

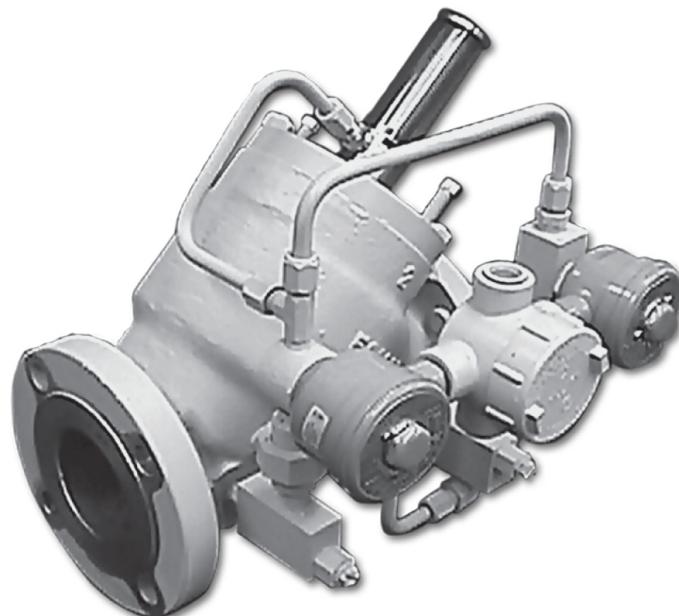
Operating and Maintenance Instructions

Part Number- 3-9008-556 Revision D

December 2012

Daniel™ Model 788 DVC digital control valves

2", 3", 4", 6" and 8" sizes



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Important safety instructions

Daniel Measurement and Control, Inc. (Daniel) designs, manufactures and tests products to function within specific conditions. Because these products are sophisticated technical instruments, it is important that the owner and operation personnel strictly adhere both to the information printed on the product nameplate and to all instructions provided in this manual prior to installation, operation, and maintenance.

Daniel also urges you to integrate this manual into your training and safety program.

BE SURE ALL PERSONNEL READ AND FOLLOW THE INSTRUCTIONS IN THIS MANUAL AND ALL NOTICES AND PRODUCT WARNINGS.

WARNING!

Installing, operating or maintaining a Daniel Product improperly could lead to serious injury or death from explosion or exposure to dangerous substances. To reduce this risk:

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- Do not allow untrained personnel to work with this product.

Use Daniel parts and work procedures specified in this manual.

Product owners (Purchasers):

- Use the correct product for the environment and pressures present. See technical data or product specifications for limitations. If you are unsure, discuss your needs with your Daniel representative.
- Inform and train all personnel in the proper installation, operation, and maintenance of this product.
- To ensure safe and proper performance, only informed and trained personnel should install, operate, repair and maintain this product.
- Verify that this is the correct instruction manual for your Daniel product. If this is not the correct documentation, contact Daniel at 1-713-827-6314. You may also download the correct manual from:
<http://www.daniel.com>
- If you resell or transfer this product, it is your responsibility to forward this instruction manual along with the product to the new owner or transferee.
- **ALWAYS READ AND FOLLOW THE INSTALLATION, OPERATIONS, MAINTENANCE AND TROUBLESHOOTING MANUAL(S) AND ALL PRODUCT WARNINGS AND INSTRUCTIONS.**
- Do not use this equipment for any purpose other than its intended service. This may result in property damage and/or serious personal injury or death.

Product operation personnel:

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- Follow all warnings, cautions, and notices marked on, and supplied with, this product.
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- Follow all instructions during the installation, operation, and maintenance of this product.
- Connect the product to the proper pressure sources when and where applicable.
- Ensure that all connections to pressure and electrical sources are secure prior to, and during, equipment operation
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Safety signal words and symbols

Pay special attention to the following signal words, safety alert symbols and statements:

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Notice is used to address safety messages or practices not related to personal injury.



Safety alert symbol

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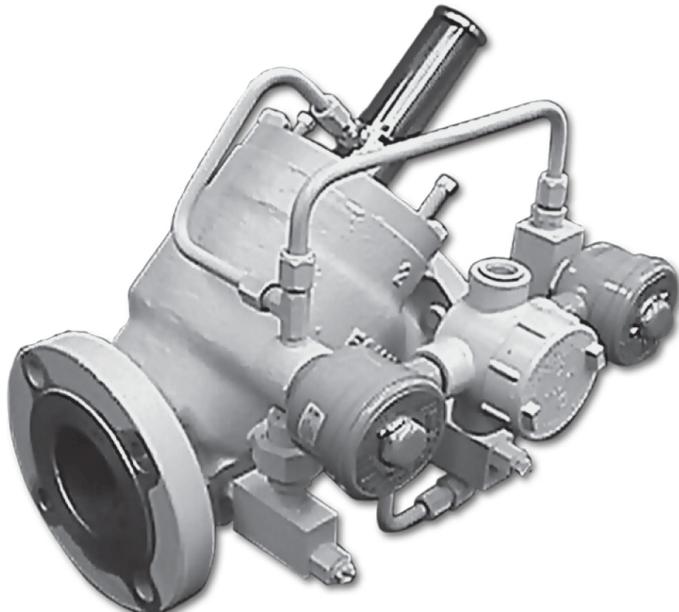
1.0 INTRODUCTION

The Daniel™ Model 788DVC Digital Control Valve is a solenoid operated device designed to provide precise flow rate control and batch delivery of liquid products. It is used in conjunction with an electronic batch control device such as the Daniel DL8000. The Model 788DVC valve is automatically controlled by the DanLoad for low flow start-up, high flow rate control, low flow shut-down, and final shut-off. It also provides for maximum flow meter accuracy by maintaining a constant flow rate in applications with varying line pressure. The Model 788DVC features an external pilot control loop that consists of a normally open solenoid pilot, a normally closed solenoid pilot, strainer and opening/closing speed controls.

1.1 Aggressive Products

Some Daniel control valves have been equipped with an “AP” (Aggressive Products) cylinder assembly. This cylinder assembly may be supplied as a direct replacement for existing units or may be supplied with the original order. It is designed for all Daniel 2", 3", 4" and 6", 150/300 lb. ANSI, Series 700 Valves. Spring-loaded Teflon® cup-seals are utilized on the main body piston and low swell Nitrile O-rings in static positions. For specific instructions for receipt, installation and maintenance of Control Valves containing the “AP” Cylinder Assembly reference manual 3-9008-554. Also contained within this manual are complete instructions for retrofitting existing standard valves with the “AP” Option package.

If you have questions or need information not contained in this manual, please contact your Daniel sales representative or the Daniel Measurement and Control service center nearest you.



1.2 Principle of Operation

Operation of the Model 788DVC Digital Control Valve is based on a balanced piston principle. When pressure on both sides of the main valve piston are equal, a spring (located on the top of the piston) acts as a differential force and closes the main valve piston. As pressure against the bottom of the piston increases and exceeds the pressure exerted against the top of the piston, plus the force of the spring, spring tension is overcome and the valve opens. Solenoid pilots are digitally controlled - full open or full closed - and are used to determine the main valve piston position required for flow control. Reference Figures 2-1, 2-2 and 2-3 for valve opening/closing positions.

CAUTION

EQUIPMENT DAMAGE

Read the entire recommended procedure for all installation operations and maintenance procedures before attempting to install or disassemble the valve. Disassembly of this cylinder assembly is different from previous Daniel Control Valves and requires strict adherence to the procedures outlined in this manual.

Failure to read and comply with these procedures could result in damage to the equipment and compromise in the integrity of the operation.

2.0 THEORY OF OPERATION

The Model 700B Series Control Valve operates on a balanced-piston principle. When pressures on both sides of the piston are equalized, a spring located on top of the piston acts as a differential force and closes the piston. 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 tension is overcome, and the valve opens. See Figure 3-1 for more information.

These valves are normally closed (N.C.) and they will open when both solenoids are energized. The valves are fail-safe as they close upon loss of power. They use the line product as the source of hydraulic power to open and close the main valve piston. An electrical supply controlled by an electronic preset is the source of power for energizing the two solenoids.

These valves are used mainly for batching and they provide a means of reducing the rate of flow on startup and before final shut-off of a predetermined delivery. This minimizes surges of pressure and line shock and assures $\pm 1/4$ gallon shut-off (sizes 2 inch - 8 inch) of the preset volume.

