ANDERSON GREENWOOD CROSBY

tyco flow control

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DWN		**MAINTENANCE INSTRUCTIONS**		
CHK		**TYPE 91/94**		
APPR				
APPR		SIZE	REPORT NUMBER	REV
APPR		A	05.9040.080	J
APPR		PAGE 1 OF 24		

REVISIONS		
REV.	**DESCRIPTION**	**APPROVALS/DATE**
G	ECR #97-023-01 Revised entire report.	S.WILLIS 1-23-97 C.PEARSON 1-31-97 D.PAPA 1-31-97
H	ECN #98-125-14 Revised entire report.	S.WILLIS 5-08-98 J.DIAL 5-12-98 D.PAPA 5-15-98
J	ECN #01-1058	S.WILLIS 8-01-01 S.CONNALLY 8-01-01 E.TEZZO 8-01-01

INSTRUCTIONS – MAINTENANCE FOR TYPE 91 AND 94 POSRV'S

The intent of these instructions is to acquaint the user with the storage, installation and operation of this product. **Please read these instructions carefully before installation.**

WARNING

Removal of the seal wires in an attempt to adjust and/or repair this product by unauthorized or unqualified persons voids the product warranty and may cause damage to equipment and serious injury or death to persons.

The product is a safety related component intended for use in critical applications. The improper application, installation or maintenance of the product or the use of parts or components not manufactured by Anderson Greenwood Crosby may result in a failure of the product.

Any installation, maintenance, adjustment, test, etc. performed on the Product must be done in accordance with the requirements of all applicable Anderson Greenwood Crosby Procedures and Instructions as well as applicable National and International Codes and Standards.

SAFETY PRECAUTIONS

When the pressure relief valve is under pressure never place any part of your body near the pilot exhaust nor the outlet of the main valve.

The main valve outlet should be piped or vented to a safe location.

Always wear proper safety gear to protect head, eyes, ears, etc. anytime you are near pressurized valves.

Never attempt to remove the pressure relief valve from a system that is pressurized.

Never make adjustments to or perform maintenance on the pressure relief valve while in service unless the valve is isolated from the system pressure. If not properly isolated from the system pressure, the pressure relief valve may inadvertently open resulting in serious injury.

Remove the pressure relief valve prior to performing any pressure testing of the system.

The safety of lives and property often depends on the proper operation of the pressure relief valve. The valve must be maintained according to appropriate instructions and must be periodically tested and reconditioned to ensure correct function.

STORAGE AND HANDLING

Pressure relief valve performance may be adversely affected if the valve is stored for an extended period without proper protection. Rough handling and dirt may damage, deform, or cause misalignment of valve parts and may alter the pressure setting and adversely affect valve performance and seat tightness. It is recommended that the valve be stored in the original shipping container in a warehouse or as a minimum on a dry surface with a protective covering until installation. Inlet and outlet protectors should remain in place until the valve is ready to be installed in the system.

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1.0 GENERAL VALVE DESCRIPTION & START-UP

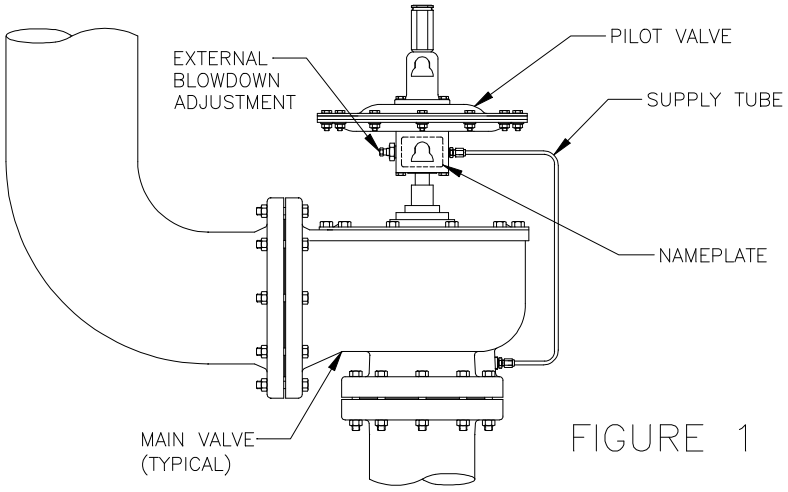


FIGURE 1

05-9040-080-FIG1.DWG

1.1 Operation

The AGCO Pilot Operated Safety-Relief Valves utilize the principle of back-loading the top, or large area, of a differential area bellows with line pressure to hold the bellows closed up to set pressure. At set pressure the pilot valve relieves, partially evacuating the dome (volume in the bellows) and the bellows lifts permitting discharge from the main valve. When the pilot reseats, line pressure is diverted to the dome closing the main valve.

1.2 Installation

The valve should be installed in accordance with accepted piping practices, in an upright position as shown in Figure 1.

When remote pressure pick-up is used the pilot supply tube is connected to a remote location rather than to the inlet neck of the valve. If a block valve is used in the remote pilot supply line, be sure it is opened before pressurizing the system or opening the isolating block valve under the main valve, if one is used.

NOTE: Remote pressure pick-up piping must have the equivalent flow area of 1/2" [15 mm] tubing for lengths up to 20 feet [6.1 m]. For lengths greater than 20 feet [6.1 m], larger tubing or pipe should be used.

