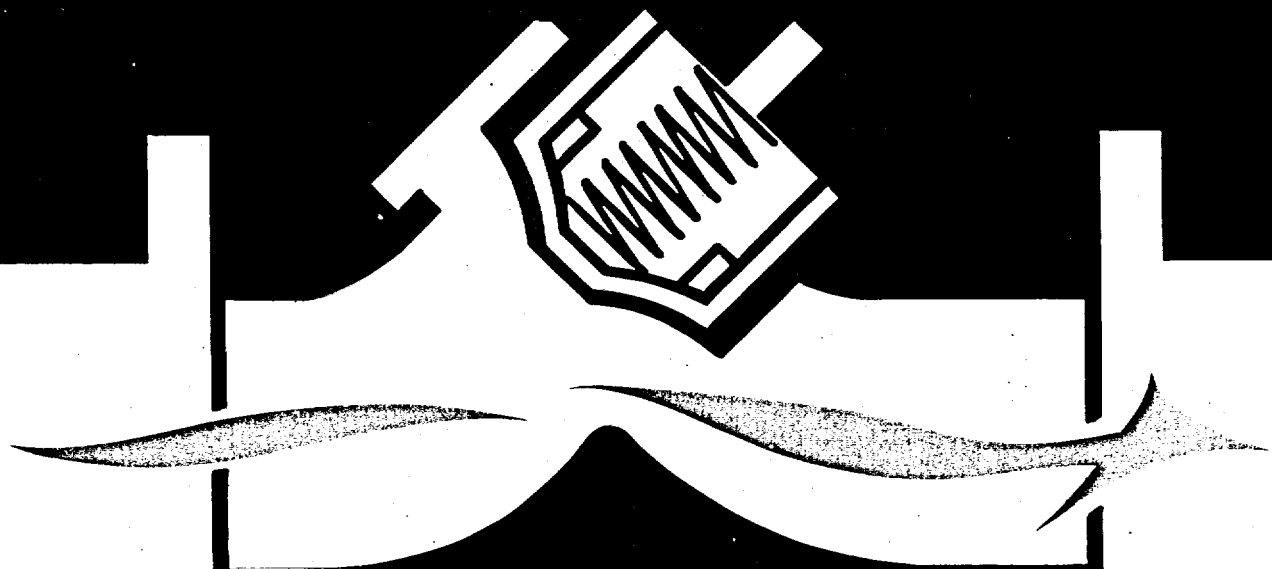


Appendix C

Relief Valve Group Factual Report

**Manufacturer's Technical Bulletin and Design Specifications
For Model 760 Control Valve and Model 1760 Pilot Valve**



BROOKINGS

Model 760 Back Pressure/Pressure Relief Control (N.C.) Opens on Increasing Inlet pressure

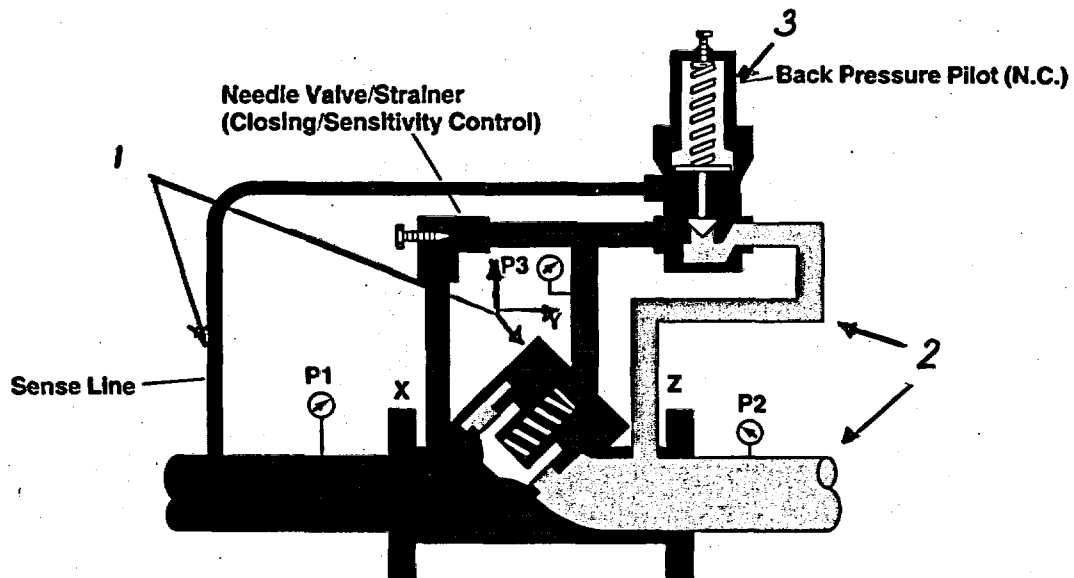
A back pressure/pressure relief valve is normally closed and throttles open on increasing inlet pressure. This valve is used to hold back a minimum pressure for more efficient operating conditions or relieve excess pressure. It is a regulating or positioning type valve that does not require any outside power source to operate.

The pilot control is normally closed. It is an adjustable spring loaded variable orifice in the Z-port. The pilot is piston operated, spring biased (loaded) with a pressure sensing chamber connected to upstream (P1).

Back pressure/pressure relief valves are used for:

1. Back pressure against a pump, meter, hill pressure, etc.
2. Pressure relief and surge control

CLOSED POSITION – The pilot is closed. Inlet pressure (P1) is less than the pilot spring setting, indicating the main line upstream (P1) has been closed off, 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 (P1) and Y-port (P3) pressures are balanced. The main valve spring, being the differential force, closes the piston and keeps it seated.



- 1 = Inlet Pressure
- 2 = Outlet Pressure
- 3 = Pilot Spring Force

Figure 4-9

OPEN - CONTROLLED POSITION – The pilot is 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 establishes a position of the valve piston such that it balances inlet (P1) pressure equal to the pilot setting (Plus or minus 2 psi.)

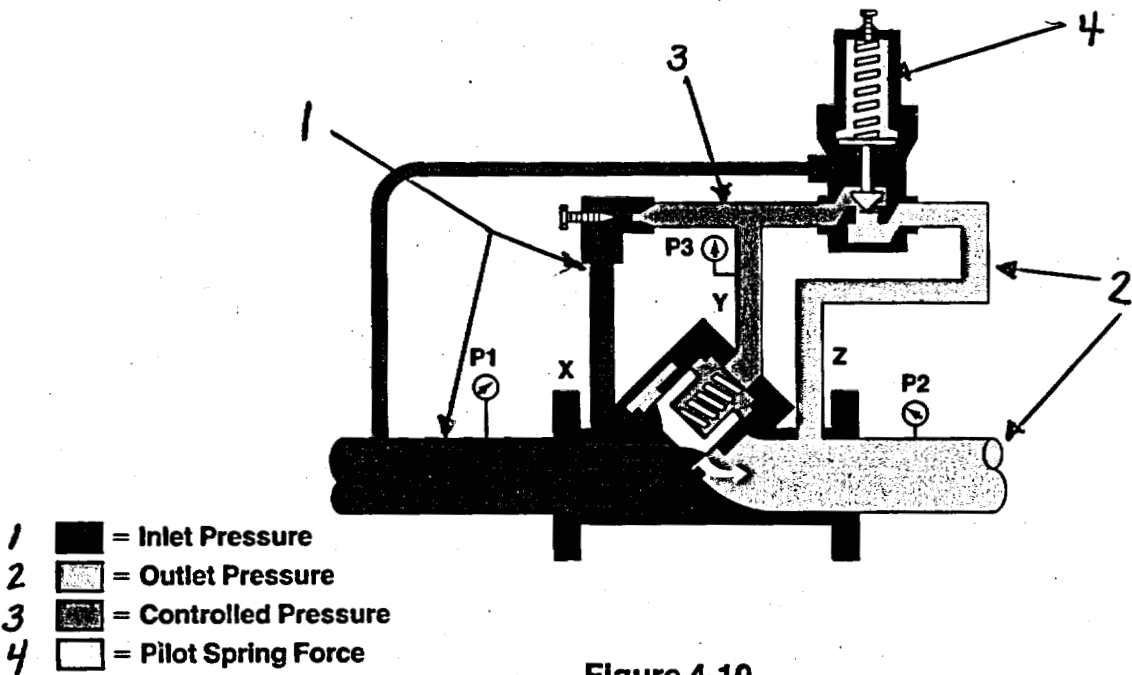


Figure 4-10

FULL OPEN - NO CONTROL – The pilot is full open. Inlet pressure (P1) is greater than the pilot setting. Y-port (P3) is open to Z-port (P2). The valve is floating the stream and is not required to control.

