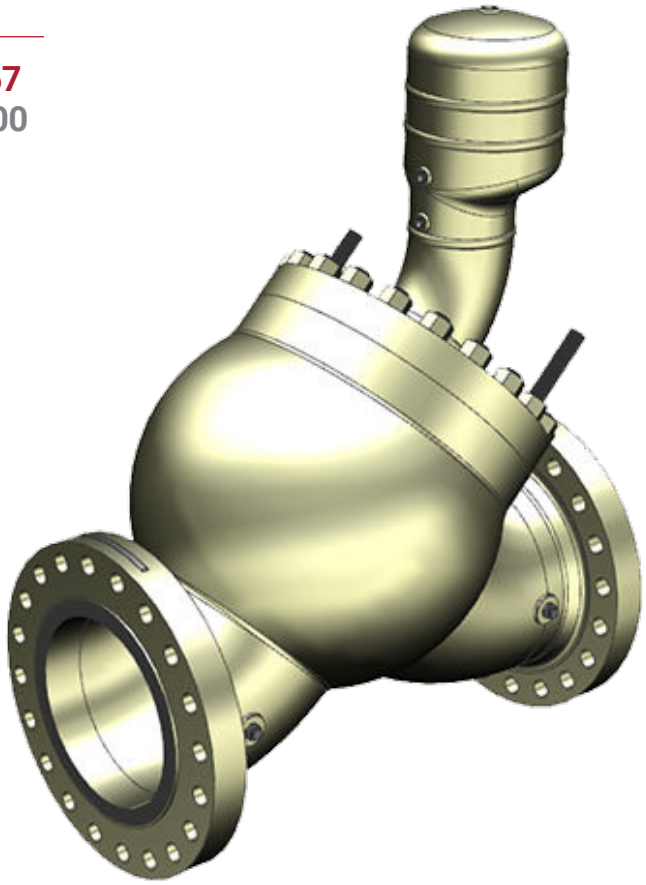
DANIEL®
CONTROL VALVES
USER MANUAL

MODELS 762, 763, 765, 766 AND 767
NPS 2 THROUGH 16 / CLASS 150-600



DANIEL®

OCTOBER 2022

Signal words and symbols

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

Safety alert symbol

This is a safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER!

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.

Important

Important is a statement the user needs to know and consider.

Tip

Tip provides information or suggestions for improved efficiency or best results.

Note

Note is “general by-the-way” content not essential to the main flow of information.

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 must strictly adhere both to the information printed on the product 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!

Failure to follow the installation, operation or maintenance instructions for a Daniel product could lead to serious injury or death from explosion or exposure to dangerous substances.

To reduce the risk:

- **Comply with all information on the product, in this manual, and in any local and national codes that apply to this product.**
- **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/en-us/automation/daniel*.
- Save this instruction manual for future reference.
- 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):

- To prevent personal injury, personnel must follow all instructions of this manual prior to and during operation of the product.
- Follow all warnings, cautions, and notices marked on, and supplied with, 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/en-us/automation/daniel* .
- Read and understand all instructions and operating procedures for this product.
- If you do not understand an instruction, or do not feel comfortable following the instructions, contact your Daniel representative for clarification or assistance.
- Install this product as specified in the INSTALLATION section of this manual per applicable local and national codes.
- Follow all instructions during the installation, operation, and maintenance of this product.
- Connect the product to the appropriate pressure and electrical sources when and where applicable.
- Ensure that all connections to pressure and electrical sources are secure prior to and during equipment operation.
- Use only replacement parts specified by Daniel. Unauthorized parts and procedures can affect this product's performance, safety, and invalidate the warranty. “Look-a-like” substitutions may result in deadly fire, explosion, release of toxic substances or improper operation.
- Save this instruction manual for future reference.

Notice

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PRODUCT NAMES USED HEREIN ARE FOR MANUFACTURER OR SUPPLIER IDENTIFICATION ONLY AND MAY BE TRADEMARKS/ REGISTERED TRADEMARKS OF THESE COMPANIES.

Warranty and Limitations

1. LIMITED WARRANTY: Subject to the limitations contained in Section 2 herein, Daniel Measurement & Control, Inc. (“Daniel”) warrants that the licensed firmware embodied in the Goods will execute the programming instructions provided by Daniel, and that the Goods manufactured by Daniel will be free from defects in materials or workmanship under normal use and care and Services will be performed by trained personnel using proper equipment and instrumentation for the particular Service provided. The foregoing warranties will apply until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Daniel, whichever period expires first. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services. Products purchased by Daniel from a third party for resale to Buyer (“Resale Products”) shall carry only the warranty extended by the original manufacturer. Buyer agrees that Daniel has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Daniel thereof in writing during the applicable warranty period, Daniel shall, at its option, correct any errors that are found by Daniel in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Daniel to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, use of unauthorized replacement parts, storage or handling, or any other cause not the fault of Daniel are not covered by this limited warranty, and shall be at Buyer's expense. Daniel shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Daniel. All costs of dismantling, reinstallation and freight and the time and expenses of Daniel's personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Daniel. Goods repaired and parts replaced by Daniel during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Daniel and can be amended only in a writing signed by Daniel. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES. Buyer acknowledges and agrees that corrosion or erosion of materials is not covered by this warranty.

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Contents

Part I
Plan

Chapters covered in this part:

- *Introduction*
- *Operating conditions and specifications*
- *Control valve handling*
- *Prepare the control valve for use*

1 Introduction

Topics covered in this chapter:

- *Purpose of this manual*
- *Description of the Models 762, 763, 765, 766 and 767 Control Valves*
- *Agency certifications for the Models 762, 763, 765, 766 and 767 Control Valves*

1.1 Purpose of this manual

This manual provides guidance to owners and personnel in the installation, operation and maintenance of the *Daniel™ Models 762, 763, 765, 766 and 767 Control Valves manual, 3-9008-562*. It is imperative that product owners and operation personnel read and follow the information contained in this manual to ensure that the control valve is installed correctly and is operating according to the design certifications and safety considerations.

1.2 Description of the Models 762, 763, 765, 766 and 767 Control Valves

1.2.1 General features of the control valve

In many applications, such as pipelines, storage terminals and marine loading and unloading, it is necessary to include surge relief systems for the purpose of equipment and personnel protection. Surge pressures result from a sudden change in fluid velocity and, without surge relief, these surge pressures can damage pipes, other piping components, equipment and personnel.

These pressure surges can be generated by anything that causes the liquid velocity in a line to change quickly (e.g., valve closure, pump trip, Emergency Shut Down (ESD) closure) and subsequently packing pressure. Total surge pressure may be significantly above the maximum allowable pressure of the system, leading to serious damage to your valuable assets.

The fundamental requirements of surge relief systems include the need for fast acting, high capacity valves which can open very quickly to remove surge pressures from the line and then return to the normal (closed) state quickly but without causing additional pressure surge during closure. These valves are often required to open fully in very short periods of time, so that they may pass the entire flowing stream if conditions dictate.

Long pipelines can produce dangerous pressures when static product is shut-in between valves and thermal expansion occurs. In this situation, pressure relief will be required. Although the time of operation and valve capacities are not as crucial in such applications, they remain as key elements of safety in the system and proper regard to selection and operation is imperative.

In general, all systems where pressure is contained must have some form of pressure relief, which is often mandated and regulated by local authorities. The design of such systems is dependent on a complex range of factors including, but not limited to, the potential for pressures increases, the volumes which must be passed by the pressure relief equipment in operation and the capacity of the system to contain pressures.

Typical tank and pressure vessel systems are required to release pressure without passing large volumes of liquid. Usually these systems operate to relieve vapor from the space above the liquid using self acting pressure relief valves.

Although these valves are commonly used as pressure relief devices, the nozzle size is quite small and hence, the capacity for passing liquids is extremely limited. Therefore, such designs are often limited to tank and vessel protection, where overpressure is readily relieved without the need to pass significant quantities of liquid.

1.2.2 Control valve application

The Daniel Models 762, 763, 765, 766 and 767 Gas Loaded Relief/Back Pressure Control Valves are specifically designed to regulate and control maximum pipeline pressures or to maintain a minimum back pressure in a system. They have proven to be reliable, rugged and very responsive in controlling pipeline surges and pressures. The Daniel Models 762, 763, 765, 766 and 767 Gas Loaded Relief/Back Pressure Control Valves are not pilot operated. They incorporate an integral oil reservoir mounted on the external surface of the valve cylinder head, which upon installation, is partially filled with a light oil. Gas under pressure is then applied to the reservoir. The oil is a moveable barrier between the gas and the valve piston. This insures that nitrogen gas does not permeate the piston seals which would result in nitrogen consumption and the need to constantly replenish the system. A major benefit of the valve design is that all internal parts, including cylinder, piston and seat ring are removed as a cartridge assembly which keeps line connections intact.

Applications

- Back pressure control
- Pipeline pump station by-pass
- Pipeline pressure and surge relief
- By-pass pressure control

Features and benefits

- Modular construction
- No diaphragms or stuffing boxes
- Linear control characteristics
- Exceptionally fast response speed
- Positive shut-off
- High flow capacity
- Balanced piston design
- No pilot controls
- Can pass dirty or viscous products

- Screwed seat rings on all sizes
- No consumption of nitrogen gas

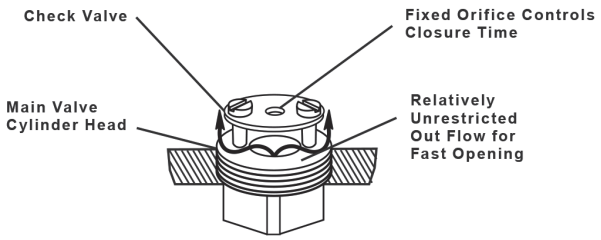
NOTICE

The Daniel Models do not comply with any internationally over-pressurization protection recognized codes. What the Daniel Models do is to allow the movement of an undetermined amount of substance *within* a pressurized system, not *from* a pressurized system.

1.2.3 Operation overview of the control valve

The Daniel Models 762, 763, 765, 766 and 767 control valves are normally closed and open on increasing inlet pressure. The basic valve is of the balanced piston operated design. Pressure applied to the inlet side of the piston is equally transmitted to the spring side of the piston. When the line pressure on the inlet side exceeds the gas pressure plus the pressure exerted by the spring, the moveable barrier of oil compresses the gas and the valve opens. As line pressure falls below set point, the gas pressure, added to the spring pressure, closes the valve and it remains closed as long as gas pressure, plus spring force, is greater than the line pressure. Opening and closing speeds are controlled by a check valve mounted to the internal surface of the cylinder head as shown in *Figure 1-1*.

Figure 1-1: Check valve

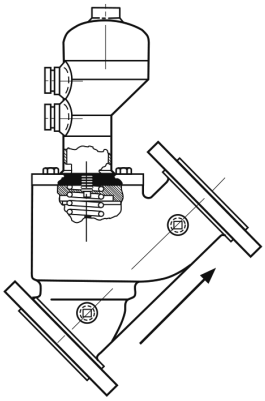


Opening speed is relatively unrestricted which results in very fast opening speed. Closing speed is controlled by the fixed orifice in the check valve.

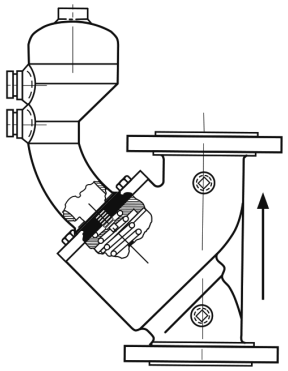
These valves are normally closed and open on increasing inlet pressure. The basic valve is the balanced piston design. Nitrogen gas is used to pressurize the valve piston to keep it in the closed position. The valve incorporates an integral oil reservoir mounted on the external surface of the cylinder head, which upon installation, is partially filled with a light oil. Gas under pressure is applied to the reservoir. The pressure of the nitrogen gas, minus the 4 psi (force of the valve spring) is the effective set point of the valve. When the pipeline pressure is less than this total force, the valve will be tightly closed. As pipeline pressure increases the spring and gas pressure is overcome and the valve opens. The oil is a moveable barrier between the gas and the valve piston. This should eliminate any possibility of gas permeating the piston seal which would result in gas bypassing the piston and gas consumption.

The valve may be mounted in a 45° angle position, horizontally or vertically. Whichever orientation is specified, the oil reservoir must be vertical.

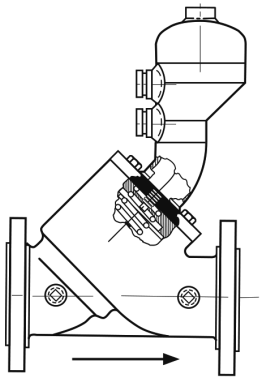
Figure 1-2: Valve orientation



Daniel Surge Relief Valve for 45 ° installation



Daniel Surge Relief Valve for vertical installation

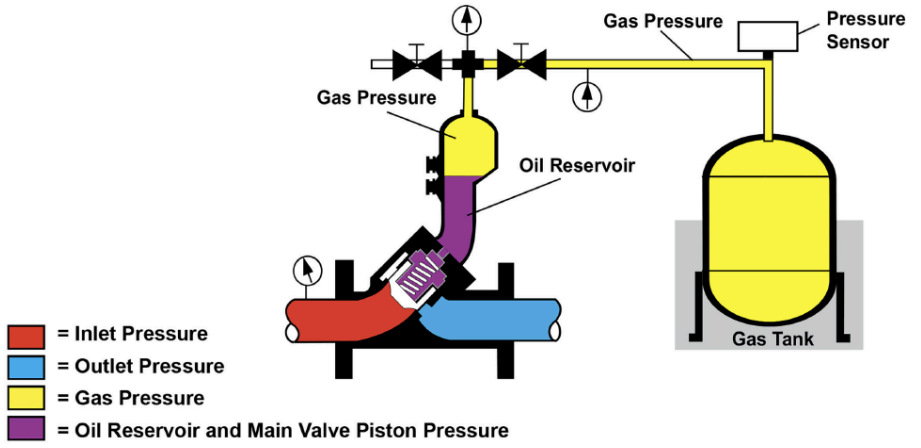


Daniel Surge Relief Valve for horizontal installation

Closed position

Line pressure on the nose of the piston is equally transmitted to the spring side of the piston. When the nitrogen pressure is applied to the top of the oil, (which is in effect a moveable barrier between the piston and nitrogen) plus the spring pressure is greater than line pressure, the valve will be in the closed position. (See below.)

Figure 1-3: Closed position

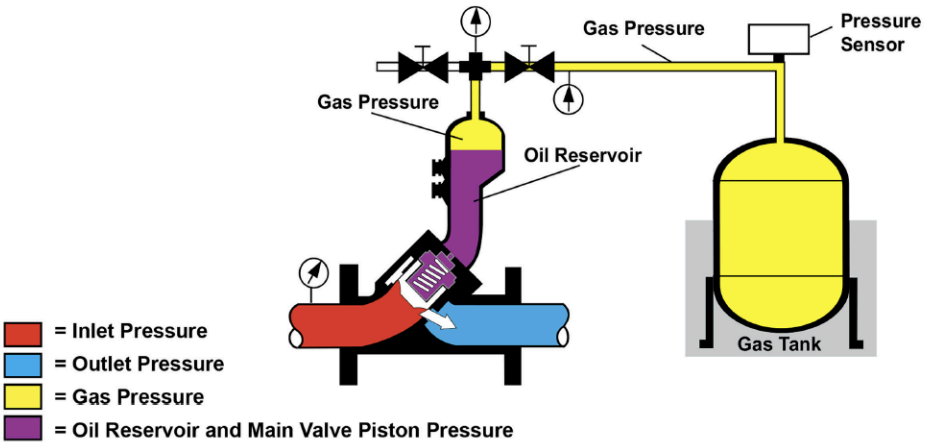


- The oil reservoir is supplied with two sight gauges. When the valve is closed the oil level in the reservoir will show oil covering the lower sight glass only.
- Oil visible in both the lower and upper sight gauges indicates that the valve is in the open position.
- Absence of oil in the lower sight gauge indicates that proper oil capacity has not been reached or that reservoir oil is leaking into the product system. (See below.)

Open position

As pipeline pressure increases, the combined force of the spring and nitrogen gas pressure is overcome and the valve opens.

Figure 1-4: Open position



- Opening and closing speed is controlled by a unique check valve mounted to the internal surface of the cylinder head. The opening of the valve is relatively unrestricted, and response time is typically under 100 msec.
- This results in an extremely fast opening response. The opening and closing speeds are controlled by an orifice in the check valve.

A simple routine visual check can be done to determine if the oil in the sight glass is within the recommended limits. This makes it easy for a pipeline operations team to be confident of the surge relief valves readiness.

Note

The spring in the Daniel Nitrogen Loaded Surge Relief Valve is for shipping purposes to ensure piston movement does not cause damage during shipment. This is the only purpose of this spring.

Note

Equal area on both sides of the piston allow the nitrogen pressure to be set at the actual set point minus spring force rather than a calculated percentage.

Note

Oil in the reservoir of the Daniel Nitrogen Loaded Surge Relief Valve has many advantages. It allows the piston seals to be exposed to a clean, lubricant fluid which helps to extend the service life of the seals tremendously. In addition, it should eliminate the possibility of nitrogen gas permeating the seals which will ultimately result in a leak and nitrogen consumption.