1.3 Start-Up

There must be pressure at the valve inlet to establish a differential in force across the bellows and "load" it in the closed position. Pressure must pass through the pilot supply tube and pilot, and exert force in the bellows. On normal start-up, the valve loads itself without incident as pressure increases.

Block valves are often used under safety valves in order to isolate them when maintenance is required. When putting the safety valve in service be sure the block valve is fully opened. If the block valve is opened after system start-up, the safety valve, may briefly vent to the atmosphere before the dome gets pressurized. It will then close off positively.

2.0 MAIN VALVE MAINTENANCE (Refer to Figure 2)

2.1 Disassembly

Remove hex bushing from guide tower, then remove cap from body by lifting cap vertically until guide tower disengates the guide tube on the bellows. Turn cap assembly upside down to remove drag ring assembly on those valves where it is used. It is not necessary to remove guide tower from cap unless one of these parts is to be replaced.

Lift bellows assembly with seat from body. Remove guide bolt to separate guide and seat plate from bellows. The bellows shield, where used, can now be removed. Remove seat retainer from seat plate and Teflon seats.

2.2 Repair

Clean all metal parts, and replace seat and seals, as required. The nozzle may be removed from the body if it cannot be adequately cleaned.

Install a new film seat by placing the film over the seat plate with the edges of the film extending beyond the outside diameter of the plate. Place the secondary seat on the film and the retainer over the secondary seat. Align the holes in the retainer with those in the seat plate and press the retainer down evenly over the seat plate ridge. Larger size valves may require that the retainer be pulled into place with the retainer screws. Start several screws in opposite holes using the screws to pierce through holes in the film and tighten one thread at a time.

NOTE: The film must be stretched tight and be free of wrinkles and scratches to insure a bubble-tight seal. Install the remaining screws in the seat retainer, trim the excess film from the outer diameter and cut a hole in center for the guide bolt.

2.3 Assembly

Assemble in reverse order of disassembly. If the nozzle was removed from the body, cross torque socket head nozzle cap screws to 45/55 in.lbs. [5.1/6.2 N?m].

The bellows shield must be installed on the bellows before the seat plate assembly is attached. A seal is used under the head of the guide bolt and between the seat plate and guide tube. On 6" [150 mm] and larger valves, a lockwasher is used under the locknut. Place the bellows assembly in the valve body. The top of the bellows and bellows shield, where used, must locate in the counterbore of the body. Locate the cap gasket on the bellows top plate and place the cap with guide tower in place. The cap gasket should be positioned in the counterbore. If not, the cap may be tilted, causing the bellows and seat plate to tip and the seat to leak. Some lubricant placed on the gasket will help keep it in place. Install the cap bolts and cross torque to 55/65 ft. lbs. [6.21/7.35 N?m].

Install drag ring assembly around bellows guide in guide tower in sequence shown in Figure 2. The wedge and taper rings **must be fully seated** in the bottom of the tower. When properly assembled, these rings will be below the top of the bellows guide. Install the spring and spacer in the tower. Apply a light coat of lubricant to the hex bushing and install in the guide tower. It will be necessary to compress the spring to install the bushing.

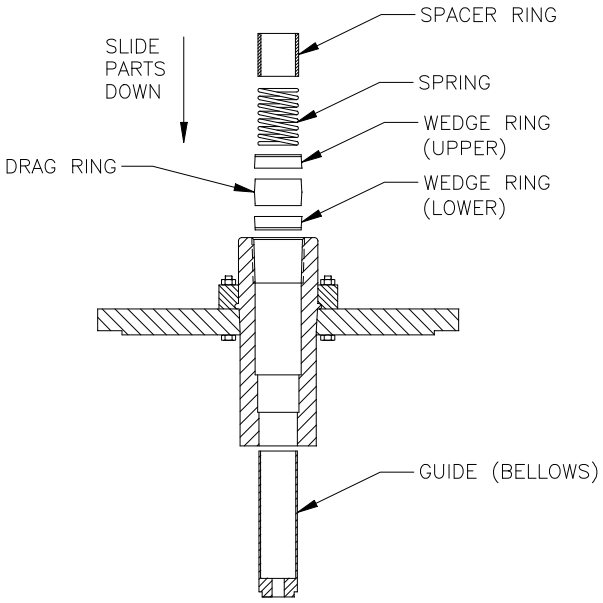
Refer to Page 23 for Soft Goods Repair Kits.

NO.	DESCRIPTION
1	GUIDE, TOWER
2	BELLOWS SHIELD (1)
3	SPACER (2)
4	SPRING (2)
5	WEDGE RING (2)
6	RETAINER DISC
7	BOLT, GUIDE
8	DIPPER TUBE
9	BODY
10	BELLOWS
11	GUIDE
12	TAPER RING
13	CAP
14	FLANGE
15	SEAT PLATE
16	SECONDARY SEAT
17	PRIMARY SEAT
18	NOZZLE
19	SEAT RETAINER
21	GUIDE BOLT SEAL
22	GUIDE SEAL *
23	GUIDE TOWER SEAL *
24	CAP GASKET *
25	NOZZLE SEAL *