The total system generally consists of three pieces of equipment: (1) a flowmeter, (2) electronic preset with digital control, and (3) a digital electric control valve. The electronic preset is the device used to set the predetermined volume of liquid that is to be delivered by the valve.

2.1 Operational Sequence

With both solenoids de-energized, the main valve is closed as shown in Figure 2-1. The main valve can be infinitely positioned anywhere between 0 - 100% open by digital control of the solenoids. With both solenoids energized, as shown in Figure 2-3, the valve begins to open. It will only open to the programmed flow rate set in the electronic preset. Normally, the electronic preset is programmed to digitally control low flow start-up, maximum flow rate, low flow rate before shut-off and no flow. The electronic preset will automatically energize and de-energize the solenoids to position the main valve to limit the required flow rate. When the required flow rate is reached, the solenoids will be as shown in Figure 2-2. This hydraulically locks the main valve piston in position. Should flow increase, the valve will close slightly to adjust to the required flow rate. All of the positioning is done by digitally controlling the two solenoids as shown in Figure 2-1, 2-2 and 2-3.

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.

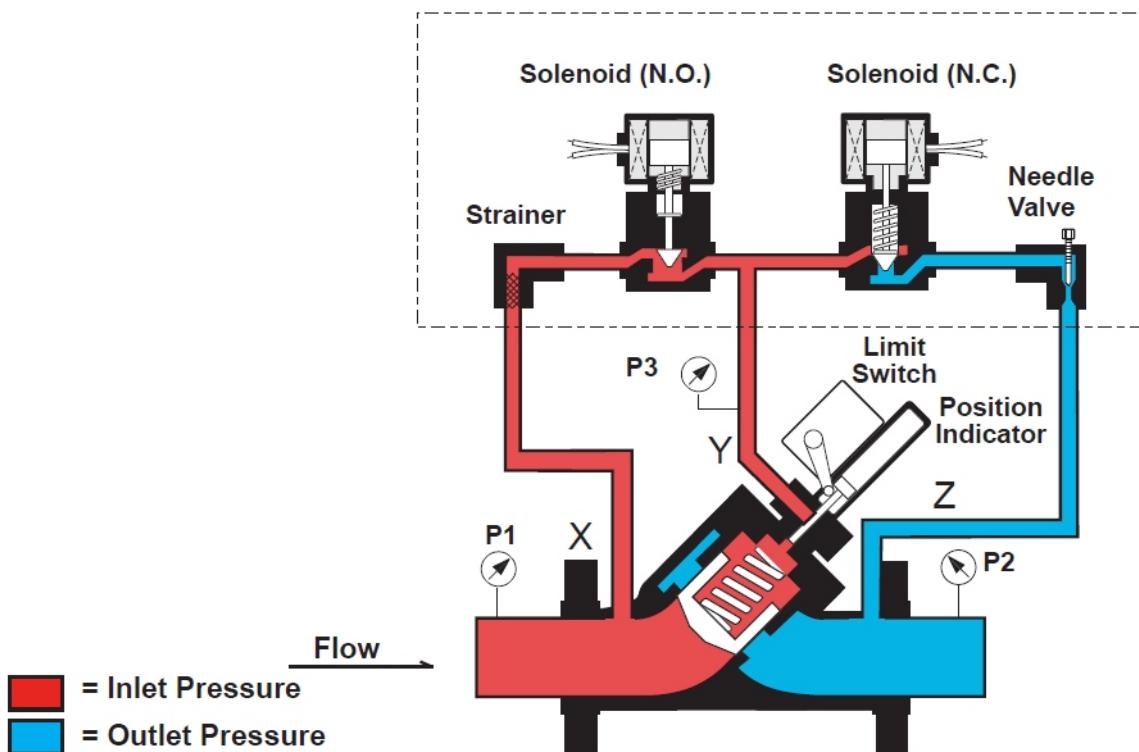


Figure 2-1. Closed Position

OPEN - CONTROL 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. The product cannot flow to or from the top of the piston. The piston is hydraulically locked in position until the electronic preset commands the valve to open or close as required to maintain the desired high flow rate, or low flow rate.

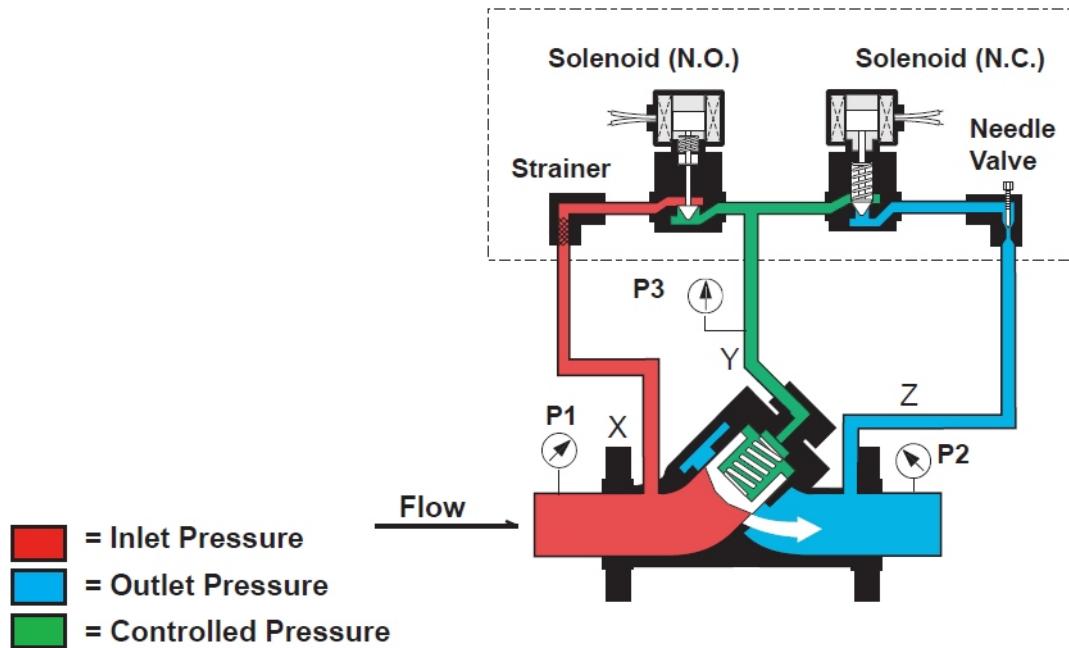


Figure 2-2. Open - Control Position

OPEN POSITION - (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. Therefore, (P1) pressure pushes the piston open. No flow control is required.

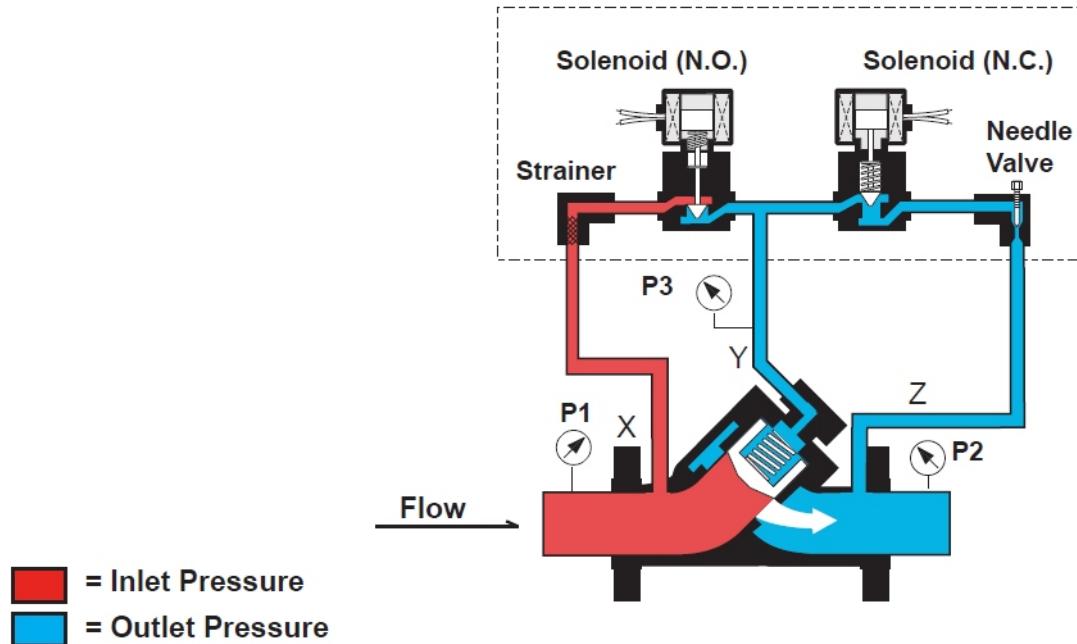


Figure 2-3. Open Position (no control)

3.0 SPECIFICATIONS



PERSONAL INJURY AND/OR EQUIPMENT DAMAGE

Do not exceed specifications listed below.

