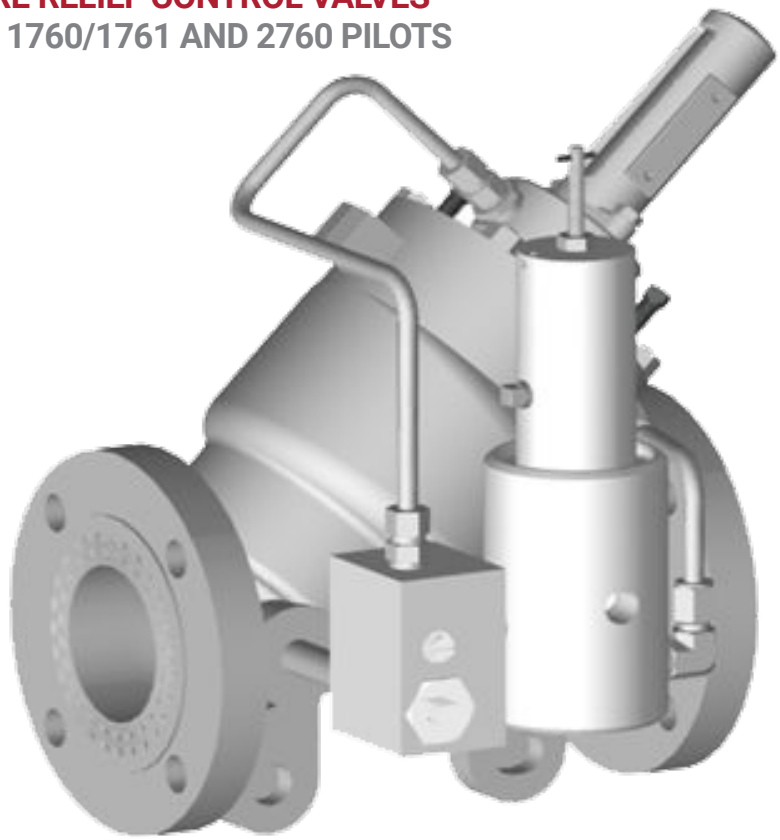
DANIEL®
CONTROL VALVES
USER MANUAL

BACK PRESSURE/PRESSURE RELIEF CONTROL VALVES
MODELS 760/761 - MODELS 1760/1761 AND 2760 PILOTS



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 1-346-509-3700. You may also download the correct manual from: *https://daniel.com/control-valves/series-700-external-pilot-operated-liquid-control-valves/*
- 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 1-346-509-3700. You may also download the correct manual from: *http://www.daniel.com/*.
- 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.
- 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.

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Part I
Plan

Chapters covered in this part:

- *Introduction*
- *Operating conditions and specifications*

1 Introduction

Topics covered in this chapter:

- *Purpose of this manual*
- *Description of the Models 760 and 761 Control Valves*
- *Agency certifications for the Models 760 and 761 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® Back Pressure/Pressure Relief Control Valves 760 and 761 and Models 1760/1761 and 2760 Pilots manual, 3-9008-558*. 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.

NOTICE

Use this manual along with the Series 700B Control Valves manual.

1.2 Description of the Models 760 and 761 Control Valves

1.2.1 Control valve general features

Daniel® Model 760 and 761 Control Valves are designed to maintain a specific minimum upstream pressure regardless of fluctuations in flow rate or downstream pressure. When correctly installed and adjusted, these valves will maintain upstream pressure at a value within 13.79 kPa (2 psi) of the valve pilot's setting. A minimum pressure differential across the valve of 69 kPa (10 psi) is required for it to fully open.

1.2.2 Operation overview of the control valve

The Models 760 and 761 Daniel® Control Valves are designed to regulate back pressure within +/- 13.8 kPa (2 psi) or closer, regardless of the variations in flow rate or downstream pressure. The pilots are balanced, single seated valves with large ports and are not affected by variations in downstream pressure.

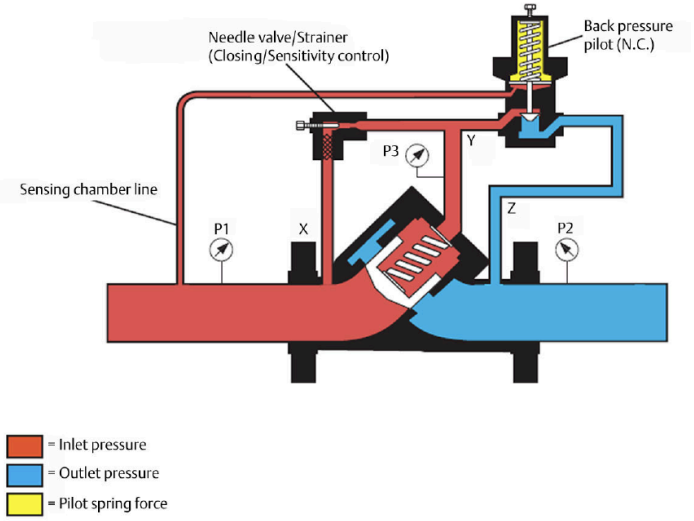
The Models 760 and 761 operate on a balanced-piston principle. When pressures on both sides of the piston are equalized, a spring located on top of the piston acts as a differential force and closes the piston. When the pressure against the bottom of the piston exceeds the pressure plus the force of the spring exerted against the top of the piston, spring tension is overcome, and the valve opens.

It is from this principle of operation that all variations of control with the use of pilot valves and accessories are made. Back pressure pilots control pressure applied to the spring side of the main valve piston, acting as a variable orifice, which in turn allows the main valve to regulate upstream pressure.

Closed position

Figure 1-1 illustrates the closed valve. Inlet pressure (P1) is less than the pilot spring setting, indicating the main line upstream (P1) is closed, or pressure is not sufficient to overcome the pilot spring setting. Pilot is closed. Y-port (P3) to Z-port (P2) is closed. X-port (P-1) and Y-port (P3) pressures are balanced. The main valve spring, being the differential force, closes the valve and keeps the piston seated.

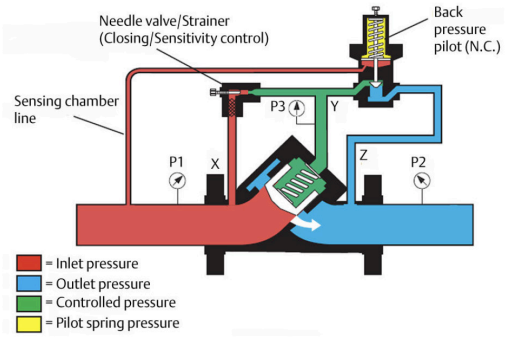
Figure 1-1: Closed position



Open controlled position

Figure 1-2 illustrates the valve partially open. Inlet pressure (P1) has slightly exceeded the pilot spring setting. Z-port (P2) is being opened by the throttling of the pilot, reducing the pressure on Y-port (P3). The decreasing pressure at Y-port (P3) plus the main valve spring force positions the valve piston so that it balances inlet (P1) pressure equal to the pilot setting (Plus or minus 2 psi).

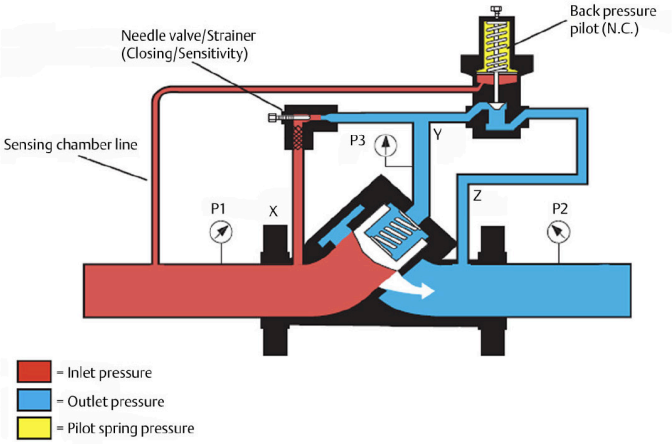
Figure 1-2: Open controlled position



Fully open - no control

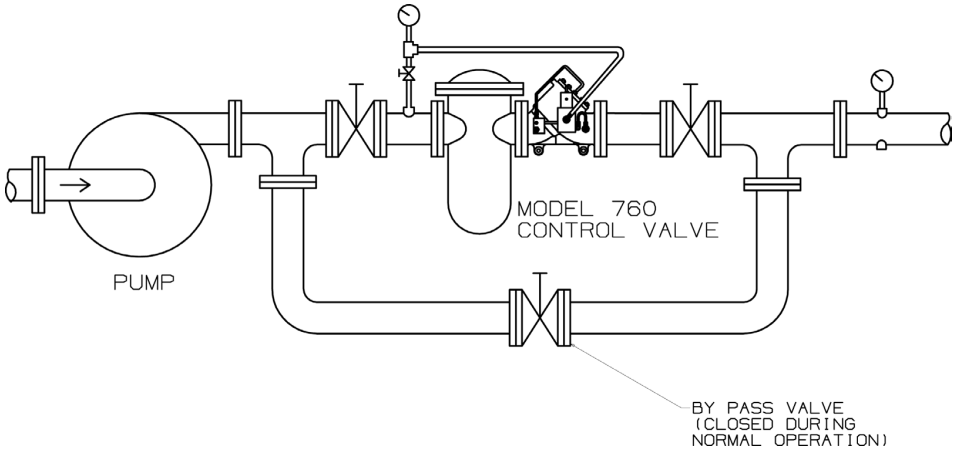
In *Figure 1-3* the valve is fully open. Inlet pressure (P1) is greater than the pilot setting. Y-port (P3) is open to Z-port (P2). The valve is floating in the stream and no flow control is required.

Figure 1-3: Fully open - no control position



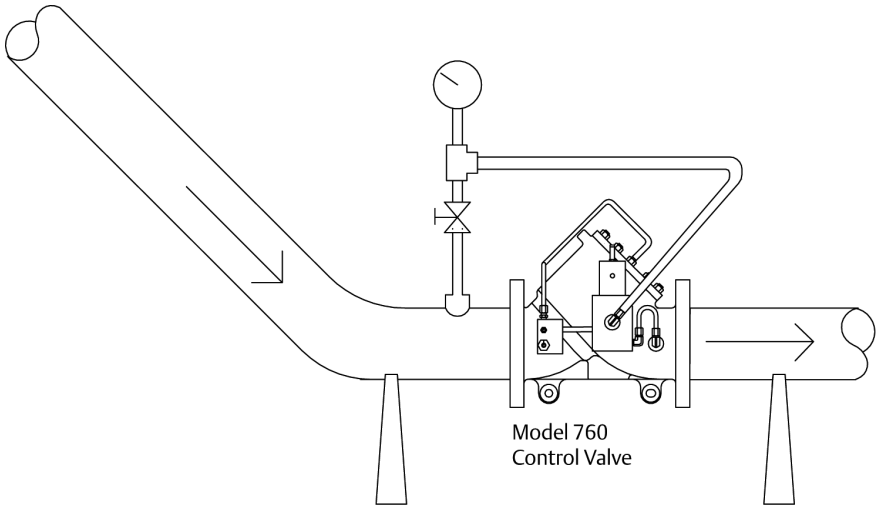
The Model 760 (refer to *Figure 1-4*) is used to maintain constant pressure at the pump discharge. The valve opens when a predetermined pressure is reached, allows flow to start, and then regulates back pressure on the pump within ±13.8 kPa (2 psi).

Figure 1-4: Model 760 control valve - constant pressure



Model 760 (refer to *Figure 1-5*) is installed in a pipeline at the bottom of an incline. The valve will maintain a back pressure equal to head pressure and prevent liquid separation.

Figure 1-5: Model 760 control valve - constant pressure



The Model 761 Control Valve illustrated in *Figure 1-6* is applied either as a relief valve to protect the line against excessive pressure and surge or as a pump by-pass valve to maintain a constant pump discharge. Flow through the valve may be piped to storage, to pump suction, to a sump, or to atmosphere.

The Models 760 and 761 valves are controlled by a normally closed pilot that senses line pressure at a point upstream of the valve and throttles the valve to maintain a desired minimum pressure at that point. If line pressure at the sense point exceeds the setting of the pilot, the pilot allows the valve to open until the correct pressure level is reached.

Conversely, if line pressure at the sense point falls below the setting of the pilot, the pilot throttles the valve closed until the correct pressure level is reached. This operation may be more easily understood by referring to the typical installations. *Figure 1-4* and *Figure 1-5* show a Model 760 used as a back pressure valve, while *Figure 1-6* shows a Model 761 used as a pressure relief/pump bypass valve. In the static condition, both the pilot and valve are closed. When the pump is activated, the initial pressure developed at the valve intake is applied to the top of the valve piston, keeping it tightly seated and preventing all flow.