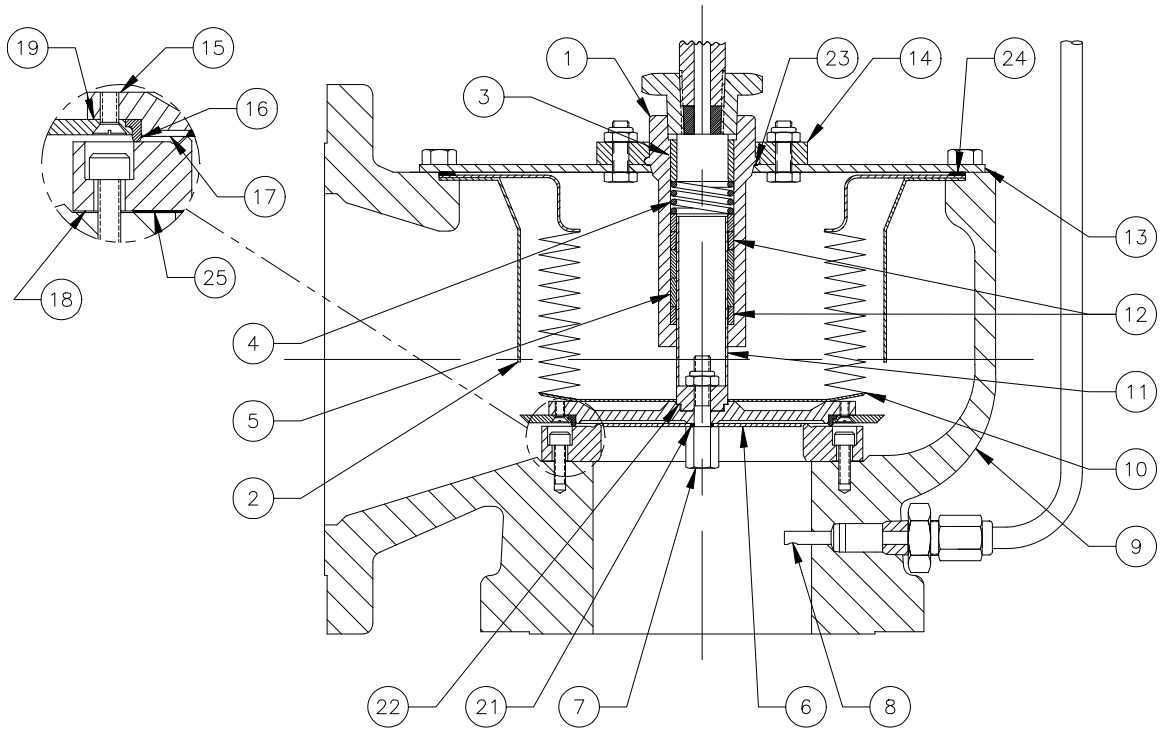
* RECOMMENDED SPARE PARTS FOR REPAIR.

(1) USED ABOVE 15 PSIG [103 KPAG].

(2) USED IN 6" [150 MM] AND LARGER SIZE VALVES.



DRAG RING ASSEMBLY



05-9040-080-FIG2.DWG

FIGURE 2

3.0 PILOT MAINTENANCE

3.1 Disassembly

To facilitate assembly, place all parts removed in an orderly arrangement so the correct parts are assembled in the proper sequence. Refer to the appropriate figure for parts description and location.

3.1.1 Begin by removing spring bonnet (Remove the spring compression before attempting to remove bonnet). Remove case bolts and upper case. Loosen tube fittings on boost tube at lower case and body. Remove spindle nut while holding hex spacer. Remove diaphragms, sense & boost plates and spacers. Remove lower case and spindle/seat assembly. Remove blowdown adjustment screw and supply port tube fitting.

3.1.2 Clean all parts and replace all soft goods. The spindle/seat assembly in the Type 94 pilot is factory assembled and must be replaced as a unit. If the nozzle in this pilot is nicked or scratched, it should be replaced. To remove it, use a deep socket.

The nozzles used on plastic seated pilots can be reworked, if scratched, by lapping flat a 2 microinch [0.05 micrometer] finish.

3.2 Assembly

Assembly is done in the reverse order of disassembly. Lubricate all screw threads and end of spring adjusting screw that bears against spring washer. Use Dow Corning No. 33 Silicone grease or equivalent. When assembling pilot, the following should be observed:

3.2.1 The holes in spindle diaphragm must be aligned with all holes in the body. The small hole in lower case must be aligned with hole in the body. Two of the six case bolts for the medium pressure pilot (Figures 4 or 5) must be assembled through holes in the lower case before it is attached to the body. After attachment there is insufficient clearance to do so.

3.2.2 For the medium pressure Type 94 pilot (Figure 5), the hole in the boost (lower) diaphragm and spacer ring must be aligned with boost tube port in lower case. The hole in the upper diaphragm must be positioned away from boost tube part.

3.2.3 Before tightening spindle nut, align holes in lower case, spacer ring and diaphragms with case bolts.

Tighten spindle nut snugly but not excessively. Three diaphragms are sandwiched in the spindle/stack assembly and excessive tightening will damage them. Hold the hex spacer when torquing spindle nut to prevent the stack from rotating.