NOTICE

The Daniel Models do not comply with any internationally over-pressurization protection recognized codes. What the Daniel Models do is to allow the movement of an undetermined amount of substance *within* a pressurized system, not *from* a pressurized system.

1.2.4 Parts list for the Models 762, 763, 765, 766 and 767 Control Valves

Figure 1-5: Models 762, 763, 765, 766 and 767 Control Valves NPS 2"-12"

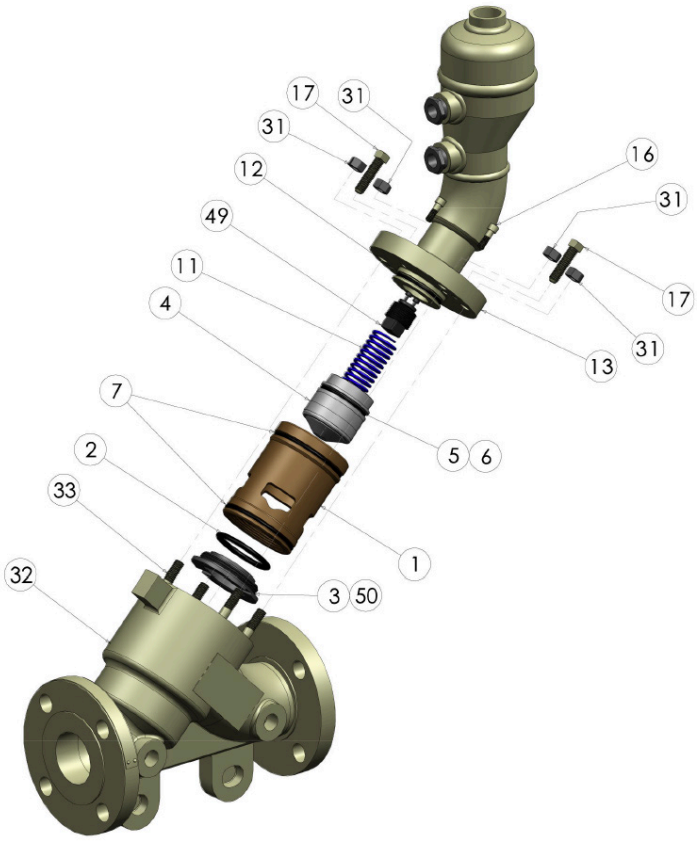


Table 1-1: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 2

Item number	Description		Part number 2 inch	Quantity
1	Cylinder		526471-690	1
2	O-ring	Buna-N	1500399	1
		EPR	1500399-005	
		FFKM	1500399-075	
		NBR (Low-swell)	1500399-120	

Table 1-1: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 2 *(continued)*

Item number	Description		Part number 2 inch	Quantity
		CR	1500399-116	
		FKM	1500399-022	
		FKM GFLT	1500399-027	
		FKM V1289	1500399-029	
3	Seat ring		526026-610	1
4	Piston	Standard	520024-691	1
		AP option	520024-693	
		High-pressure	526024-691	
5	O-ring	Buna-N	152073	1
		EPR	152073-005	
		FFKM	152073-075	
		NBR (Low-swell)	152073-120	
		CR	152073-116	
		FKM	152073-022	
		FKM GFLT	152073-027	
		FKM V1289	152073-029	
6	Backup ring (High pressure)		157194	2
7	O-ring	Buna-N	157000	2
		EPR	157000-005	
		FFKM	157000-075	
		NBR (Low-swell)	157000-120	
		CR	157000-116	
		FKM	157000-022	
		FKM GFLT	157000-027	
		FKM V1289	157000-029	
11	Spring	Light (blue)	520031	1
12	O-ring	Buna-N	157029	1
		EPR	157029-005	
		FFKM	157029-075	
		NBR (Low-swell)	157029-120	
		CR	157029-116	
		FKM	157029-022	
		FKM GFLT	157029-027	
		FKM V1289	157029-029	

Table 1-1: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 2 *(continued)*

Item number	Description		Part number 2 inch	Quantity
13	Cylinder head	Horizontal		
		Daniel Class 150 and 300	520754-590M	1
		Daniel Class 600	526754-590M	
		45°		
		Daniel Class 150 and 300	520854-590M	1
		Daniel Class 600	526854-590M	
		Vertical		
		Daniel Class 150 and 300	520954-590M	1
		Daniel Class 600	526954-590M	
16	Screw	Daniel Class 150 and 300	151066M	4
		Daniel Class 600	151032M	4
17	Jack-out screws		150691	2
27	Bal-seal (AP option)		159775	2
28	Piston seal retainer		520027-690	2
29	External retaining ring		156576	2
31	Nuts	Daniel Class 150 and 300	151546M	4
		Daniel Class 600	151553M	4
32	Valve body	Daniel Class 150	521001M	1
		Daniel Class 300	523001M	
		Daniel Class 600	526001M	
		DIN PN 16	521001-016M	
		DIN PN 40	523001-040M	
		DIN PN 64	526001-064M	
		DIN PN 100	526001-100M	
33	Studs	Daniel Class 150 and 300	151309M	4
		Daniel Class 600	151451M	4
34	Pipe plug		154721	2
49	Check valve assembly		520045-701	1
50	Set screw		150975	1

Table 1-1: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 2 *(continued)*

Item number	Description		Part number 2 inch	Quantity
A	Cylinder assembly Daniel Class 150 and 300	Horizontal		
		Buna-N	520770-690	1
		EPR	520770-697	1
		FFKM	520770-695	1
		NBR (Low-swell)	520770-696	1
		CR	520770-693	1
		FKM	520770-692	1
		FKM GFLT	520770-69G	1
		FKM V1289	520770-69M	1
		45°		
		Buna-N	520870-690	1
		EPR	520870-697	1
		FFKM	520870-695	1
		NBR (Low-swell)	520870-696	1
		CR	520870-693	1
		FKM	520870-692	1
		FKM GFLT	520870-69G	1
		FKM V1289	520870-69M	1
		Vertical		
		Buna-N	520970-690	1
		EPR	520970-697	1
		FFKM	520970-695	1
		NBR (Low-swell)	520970-696	1
		CR	520970-693	1
		FKM	520970-692	1
		FKM GFLT	520970-69G	1
		FKM V1289	520970-69M	1
	Cylinder assembly Daniel Class 600	Horizontal		
		Buna-N	526770-690	1
		EPR	526770-697	1
		FFKM	526770-695	1
		NBR (Low-swell)	526770-696	1
		CR	526770-693	1
		FKM	526770-692	1

Table 1-1: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 2 *(continued)*

Item number	Description		Part number 2 inch	Quantity
		FKM GFLT	526770-69G	1
		FKM V1289	52770-69M	1
		45°		
		Buna-N	526870-690	1
		EPR	526870-697	1
		FFKM	526870-695	1
		NBR (Low-swell)	526870-696	1
		CR	526870-693	1
		FKM	526870-692	1
		FKM GFLT	526870-69G	1
		FKM V1289	526870-69M	1
		Vertical		
		Buna-N	526970-690	1
		EPR	526970-697	1
		FFKM	526970-695	1
		NBR (Low-swell)	526970-696	1
		CR	526970-693	1
		FKM	526970-692	1
		FKM GFLT	526970-69G	1

Table 1-2: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 3

Item number	Description		Part number 3 inch	Quantity
1	Cylinder		536471-690	1
2	O-ring	Buna-N	1500480	1
		EPR	1500480-005	
		FFKM	1500480-075	
		NBR (Low-swell)	1500480-120	
		CR	1500480-116	
		FKM	1500480-022	
		FKM GFLT	1500480-027	
		FKM V1289	1500480-029	

Table 1-2: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 3 *(continued)*

Item number	Description		Part number 3 inch	Quantity
3	Seat ring		536026-610	1
4	Piston	Standard	530024-691	1
		AP option	530024-693	
		High-pressure	536024-691	
5	O-ring	Buna-N	152075	1
		EPR	152075-005	
		FFKM	152075-075	
		NBR (Low-swell)	152075-120	
		CR	152075-116	
		FKM	152075-022	
		FKM GFLT	152075-027	
		FKM V1289	152075-029	
6	Backup ring (High pressure)		157195	2
7	O-ring	Buna-N	152095	2
		EPR	152095-005	
		FFKM	152095-075	
		NBR (Low-swell)	152095-120	
		CR	152095-116	
		FKM	152095-022	
		FKM GFLT	152095-027	
		FKM V1289	152095-029	
11	Spring	Light (blue)	530031	1
12	O-ring	Buna-N	159575	1
		EPR	159575-005	
		FFKM	159575-075	
		NBR (Low-swell)	159575-120	
		CR	159575-116	
		FKM	159575-022	
		FKM GFLT	159575-027	
		FKM V1289	159575-029	
13	Cylinder head	Horizontal		
		Standard	530754-590M	1
		High-pressure	536754-590M	
		45°		

Table 1-2: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 3 *(continued)*

Item number	Description		Part number 3 inch	Quantity
		Standard	530854-590M	1
		High-pressure	536854-590M	
		Vertical		
		Standard	530954-590M	1
		High-pressure	536954-590M	
16	Screw	Daniel Class 150 and 300	151012M	6
		Daniel Class 600	151033M	6
17	Jack-out screws		150695	2
27	Bal-seal (AP option)		159714	2
31	Nuts	Daniel Class 150 and 300	151547M	6
		Daniel Class 600	151553M	8
32	Valve body	Daniel Class 150	531001M	1
		Daniel Class 300	533001M	
		Daniel Class 600	536001M	
		DIN PN 16	531001-016M	
		DIN PN 40	533001-040M	
		DIN PN 64	536001-064M	
		DIN PN 100	536001-100M	
33	Studs	Daniel Class 150 and 300	151305M	6
		Daniel Class 600	151451M	8
34	Pipe plug		154721	2
49	Check valve assembly		530045-701	1
50	Set screw		150975	1
A	Cylinder assembly Daniel Class 150 and 300	Horizontal		
		Buna-N	530770-690	1
		EPR	530770-697	1
		FFKM	530770-695	1
		NBR (Low-swell)	530770-696	1
		CR	530770-693	1
		FKM	530770-692	1
		FKM GFLT	530770-69G	1
		FKM V1289	530770-69M	1

Table 1-2: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 3 *(continued)*

Item number	Description		Part number 3 inch	Quantity
		45°		
		Buna-N	530870-690	1
		EPR	530870-697	1
		FFKM	530870-695	1
		NBR (Low-swell)	530870-696	1
		CR	530870-693	1
		FKM	530870-692	1
		FKM GFLT	530870-69G	1
		FKM V1289	530870-69M	1
		Vertical		
		Buna-N	530970-690	1
		EPR	530970-697	1
		FFKM	530970-695	1
		NBR (Low-swell)	530970-696	1
		CR	530970-693	1
		FKM	530970-692	1
		FKM GFLT	530970-69G	1
		FKM V1289	530970-69M	1
	Cylinder assembly Daniel Class 600	Horizontal		
		Buna-N	536770-690	1
		EPR	536770-697	1
		FFKM	536770-695	1
		NBR (Low-swell)	536770-696	1
		CR	536770-693	1
		FKM	536770-692	1
		FKM GFLT	53670-69G	1
		FKM V1289	536770-69M	1
		45°		
		Buna-N	536870-690	1
		EPR	536870-697	1
		FFKM	536870-695	1
		NBR (Low-swell)	536870-696	1
		CR	536870-693	1
		FKM	536870-692	1

Table 1-2: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 3 *(continued)*

Item number	Description		Part number 3 inch	Quantity
		FKM GFLT	536870-69G	1
		FKM V1289	536870-69M	1
		Vertical		
		Buna-N	536970-690	1
		EPR	536970-697	1
		FFKM	536970-695	1
		NBR (Low-swell)	536970-696	1
		CR	536970-693	1
		FKM	536970-692	1
		FKM GFLT	536970-69G	1

Table 1-3: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 4

Item number	Description		Part number 4 inch	Quantity
1	Cylinder		546471-690	1
2	O-ring	Buna-N	152080	1
		EPR	152080-005	
		FFKM	152080-075	
		NBR (Low-swell)	152080-120	
		CR	152080-116	
		FKM	152080-022	
		FKM GFLT	152080-027	
		FKM V1289	152080-029	
3	Seat ring		546026-610	1
4	Piston	Standard	540024-691	1
		AP option	540024-693	
		High-pressure	546024-691	
5	O-ring	Buna-N	152078	1
		EPR	152078-005	
		FFKM	152078-075	
		NBR (Low-swell)	152078-120	
		CR	152078-116	

Table 1-3: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 4 *(continued)*

Item number	Description		Part number 4 inch	Quantity
		FKM	152078-022	
		FKM GFLT	152078-027	
		FKM V1289	152078-029	
6	Backup ring (High pressure)		157196	2
7	O-ring	Buna-N	152094	2
		EPR	152094-005	
		FFKM	152094-075	
		NBR (Low-swell)	152094-120	
		CR	152094-116	
		FKM	152094-022	
		FKM GFLT	152094-027	
		FKM V1289	152094-029	
11	Spring	Light (blue)	540031	1
12	O-ring	Buna-N	157032	1
		EPR	157032-005	
		FFKM	157032-075	
		NBR (Low-swell)	157032-120	
		CR	157032-116	
		FKM	157032-022	
		FKM GFLT	152032-027	
		FKM V1289	152032-029	
13	Cylinder head	Horizontal		
		Standard	540754-590M	1
		High-pressure	546754-590M	
		45°		
		Standard	540854-590M	1
		High-pressure	546854-590M	
		Vertical		
		Standard	540954-590M	1
		High-pressure	546954-590M	
16	Screw	Daniel Class 150 and 300	151012M	6
		Daniel Class 600	151033M	
17	Jack-out screws		150695	2

Table 1-3: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 4 *(continued)*

Item number	Description		Part number 4 inch	Quantity
27	Bal-seal (AP option)		159715	2
31	Nuts	Daniel Class 150 and 300	151547M	8
		Daniel Class 600	151551M	8
32	Valve body	Daniel Class 150	541001M	1
		Daniel Class 300	543001M	
		Daniel Class 600	546001M	
		DIN PN 16	541001-016M	
		DIN PN 40	543001-040M	
		DIN PN 64	546001-064M	
		DIN PN 100	546001-100M	
33	Studs	Daniel Class 150 and 300	151305M	8
		Daniel Class 600	151454M	8
34	Pipe plug	Daniel Class 150 and 300	154721M	2
		Daniel Class 600	154704M	
49	Check valve assembly		540045-701	1
50	Set screw		150975	1
A	Cylinder assembly Daniel Class 150 and 300	Horizontal		
		Buna-N	540770-690	1
		EPR	540770-697	1
		FFKM	540770-695	1
		NBR (Low-swell)	540770-696	1
		CR	540770-693	1
		FKM	540770-692	1
		FKM GFLT	540770-69G	1
		FKM V1289	540770-69M	1
		45°		
		Buna-N	540870-690	1
		EPR	540870-697	1
		FFKM	540870-695	1
		NBR (Low-swell)	540870-696	1
		CR	540870-693	1
		FKM	540870-692	1

Table 1-3: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 4 *(continued)*

Item number	Description		Part number 4 inch	Quantity
		FKM GFLT	540870-69G	1
		FKM V1289	540870-69M	1
		Vertical		
		Buna-N	540970-690	1
		EPR	540970-697	1
		FFKM	540970-695	1
		NBR (Low-swell)	540970-696	1
		CR	540970-693	1
		FKM	540970-692	1
		FKM GFLT	540970-69G	1
		FKM V1289	540970-69M	1
	Cylinder assembly Daniel Class 600	Horizontal		
		Buna-N	546770-690	1
		EPR	546770-697	1
		FFKM	546770-695	1
		NBR (Low-swell)	546770-696	1
		CR	546770-693	1
		FKM	546770-692	1
		FKM GFLT	546770-69G	1
		FKM V1289	546770-69M	1
		45°		
		Buna-N	546870-690	1
		EPR	546870-697	1
		FFKM	546870-695	1
		NBR (Low-swell)	546870-696	1
		CR	546870-693	1
		FKM	546870-692	1
		FKM GFLT	54670-69G	1
		FKM V1289	546870-69M	1
		Vertical		
		Buna-N	546970-690	1
		EPR	546970-697	1
		FFKM	546970-695	1
		NBR (Low-swell)	546970-696	1

Table 1-3: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 4 *(continued)*

Item number	Description		Part number 4 inch	Quantity
		CR	546970-693	1
		FKM	546970-692	1
		FKM GFLT	546970-69G	1
		FKM V1289	546970-69M	1

Table 1-4: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 6

Item number	Description		Part number 6 inch	Quantity
1	Cylinder		566471-590	1
2	O-ring	Buna-N	1500407	1
		EPR	1500407-005	
		FFKM	1500407-075	
		NBR (Low-swell)	1500407-120	
		CR	1500407-116	
		FKM	1500407-022	
		FKM GFLT	1500407-027	
		FKM V1289	1500407-029	
3	Seat ring		566026-610	1
4	Piston	Standard	560024-691	1
		AP option	560024-693	
		High-pressure	566024-691	
5	O-ring	Buna-N	157002	1
		EPR	157002-005	
		FFKM	157002-075	
		NBR (Low-swell)	157002-120	
		CR	157002-116	
		FKM	157002-022	
		FKM GFLT	157002-027	
		FKM V1289	157002-029	
6	Backup ring (High pressure)		157197	2
7	O-ring	Buna-N	152079	2
		EPR	152079-005	