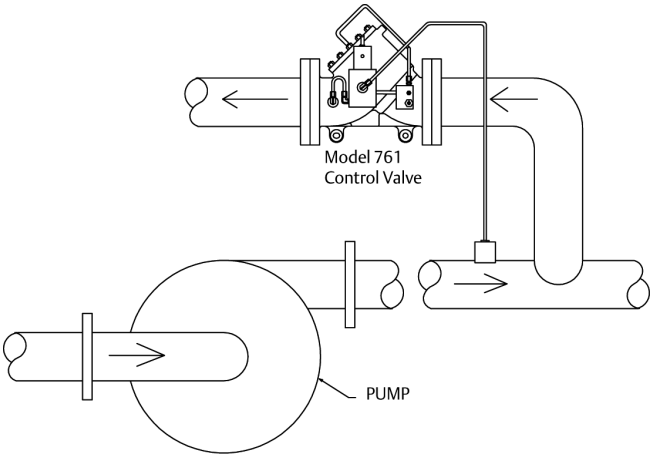
As pump discharge pressure rises, however, it soon exceeds the set point of the pilot, which then opens the valve to provide flow. Once the valve has opened and a continuous flow is established, the pilot monitors upstream pressure and compares it with the set point. If upstream pressure is greater than the set point, the pilot vents the pressure on top of the valve piston downstream, and the valve opens wider to conduct more flow.

If upstream pressure is less than the set point, however, the pilot applies additional pressure to the top of the valve piston, and the valve throttles closed to restrict flow. The valve will limit flow in this manner in order to maintain the required minimum back pressure. The needle valve is a sensitivity adjustment used to regulate the speed at which the valve responds. It also controls valve closing speed.

The Model 760 and 761 valves are identical in their construction. Different model numbers are used to differentiate between the applications.

When control of this valve is transferred to downstream pressure by the 3-way spring return valve, the Model 760 will close if downstream pressure drops below the pilot spring setting. The valve is initially opened and reset by actuating the 3-way valve to momentarily apply valve inlet pressure to the pilot and open the valve. Back flow is prevented by the Model 702 check valve.

Figure 1-6: Pressure relief/Pump bypass Model 761 control valve



1.2.3 Parts lists for the back pressure/Pressure relief control valve

This section includes the necessary parts required to make up any standard unit covered in this manual.

For spring/piston combinations go to *Section 2.3.1*.

Table 1-1: Pilot selection guide 1

1760 Pilot Assembly	Spring range (Spring)
453200-X1E	0-20 psi (460223)
453200-X2E	0-40 psi (460022)
453200-X3E	30-80 psi (460023)
453200-X4E	70-180 psi (460024)
456100-X3E	150-350 psi (460023)
456100-X4E	150-350 psi (460024)

Table 1-2: Pilot selection guide 2

1761 Pilot Assembly	Spring range (Spring)
456200-X1E	0-20 psi (460223)
456200-X2E	0-40 psi (460022)
456200-X3E	30-80 psi (460023)
456200-X4E	70-180 psi (460024)

Table 1-3: Pilot selection guide 3

2760 Pilot Assembly	Spring range (Spring)
475100-X1E	5-100 psi (460223)
475100-X2E	50-250 psi (460022)
475100-X3E	200-400 psi (460023)
475100-X4E	350-650 psi (460024)
465100-X4E	600-950 psi (460024)
465100-X5E	900-1500 psi (460024)

Pilot body material

X = (5) Steel

X = (6) Stainless steel

Elastomers

E = (0) NBR

E = (7) EPR

E = (5) FFKM

E = (4) NBR (Low swell)

E = (3) CR

E = (2) FKM

E = (G) FKM GFLT

E = (M) FKM V1289

E = (9) FKM for LPG Service

Important

Item numbers reference actual engineering drawings and are not meant to be consecutively numbered.

Figure 1-7: Part identification for Model 1760 (453200) 0-180 psi range

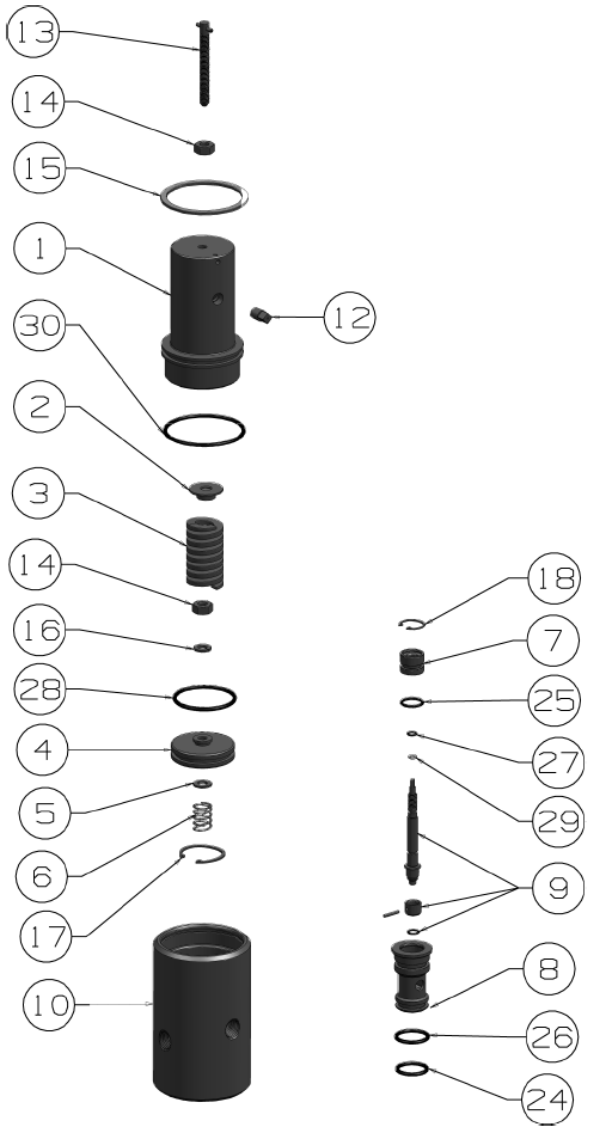


Table 1-4: Part description for Model 1760 (453200) 0-180 psi range

Item number	Description	Part number	Quantity required
1	Pilot valve cover	460006-600M	1
2	Spring guide (stainless steel)	460017	1
3	Pressure Spring		
	Spring, 0-20 psi.	460223	1

Table 1-4: Part description for Model 1760 (453200) 0-180 psi range *(continued)*

Item number	Description	Part number	Quantity required
	Spring, 0-40 psi.	460022	1
	Spring, 30-80 psi.	460023	1
	Spring, 70-180 psi.	460024	1
4	Piston	460116	1
5	Thrust washer (stainless steel)	460013	1
6	Damper spring	460021	1
7	Guide bushing	460008	1
8	Pilot valve cage	460007	
9	Poppet shaft assembly, NBR	460110-000	1
	Poppet shaft assembly, EPR	460110-007	1
	Poppet shaft assembly, FFKM	460110-005	1
	Poppet shaft assembly, NBR (Low-swell)	460110-00L	1
	Poppet shaft assembly, CR	460110-003	1
	Poppet shaft assembly, FKM	460110	1
	Poppet shaft assembly, FKM GFLT	460110-00G	1
	Poppet shaft assembly, FKM V1289	460110-00M	1
10	Pilot body CS	453301-500M	1
	Pilot body SS	453301-600M	1
12	Vent plug assembly	460015-500M	1
13	Screw set, square head	150687-024	1
14	Nut, hex	151543-019	2
15	Retaining ring, internal	156465	1
16	Washer SS lock, spring	152267	1
17	Retaining ring, internal	156466	1
18	Retaining ring, internal	156467	1
24	O-ring, NBR	157009	1
	O-ring, EPR	157009-005	1
	O-ring, FFKM	157009-075	1
	O-ring, NBR (Low-swell)	157009-120	1
	O-ring, CR	157009-116	1
	O-ring, FKM	157009-022	1
	O-ring, FKM GFLT	157009-027	1
	O-ring, FKM V1289	157009-029	1
25	O-ring, NBR	152090	1

Table 1-4: Part description for Model 1760 (453200) 0-180 psi range *(continued)*

Item number	Description	Part number	Quantity required
	O-ring, EPR	152090-005	1
	O-ring, FFKM	152090-075	1
	O-ring, NBR (Low-swell)	152090-120	1
	O-ring, CR	152090-116	1
	O-ring, FKM	152090-022	1
	O-ring, FKM GFLT	152090-027	1
	O-ring, FKM V1289	152090-029	1
26	O-ring, NBR	157010	1
	O-ring, EPR	157010-005	1
	O-ring, FFKM	157010-075	1
	O-ring, NBR (Low-swell)	157010-120	1
	O-ring, CR	157010-116	1
	O-ring, FKM	157010-022	1
	O-ring, FKM GFLT	157010-027	1
	O-ring, FKM V1289	157010-029	1
27	O-ring, NBR	152066	1
	O-ring, EPR	152066-005	1
	O-ring, FFKM	152066-075	1
	O-ring, NBR (Low-swell)	152066-120	1
	O-ring, CR	152066-116	1
	O-ring, FKM	152066-022	1
	O-ring, FKM GFLT	152066-027	1
	O-ring, FKM V1289	152066-029	1
28	O-ring, NBR	152073	1
	O-ring, EPR	152073-005	1
	O-ring, FFKM	152073-075	1
	O-ring, NBR (Low-swell)	152073-120	1
	O-ring, CR	152073-116	1
	O-ring, FKM	152073-022	1
	O-ring, FKM GFLT	152073-027	1
	O-ring, FKM V1289	152073-029	1
29	O-ring, NBR	152064	1
	O-ring, EPR	152064-005	1
	O-ring, FFKM	152064-075	1
	O-ring, NBR (Low-swell)	152064-120	1

Table 1-4: Part description for Model 1760 (453200) 0-180 psi range *(continued)*

Item number	Description	Part number	Quantity required
	O-ring, CR	152064-116	1
	O-ring, FKM	152064-022	1
	O-ring, FKM GFLT	152064-027	1
	O-ring, FKM V1289	152064-029	1
30	O-ring, NBR	157011	1
	O-ring, EPR	157011-005	1
	O-ring, FFKM	157011-075	1
	O-ring, NBR (Low-swell)	157011-125	1
	O-ring, CR	157011-116	1
	O-ring, FKM	157011-022	1
	O-ring, FKM GFLT	157011-027	1
	O-ring, FKM V1289	157011-029	1

Figure 1-8: Part identification for Model 1760 (456100) 150-650 psi range

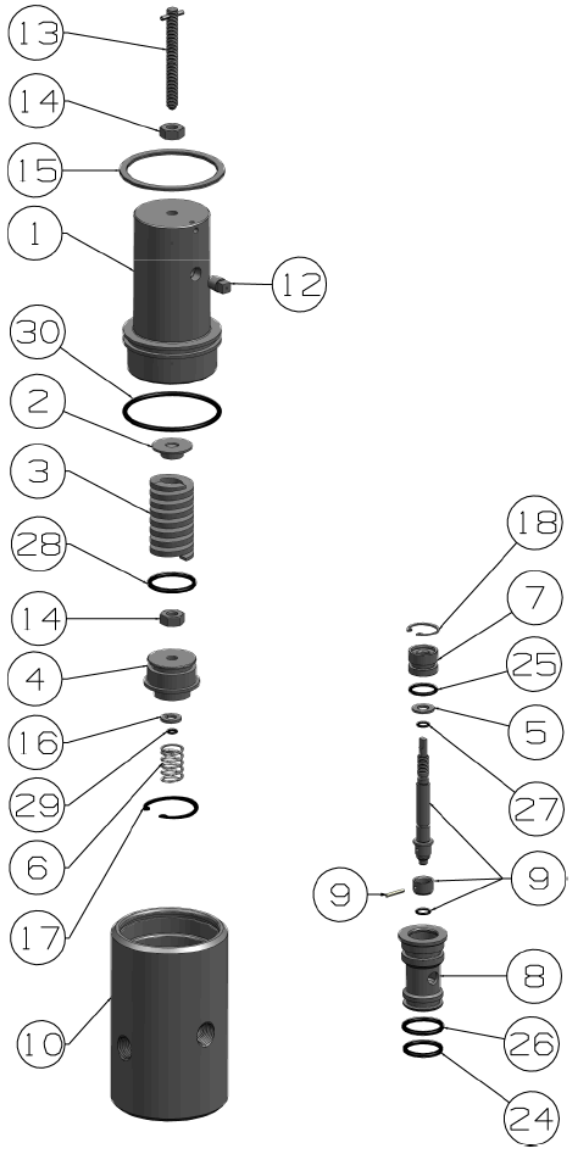


Table 1-5: Part description for Model 1760 (456100) 150-650 psi range

Item number	Description	Part number	Quantity required
1	Pilot cover	463006-600M	1
2	Spring guide (stainless steel)	460017	1
3	Pressure spring		
	Spring, 150-350 psi.	460023	1

