes two o-rings to seal subbase to end cap, and two M4 socket head cap screws to secure tie rod spacers.



BLOCK-OFF PLATE

Model 8-420A anodized aluminum block-off plate is used to suspend the use of any SB-2 or SBMP-2 subbase. It can also be used to permit future valve additions related to machine options. Supplied with screws and o-rings to mate with subbase.

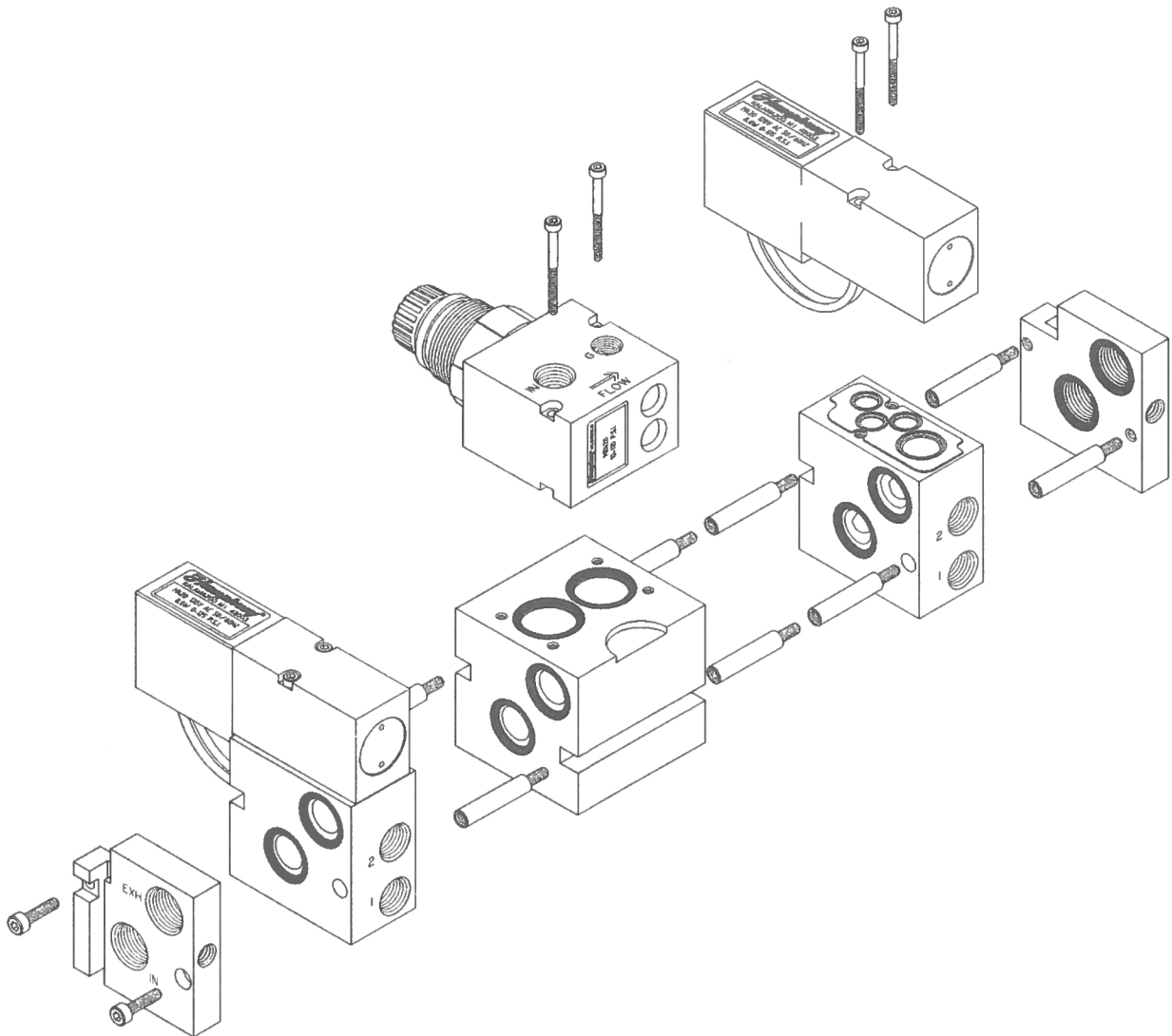
Model 8-240A accomplishes the same functions for HA240 series valves.



TO ASSEMBLE A VALVE MANIFOLD

1. Hand tighten each set of threaded spacers (two supplied per subbase) into units of equal length.
2. Ensure that o-ring seals (supplied) are placed in subbase side ports having o-ring grooves.
3. Place o-ring seals (two supplied) into End Cap that has o-ring grooves and thread spacers into this End Cap.
4. Assemble subbases onto spacers using subbase through-holes.
5. Secure entire assembly with M4 socket head screws (supplied with End Caps) and tighten with 3mm hex drive wrench (not supplied).
6. Place gasket (supplied with valve) onto the valve mounting surface on the subbase.
7. Mount valves to subbase assembly with M3 socket head cap screws (supplied with valve) and tighten with 2.5mm hex drive wrench (not supplied). Use 12 lb.·in. of torque, maximum.