Failure to heed this warning could result in serious injury and/or damage to the equipment.

Pressure Class

150 lb., 300 lb., or 600 lb. ANSI steel

DIN PN 16, 40, 64, and 100

Safe Working Temperature Ranges

Standard: -20°F, -29°C to 150°F, 66°C

Optional: -20°F, -29°C to 250°F, 121°C

Maximum Safe Working Pressure

150 lb. ANSI steel body - 285 psi (1965 kPa)

300 lb. ANSI steel body - 740 psi (5100 kPa)

600 lb. ANSI steel body - 1480 psi (10,200 kPa)

DIN PN 16-16 bars

DIN PN 25 - 25 bars

DIN PN 40 - 10 bars

DIN PN 64 - 64 bars

DIN PN 100 - 100 bars

Size:

2-in., 3-in., 4-in., 6-in., 8-in.

Ratings

UL and CSA Listed:

- Class I, Group C and D, Div.1; Class II, Group E, F and G
- Explosion-Proof NEMA types 7C, 7D, 9E, 9F and 9G
- NEMA 4 Weather-Proof
- ATEX II2G Eexe/Eexd

INMETRO Certification:

- Certificate Number: NCC 12.1244 X
- INMETRO Marking: Ex d nC IIB T3 Gc
Ex d IIC T* Gb

*See Tables 1 and 2 in the certificate for temperature range details.

Special condition for safe use: When the digital control valve is assembled with solenoid models 80174, 80173, 80143, 80144, HP80143, 8014G2 and F8003G1, the temperature of the process fluid must not be greater than 40°C.

Connections

2" through 6" ANSI flanged

Valve Capacity

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

*Cv based on valve full open using water at 60°F (16°C)

NOTICE

For Valve Flow vs. Pressure Loss see Figure 3-1. Consult manual 3-9008-550, Capacity Charts for valve sizing.

Flow vs. Pressure Drop (See Figure 3-1)

Curve A - Wide open valves with no spring resistance.

Applicable to pilot operated valves with Y and Z ports vented to sump, atmosphere or pump station.

Curve B - Light main valve spring.

Applies only to On-Off valves, rate of flow control valves and check valves with ANSI 150 to 300 lb. flanges.

Curve C - Medium main valve spring.

Applies to all modulating control valves except rate of flow and valves using ANSI 600 lb. flanges.

Curve D- Heavy main valve spring.

Applies to all valves using ANSI 600 lb. flanges.

The main valve is full open when curves B, C, and D intersect Curve A. After they intersect, continue reading pressure drop curve from curve A. In applications requiring a constant pressure drop over 40 psid a heavy main valve spring must be used.

NOTICE

Curves A, B, C and D are based on water (specific gravity: 1.0). For liquids having a specific gravity of 0.8 or greater, multiply the pressure drop shown times the actual specific gravity. This results in the actual pressure drop. For specific gravities less than 0.8, use 0.8 to get the corrected pressure drop (curves B, C and D only).

VALVE FLOW CURVES

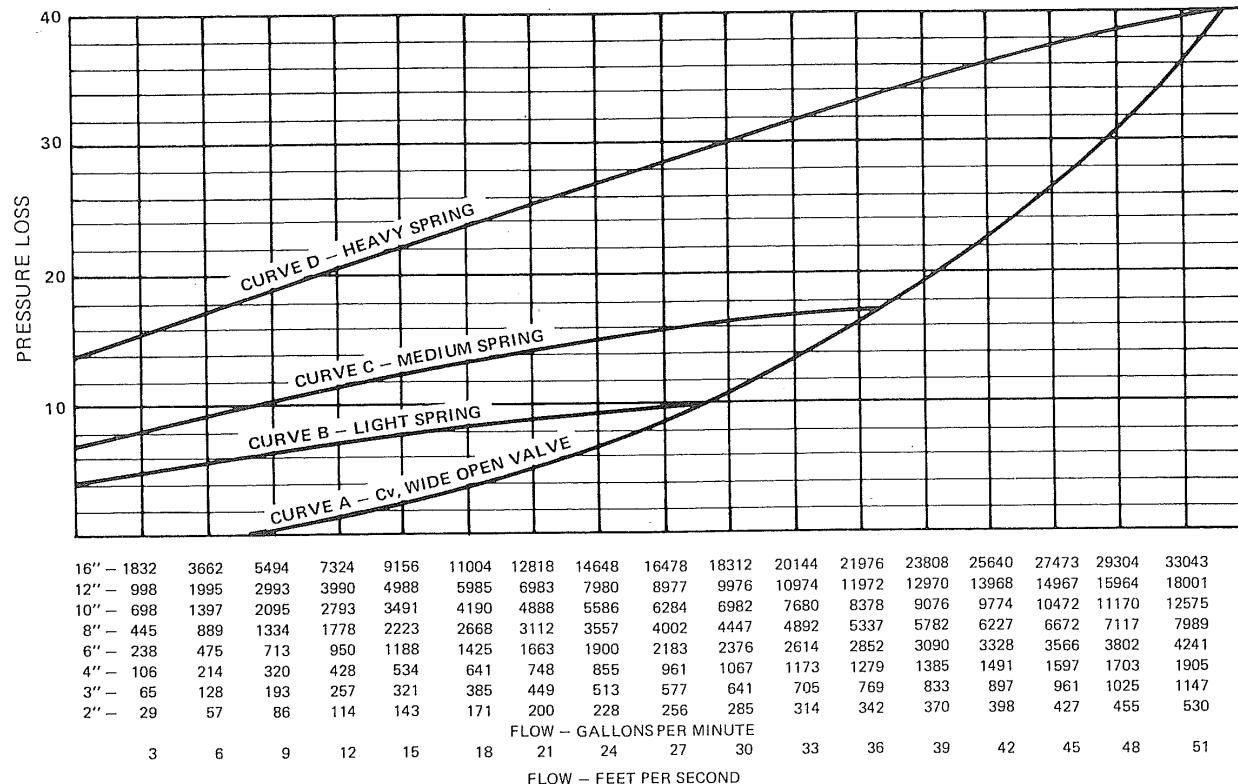


Figure 3-1. Flow vs Pressure Loss

Materials of Construction**Main Valve Body**

steel, ASTM-352 LCC

Cylinder Head

steel, ASTM-352 LCC

Main Valve Cylinder

steel

nickel coated steel

Main Valve Piston

Standard: stainless steel

Seat Ring

steel

nickel coated steel

Seals

steel

O-rings

Standard: Viton® dynamic, Buna-N

Optional: EPR, Kalrez®, Low-Swell Nitrile, Neoprene™, Viton®-A, Viton®-GFLT

Optional

Visual position indicator

Microswitch-type indicator

AP (aggressive products) option

Pressure/Temperature Ratings

The maximum working pressure for the Model 700B Series Control Valve is based on temperature/pressure rating of the ANSI B16.5 flanges. The Table 3-2 lists the maximum working pressure of ASTM 352 LCC WC_b at 100°F.

