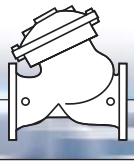


700 Series

Model 735-M

Surge Anticipating Control Valve

- Eliminates surge in all pumping systems:
  - Booster & deep well, single & variable speed
- Eliminates surge in all distribution networks:
  - Municipal, high-rise buildings, sewage, HVAC, irrigation
  - Difficult to maintain, remote locations, and older systems

The Model 735-M Surge Anticipating Valve is an off-line, hydraulically operated, diaphragm actuated valve. The valve, sensing line pressure, opens in response to the pressure drop associated with abrupt pump stoppage. The pre-opened valve dissipates the returning high pressure wave, eliminating the surge.
The Model 735-M smoothly closes drip tight as quickly as the relief feature allows, while preventing closing surge.
The valve also relieves excessive system pressure.

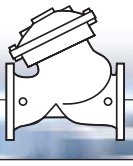
Features and Benefits

- **Replaces surge air vessels**
  - Relieves surge, fail-safe open
  - Minimal maintenance
  - Economy of space
  - Lower investment & maintenance costs
  - Especially economic for higher pressure ratings
- **Line pressure driven**
  - Independent operation
  - No motor required
  - Long term drip tight sealing
  - Adjustable hydraulic actuation
- **Double chamber**
  - Moderated valve closing (no surges)
  - Protected diaphragm
- **In-line serviceable** – Easy maintenance
- **Obstacle free, full bore** – Uncompromising reliability
- **Balanced seal disk** – High flow capacity

Major Additional Features

- Solenoid control – **735-55-M**
- Sensing diaphragm (for sewage) – **735-Md**
- Electric override for fire protection – **FP-730-59**
- Quick pressure relief valve – **73Q**

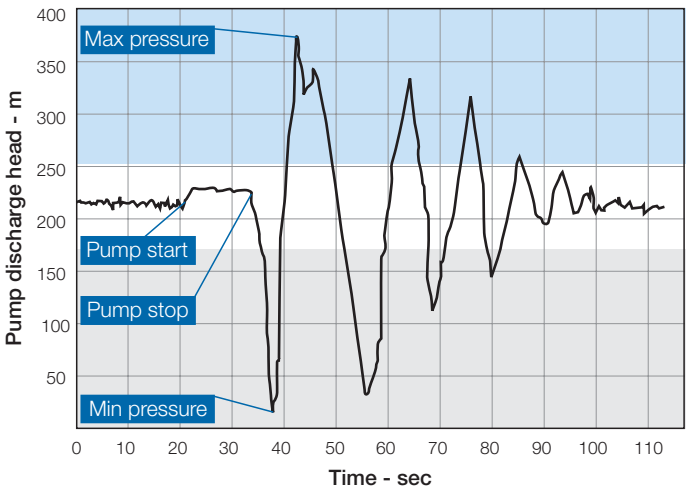
See relevant BERMAD publications.



Operation

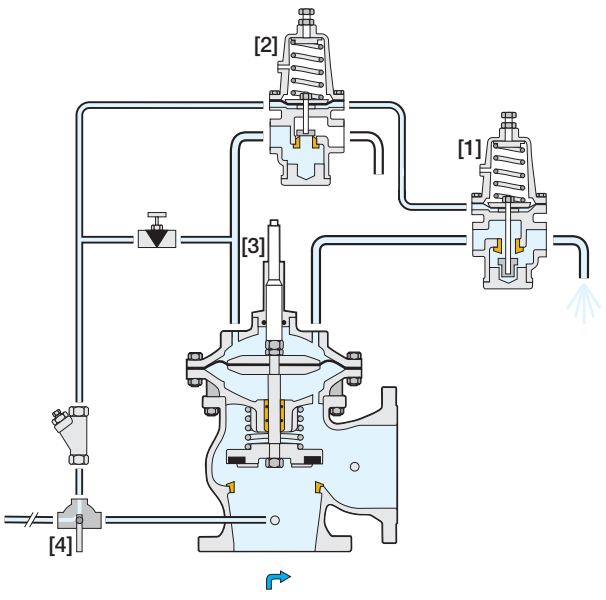
The abrupt stopping of a pump produces a pressure drop as the traveling column of water, with its inherent momentum, continues to travel along the line, generating severe low pressure.
When the traveling column of water loses its momentum, it travels back towards the pump. Should it hit the closed check valve, a very high pressure surge is created and travels throughout the system as a damaging wave at velocities of up to "Mach 4". No quick relief valve can react quickly enough to eliminate it.