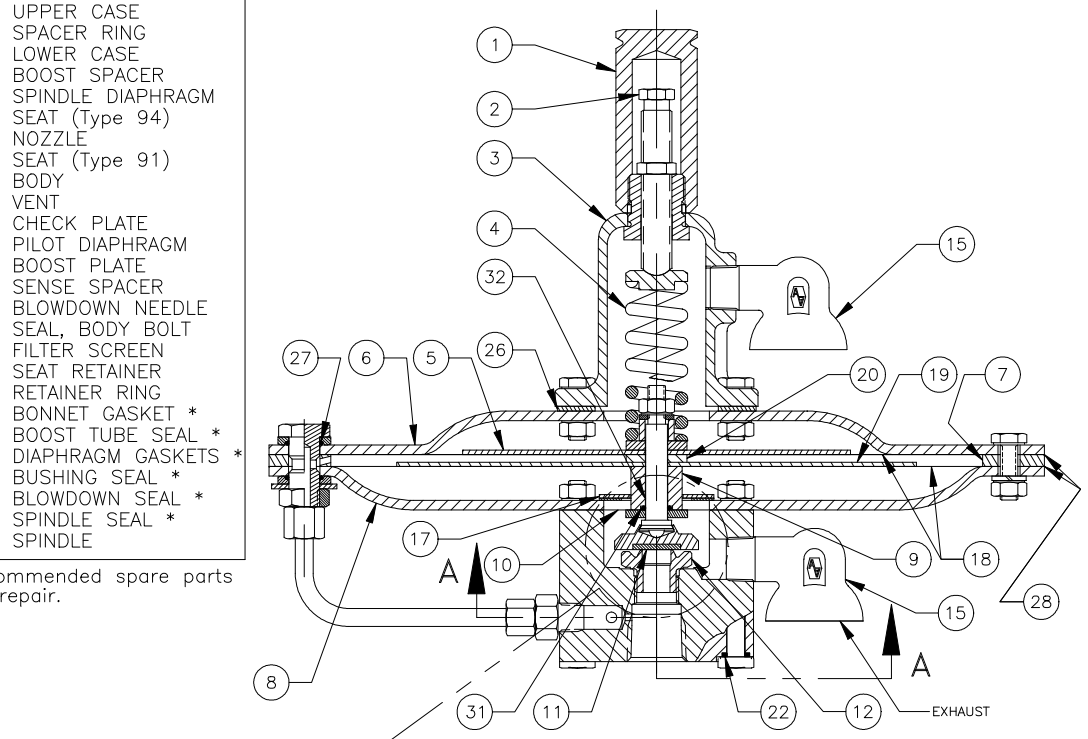
3.2.4 Type 91 pilots used on valves for Marine service have a Teflon sense diaphragm. Standard Type 91 pilots use a stainless steel sense diaphragm.

Both Type 91 and Type 94 pilots use gaskets on the sense and boost diaphragms. The Type 91 pilot also has gaskets on the spindle diaphragm.

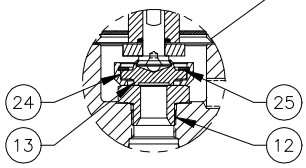
Refer to Pages 23 and 24 for Soft Goods Repair Kits.

NO.	DESCRIPTION
1	CAP
2	PRESSURE ADJ. BOLT
3	BONNET
4	SPRING
5	SENSE PLATE
6	UPPER CASE
7	SPACER RING
8	LOWER CASE
9	BOOST SPACER
10	SPINDLE DIAPHRAGM
11	SEAT (Type 94)
12	NOZZLE
13	SEAT (Type 91)
14	BODY
15	VENT
17	CHECK PLATE
18	PILOT DIAPHRAGM
19	BOOST PLATE
20	SENSE SPACER
21	BLOWDOWN NEEDLE
22	SEAL, BODY BOLT
23	FILTER SCREEN
24	SEAT RETAINER
25	RETAINER RING
26	BONNET GASKET *
27	BOOST TUBE SEAL *
28	DIAPHRAGM GASKETS *
29	BUSHING SEAL *
30	BLOWDOWN SEAL *
31	SPINDLE SEAL *
32	SPINDLE

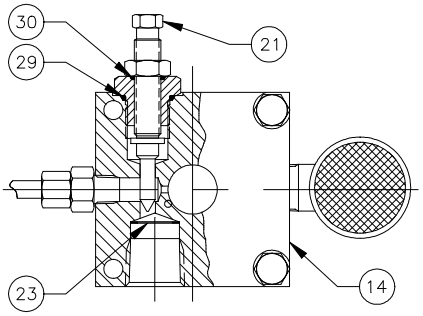
*Recommended spare parts for repair.



TYPE 94
(RUBBER SEAT)



TYPE 91
(TEFLON SEAT)



VIEW A–A

FIGURE 3

05–9040–080–FIG3.DWG

TYPE 91

NO.	DESCRIPTION
1	CAP
2	PRESSURE ADJ. BOLT
3	BONNET
4	SPRING
5	SENSE PLATE
6	UPPER CASE
7	SPACER RING
8	LOWER CASE
9	BOOST SPACER
10	SPINDLE DIAPHRAGM
12	NOZZLE
13	SEAT
15	VENT
17	CHECK PLATE
18	PILOT DIAPHRAGM
19	BOOST PLATE
20	SENSE SPACER
21	BLOWDOWN NEEDLE
22	SEAL, BODY BOLT
23	FILTER SCREEN
24	SEAT RETAINER
25	RETAINER RING
26	BONNET GASKET *
28	DIAPHRAGM GASKETS *
29	BUSHING SEAL *
30	BLOWDOWN SEAL *
31	SPINDLE SEAL *
32	SPINDLE

*Recommended spare parts for repair.