Table 1-4: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 6 *(continued)*

Item number	Description		Part number 6 inch	Quantity
		FFKM	152079-075	
		NBR (Low-swell)	152079-120	
		CR	152079-116	
		FKM	152079-022	
		FKM GFLT	152079-027	
		FKM V1289	152079-029	
11	Spring	Light (blue)	560031	1
12	O-ring	Buna-N	159576	1
		EPR	159576-005	
		FFKM	159576-075	
		NBR (Low-swell)	159576-120	
		CR	159576-116	
		FKM	159576-022	
		FKM GFLT	159576-027	
		FKM V1289	159576-029	
13	Cylinder head	Horizontal		
		Standard	560754-590M	1
		High-pressure	566754-590M	
		45°		
		Standard	560854-590M	1
		High-pressure	566854-590M	
		Vertical		
		Standard	560954-590M	1
		High-pressure	566954-590M	
16	Screw	Daniel Class 150 and 300	151012M	8
		Daniel Class 600	151068M	8
17	Jack-out screws		150695	2
27	Bal-seal (AP option)		159716	2
31	Nuts	Daniel Class 150 and 300	151553M	10
		Daniel Class 600	151558M	8
32	Valve body	Daniel Class 150	561001M	1
		Daniel Class 300	563001M	

Table 1-4: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 6 *(continued)*

Item number	Description		Part number 6 inch	Quantity
		Daniel Class 600	566001M	
		DIN PN 16	561001-016M	
		DIN PN 40	563001-040M	
		DIN PN 64	566001-064M	
		DIN PN 100	566001-100M	
33	Studs	Daniel Class 150 and 300	151347M	10
		Daniel Class 600	151450M	8
34	Pipe plug	Daniel Class 150 and 300	154721M	2
		Daniel Class 600	154704M	2
49	Check valve assembly		560045-701	1
50	Set screw		150975	1
A	Cylinder assembly Daniel Class 150 and 300	Horizontal		
		Buna-N	560770-690	1
		EPR	560770-697	1
		FFKM	560770-695	1
		NBR (Low-swell)	560770-696	1
		CR	560770-693	1
		FKM	560770-692	1
		FKM GFLT	560770-69G	1
		FKM V1289	560770-69M	1
		45°		
		Buna-N	560870-690	1
		EPR	560870-697	1
		FFKM	560870-695	1
		NBR (Low-swell)	560870-696	1
		CR	560870-693	1
		FKM	560870-692	1
		FKM GFLT	560870-69G	1
		FKM V1289	560870-69M	1
		Vertical		
		Buna-N	560970-690	1
		EPR	560970-697	1

Table 1-4: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 6 *(continued)*

Item number	Description		Part number 6 inch	Quantity
		FFKM	560970-695	1
		NBR (Low-swell)	560970-696	1
		CR	560970-693	1
		FKM	560970-692	1
		FKM GFLT	560970-69G	1
		FKM V1289	560970-69M	1
	Cylinder assembly Daniel Class 600	Horizontal		
		Buna-N	566770-690	1
		EPR	566770-697	1
		FFKM	566770-695	1
		NBR (Low-swell)	566770-696	1
		CR	566770-693	1
		FKM	566770-692	1
		FKM GFLT	566770-69G	1
		FKM V1289	566770-69M	1
		45°		
		Buna-N	566870-690	1
		EPR	566870-697	1
		FFKM	566870-695	1
		NBR (Low-swell)	566870-696	1
		CR	566870-693	1
		FKM	566870-692	1
		FKM GFLT	566870-69G	1
		FKM V1289	566870-69M	1
		Vertical		
		Buna-N	566970-690	1
		EPR	566970-697	1
		FFKM	566970-695	1
		NBR (Low-swell)	566970-696	1
		CR	566970-693	1
		FKM	566970-692	1
		FKM GFLT	566970-69G	1
		FKM V1289	566970-69M	1

Table 1-5: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 8

Item number	Description		Part number 8 inch	Quantity
1	Cylinder		586471-500	1
2	O-ring	Buna-N	157006	1
		EPR	157006-005	
		FFKM	157006-075	
		NBR (Low-swell)	157006-120	
		CR	157006-116	
		FKM	157006-022	
		FKM GFLT	157006-027	
		FKM V1289	157006-029	
3	Seat ring		586026-600	1
4	Piston	Standard	580057-601	1
		AP option	580057-630	
		High-pressure	586057-601	
5	O-ring	Buna-N	157005	1
		EPR	157005-005	
		FFKM	157005-075	
		NBR (Low-swell)	157005-120	
		CR	157005-116	
		FKM	157005-022	
		FKM GFLT	157005-027	
		FKM V1289	157005-029	
6	Backup ring (High pressure)		157198	2
7	O-ring	Buna-N	157004	2
		EPR	157004-005	
		FFKM	157004-075	
		Low-swell NBR	157004-120	
		CR	157004-116	
		FKM	157004-022	
		FKM GFLT	157004-027	
		FKM V1289	157004-029	
11	Spring	Light (blue)	580031	1
12	O-ring	Buna-N	157074	1
		EPR	157074-005	
		FFKM	157074-075	

Table 1-5: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 8 *(continued)*

Item number	Description		Part number 8 inch	Quantity
		NBR (Low-swell)	157074-120	
		CR	157074-116	
		FKM	157074-022	
		FKM GFLT	157074-027	
		FKM V1289	157074-029	
13	Cylinder head	Horizontal		
		Standard	580754-590M	1
		High-pressure	586754-590M	
		45°		
		Standard	580854-590M	1
		High-pressure	586854-590M	
		Vertical		
		Standard	580954-590M	1
		High-pressure	586954-590M	
16	Screw	Standard	151072	8
		High-pressure	151038	8
17	Jack-out screws		150696	2
27	Bal-seal (AP option)		159651	2
31	Nuts	Daniel Class 150 and 300	151558M	10
		Daniel Class 600	151559M	12
32	Valve body	Daniel Class 150	581008M	1
		Daniel Class 300	583001M	
		Daniel Class 600	586001M	
		DIN PN 16	581001-016M	
		DIN PN 40	583001-040M	
		DIN PN 64	586001-064M	
		DIN PN 100	586001-100M	
33	Studs	Daniel Class 150 and 300	151335M	10
		Daniel Class 600	151455M	12
34	Pipe plug		154704M	2
49	Check valve assembly		580045-701	1
50	Set screw		150975-019	1

Table 1-5: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 8 *(continued)*

Item number	Description		Part number 8 inch	Quantity
A	Cylinder assembly Daniel Class 150 and 300	Horizontal		
		Buna-N	580770-690	1
		EPR	580770-697	1
		FFKM	580770-695	1
		NBR (Low-swell)	580770-696	1
		CR	580770-693	1
		FKM	580770-692	1
		FKM GFLT	580770-69G	1
		FKM V1289	580770-69M	1
		45°		
		Buna-N	580870-690	1
		EPR	580870-697	1
		FFKM	580870-695	1
		NBR (Low-swell)	580870-696	1
		CR	580870-693	1
		FKM	580870-692	1
		FKM GFLT	580870-69G	1
		FKM V1289	580870-69M	1
		Vertical		
		Buna-N	580970-690	1
		EPR	580970-697	1
		FFKM	580970-695	1
		NBR (Low-swell)	580970-696	1
		CR	580970-693	1
		FKM	580970-692	1
		FKM GFLT	50970-69G	1
		FKM V1289	580970-69M	1
	Cylinder assembly Daniel Class 600	Horizontal		
		Buna-N	586770-690	1
		EPR	586770-697	1
		FFKM	586770-695	
		NBR (Low-swell)	586770-696	
		CR	586770-693	
		FKM	586770-692	

Table 1-5: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 8 *(continued)*

Item number	Description		Part number 8 inch	Quantity
		FKM GFLT	586770-69G	1
		FKM V1289	586770-69M	1
		45°		
		Buna-N	586870-690	1
		EPR	586870-697	1
		FFKM	586870-695	1
		NBR (Low-swell)	586870-696	1
		CR	586870-693	1
		FKM	586870-692	1
		FKM GFLT	586870-69G	1
		FKM V1289	586870-69M	1
		Vertical		
		Buna-N	586970-690	1
		EPR	586970-697	1
		FFKM	58970-695	1
		NBR (Low-swell)	586970-696	1
		CR	586970-693	1
		FKM	586970-692	1
		FKM GFLT	586970-69G	1
		FKM V1289	586970-69M	1

Table 1-6: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 10

Item number	Description		Part number 10 inch	Quantity
1	Cylinder		606471-510	1
2	O-ring	Buna-N	157014	1
		EPR	157014-005	
		FFKM	157014-075	
		NBR (Low-swell)	157014-120	
		CR	157014-116	
		FKM	157014-022	
		FKM GFLT	157014-027	

Table 1-6: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 10 *(continued)*

Item number	Description		Part number 10 inch	Quantity
		FKM V1289	157014-029	
3	Seat ring		606026-600	1
4	Piston assembly	Standard pressure		
		Buna-N	600057-600	1
		FFKM	600057-608	
		NBR (Low-swell)	600057-60L	
		CR	600057-603	
		FKM	600057-602	
		AP option	600057-631	1
		High-pressure		
		Buna-N	606057-600	1
		FKM	606057-602	
5	O-ring	Buna-N	157015	1
		EPR	157015-005	
		FFKM	157015-075	
		NBR (Low-swell)	157015-120	
		CR	157015-116	
		FKM	157015-022	
		FKM GFLT	157015-027	
		FKM V1289	157015-029	
6	Backup ring		157190	2
7	O-ring	Buna-N	157013	2
		EPR	157013-005	
		FFKM	157013-075	
		NBR (Low-swell)	157013-120	
		CR	157013-116	
		FKM	157013-022	
		FKM GFLT	157013-027	
		FKM V1289	157013-029	
11	Spring	Light (blue)	600031	1
12	O-ring	Buna-N	157340	1
		EPR	157340-005	
		FFKM	157340-075	
		NBR (Low-swell)	157340-120	

Table 1-6: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 10 *(continued)*

Item number	Description		Part number 10 inch	Quantity
		CR	157340-116	
		FKM	157340-022	
		FKM GFLT	157340-027	
		FKM V1289	157340-029	
13	Cylinder head	Horizontal		
		Standard	600754-510M	1
		High-pressure	606754-590M	
		45°		
		Standard	600854-590M	1
		High-pressure	606854-590M	
		Vertical		
		Standard	600954-590M	1
		High-pressure	606954-590M	
16	Screw	Standard	151017M	8
		High-pressure	151026M	8
17	Jack-out screws		150698	2
27	Bal-seal (AP option)		159805	2
31	Nuts	Daniel Class 150 and 300	151559M	12
		Daniel Class 600	151560M	16
32	Valve body	Daniel Class 150	601001M	1
		Daniel Class 300	603001M	
		Daniel Class 600	606001M	
		DIN PN 16	601001-016M	
		DIN PN 40	603001-040M	
		DIN PN 64	606001-064M	
		DIN PN 100	606001-100M	
33	Studs	Daniel Class 150 and 300	151345M	12
		Daniel Class 600	151456M	16
34	Pipe plug		154704M	2
49	Check valve assembly		600045-701	1
50	Set screw		150977-019	1
A	Cylinder	Horizontal		

Table 1-6: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 10 *(continued)*

Item number	Description		Part number 10 inch	Quantity
	assembly Daniel Class 150 and 300	Buna-N	600770-690	1
		EPR	600770-697	1
		FFKM	600770-695	1
		NBR (Low-swell)	600770-696	1
		CR	600770-693	1
		FKM	600770-692	1
		FKM GFLT	600770-69G	1
		FKM V1289	600770-69M	1
		45°		
		Buna-N	600870-690	1
		EPR	600870-697	1
		FFKM	600870-695	1
		NBR (Low-swell)	600870-696	1
		CR	600870-693	1
		FKM	600870-692	1
		FKM GFLT	600870-69G	1
		FKM V1289	600870-69M	1
		Vertical		
		Buna-N	600970-690	1
		EPR	600970-697	1
		FFKM	600970-695	1
		NBR (Low-swell)	600970-696	1
		CR	600970-693	1
		FKM	600970-692	1
		FKM GFLT	60970-69G	1
		FKM V1289	600970-69M	1
	Cylinder assembly Daniel Class 600	Horizontal		
		Buna-N	606770-690	1
		EPR	606770-697	1
		FFKM	606770-695	1
		NBR (Low-swell)	606770-696	1
		CR	606770-693	1
		FKM	606770-692	1
		FKM GFLT	606770-69G	1

Table 1-6: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 10 *(continued)*

Item number	Description		Part number 10 inch	Quantity
		FKM V1289	606770-69M	1
		45°		
		Buna-N	606870-690	1
		EPR	606870-697	1
		FFKM	606870-695	1
		NBR (Low-swell)	606870-696	1
		CR	606870-693	1
		FKM	606870-692	1
		FKM GFLT	606870-69G	1
		FKM V1289	606870-69M	1
		Vertical		
		Buna-N	606970-690	1
		EPR	606970-697	1
		FFKM	60970-695	1
		NBR (Low-swell)	606970-696	1
		CR	606970-693	1
		FKM	606970-692	1
		FKM GFLT	606970-69G	1
		FKM V1289	606970-69M	1

Table 1-7: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 12

Item number	Description		Part number 12 inch	Quantity
1	Cylinder		626471-500	1
2	O-ring	Buna-N	157017	1
		EPR	157017-005	
		FFKM	157017-075	
		NBR (Low-swell)	157017-120	
		CR	157017-116	
		FKM	157017-022	
		FKM GFLT	157017-027	
		FKM V1289	157017-029	

Table 1-7: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 12 *(continued)*

Item number	Description		Part number 12 inch	Quantity
3	Seat ring		626026-600	1
4	Piston assembly	Standard		
		Buna-N	620057-600	1
		FKM	620057-602	
		FKM V1289	620057-6M	
		AP	620057-630	1
		High-pressure		
		FKM	626057-602	1
		FKM V1289	626057-60M	
5	O-ring	Buna-N	157018	1
		EPR	157018-005	
		FFKM	157018-075	
		NBR (Low-swell)	157018-120	
		CR	157018-116	
		FKM	157018-022	
		FKM GFLT	157018-027	
		FKM V1289	157018-029	
6	Backup ring (High pressure)		157200	2
7	O-ring	Buna-N	157019	2
		EPR	157019-005	
		FFKM	157019-075	
		NBR (Low-swell)	157019-120	
		CR	157019-116	
		FKM	157019-022	
		FKM GFLT	157019-027	
		FKM V1289	157019-029	
11	Spring	Light (blue)	620031	1
		Medium (bronze)	620029	
		Heavy (green)	620059-012	1
			620059-018	
12	O-ring	Buna-N	157030	1
		EPR	157030-005	
		FFKM	157030-075	
		NBR (Low-swell)	157030-120	

Table 1-7: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 12 *(continued)*

Item number	Description		Part number 12 inch	Quantity
		CR	157030-116	
		FKM	157030-022	
		FKM GFLT	157030-027	
		FKM V1289	157030-029	
13	Cylinder head	Horizontal		
		Standard	620754-590M	1
		High-pressure	626754-590M	
		45°		
		Standard	620854-590M	1
		High-pressure	626854-590M	
		Vertical		
		Standard	620954-590M	1
		High-pressure	626954-590M	
16	Screw	Standard	151052M	12
		High-pressure	151074M	16
17	Jack-out screws		150697	2
31	Nuts	Daniel Class 150 and 300	151560M	12
		Daniel Class 600	151561M	16
32	Valve body	Daniel Class 150	621001M	1
		Daniel Class 300	623001M	
		Daniel Class 600	626001M	
		DIN PN 16	621001-016M	
		DIN PN 40	623001-040M	
		DIN PN 64	626001-064M	
		DIN PN 100	626001-100M	
33	Studs	Daniel Class 150 and 300	151395M	12
		Daniel Class 600	151457M	16
34	Pipe plug		154704M	2
49	Check valve assembly		620045-701	1
50	Set screw		150977-019	1
A	Cylinder	Horizontal		
		Buna-N	620770-690	1

Table 1-7: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 12 *(continued)*

Item number	Description		Part number 12 inch	Quantity
	assembly Daniel Class 150 and 300	EPR	620770-697	1
		FFKM	620770-695	1
		NBR (Low-swell)	620770-696	1
		CR	620770-693	1
		FKM	620770-692	1
		FKM GFLT	620770-69G	1
		FKM V1289	620770-69M	1
		45		
		Buna-N	620870-690	1
		EPR	620870-697	1
		FFKM	620870-695	1
		NBR (Low-swell)	620870-696	1
		CR	620870-693	1
		FKM	620870-692	1
		FKM GFLT	620870-69G	1
		FKM V1289	620870-69M	1
		Vertical		
		Buna-N	620970-690	1
		EPR	620970-697	1
		FFKM	620970-695	1
		NBR (Low-swell)	620970-696	1
		CR	620970-693	1
		FKM	620970-692	1
		FKM GFLT	62970-69G	1
		FKM V1289	620970-69M	1
	Cylinder assembly Daniel Class 600	Horizontal		
		Buna-N	626770-690	1
		EPR	626770-697	1
		FFKM	626770-695	1
		NBR (Low-swell)	626770-696	1
		CR	626770-693	1
		FKM	626770-692	1
		FKM GFLT	626770-69G	1
		FKM V1289	626770-69M	1