Surge at Pump Station Without Protection

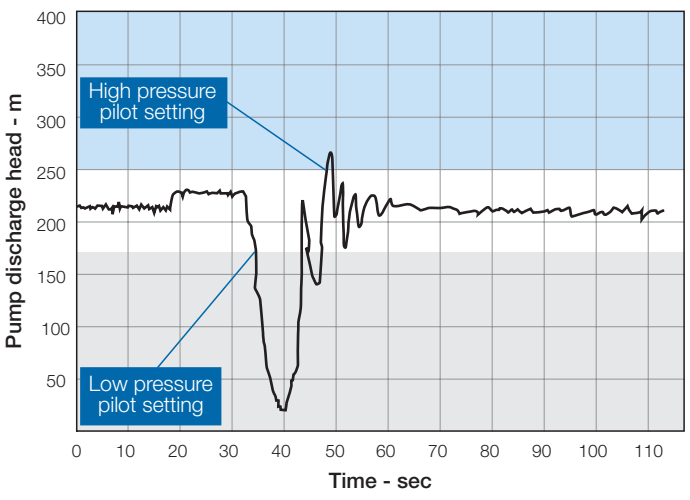


Eliminating surge requires anticipation and pre-action. The Model 735-M is well suited to this task.
The Low Pressure (LP) pilot **[1]** senses the initial pressure drop and opens. This immediate reaction allows remaining line pressure to quickly open the main valve.
The already opened Model 735-M releases the returning column of water, minimizing the line pressure rise. Should the relief rate be insufficient, and the pressure exceed the High Pressure (HP) pilot **[2]** setting, the pilot immediately opens, further opening the main valve.
As system pressure stabilizes again at static pressure, both pilots close and the main valve begins closing. Should line pressure rise during main valve closing, the HP pilot briefly stops the process, preventing the pressure from continuing to rise.
The flow stem **[3]** limits the relief flow to prevent column separation and preserve closing pressure.
Cock valve **[4]** serves for selecting operating and sensing source:

- Directly from main discharge line - Recommended (see “Typical Application”)
- From Model 735-M inlet