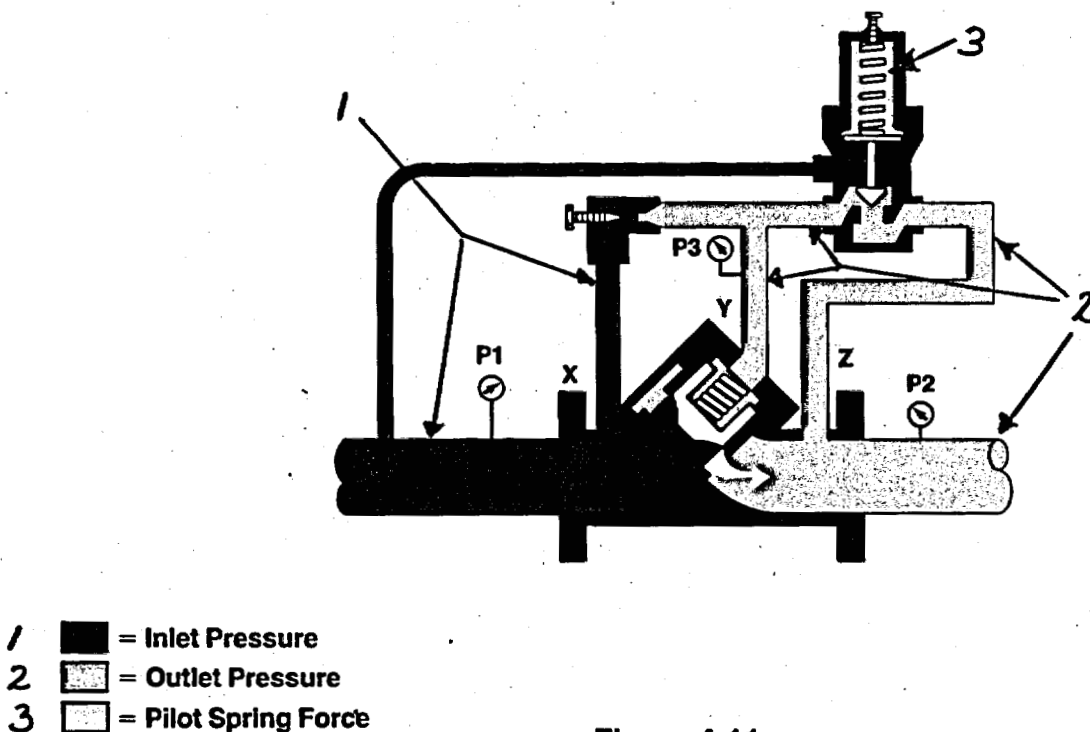


Figure 4-11

Model 760

CONTROL VALVES - BACK PRESSURE/PRESSURE RELIEF

DESCRIPTION

The Model 760 Back Pressure Control Valves are designed to regulate valve inlet pressure within ± 2 psi (13.8 kPa) or closer, regardless of 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.

DESIGN FEATURES

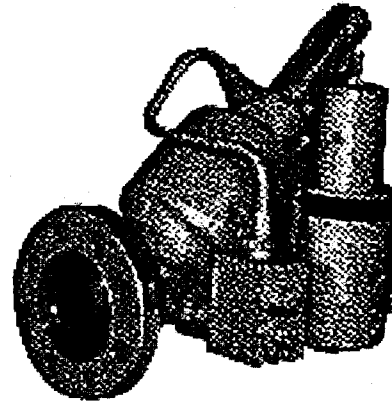
- Modular construction - all internal parts including seat ring can be removed with the cylinder assembly without disturbing line connections.
- No diaphragms or stuffing boxes
- 45° body design assures high capacity
- Positive shut-off
- Uniform speed of response
- Linear control characteristics
- Inherently checks reverse flow
- O-Ring plus metal-metal seat

APPLICATIONS

- Metering systems back pressure
- Pipelines (surge control)
- Pump bypass or pressure relief

"AP" (AGGRESSIVE PRODUCTS) OPTION

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



WARNING

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

PRINCIPLE OF OPERATION

The valves are pilot operated and operate on a balanced piston principle, spring biased to a closed position. Pressure differential overcomes the force of the spring, causing the main valve to open and establish flow. The pilot control(s) vary the pressure on the spring side of the piston for position.

FLANGE CONNECTIONS / RATINGS (ANSI)

Valve Size	MAXIMUM WORKING PRESSURE @ 100° F		
	150 lbs. ANSI	300 lbs. ANSI	600 lbs. ANSI
2" - 12"	285 psi	740 psi	1480 psi

FLANGE CONNECTIONS / RATINGS (DIN)

Valve Size	DIN PN16	DIN PN25	DIN PN40	DIN PN64 (300 lbs.)	DIN PN64 (600 lbs.)	DIN PN100
	MAX. WORKING PRESSURE @ 120°C	MAX. WORKING PRESSURE @ 120°C	MAX. WORKING PRESSURE @ 120°C	MAX. WORKING PRESSURE @ 38°C	MAX. WORKING PRESSURE @ 120°C	MAX. WORKING PRESSURE @ 38°C
DN50 - DN300	16 bar	25 bar	40 bar	51 bar	64 bar	100 bar

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

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MATERIALS OF CONSTRUCTION

Main Valve Body

Steel - ASTM-A216-GR-WCB

Main Valve Cylinder

2-6" Ductile Iron, Nickel Coated

8-12" Steel, Nickel Coated

Main Valve Piston

Standard - Bronze on 150 and 300 lb. valves.

Optional - Stainless Steel

Standard - Stainless Steel on 600 lb. valves.

Seat Ring

Steel, Nickel Coated (Stainless Steel on 600 lb.)

O-Rings

Standard - Viton[®] Dynamic, Buna-N[†] Static

Optional - Other O-Rings are available Neoprene[†],

EPR, all Viton, all Buna-N, Kalrez/Teflon ("AP" Valves)

Other Internal Parts

Stainless Steel

Pilot Valve Strainer/Needle Valve Body

Standard - Steel

Pilot Valve Strainer/Needle Valve Trim

Stainless Steel

Tubing and Fittings

Standard - Steel

Optional - Stainless Steel

PILOT SPRING RANGES

150 - 300 lb. Valves		600 lb. Valves	
(psi)	(kPa)	(psi)	(kPa)
0 - 20	0 - 138	*5 - 100	345 - 690
*0 - 40	0 - 276	50 - 250	345 - 1724
30 - 80	207 - 552	200 - 400	1379 - 2758
70 - 180	483 - 1241	350 - 650	2413 - 4482
150 - 350	1034 - 2413	600 - 950	4137 - 6550
350 - 650	2413 - 4482	900 - 1500	6205 - 10342

*Spring selection based on control pressure set point.

PRESSURE DROP

Refer to Publication DSVALVEC_v.

VALVE CAPACITY DATA

Valve Size	2"	3"	4"	6"	8"	10"	12"
*C _v - gpm	86	186	309	688	1296	2040	2,920

For capacities and pressure drops, please consult Publication DSVALVEC_v "Capacity Charts for Valve Sizing."

*C_v based on wide open valve utilizing water at 60°F (15.6°C).