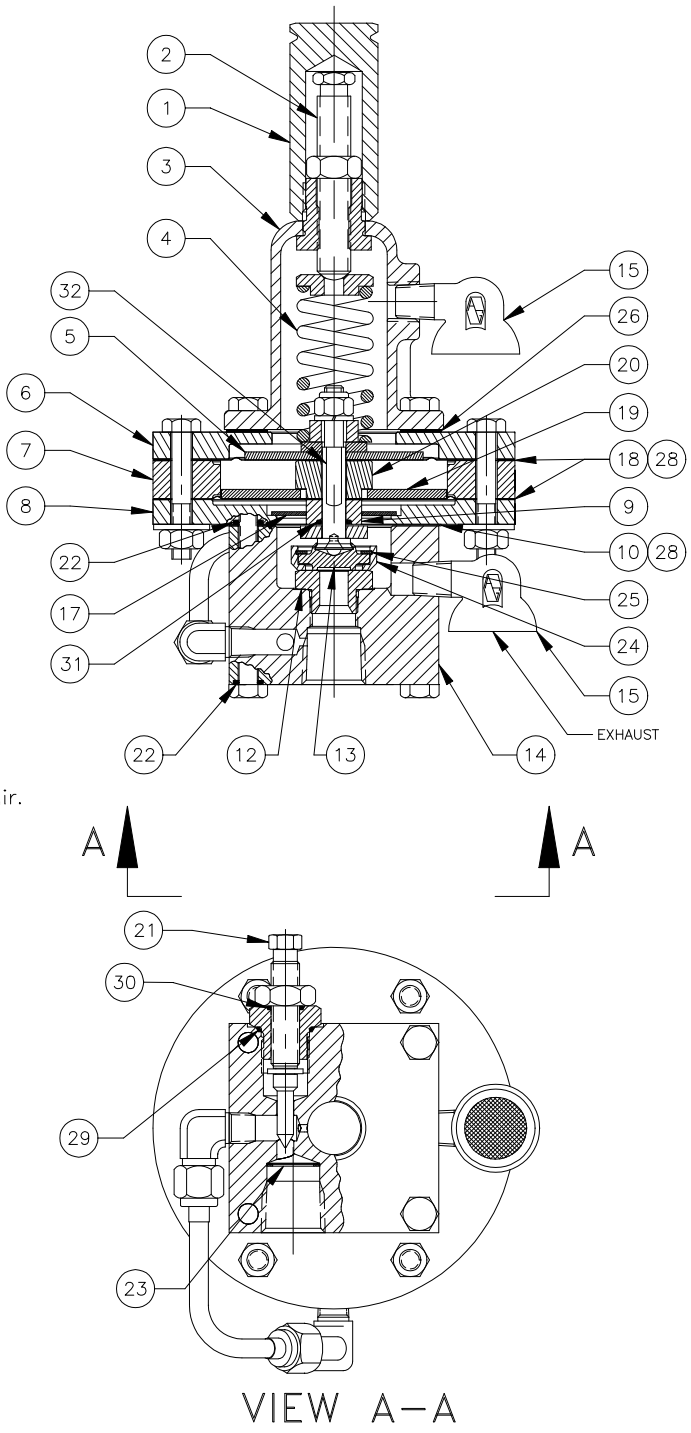


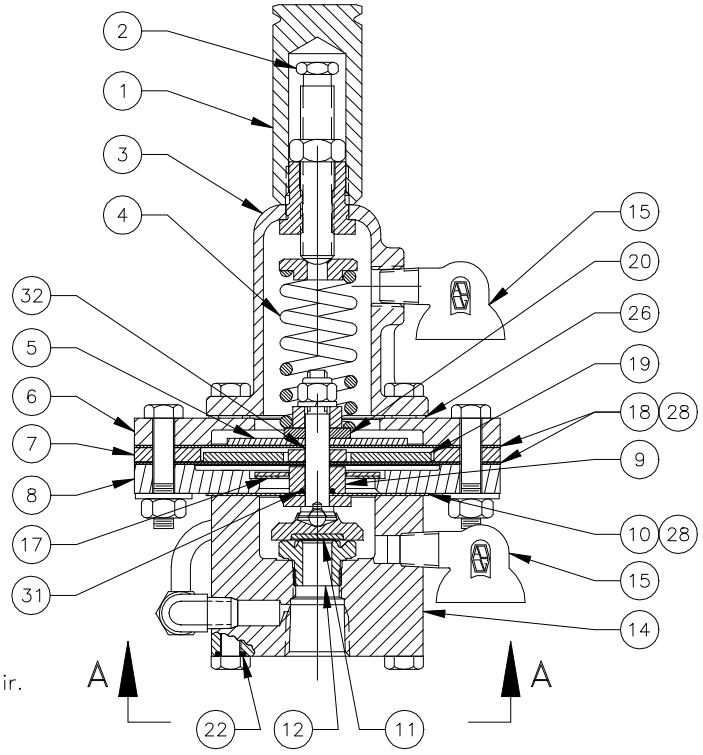
FIGURE 4

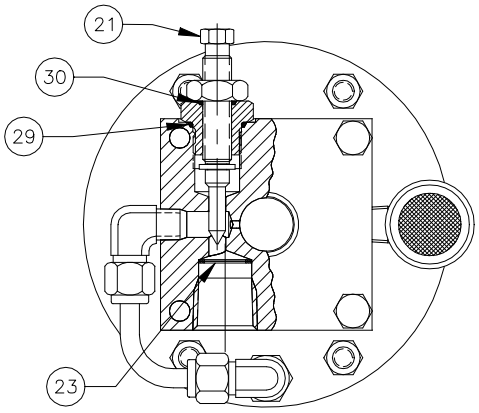
05–9040–080–FIG4.DWG

TYPE 94

NO.	DESCRIPTION
1	CAP
2	PRESSURE ADJ. BOLT
3	BONNET
4	SPRING
5	SENSE PLATE
6	UPPER CASE
7	SPACER RING
8	LOWER CASE
9	BOOST SPACER
10	SPINDLE DIAPHRAGM
11	SEAT
12	NOZZLE
14	BODY
15	VENT
17	CHECK PLATE
18	PILOT DIAPHRAGM
19	BOOST PLATE
20	SENSE SPACER
21	BLOWDOWN NEEDLE
22	SEAL, BODY BOLT
23	FILTER SCREEN
26	BONNET GASKET *
28	DIAPHRAGM GASKETS *
29	BUSHING SEAL *
30	BLOWDOWN SEAL *
31	SPINDLE SEAL *
32	SPINDLE

*Recommended spare parts for repair.





VIEW A–A

FIGURE 5

05–9040–080–FIG5.DWG

4.0 PILOT SET PRESSURE ADJUSTMENT

4.1 PILOT ADJUSTMENT

General

Two adjustments are provided; one for varying the pressure at which the pilot opens and one for varying the pressure at which the pilot closes. The first adjustment controls the "set" or "popping" pressure, the second the "reseat" or "blowdown" pressure. To adjust set pressure, a test set-up similar to that shown in Figure 6 should be used.

4.2 Set Pressure

This adjustment is obtained by turning the pressure adjusting bolt, clockwise (in) to increase set pressure and counter-clockwise (out) to decrease set pressure.

4.3 Reseat Pressure

This adjustment is obtained by turning the blowdown needle adjusting screw, clockwise (in) to increase blowdown, counter-clockwise (out) to decrease blowdown. A small interaction between set pressure and reseat pressure adjustments will occur, therefore it may be necessary to readjust the set pressure after setting reseat pressure.

NOTE: If the blowdown adjusting screw has been moved or turned to either extreme, positioning it midway will aid in obtaining the correct blowdown. There are approximately 7 to 8 turns to obtain full travel of the adjustment. Midway from either end should produce a blowdown for "snap action". For "modulating pilot action", back the adjustment screw out (counter-clockwise) to obtain the adjustment limits given in paragraph 4.5.