Other Internal Parts

stainless steel

Pilot Valve Body and Trim

stainless steel

Tubing

steel or stainless steel

Table 3-1. Solenoid Electrical Data (150 lb. MOPD)

Voltage*	Current (Inrush)	Current Holding
110/50 Vac	0.71 amps	0.37 amps
120/60 Vac	0.65 amps	0.34 amps
220/50 Vac	0.36 amps	0.19 amps
240/60 Vac	0.33 amps	0.17 amps

*DC voltage and 440/480 Vac upon request

DANIEL™ MODEL 788DVC DIGITAL CONTROL VALVES

Table 3-2. Maximum Working Pressure

Pressure/Temperature	ASTM A352 LCC WCB
150# ANSI/-20 to 100°F	285 psig WP
150# ANSI/150°F	272 psig WP
150# ANSI/250°F	245 psig WP
150# ANSI/450°F	185 psig WP
300# ANSI/-20 to 100°F	740 psig WP
300# ANSI/150°F	707 psig WP
300# ANSI/250°F	665 psig WP
300# ANSI/450°F	334 psig WP
600# ANSI/-20 to 100°F	1480 psig WP
600# ANSI/150°F	1415 psig WP
600# ANSI/250°F	1332 psig WP
600# ANSI/450°F	667 psig WP
P/N 16/-29 to 66°C	16 bar WP
P/N 16/121°C	15.8 bar WP
P/N 16/232°C	13.7 psig WP
P/N 25/-29 to 66°C	25 bar WP
P/N 25/121°C	24.7 bar WP
P/N 25/232°C	21.6 psig WP
P/N 40/-29 to 66°C	40 bar WP
P/N 40/121°C	39.6 bar WP
P/N 40/232°C	34.4 bar WP
P/N 63/-29 to 66°C	63 bar WP
P/N 63/121°C	62.4 bar WP
P/N 63/232°C	54.3 bar WP
P/N 100/-29 to 66°C	100 bar WP
P/N 100/121°C	99 bar WP
P/N 100/232°C	86.2 bar WP

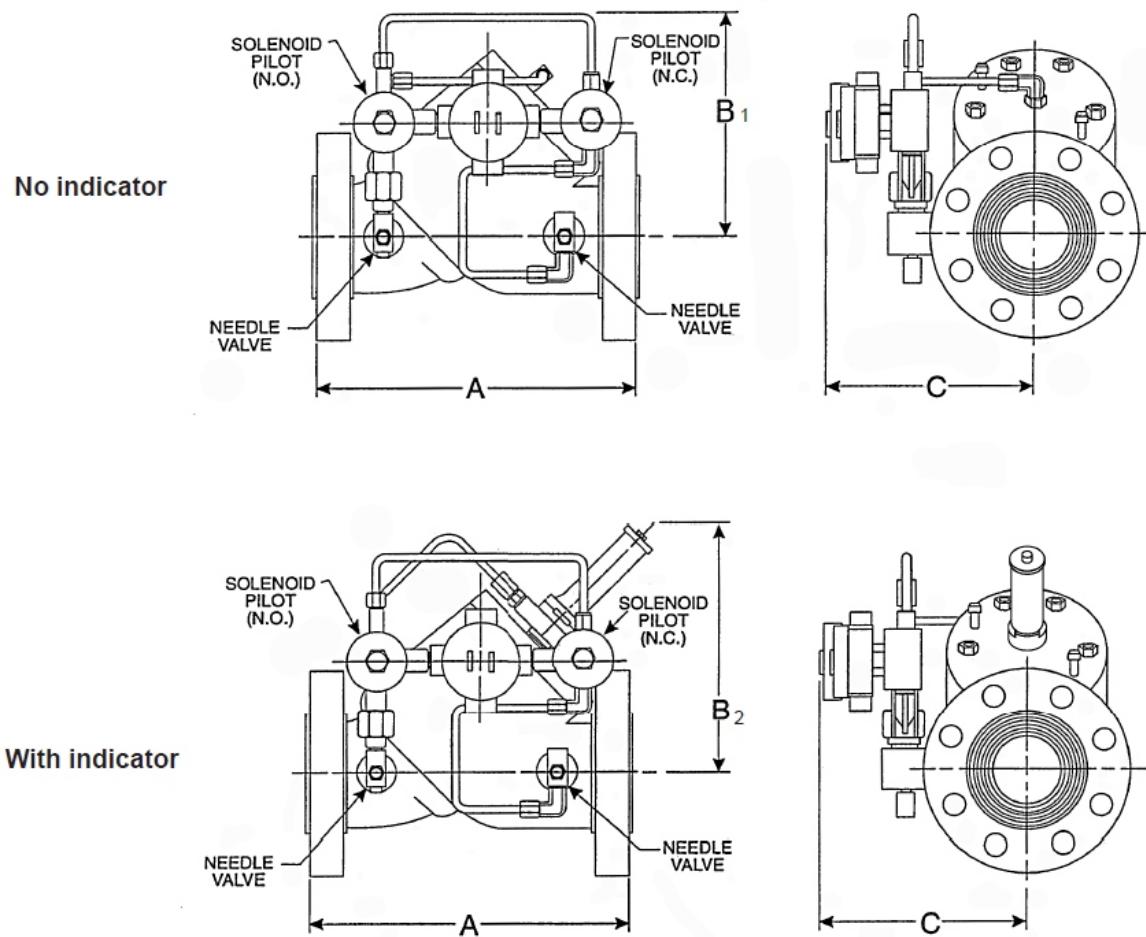


Figure 3-2. Dimensions

DANIEL™ MODEL 788DVC DIGITAL CONTROL VALVES

Table 3-3. Dimensions (see Figure 3-2)

Valve Size	A 150# ANSI	A 300# ANSI	B ₁ No Indicator	B ₂ With Indicator	C
2"	10-1/4"	10-1/2"	9"	11"	8.25"
	260 mm	267 mm	229 mm	279 mm	210 mm
3"	11"	11"	9"	12"	8-3/4"
	279 mm	333 mm	229 mm	305 mm	222 mm
4"	13"	13"	9"	12-1/2"	9"
	330 mm	368 mm	229 mm	318 mm	229 mm
6"	17"	17"	12"	15-3/4"	11"
	432 mm	454 mm	305 mm	400 mm	279 mm
8"	22.25"	22.25"	15"	17.5"	11.75"
	565 mm	591 mm	381 mm	445 mm	298 mm

4.0 INSTALLATION AND MAINTENANCE

The most common application of the Daniel Model 788DVC Digital Control Valve is for truck loading of petroleum products. The valve may be used with a variety of flow meter types, including Coriolis and turbine meters, as shown in Figure 4-1. In this installation the DL8000 is the primary batch and control device. Reference Figure 4-2 and 4-3 for configuration information.

NOTICE

Flow must be horizontal or vertical up but never vertical down.

4.1 Recommended Installation Instructions

As with all control valves, it is most important that proper installation be accomplished if the valve is to operate as designed. Preliminary set-up should include the following steps:

1. Evaluate the metering system in the process line to determine that criteria pertinent to digital valve control is met.
 - Minimum meter K-factor: 20 pulses/unit
 - Minimum meter pulse frequency (low flow): 50 Hz
 - Minimum opening time (shut-off to full open): 1.5 seconds
 - Minimum closing time (full open to shut-off): 1.5 seconds
2. Reference engineering drawings for proper in-line sequence of all components.
3. Check valve position. The inlet flange has been marked and is to be in the upstream position.
4. Verify all electrical connections against wiring diagrams and unit specifications. Reference Figure 4-3 for Control Valve configuration.

CAUTION**EQUIPMENT DAMAGE**

It is recommended that the external pump control be turned to the OFF position when performing any electrical wiring installation and until initial control valve adjustments are made in the DL8000.

Failure to comply with these procedures could result in damage to the equipment and compromise in the integrity of the operation.

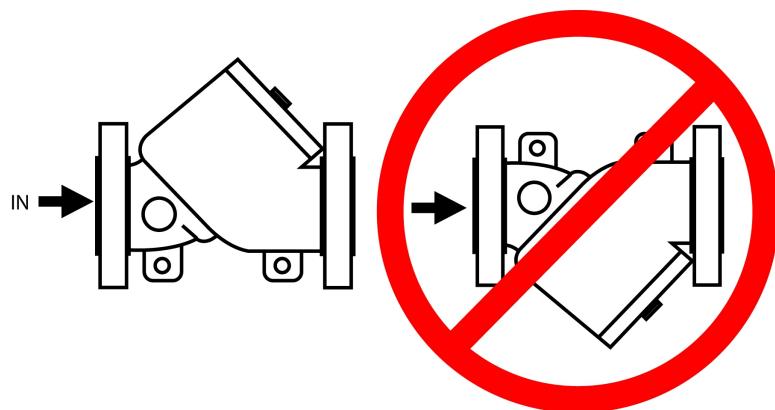
5. Flush the line of any and all contaminates.
6. Bleed as much air as possible from the system before start up.