Table 1-5: Part description for Model 1760 (456100) 150-650 psi range *(continued)*

Item number	Description	Part number	Quantity required
	Spring, 350-650 psi.	460024	1
4	Piston (stainless steel)	463016	1
5	Thrust washer (stainless steel)	460013	1
6	Damper spring	460021	1
7	Guide bushing	460008	1
8	Cage pilot valve	460007	1
9	Poppet shaft assembly, NBR	460110-000	1
	Poppet shaft assembly, EPR	460110-007	1
	Poppet shaft assembly, FFKM	460110-005	1
	Poppet shaft assembly, NBR (Low-swell)	460110-00L	1
	Poppet shaft assembly, CR	460110-003	1
	Poppet shaft assembly, FKM	460110	1
	Poppet shaft assembly, FKM GFLT	460110-00G	1
	Poppet shaft assembly, FKM V1289	460110-00M	1
10	Pilot body CS	453301-500M	1
	Pilot body SS	453301-600M	1
12	Vent plug assembly	460015-500M	1
13	Screw set, square head	150687-024	1
14	Nut, hex	151543-019	2
15	Retaining ring, internal	156465	1
16	Washer SS lock, spring	152267	1
17	Retaining ring, internal	156466	1
18	Retaining ring, internal	156467	1
24	O-ring, NBR	157009	1
	O-ring, EPR	157009-005	1
	O-ring, FFKM	157009-075	1
	O-ring, NBR (Low-swell)	157009-120	1
	O-ring, CR	157009-116	1
	O-ring, FKM	157009-022	1
	O-ring, FKM GFLT	157009-027	1
	O-ring, FKM V1289	157009-029	1
25	O-ring, NBR	152090	1
	O-ring, EPR	152090-005	1
	O-ring, FFKM	152090-075	1

Table 1-5: Part description for Model 1760 (456100) 150-650 psi range *(continued)*

Item number	Description	Part number	Quantity required
	O-ring, NBR (Low-swell)	152090-120	1
	O-ring, CR	152090-116	1
	O-ring, FKM	152090-022	1
	O-ring, FKM GFLT	152090-027	1
	O-ring, FKM V1289	152090-029	1
26	O-ring, NBR	157010	1
	O-ring, EPR	157010-005	1
	O-ring, FFKM	157010-075	1
	O-ring, NBR (Low-swell)	157010-120	1
	O-ring, CR	157010-116	1
	O-ring, FKM	157010-022	1
	O-ring, FKM GFLT	157010-027	1
	O-ring, FKM V1289	157010-029	1
27	O-ring, NBR	152066	1
	O-ring, EPR	152006-005	1
	O-ring, FFKM	152006-075	1
	O-ring, NBR (Low-swell)	152006-120	1
	O-ring, CR	152006-116	1
	O-ring, FKM	152006-022	1
	O-ring, FKM GFLT	152006-027	1
	O-ring, FKM V1289	152006-029	1
28	O-ring, NBR	152091	1
	O-ring, EPR	152091-005	1
	O-ring, FFKM	152091-075	1
	O-ring, NBR (Low-swell)	152091-120	1
	O-ring, CR	152091-116	1
	O-ring, FKM	152091-022	1
	O-ring, FKM GFLT	152091-027	1
	O-ring, FKM V1289	152091-029	1
29	O-ring, NBR	152064	1
	O-ring, EPR	152064-005	1
	O-ring, FFKM	152064-075	1
	O-ring, NBR (Low-swell)	152064-120	1
	O-ring, CR	152064-116	1
	O-ring, FKM	152064-022	1

Table 1-5: Part description for Model 1760 (456100) 150-650 psi range *(continued)*

Item number	Description	Part number	Quantity required
	O-ring, FKM GFLT	152064-027	1
	O-ring, FKM V1289	152064-029	1
30	O-ring, NBR	157011	1
	O-ring, EPR	157011-005	1
	O-ring, FFKM	157011-075	1
	O-ring, NBR (Low-swell)	157011-120	1
	O-ring, CR	157011-116	1
	O-ring, FKM	157011-022	1
	O-ring, FKM GFLT	157011-027	1
	O-ring, FKM V1289	157011-029	1

Figure 1-9: Part identification for Model 1761 Surge Pilot (456200) 0-180 psi range

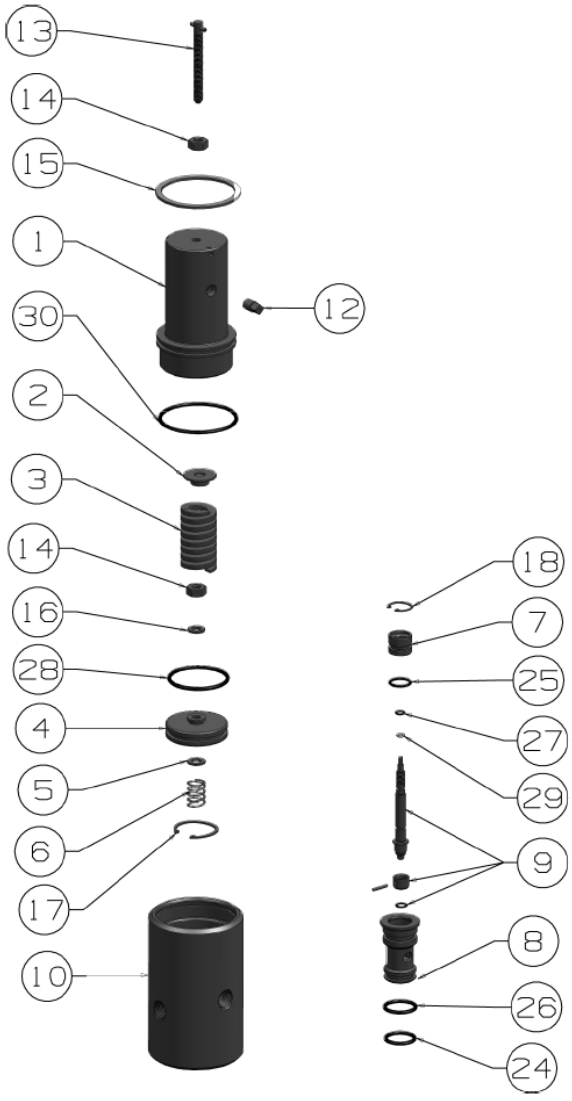


Table 1-6: Part description for Model 1761 Surge Pilot (456200) 0-180 psi range

Item number	Description	Part number	Quantity required
1	Pilot cover	460006-600M	1
2	Spring guide (stainless steel)	460017	1
3	Pressure spring, 0-20 lbs.	460223	1
	Spring, 0-40 psi.	460022	1

Table 1-6: Part description for Model 1761 Surge Pilot (456200) 0-180 psi range ***(continued)***

Item number	Description	Part number	Quantity required
	Spring, 30-80 psi.	460023	1
	Spring, 70-180 psi.	460024	1
4	Piston (stainless steel)	460116	1
5	Thrust washer (stainless steel)	460113	1
6	Damper spring	460021	1
7	Bush 303 guide for 1760	456201	1
8	Cage pilot valve	456202	1
9	Poppet shaft assembly, NBR	456205-000	1
	Poppet shaft assembly, EPR	456205-007	1
	Poppet shaft assembly, FFKM	456205-005	1
	Poppet shaft assembly, NBR (Low-swell)	456205-00L	1
	Poppet shaft assembly, CR	456205-003	1
	Poppet shaft assembly, FKM	456205	1
	Poppet shaft assembly, FKM GFLT	456205-00G	1
	Poppet shaft assembly, FKM V1289	456205-00M	1
10	Pilot body CS	453301-500M	1
	Pilot body SS	453301-600M	1
12	Vent plug assembly	460015-500M	1
13	Screw set, square head	150687-024	1
14	Nut, hex	151543-019	2
15	Retaining ring, internal	156465	1
16	Washer SS lock, spring	152267	1
17	Retaining ring, internal	156466	1
18	Retaining ring, internal	156467	1
24	O-ring, NBR	157009	1
	O-ring, EPR	157009-005	1
	O-ring, FFKM	157009-075	1
	O-ring, NBR (Low-swell)	157009-120	1
	O-ring, CR	157009-116	1
	O-ring, FKM	157009-022	1
	O-ring, FKM GFLT	157009-027	1
	O-ring, FKM V1289	157009-029	1
25	O-ring, NBR	152090	1

Table 1-6: Part description for Model 1761 Surge Pilot (456200) 0-180 psi range ***(continued)***

Item number	Description	Part number	Quantity required
	O-ring, EPR	152090-005	1
	O-ring, FFKM	152090-075	1
	O-ring, NBR (Low-swell)	152090-120	1
	O-ring, CR	152090-116	1
	O-ring, FKM	152090-022	1
	O-ring, FKM GFLT	152090-027	1
	O-ring, FKM V1289	152090-029	1
26	O-ring, NBR	157010	1
	O-ring, EPR	157010-005	1
	O-ring, FFKM	157010-075	1
	O-ring, NBR (Low-swell)	157010-120	1
	O-ring, CR	157010-116	1
	O-ring, FKM	157010-022	1
	O-ring, FKM GFLT	157010-027	1
	O-ring, FKM V1289	157010-029	1
27	O-ring, NBR	152067	1
	O-ring, EPR	152067-005	1
	O-ring, FFKM	152067-075	1
	O-ring, NBR (Low-swell)	152067-120	1
	O-ring, CR	152067-116	1
	O-ring, FKM	152067-022	1
	O-ring, FKM GFLT	152067-027	1
	O-ring, FKM V1289	152067-029	1
28	O-ring, NBR	152073	1
	O-ring, EPR	152073-005	1
	O-ring, FFKM	152073-075	1
	O-ring, NBR (Low-swell)	152073-120	1
	O-ring, CR	152073-116	1
	O-ring, FKM	152073-022	1
	O-ring, FKM GFLT	152073-027	1
	O-ring, FKM V1289	152073-029	1
29	O-ring, NBR	152064	1
	O-ring, EPR	152064-005	1
	O-ring, FFKM	152064-075	1

Table 1-6: Part description for Model 1761 Surge Pilot (456200) 0-180 psi range ***(continued)***

Item number	Description	Part number	Quantity required
	O-ring, NBR (Low-swell)	152064-120	1
	O-ring, CR	152064-116	1
	O-ring, FKM	152064-022	1
	O-ring, FKM GFLT	152064-027	1
	O-ring, FKM V1289	152064-029	1
30	O-ring, NBR	157011	1
	O-ring, EPR	157011-005	1
	O-ring, FFKM	157011-075	1
	O-ring, NBR (Low-swell)	157011-120	1
	O-ring, CR	157011-116	1
	O-ring, FKM	157011-022	1
	O-ring, FKM GFLT	157011-027	1
	O-ring, FKM V1289	157011-029	1