OPTIONAL EQUIPMENT

1. Valve Position Indicator
2. Position Indicator Switches
3. Stainless Steel Main Valve Piston
4. Independent Opening Speed Control
5. Stainless Steel Tubing
6. Thermal Relief
7. Additional Pilot Control Functions
8. Excess Flow Shutoff (Pressure Sensitive)
9. Pilot Line Isolation Block Valves
10. Fusible Link Pilot Valve (closes at 160°F)
11. Manual Override (Opens Valve)
12. Epoxy coating main valve body unmachined surfaces

RECOMMENDED SPARE PARTS

O-Rings

SHIPPING WEIGHT AND VOLUME (Approximate)

Size	150-300 lb. (ANSI Fig.)		600 lb. (ANSI Fig.)		150-300 lb. (ANSI Fig.)		600 lb. (ANSI Fig.)	
	lbs.	Kg.	lbs.	Kg.	Cubic Feet	Cubic Meters	Cubic Feet	Cubic Meters
2"	60	27.22	100	45.36	1.66	0.047	1.79	0.051
3"	105	47.63	150	68.04	2.36	0.067	2.5	0.071
4"	140	63.5	205	92.99	2.51	0.071	3.13	0.089
6"	250	113.4	400	181.44	4.84	0.137	6.07	0.172
8"	465	210.92	725	328.85	8.94	0.253	9.98	0.283
10"	700	317.51	1170	530.7	12.08	0.342	15.13	0.428
12"	1251	551.11	1820	825.54	20.25	0.573	21.94	0.621

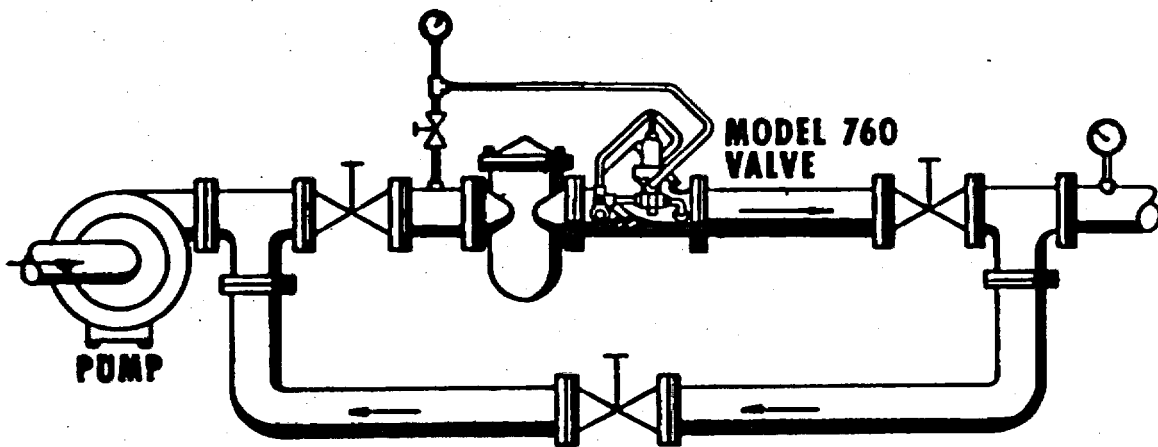


Figure 1 - The Model 760 is used to maintain constant pressure at the pump discharge. The valve opens when a predetermined pressure is reached, allows flow to start, and then regulates back pressure on the pump within ± 2 psi. (13.8 kPa)

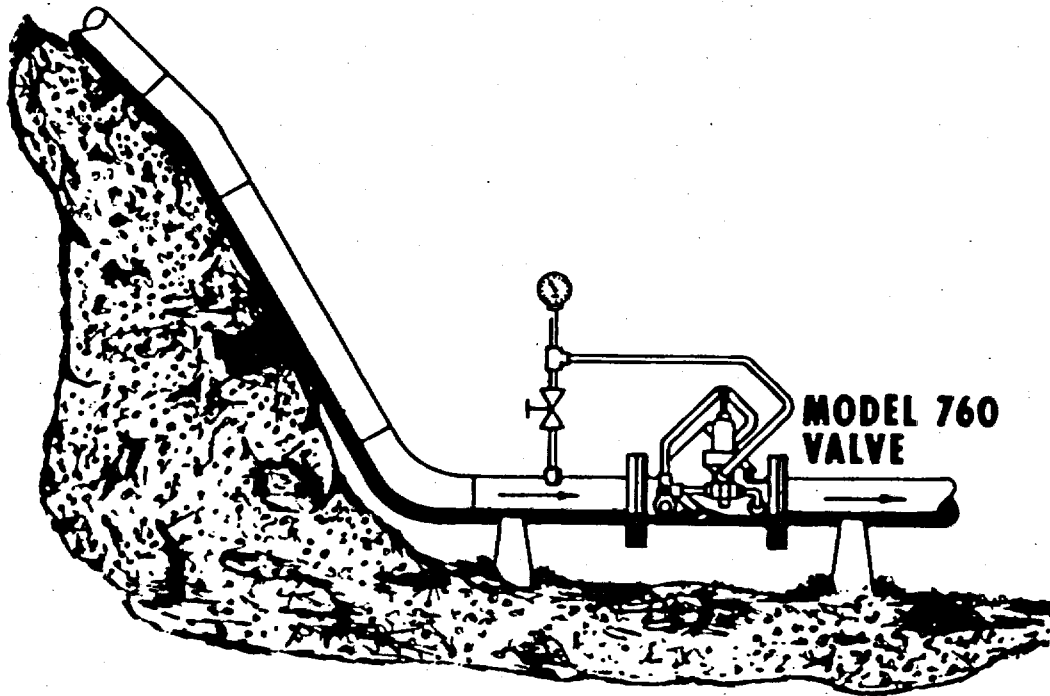


Figure 2 - The Model 760 is installed in a pipeline at the bottom of an incline. The valve will maintain a back pressure equal to head pressure and prevent liquid separation.

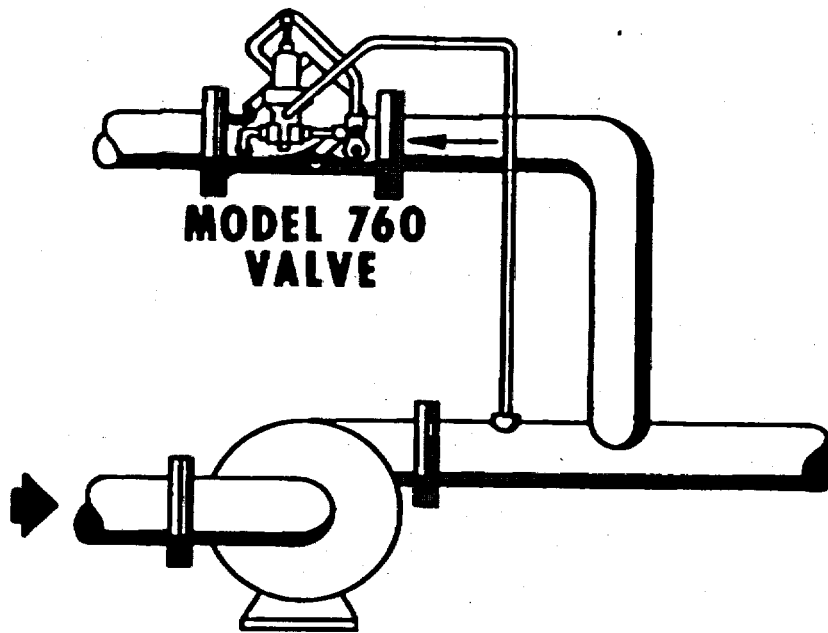
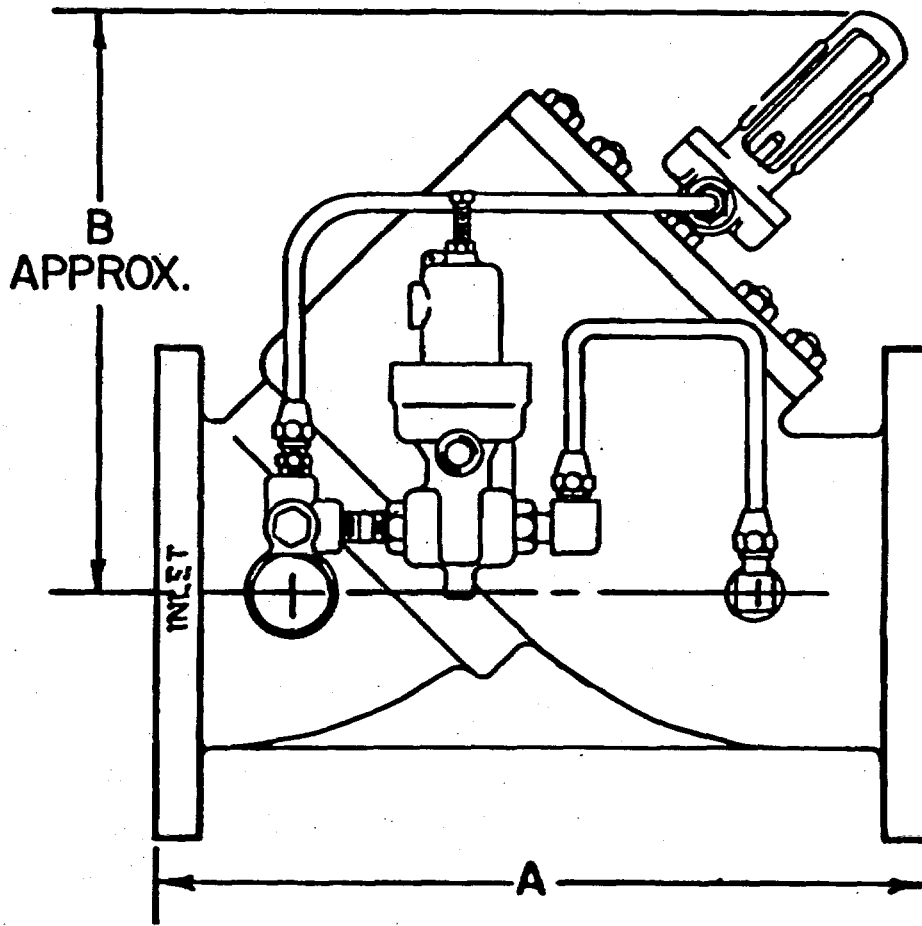