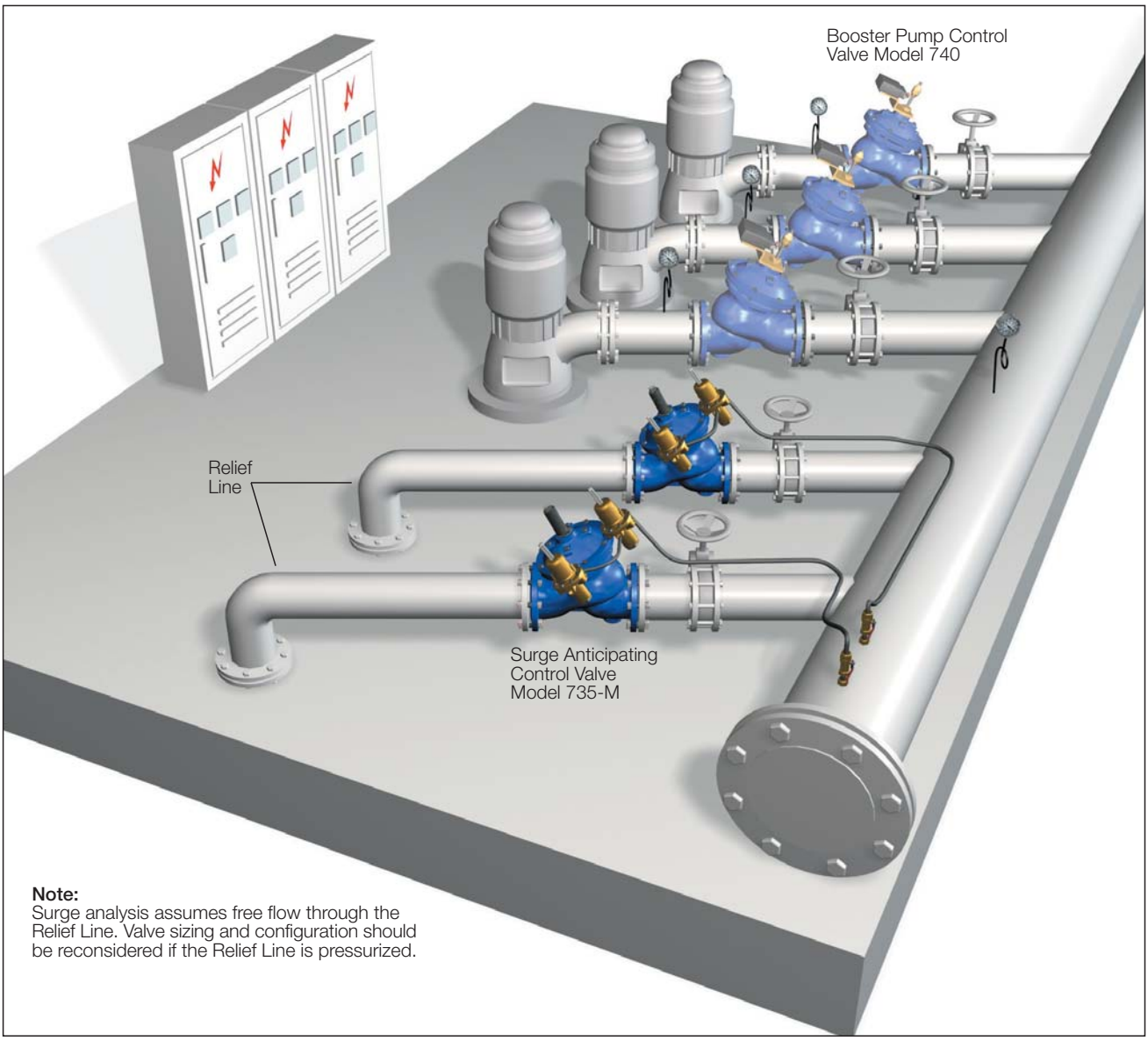
Pressure at Pump Station Protected by Model 735-M



Typical Applications

In this system, a pump battery supplies the main line through a manifold. The Model 735-M:

- Eliminates surge upon power failure
- Provides surge free switching between “on-duty” pumps
- Closes smoothly according to pilot setting



Note:
Surge analysis assumes free flow through the Relief Line. Valve sizing and configuration should be reconsidered if the Relief Line is pressurized.

Bermad Surge Analysis Program – "BERSAP II"

Surge is the result of many factors: designed flow rate, pumping system, main line characteristics, etc. By using advanced mathematics and computer software, BERMAD's experienced engineers can perform the desired analysis.
For best analysis, all of the following data is required.

- Main Line
  - Line Profile (Chainage), elevations at accumulated length
  - Internal diameter
  - Length
  - Material
  - Wall thickness
- Pumps
  - Pump curve(s)
  - Max. number of pumps in simultaneous operation
  - Type of non-return valve
- System
  - Max. designed flow rate
  - Max. & min. levels at suction and at delivery reservoirs

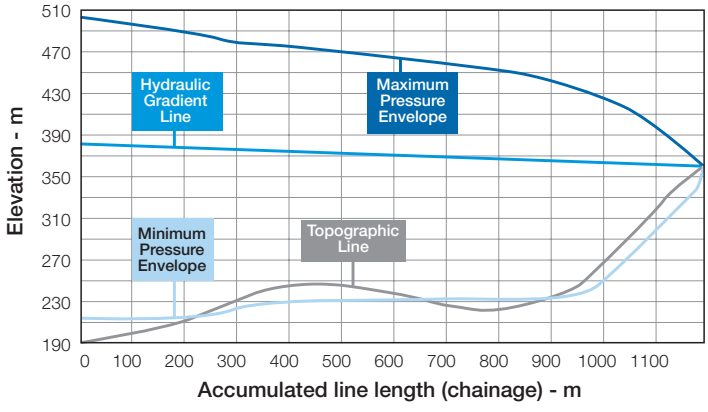
For systems with multiple pumping stations and/or multiple consumers along the supply line, the following data is also required:

