

Quantity Control Valves

GENERAL INSTRUMENTATION

Description

The IE Models 787, 788 and 789 Quantity Control Valves are normally closed, two-stage electrical valves designed for precise, accurate shutoff of petroleum products. They are available in both in-line and angle configurations for load rack applications. In operation the valve reduces the flow rate of a predetermined amount of product at specific quantities to guarantee smooth, positive shutoff. Operational functions may include low flow startup when used with a time delay circuit or the IE Control Electronics. The Model 787 provides maximum flow rate control as well as two-stage shutoff. This is accomplished by using a Model 1787 pilot to sense differential pressure across the meter or orifice face. An electrically controlled solenoid pilot, Model 1788, is used with the Model 788 Control Valve to provide two-stage closing. The valve is either open, closed or held in a low-flow state. Series 789 valves provide maximum flow rate control as well as two-stage shutoff. This is accomplished by using a Model 1789 Pilot to monitor downstream pressure.

Design Features

- Accurate Two-Stage Shutoff
- Minimizes Surge Pressure and Line Shock
- Provides Maximum Flow Rate Control
- Positive, Accurate Shutoff
- In-line or Angle Body Designs (4" and 6")
- Uniform Speed of Response
- Fail-safe Shutoff

Principle Of Operation

The IE Quantity Control System consists of four primary pieces of equipment: flow meter, preset counter, sequencing switches, and two-stage shutoff 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 convert the mechanical motion of the batch controlling mechanism of the preset counter to electrical signals used to control the solenoid pilots of the control valve. The control valve operates on a balanced piston principle. An electrically operated solenoid controlled pilot module positions the valve piston by increasing or decreasing hydraulic pressure against 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 on the top, the valve is designed to close in two distinct stages. As the preset counter reaches the first stage of shutoff, a cam located in the preset trips the shutoff ring causing the sequence switches to place the valve in the first stage (low flow) shutoff 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 cam trips the shutoff ring again and the sequencing switches place the valve in the closed, or no flow position.

Applications

- Two-stage quantity control valves are suited for those applications requiring precise measurement shutoff. Table 1 Control Functions Series Control Functions Two-stage shutoff plus maximum flow rate control achieved by sensing differential pressure across a meter or an orifice plate. Two-stage shutoff only. Two-stage shutoff plus back pressure control achieved by sensing and controlling valve outlet pressure

Table 1 Control Functions

Series	Control Functions
787	Two-stage shutoff plus maximum flow rate control achieved by sensing differential pressure across a meter or an orifice plate.
788	Two-stage shutoff only.
789	Two-stage shutoff plus back pressure control achieved by sensing and controlling valve outlet pressure.

SPECIFICATIONS

Materials of Construction

MAIN VALVE

Main Valve Body: Steel, ASTM-A216-GR-WCB, 150 lb.. ANSI
(Optional 300 lb. ANSI)

Main Valve Cylinder Assembly: Ductile Iron, Nickel coated

Main Valve Piston: Bronze (Optional Stainless Steel)

Seat Ring: Steel, Nickel coated

O-Rings: Viton

Other Internal parts: Stainless Steel

PILOT MODULE

Pilot Body: Steel with Stainless Steel internals

Tubing and Fittings: Steel (Optional Steel and Stainless Steel)

Ratings

WARNING: Do not operate this instrument in excess of the specifications listed below. Failure to heed warning may result in serious personal injury or damage to the equipment.

Maximum Working Pressure: 275 psi

Maximum Operating Pressure Differential: 175 psid

Maximum Working Temperature: 66°C (Optional 121°C)

Sizes Available: 2" through 10"

Table 2 Valve Capacity Data

Valve Size	2"	3"	4"	6"	8"	10"
*CV-gpm	86	186	309	688	1296	2040

*CV based on wide open valve utilizing water at 16°C

Table 3 Solenoid Electrical Data*

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

*Class I, Division I, Groups C & D, Class II, Division I, Groups E, F & G

Preset Switch Enclosure Electrical Data

Voltage: 125 or 250 Vac, Current: 15 amps, Class I, Group D

Micro Switch Enclosure Electrical Data

Voltage: 125, 250 or 440 Vac, Current: 20 amps Class I, Division I, Groups C and D, Class II, Division I, Groups E, F and G

Table 4 Pilot Module Spring Ranges

Spring Range	Application
0-20 psi	Standard for 787: Controls flow rate by sensing differential pressure. Standard for 789: Controls back pressure by sensing outlet pressure, top loading to atmosphere, or similar installation.
10-50 psi	Standard for 789: Delivery to closed system (Bottom Loading)
30-130 psi	Delivery through 789 to closed system which required more than 60 psi outlet pressure for control.