Figure 1-10: Part identification for Model 2760 (475100) 5-650 psi range

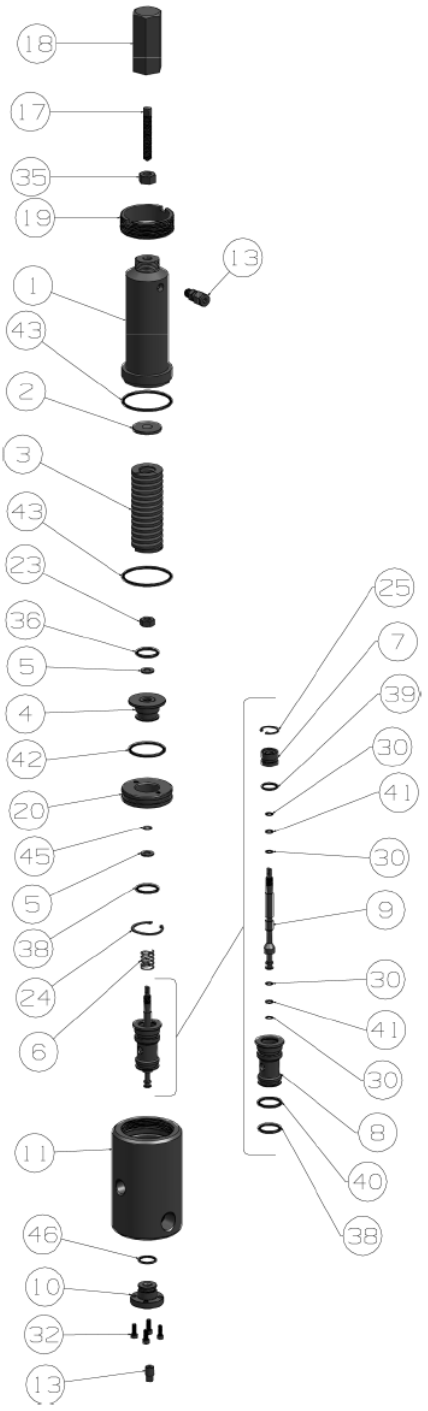


Table 1-7: Part description for Model 2760 (475100) 5-650 psi range

Item number	Description	Part number	Quantity required
1	Pilot cover	466006	1
2	Spring guide (stainless steel)	466017	1
3	Spring, 5-100 psi.	466223	1
	Spring, 50-250 psi.	466022	1
	Spring, 200-400 psi.	466023	1
	Spring, 350-650 psi.	466024	1
4	Piston (stainless steel)	466116	1
5	Thrust washer (stainless steel)	460013	2
6	Damper spring	460021	1
7	Guide bushing	460008	1
8	Pilot valve cage	466007	1
9	Poppet shaft	460111	1
10	Bushing	466004	1
11	Pilot body CS	465001	1
	Pilot body SS	465001-600M	1
13	Vent plug assembly w/mtr	460015-500M	2
17	Adjustment screw	466008	1
18	Cap	466003	1
19	Cover retainer	466207	1
20	Cylinder	466102	1
23	Nut, hex	151543-019	1
24	Retaining ring, internal	156466	1
25	Retaining ring, internal	156467	1
30	Back-up ring Teflon w	157212	4
32	Screw hex socket head w/mtr	151001-019M	4
35	Nut, jam	151627	1
36	Washer SS lock, spring	152267	1
38	O-ring, NBR	157009	2
	O-ring, EPR	157009-005	2
	O-ring, FFKM	157009-075	2
	O-ring, NBR (Low-swell)	157009-120	2
	O-ring, CR	157009-116	2
	O-ring, FKM	157009-022	2
	O-ring, FKM GFLT	157009-027	2
	O-ring, FKM V1289	157009-029	2

Table 1-7: Part description for Model 2760 (475100) 5-650 psi range *(continued)*

Item number	Description	Part number	Quantity required
39	O-ring, NBR	152090	1
	O-ring, EPR	152090-005	1
	O-ring, FFKM	152090-075	1
	O-ring, NBR (Low-swell)	152090-120	1
	O-ring, CR	152090-116	1
	O-ring, FKM	152090-022	1
	O-ring, FKM GFLT	152090-027	1
	O-ring, FKM V1289	152090-029	1
40	O-ring, NBR	157010	1
	O-ring, EPR	157010-005	1
	O-ring, FFKM	157010-075	1
	O-ring, NBR (Low-swell)	157010-120	1
	O-ring, CR	157010-116	1
	O-ring, FKM	157010-022	1
	O-ring, FKM GFLT	157010-027	1
	O-ring, FKM V1289	157010-029	1
41	O-ring, NBR	152066	2
	O-ring, EPR	152066-005	2
	O-ring, FFKM	152066-075	2
	O-ring, NBR (Low-swell)	152066-120	2
	O-ring, CR	152066-116	2
	O-ring, FKM	152066-022	2
	O-ring, FKM GFLT	152066-027	2
	O-ring, FKM V1289	152066-029	2
42	O-ring, NBR	152092	1
	O-ring, EPR	152092-005	1
	O-ring, FFKM	152092-075	1
	O-ring, NBR (Low-swell)	152092-120	1
	O-ring, CR	152092-116	1
	O-ring, FKM	152092-022	1
	O-ring, FKM GFLT	152092-027	1
	O-ring, FKM V1289	152092-029	1
43	O-ring, NBR	157061	2
	O-ring, EPR	157061-005	2
	O-ring, FFKM	157061-075	2

Table 1-7: Part description for Model 2760 (475100) 5-650 psi range *(continued)*

Item number	Description	Part number	Quantity required
	O-ring, NBR (Low-swell)	157061-120	2
	O-ring, CR	157061-116	2
	O-ring, FKM	157061-022	2
	O-ring, FKM GFLT	157061-027	2
	O-ring, FKM V1289	157061-029	2
45	O-ring, NBR	152067	1
	O-ring, EPR	152067-005	1
	O-ring, FFKM	152067-075	1
	O-ring, NBR (Low-swell)	152067-120	1
	O-ring, CR	152067-116	1
	O-ring, FKM	152067-022	1
	O-ring, FKM GFLT	152011-027	1
	O-ring, FKM V1289	152011-029	1
46	O-ring, NBR	157024	1
	O-ring, EPR	157024-005	1
	O-ring, FFKM	157024-075	1
	O-ring, NBR (Low-swell)	157024-120	1
	O-ring, CR	157024-116	1
	O-ring, FKM	157024-022	1
	O-ring, FKM GFLT	157024-027	1
	O-ring, FKM V1289	157024-029	1

Figure 1-11: Part identification for Model 2760 (465100) 600-1500 psi range

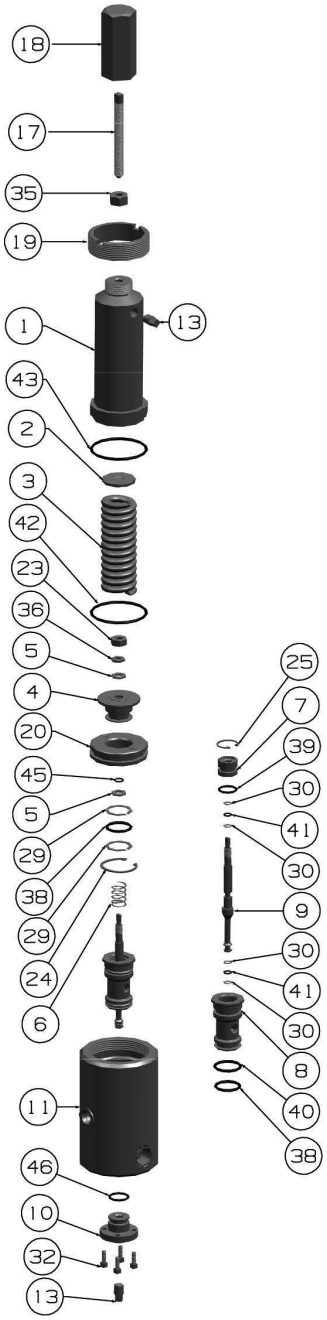


Table 1-8: Part description for Model 2760 (465100) 600-1500 psi range

Item number	Description	Part number	Quantity required
1	Pilot cover (all pressures)	466006	1
2	Spring guide	466017	1
3	Spring, 600-950 psi.	466023	1
	Spring, 900-1500 psi.	466024	1
4	Piston (stainless steel)	466016	1
5	Thrust washer (stainless steel)	460013	2
6	Damper spring	460021	2
7	Guide bushing	460008	1
8	Pilot valve cage	466007	1
9	Poppet shaft	466111	1
10	Bushing	466004	1
11	Pilot body CS	465001	1
	Pilot body SS	465001-600M	1
13	Vent plug assembly w/mtr	460015-500M	2
17	Adjustment screw	466008	1
18	Cap	466003	1
19	Cover retainer	466207	1
20	Cylinder	466002	1
23	Nut, hex	151543-019	1
24	Retaining ring, internal	156466	1
25	Retaining ring, internal	156467	1
27	Plug cap #6-X	154769	1
28	Decal pilot valve	154530	1
29	Back-up ring Teflon 2	157213	2
30	Back-up ring Teflon 2	157212	4
32	Screw hex socket head w/mtr	151001-019M	4
35	Nut, jam	151627	1
36	Washer SS lock, spring	152267	1
38	O-ring, NBR	157009	2
	O-ring, EPR	157009-005	2
	O-ring, FFKM	157009-075	2
	O-ring, NBR (Low-swell)	157009-120	2
	O-ring, CR	157009-116	2
	O-ring, FKM	157009-022	2
	O-ring, FKM GFLT	157009-027	2

Table 1-8: Part description for Model 2760 (465100) 600-1500 psi range *(continued)*

Item number	Description	Part number	Quantity required
	O-ring, FKM V1289	157009-029	2
39	O-ring, NBR	152090	2
	O-ring, EPR	152090-005	2
	O-ring, FFKM	152090-075	2
	O-ring, NBR (Low-swell)	152090-120	2
	O-ring, CR	152090-116	2
	O-ring, FKM	152090-022	2
	O-ring, FKM GFLT	152090-027	2
	O-ring, FKM V1289	152090-029	2
40	O-ring, NBR	157010	1
	O-ring, EPR	157010-005	1
	O-ring, FFKM	157010-075	1
	O-ring, NBR (Low-swell)	157010-120	1
	O-ring, CR	157010-116	1
	O-ring, FKM	157010-022	1
	O-ring, FKM GFLT	157010-027	1
	O-ring, FKM V1289	157010-029	1
41	O-ring, NBR	152066	2
	O-ring, EPR	152066-005	2
	O-ring, FFKM	152066-075	2
	O-ring, NBR (Low-swell)	152066-120	2
	O-ring, CR	152066-116	2
	O-ring, FKM	152066-022	2
	O-ring, FKM GFLT	152066-027	2
	O-ring, FKM V1289	152066-029	2
43	O-ring, NBR	152061	2
	O-ring, EPR	152061-005	2
	O-ring, FFKM	152061-075	2
	O-ring, NBR (Low-swell)	152061-120	2
	O-ring, CR	152061-116	2
	O-ring, FKM	152061-022	2
	O-ring, FKM GFLT	152061-027	2
	O-ring, FKM V1289	152061-029	2
45	O-ring, NBR	152067	1
	O-ring, EPR	152067-005	1

Table 1-8: Part description for Model 2760 (465100) 600-1500 psi range *(continued)*

Item number	Description	Part number	Quantity required
	O-ring, FFKM	152067-075	1
	O-ring, NBR (Low-swell)	152067-120	1
	O-ring, CR	152067-116	1
	O-ring, FKM	152067-022	1
	O-ring, FKM GFLT	152011-027	1
	O-ring, FKM V1289	152011-029	1
46	O-ring, NBR	157024	1
	O-ring, EPR	157024-005	1
	O-ring, FFKM	157024-075	1
	O-ring, NBR (Low-swell)	157024-120	1
	O-ring, CR	157024-116	1
	O-ring, FKM	157024-022	1
	O-ring, FKM GFLT	157024-027	1
	O-ring, FKM V1289	157024-029	1

1.3 Agency certifications for the Models 760 and 761 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 (1)

(1) Applies only to control valve 760

2 Operating conditions and specifications

Topics covered in this chapter:

- *Operating conditions for the Model 760 and 761*
- *Description of the Models 760 and 761 Control Valves*
- *Pilot spring selection*

2.1 Operating conditions for the Model 760 and 761

Table 2-1: Operating conditions for the Model 760 and 761 control valves

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 30 ft/sec. Beyond this point a high pressure drop and increased wear will result.
Fluid(s) controlled	• Low/Medium viscosity crude oils and condensates • Refined products and intermediates (e.g.: *gasoline, diesel, kerosene, light fuel oils, jet fuel, LPG, butanes, naphtha, alkylate, reformate, straight run gasoline, cat-cracked gasoline*) • Petrochemicals (e.g.: *benzene, toluene, xylenes, cumene, olefins, pyrolysis gasoline*) • Natural gas liquids
Differential pressure	The maximum allowable differential pressure of 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
Pressure class (ANSI)	150, 300, 600
Maximum safe working temperature range	• -26°C to 205°C (-15°F to 400°F) • Using FKM O-rings • Temperature range is dependent on O-ring T_{min} and T_{max} • Consult the factory for other safe working temperatures

Table 2-1: Operating conditions for the Model 760 and 761 control valves *(continued)*

<table>
<tr><th>Condition type</th><th colspan="4">Description</th></tr>
<tr><td>Maximum safe working pressure</td><td colspan="4">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 (class 300) MWP at 120°C: 51 bar
• DIN PN64 (class 600) MWP at 120°C: 64 bar
• DIN PN100 MWP at 120°C: 100 bar
Flange connections/Ratings (ANSI) for valve sizes 2"-16":
• Class 150 MWP at 100°F: 285 psi
• Class 300 MWP at 100°F: 740 psi
• Class 600 MWP at 100°F: 1480 psi
* MWP: Maximum Working Pressure</td></tr>
<tr><td>Materials of construction</td><td colspan="4">O-Rings:
• Standard: FKM
• Optional: Neoprene™, EPR, FKM V1289, Nitrile, FFKM, FKM GLT
• For other material contact the factory
External hook up:
• Class 150 and 300:
- NPS 2-6: Carbon steel/Stainless steel 10 mm (0.372")
- NPS 8-16 Carbon steel/Stainless steel 13 mm (0.5")
• Class 600:
- NPS 2-6: Stainless steel 13 mm (0.5")
- Can be furnished in metric sizes
Other internal parts: Stainless steel</td></tr>
<tr><td rowspan="9">Pilot spring ranges</td><td colspan="2">Class 150-300</td><td colspan="2">Class 600</td></tr>
<tr><td>(kPa)</td><td>(PSI)</td><td>(kPa)</td><td>(PSI)</td></tr>
<tr><td>0-138</td><td>0-20</td><td>345-690</td><td>5-100</td></tr>
<tr><td>0-276</td><td>0-40</td><td>345-1724</td><td>50-250</td></tr>
<tr><td>207-552</td><td>30-80</td><td>1379-2758</td><td>200-400</td></tr>
<tr><td>485-1241</td><td>70-180</td><td>2413-4482</td><td>350-650</td></tr>
<tr><td>1034-2413</td><td>150-350</td><td>4137-6550</td><td>600-950</td></tr>
<tr><td>2413-4482</td><td>350-650</td><td>6205-10342</td><td>900-1500</td></tr>
<tr><td colspan="3">Spring selection based on control pressure set point. Refer to Section 2.3 Pilot spring selection for details.</td><td></td></tr>
</table>

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.

