Models 787, 788, 789
TWO - STAGE VALVES

DESCRIPTION

The 787, 788 and 789 two-stage electrical valves are normally closed and designed for precise, accurate control and shut-off of petroleum products. The valve controls a predetermined amount of product to guarantee smooth, positive shut-off. Operational functions may include low flow start-up when used with a time delay circuit or the PetroCount.

The **Model 787** - Two-stage shut-off plus maximum flowrate control achieved by sensing differential pressure across a meter or an orifice plate.

The **Model 788** - Two-stage shut-off only.

The **Model 789** - Two-stage shut-off plus pressure control achieved by sensing and controlling valve outlet pressure.

⚠ WARNING

Do not operate this instrument in excess of the specifications listed. Failure to heed this warning could result in serious injury and/or damage to the equipment.

DESIGN FEATURES

- Modular construction - All internal parts including seat ring can be removed with the cylinder assembly without disturbing line connections.
- 45⁰ body design assures high capacity
- Positive shut-off
- Uniform speed of response
- Linear control characteristics
- Inherently checks reverse flow
- O-Ring plus metal-metal seat
- Accurate two-stage shut-off
- Minimizes surge pressure and line shock
- Provides maximum flow rate control
- Fail-safe shut-off

APPLICATIONS

Two-stage electrical control valves are suited for those applications requiring precise shut-off, such as truck or railcar loading or similar batching operations.

"AP" (AGGRESSIVE PRODUCTS) OPTION

The "AP" option valve cylinder incorporates a combination of seals and O-ring materials to provide optimum performance in aggressive product applications. This option includes reinforced cylinder heads, stat-o-seals, washers and gaskets. Specify "AP" Option at time of order when used on alcohols, MTBE, TAME and reformulated fuels.

FLANGE CONNECTIONS / RATINGS (DIN)

Valve Size	DIN PN16 MAX. WORKING PRESSURE @ 120oC
DN50 - DN300	16 bar

Temperature Range: -20°F to 150°F (-29°C to 66°C) Optional 250°F (121°C)

FLANGE CONNECTIONS/RATINGS (ANSI)

VALVE SIZE	MAXIMUM WORKING PRESSURE @ 100°F
	150 ANSI
2" - 10"	285 psi

EMERSON
Process Management

PRINCIPLE OF OPERATION

The Control System consists of three primary pieces of equipment: flowmeter, preset counter (electronic or mechanical), and two-stage shut-off valve. The meter is the primary flow measuring device. The preset counter is used to determine the volume of liquid to be controlled by the valve at predetermined settings. The sequential switches of the batch controlling mechanism control the solenoid pilots of the control valve.

The control valve operates on a balanced piston principle. Electrically operated solenoid pilots position the valve piston by increasing or decreasing hydraulic pressure on the top of the piston as dictated by sequencing switches. When pressure on both sides of the valve piston is equalized, a spring (located on top of the piston) acts as a differential force and closes the valve. When the pressure against the bottom of the piston exceeds the pressure (plus the force of the spring) exerted against the top of the piston, spring pressure is overcome and the valve is opened.

The control valve is designed to close in two distinct stages. As the preset counter reaches the first stage of shut-off, the preset trips the sequence switches to place the valve in the first stage (low flow) shut-off position. The first stage closure reduces the flow rate through the valve to approximately 10 to 20 percent of the rated capacity of the meter. The preset trips the sequencing switches again and the valve closes.

MATERIALS OF CONSTRUCTION

Main Valve Body
- Steel - ASTM-A216-GR-WCB

Main Valve Cylinder
- 2-4" Stainless Steel
- 6-10" Steel, Nickel Coated

Main Valve Piston
- 2-4" Stainless Steel
- 6-10" Bronze Standard
- Stainless Steel - Optional

Seat Ring
- 2-4" Stainless Steel
- 6-10" Steel, Nickel Coated

O-Rings
- Standard - Buna-N
- Other O-Rings are available Neoprene®, EPR, all Viton®, all Buna-N, Kalrez/Teflon ("AP" Valves) optional

Other Internal Parts
- Stainless Steel

Pilot Valve Body
- Steel Standard

Pilot Valve Trim
- Stainless Steel

Tubing and Fittings
- Standard - Steel
- Optional - Stainless Steel

PRESSURE DROP

Refer to Publication DSVALVEC$_v$.

MAXIMUM OPERATING PRESSURE DIFFERENTIAL (MOPD):

787C, 788C, 789C - 175 psi (1207.5 kPa) MOPD ANSI 150. For higher M.O.P.D. Consult factory.

DOCUMENTATION & APPROVALS

UL and CSA Listed
Class I - Group C & D
Class II - Group E, F & G
Explosion Proof Nema Types 7C, 7D, 9E, 9F, 9G and Waterproof Nema Type 4
CENELEC EEx d II B T3 (Optional)

Limit Switch Enclosure Electrical Data - UL Listed
Voltage: 125, 250 or 440 Vac, Current: 20 amps
Class I, Division I, Groups C and D, Class II, Division 1, Groups E,F and G

Power Wiring Requirements
Wiring should be in accordance with National Electric Code, State Code, or Local Electric Code if applicable.