Table 1-7: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 12 *(continued)*

Item number	Description		Part number 12 inch	Quantity
		45°		
		Buna-N	626870-690	1
		EPR	626870-697	1
		FFKM	626870-695	1
		NBR (Low-swell)	626870-696	1
		CR	626870-693	1
		FKM	626870-692	1
		FKM GFLT	626870-69G	1
		FKM V1289	626870-69M	1
		Vertical		
		Buna-N	626970-690	1
		EPR	626970-697	1
		FFKM	62970-695	1
		NBR (Low-swell)	626970-696	1
		CR	626970-693	1
		FKM	626970-692	1
		FKM GFLT	626970-69G	1
		FKM V1289	62970-69M	1

Figure 1-6: Models 762, 763, 765, 766 and 767 Control Valves NPS 16"

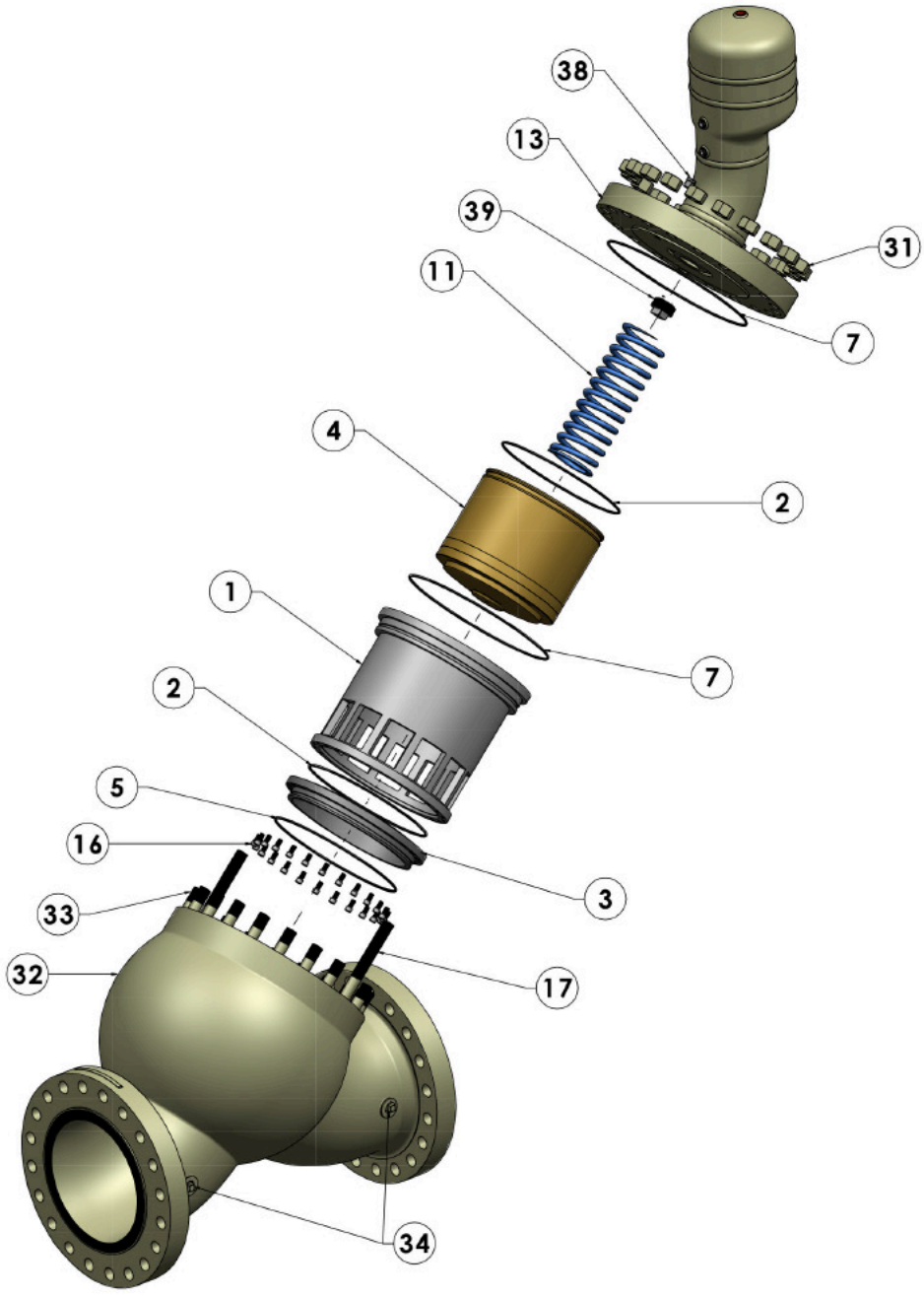


Table 1-8: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 16

Item number	Description		Part number 16 inch	Quantity
1	Cylinder		666021-500	1
2	O-ring	Buna-N	157095	2
		EPR	157095-005	
		FFKM	157095-075	
		NBR (Low-swell)	157095-120	
		CR	157095-116	
		FKM	157095-022	
		FKM GFLT	157095-027	
		FKM V1289	157095-029	
3	Seat ring		666026-500	1
4	Piston	Standard	660124-600	1
		AP	Consult factory	
		High-pressure	666057-601	
5	O-ring	Buna-N	157086	1
		EPR	157086-005	
		FFKM	157086-075	
		NBR (Low-swell)	157086-120	
		CR	157086-116	
		FKM	157086-022	
		FKM GFLT	157086-027	
		FKM V1289	157086-029	
6	Backup ring (High pressure)		157201	2
7	O-ring	Buna-N	157087	2
		EPR	157087-005	
		FFKM	157087-075	
		NBR (Low-swell)	157087-120	
		CR	157087-116	
		FKM	157087-022	
		FKM GFLT	157087-027	
		FKM V1289	157087-029	
11	Spring	Light (blue)	660031	1
13	Cylinder head	Standard	660754-500	1
		High-pressure	666754-500	
16	Screw		151019	24

Table 1-8: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 16 *(continued)*

Item number	Description		Part number 16 inch	Quantity
17	Jack-out screws	Standard	151453-100M	2
		High pressure	151399-100M	
31	Nuts	Daniel Class 150 and 300	151560M	20
		Daniel Class 600	151563M	20
32	Valve body	Daniel Class 150	661001M	1
		Daniel Class 300	663001M	
		Daniel Class 600	666001M	
		DIN PN 16	661001-016M	
		DIN PN 40	663001-040M	
		DIN PN 64	666001-064M	
		DIN PN 100	666001-100M	
33	Studs	Daniel Class 150 and 300	151453M	20
		Daniel Class 600	151399M	20
34	Pipe plug	Standard	154704M	2
		High pressure	154718-074M	
38	Cap plug		154774	1
39	Check valve		660045-701	1
A	Cylinder assembly Daniel Class 150 and 300	Horizontal		
		Buna-N	660770-690	1
		EPR	660770-697	1
		FFKM	660770-695	1
	Cylinder assembly Daniel Class 600	NBR (Low-swell)	660770-696	1
		CR	660770-693	1
		FKM	660770-692	1
		FKM GFLT	660770-69G	1
		FKM V1289	660770-69M	
		Buna-N	660870-690	1
		EPR	660870-697	1
		FFKM	660870-695	1
		NBR (Low-swell)	660870-696	1
		CR	660870-693	1
		FKM	660870-692	1

Table 1-8: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 16 *(continued)*

Item number	Description		Part number 16 inch	Quantity
		FKM GFLT	660870-69G	1
		FKM V1289	660870-69M	1
		Vertical		
		Buna-N	660970-690	1
		EPR	660970-697	1
		FFKM	660970-695	1
		NBR (Low-swell)	660970-696	1
		CR	660970-693	1
		FKM	660970-692	1
		FKM GFLT	66970-69G	1
		FKM V1289	660970-69M	1
		Horizontal		
		Buna-N	666770-690	1
		EPR	666770-697	1
		FFKM	666770-695	1
		NBR (Low-swell)	666770-696	1
		CR	666770-693	1
		FKM	666770-692	1
		FKM GFLT	666770-69G	1
		FKM V1289	666770-69M	1
		45°		
		Buna-N	666870-690	1
		EPR	666870-697	1
		FFKM	666870-695	1
		NBR (Low-swell)	666870-696	1
		CR	666870-693	1
		FKM	666870-692	1
		FKM GFLT	666870-69G	1
		FKM V1289	666870-69M	1
		Vertical		
		Buna-N	666970-690	1
		EPR	666970-697	1
		FFKM	66970-695	1
		NBR (Low-swell)	666970-696	1

Table 1-8: Part description for a model 762, 763, 765, 766 and 767 Control Valve NPS 16 *(continued)*

Item number	Description		Part number 16 inch	Quantity
		CR	666970-693	1
		FKM	666970-692	1
		FKM GFLT	66970-69G	1
		FKM V1289	66970-69M	1

1.3 Agency certifications for the Models 762, 763, 765, 766 and 767 Control Valves

The following product agency certifications are applicable to the Daniel Control Valves.

Table 1-9: Agency certifications for control valves

Certification type	Description
Pressure equipment	PED

NOTICE

The Daniel Models do not comply with any internationally over-pressurization protection recognized codes. What the Daniel Models do is to allow the movement of an undetermined amount of substance *within* a pressurized system, not *from* a pressurized system.

2 Operating conditions and specifications

Topics covered in this chapter:

- *Operating conditions for the control valve*
- *Description of the Models 762, 763, 765, 766 and 767 Control Valves*

2.1 Operating conditions for the control valve

Table 2-1: Operating conditions for the control valve

Condition type	Description
Fluid phase	Liquid
Process temperature	-26°C to 205°C (-15°F to 400°F)
Optional process temperature	-46°C to 205°C (-51°F to 400°F)
Fluid velocity	Operational recommended flow velocity up to 58 ft/sec, beyond this point will result in a high pressure drop and increased wear.
Fluid(s) controlled	• Low/Medium viscosity crude oils and condensates • Refined products and intermediates (ie: *gasoline, diesel, kerosene, light fuel oils, jet fuel, LPG, butanes, naphtha, alkylate, reformate, straight run gasoline, cat-cracked gasoline*) • Petrochemicals (ie: *benzene, toluene, xylenes, cumene, olefins, pyrolysis gasoline*) • Natural gas liquids
Viscosity limits on valves	• Maximum valve viscosity is 8800 Cst • Maximum viscosity for valves with pilots is 440 Cst due to response time of high viscosity pilot
Differential pressure	The maximum allowable differential pressure across a control valve is 6894 kPa (1,000 psi). Consult factory for location of first shut down valve.
Atmospheric pressure	Absolute
Sizes (NPS)	2, 3, 4, 6, 8,10,12,16
Maximum safe working temperature range	• -26°C to 205°C (-15°F to 400°F) • Using FKM O-rings • Temperature range is dependent of O-ring T_{min} and T_{max} • Consult the factory for other safe working temperatures

Table 2-1: Operating conditions for the control valve *(continued)*

Condition type	Description
Maximum safe working pressure	Flange connections/Ratings (DIN) for valve sizes DN50 and DN400: • DIN PN16 MWP at 120°C: 16 bar • DIN PN25 MWP at 120°C: 25 bar • DIN PN40 MWP at 120°C: 40 bar • DIN PN64 MWP at 120°C: 51 bar • DIN PN64 MWP at 120°C: 64 bar • DIN PN100 MWP at 120 °C: 100 bar Flange connections/Ratings (Daniel Class) for valve sizes 2"-16": See *Section 2.1*
Valve capacity	C_v is a capacity coefficient that defines as the number of US gpm of water that flows through a valve with a pressure drop of 1 psi across the valve. Daniel valves have the following C_v: • NPS 2: 86 gpm • NPS 3: 186 gpm • NPS 4: 309 gpm • NPS 6: 688 gpm • NPS 8: 1296 gpm • NPS 10: 2040 gpm • NPS 12: 2920 gpm • NPS 16: 5360 gpm *C_v based on wide open valve with water temperature at 16°C (60°F)

Table 2-2: Maximum allowable working pressure

Maximum allowable working pressure (psig)				
Temp. °F	Daniel Class			
	150	300	600	900
-20 to 100	290	750	1500	2250
200	260	750	1500	2250
300	230	730	1455	2185
400	200	705	1405	2110

2.1.1 Design considerations

Some conditions to consider:

- Service operating pressure
- Service testing pressures
- Service process temperature and ambient site temperatures
- Chemical composition and toxicity of fluid in operating conditions
- Traffic, wind and earthquake at loading site

- Adverse force or stress caused by inadequate supports, attachments, piping, etc.
- Corrosion, erosion, fatigue, etc.
- Decomposition of unstable fluids in operating and test conditions
- Possible damage from external fire
- Mass fluid in process and test conditions

⚠ WARNING!

FUNCTIONAL AND ENVIRONMENTAL HAZARD

Evaluate the functional and environmental conditions prior to installing a control valve. Install the control valve in a well-designed piping system.

Failure to comply may result in death or serious injury from pipe failure.

NOTICE

The Daniel Models do not comply with any internationally over-pressurization protection recognized codes. What the Daniel Models do is to allow the movement of an undetermined amount of substance *within* a pressurized system, not *from* a pressurized system.

2.1.2 Environmental conditions

⚠ WARNING!

EQUIPMENT HAZARD

Never use this equipment for any purpose other than its intended use.

Failure to comply may result in death, serious personal injury and/or property damage.

Table 2-3: Environmental conditions

Parameter type	Description
Severe service conditions	Ensure that piping or other attachments connected to the valve are not under stress. The design of the control valve has not been assessed for the effects of wind, earthquake loading and severe weather conditions.
Additional severe service conditions	The valves are designed to be used on liquid applications for crude oil and refined products. The use of aggressive additives or oxygenates requires the use of the Aggressive Products (AP) option. The AP option valve cylinder incorporates cup-seals (PTFE Bal Seals) and an O-ring made from appropriate materials for severe conditions.

Table 2-3: Environmental conditions *(continued)*

Parameter type	Description
Corrosive service	Select the material compatible with the specific processes and atmospheric environments. Implement a periodic inspection and maintenance program to ensure that pressure retaining components are free from corrosion and erosion. The valve is not designed with corrosion allowance. Inspect the valve's metal parts periodically for corrosion and erosion, and inspect the seals and O-rings for wear and chemical deterioration.
Populated areas	For new installations, locate the control valve to an area that has fewer than 10 buildings intended for human occupancy within an area that extends 200 meters (220 yards) radially from the control valve. (Reference: Class 1 Location: U.S. DOT, CFR Title 49: Part 192.5)
Closed, poorly ventilated areas	Install the control valve in a well ventilated area, not less than one meter (approximately three feet) from source of ignition or source of heat which might damage the unit.
Elevation	No limit
Humidity	No limit
Proximity to open flame	Provide fire prevention measures and equipment per local regulations.
Proximity to vehicular traffic	The design of the control valve has not been assessed for the effects of traffic.

2.2 Description of the Models 762, 763, 765, 766 and 767 Control Valves

2.2.1 Interface requirements

⚠ WARNING!

EXCEEDING REQUIREMENTS HAZARD

Control valve requirements are defined to ensure safe equipment operation. Do not exceed published specifications.

Failure to comply may result in death, serious injury and/or damage to the equipment.

Table 2-4: Interface requirements

Requirements	Description
Flange type	The mechanical connections for Models 762, 763, 765, 766 and 767 control valve are raised face flanges. Other types of flange connections are available per customer request for Daniel control valves. For other ratings or flanges consult the factory engineers.

⚠ WARNING!

FLANGE SIZE HAZARD

Customers must choose the appropriate size material of the flange for their piping requirements.

Choosing an incorrect flange may cause a pressure leak, resulting in death or serious injury.

2.2.2 Requirements and limitations for installation

NOTICE

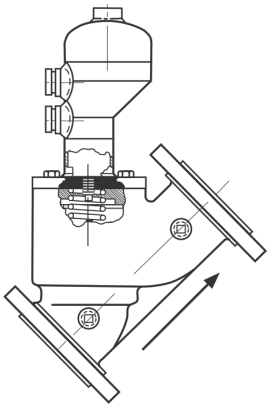
Comply with local government regulations and company requirements.

See *Figure 2-1* for flow direction.

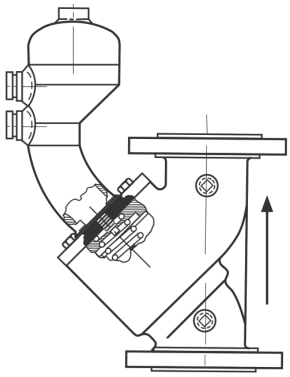
NOTICE

Flush lines to remove welding bead, pipe scale, etc.

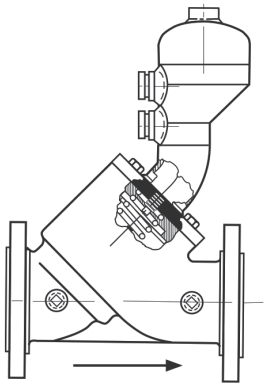
Figure 2-1: Valve orientation



Daniel Surge Relief Valve for 45 ° installation



Daniel Surge Relief Valve for vertical installation



Daniel Surge Relief Valve for horizontal installation

⚠ WARNING!