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 2-2: 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. Materials for pilots such as Low Swell NBR (main valve static O-rings) and FFKM or PTFE are available.

Table 2-2: 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.
Low and freezing temperatures	Specific gravities and viscosities at low or freezing temperature will reduce the flow range of the valve. Refer to *Section 1.2.2* for more information.
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 760 and 761 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 2-3: Interface requirements

Requirements	Description
Hydraulic lines	External hook up: • ANSI class 150 and 300: - NPS 2-6: Carbon steel/Stainless steel 10 mm (0.375") - NPS 8-16 Carbon steel/Stainless steel 13 mm (0.5") - Can be furnished in metric sizes • ANSI class 600: - NPS 2-16: Stainless steel 13 mm (0.5") - Can be furnished in metric sizes
Flange type	The mechanical connections for Model 760 and 761 control valves are standard class 150, 300 and 600 ANSI R.F. flanges which are available only in stainless steel. Other types of flange connections are available per customer request for Daniel control valves. For other ANSI ratings or flanges consult the factory engineers. For maximum working pressures at intermediate temperatures refer to ANSI B16.5.

⚠ 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

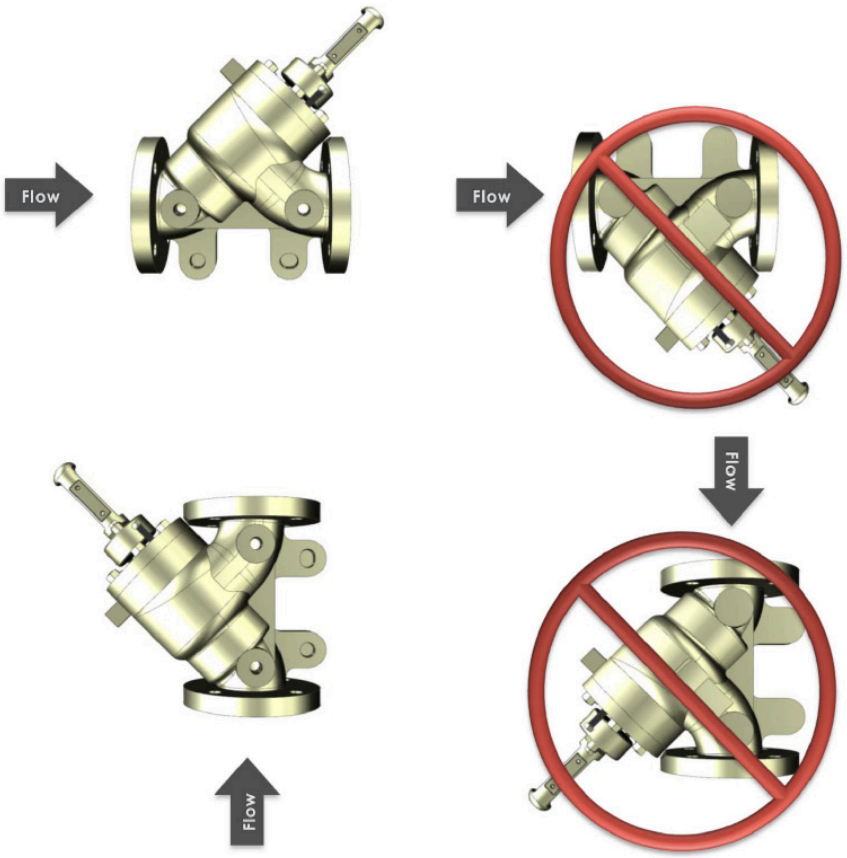
Comply with local government regulations and company requirements.

See *Figure 2-1* for flow direction.

NOTICE

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

Figure 2-1: Valve orientation



⚠ 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: Flange connection/Ratings (DIN)

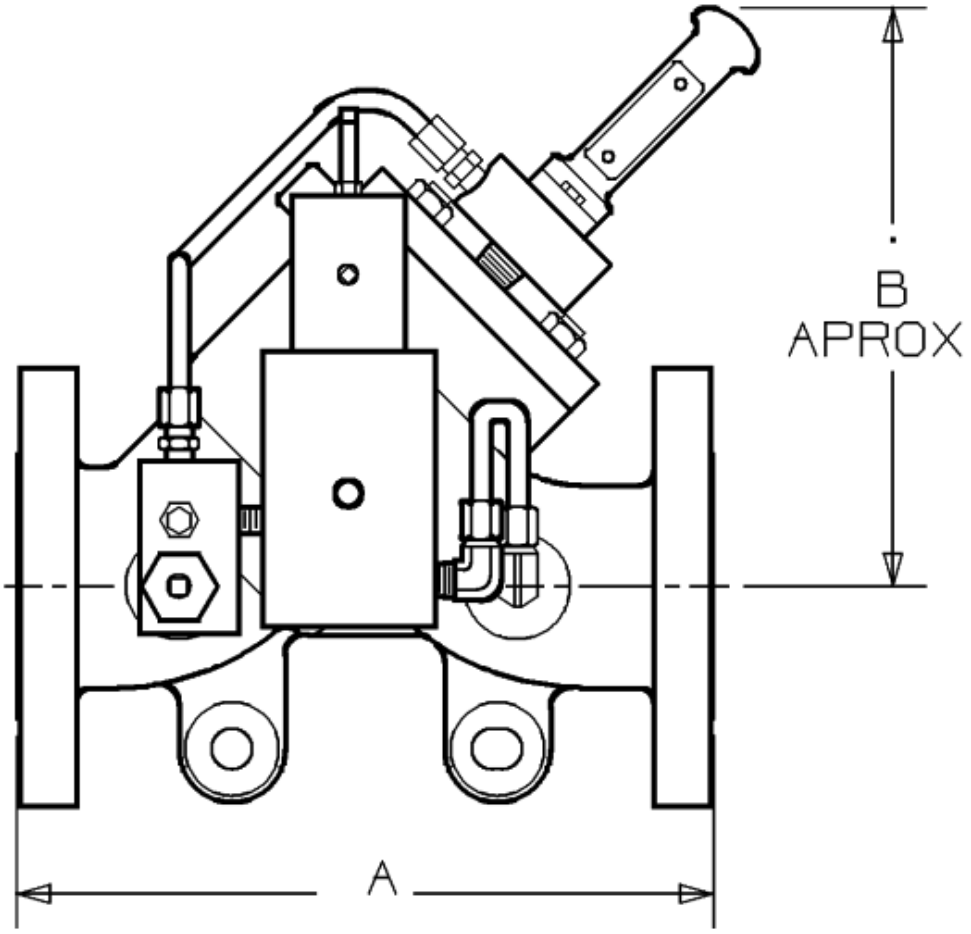


Table 2-4: Approximate shipping weights and cube for models 760 and 761

	Approximate shipping weight						Approximate shipping cube			
	Model 760-761						Model 760-761			
	Class 150		Class 300		Class 600		Class 150-300		Class 600	
Valve size	lbs.	kilos	lbs.	kilos	lbs.	kilos	cubic feet	cubic me-ters	cubic feet	cubic me-ters
2	55	21	60	22	100	37	1.66	0.047	1.79	0.051
3	95	35	105	39	150	56	2.36	0.067	2.50	0.071
4	115	43	140	52	205	77	2.51	0.071	3.13	0.089
6	210	78	250	93	400	149	4.84	0.137	6.07	0.172

Table 2-4: Approximate shipping weights and cube for models 760 and 761 ***(continued)***

	Approximate shipping weight						Approximate shipping cube			
	Model 760-761						Model 760-761			
	Class 150		Class 300		Class 600		Class 150-300		Class 600	
Valve size	lbs.	kilos	lbs.	kilos	lbs.	kilos	cubic feet	cubic me-ters	cubic feet	cubic me-ters
8	400	149	465	174	725	271	8.94	0.253	9.98	0.283
10	640	239	700	261	1170	437	12.08	0.342	15.13	0.428
12	1040	388	1215	454	1820	679	20.25	0.573	21.94	0.621
16	CF	CF	CF	CF	CF	CF	39.53	1.119	42.17	1.194

CF=consult factory

2.3 Pilot spring selection

2.3.1 Pilot spring selection table

The following Pilot spring selections table is a complete listing of regulating pilot valve figure numbers, part numbers, pilot springs, spring part numbers, and piston diameters.

The application of pilot springs is significant and often misunderstood. The pressure range of a specific pilot spring relates directly to the area of the pilot piston exposed to fluid sensing (FORCE = PRESSURE X AREA). In other words, the control range of a spring will vary with the outside diameter of the pilot's piston. In effect, a light spring combined with various piston diameters increases pilot sensitivity, whereas a heavier spring used without changing the piston size decreases sensitivity and accuracy of set point. The use of various sizes assures the most compact and flexible pilot available and is a key to the accurate set point control found in Daniel valves.

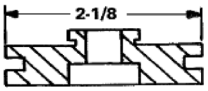
The table outlines the standard and optional springs, spring ranges and piston diameters for all integral and external piston operated pilots for Series 700 control valves.

Figure 2-3: Conversion factors

$$psi\,X\ \ 0.07030695 = kg / cm^2$$
$$psi\,X\ \ 6.894757 = kPa$$

Figure 2-4: Pilot spring selections

Model No.	Description	Pilot Assy Part No.
1750	Pressure Reducing	435600
1754	Pressure Differential	453700
1760	Back Pressure	453200
1761	Pressure Relief	456200
1770	Pressure Differential	453500

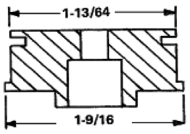


Available Spring Ranges (Psi)	Part number	Color Code
0-20	460223	Unpainted
0-40	460022	Blue
30-80	460023	Black or Red
70-180	460024	Bronze

Large piston

Classs	Max Range
150-300	180 psi

Model No.	Description	Pilot Assy Part No.
1750	Pressure Reducing	456600
1754	Pressure Differential	456700
1760	Back Pressure	456100
1770	Pressure Differential	456500

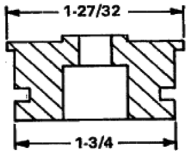


Available Spring Ranges (Psi)	Part number	Color Code
150-350	460023	Black or Red
350-650	460024	Bronze

Small piston

Classs	Max Range
150-300	650 psi

Model No.	Description	Pilot Assy Part No.
2750	Pressure Reducing	475000
2754	Pressure Differential	475600
2760	Back Pressure	475100
2770	Pressure Differential	475500

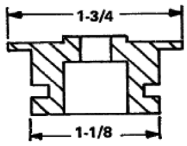


Available Spring Ranges (Psi)	Part number	Color Code
5-100	466223	Unpainted
50-250	466022	Blue
200-400	466023	Black or Red
350-650	466024	Bronze

Large piston

Classs	Max Range
600	650 psi

Model No.	Description	Pilot Assy Part No.
2750	Pressure Reducing	465000
2754	Pressure Differential	465600
2760	Back Pressure	465100
2770	Pressure Differential	465500



Available Spring Ranges (Psi)	Part number	Color Code
600-950	466023	Black or Red
900-1,500	466024	Bronze

Small piston

Classs	Max Range
600	1,500 psi

2.3.2 Table usage

Example: A customer has an ANSI 300 lb. Model 760 Back Pressure Valve with a 207-552 kPa (30-80 psi) pilot spring set for 483 kPa (70 psi) control. Due to change in the system, he desires to control a 2068 kPa (300 psi) downstream pressure. For a spring range of 1034-2413 kPa (150-350 psi) the table lists a 460023 spring. But the existing spring range of 207-552 kPa (30-80 psi) also requires a 460023 spring.

Conclusion: Changing the spring will not solve this customer's problem. The pilot piston must be changed.