4.4 Range of Adjustment

All Pilots can be adjusted $\pm$ 10% beyond the nameplate setting.

4.5 Adjustment Tolerances

NON-MARINE SERVICE

(1) PILOT ACTION	SET PRESSURE		SET PRESSURE TOLERANCE	MINIMUM CRACK PRESSURE AS % OF SET	SUPPLY PRESSURE AS % OF SET FOR DOME PRESSURE RECOVERY (2)
	ENGLISH	METRIC			
SNAP	7"WC TO 1.0 PSIG ABOVE 1 PSIG TO 15 PSIG ABOVE 15 PSIG TO 50 PSIG	1.74 KPAG TO 6.89 KPAG ABOVE 6.89 KPAG TO 103 KPAG ABOVE 103 KPAG TO 345 KPAG	± 3% ± 3% ± 3%	90 92 1/2 92 1/2	90 ± 1 92 1/2 ± 1/2 92 1/2 ± 1/2
	-7"WC TO -1.0 PSIG ABOVE -1.0 PSIG TO -14.7 PSIG	-1.74 KPAG TO -6.89 KPAG ABOVE -6.89 KPAG TO -101 KPAG	± 3% ± 3%	90 92 1/2	90 ± 1 90 1/2 ± 1/2
MODULATING	7"WC TO 1.0 PSIG ABOVE 1.0 PSIG TO 15 PSIG ABOVE 15 PSIG TO 50 PSIG	1.74 KPAG TO 6.89 KPAG ABOVE 6.89 KPAG TO 103 KPAG ABOVE 103 KPAG TO 345 KPAG	± 3% ± 3% ± 3%	90 92 1/2 92 1/2	100 + 0/-2 100 + 0/-2 100 + 0/-2
	-7"WC TO -1.0 PSIG ABOVE -1.0 PSIG TO -14.7 PSIG	-1.74 KPAG TO -6.89 KPAG ABOVE -6.89 KPAG TO -101 KPAG	± 3% ± 3%	90 92 1/2	100 + 0/-2 100 + 0/-2

MARINE SERVICE

(1) PILOT ACTION	SET PRESSURE		SET PRESSURE TOLERANCE	MINIMUM CRACK PRESSURE AS % OF SET	SUPPLY PRESSURE AS % OF SET FOR DOME PRESSURE RECOVERY (3)
	ENGLISH (PSIG)	METRIC (KPAG)			
SNAP	4 TO 21	27.6 TO 145	± 10%	75	92 ± 2
	ABOVE 21 TO 42	ABOVE 145 TO 290	± 6%	75	92 ± 2
	ABOVE 42 TO 150	ABOVE 290 TO 1034	± 3%	75	92 ± 2

NOTES: (1) Snap Action - Dome pressure decreases rapidly with a "snap" to 15% ± 10% of set pressure at set pressure. Pilot seat should be bubble tight at dome pressure recovery.

Modulating Action - Dome pressure decreases slowly to 30% ± 5% of set pressure and recovers to 60% ± 10% of set pressure at set pressure.