OPERATIONAL SEQUENCE

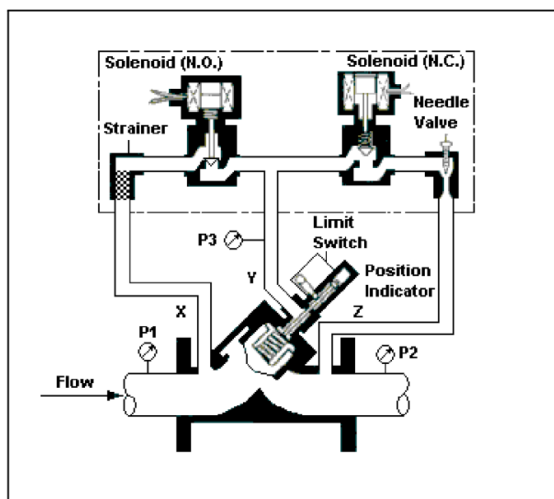
Closed Position - The normally closed solenoid is closed. The normally open solenoid is open. Y-port (P3) to Z-port (P2) is closed. X-port (P1) and Y-port (P3) pressures are balanced. The main valve spring being the differential force, closes the piston and keeps it seated. Reference Figure 1.

Figure 1 Closed Position - Model 788C

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 to Y-port 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

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Figure 2 Low Flow Position - Model 788C



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. Reference Figure 3.

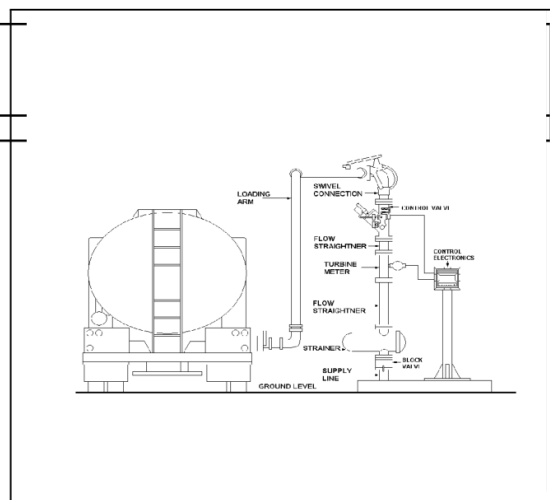
Figure 3 Full Open/No Control - Model 788C

TYPICAL INSTALLATIONS

Dimensions (See Figure 6)

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The most common application of the IE Two-stage Electrical Control Valves is for truck loading of petroleum products. As shown in Figures 4 and 5, the valve is used with the IE Positive Displacement Flow Meter and IE Turbine flow meters. In both installations the IE Control electronics is the primary batch and control device.

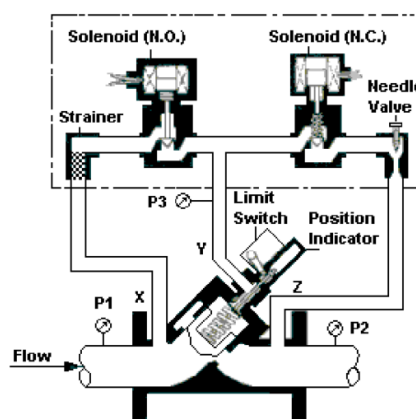
Figure 4 Typical Application - Top Loading

Figure 5 Typical Application - Bottom Loading

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Optional Equipment

- Stainless Steel Main Valve Piston
- Adjustable Thermal Relief
- Manual Override
- Closing Speed Control



Low Flow Start up

Recommended Spare Parts: O-Rings

ORDERING INFORMATION

When ordering, the following information must be provided:

1. Size
2. Product, Viscosity and Specific Gravity
3. Minimum and Maximum Operating Temperatures
4. Minimum and Maximum Flow Rates
5. Minimum and Maximum Operating Pressure
6. Control Functions to be performed
7. Flange Connections
8. Control Pilot Materials
9. Tubing Materials
10. Main Valve Piston Materials

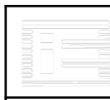
 IE FLOW METERS The Measure Of Excellence...	
	Quantity Control Valves

Figure 6 Dimensions

Dimensions (mm)

A	150 lb.	300 lb.	150 lb.	300 lb			
2"	260	267	81	84	257	73	248
3"	279	333	89	108	283	86	254
4"	330	368	102	118	286	108	260
6"	432	454	111	117	400	194	305
8"	565	591	119	132	445	197	330
10"	673	708	135	152	502	241	356

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