- System layout including pumping station, and consumer locations, and characteristics
- Head Gradient Line (HGL) for each and every node based on "Network-Solver" analysis

This surge analysis indicates that without protection the system is exposed to:

- Pressure of ~32 bar (see max. pressure envelope line)
- Vacuum conditions (see min. pressure envelope line)

Line Hydraulic Behavior without Protection



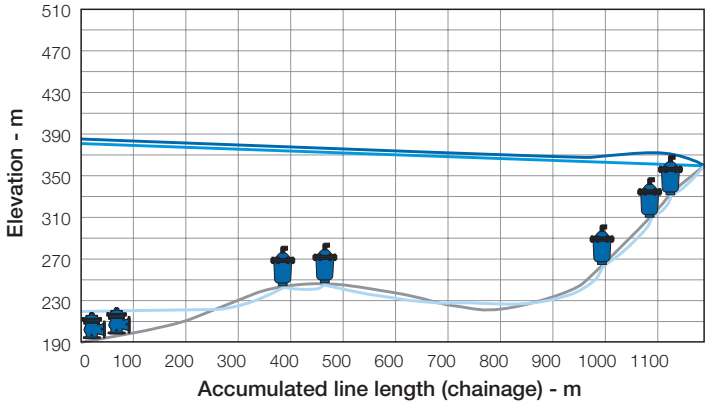
Simulated surge protection recommends:

- Two Model 735-M valves installed in parallel at the pumping station
- Five Non-Slam Air Valves installed along the line

With full surge protection, the simulation shows no surge and minimal vacuum.

- Pressure at max. of ~19 bar (see max. pressure envelope line)
- No appreciable vacuum (see min. pressure envelope line)

Line Hydraulic Behavior with Full Protection



Any pipeline design requires air valves to admit air under vacuum conditions and to release air under pressure. The size, type and location of these air valves should consider surge protection requirements.

Additional Application

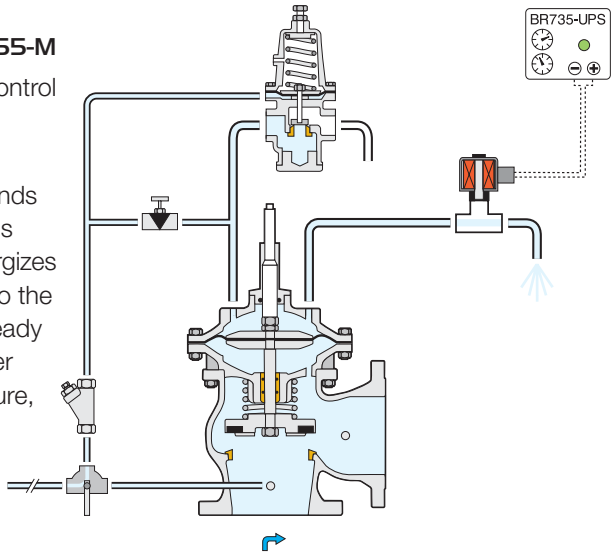
Surge Anticipating Valve with Solenoid Control Model 735-55-M

The Model 735-55-M Surge Anticipating Valve with Solenoid Control provides the appropriate solution to pumping systems when:

- Static pressure is lower than 3 bar (45 psi)
- Discharge line is short & wave critical time is less than 3 seconds
- Electric control is preferred due to maintenance considerations

Upon power failure, the BR 735-UPS Controller immediately energizes the Model 735-55-M, normaly closed DC solenoid, even prior to the pressure drop associated with abrupt pump stoppage. The already opened Model 735-55-M releases the returning column of water eliminating the surge. The Model 735-55-M, sensing line pressure, smoothly closes drip tight as quickly as the relief feature allows, while preventing closing surge.

The valve also relieves excess system pressure.



BR-735-UPS Controller

As the Model 735-55-M Surge Anticipating Valve with Solenoid Control remains closed except in the event of power failure, it requires a Normally Open (N.O.) always energized solenoid, which is vulnerable to problems (coil heating, sticking problems, calcium build-up, etc.). The recommended alternative is using a combination of a Normally Closed (N.C.) de-energized solenoid, and an **U**n-Interruptible **P**ower **S**ource **(UPS)**. The BR-735-UPS Controller includes two re-chargeable lithium batteries and a settable timer for determining the period that the valve remains open. The Controller, as a part of the pump control panel, immediately energizes the N.C. solenoid to open the valve for a preset time after which it de-energizes the solenoid, allowing the Model 735-55-M to start closing.