EQUIPMENT HAZARD

Never use this equipment for any purpose other than its intended use.

Failure to comply may result in death, serious personal injury and/or property damage.

2.2.3 Minimum clearances for installation, operation and maintenance

For certified prints, consult the factory.

Figure 2-2: Dimensions - 45° in-line installation

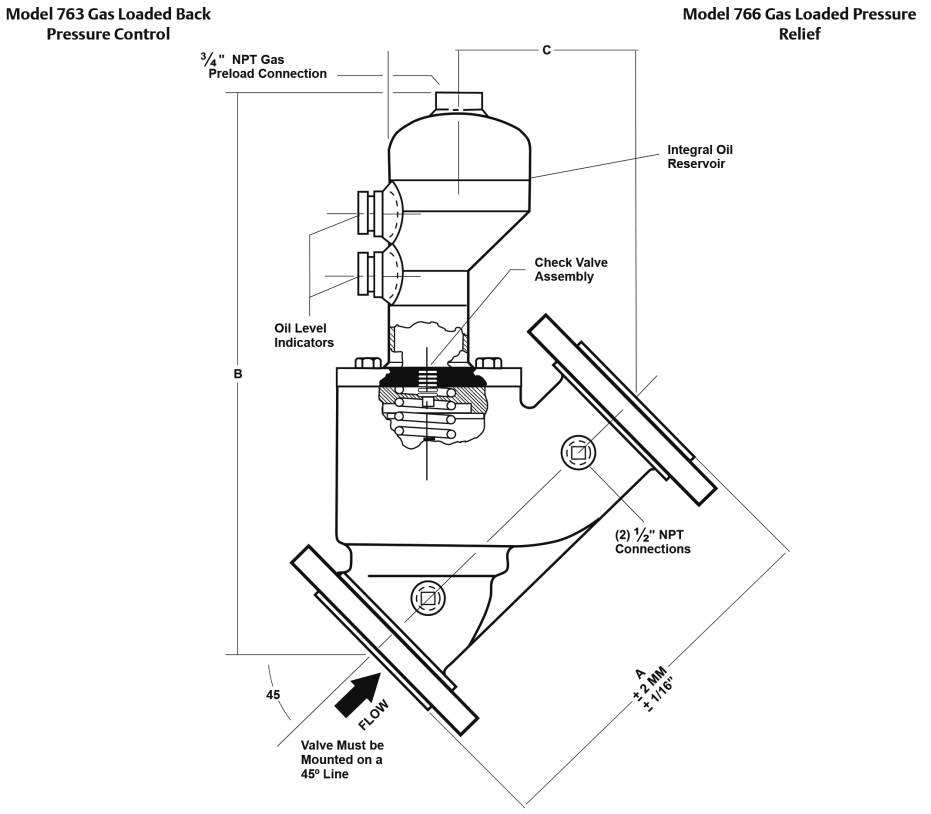


Table 2-5: Dimensions A - 45° in-line installation

	Dimension A (Flanges)					
	150		300		600	
Valve size	inches	millimeters	inches	millimeters	inches	millimeters
2"	10 1/4	260	10 1/2	267	11 1/2	292
3"	11	279	13 1/8	333	14	356
4"	13	330	14 1/2	368	17	432
6"	17	432	17 7/8	454	22	559
8"	22 1/4	565	23 1/4	591	26	660
10"	26 1/2	673	27 7/8	708	31	787
12"	30 7/8	784	33 5/8	854	36 1/2	927
16"	41 3/8	1,051	43 5/8	1,108	46	1,168

Table 2-6: Dimensions B - 45° in-line installation

	Dimension B (Flanges)					
	150		300		600	
Valve size	inches	millimeters	inches	millimeters	inches	millimeters
2"	15 1/2	394	15 1/2	394	16 1/8	410
3"	18 5/8	473	20 1/4	514	20 1/4	514
4"	19 1/4	487	19 3/4	502	27 1/2	699
6"	25 5/8	651	25 7/8	657	27 3/4	705
8"	29 7/8	759	30 1/4	768	32 3/4	832
10"	35 3/4	895	36 1/4	921	39	991
12"	42 1/4	1,086	43 5/8	1,108	45 1/2	1,156
16"	58	1,473	58 3/4	1,492	56 1/4	1,429

Table 2-7: Dimensions C - 45° in-line installation

	Dimension C (Flanges)					
	150		300		600	
Valve size	inches	millimeters	inches	millimeters	inches	millimeters
2"	5 1/2	140	5 3/8	137	5 3/4	146
3"	5 3/8	137	6 1/4	159	7 1/8	181
4"	6 3/4	171	7 1/4	184	8 5/8	219
6"	8 5/8	219	8 3/4	222	10 1/2	267
8"	10	254	11 1/4	286	12 5/8	321
10"	12	305	13 3/8	340	17 1/2	445
12"	15 1/2	394	16 3/4	425	18	457
16"	20 3/4	527	21 3/4	552	23 3/4	603

Figure 2-3: Dimensions - 45° horizontal installation

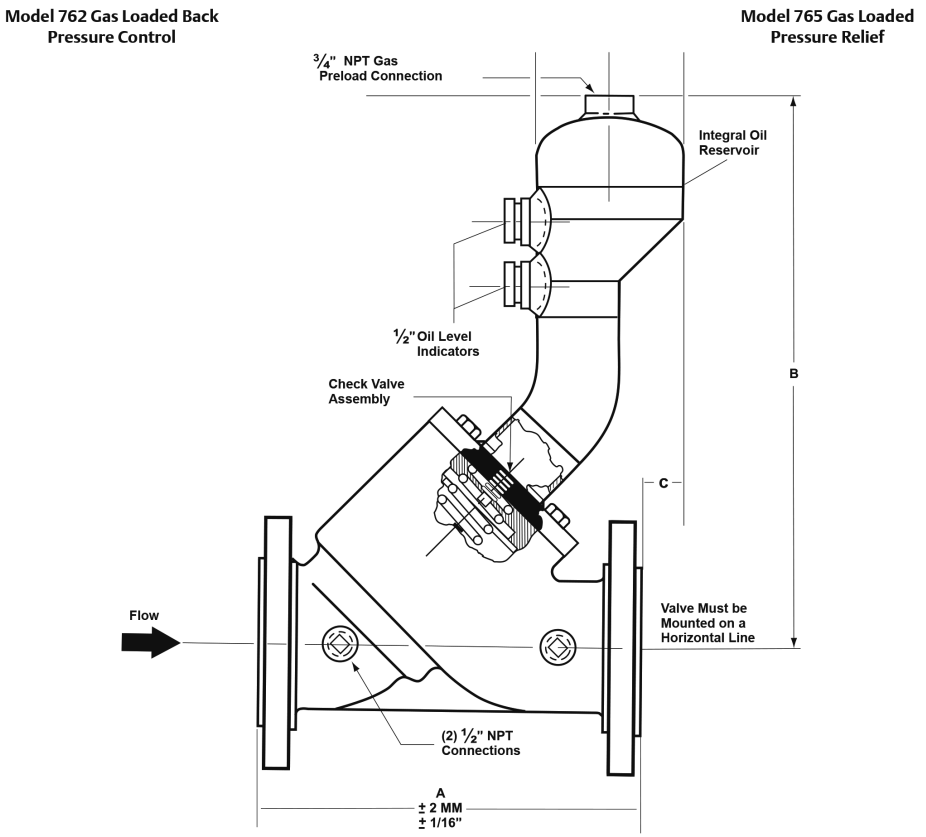


Table 2-8: Dimensions A - Horizontal installation

Valve size	Dimension A (Daniel Class)					
	150		300		600	
	inches	millimeters	inches	millimeters	inches	millimeters
2"	10 1/4	260	10 1/2	267	11 1/2	292
3"	11	279	13 1/8	333	14	356
4"	13	330	14 1/2	368	17	432
6"	17	432	17 7/8	454	22	559
8"	22 1/4	565	23 1/4	591	26	660
10"	26 1/2	673	27 7/8	708	31	787
12"	30 7/8	784	33 5/8	854	36 1/2	927
16"	41 3/8	1,051	43 5/8	1,108	46	1,168

Table 2-9: Dimensions B - Horizontal installation

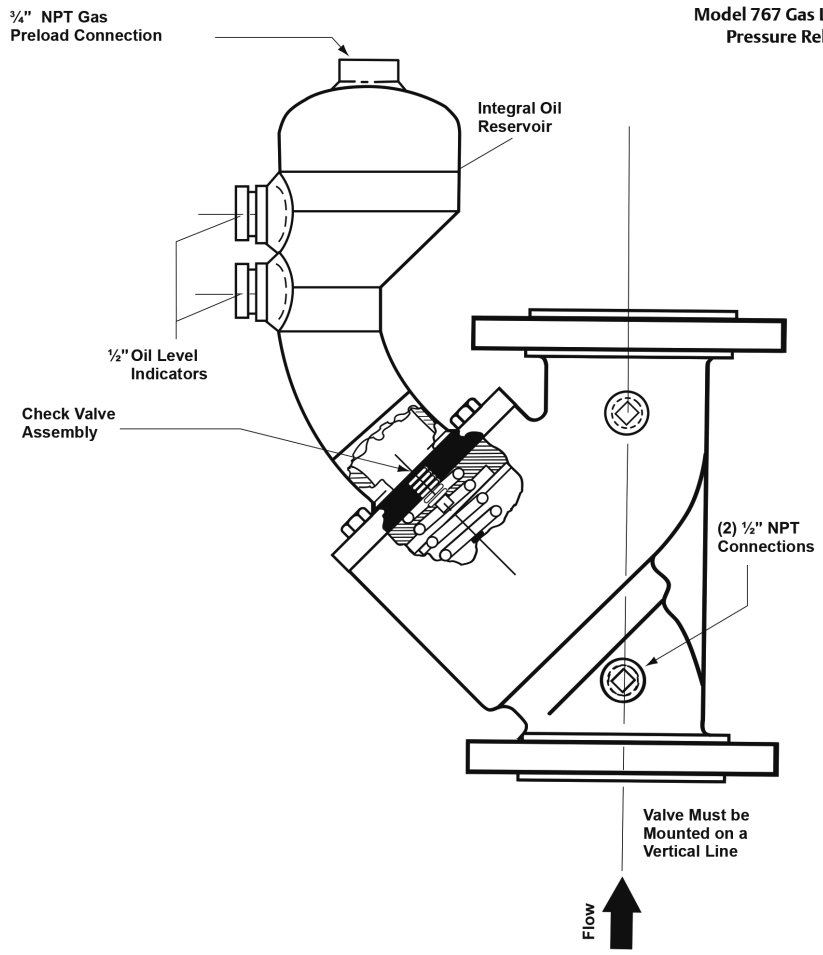
	Dimension B (Daniel Class)					
	150		300		600	
Valve size	inches	millimeters	inches	millimeters	inches	millimeters
2"	14 3/8	365	14 3/8	365	14 1/2	368
3"	18 1/4	464	18 1/4	464	18 7/8	479
4"	18 3/4	476	18 3/4	476	19 3/8	492
6"	23 3/8	594	23 3/8	594	24 3/8	619
8"	27 7/8	706	27 7/8	706	28 1/2	724
10"	33 3/4	857	33 3/4	857	34 3/4	883
12"	40 1/4	1023	40 1/4	1023	41 1/8	1045
16"	54 1/4	1377	54 1/4	1377	49 1/4	1251

Table 2-10: Dimensions C - 45° horizontal installation

	Dimension C (Daniel Class)					
	150		300		600	
Valve size	inches	millimeters	inches	millimeters	inches	millimeters
2"	3/4	19	5/8	16	1/4	6
3"	2 3/4	70	1 3/8	35	1 1/8	29
4"	1 3/8	35	3/4	19	9/16	14
6"	2 3/8	60	1 7/8	48	1/8	3
8"	2 3/4	70	2 1/4	57	7/8	22
10"	3 3/8	86	2 3/4	70	1 1/8	29
12"	4 5/4	108	1 3/8	35	1 5/8	41
16"	5 1/4	133	4 1/8	104	1 1/2	38

CF=Consult factory

Figure 2-4: Vertical installation



For certified dimension prints of the Model 767, please consult the factory.

Table 2-11: Approximate shipping weight and volume for vertical installation

Valve size	150 - 300 Daniel Class				600 Daniel Class			
	Shipping weights		Shipping volume		Shipping weights		Shipping volume	
	lbs	Kgs	Cubic feet	Cubic meters	lbs	Kgs	Cubic feet	Cubic meters
2"	63	29	1.26	0.036	103	47	1.43	0.04
3"	113	51	2.11	0.06	158	72	2.25	0.063
4"	148	67	2.66	0.075	213	97	4.23	0.12

Table 2-11: Approximate shipping weight and volume for vertical installation ***(continued)***

Valve size	150 - 300 Daniel Class				600 Daniel Class			
	Shipping weights		Shipping volume		Shipping weights		Shipping volume	
	lbs	Kgs	Cubic feet	Cubic meters	lbs	Kgs	Cubic feet	Cubic meters
6"	268	122	5.12	0.145	363	165	7.19	0.204
8"	493	224	9.84	0.279	423	192	11.84	0.335
10"	743	337	16.32	0.462	1,225	556	20.45	0.579
12"	1,278	580	26.83	0.76	1,883	854	33.29	0.943
16"	CF	CF	CF	CF	CF	CF	CF	CF

CF=Consult factory

3 Control valve handling

Topics covered in this chapter:

- *Receive the control valve*
- *Store the control valve*

3.1 Receive the control valve

⚠ WARNING!

EQUIPMENT HANDLING AND OPERATING HAZARD

Wear personal protective equipment appropriate to the situation when working with the control valve. Adhere to all safety standards and best practices for operating the equipment.

Failure to comply may result in death or serious injury.

3.1.1 Unpack and inspect the control valve

Check the control valve when it is received at the customer facility.

1. Remove the control valve from the shipping container.
2. Inspect the control valve for damage.
3. See *Chapter 6* for Installation Procedure.

3.2 Store the control valve

3.2.1 Rust inhibitor

Apply light oil or rust inhibitor on surfaces that are in contact with the environment.

3.2.2 Pack the control valve

1. Use stretch wrap (not adhesive) to attach the correct size flange cover to the valve end flanges. This protects the unpainted surfaces of the flange sealing.
2. A flush contact between the flange cover and the flange sealing face is important.

3.2.3 Storage conditions

Store the control valve in a safe area to avoid damage.

⚠ WARNING!

CRUSHING HAZARD

During installation or removal of a control valve, always place the unit on a stable platform or surface that supports its assembled weight.

Failure to comply may allow the control valve to roll, resulting in death, serious injury or equipment damage.

Table 3-1: Control valve storage conditions

Parameter type	Description
Storage environment conditions	For long term storage, it is recommended that the complete control valve assembly be stored under cover in a controlled environmental atmosphere in the original packaging. The storage temperature limits are: 20 ºC to 60 ºC (68 ºF to140 ºF) .
Shelf life for elastomers	Inspect O-rings for wear or damage during disassembly of the cover and right before assembling the unit. Replace damaged elastomer. FKM has an unlimited shelf life.
Inspect stored equipment	Examine the internal surfaces and flange faces of the control valve at least once every three months. Repack the control valve as originally received.
Labels and nameplates	Do not remove nameplates or labels. Doing so will void the control valve warranty.
Stacking conditions	When stacking equipment, follow all the safety standards taking into account the type of box used, the maximum height of the equipment, the maximum number of boxes stacked, etc.

4 Prepare the control valve for use

Topics covered in this chapter:

- *Lifting conditions*
- *Lifting requirements for personnel*
- *Configure the control valve*

4.1 Lifting conditions

⚠ WARNING!

CRUSHING HAZARD

During installation or removal of a control valve, always place the unit on a stable platform or surface that supports its assembled weight.

Failure to comply may allow the control valve to roll, resulting in death, serious injury or equipment damage.

⚠ WARNING!

LIFTING HAZARD

The lifting instructions are for installation and removal of a Daniel control valve only and do not address lifting the control valve while it is attached or bolted to piping.

Failure to follow these instructions may result in death, serious injury or equipment damage.

⚠ CAUTION!

FORKLIFT HAZARD

Do not insert the forks of a forklift into the bore when moving the control valve.

Inserting the forks may cause the meter to become unstable, resulting in serious injury or equipment damage.

Table 4-1: Lifting and installation conditions

Conditions	Description
Ventilation and lightning	Install the control valve in a well lit and ventilated location, not less than one meter (approximately three feet) from source of ignition or source of heat which might damage the unit.
Surface considerations	Stable surface.

Table 4-1: Lifting and installation conditions *(continued)*

Conditions	Description
Soil/floor loadings and product/piping support	Follow local procedures that meet the standards for soil/floor loading and product/piping support.

4.2 Lifting requirements for personnel

4.2.1 Safety precautions using appropriately rated lifting slings

⚠ WARNING!

LIFTING HAZARD

The lifting instructions are for installation and removal of a Daniel control valve only and do not address lifting the control valve while it is attached or bolted to piping.

Failure to follow these instructions may result in death, serious injury or equipment damage.