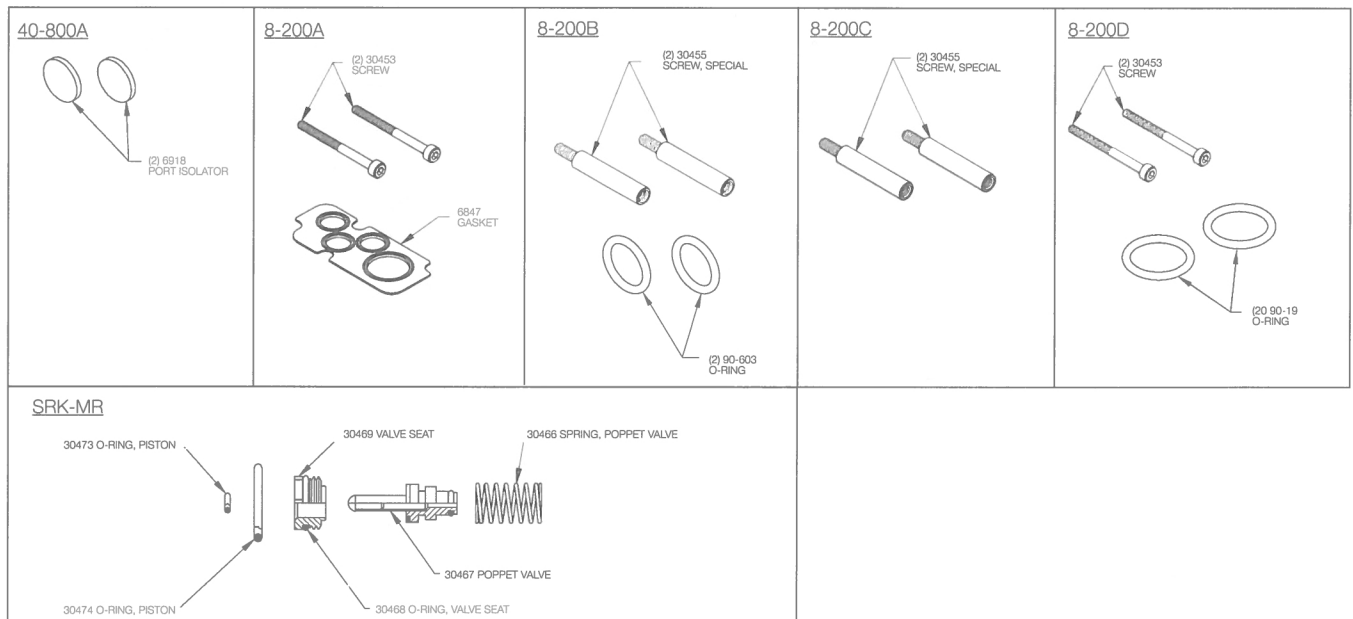
NOTE: Coils face away from subbase Delivery ports.



ORDER INFORMATION

SUBBASES AND ACCESSORIES

Model	Description
SB-2	Subbase with two delivery ports.
SBMP-2	Subbase with two delivery ports, and one IN and one EXH port.
SB-2H	Subbase for HA240 series valves, gasket, two spacer screws, two o-rings.
SB-2R	Subbase for Model MR420 regulator, four spacer screws, two o-rings.
7-200A	End cap kit (two subbase End Caps, two o-rings, and two screws).
8-200A	Valve mounting kit (one gasket, two screws).
8-200B	Subbase mounting kit (two spacer screws, two o-rings).
8-200C	Mounting kit (two spacer screws).
8-200D	Regulator mounting kit (two screws, two o-rings).
8-240A	Block-off plate for HA240 series valves, gasket, three screws.
8-420A	Block-off plate for M420 series valves, gasket, two screws.
40-800A	Port isolator kit (two port isolators).
130-15	Port plug.
SRK-MR	Seals repair kit for Model MR420 regulator.
HS-3	DIN receptacle for use with Code 39 connector.
HS-3L	Lighted DIN receptacle for use with Code 39 connector. Specify voltage: AC/DC 12V, 24V, 120V or 240V.



M420 Series Valves

	DIN type Connector	Transient Suppression Diode (TSD)*	Flying Leads		Spring Return Override	Locking Manual Override	No Manual Override	Specify Voltage	Rotated Coil 180°
			24"	72"					
Option Code	39	50		LL		81	87	See Below	RC
Model M420	SP	SP	STD	SP	STD	SP	SP	N/C	SP

*DC Voltages Only

Available Voltages

12V DC
 24V DC
 24V AC 50/60
 100V AC 50/60
 120V AC 50/60
 200V AC 50/60
 240V AC 50/60
 12V DC-50
 24V DC-50

SP = Specify; Additional charge for this option
 STD = Standard
 N/C = No charge

HOW TO ORDER

Starting with Model Number specify options in order from left to right.

Example:

To order Model M420-39-81 24VDC
 Code 39 DIN connector (M420-39)
 Locking manual override (M420-39-81)
 Voltage, 24VDC (M420-39-81 24VDC)

Remember:

Option Codes marked STD are not used as part of the model number when ordering. N/C indicates no charge but voltage must be included in the model number.