Engineer Specifications

The Surge Anticipating Valve shall open in response to the pressure drop associated with abrupt pump stoppage to dissipate the returning high pressure wave, eliminating the surge. It shall smoothly close drip tight as quickly as the relief feature allows, while preventing closing surge. The valve shall also relieve excessive system pressure.

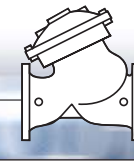
Main Valve: The main valve shall be a center guided, diaphragm actuated globe valve of either oblique (Y) or angle pattern design. The body shall have a replaceable, raised, stainless steel seat ring. The valve shall have an unobstructed flow path, with no stem guides, bearings, or supporting ribs. The body and cover shall be ductile iron. All external bolts, nuts, and studs shall be Duplex® coated. All valve components shall be accessible and serviceable without removing the valve from the pipeline.

Actuator: The actuator assembly shall be double chambered with an inherent separating partition between the lower surface of the diaphragm and the main valve. The entire actuator assembly (seal disk to top cover) shall be removable from the valve as an integral unit. The stainless steel valve shaft shall be center guided by a bearing in the separating partition. The replaceable radial seal disk shall include a resilient seal and shall be capable of accepting a V-Port Throttling Plug by bolting.

Control System: The control system shall consist of two adjustable 2-way pilots, a needle valve, a flow stem, a cock valve, and a filter. All fittings shall be forged brass or stainless steel. The assembled valve shall be hydraulically tested.

Quality Assurance: The valve manufacturer shall be certified according to the ISO 9001 Quality Assurance Standard. The main valve shall be certified as a complete drinking water valve according to NSF, WRAS, and other recognized standards.

BERMAD Waterworks



700 Series

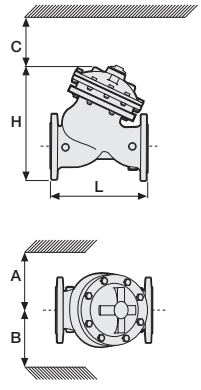
Model 735-M

Technical Data

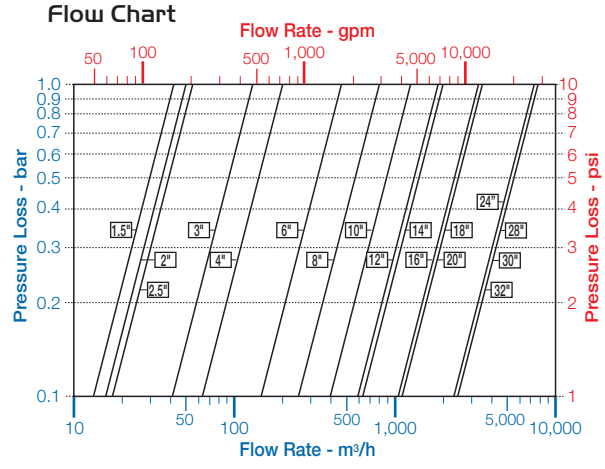
Dimensions and Weights

Size		A, B		C		L		H		Weight	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	kg	lbs
40	1½"	350	14	180	7	205	8.1	239	9.4	9.1	20
50	2	350	14	180	7	210	8.3	244	9.6	10.6	23
65	2½"	350	14	180	7	222	8.7	257	10.1	13	29
80	3"	370	15	230	9	250	9.8	305	12.0	22	49
100	4"	395	16	275	11	320	12.6	366	14.4	37	82
150	6"	430	17	385	15	415	16.3	492	19.4	75	165
200	8"	475	19	460	18	500	19.7	584	23.0	125	276
250	10"	520	21	580	23	605	23.8	724	28.5	217	478
300	12"	545	22	685	27	725	28.5	840	33.1	370	816
350	14"	545	22	685	27	733	28.9	866	34.1	381	840
400	16"	645	26	965	38	990	39.0	1108	43.6	846	1865
450	18"	645	26	965	38	1000	39.4	1127	44.4	945	2083
500	20"	645	26	965	38	1100	43.3	1167	45.9	962	2121