4.2 General Considerations as Applied to the DL8000

Upon completion of the preliminary installation of the Digital Control Valve a Start-up Adjustment Procedure must be administered. Reference “DL8000 Preset Controller Instruction Manual”, P/N D301244X012.

NOTICE

The Daniel valve may be installed with a flow direction horizontal or vertical up but should never be installed with flow direction vertical down. When installed in a horizontal line, the valve should be installed so that the cylinder head is at the top of the valve and not the bottom. See below.

**WARNING****PERSONAL INJURY OR DEATH AND/OR PROPERTY DAMAGE**

Use equipment for its intended purpose.

Use of this equipment for any purpose other than its intended purpose may result in property damage and/or serious personal injury or death.

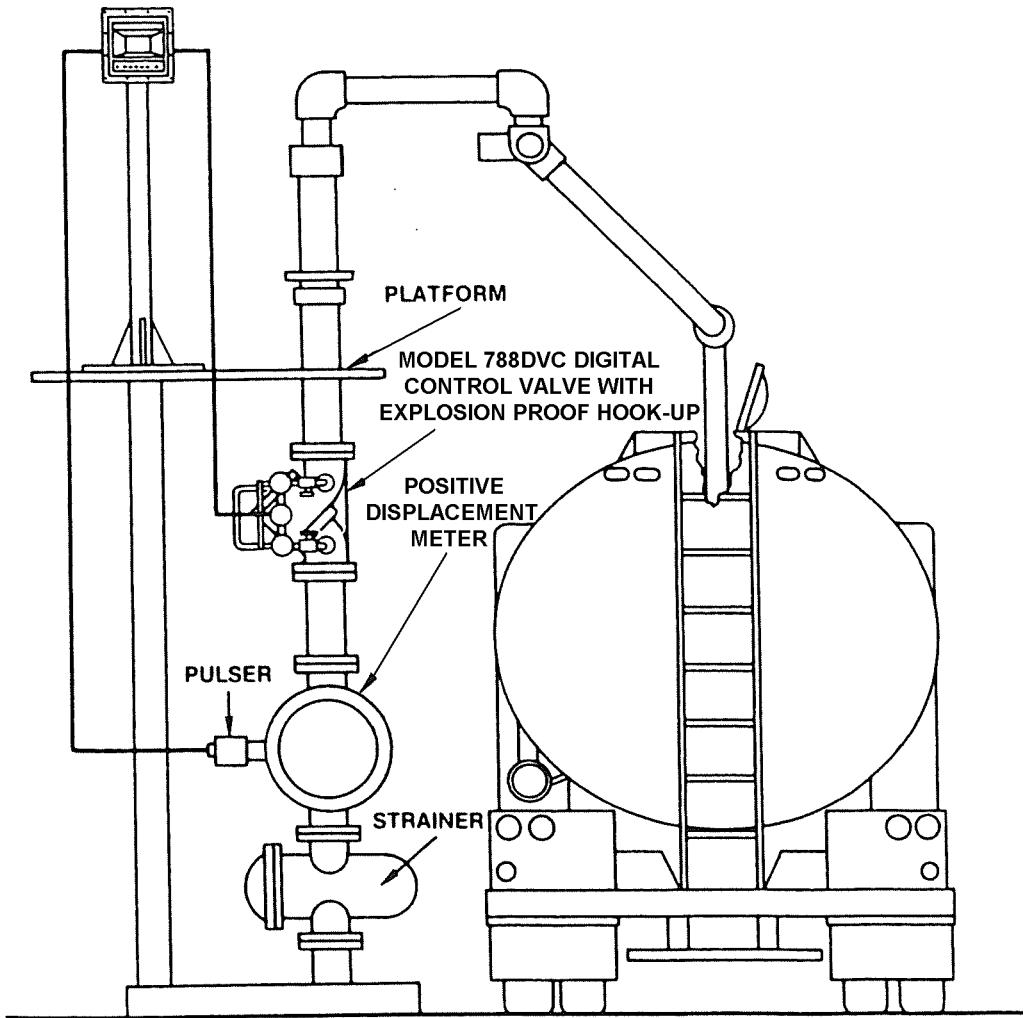
DANIEL™ MODEL 788DVC DIGITAL CONTROL VALVES

Figure 4-1. Typical Application - Top Loading

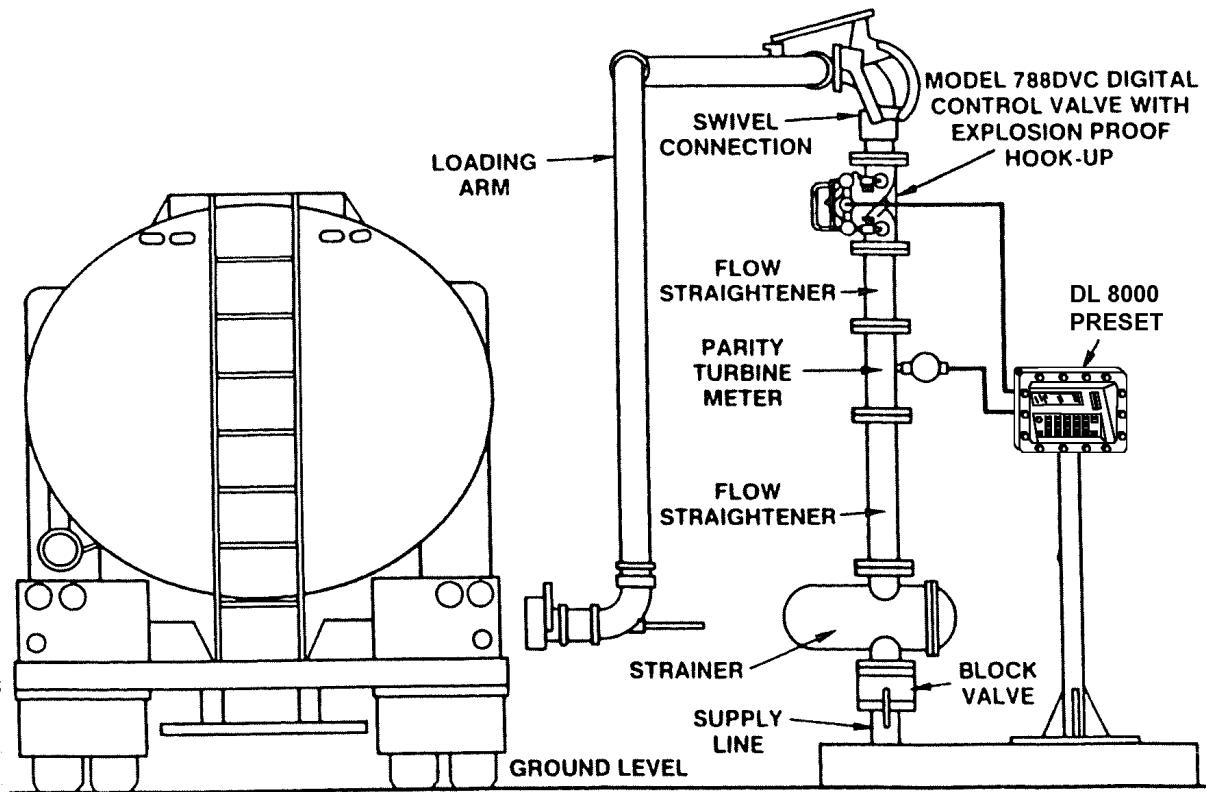


Figure 4-2. Typical Application - Bottom Loading

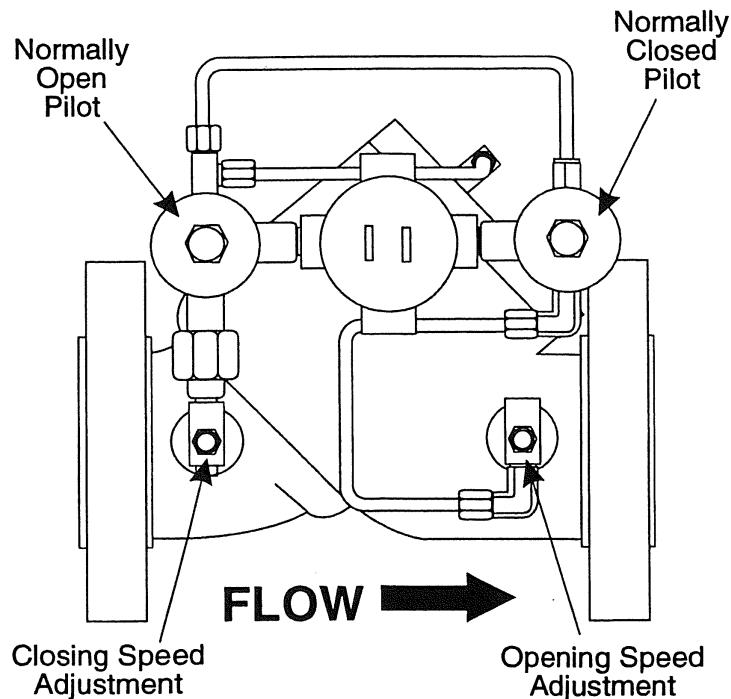
DANIEL™ MODEL 788DVC DIGITAL CONTROL VALVES