Figure 3 - The 760 illustrated here is applied either as a relief valve to protect the line against excessive pressure and surge or as a pump bypass valve to maintain a constant pump discharge. Flow through the valve may be piped to storage, to pump suction, to a sump, or to atmosphere.

DIMENSIONS (For certified dimension prints - consult factory)



Valve Size	DIMENSION A (ANSI Flanges)						DIMENSION B (ANSI Flanges)	
	150 lbs.		300 lbs.		600 lbs.		150-600 lb.	
	Inches	mm	Inches	mm	Inches	mm	Inches	mm
2"	10 1/4	260	10 1/2	267	11 1/2	292	10 7/8	276
3"	11	279	13 1/8	333	14	356	11 1/4	286
4"	13	330	14 1/2	368	17	432	11 1/2	292
6"	17	432	17 7/8	454	22	559	13 5/8	346
8"	22 1/4	565	23 1/4	591	26	660	17 3/4	451
10"	26 1/2	673	27 7/8	708	31	787	20 5/8	524
12"	30 7/8	784	33 5/8	854	36 1/2	927	22 7/8	581

PURCHASE SPECIFICATIONS

These valves shall maintain a constant back pressure regardless of variations in flow rate or downstream pressure. They shall be hydraulically operated and pilot controlled using the flowing stream as the operating medium. The main valves shall be pressure balanced, single seated, piston operating with 45° body construction. All internal parts, including cylinder, spring, piston and seat ring shall be removed as a cartridge assembly without disturbing line connections. The pilot valves shall be pressure balanced, piston operated and single seated. A manual flow control valve shall be included in the pilot supply line of the 760 to provide an adjustable closing rate. The 760 pilot supply shall also include a strainer. These valves shall, in all respects, be similar or equal to a Model 760 back pressure control valve.

ORDERING INFORMATION

When ordering, the following information must be supplied:

1. Size
2. Flange connections
3. Product, product viscosity, product specific gravity
4. Minimum and maximum operating temperature
5. Minimum and maximum flow rate
6. Minimum, normal and maximum operating pressure
7. Control functions to be performed
8. O-Ring material
9. Control pilot materials
10. Tubing material
11. Main valve piston material
12. Pilot spring range
13. Pilot spring setting (psi or kPa)

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BROOKS

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INSTALLATION
& OPERATION
INSTRUCTIONS

BROOKS-Control Valves
Safety Relief

June, 1979

(Supersedes issue dated June, 1976)

MODELS 760 and 7601

CAUTION: It is recommended that this publication be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

Should this equipment require repair or adjustment, contact the nearest Brooks District 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.

INTRODUCTION

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.

OPERATION (Refer to installation schematic)

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.

PRIMARY PILOT VALVE

The primary regulator, a 1760 Pilot Valve, is spring set (adjustable) and the minimum to maximum range of the spring is stamped 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.

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.

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. The last three (3) digits of its model number represents the setting: (51305-3MP-XXX). **IMPORTANT:** The 1760 pilot (primary) must be set at least 10 psi lower than the Circle Seal Relief Valve (secondary).

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 is required. Installation of a small block 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.

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:

- 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.
- 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.



BROOKS INSTRUMENT DIVISION EMERSON ELECTRIC CO., STATESBORO, GEORGIA 30458

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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.

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).

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:

- 1) Closing block valve (A), permits testing the 1760 pilot valve set point when using a "dead weight tester" or some auxiliary hydraulic device.
- 2) Closing block valves (B), (C), and (E) allows removal of the 1760 pilot with the Circle Seal Valve still operable.

3) Opening block valve (D) permits the model 760 valve to open full for emergency or other reasons.

4) 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)

MAINTENANCE: To perform maintenance on the valve or pilot, refer to the following bulletins:

V1500-21 Basic Valve Service Instructions

V1700-20 Basic Valve Parts List

V7760-20 1760 Pilot Parts List

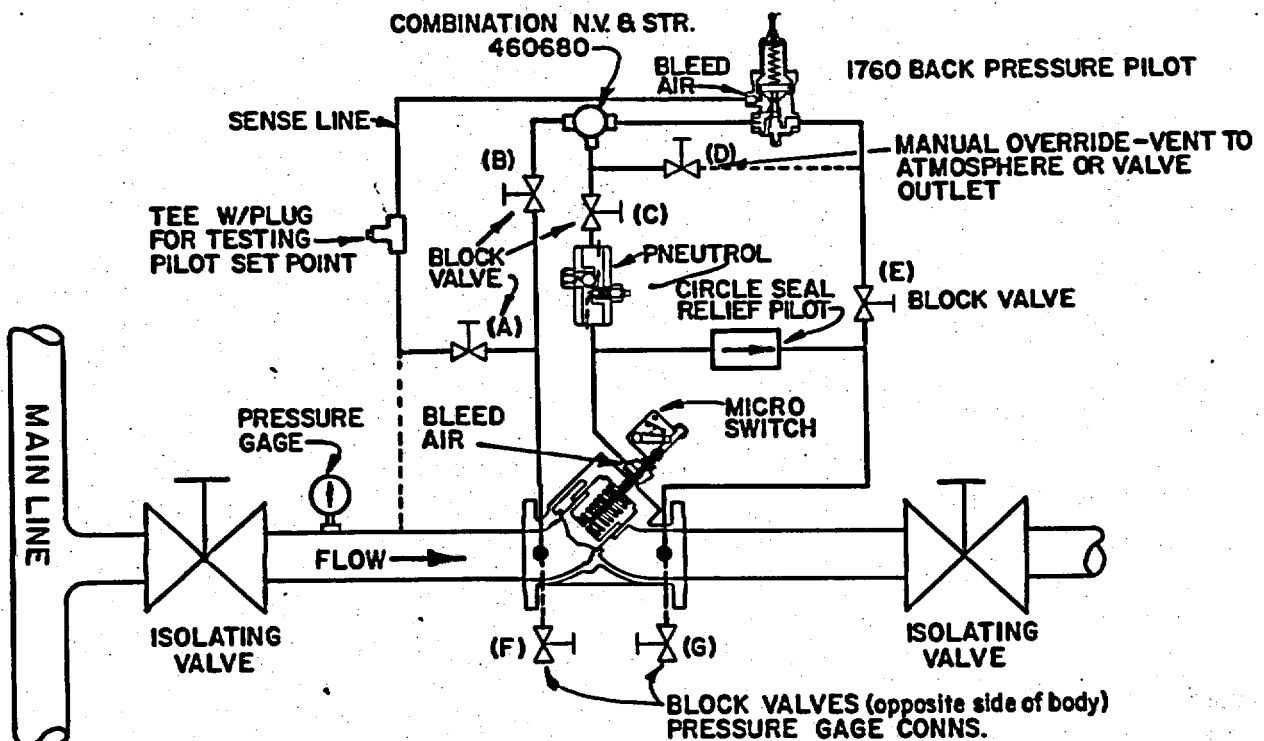
V7460-20 Needle Valve and Strainer Combinator Parts List

GUARANTEES:

If at any time within one year after shipment but not thereafter it is proved that any part of the equipment furnished by us was defective when shipped by us we will replace the same free of charge F.O.B. our plant. Notice of this claim must be made to us within one year after delivery. Our liability is limited to replacement of such defective parts or equipment. There are no guarantees or warranty expressed or implied other than those herein specifically mentioned.