Proper use of the pilot spring selection table should eliminate any difficulty associated with changing a pilot spring. If any two facts are known about a pilot, other tabulated data can be determined. For example:

- Knowledge of piston diameter and spring color indicates the spring range of the pilot.
- Knowledge of the model number and piston diameter indicates the pilot part number.
- Knowledge of the pilot part number and spring color indicates the spring range.

Part II
Install

3 Installation prerequisites

Topics covered in this chapter:

- *Models 760 and 761 pre-start checks*
- *Model 760 and 761 installation*

3.1 Models 760 and 761 pre-start checks

⚠ CAUTION!

EQUIPMENT HAZARD

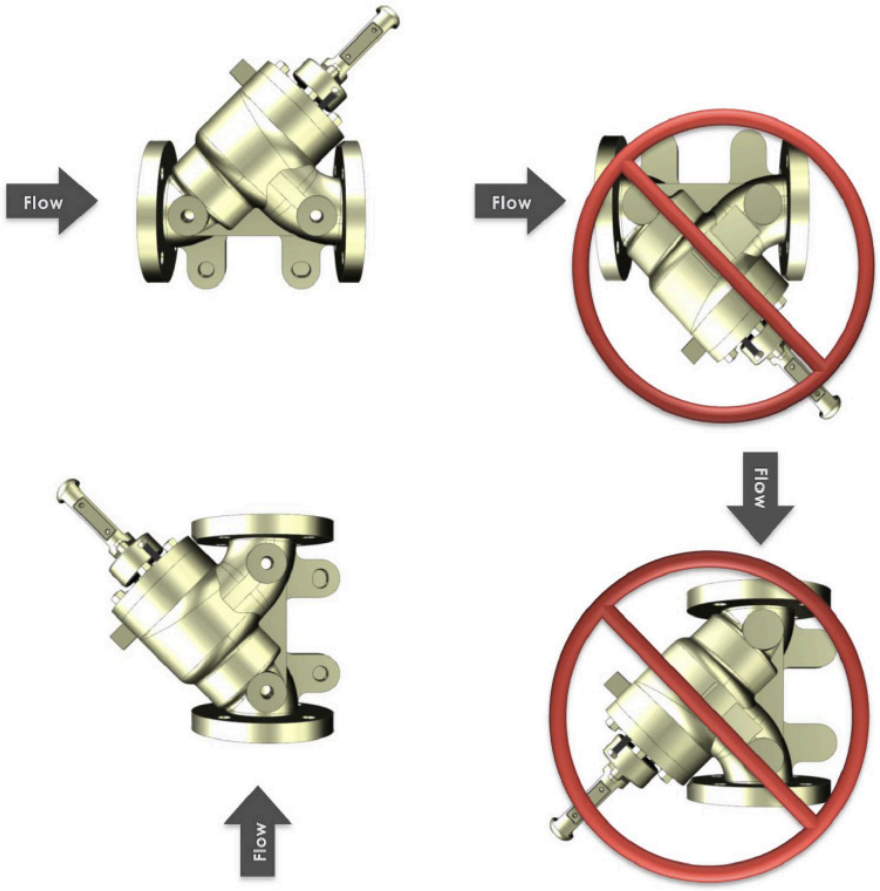
Observe all precautionary signs posted on the equipment.

Failure to comply may result in injury to personnel or cause damage to the equipment.

Important

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

Figure 3-1: Valve orientation



3.2 Model 760 and 761 installation

Prerequisites

The following instructions are intended as a guide for installing the Model 760 and 761 valves and should be carefully complied with if the valves are to operate as designed. Refer to typical installation for item numbers.

⚠ 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.

Procedure

1. If possible, install the control valve within 7.6 M (25 feet) of the point at which upstream line pressure is to be controlled. This distance limitation is due to the sense line which must be run to the pilot. Consult the factory if sense lines of greater length are required.

Important

It is recommended that the control valve be installed between isolating valves. This will permit the system to remain operational while maintenance is being performed on the valve.

2. Ensure that the line is completely free of all foreign material before the valve is bolted into the line.
   a. If it is impractical to flush the line before installing the valve, bolt in spool piece or the valve body. Remove the cylinder assembly per the disassembly instructions on the basic valve and seal the opening with a temporary cover.
   b. Disconnect or isolate the sense line if it is connected to the pilot. This will eliminate the possibility of foreign material flowing into the sensing chamber of the pilot. (Flushing will not be necessary if the product line and liquid are positively known to be clean.)
3. One 3/8" (1760/1761) or 1/2" (2760) sense line is required between the pilot and the upstream sense point. The size line is a minimum requirement based on a maximum product viscosity of 500 SSU. Use a larger size sense line if the viscosity of the product is in excess of 500 SSU. This sense line is mated with the lower connection of the pilot.
4. Installing a pressure gauge in the valve circuit is recommended. This gauge will monitor the upstream pressure. In order to monitor and adjust the valve properly, it is very important that the gauge be installed at the upstream sense point located on the valve schematic. The pressure gauge is not furnished with the Daniel control valve and will need to be sourced from a third party.
5. Verify that the 1760, 1761 or 2760 pilots set point is correct as ordered. A paper tag is attached to the pilot with the factory set point. The set point can be changed in the field to any set point within the pilot spring range. Refer to *Figure C-1* and *Figure C-2*.

4 Operation start up

Topics covered in this chapter:

- *Model 760 adjustment and startup*
- *Model 761 adjustment and startup*

4.1 Model 760 adjustment and startup

Prerequisites

Adjust the valve as outlined below. All isolation valves (A1, A2 and A3) must be closed before adjustment can begin.

Procedure

1. The first step in adjusting the valve is to bleed all air from the system. This is done by starting the pump (if a static head of 5-10 PSIs is not present), slowly opening the isolation valve A1, and loosening the external sense line connection at the pilot (C) and at the top of the valve cylinder. Re-tighten the connections, close valve A1, and deactivate the pump when the line is free of air.
2. Turn the sensitivity adjustment (Item B) counterclockwise until all spring tension is relieved. The valve will now open when nominal pump discharge pressure is sensed by the pilot
3. Start the pump and slowly open isolating valve A1. (Valve A2 is never open under normal operating conditions. It is included in the circuit only to bypass the control valve when it is being repaired or maintained). Partially open isolating valve A3 and observe pressure gauge (G) to determine when the valve begins controlling. This will be indicated by a drop in upstream pressure as valve A3 opens. When a pressure drop is observed on gauge (G), slowly turn the pilot adjustment screw (D) clockwise until upstream pressure begins to rise.
4. Completely open valve A3. Upstream pressure should remain unvaryingly at the set point of the pilot. If the pressure is incorrect, turn the pilot adjustment screw (D) clockwise to increase pressure and counterclockwise to decrease pressure.
5. If pulsation occurs in the control valve, it may be eliminated by turning the sensitivity, adjustment (B) clockwise.

⚠ CAUTION!

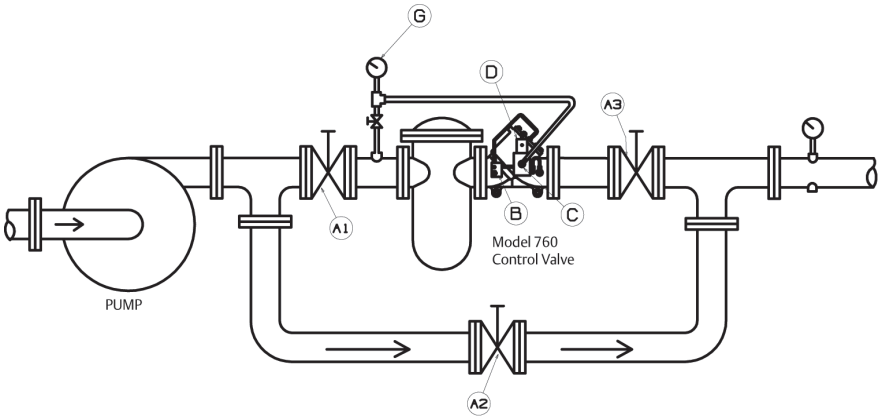
EQUIPMENT DAMAGE POSSIBLE

Never completely close the sensitivity adjustment. It should remain at least ¼ turn open.

If the sensitivity adjustment is fully closed, the valve will not operate properly.

The sensitivity adjustment may also be used to regulate the speed of valve response. By turning the sensitivity control clockwise, the opening speed of the valve will be increased, and the closing speed will be decreased. An opposite effect occurs if the sensitivity control is turned counterclockwise.

Figure 4-1: Back pressure Model 760



4.2 Model 761 adjustment and startup

1. The first step in adjusting the valve is to bleed all air from the system. This is done by starting the pump (if a static head of 5-10 PSI is not present), and loosening the external sense line connection at the pilot and at the top of the valve cylinder. Re-tighten the connections, and deactivate the pump when the line is free of air.
2. Turn the sensitivity adjustment counterclockwise, (B)1/2 turn from closed if it is a needle valve only or three turns from closed if it is a needle valve and strainer combination. Turn the pilot adjustment stem (D) counterclockwise until all spring tension is relieved. The valve will now open when nominal pump discharge pressure is sensed by the pilot.
3. Start the pump and observe pressure gauge and slowly turn the pilot adjustment screw clockwise until the desired pump discharge pressure is achieved.
4. If pulsation occurs in the control valve, it may be eliminated by turning the sensitivity adjustment clockwise.

⚠ CAUTION!

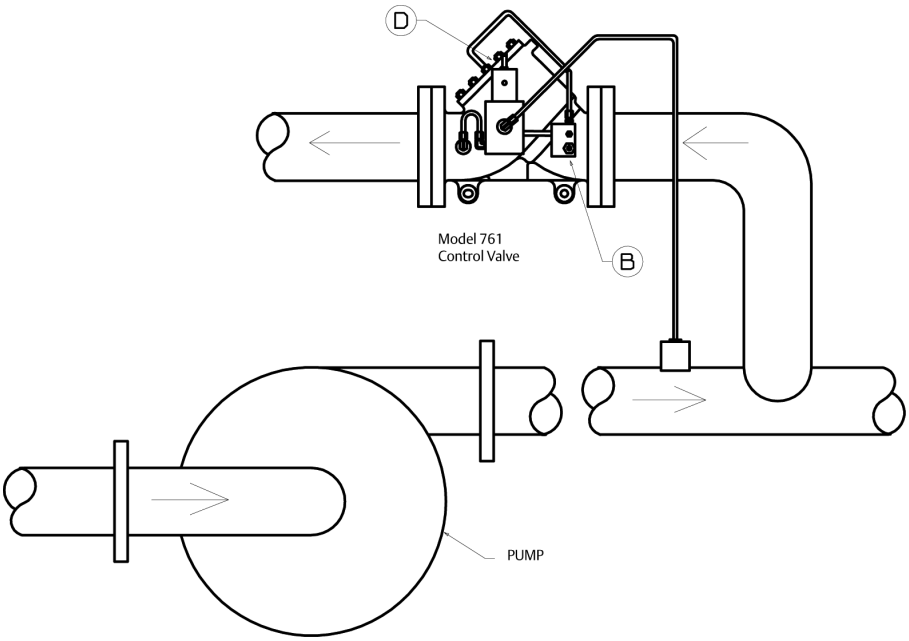
EQUIPMENT DAMAGE POSSIBLE

Never completely close the sensitivity adjustment. It should remain at least ¼ turn open.

If the sensitivity adjustment is fully closed, the valve will not operate properly.

The sensitivity adjustment may also be used to regulate the speed of valve response. By turning the sensitivity control clockwise, the opening speed of the valve will be increased, and the closing speed will be decreased. An opposite effect occurs if the sensitivity control is turned counterclockwise.

Figure 4-2: Pressure relief/Pump bypass Model 761



Part IV
Maintain

Chapters covered in this part:

- *Planned maintenance*
- *Spare parts*

5 Planned maintenance

Topics covered in this chapter:

- *Maintenance considerations*
- *Pilot disassembly (1760/1761)*
- *Pilot disassembly (2760)*
- *Pilot assembly (760/761)*

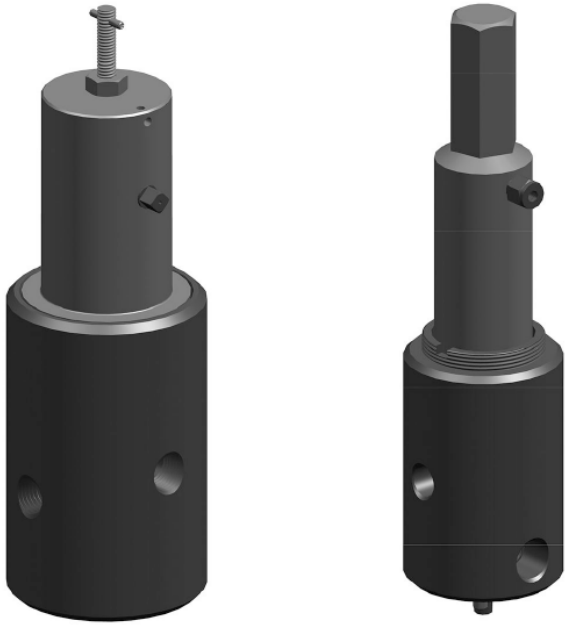
5.1 Maintenance considerations

Inspect and clean all pilots and their parts at regularly scheduled intervals. All O-rings should be checked for nicks, cuts and wear. Any defective or doubtful O-rings should be replaced.