VALVE CAPACITY DATA

Valve Size	2"	3"	4"	6"	8"	10"
*Cv - gpm	86	186	309	686	1296	2040

For capacities and pressure drops, please consult bulletin DSVALVEC$_V$ "Capacity Charts for Valve Sizing."
*Cv based on wide open valve utilizing water at 60°F (16°C).

PILOT SPRING RANGES

Spring Range	Applications
0-20 psi "C"	0-20 Standard for 787C: Controls flow rate by sensing differential pressure.
10-50 psi "C"	10-50 Standard for 789C: Delivery to closed system (Bottom Loading).
30-130 psi "C"	Optional - delivery through 789 to closed system which requires more than 50 psi outlet pressure for control.

OPTIONAL EQUIPMENT

1. Stainless Steel Tubing
2. Fusible Link Pilot Valve (closes at 160°F)
3. Manual Override (Opens Valve)
4. Epoxy coating main valve body unmachined surfaces
5. Stainless Steel Main Valve Piston
6. Adjustable Thermal Relief
7. Low Flow Start-up

RECOMMENDED SPARE PARTS

O-Rings

SOLENOID ELECTRICAL DATA- UL LISTED*

Voltage	Current (In Rush)	Current (Holding)
120-50/60 ac	0.7 amps	0.33 amps
220-50/60 ac	0.35 amps	0.17 amps

SHIPPING WEIGHT AND VOLUME (Approx.)

Model "C"				
Valve Size	150 lbs. (ANSI)			
	lbs.	kg.	Cubic Feet	Cubic Meters
2"	60	27	1.66	0.047
3"	105	48	2.36	0.067
4"	150	68	2.51	0.071
6"	245	111	4.84	0.137
8"	465	211	8.94	0.253
10"	725	329	12.08	0.343

OPERATION SEQUENCE

Closed Position - The normally closed solenoid is closed. The normally open solenoid is open. Y-port (P3) to Z-port (P2) is closed. X-port (P1) and Y-port (P3) pressures are balanced. The main valve spring being the differential force, closes the piston and keeps it seated. Reference Figure 1.

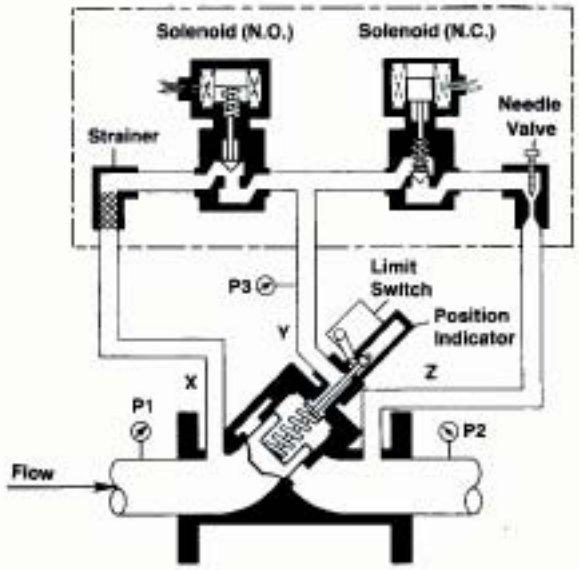


Figure 1 Closed Position - Model 788

Low Flow Position - The normally closed solenoid is closed. The normally open solenoid is closed. Y-port (P3) to Z-port (P2) is closed. X-port (P1) to Y-port (P3) is closed. ***Note***: The product cannot flow to or from the top of the piston (Y-port). The piston is locked hydraulically in the low flow position. During the transition stage, from high flow to low flow, the normally closed solenoid was closed and the normally open solenoid was open (X-port/P1/ to Y-port/P3/ was open). During the closing cycle the limit switch was activated causing the normally opened solenoid to be closed, thus hydraulically locking the valve in an intermediate position. Reference Figure 2.

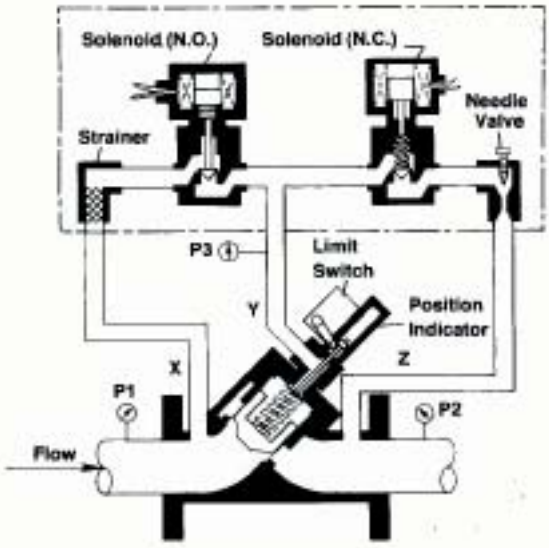


Figure 2 Low Flow Position - Model 788

Full Open - No Control - The normally closed solenoid is open. The normally open solenoid is closed. Y-port (P3) is open to Z-port (P2). X-port (P1) is closed off by the normally open solenoid. The pressure on the bottom of the piston (P1) is greater than the pressure at P3 plus the spring force. P1 minus P2 is equal to, or greater than, the spring force. Reference Figure 3.