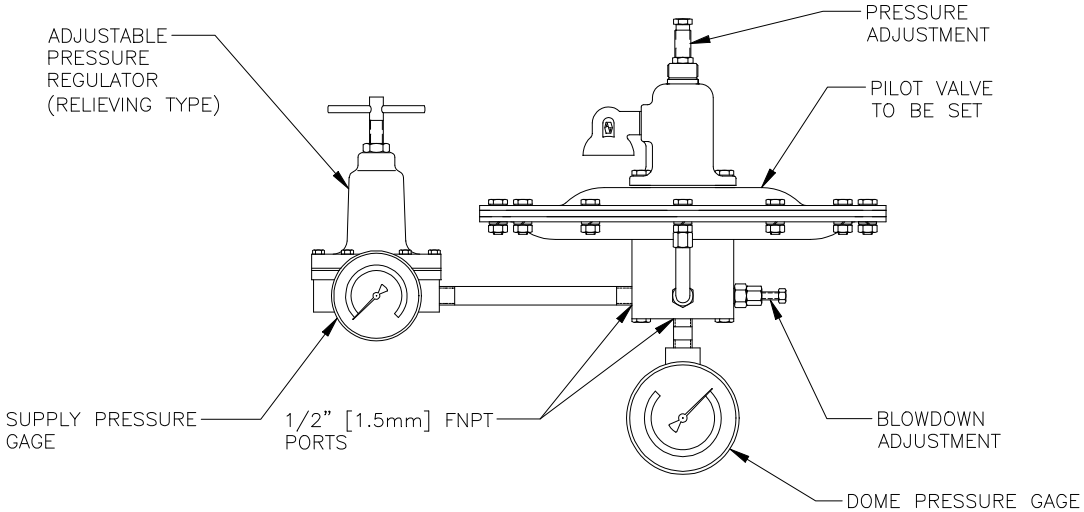
(2) Pilot seat should be bubble tight at dome pressure recovery for "snap" pilot action and at 90% of set pressure for "modulating" pilot action non-marine.

(3) For marine valves, the pilot seat should be bubble tight at 75% of set pressure.

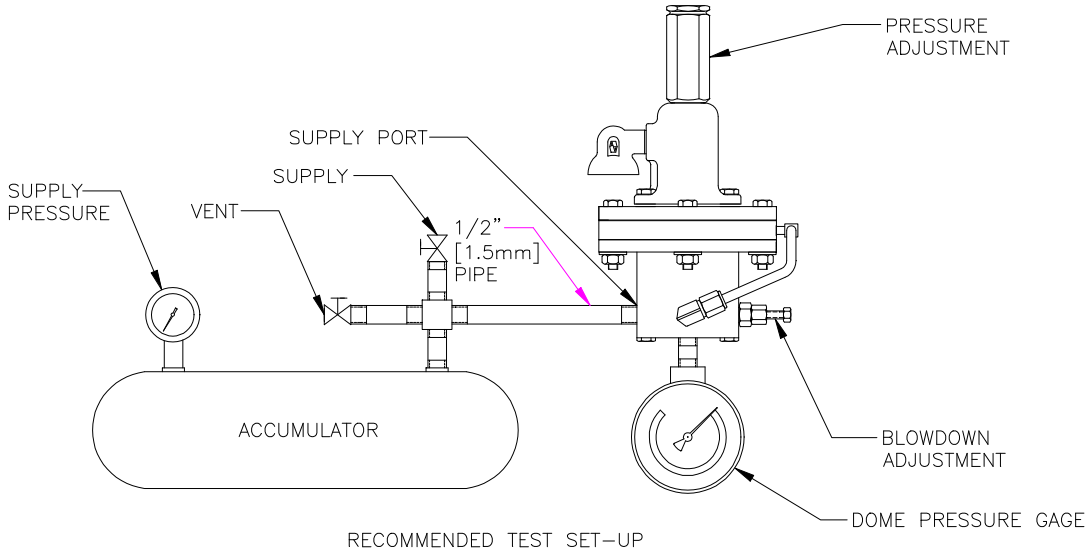
4.6 Definitions

Set Pressure is defined as that pressure where the dome pressure is 15% of the supply pressure.

Crack Pressure is defined as the supply pressure where gas flow begins at the pilot exhaust.



OPTIONAL BENCH SET–UP
PILOT ONLY



RECOMMENDED TEST SET–UP

FIGURE 6

05–9040–0808–FIG6.DWG

5.0 ACCESSORY REPAIR

5.1 Check Valve

The check valves used on the Dual Pilot, Backflow Preventer, and Field Test consist of an upper body, a lower body, and a diaphragm. Refer to Figure 7.

The check valve diaphragm is the only part that should require servicing. If the diaphragm is to be replaced, care should be taken not to scratch or distort it in the center nozzle sealing area. When reassembling the check valve, uniformly tighten the body bolts, first one side, then the opposite side until all are tight. **DO NOT OVERTIGHTEN** bolts as this will distort the diaphragm and cause leakage.