Data is for Y-pattern, flanged, PN16 valves
Weight is for PN16 basic valves
"C" enables removing the actuator in one unit
"L", ISO standard lengths available
For more dimensions and weights tables, refer to Engineering Section



Flow Chart



Data is for Y-pattern, flat disk valves
For more flow charts, refer to Engineering Section

Main Valve

Valve Patterns: "Y" (globe) & angle
Size Range: 1½–32" (40-800 mm)
End Connections (Pressure Ratings):
Flanged: ISO PN16, PN25 (ANSI Class 150, 300)
Threaded: BSP or NPT
Others: Available on request
Working Temperature:
Water up to 80°C (180°F)
Standard Materials:
Body & Actuator: Ductile Iron
Internals:
Stainless Steel, Bronze & coated Steel
Diaphragm:
NBR Nylon fabric-reinforced
Seals: NBR
Coating:
Fusion Bonded Epoxy, RAL 5005 (Blue) NSF & WRAS approved or Electrostatic Polyester Powder, RAL 6017 (Green)

Control System

Standard Materials:
Accessories:
Bronze, Brass, Stainless Steel & NBR
Tubing: Copper or Stainless Steel
Fittings: Forged Brass or Stainless Steel
Pilot Standard Materials:
Body: Brass, Bronze or Stainless Steel
Elastomers: NBR
Springs: Galvanized Steel or Stainless Steel
Internals: Stainless Steel

Pilot Valve Selection

Valve Size	Pilot Setting (bar)	Pilot Type #2 #3	Pilot Type #2HC #3HC	Pilot Type #2+Ac #3+Ac
1½ - 4"	<15	■		
40 -100 mm	>15	●		
6 -14"	<15		■	
150 - 350 mm	>15		●	
16 - 32"	<15			■
400-800 mm	>15			●

■ Standard model ● with high pressure setting kit
Ac-Accelerated Opening valve

How to Order

Please specify the requested valve in the following sequence: (for more options, refer to Ordering Guide)

Sector	Size	Primary Feature	Additional Feature	Pattern	Body Material	End Connections	Coating	Voltage & Position	Tubing & Fittings	Additonal Attributes
WW	6"	735	00	Y	C	16	EB	–	CB	FM

Sector: WW — Waterworks

Size: 6" — 1½ - 32"

Primary Feature: 735 — Surge Anticipating Control

Additional Feature: 00
- No Additional Feature — 00
- Solenoid Controlled — 55

Multiple choices permitted

Pattern: Y
- Oblique (up to 20") — Y
- Angle (up to 18") — A
- Globe (24-32" only) — G

Body Material: C
- Ductile Iron Standard — C
- Cast Steel — S
- St. Steel 316 — N
- Nickel Alumin. Bronze — U

End Connections: 16
- ISO-16 — 16
- ISO-25 — 25
- ANSI-150 — A5
- ANSI-300 — A3
- JIS-16 — J6
- JIS-20 — J2

Coating: EB
- Epoxy FB Blue — EB
- Polyester Green — PG
- Polyester Blue — PB
- Uncoated — UC

Voltage & Position: –
- 24VAC/50Hz - N.C. — 4AC
- 24VAC/50Hz - N.O. — 4AO
- 24VDC - N.C. — 4DC
- 24VDC - N.O. — 4DO
- 24VDC - L.P. — 4DP
- 220VAC/50-60Hz N.C. — 2AC
- 220VAC/50-60Hz N.O. — 2AO

Use when additional electric control feature is selected

Tubing & Fittings: CB
- Copper Tubing & Brass Fittings — CB
- Plastic Tubing & Brass Fittings — PB
- St. St. 316 Tubing & Fittings — NN

Additonal Attributes: FM
- Flow Stem — M
- Large Control Filter — F
- Sensing Diaphragm — d
- V-Port Throttling Plug — V
- Orifice Assembly — U
- St. St. 316 Control Accessories — N
- St. St. 316 Internal Trim (Closure & Seat) — T
- St. St. 316 Actuator Internal Assembly — D
- Delrin Bearing — R
- Viton Elastomers for Seals & Diaphragm — E
- Pressure Gauge — 6

Multiple choices permitted

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