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It is understood that corrosion or erosion of materials is not covered by our guarantee.





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TECHNICAL
BULLETIN

BROOKS-Control Valves
Pilot Springs

September, 1984

(Supersedes issue dated October, 1979)

Description

The table on the reverse side of this sheet is a complete listing of regulating pilot valve figure numbers, part numbers, pilot springs, spring part numbers and piston diameters.

Of special significance and often misunderstood is the application of pilot springs. The pressure range of a specific pilot spring relates directly to the area of the pilot piston exposed to fluid sensing. ($\text{FORCE} = \text{PRESSURE} \times \text{AREA}$). 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 a Brooks Valve.

Table Usage

Example: A customer has an ANSI 300 lb. Model 750 Pressure Reducing Valve with a 30 - 80 psi (207 - 552 kPa) pilot spring set for 70 psi (483 kPa) control. Due to change in the system, he desires to control a 300 psi (2068 kPa) downstream pressure. For a spring range of 150 to 350 psi (1034 - 2413 kPa) the table lists a 460023 spring. But the existing spring range of 30 - 80 psi (207 - 552 kPa) 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 a pilot spring change. If any two facts are known about a pilot, other tabulated data can be determined. For example:

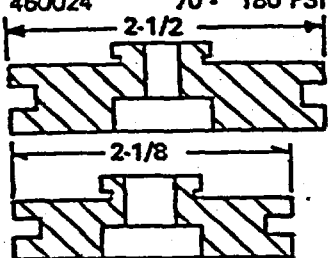
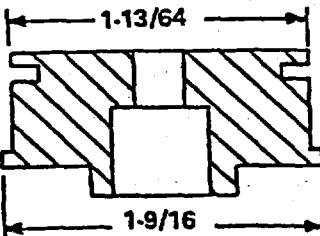
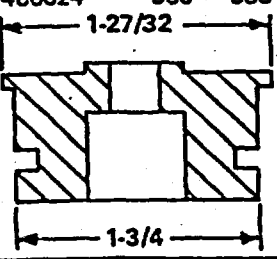
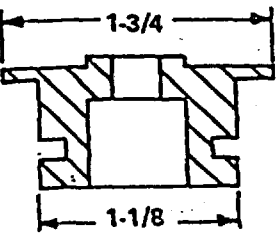
1. Knowledge of piston diameter and spring color indicates the spring range of the pilot.
2. Knowledge of the model number and piston diameter indicates the pilot part number.
3. Knowledge of the pilot part number and spring color indicates the spring range.



PILOT SPRING SELECTION TABLE

The following table outlines the standard and optional springs, spring ranges and piston diameters for all integral and external piston operated pilots for series 500 and series 700 control valves.

Conversion Factors: PSI X .07030695 = kg/cm²
PSI X 6.894757 = kPa

Spring Part Number	Spring Range	Color Coding	Pilot Description	Model Number Figure Number	Pilot Assembly Part Number	Standard Spring Range
460223 460022 460023 460024	0 - 20 PSI 0 - 40 PSI 30 - 80 PSI 70 - 180 PSI	Unpainted Blue Black or Red Bronze	 <p>FOR MAX. RANGE of 180 PSI (LARGE PISTON) USED ON ANSI FLANGED 125 - 300 lb. VALVES</p>	1550 1554 1560 1570 1580 1750* 1754 1760 1770 1780	460000 460600 460100 460500 460200 453100 453700 453200 453500 453300	30 - 80 PSI 0 - 20 PSI 30 - 80 PSI 0 - 40 PSI 0 - 20 PSI 30 - 80 PSI 0 - 20 PSI 30 - 80 PSI 0 - 40 PSI 0 - 20 PSI
		Bronze Pilot Steel Pilot				
460023 460024	150 - 350 PSI 350 - 650 PSI	Black or Red Bronze	 <p>FOR MAX. RANGE OF 650 PSI (SMALL PISTON) USED ON ANSI FLANGED 125 - 300 lb. VALVES</p>	1550 1554 1560 1570 1750 1754 1760 1770	463000 463600 463100 463500 456600 456700 456100 456500	350 - 650 PSI 150 - 350 PSI 350 - 650 PSI 150 - 350 PSI 350 - 650 PSI 150 - 350 PSI 350 - 600 PSI 150 - 350 PSI
		Bronze or Steel Pilot				
466223 466022 466023 466024	5 - 100 PSI 50 - 250 PSI 200 - 400 PSI 350 - 650 PSI	Blue Black or Red Bronze Green	 <p>FOR MAX. RANGE OF 650 PSI (LARGE PISTON) USED ON ANSI FLANGED 600 lb. VALVES</p>	2550 2554 2560 2570 2580 2750 2754 2760 2770 2780	476000 476600 476100 476500 476600 475000 475600 475100 475500 475600	350 - 650 PSI 5 - 100 PSI 350 - 650 PSI 350 - 650 PSI 5 - 100 PSI 350 - 650 PSI 5 - 100 PSI 350 - 650 PSI 350 - 650 PSI 5 - 100 PSI
466023 466024	600 - 950 PSI 900 - 1500 PSI	Bronze Green	 <p>FOR RANGE OF 1500 PSI (SMALL PISTON) USED ON ANSI FLANGED 600 lb. VALVES</p>	2550 2554 2560 2570 2580 2750 2754 2760 2770 2780	466000 466600 466100 466500 466600 465000 465600 465100 465500 465600	900 - 1500 PSI 900 - 1500 PSI 900 - 1500 PSI 900 - 1500 PSI 900 - 1500 PSI 900 - 1500 PSI 900 - 1500 PSI 900 - 1500 PSI 900 - 1500 PSI 900 - 1500 PSI

BACK PRESSURE PILOT VALVES

All pilot valves should be inspected and cleaned at regularly scheduled intervals. At these times, all parts should be thoroughly cleaned and all o-rings should be checked for nicks, cuts and wear. Any defective or doubtful o-rings should be replaced.

To Disassemble Pilot

1. The 1560 pilot is removed from the basic valve by removing screws (Item 6) or the 1760 pilot is removed from valve by disconnecting the external tubing.
2. Turn pressure adjustment screw (Item 31) counter-clockwise until tension is relieved on spring. Push in on pilot cover (Item 2) and remove by extracting Spirolex retaining ring (Item 30).
3. Disengage poppet shaft assembly (Item 19) from sensing piston (Item 24) by holding shaft and removing nut (Item 26) and lockwasher (Item 25).
4. Remove sensing piston (Item 24).
5. Remove poppet shaft (Item 19) and cage (Item 14) as a unit after removing retainer ring (Item 20). Remove poppet shaft and guide bushing (Item 16) after removing retainer ring (Item 17). Remove poppet shaft from guide bushing.
6. Using a 3/32" punch, drive pin (Item 8) from poppet shaft. Remove retainers sleeve (Item 10) and o-ring (Item 11) from shaft. Remove adjustment cap (Item 4) and adjustment screw (Item 5) on the 1560 pilot.
7. Remove and inspect all o-rings.