1. Remove the strainer (combination valve and strainer unit) by removing the strainer cap.
2. All parts associated with the adjustment stem are removable when the strainer is removed. The adjustment stem must be removed by turning counterclockwise.
3. Reassemble by reversing disassembly order. Be careful not to cut O-rings when assembling parts and assemblies. Be sure spring under the sensing piston is in place.

    - Retaining ring pliers
    - Ratchet wrench
    - Pin removal tool
    - Needle nose pliers

Figure 5-1: Model 1760/1761 Back Pressure Pilot and 2760 Back Pressure Pilot



5.2 Pilot disassembly (1760/1761)

1. Isolate and remove all pressure and drain before maintenance.
2. Remove the pilot from the valve by disconnecting the external tubing.
3. Turn pressure adjustment screw counter-clockwise until tension is relieved on the spring. Push in on the pilot cover and remove by extracting the retaining ring.
4. Disengage the poppet shaft from the sensing piston by holding the shaft and removing the nut and lock washer.
5. Remove sensing piston.
6. Remove poppet shaft and cage as a unit after removing retainer ring. Remove poppet shaft and guide bushing after removing retainer ring. Remove poppet shaft from the guide bushing.
7. Using a 3/32" punch, drive pin from poppet shaft, remove the retainer sleeve and O-ring from the shaft.

⚠ CAUTION!

EQUIPMENT HAZARD

Observe all precautionary signs posted on the equipment.

Failure to comply may result in injury to personnel or cause damage to the equipment

⚠ CAUTION!

BENT SHAFT HAZARD

Be careful to avoid bending the shaft when using the punch.

The shaft can be easily bent when using the punch incorrectly.

Failure to comply may result in injury to personnel or cause damage to equipment.

8. Remove and inspect all O-rings.

5.3 Pilot disassembly (2760)

1. Isolate and remove all pressure and drain before maintenance.
2. Remove the pilot from the valve by disconnecting the external tubing.
3. Turn pressure adjustment screw counter-clockwise until tension is relieved on the spring. Push in on the pilot cover and remove by extracting cover retainer. Unscrew counter-clockwise.
4. Disengage the poppet shaft assembly from the sensing piston by holding the shaft and removing the nut and lock washer.
5. Remove sensing piston.
6. Remove the poppet shaft and cage as a unit after removing the retainer ring. Remove the poppet shaft and remove the nut, the lock washer and the retainer sleeve. Remove the guide bushing by removing the retainer ring.
7. Remove and inspect all O-rings.

⚠ CAUTION!

EQUIPMENT HAZARD

Observe all precautionary signs posted on the equipment.

Failure to comply may result in injury to personnel or cause damage to the equipment.

⚠ CAUTION!

BENT SHAFT HAZARD

Be careful to avoid bending the shaft when using the punch.

The shaft can be easily bent when using the punch incorrectly.

Failure to comply may result in injury to personnel or cause damage to equipment.

5.4 Pilot assembly (760/761)

1. For pilots used on crude oil, gasoline, diesel fuel or other general liquid hydrocarbon service, apply a light oil or general purpose grease to all O-rings to prevent cutting and to facilitate assembly. Use a light oil only for Butane and Propane service.
2. Reassemble by reversing disassembly order. Be careful not to cut O-rings when assembling parts and assemblies. Be sure spring (Item 21) under the sensing piston is in place.

Important

This pilot was designed without corrosion allowance. The valve's metal parts should be periodically inspected for corrosion and erosion. The seals and O-rings should be inspected for wear and chemical deterioration.

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.

6 Spare parts

Topics covered in this chapter:

- *Recommended spare parts*
- *Order spare parts*

6.1 Recommended spare parts

Table 6-1: Recommended spare parts for models 760-761

Description	Part Number	Quantity
O-ring	152064	1
Roll pin	153511	1
Retainer ring	Order 460110	1
O-ring	152067	1
O-ring	157009	1
O-ring	157010	1
O-ring	152090	1
O-ring	152066	1
Poppet shaft	Order 460110	1
O-ring	152073	1
O-ring	152091	1
Piston (0-180 psi)	460116	1
Piston (150-650 psi)	463016	1
O-ring	157011	1
O-ring FFKM	W453200-505	1
O-ring FFKM/NBR	W453200-508	1
O-ring FKM/NBR	W453200-511	1
O-ring FKM	W453200-512	1

6.2 Order spare parts

Provide the following information when ordering replacement parts:

- Daniel valve serial number
- Part number
- Part description

- Quantity required
- Size
- Product, product viscosity, product specific gravity
- Minimum and maximum operating temperatures
- Minimum and maximum flow rates
- Minimum, normal and maximum operating pressure
- Control functions to be performed
- Flange connections
- O-ring material
- Control pilot materials
- Tubing material
- Main valve piston material

Appendix A
Combination needle valve and strainer

Topics covered in this appendix:

- *Disassembly and assembly*
- *Needle valve and strainer combination*
- *Order spare parts*

A.1 Disassembly and assembly

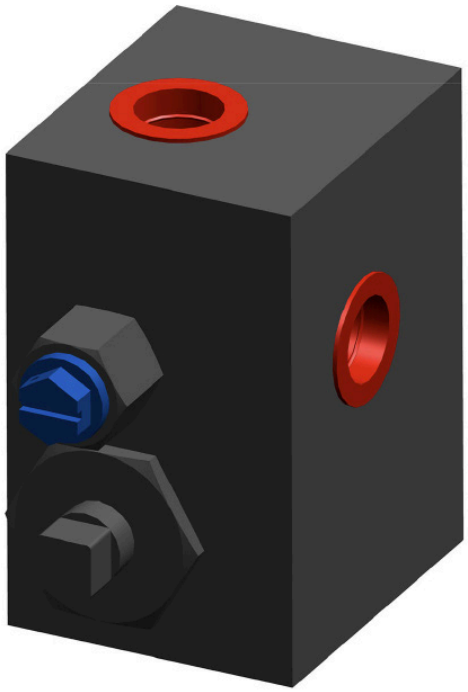
Procedure

1. Isolate and remove all pressure and drain before maintenance.
2. Remove strainer (combination valve and strainer unit) by removing the strainer cap.
3. All parts associated with the adjustment stem are removable when the retainer is removed. Remove the adjustment stem by turning it counterclockwise.
4. For pilots used on crude oil, gasoline, diesel fuel or other general liquid hydrocarbon service, apply a light oil or general purpose grease to all O-rings to prevent cutting and to facilitate assembly. Use a light oil only for Butane and Propane service.

   Tools required:

   - Retaining ring pliers
   - Ratchet wrench
   - Pin removal tool
   - Needle nose pliers

Figure A-1: Combination needle valve and strainer



A.2 Needle valve and strainer combination

- Part number 460710

Figure A-2: Needle valve and strainer combination

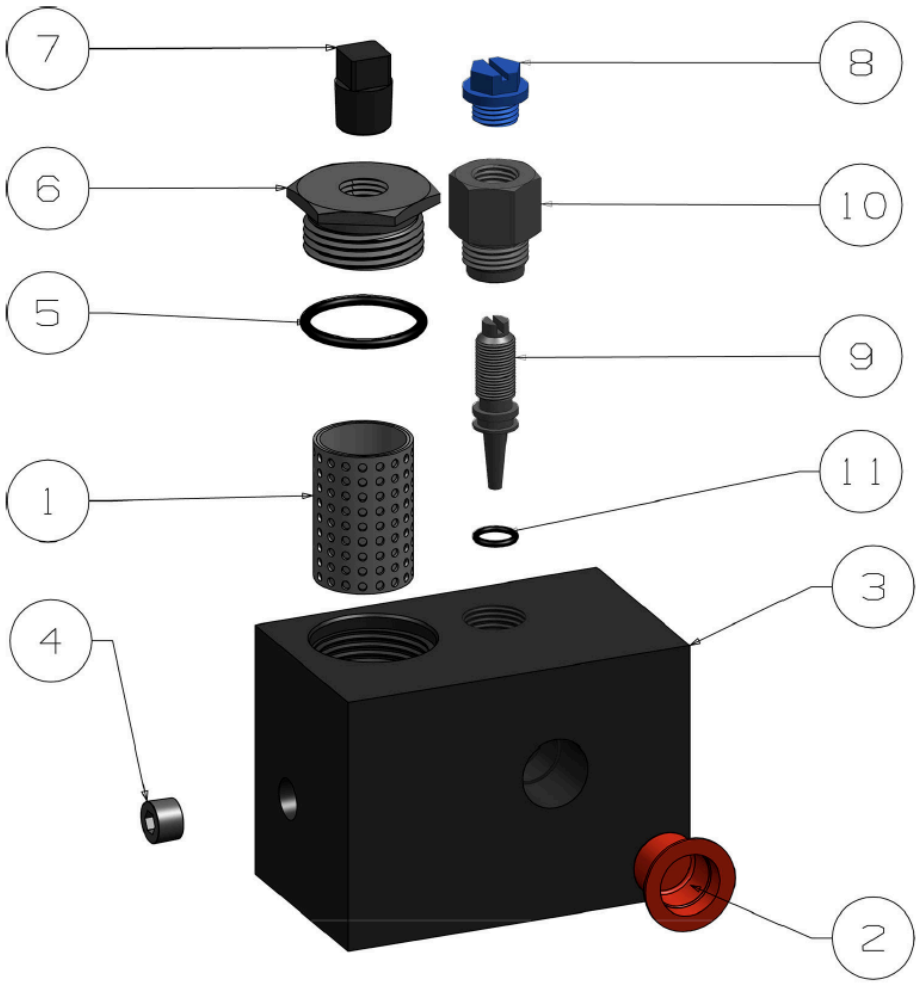


Table A-1: Part description for needle valve and strainer combination

Item	Description	Part number	Quantity required
1	Strainer assembly	460665	1
3	Needle body carbon steel	460688-500M	1
	Needle body stainless steel	460688-600M	1
4	Plug pipe	154772-019M	1

Table A-1: Part description for needle valve and strainer combination *(continued)*

Item	Description	Part number	Quantity required
5	O-ring, Buna-A	152042	1
	O-ring, EPR	152042-005	1
	O-ring, Kalrez	152042-075	1
	O-ring, low-swell Nitrile	152042-120	1
	O-ring, Neoprene	152042-116	1
	O-ring, FKM	152042-022	1
	O-ring, FKM V1289-75	152042-027	1
6	Strainer cap	460682M	1
7	Plug pipe square hd	154783M	1
8	Retainer cap	460686	1
9	Adjustment stem	460683-001M	1
10	Retainer	460684M	1
11	O-ring, Buna-A	152067	1
	O-ring, EPR	152067-005	1
	O-ring, Kalrez	152067-075	1
	O-ring, low-swell Nitrile	152067-120	1
	O-ring, Neoprene	152067-116	1
	O-ring, FKM	152067-022	1
	O-ring, FKM V1289-75	152067-027	1

A.3 Order spare parts

Provide the following information when ordering parts:

- Daniel valve serial number
- Part number
- Part description
- Quantity

Appendix B
Relief valve pilot bypass

Topics covered in this appendix:

- *Introduction*
- *Operation*
- *Primary pilot valve*
- *Secondary pilot valve*
- *Pilot control set points*
- *Installation*
- *Adjustments*
- *Needle valves*
- *Micro Switch*
- *Pilot line block valves*

B.1 Introduction

⚠ CAUTION!

INSTRUCTIONS HAZARD

Read this publication entirely before performing any operation.

Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

⚠ CAUTION!

REPAIR HAZARD

Should this equipment require repair or adjustment, contact the nearest Daniel Measurement and Control sales office.

It is important that servicing be performed only by trained and qualified service personnel.

If this equipment is not properly serviced, serious personal injury and/or damage to the equipment could result.

The Model 760 Relief Valve is a normally closed, pilot operated, "safety valve". It remains in a closed position unless an abnormal line pressure rises above safe operating conditions or an established maximum. Once the pressure reaches the predetermined maximum, the model 760 valve "must open" dissipating excess pressure that could rupture the pipe line.