Figure 4-3. Control Valve Configuration (new for DL8000)

5.0 CYLINDER DISASSEMBLY AND REASSEMBLY

The following tools will be needed to disassemble and reassemble your control valve:

- socket wrench
- adjustable wrench
- T-handle or extended Allen wrench
- arbor press (may be needed for 4- and 6-inch valves)
- retaining ring pliers

Numbers in parentheses correspond with the item numbers in Table 7-1 and Figure 7-1.

CAUTION

EQUIPMENT DAMAGE

Read the entire recommended procedure for all installation operations and maintenance procedures before attempting to install or disassemble the valve. Disassembly of this cylinder assembly is different from previous Daniel Control Valves and requires strict adherence to the procedures outlined in this manual.

Failure to read and comply with these procedures could result in damage to the equipment and compromise in the integrity of the operation.

5.1 Cylinder Assembly Removal - All Daniel Valves

1. Isolate the Control Valve from the system and bleed off pressure.
2. Loosen and remove the tubing from the cylinder head.
3. Remove the nuts securing the cylinder assembly within the valve body.
4. Tighten the two jack screws provided in the cylinder head until the cylinder assembly has been freed from the valve body. These screws should be tightened evenly to prevent damage to the cylinder O-ring and binding the cylinder assembly.
5. Remove the cylinder assembly from the valve body by pulling upward and evenly using both hands (on smaller valves) or a mechanical device (for larger models).
6. Remove the two jack screws from the cylinder head.

5.2 Cylinder Disassembly

Refer to Figure 5-2.



PERSONAL INJURY AND/OR EQUIPMENT DAMAGE

Caution is required when performing any disassembly procedure as the Cylinder head is bolted to a spring loaded cylinder assembly. Service should only be performed by trained and qualified service personnel.

Failure to comply with recommended could result in serious injury and/or damage to the equipment.

1. Position the cylinder assembly in an arbor press with the cylinder head (5) down. Valves smaller than 6" may not require a press. Larger units may require the use of a spindle or arbor press to facilitate removal of the piston assembly, in which case, the arbor should be resting against the cylinder head.
2. Place a metal sleeve over the piston nose to protect the sense line during removal. This can be fabricated from a pipe section and should have an internal diameter large enough to encircle the piston nose. The length must be sufficient to accommodate complete spring compression with allowing the sense line to strike the press plunger.
3. Using EXTREME CAUTION depress the piston against the spring until the rectangular ports are cleared. Block the piston in the open position, fully compressed, by inserting a suitable wedge through the port opening. Any wood, nylon or non-marring dowel or handle that will safely guarantee piston position can be used for this operation. It is recommended that a brass or other soft metal bar be used for this operation.
4. Remove the retaining ring, sealing ring and O-ring.
5. Using EXTREME CAUTION depress the piston against the spring and remove the piston blocks. CAREFULLY remove the piston from the cylinder body while maintaining pressure on the valve spring.

6. Lift off the cylinder head by taking out the socket screws.
7. Remove and inspect all O-rings for nicks, cuts and wear.

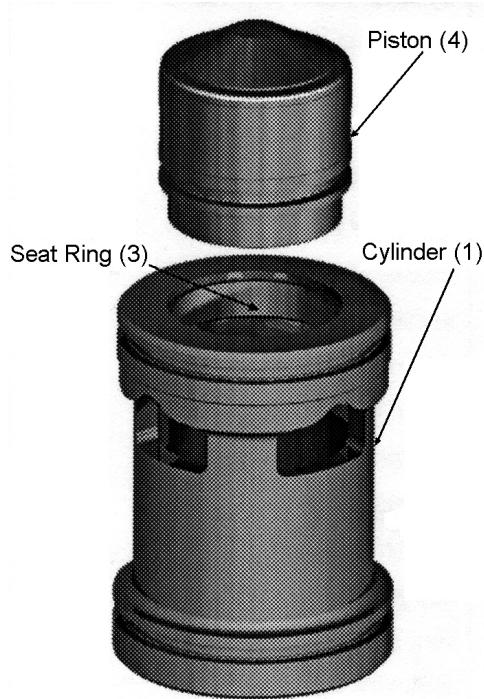


Figure 5-1. Using the Piston to Insert the Seat Ring into the 150/300 lb. Cylinder

Table 5-1. Typical Opening/Closing Speed

Line Size Inches	Typical Dead Time Setting (Seconds)	Recommended Low Flow Set-point				Typical Opening Speed Adjust- ment (Turns Open)	Typical Opening Time (Shut-off to Full Open) Seconds	Typical Closing Speed Adjust- ment (Turns Open)	Typical Closing Time (Full Open to Shut-off) Seconds				
		Turbine		PD Meter									
		gpm	K-factor	gpm	K-factor								
2-3	0.015	100	50	100	100	0.25	5.0	0.75	2.0				
4	0.015	150	25	150	25	0.25	5.0	0.75	2.0				
6	0.030	150	25	150	25	0.75	5.0	1.25	2.0				
8	0.030	150	25	150	25	0.75	5.0	1.25	2.0				

5.3 Cylinder Reassembly

Refer to Figure 5-2.

1. Inspect all O-rings for wear and damage and replace as required.
2. If removed, attach the cylinder head to the main cylinder body.
3. Insert the valve spring into the cylinder housing.
4. Inspect and position the piston into the cylinder housing.
5. Insert the fabricated sleeve over the valve piston and spring assembly. Once fully compressed, block the spring following the procedure used in step 3 of the Disassembly procedure.
6. Inspect and reposition the seat O-ring.
7. Replace seating and retaining ring. Once the entire retaining ring is in its' groove, position a punch or screwdriver over the end of the ring and tap sharply. This will seat the ring.
8. Again, using CAUTION, apply pressure to the valve piston and remove the block. Carefully relieve the tension on the spring until it is properly resting against the seat ring.
9. Reinstall the cylinder assembly in the valve body being careful to properly seat O-rings and secure in place using lock nuts.

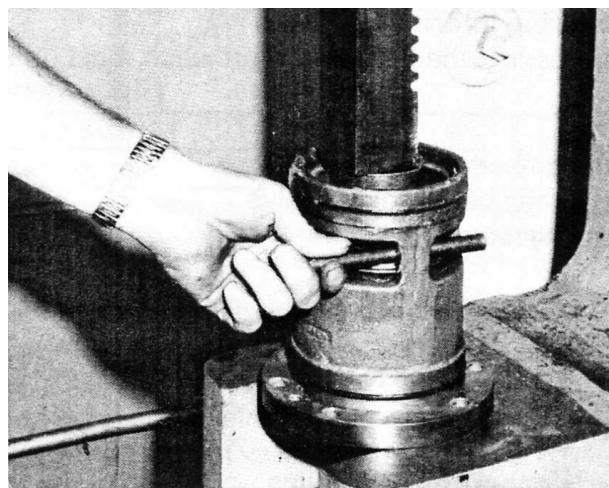


Figure 5-2. Cylinder Assembly Removal

5.4 Cup-seal Replacement on Existing “AP” Option Piston

If your Daniel Valve is being modified to accommodate applications requiring the use of aggressive products used in petroleum blending operations, the following procedures should be followed in retrofitting your valve.