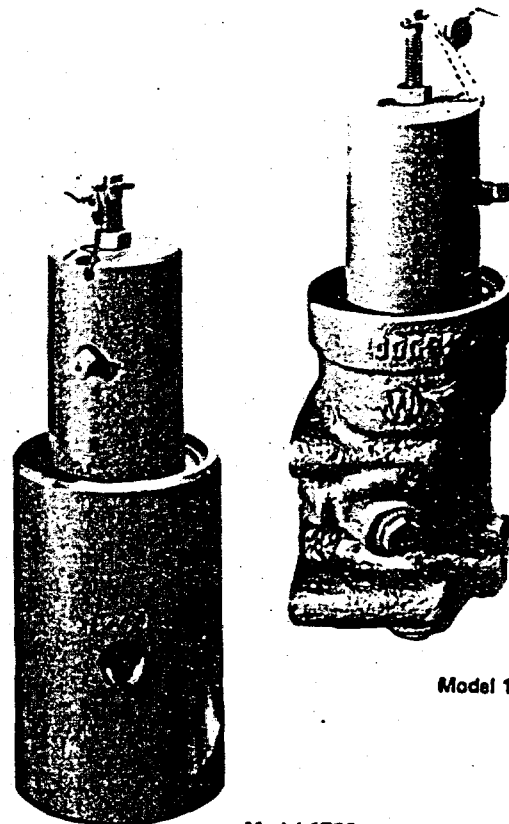
To Reassemble Pilot

1. Apply oil or grease to all o-rings to prevent cutting and to facilitate assembly. Use a light oil only for Butane and Propane, a non-lubricant petroleum base lubricant on Anhydrous ammonia.
2. Reassemble by reversing disassembly order. BE CAREFUL not to cut o-rings when assembling parts and assemblies. Be sure spring (Item 21) under sensing piston is in place.

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Viton-A E. I. DuPont deNemours & Co.

MODELS 1560 and 1760



Model 1560

Model 1760

1560 and 1760 Complete Pilot Assemblies

1560		1760	
Bronze	Steel	Bronze	Steel
460100-210 0-20	460100-510 0-20	453200-220 0-40	453200-520 0-40
460100-220 0-40	460100-520 0-40	453200-230 30-80	453200-530 30-80
460100-230 30-80	460100-530 30-80	453200-240 70-180	453200-540 70-180
460100-240 70-180	460100-540 70-180	456100-230 150-350	456100-530 150-350
463100-230 150-350	463100-530 150-350	456100-240 350-650	456100-540 350-650
463100-240 350-650	463100-540 350-650		

Parts List — Models 1560 and 1760

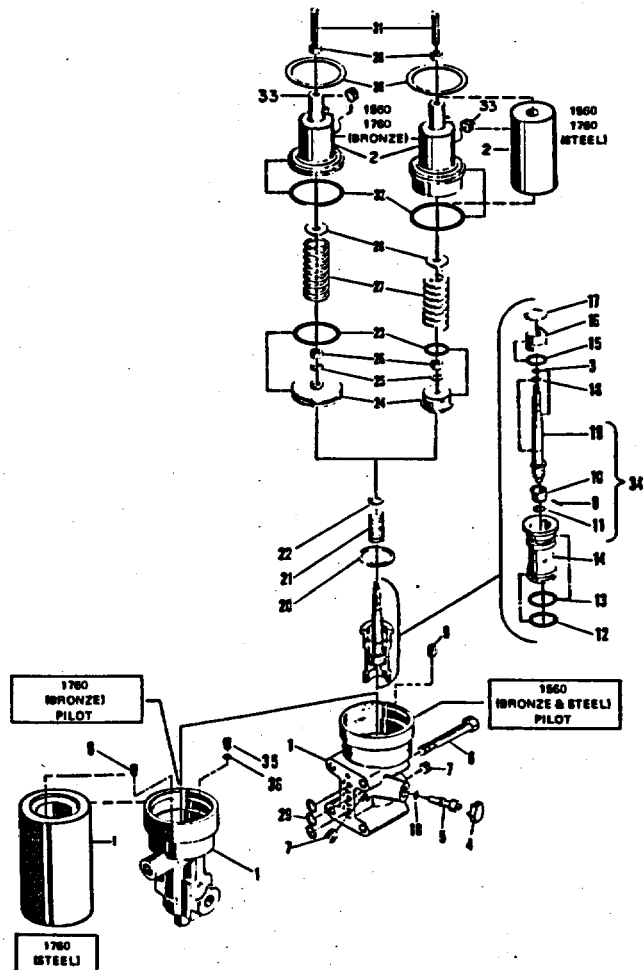
Item No.	Description	Part Number		Qty. Req.
		3"	4"	
1	Pilot Body (Bronze)	460001-200	453101-200	1
	Pilot Body (Steel)	460001-500	453301-500	1
2	Cover (Bronze, 0-180 psf)	460006-200	460006-200	1
	Cover (Bronze, 150-650 psf)	430006-200	430006-200	1
	Cover (Steel, 0-180 psf)	460006-600	460006-600	1
	Cover (Steel, 150-650 psf)	463006-600	463006-600	1
*3	O-Ring**	152064	152064	1
4	Adjustment Cap	460118	—	1
5	Adjustment Screw	460118	—	1
6	Cap Screw	150761	—	4
7	Pipe Plug (Bronze)	154772	—	2
	Pipe Plug (Steel)	154720	—	2
8	Roll Pin	153511	153511	1
9	Orifice Screw	460108	460108	1
10	Retainer Sleeve	460112	460112	1
*11	O-Ring**	152067	152067	1
*12	O-Ring**	157008	157008	1
*13	O-Ring**	157010	157010	1
14	Pilot Valve Cage	460007	460007	1
*15	O-Ring**	152090	152090	1
16	Guide Bushing	460008	460008	1
17	Retainer Ring	156467	156467	1
*18	O-Ring** (quantity in [])]	152066 [2]	152066 [1]	
19	Poppet Shaft	460111	460111	1
20	Retainer Ring	156466	156466	1
21	Spring	460021	460021	1
22	Thrust Washer	460013	460013	1
*23	O-Ring (Bronze, 0-180 psf)	157007	157007	1
	O-Ring (Steel, 0-180 psf)	152073	152073	1
	O-Ring (Bronze & Steel 150-650 psf)	152091	152091	1
24	Piston (Bronze, 0-180 psf)	460016	460016	1
	Piston (Steel, 0-180 psf)	460116	460116	1
	Piston (Bronze & Steel 150-650 psf)	463016	463016	1
25	Lockwasher	152267	152267	1
26	Nut	151543-019	151543-019	2
27	Spring, 0-20 lbs.	460223	—	1
	Spring, 0-40 lbs.	460022	460022	1
	Spring, 30-80 lbs.	460023	460023	1
	Spring, 70-180 lbs.	460024	460024	1
	Spring, 150-350 lbs.	460023	460023	1
	Spring, 350-650 lbs.	460024	460024	1
28	Spring Guide	460017	460017	1
*29	O-Ring **	152070	—	3
30	Retainer Ring	156465	156465	1
31	Screw	150687-024	150687-024	1
*32	O-Ring**	157011	157011	1
	O-Ring**	157011	157011	1
33	Vent Pipe Plug (Bronze)	460015	460015	1
	Vent Pipe Plug (Steel)	460015-500	460015-500	1
34	Poppet Shaft Assembly	460110	460110	1
35	Orifice Plug, Bronze	—	150688	1
*36	O-Ring, Bronze	—	152062	1

NOTES:

* Recommended Spare Parts

** O-Ring part numbers listed are for Buna-N. For other O-Ring materials, add suffix as follows:

Description	Suffix
EPR (Use in place of Butyl)	-005
PL (low temperature)	-016
Viton-A™	-022
Neoprene™	-116



Brooks Instrument
 Highway 301 North
 P.O. Box 450
 Statesboro, GA 30458
 Tel (912) 764-5471
 Fax (912) 764-2538
 Telex 160069

Specifications Subject to Change Without Notice

BROOKS INSTRUMENT **ROSEMOUNT**® Measurement
 Control
 Analytical
 Valves

PARTS LIST

BACK PRESSURE PILOT VALVES

All pilot valves should be inspected and cleaned at regularly scheduled intervals. At these times, all parts should be thoroughly cleaned and all o-rings should be checked for nicks, cuts and wear. Any defective or doubtful o-rings should be replaced.

To Disassemble Pilot

1. The 1560 pilot is removed from the basic valve by removing screws (Item 6) or the 1760 pilot is removed from valve by disconnecting the external tubing.
2. Turn pressure adjustment screw (Item 31) counter-clockwise until tension is relieved on spring. Push in on pilot cover (Item 2) and remove by extracting Spirolex retaining ring (Item 30).
3. Disengage poppet shaft assembly (Item 19) from sensing piston (Item 24) by holding shaft and removing nut (Item 26) and lockwasher (Item 25).
4. Remove sensing piston (Item 24).
5. Remove poppet shaft (Item 19) and cage (Item 14) as a unit after removing retainer ring (Item 20). Remove poppet shaft and guide bushing (Item 16) after removing retainer ring (Item 17). Remove poppet shaft from guide bushing.
6. Using a 3/32" punch, drive pin (Item 8) from poppet shaft. Remove retainersleeve (Item 10) and o-ring (Item 11) from shaft. Remove adjustment cap (Item 4) and adjustment screw (Item 5) on the 1560 pilot.
7. Remove and inspect all o-rings.