B.2 Operation

The 760 valve is equipped with two (2) relief pilots. Each pilot continuously monitors line pressure to control the opening and closing of the main valve.

B.3 Primary pilot valve

The primary regulator, a 1760 Pilot Valve, is spring set (adjustable) and the minimum to maximum range of the spring is tamped on the nameplate of the valve body. The 1760 pilot senses line pressure by an external sense line to the inlet side of the valve. When a pressure rise equal to or greater than the pilot's spring tension occurs, the pilot opens, causing the main valve to open.

B.4 Secondary pilot valve

If the 1760 pilot valve fails to open, the secondary relief pilot will take control at a minimum of 10 psi above the set point of the 1760 pilot. The secondary pilot is a Circle Seal direct operated relief valve. It is mounted inline and has no external adjustments, insuring complete tamper proof operation. Regardless of mis-adjustments, failure of the 1760 pilot, or tampering, the secondary pilot will open the main valve very rapidly. It is piped so that its flow path is restrictionless.

B.5 Pilot control set points

The 1760 pilot valve and the Circle Seal pilot have been factory set to open at a specified pressure. These settings should be checked before attempting any adjustments. The 1760 pilot setting is on a tag attached to the pilot, and the Circle Seal valve setting is stamped on its body.

Important

The 1760 pilot (primary) must be set at least 10 psi lower than the Circle Seal Relief Valve (secondary).

B.6 Installation

The Model 760 valve should be installed as illustrated in the accompanying schematic, which indicates block valves in the pilot lines, a sense line to the 1760 pilot piped with tee for testing set point, and a micro switch for remote indication of an open valve. These options may not be included on your valve. Unless pre-piped at the factory, a sense line from the 1760 pilot to the upstream side of the valve in this sense line is recommended. With the valve properly installed and the 1760 pilot sense line connected, it is necessary to bleed air from the 1760 pilot sense line and from the rear of the main valve piston. Slowly

allow line product to enter the valve inlet. Loosen the tubing fittings of the sense line as connected to the 1760 pilot valve and the fitting connected to the top of the main valve piston chamber. Dissipate all air and retighten fittings.

B.7 Adjustments

1760 PILOT: This pilot has been factory set according to instructions received. To check the setting, it will be necessary to do one of two things:

1. Allow pressure to build up on the valve inlet until it begins to open. The pressure reading on initial valve opening would be set-point.
2. Use a "dead weight tester" or some hydraulic pressure device, by closing off the pilot sense line and inducing pressure directly to the 1760 pilot sensing chamber. Initial opening of the main valve would indicate set point.

Turning the 1760 pilot adjustment stem CW increases pressure set point, CCW decreases. NOTE: The maximum setting of the 1760 pilot is 10 psi less than the Circle Seal relief pilot set point. To change the setting of the Circle Seal pilot it must be removed from the valve and bench tested, or returned to the factory.

B.8 Needle valves

The needle valve contained in the combination needle valve and strainer is a sensitivity and closing speed adjustment. The Pneu-trol valve is an opening speed adjustment. Nominal turns open from a closed position are as follows:

Valve size	Sensitivity (closing speed)	Pneu-trol (opening speed)
2"	3/4 Turn	1/4 Turn
3"	1 Turn	1/4 Turn
4"	1-1/4 Turn	1/2 Turn
6"	2 Turn	1/2 Turn
8"	2-1/2 Turn	1 Turn
10"	3-1/2 Turn	1-1/4 Turn
12"	4 Turn	1-1/2 Turn

Turn needle valve CCW to increase closing speed or opening speed. CW direction decreases closing speed or opening speed.

B.9 Micro Switch

An optional feature, the micro switch is actuated by the adjustable cam on the valve position indicator. Moving the cam up or down on the stem determines the point of valve opening at which the switch is actuated. Normally the switch is adjusted to indicate initial valve opening (factory set).

B.10 Pilot line block valves

These are optional features but most valves include those labeled B and E. Block valves are used to isolate the pilot lines for various reasons:

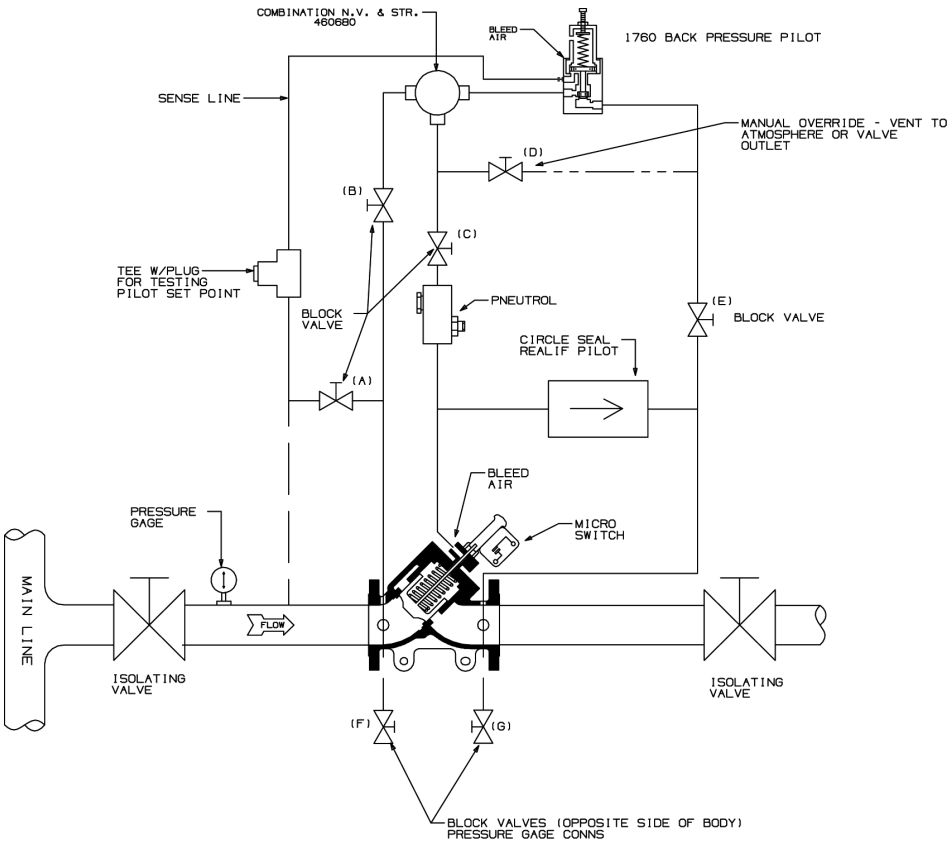
- Closing block valve (A), permits testing the 1760 pilot valve set point when using a "dead weight tester" or some auxiliary hydraulic device.
- Closing block valves (B), (C), and (E) allows removal of the 1760 pilot with the Circle Seal valve still operable.
- Opening block valve (D) permits the Model 760 valve to open fully for emergency or other reasons.
- Block valves (F) and (G) permit attachment of temporary pressure gauges.

For normal operation, the block valves should be in the following positions:

Normally open: (A), (B), (C), and (E)

Normally closed: (D), (F), and (G)

Figure B-1: Control valve with Micro-switch



Appendix C
Testing Daniel Model 1760/1761 or 2760 Relief valve pilot set point in the field

C.1 Testing models 1760/1761 or 2760

Important

The test described below confirms pilot set point setting and main valve functionality. The open pilot signals the main valve to open. In order for the main valve to open there must be a minimum of 5 psi differential pressure from valve inlet to valve outlet and there must be flow available in the pipeline. The Daniel pilot operated valve will not open if there is another valve closed on the downstream side.

Prerequisites

Refer to drawings attached (*Figure C-1*) for external Sense line installed by customer or (*Figure C-2*) for the Factory installed sense line.

Procedure

1. Install (A), (B) and (C) in pilot sense line.

   Note: Sense lines can be fitted at the factory or installed in the field by the customer.
2. Normal operation
   a. (A) Valve OPEN
   b. (B) Valve OPEN
   c. (C) Tee CLOSED (Plugged)
3. Testing set point with external pressure source
   a. (A) Valve CLOSED
   b. (B) Valve OPEN
   c. (C) Tee - Remove plug, drain and attach pressure source with pressure gauge. Gradually apply pressure until set point is reached and valve begins to open. Set point may be raised or lowered by adjusting the set screw on top of the pilot clockwise (to increase), counterclockwise (to decrease). Verify with pressure gauge on external pressure bottle. At the conclusion of test remove pressure source, return pipe plug to (C), open block valve (A) and return valve to normal operation.
4. Install (A), (B) and (C) in pilot sense line.

   Note: Sense lines can be fitted at the factory or installed in the field by the customer.
5. Normal operation
   a. (A) Valve OPEN

b. (B) Valve OPEN

c. (C) Tee CLOSED (Plugged)

6. Testing set point with external pressure source

a. (D) Valve CLOSED

b. (E) Valve OPEN

c. (F) Tee - Remove plug, drain and attach pressure bottle with pressure gauge. Gradually apply pressure until set point is reached and valve begins to open. Set point may be raised or lowered by adjusting the set screw on top of the pilot clockwise (to increase), counterclockwise (to decrease). Verify with pressure gauge on external pressure bottle.

Figure C-1: External sense line by customer testing

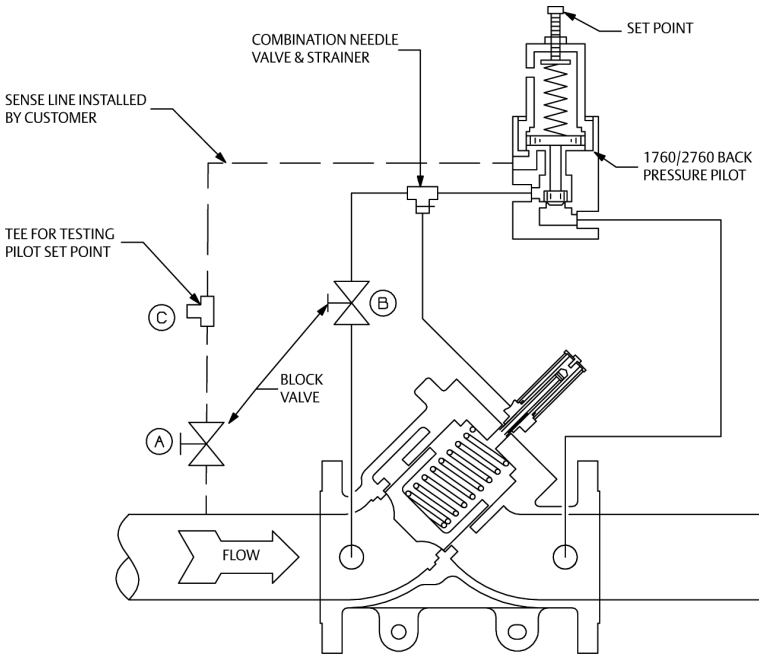
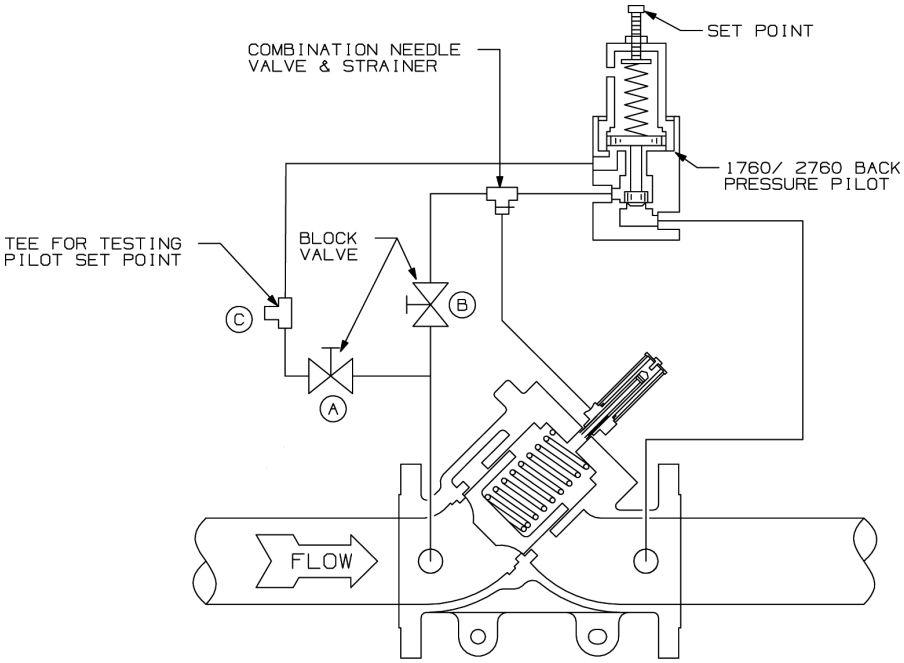


Figure C-2: Factory installed sense line testing



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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