- Only personnel properly trained in the safe practices of rigging and lifting should lift valves.
- Prior to use, visually inspect the slings for any signs of abrasion or other damage. Refer to the sling manufacturer for inspection procedures specific to the sling you are using.
- Never attempt to lift the valve by wrapping slings around the visual indicator, position indicator pilots, needle valves, accessories or tubing.
- Never attempt to lift the valve using only one sling around the valve. Always use two slings wrapped around each end of the body as shown below. Use a choker style sling with a spreader bar.
- Only use slings with ratings that exceed the weight to be lifted. Reference all safety standards for safety factors that must be included when calculating the load rating.

⚠ CAUTION!

SLING HAZARD

Never allow the slings to come in contact with the visual indicator, position indicator, pilots, needle valves, accessories or tubing. Use a spreader bar on the sling to prevent contact.

Failure to comply may cause equipment damage.

- Never apply shock loads to the valve. Always lift the control valve gradually. If shock loading occurs, inspect the slings per manufacturer's procedures before reuse.

⚠ WARNING!

EQUIPMENT HANDLING AND OPERATING HAZARD

Wear personal protective equipment appropriate to the situation when working with the control valve. Adhere to all safety standards and best practices for operating the equipment.

Failure to comply may result in death or serious injury.

4.3 Configure the control valve

The factory configures Daniel control valve internal components. Inspect the internal components before installation.

4.3.1 Orientation and position of the control valve

Flow direction

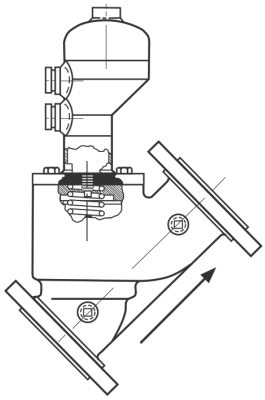
NOTICE

Comply with local government regulations and company requirements.

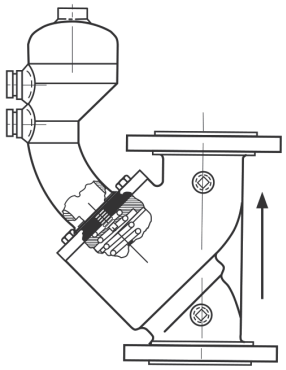
NOTICE

Flush lines to remove welding bead, pipe scale, etc.

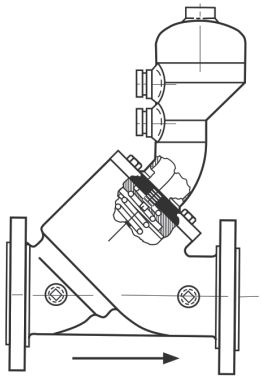
Figure 4-1: Control valve position



Daniel Surge Relief Valve for 45 ° installation



Daniel Surge Relief Valve for vertical installation



Daniel Surge Relief Valve for horizontal installation

⚠ WARNING!

EQUIPMENT HAZARD

Never use this equipment for any purpose other than its intended use.

Failure to comply may result in death, serious personal injury and/or property damage.

4.3.2 Piping recommendations

NOTICE

When installing the control valve, ensure that the bolts conform to the requirements of ASME B16.5 paragraph 5.3 and to the material requirements of ASME B16.5 Table 1B. Gaskets must conform to the requirements of ASME B16.20.

The design of the control valve has not been assessed for the effects of traffic, wind or earthquake loading.

Important

Ensure that piping or other attachments connected to the control valve are not under stress.

Important

Provide fire prevention measures and equipment per local regulations.

Part II
Install

Chapters covered in this part:

- *Installation prerequisites*
- *Installation procedure*
- *Testing the product*

5 Installation prerequisites

Topics covered in this chapter:

- *Pre-start checks*
- *Torque information*
- *Torque values (flanges)*
- *Torque pattern sequences*
- *Tools required for control valve installation*
- *Typical installation*
- *Nitrogen system*
- *Gas plenum tank installation and sizing*
- *Nitrogen system panel*

5.1 Pre-start checks

Ensure that the pipeline is completely free of all foreign material before installing the valve. The design of the control valve has not been assessed for the effects of traffic, wind or earthquake loading. Provide fire prevention measures and equipment per local regulations.

5.2 Torque information

NOTICE

When installing the control valve, ensure that the bolts conform to the requirements of ASME B16.5 paragraph 5.3 and to the material requirements of ASME B16.5 Table 1B. Gaskets must conform to the requirements of ASME B16.20.

Tightening procedure:

1. Lubricate the nuts and bolts.
2. Hand-tighten until the nuts and bolts are snug against the flanges.
3. Use the minimum pressure setting on an air wrench.
4. Use the correct tightening sequence for the bolt flanges.
5. Follow your company's internal flange installation procedures.

Important

Ensure that piping or other attachments connected to the control valve are not under stress.

Important
Provide fire prevention measures and equipment per local regulations.

Flanges with 4 and 8 bolts

- First round - 30% of final torque (flange sequential order)
- Second round- 60% of final torque (flange sequential order)
- Third round - 100% of final torque (flange sequential order)
- One final time - clockwise or counter clockwise sequentially around the flange

Flanges with 12 or more bolts

- First round - 20% of final torque (flange sequential order)
- Second round - 40% of final torque (flange sequential order)
- Third round - 80% of final torque (flange sequential order)
- Fourth round - 100% of final torque (sequential order)
- One final time - clockwise or counter clockwise sequentially around the flange

5.3 Torque values (flanges)

Table 5-1: Reference torque values for Daniel Control Valve (ft-lb) flange connections

Nominal pipe size (NPS)	Daniel Class 150	Daniel Class 300	Daniel Class 600
2	90	90	90
3	90	160	160
4	90	160	250
6	160	160	400
8	160	250	550
10	250	400	800
12	250	550	800
16	400	800	1400

5.4 Torque pattern sequences

Table 5-2: Cross-pattern tightening sequence when using single tool

Nominal pipe size (NPS)	Daniel Class 150	Daniel Class 300	Daniel Class 600
2	1-3-2-4	1-5-3-7 2-6-4-8	1-5-3-7 2-6-4-8

Table 5-2: Cross-pattern tightening sequence when using single tool *(continued)*

Nominal pipe size (NPS)	Daniel Class 150	Daniel Class 300	Daniel Class 600
3	1-3-2-4	1-5-3-7 2-6-4-8	1-5-3-7 2-6-4-8
4	1-5-3-7 2-6-4-8	1-5-3-7 2-6-4-8	1-5-3-7 2-6-4-8
6	1-5-3-7 2-6-4-8	1-7-4-10 2-8-5-11 3-9-6-12	1-7-4-10 2-8-5-11 3-9-6-12
8	1-5-3-7 2-6-4-8	1-7-4-10 2-8-5-11 3-9-6-12	1-7-4-10 2-8-5-11 3-9-6-12
10	1-7-4-10 2-8-5-11 3-9-6-12	1-9-5-13 3-11-7-15 2-10-6-14 4-12-8-16	1-11-6-16 3-13-8-18 5-15-10-20 2-12-7-17 4-14-9-19
12	1-7-4-10 2-8-5-11 3-9-6-12	1-9-5-13 3-11-7-15 2-10-6-14 4-12-8-16	1-11-6-16 3-13-8-18 5-15-10-20 2-12-7-17 4-14-9-19
16	1-9-5-13 3-11-7-15 2-10-6-14 4-12-8-16	1-11-6-16 3-13-8-18 5-15-10-20 2-12-7-17 4-14-9-19	1-11-6-16 3-13-8-18 5-15-10-20 2-12-7-17 4-14-9-19

The position of the number 1 screw determines the position of the clockwise rotation of the subsequent screws.

5.5 Tools required for control valve installation

Flange installation tools

Follow all best practice procedures when installing or removing flanges.

Control valve components

The control valve does not have pre-installation requirements. If installation is required for maintenance purposes, use the following tools:

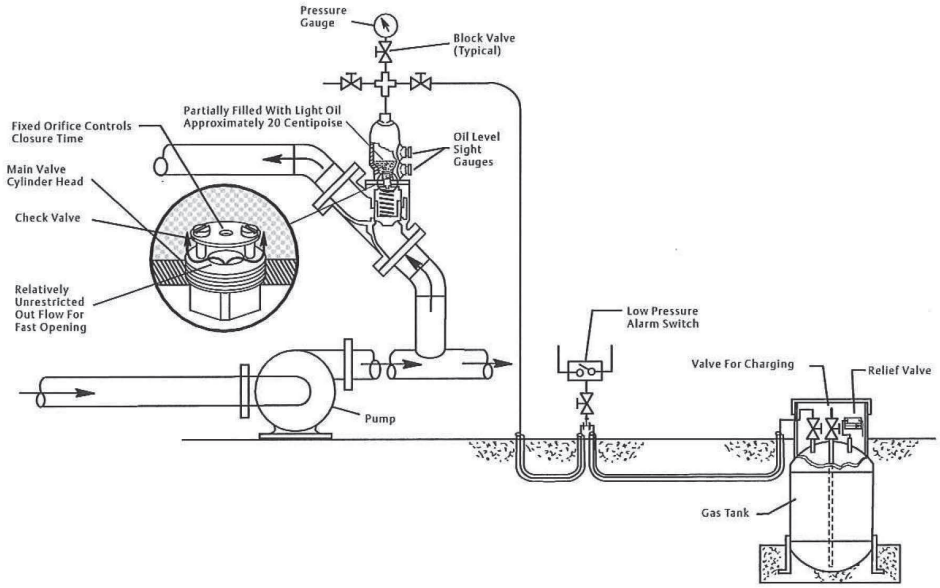
- Socket wrench
- Adjustable wrench
- T-handle or extended Allen wrench
- Arbor press (may be needed for 4- and 6-inch valves)
- Retaining ring pliers

5.6 Typical installation

Although quick opening of the surge relief valve is desirable, if the valve were to shut in a similar time, then further problems could occur - a valve slamming shut can produce hydraulic shock (water hammer) in the system, creating an undesirable secondary surge.

Good surge relief system design will include systems to dampen, or slow the valve, on closing. Often, this requires sophisticated reverse flow when opening and reduced orifice to limit closing speed. This design is extremely versatile and offers the user the opportunity to determine different closing speeds as required by the system when the valve is built.

Figure 5-1: Typical installation - 766 Gas loaded pressure relief valve



NOTICE

The Daniel Models do not comply with any internationally over-pressurization protection recognized codes. What the Daniel Models do is to allow the movement of an undetermined amount of substance *within* a pressurized system, not *from* a pressurized system.

5.7 Nitrogen system

The nitrogen system must supply a constant pressure to the valve, even under conditions of varying ambient temperatures. Normally, the system will be designed to use standard gas bottles and will incorporate a control panel to regulate the nitrogen supply pressure.

Supply pressure should be set at, or close to, the relief pressure required. The valve is a hydraulically balanced piston design which means that the forces applied across the piston are proportional to the pressures. This is particularly important when setting the system up: the gas pressure set point, minus the force exerted by the spring is the relief pressure for the system.

The gas tank should be buried underground or insulated to keep the gas at a constant temperature. Thermal expansion, caused by the increases in temperature of the gas will change the relief set point.

5.8 Gas plenum tank installation and sizing

The gas plenum should be buried underground to keep the gas at a constant temperature. Thermal expansion, caused by increases in temperature, will change the relief set point.

The effective volume of the gas plenum decreases as the valve opens by an amount equal to the piston displacement. The size of the gas plenum determines the percentage that the pressure relief set point will change as the valve opens. For example, a 12" valve piston displacement is 554 cubic inches from a closed to an open position. Thus, when fully opened, an equal amount of gas is contained in a volume that is decreased by 554 cubic inches. From Boyles Law, we can see the proportional increase in pressure as: $P_1V_1 = P_2V_2$. For example, a 12" valve piston displacement is 554 cubic inches from a closed to an open position.

Before the gas tank is sized, determine:

1. Set point (PSI) (1)
2. Valve size
3. Allowable over-pressure (PSI) (1) (typically 10%)

Equation 5-1: Gas plenum sizing formula

$$V = \frac{\left[PD\left(\frac{P_2}{P_1}\right)^{0.709}\right]}{\left[\left(\frac{P_2}{P_1}\right)^{0.709} - 1\right]}$$

No consideration is given to the volume of gas contained in tubing, fittings and the top portion of the valve itself.

Volume displacement (Main valve piston)			
Valve size	Cubic inches	Valve size	Cubic inches
2"	3.7	8"	165
3"	12.6	10"	347
4"	20	12"	554

Volume displacement (Main valve piston)			
6"	66	15"	1,207

Example:

(12" valve, set point 640 psi and over-pressure is 40 psi)

Equation 5-2: Solving V_1

$$V_1 = \frac{576.74779}{0.041061} = 14,046.12in^3$$

$$V_1 = \frac{14,046.121}{231} = 60.80U.S.Gallons\left(TankVolume\right)$$

Note

Valve is fitted with light piston spring which provides:

- 4 psi Preload with valve close
- 6 psi Preload with valve open

This 4 and 6 psi Preload must be subtracted from P_1 & P_2, respectively, to arrive at actual gas pressure.

Conditions assume adiabatic compression.

5.9 Nitrogen system panel

A nitrogen control panel may be advantageous if there are large variations in ambient temperature or if it is not practical to bury the nitrogen plenum underground.

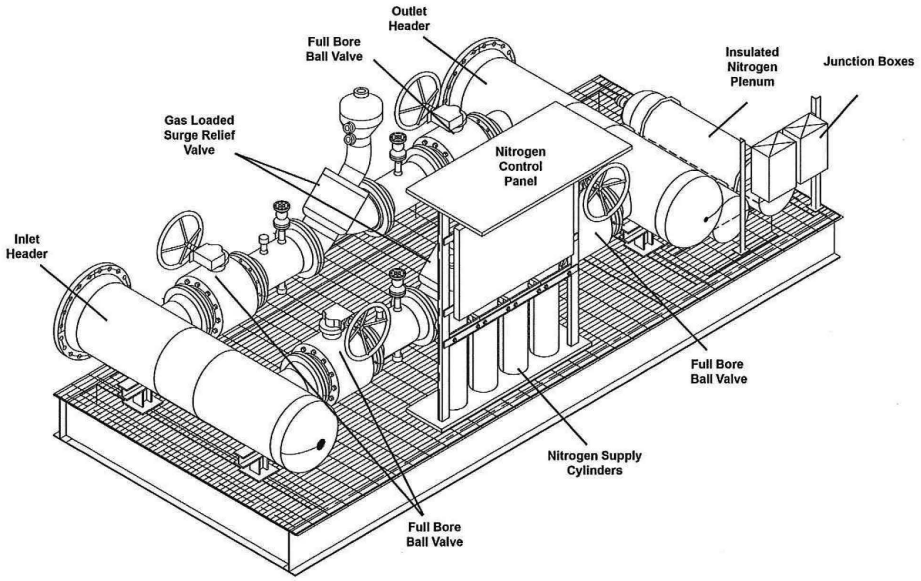
The control panel can be used to provide a precise output which is used to regulate the set point of the gas loaded relief valve.

The Nitrogen Supply Cylinders shown in Figure 5-2 are used as a source of the nitrogen and the control panel will use this to replenish the nitrogen pressure within the valve anytime it falls below the desire set point. Conversely if the set point at the valve is higher than the desired set point, the control panel will relieve the excess pressure from the valve.

Since the Daniel valve does not consume nitrogen, unlike competitive valves, the need to adjust nitrogen is normally due to changes in pressure due to ambient temperatures.

The nitrogen set point pressure is measured using a pressure transmitter, which can be transmitted to a remote control room. The system nitrogen set point is field adjustable by authorized personnel. A complete Daniel control valve system can be furnished that will include the surge relief valve, inlet/outlet piping, nitrogen control panel, supply cylinders and the plenum. The system is carefully designed, engineered and assembled onto a structural skid with a lifting facility (as shown below in Figure 5-2).

Figure 5-2: Surge relief system with nitrogen panel and plenum



6 Installation procedure

Topics covered in this chapter:

- *External components assembly*
- *Oil filling procedure for valve with drain port*

6.1 External components assembly

Install the external components (e.g., flanges) onto the pipeline.

The control valve is assembled at the factory. The components do not need to be uninstalled or reinstalled unless maintenance is required.

⚠ CAUTION!

SURFACE TEMPERATURE HAZARD

The control valve body and piping may be extremely hot or cold.

Wear personal protective equipment appropriate to the situation when working with the control valve. Adhere to your company's safety standards and practices.

Failure to comply may cause serious injury.

6.1.1 Fasteners

The property class of the fastener is in accordance with ASME B16.5.

Stud bolt and nut types

All fasteners (nuts and studs) used in assembling Daniel control valves are made of one of the materials listed in the table below.

Table 6-1: Bolt material selection

Bolt material selection	Description
ASTM SA 193 Grade B7 <63.5 mm (<2.5 in.)	High strength low alloy steel
ASTM SA 193 Grade B7M <63.5 mm (<2.5 in.)	Controlled strength low alloy steel
ASTM SA 320 Grade L7 <63.5 mm (<2.5 in.)	High strength low alloy low temperature steel
ASTM SA 320 Grade L7M <63.5 mm (<2.5 in.)	Controlled hardness low temperature steel
ASTM SA 449 <25.4 mm (<1.0 in.)	Quenched and tempered steel
ASTM SA 453 Grade 660	High temperature stainless steel

Selection of stud bolts and nuts

- Select all fasteners (nuts and studs) used in a hydrostatic test according to the flange size and class listed in ASME B16.5.
- Use the shortest stud bolt that permits full engagement of the thread through the nut by hand-tightening.
- Use only clean, rust-free nuts and stud bolts.