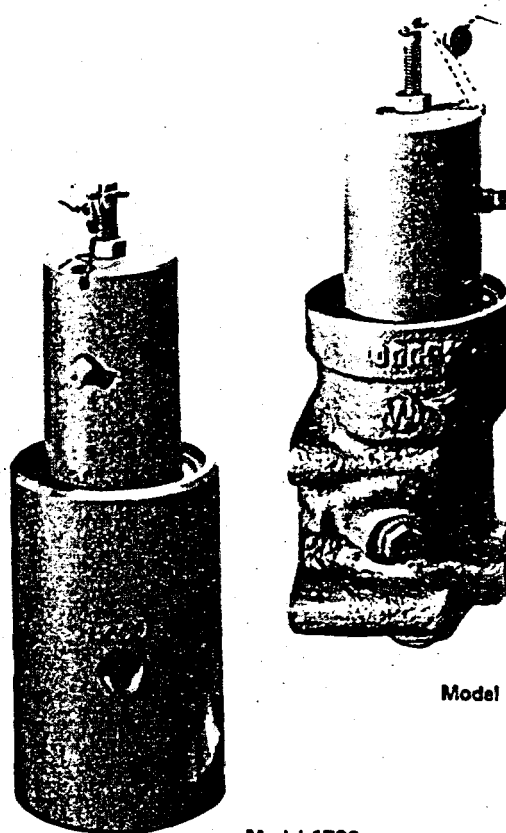
To Reassemble Pilot

1. Apply oil or grease to all o-rings to prevent cutting and to facilitate assembly. Use a light oil only for Butane and Propane, a non-lubricant petroleum base lubricant on Anhydrous ammonia.
2. Reassemble by reversing disassembly order. BE CAREFUL not to cut o-rings when assembling parts and assemblies. Be sure spring (Item 21) under sensing piston is in place.

Trademarks

Brooks Brooks Instrument Division, Emerson Electric Co.
Neoprene E. I. DuPont deNemours & Co.
Rosemount Rosemount, Inc.
Viton-A E. I. DuPont deNemours & Co.

MODELS 1560 and 1760



Model 1560

Model 1760

1560 and 1760 Complete Pilot Assemblies

1560		1760	
Bronze	Steel	Bronze	Steel
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460100-220 0-40	460100-520 0-40	453200-230 30-80	453200-530 30-80
460100-230 30-80	460100-530 30-80	453200-240 70-180	453200-540 70-180
460100-240 70-180	460100-540 70-180	456100-230 150-350	456100-530 150-350
463100-230 150-350	463100-530 150-350	456100-240 350-650	456100-540 350-650
463100-240 350-650	463100-540 350-650		

BROOKS INSTRUMENT **ROSEMOUNT**® Measurement Control Analytical Valves

Parts List — Models 1560 and 1760

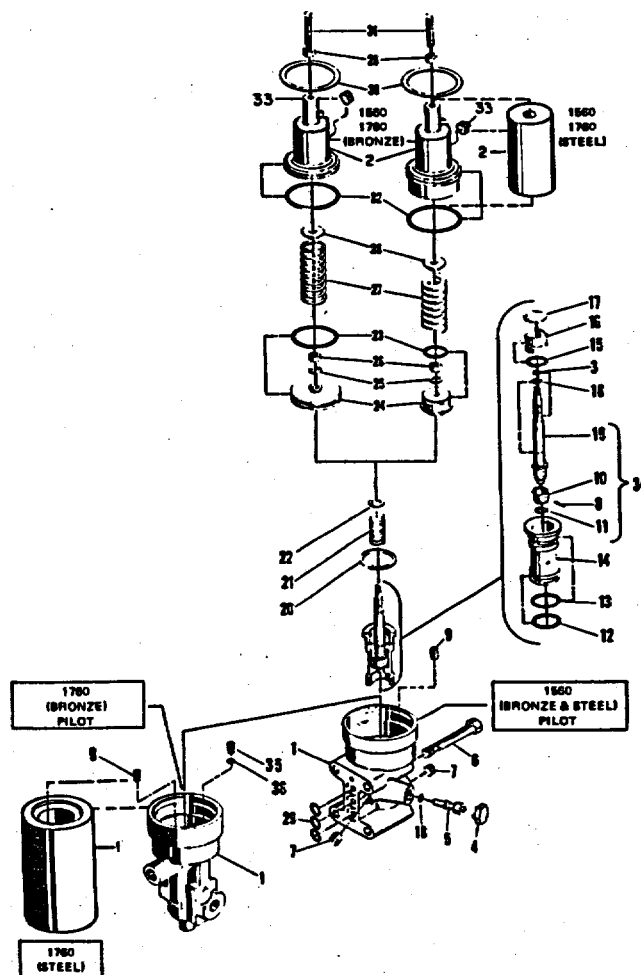
Item No.	Description	Part Number		Qty. Req.
		3"	4"	
1	Pilot Body (Bronze)	460001-200	453101-200	1
	Pilot Body (Steel)	460001-500	453301-500	1
2	Cover (Bronze, 0-180 ps)	460006-200	460006-200	1
	Cover (Bronze, 150-650 ps)	430006-200	430006-200	1
	Cover (Steel, 0-180 ps)	460006-600	460006-600	1
	Cover (Steel, 150-650 ps)	463006-600	463006-600	1
*3	O-Ring**	152064	152064	1
4	Adjustment Cap	460118	—	1
6	Adjustment Screw	460118	—	1
6	Cap Screw	150761	—	4
7	Pipe Plug (Bronze)	154772	—	2
	Pipe Plug (Steel)	154720	—	2
8	Roll Pin	153511	153511	1
9	Orifice Screw	460108	460108	1
10	Retainer Sleeve	460112	460112	1
*11	O-Ring**	152067	152067	1
*12	O-Ring**	157008	157008	1
*13	O-Ring**	157010	157010	1
14	Pilot Valve Cage	460007	460007	1
*15	O-Ring**	152090	152090	1
16	Guide Bushing	460008	460008	1
17	Retainer Ring	156467	156467	1
*18	O-Ring** (quantity in []))	152066 [2]	152066 [1]	
19	Poppet Shaft	460111	460111	1
20	Retainer Ring	156466	156466	1
21	Spring	460021	460021	1
22	Thrust Washer	460013	460013	1
*23	O-Ring (Bronze, 0-180 ps)	157007	157007	1
	O-Ring (Steel, 0-180 ps)	152073	152073	1
	O-Ring (Bronze & Steel 150-650 ps)	152091	152091	1
24	Piston (Bronze, 0-180 ps)	460016	460016	1
	Piston (Steel, 0-180 ps)	460116	460116	1
	Piston (Bronze & Steel 150-650 ps)	463016	463016	1
25	Lockwasher	152267	152267	1
26	Nut	151543-018	151543-018	2
27	Spring, 0-20 lbs.	460223	—	1
	Spring, 0-40 lbs.	460022	460022	1
	Spring, 30-80 lbs.	460023	460023	1
	Spring, 70-180 lbs.	460024	460024	1
	Spring, 150-350 lbs.	460023	460023	1
	Spring, 350-650 lbs.	460024	460024	1
28	Spring Guide	460017	460017	1
*29	O-Ring**	152070	—	3
30	Retainer Ring	156465	156465	1
31	Screw	150687-024	150687-024	1
*32	O-Ring**	157011	157011	1
33	Vent Pipe Plug (Bronze)	460015	460015	1
	Vent Pipe Plug (Steel)	460015-500	460015-500	1
34	Poppet Shaft Assembly	460110	460110	1
35	Orifice Plug, Bronze	—	150688	1
*36	O-Ring, Bronze	—	152062	1

NOTES:

- * Recommended Spare Parts

** O-Ring part numbers listed are for Buna-N. For other O-Ring materials, add suffix as follows:

Description	Suffix
EPR (Use in place of Butyl)	-005
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BROOKS INSTRUMENT ROSEMOUNT® Measurement Control Analytical Valves

COMBINATION NEEDLE VALVE AND STRAINER

WARNING:

It is recommended that this publication be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

Should this equipment require repair or adjustment, contact the nearest Brooks Sales Office. It is important that servicing only be performed by trained and qualified service personnel. If this equipment is not properly serviced, serious personal injury and/or damage to the equipment could result.