Retrofit**5.4.1 To Replace Existing Standard Cylinder Assemblies with the Current Daniel “AP” Option:**

- a. Remove original cylinder assembly as shown in Section 5-1. The cylinder assembly will be supplied from the factory with or without an indicator (specified on order).
- b. Clean and inspect O-ring sealing surfaces in the main valve body. Apply a lightweight lubricant to these surfaces before installing the new cylinder assembly.
- c. Lower the “new” cylinder assembly and cylinder head into the valve body. Align the bolt holes in the cylinder head with the studs in the main valve body.
- d. Fasten the cylinder head into position using retaining nuts. Tighten nuts, alternating to opposite sides, to assure a uniform seat.
- e. Return all tubing and/or valve accessories to their original position.
- f. The cup-seals (27) should be protected at all times against damage or distortion of any kind.
- g. Proper installation dictates that cup-seals (27) be installed with the closed ends facing “in”.

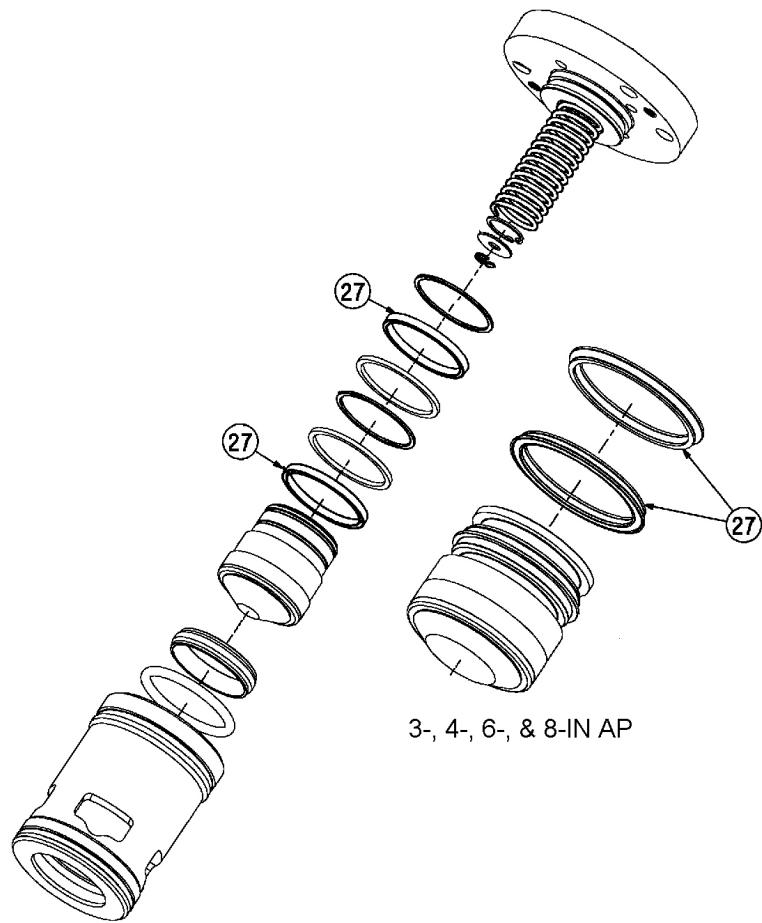


Figure 5-3. Option Assembly

5.4.2 To upgrade existing valves having the original “AP” option (received prior to September 1992), the following parts have been supplied as a separate kit:

- washers (29)
- Stat-O-Seals (30)
- one gasket (31)
- three O-rings (replaces existing O-rings (3) and (4) of the same part numbers.)

Reference Figure 7-1 for complete valve part numbers.

5.4.3 To upgrade existing “AP” units supplied prior to September, 1992:

- a. Follow procedures described in Section 5-1 for general disassembly and Section 5-2 for Aggressive Products Cylinder disassembly.
- b. Replace O-rings and install gasket, Stat-O-Seal and washers as required (reference Figure 7-1).
- c. Complete cylinder assembly by installing piston and all component parts through the top of the cylinder housing.

NOTICE

Do not attempt to install the piston through the seat area. Attempts to assemble through the seat area will destroy the spring-loaded Teflon® cup-seals.

- d. Secure cylinder assembly to cylinder heads using hand pressure or arbor press for ease of installation.

**PERSONAL INJURY AND/OR EQUIPMENT DAMAGE**

Caution is required when performing any disassembly procedure as the Cylinder head is bolted to a spring loaded cylinder assembly. Service should only be performed by trained and qualified service personnel.

Failure to comply with recommended could result in serious injury and/or damage to the equipment.

- e. Lower the “new” cylinder assembly and cylinder head into the valve body. Align the bolt holes in the cylinder head with the studs in the main valve body.
- f. Fasten the cylinder head into position using retaining nuts. Tighten nuts, alternating to opposite sides, to assure a uniform seat.
- g. Return all tubing and/or valve accessories to their original position.

6.0 TROUBLESHOOTING

The most frequent problem encountered with any control valve is the accumulation of sediment, rouge, scale and other foreign material in the pilot or its supply system. It is, therefore, good practice to periodically remove the pilot from the valve and inspect it for accumulation of these materials.

The strainer and needle valve in the pilot supply line should also be flushed periodically to avoid erratic control and slow response typical to obstructed flow. If sub-standard conditions persist after thoroughly cleaning the system, examine the pilot for swollen o-rings.

Periodic examination of all seal and o-rings for nicks, cuts and wear is recommended. Reference Section 5, Cylinder Disassembly/Reassembly.

Table 6-1 provides information for identifying and correcting operational problems you may experience with your control valve. Please keep in mind this information is not exhaustive and that system abnormalities may result from causes other than valve error. This information is provided to assist in general field repairs.

Table 6-1. Troubleshooting

Condition	Probable Cause	Correction
Valve will not open	Upstream valve is closed.	Open valve.
	Pump is not operating.	Start pump and check for cavitation.
	Downstream valve is closed.	Open valve. (Check coupler on bottom loading units and internal valve in truck.)
	Insufficient pressure.	Check pump. Check bypass and strainer in line.
	Clogged strainer.	Clean strainer.
	Swollen o-rings.	Disassemble valve and replace o-rings. Check compatibility of o-rings with product.
Valve opens too slowly	Pilot malfunction.	Consult pilot manual.
	Valve inlet pressure below normal.	Check strainer and pump for obstruction.
	Swollen o-rings.	Disassemble valve and replace o-rings. Check compatibility of o-rings with product.
Valve will not close off tightly	Pilot malfunction.	Consult pilot manual.
	Bent indicator stem.	Replace indicator
	Foreign material lodged in main valve piston seat.	Disassemble valve and inspect piston.
	Swollen o-rings	Disassemble valve and replace o-rings. Check compatibility of o-rings with product.
	Piston or seat o-ring cut or defective.	Disassemble valve and replace, if necessary.
	Pilot malfunction.	Consult pilot manual.

7.0 PARTS LIST

Table 7-1 lists the replacement parts for 2- through 6-inch Model V2700-20 Series Control Valves. The item numbers in the parts list (Table 7-1) correspond with the sequence numbers in Figure 7-1.

This section contains the necessary parts required to assemble any standard unit that is covered in this manual. Recommended spare parts have been indicated using an asterisk before the item number. All part numbers shown reflect standard materials of construction. For other materials of construction, special requirements or part numbers not listed, consult the factory.

TRADEMARKS:

Daniel™	Daniel, a division of Emerson Process Management
Kalrez®	E.I. du Pont de Nemours and Company
Teflon®	E.I. du Pont de Nemours and Company
Viton®	E.I. du Pont de Nemours and Company

When ordering replacement parts you must furnish the following information:

- Valve serial number
- Part number, if available
- Part description
- Quantity required.

To order replacement parts, contact your Daniel sales representative.