Note

Ensure that once the nut is tightened two threads outside the nut are exposed. The only exception is when a flange requires hydraulic bolt tensioning. The manufacturer of the hydraulic bolt tensioning equipment will specify number of exposed threads outside the nut.

- Do not use damaged or worn stud bolts or nuts.
- Do not use nuts or stud bolts that do not fit together correctly.
- Do not use nuts or stud bolts without grade or type identification.
- Do not mix nuts or stud bolts of different coatings. Different nut and stud bolt coatings require different torques to achieve the same bolt tension.
- Do not assemble nuts with the identification hard stamp against the back face of the flange

Stud bolt and nut storage

Remove each nut and bolt as a pair. Thread the matching nut back onto the bolt. Stack them in a fashion that will not cause thread damage.

Reuse of stud bolts and nuts

The reuse of threaded fasteners is permitted on Daniel control valves under the following conditions:

- Fasteners are clean, free of corrosion, paint, thread damage, cracks, teeth marks (caused by wrenches) or other signs of damage.
- Fasteners are not tightened to or beyond their yield strength.
- Fasteners have not lost their coating.

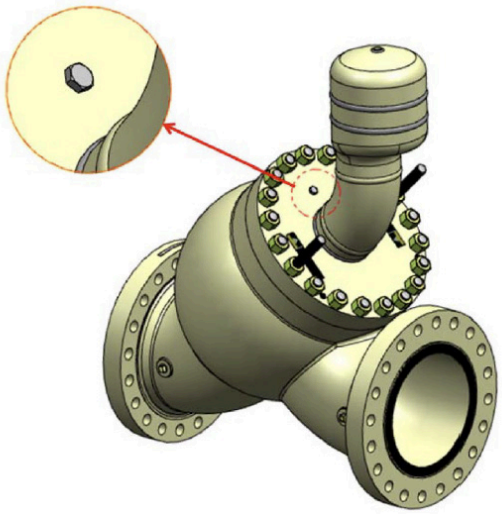
Compare the threads of a used stud bolt with the thread of a new stud bolt. Finger-tighten the nut over the entire thread length of the bolt.

6.2 Oil filling procedure for valve with drain port

The oil reservoir is supplied with two sight gauges. When properly filled and the valve closed, the oil level will be half way between the two sight gauges. In the closed valve position oil is visible only at the lower sight gauge. Oil visible in the upper sight gauge indicates that the valve is in the open position or that the line product is present in the oil reservoir.

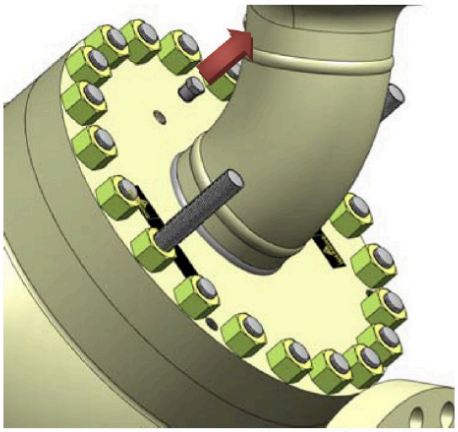
1. a) Locate NPT plug on the Cylinder Head as shown in *Figure 6-1*.

Figure 6-1: NPT plug location



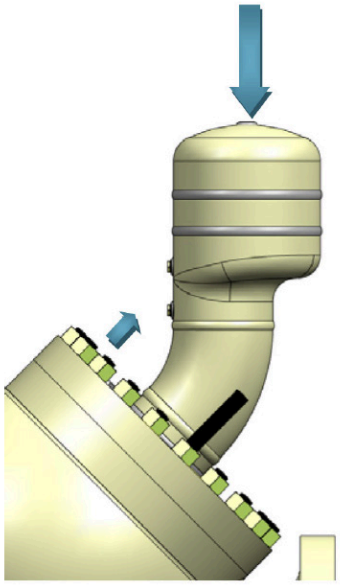
2. Remove plug.

Figure 6-2: Removing NPT plug



3. Pour oil through the reservoir port shown in *Figure 6-3*. The oil should come out of the bleed port.

Figure 6-3: Nitrodome oil port



4. Add Teflon tape or liquid thread sealant to the plug and close the bleed port. Use the recommended torque for this NPT connection.
5. Pour the additional of oil into the reservoir port until the level is just below the top sight gauge.

Table 6-2: Oil reservoir capacities(1)

	Horizontal installation with elbow		45° angle installation without elbow	
Valve size	Quarts	cc's	Quarts	Cubic centemeter
2"	0.5	473	0.4	378
3"	1.75	1,656	1.25	1,183
4"	2.0	1,893	1.5	1,420
6"	6.0	5,678	5.0	4,732
8"	10.875	10,292	8.75	8,281
10"	24.0	22,714	20.5	19,401
12"	43.5	41,168	35.25	33,361
16"	61.0	57,730	44.5	42,115

(1) Consult factory for vertical mounted oil capacities.

7 Testing the product

7.1 Commission the control valve

After installation, commission the control valve to ensure that the equipment is working properly.

1. Inspect all bolts used to secure the control valve in-line to ensure that proper mounting procedures have been followed and that flange connections are leak-free.
2. Evaluate the system setup to ensure that all components are in the correct operating sequence.
3. Evaluate the system setup to ensure that all components are in the correct sequence for accurate product measurement. Some components are isolation valves, strainers, flow straighteners, turbine meters, downstream sections, etc.

⚠ WARNING!

ISOLATING UPPER CHAMBER HAZARD
The only function of the socket-head screws that secure the cylinder head to the cylinder is to provide a mechanical joint between components during assembly or disassembly.

Do not Isolate the upper chamber (Nitrogen Reservoir) during Shell or Hydro Testing, pressure must be applied to the inlet and upper chamber at the same time.

Part III
Operate

8 Operation parameters

Topics covered in this chapter:

- *Control valve normal operation*
- *Features and benefits*
- *Oil reservoir*
- *Applications*

8.1 Control valve normal operation

All series 700 control valves are pressure balanced, single-seated piston operated with 45° body construction.

Unique design features and unit-built construction ensures positive leak-proof performance. In addition, the basic valves body and internals are the same throughout the line, simplifying spare parts inventory and reducing costs.

8.2 Features and benefits

- Balanced piston principle, spring biased
- Linear valve action: Rectangular ports provide smooth linear action with maximum flow and minimum pressure drop
- Uniform speed of response: Uniform area above main piston provides uniform opening and closing.
- Positive (pressure type sealing) O-ring seal and valve seats are not affected by fluid viscosity or pressure drop
- High capacity 45° (in-line) valve body ensures high capacity at low pressure drop
- Zero leakage: Contoured edge of piston provides a tight seal and ensures drip-tight operation and dead-end service
- Unit-built construction: All internal parts, including seat ring, can be removed as a unit without disturbing valve body and connections.
- Simple design: No diaphragms or stuffing boxes

8.3 Oil reservoir

The Oil reservoir is supplied with two (2) sight gauges. In a closed position, the oil is visible only at the lower sight gauge. Should oil be visible in the upper sight gauge, this indicates line product is leaking into the reservoir or that the valve is open. If no oil is visible in the lower sight gauge, this indicates the reservoir oil is leaking into the product stream.

Oil specifications

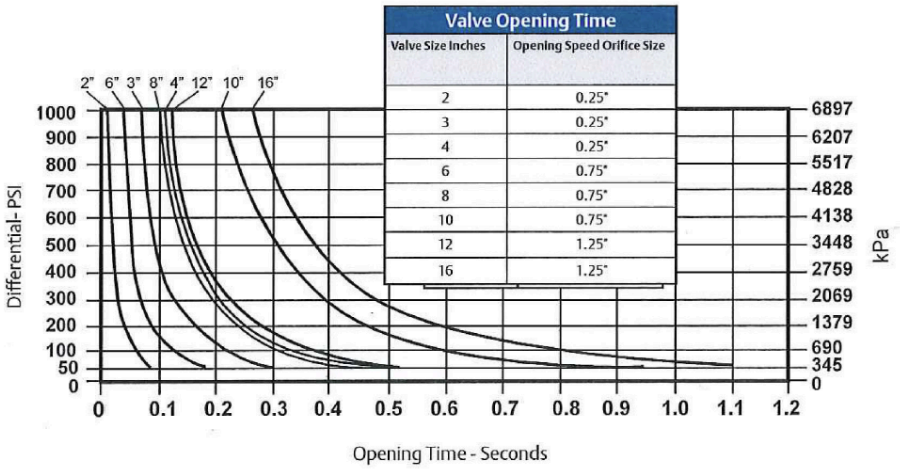
Use a light weight non-detergent oil between 5-30 Centipoise based on climate conditions of user.

The oil to fill the reservoir, gas tank, pressure switch and other interconnecting pieces is to be supplied by the customer.

Opening/Closing speed

The opening speed of the valve is virtually unrestricted. Closing speed is standard at three (3) seconds from a full open position, based on gas pressure being 25 psi (1,724 kPa) above line pressure. The fastest closure is limited to 0.5 seconds at 1,500 seat ring. For closure speeds longer than three (3) seconds, the orifice size can be changed to match customer requirements. It should be noted that the calculated closing speeds are a function of the viscosity of the oil in the reservoir. Typical valve opening times are illustrated in *Figure 8-1* below .

Figure 8-1: Typical valve opening time



Pressure switch

The valve will open any time gas pressure is less than line pressure. A pressure switch is recommended in the gas supply line to the valve for alarm actuation should gas pressure decrease below an acceptable operating level.

8.4 Applications

NOTICE

The Daniel Models do not comply with any internationally over-pressurization protection recognized codes. What the Daniel Models do is to allow the movement of an undetermined amount of substance *within* a pressurized system, not *from* a pressurized system.

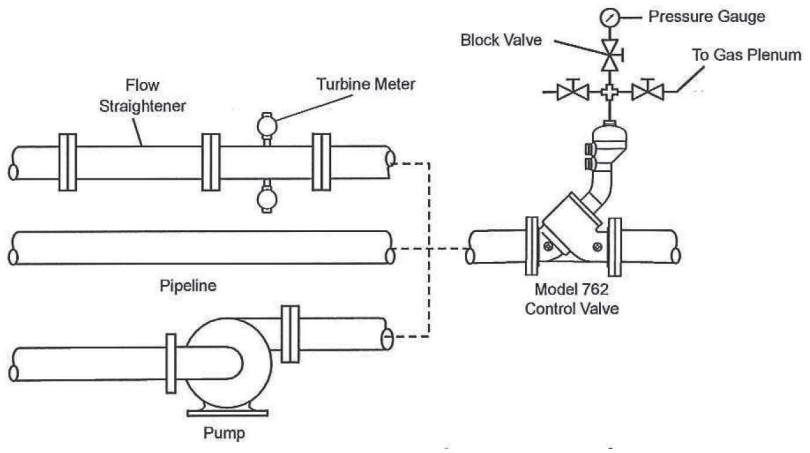
Back pressure control

The Model 762 is ideally suited for back pressure control and minimum pressure drop. When line pressure exceeds the gas pressure, the valve will open and follow the C_v curve for pressure loss.

Typical applications for minimum back pressure control requirements are illustrated in *Figure 8-2*.

- Reference API Chapter 5 for minimum back pressure requirements of the turbine and ultrasonic meters.
- On the end of a pipeline or any point along the pipeline where the upstream pressure is subject to drop below minimum requirements.
- Discharge of centrifugal pumps to maintain maximum efficiency and to start against a closed valve.

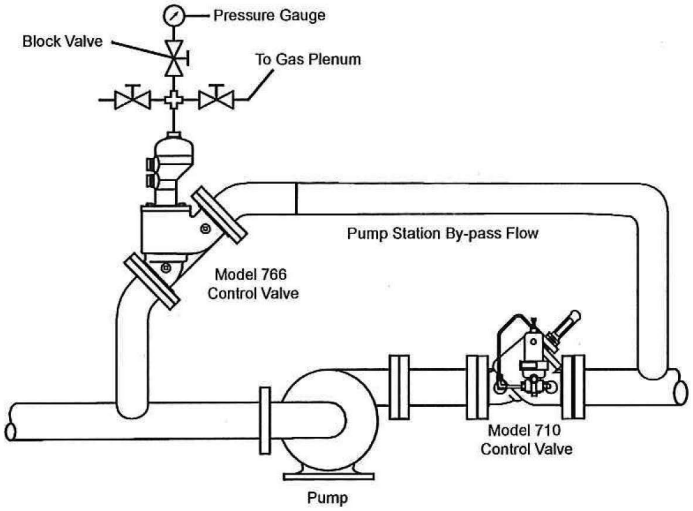
Figure 8-2: Back pressure control



Pipeline pump station by-pass

Most pipeline have booster pumps at intervals along the pipeline. If a pump station is shut-down, it must be by-passed or the entire pipeline is subject to being shutdown. The Model 766 control valve, when installed as shown in *Figure 8-3*, will automatically open and by-pass the pump station when line pressure exceeds set point.

Figure 8-3: Pipeline pump station by-pass



Part IV
Maintain

Chapters covered in this part:

- *Planned maintenance*
- *Corrective maintenance*
- *Spare parts*
- *Decommission*

9 Planned maintenance

Topics covered in this chapter:

- *Maintenance considerations*
- *Tools required for mechanical components*
- *Disassemble/Assemble the control valve*
- *Mechanical assembly*
- *Planned maintenance tasks*

9.1 Maintenance considerations

Read and understand all instructions and operating procedures before performing maintenance procedure, internal component inspection, or field requirement changes.

To ensure safe and accurate performance, only informed and trained personnel should install, operate, repair and maintain this product.

Follow the recommendations below before servicing the control valve:

1. Label all parts or place parts in labeled containers during disassembly.
2. Do not use metal clamping devices in direct contact with any control valve part or surface.

Important

All control valve adjustments were completed at the factory during liquid calibration and should not require field setup.

9.2 Tools required for mechanical components

Flange installation tools

Follow all best practice procedures when installing or removing flanges.

Control valve components

The control valve does not have pre-installation requirements. If installation is required for maintenance purposes, use the following tools:

- Socket wrench
- Adjustable wrench
- T-handle or extended Allen wrench
- Arbor press (may be needed for 4- and 6-inch valves)

9.3 Disassemble/Assemble the control valve

Before removing the control valve from the system, the following precautions must be taken:

The meter must be cleaned completely inside the housing components and stored/ shipped as it was received.

1. Label all parts or place parts in labeled containers during disassembly.
2. Do not use metal clamping devices in direct contact with any control valve part or surface.

The control valve must be cleaned completely inside the housing components and stored/ shipped as it was received. Refer to Storage Preparations for cleaning instructions.

After the meter is shut down, refer to *Disassembly* for the detailed disassembly procedure.

After the previous steps have taken place, assemble the control valve per the instructions in*Section 9.4* .

9.3.1 Cylinder disassembly (NPS 2-12)

1. Remove the nuts that secure the cylinder head to the valve body.
2. Alternately tighten the jack-out screws until the cylinder assembly is free to be lifted out of the valve body.
3. Lift the cylinder assembly by the cylinder head. Remove it from the valve body and set it in a vertical position with the cylinder head on top.
4. Before removing the screws, place the cylinder assembly in an arbor press to immobilize the cylinder head. This is to prevent sudden spring pressure from being released and causing injury or damage.

⚠ CAUTION!

SPRING PRESSURE HAZARD

Follow the instructions in step 5.

Failure to comply may cause release of spring pressure, resulting in serious injury or equipment damage.

5. Use an Allen wrench to remove the screws that secure the cylinder head to the cylinder, and then gradually release the arbor press to remove the cylinder head from the cylinder. Remove the indicator guard and the upper bearing first, if your valve has a position indicator.
6. Remove the valve spring, indicator stem, retaining ring, washer, and piston from the cylinder. Remove only the valve spring and the piston if your valve does not have a position indicator.
7. Turn the cylinder over with the ports on top when removing the high pressure seat ring. Remove the set screw from the seat ring. Turn the seat ring counterclockwise to remove the seat ring and then remove the O-ring from the cylinder.

9.3.2 Cylinder disassembly NPS 16 valve only

Important

The 16" valve does NOT disassemble as a complete assembly. The first step is to remove the cylinder head from the valve body.

Prerequisites

The construction of the NPS 16 valve cylinder assembly is different from all other valve cylinder assemblies and requires different procedures. The following tools are needed to disassemble and reassemble the control valve.

- Socket wrench
- Adjustable wrench
- Extended allen wrench set
- Mallet and cold chisel
- Appropriate lifting gear and sling
- (2) all thread rods, 3/4" no. 10x18"-24" long
- (2) 3/4" no. 10x2" bolts with 3/4" flatwashers
- Hand pump
- Drip pan
- (3) hoist rings 1"-8" nnc 10,000 lb, part number 1-504-90-094

Procedure

1. Completely block all product flow to the valve and drain the process line.
2. Disconnect "Y" port on top of cylinder head and relieve pressure in the valve.