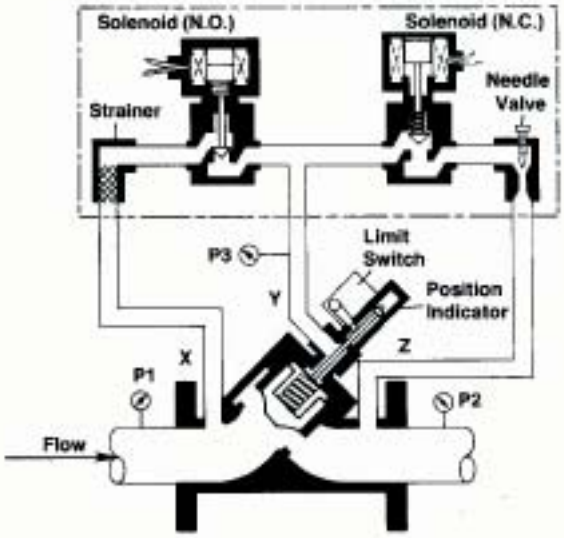
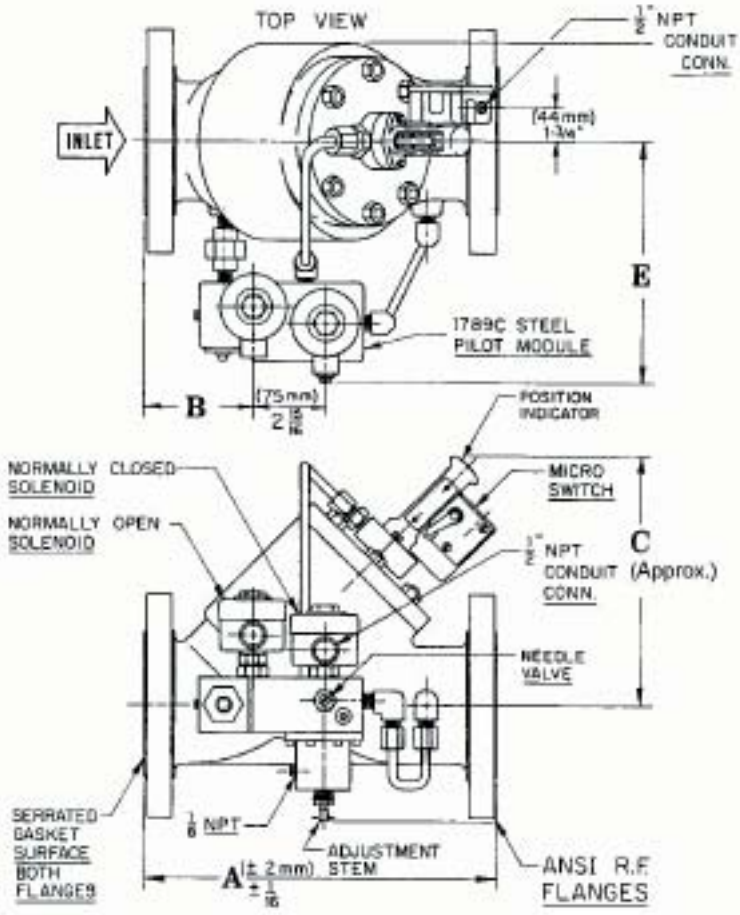


Figure 3 Full Open/No Control - Model 788

DIMENSIONS- IN-LINE VALVES - MODEL "C" (For certified prints - consult factory)



Valve Size	Dimensions - A 150 lbs. ANSI		Dimensions - C	
	mm	Inches	mm	Inches
2"	260	10 1/4	257	10 1/8
3"	279	11	283	11 1/8
4"	330	13	286	11 1/4
6"	432	17	400	15 3/4
8"	565	22 1/4	445	17 1/2
10"	673	26 1/2	502	19 3/4

ORDERING INFORMATION

When ordering, the following information must be supplied:

1. Size
2. Product, product viscosity, product specific gravity
3. Minimum and maximum operating temperature
4. Minimum and maximum flow rate
5. Minimum, normal and maximum operating pressure
6. Control functions to be performed
7. Flange connections
8. O-Ring material
9. Control pilot materials
10. Tubing material
11. Main valve piston material
12. Voltage Required

DANIEL

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