Disassembly/Reassembly

1. Remove strainer (combination valve and strainer unit) by removing strainer cap (Item 9).
2. All parts associated with the adjustment stem are removable when the retainer (Item 4) is removed. The adjustment stem (Item 3) must be removed by turning counterclockwise.
3. When reassembling, lubricate all O-rings to facilitate assembly and prevent cutting. Use Gargoyle Sovarex Grease, if available.

Parts Orders

In order to facilitate prompt handling of parts orders, communicate directly with the Brooks Regional Office in your area. Be sure to specify (1) Quantity, (2) Name of Part, and (3) Part Number.

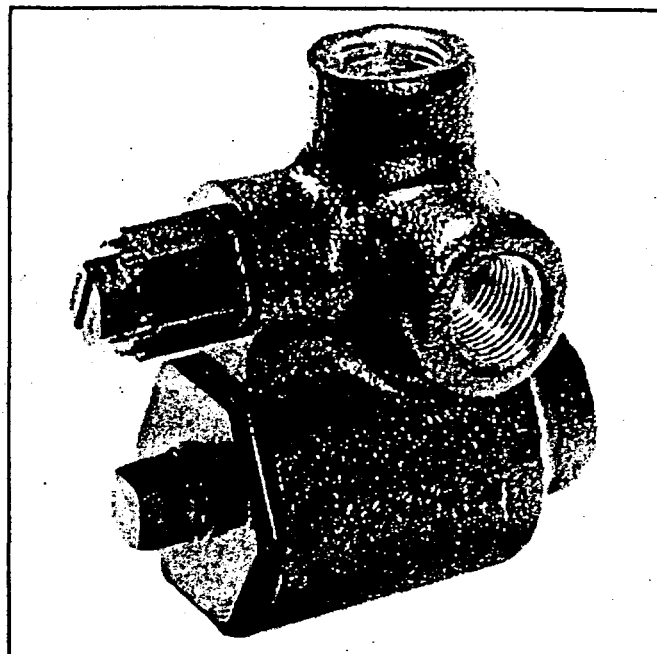
Repair

If factory repairs are necessary, obtain a return materials report (RMR) form from our nearest district sales office and ship the unit directly to:

Brooks Instrument
ATTN: Customer Service & Repair
Highway 301 North
Statesboro, GA 30458

Trademarks

Brooks Brooks Instrument Division, Emerson Electric Co.
Rosemount Rosemount, Inc.

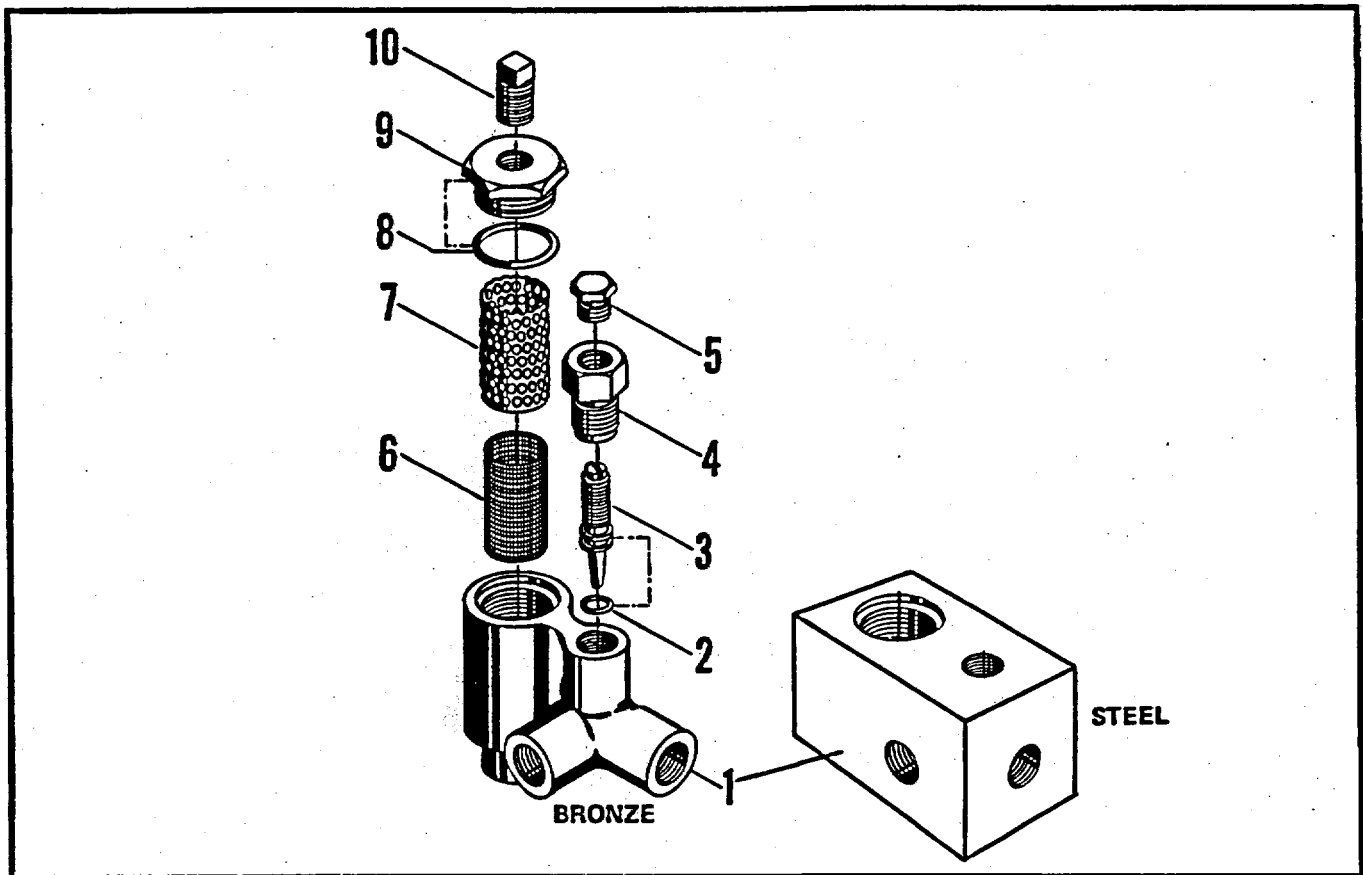


GUARANTEES

If at any time within one year after shipment, but not thereafter, it is proved that any part of the equipment furnished by us was defective when shipped by us, we will replace the same free of charge F.O.B. our plant. Notice of this claim must be made to us within one year after delivery. Our liability is limited to replacement of such defective parts or equipment. There are no guarantees or warranty expressed or implied other than those herein specifically mentioned.

Brooks Instrument shall not, in any event, be liable for any consequential damages, secondary charges, expenses for erection or disconnecting for losses resulting from any alleged defect in the apparatus.

It is understood that corrosion or erosion of materials is not covered by our guarantee.



Parts List

Item	Description	Pilot part numbers 460680-200 and 460680-500 were shipped on all size valves before July 1, 1975.		Pilot part numbers 460710-200 and 460710-500 were shipped on 8", 10" and 12" valves after July 1, 1975.		Quantity Required
		Bronze 460680-200	Steel 460680-500	Bronze 460710-200	Steel 460710-500	
1	Body	460681-200	460681-500	460688-200	460688-500	1
2	O-Ring	152067	152067	152067	152067	1
3	Adjustment Stem	460683	460683	460683-001	460683-001	1
4	Retainer	460684	460684	460684	460684	1
5	Cap	460686	460686	460686	460686	1
6	Strainer Screen	460687	460666	460687	460666	1
7	Strainer Basket	—	460667	—	460667	1
8	O-Ring	152042	152042	152042	152042	1
9	Cap-Strainer	460682	460682	460682	460682	1
10	Pipe Plug	157493	154783-024	157493	154783-024	1

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