DANIEL™ MODEL 788DVC DIGITAL CONTROL VALVES

Table 7-1. Parts List - 2", 3", 4", 6", 8" Sizes

Item	Description	Qty	2-inch	3-inch	4-inch	6-inch	8-inch
1	valve body - in line 150 ANSI steel	1	521001	531001	541001	561001	581001
2	solenoid (N.C.) 110/50, 120/60 220/50, 240/60	1	456800-612 456800-621	456800-612 456800-621	456800-612 456800-621	456800-612 456800-621	456800-612 456800-621
3	junction box	1					
4	solenoid (N.O.) 110/50, 120/60 220/50, 240/60	1	456815-012 456815-022	456815-012 456815-022	456815-012 456815-022	456815-012 456815-022	456815-012 456815-022
5	needle valve		460385-522	460385-522	460385-522	460385-522	460385-522
6	strainer assembly	2	530245	530245	530245	530245	530245
9	indicator	1		consult factory			
10	mounting screws	1		consult factory			
11	cylinder assembly (std. Construction w/Viton® Dynamic O-rings)	1	520065-421	530065-421	640065-421	560065-421	580065-421
12	cylinder head	1	520056-500	530056-500	540056-500	560056-500	580056-500
13	cylinder	1	520471-400	530471-400	540471-400	560471-400	580471-400
14	valve spring Std. Med. (5-10 psi) light (4-6 psi) heavy (10-30 psi)	1	520029 520031 520059	530029 530031 530059	540029 540031 540059	560029 560031 560059	580029 580031 580059
15	piston stainless steel	1	520084-600	150333	150333	150333	CF
16	sealing ring	1	520026-500	152048-120	152048-120	152048-120	152048-120
17	retaining ring						
18	socket screw	3	151001-019	151001-019	151042	151042	151042
19	O-ring/Buna-N O-ring/Viton® O-ring/EPR	1	152073 152073-022 152073-005	152075 152075-022 152075-005	152078 152078-022 152078-005	157002 157002-022 157002-005	157005 CF CF
20	O-ring/Buna-N O-ring/Viton® O-ring/EPR	1	152085 152085-022 152085-005	152100 152100-022 152100-022	152080 152080-022 152080-005	157003 157003-022 157003-005	157006 CF CF

DANIEL™ MODEL 788DVC DIGITAL CONTROL VALVES

DEC 2012

Item	Description	Qty	2-inch	3-inch	4-inch	6-inch	8-inch
21	O-ring/Buna-N O-ring/Viton® O-ring/EPR	1	---	157079 157079-022 157079-005	150727 157078-022 157078-005	150727 157061-022 157061-005	CF CF CF
22	O-ring/Buna-N O-ring/Viton® O-ring/EPR	1	---	152067 152067-022 152067-055	152070 152070-022 152070-005	152070 152070-022 152070-005	CF CF CF
23	seal spacer		530028	----	----	----	
24	O-ring/Buna-N O-ring/Viton® O-ring/EPR		152061 152061-022 152061-005	152095 152095-022 152095-005	152094 152094-022 152094-005	152079-022 152079-022 152079-005	CF CF CF

* Recommended Spare Parts

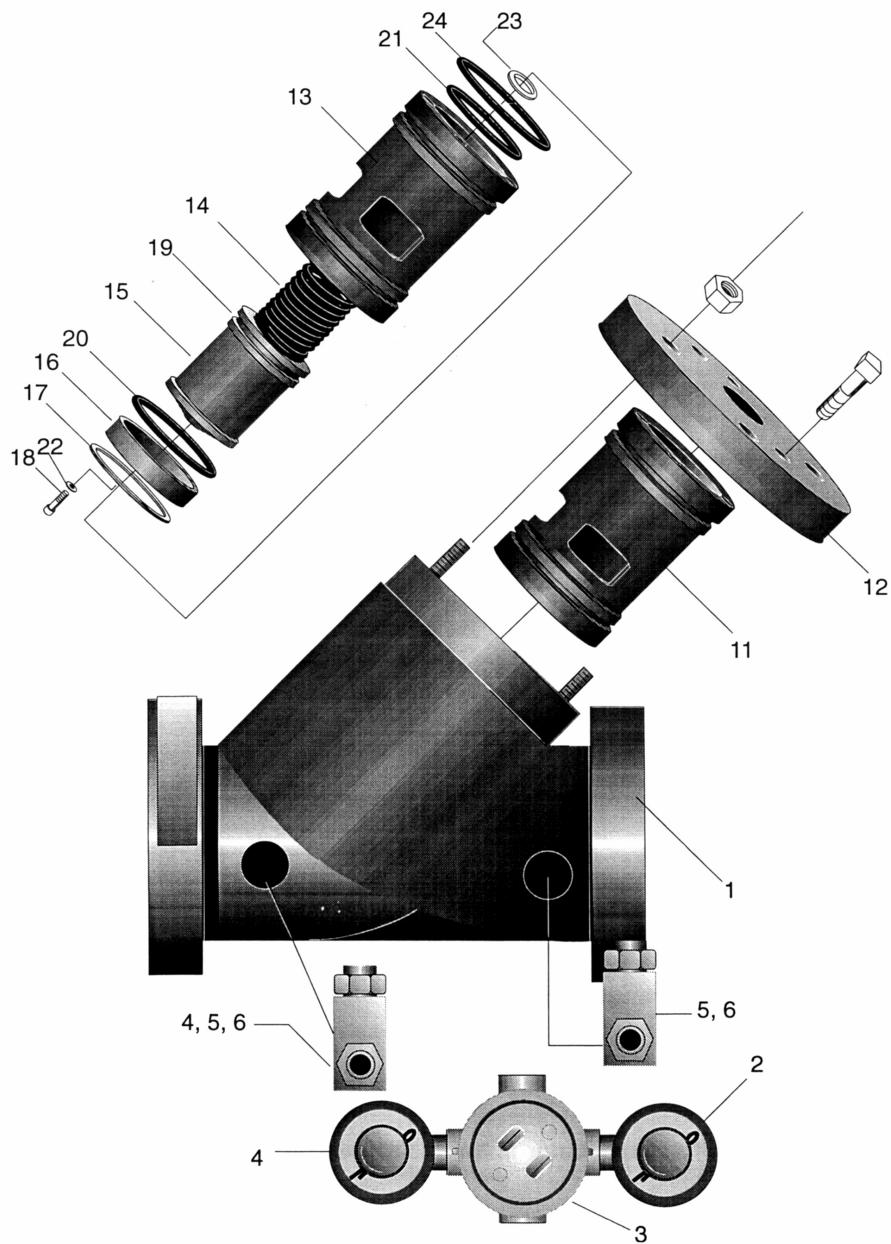
DANIEL™ MODEL 788DVC DIGITAL CONTROL VALVES

Figure 7-1. Valve Cylinder Assembly

Daniel™ Measurement and Control, Inc.
Returned Material Authorization

Repair Form for Used Equipment
Including Decontamination/Cleaning Statement

A Return Material Authorization (RMA) number must be obtained prior to returning any equipment for any reason. Download the RMA form from the Support Services web page by selecting the link below.

<http://www2.emersonprocess.com/EN-US/BRANDS/DANIEL/SUPPORT-SERVICES/Pages/Support-Services.aspx>

1. Return Material Authorization (RMA) Number _____
2. Equipment to be returned:
Model Number _____ Serial Number _____
3. Reason for return: _____

Decontamination/Cleaning Fluids Process

A. List each substance in which the equipment was exposed. Attach additional documents if necessary.

Common Name	CAS# if available	Used for Hazardous Waste (20 CFR 261)	EPA Waste Code if used for hazardous waste
		[] Yes [] No	
		[] Yes [] No	
		[] Yes [] No	
		[] Yes [] No	
		[] Yes [] No	
		[] Yes [] No	

B. Circle any hazards and/or process fluid types that apply:

Infectious Cyanides Carcinogen	Radioactive Sulfides Peroxide	Explosive Corrosive Reactive-Air	Pyrophoric Oxidizer Reactive-Air	Poison Gas Poison Reactive-Other (list)
---------------------------------------------	--------------------------------------------	-----------------------------------------------	-----------------------------------------------	------------------------------------------------------

Other hazard category (list):

C. Describe decontamination/cleaning process. Include MSDS description for substances used in decontamination and cleaning processes. Attach additional documents if necessary.

Shipping Requirements

Failure to comply with this procedure will result in the shipment being refused.

1. Write the RMA number on the shipping package.
2. Inside the package include one copy of this document and all required Material Safety Data Sheets (MSDS)
3. Outside of the package attach one copy of this document and all required Material Safety Data Sheets (MSDS).

THIS EQUIPMENT, BEING RETURNED "FOR REPAIR," HAS BEEN COMPLETELY DECONTAMINATED AND CLEANED. ALL FOREIGN SUBSTANCES HAVE BEEN DOCUMENTED ABOVE AND MSDS SHEETS ARE ATTACHED.

By: _____

(Signature) _____

(Print name) _____

Title: _____

Date: _____

Company: _____

Phone: _____

Fax: _____

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