⚠ WARNING!

SPRING FORCE HAZARD

Use extreme caution when removing the cylinder head from the valve body.

Failure to disassemble or reassemble the valve without carefully being aware of the force of the spring against the cylinder head may result in death, serious injury or damage to the equipment.

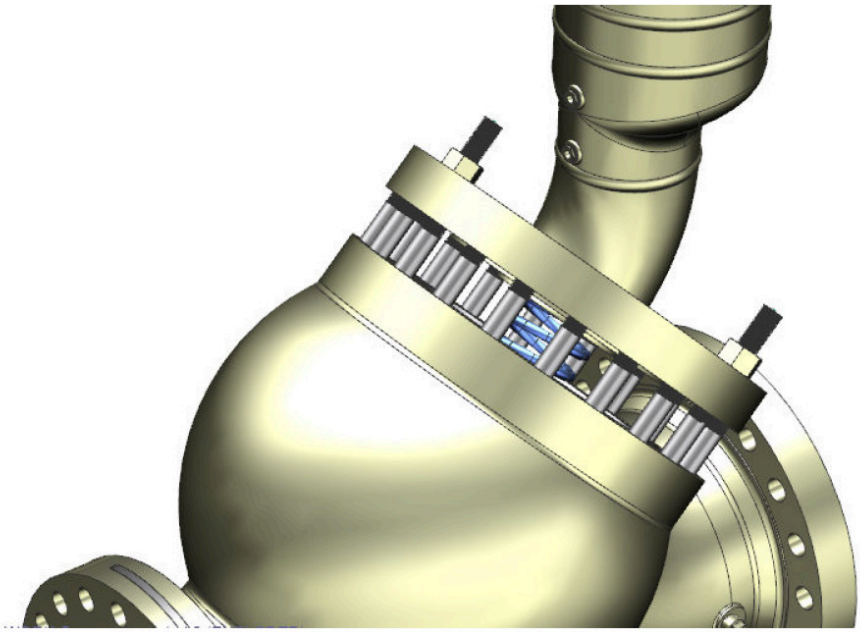
⚠ WARNING!

SPRING TENSION HAZARD

Do not remove jack screws (long bolts). Jack screws are spring tension retaining devices and must NOT be tampered with. Follow disassembly procedure above.

Failure to comply with instructions may result in serious personal injury or damage to the equipment.

Figure 9-1: Models 762, 763, 765, 766 and 767 Control Valve jack screws and spring



3. Product remains in the valve below the cylinder head in the piston. Place a drip pan below the valve before starting step 4 (removal of the cylinder head).
4. Remove nuts; except the jack screws (long bolts).
5. Alternatively, loosen the remaining two nuts from threaded rods allowing the cylinder head to slowly raise from the valve body and relieve spring tension. Oil from the piston will flow into drip pan. It is important to avoid damaging or bending the threaded rods during this operation.
6. Once spring tension is fully relieved, remove remaining nuts from threaded rods and lift cylinder head and reservoir away from threaded rods.
7. Remove spring from valve.
8. Use a hand pump to remove the remaining oil from the cylinder/piston assembly.
9. Insert (2) 3/4" - 10 N.C. bolts with large washers behind bolt heads into threaded holes in the cylinder.
10. Use a chain or other suitable lifting device attached to the bolts and carefully remove the cylinder and piston from the valve body.
11. Secure the cylinder assembly and remove the piston from the cylinder by pushing the bottom of the piston.
12. Remove (24) bolts (item 12) while holding the seal ring to the cylinder. Remove the seal ring and the seat O-ring.
13. Inspect all components, remove any foreign material and replace O-rings, as necessary.

9.4 Mechanical assembly

9.4.1 Valve torque specifications

Table 9-1: Valve cylinder head torque specifications (stud-nuts)

Valve size (in)	Daniel Class	Num. bolts	Min. torque (lbs/ft)
2	150	6	6
	300	6	15
	600	6	67
3	150	6	15
	300	6	40
	600	8	49
4	150	8	13
	300	8	35
	600	8	100
6	150	8	18
	300	8	46
	600	10	211
8	150	10	51
	300	10	132
	600	12	274
10	150	12	67
	300	12	199
	400	16	216
	600	16	369
12	150	12	117
	300	12	302
	600	16	565
16	150	20	142
	300	20	368
	600	20	922

Table 9-2: Torque specification for socket-head screws

Nominal pipe size	Daniel Class	Max Torque (ft-lb)
6"	600	5
8"	600	11

Table 9-2: Torque specification for socket-head screws *(continued)*

Nominal pipe size	Daniel Class	Max Torque (ft-lb)
10" - 12"	600	17

Table 9-3: Check valve shoulder screws

Valve size	Screw size	Max torque (in-lb)
2-4	4-40 UNC	5.2
6-16	8-32 UNC	19.8

⚠ WARNING!

OVER-TORQUING SCREWS HAZARD
The only function of the socket-head screws that secure the cylinder head to the cylinder is to provide a mechanical joint between components during assembly or disassembly.

Do not Over torque the screws during assembly, see *Table 9-2*.

9.4.2 Cylinder reassembly (2" - 12" valves with socket head screws in circular pattern on cylinder head) B style

NOTICE

Lightly coat the O-rings with a high grade lubricant to ensure proper seal and assist in the reassembly procedure. All O-rings should be inspected for nicks, cuts, distortion or other signs of wear and be replaced as required.

Procedure

1. Install check valve assembly, if removed.
2. Return the O-rings to the cylinder head.
3. Reinstall the O-ring (seat ring) and sealing ring (clockwise). Tighten locking set screw (8).
4. Reinstall the piston O-rings or Spring energized seals.
5. Insert the piston in the cylinder followed by the spring.
6. Assemble the cylinder and cylinder head, compressing the spring.

⚠ CAUTION!

CYLINDER RELEASE HAZARD

The cylinder assembly is now spring loaded and should be handled with extreme care.

Failure to comply may cause serious injury or damage to the equipment.

7. Insert and tighten the cylinder socket head screws maintaining sufficient force to hold the cylinder and the cylinder head together.

⚠ WARNING!

OVER-TORQUING SCREWS HAZARD
The only function of the socket-head screws that secure the cylinder head to the cylinder is to provide a mechanical joint between components during assembly or disassembly.

Do not Over torque the screws during assembly, see *Table 9-2*.

⚠ WARNING!

ISOLATING UPPER CHAMBER HAZARD
The only function of the socket-head screws that secure the cylinder head to the cylinder is to provide a mechanical joint between components during assembly or disassembly.

Do not Isolate the upper chamber (Nitrogen Reservoir) during Shell or Hydro Testing, pressure must be applied to the inlet and upper chamber at the same time.

8. Return the jacket screws (6) to the original position.
9. Install O-rings on the outside of the cylinder.
10. Reinsert the cylinder assembly into the valve body.
11. Return the cylinder head assembly to its original position and lock into place using the original studs and bolts. (It may be necessary to tap the cylinder assembly home in the valve body.)
12. Fill the reservoir with the correct amount of oil. The level will be between the two sight glasses.
13. Re-establish nitrogen line connections to the valve.
14. Open nitrogen lines to the tank and establish the required pressure.

9.4.3 Cylinder reassembly (NPS 16 valve only)

1. Reinstall seat O-ring and seal ring and tighten (24) bolts.

Important
Lightly coat the O-rings with a high grade lubricant to ensure proper seal. Inspect all O-rings for nicks, cuts, distortion or other signs of wear and replace as required.

2. Carefully reinstall piston into cylinder assembly.
3. Install outside cylinder O-ring.
4. Using ¾" - 10 bolts and suitable lifting device, reinstall cylinder and piston assembly back into valve body.
5. Remove ¾" - 10 bolts from cylinder. Reinstall spring into valve.
6. Reverse jack-out nut procedure to alternately tighten.
7. Reinstall cylinder head and reservoir to valve body.

8. Reinstall and tighten nuts.
9. Remove (2) long rods. Reinstall studs.
10. Re-establish nitrogen line connections to the valve.
11. Open all product flow to the valve.
12. Return the valve to service.

9.5 Planned maintenance tasks

Table 9-4: Planned maintenance tasks

Task	Recommended action
Inspect	Implement a periodic inspection program to ensure all parts are free from damage during its use due to process, ambient or other abnormal conditions. • Internal components: cylinder, piston, spring, cylinder head, seat retainer • Control valve body • Bolting
Clean	Use a non-toxic metal cleaning solvent. Do not use common petrochemical solvents like Benzene, Toluene or Xylene as they can pose potential health hazards.
Monitor corrosion / erosion / wear	A careful review of the control valve proving history, such as control valve factor control charts, can reveal potential problems bearing drag due to wear or increased internal cross-sectional area due to erosion.
Part (seal) replacement	Visual inspection of the O-rings is recommended once a year and replacement of the O-rings is recommended at least once every five years. Follow internal procedures for part replacement. Do not twist or overstretch the O-ring during assembly.
Corrosion monitoring	Daniel recommends visually inspecting the control valve for corrosion in the internal components at least once a year. Follow internal procedures for corrosion. The valve was designed without corrosion allowance. Periodically inspect the valve's metal parts for corrosion and erosion, and inspect the seals and O-rings for wear and chemical damage.
Lubricant information	High-viscosity silicone oil with a temperature range of -54° C to 204° C (-65° F to 400° F).
Proper lubrication procedure	Lubricate the entire surface of the O-ring before installation with a thin layer of high-viscosity silicone oil. Remove excess lubricant.

Procedure

1. Inspect all bolts used to secure the control valve in-line to ensure that proper mounting procedures have been followed and that flange connections are leak-free.
2. Evaluate the system setup to ensure that all components are in the correct operating sequence.
3. Evaluate the system setup to ensure that all components are in the correct sequence for accurate product measurement. Some components are isolation valves, strainers, flow straighteners, turbine meters, downstream sections, etc.

⚠ WARNING!

ISOLATING UPPER CHAMBER HAZARD
The only function of the socket-head screws that secure the cylinder head to the cylinder is to provide a mechanical joint between components during assembly or disassembly.

Do not Isolate the upper chamber (Nitrogen Reservoir) during Shell or Hydro Testing, pressure must be applied to the inlet and upper chamber at the same time.

10 Corrective maintenance

Topics covered in this chapter:

- *Control valve troubleshooting*
- *Verify the return to operational condition*

10.1 Control valve troubleshooting

Use the table below to troubleshoot the control valve. Contact the nearest Flow Lifecycle Services center for assistance with repairs of Daniel products. It is important that servicing be performed by trained and qualified service personnel.

Table 10-1: Troubleshooting issues for 765 Control Valves

Condition	Probable cause	Correction (1)
Valve will not open	Upstream valve is closed	Open upstream valve.
	Pump is not operating	Start pump and check for cavitation.
	Downstream valve is closed	Open downstream valve. (Check coupler on bottom loading units and internal valve in truck.)
	Insufficient pressure	Check pump. Check bypass and strainer located in line.
	Swollen O-rings	Disassemble valve and replace O-rings. Check compatibility of O-rings with product.
Valve opens too slowly	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	Foreign material 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.

(1) Refer to Mechanical disassembly procedures.

10.2 Verify the return to operational condition

Once corrective maintenance has taken place, verify that the control valve is working properly by following the steps below.

11 Spare parts

11.1 Recommended spare parts

Table 11-1: Recommended spare parts

Description	NPS	Daniel Class	Elastomer	O-ring kit
Valve Assembly O-ring kit	2	150-300	Buna-N	W520155-690
			EPR	W520155-697
			FFKM	W520155-695
			Aggressive Products	W520155-696
			CR	W520155-693
			FKM	W520155-692
			FKM GFLT	W520155-69G
			FKM V1289	W520155-69M
		600	Buna-N	W526750-690
			EPR	W526750-697
			FFKM	W526750-695
			Aggressive Products	W520155-696
			CR	W526750-693
			FKM	W526750-692
			FKM GFLT	W526750-69G
			FKM V1289	W526750-69M
	3	150-300	Buna-N	W530155-690
			EPR	W530155-697
			FFKM	W530155-695
			Aggressive Products	W530155-696
			CR	W530155-693
			FKM	W530155-692
			FKM GFLT	W530155-69G
			FKM V1289	W530155-69M
		600	Buna-N	W536750-690
			EPR	W536750-697
			FFKM	W536750-695
			Aggressive Products	W530155-696
			CR	W536750-693
			FKM	W536750-692

Table 11-1: Recommended spare parts *(continued)*

Description	NPS	Daniel Class	Elastomer	O-ring kit
			FKM GFLT	W536750-69G
			FKM V1289	W536750-69M
	4	150-300	Buna-N	W540155-690
			EPR	W540155-697
			FFKM	W540155-695
			Aggressive Products	W540155-696
			CR	W540155-693
			FKM	W540155-692
			FKM GFLT	W540155-69G
			FKM V1289	W540155-69M
		600	Buna-N	W546750-690
			EPR	W546750-697
			FFKM	W546750-695
			Aggressive Products	W540155-696
			CR	W546750-693
			FKM	W546750-692
			FKM GFLT	W546750-69G
			FKM V1289	W546750-69M
	6	150-300	Buna-N	W560155-690
			EPR	W560155-697
			FFKM	W560155-695
			Aggressive Products	W560155-696
			CR	W560155-693
			FKM	W560155-692
			FKM GFLT	W560155-69G
			FKM V1289	W560155-69M
		600	Buna-N	W566750-690
			EPR	W566750-697
			FFKM	W566750-695
			Aggressive Products	W560155-696
			CR	W566750-693
			FKM	W566750-692
			FKM GFLT	W566750-69G
			FKM V1289	W566750-69M
	8	150-300	Buna-N	W580155-690
			EPR	W580155-697

Table 11-1: Recommended spare parts *(continued)*

Description	NPS	Daniel Class	Elastomer	O-ring kit
			FFKM	W580155-695
			Aggressive Products	W580155-696
			CR	W580155-693
			FKM	W580155-692
			FKM GFLT	W580155-69G
			FKM V1289	W580155-69M
		600	Buna-N	W586750-690
			EPR	W586750-697
			FFKM	W586750-695
			Aggressive Products	W580155-696
			CR	W586750-693
			FKM	W586750-692
			FKM GFLT	W586750-69G
			FKM V1289	W586750-69M
	10	150-300	Buna-N	W600155-690
			EPR	W600155-697
			FFKM	W600155-695
			Aggressive Products	W600155-696
			CR	W600155-693
			FKM	W600155-692
			FKM GFLT	W600155-69G
			FKM V1289	W600155-69M
		600	Buna-N	W606750-690
			EPR	W606750-697
			FFKM	W606750-695
			Aggressive Products	W600155-696
			CR	W606750-693
			FKM	W606750-692
			FKM GFLT	W606750-69G
			FKM V1289	W606750-69M
	12	150-300	Buna-N	W620155-690
			EPR	W620155-697
			FFKM	W620155-695
			Aggressive Products	W620155-696
			CR	W620155-696
			FKM	W620155-692

Table 11-1: Recommended spare parts *(continued)*

Description	NPS	Daniel Class	Elastomer	O-ring kit
			FKM GFLT	W620155-69G
			FKM V1289	W620155-69M
		600	Buna-N	W626750-690
			EPR	W626750-697
			FFKM	W626750-695
			Aggressive Products	W620155-696
			CR	W626750-693
			FKM	W626750-692
			FKM GFLT	W626750-69G
			FKM V1289	W626750-69M
	16	150-300	Buna-N	W660155-690
			EPR	W660155-697
			FFKM	W660155-695
			Aggressive Products	W660155-696
			CR	W660155-693
			FKM	W660155-692
			FKM GFLT	W660155-69G
			FKM V1289	W660155-69M
		600	Buna-N	W666750-690
			EPR	W666750-697
			FFKM	W666750-695
			Aggressive Products	W660155-696
			CR	W666750-693
			FKM	W666750-692
			FKM GFLT	W666750-69G
			FKM V1289	W666750-69M

Note

For Class 150-300 discard the small O-rings and teflon back up rings. Those are intended for valves with position indicator.

Order spare parts

Contact Flow Lifecycle Services for Daniel products and provide the following information when ordering parts:

- Daniel control valve serial number
- Part number

- Part description
- Quantity

12 Decommission

Topics covered in this chapter:

- *Shut down the control valve*
- *Shipment of the control valve*

12.1 Shut down the control valve

Follow the steps below to shut down and disassemble the control valve for storage or shipment.

⚠ WARNING!

PRESSURE HAZARD

The control valve is subject to pressurized fluids. Isolate the control valve upstream and downstream.

Always depressurize the control valve before disassembly.

Failure to comply may cause high pressure fluids to leak, resulting in death or serious injury.

Procedure

1. Ensure that the valve is free of contaminants.
2. Drain the valve of liquids.
3. Clean the valve components.
4. Label all parts or place parts in labeled containers during disassembly.
5. Do not use metal clamping devices in direct contact with control valve parts or surfaces.

12.2 Shipment of the control valve

Refer to Flow Lifecycle Services for Daniel products information in the preface of this document.

With over 90 years of experience, Daniel is the only manufacturer that has the knowledge and experience to engineer and offer superior products that are trusted to provide the most reliable and accurate measurements in the global oil and gas industry.

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