Item	Description
1	Hex Head Cap Screw
2	Upper Body
3	Diaphragm
4	Nut
5	Lower Body
6	Spring Pin
7	Lockwasher
8	Diaphragm Support Washer

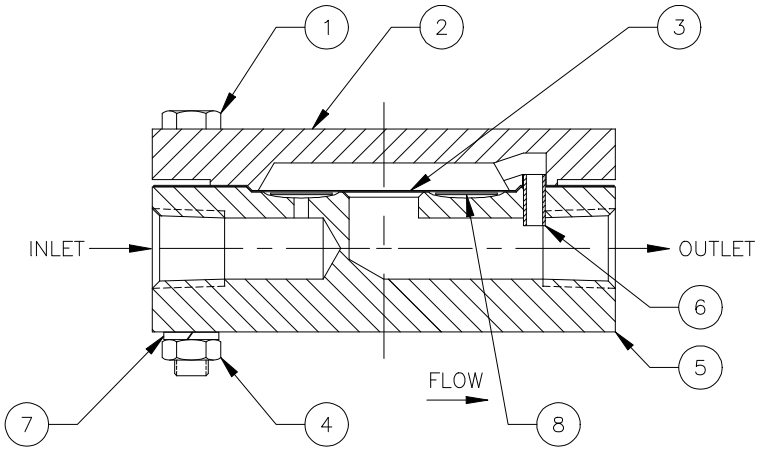


FIGURE 7

05-9040-080-FIG7.DWG

5.2 Auxiliary Pilot Valve Setting Device

The auxiliary setting device used in those applications where multiple relief valve settings are required should require no servicing. The device is not a pressure-containing member and therefore contains no pressure seals.

Should the Extension Rod, Item 14, Figure 8 need replacing, disassemble the device as you would a Pilot Valve Spring Bonnet and remove the Rod from the Top Washer. Install a new Rod in the Top Washer. Use Loctite "Nut Lock" adhesive or equivalent on the Rod threads before assembly to lock the two pieces together. Reassemble in the reverse order of disassembly.

To readjust the pressure setting, install the Setting Device on the Pilot Valve by threading it on the Cap Adaptor until fully seated. Adjust the pressure setting as you would a Pilot Valve.

ITEM	DESCRIPTION
1	ADJUSTING SCREW
2	NUT, HEX JAM
3	CAP
4	BONNET
5	SPRING WASHER
6	SPRING
7	WASHER, TOP
8	BOLT
9	NUT
10	ADAPTER
11	CAP ADAPTER
12	ADJUSTING SCREW
13	SPRING WASHER
14	EXTENSION ROD
15	NUT
16	SEAL WIRE
17	VENT

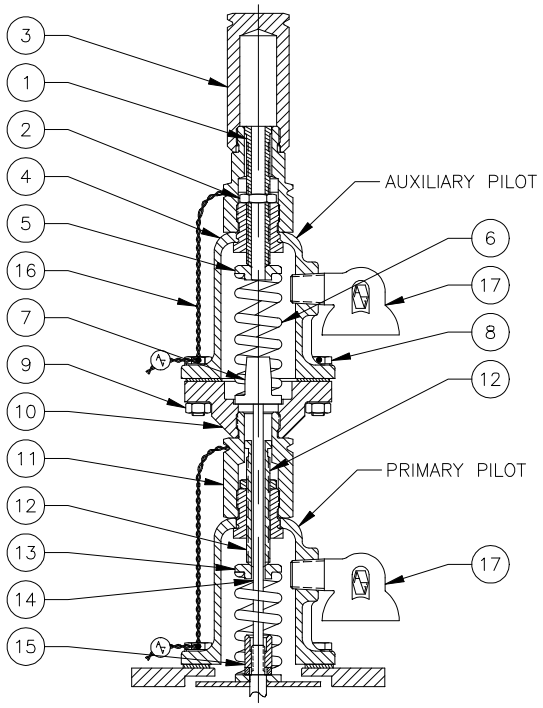


FIGURE 8

05-9040-080-FIG8.DWG

6.0 LEAK TESTING ASSEMBLY

6.1 General

The complete valve assembly should be leak tested for internal and external leaks using a pressure equal to 10% and 90% of set.

6.2 Internal Leak Test

NOZZLE: Use a piece of wide masking tape to cover the lower part of the main valve outlet, taped across the opening 2" to 3" [50 to 76 mm] high. Pour in enough water to cover just the base of the nozzle. If bubbles are detected, the nozzle seal is leaking.

MAIN SEAT: Pour in enough water to just cover the bottom of the bellows and seat plate. If bubbles are detected, the main seat is leaking. Nozzle or seat may be damaged or the bellows may not be seating squarely on the nozzle. Improper bellows seating may be due to incorrect assembly of cap to body. Refer to Section 2.0.

6.3 External Leak Test

Following the internal leak test, check for external leakage by applying leak test solution to all joints and seals. Tighten bolts or fittings as required.

7.0 PILOT SET PRESSURE FIELD TEST PROCEDURE

7.1 General

The pilot set pressure can be checked in the field by applying an external test pressure to the pilot through the Field Test Hand Valve as shown in Figure 9.

NOTE: If the process pressure at the time of test is less than approximately 30% of the pilot set pressure, the main valve will not open. If the process pressure is greater than 30% and the main valve must remain closed, temporarily replace the pilot exhaust vent with an orifice plug having an orifice diameter of .040"/.060" [1.02 mm/1.52 mm]. This orifice must be removed on completion of Field Testing as it prevents the Main Valve from opening.

7.2 Procedure

A. Connect test gas bottle as shown in FIGURE 9.
B. Close vent valve "C".
C. Open Field Test Valve "B". Test gauge will read process pressure.
D. Open Block Valve "A" SLOWLY to increase pressure until pilot "pops". The set pressure will be the pressure indicated on the test gauge at the time of pop.
E. To remove test set up, close valves "A" and "B", open valve "C".

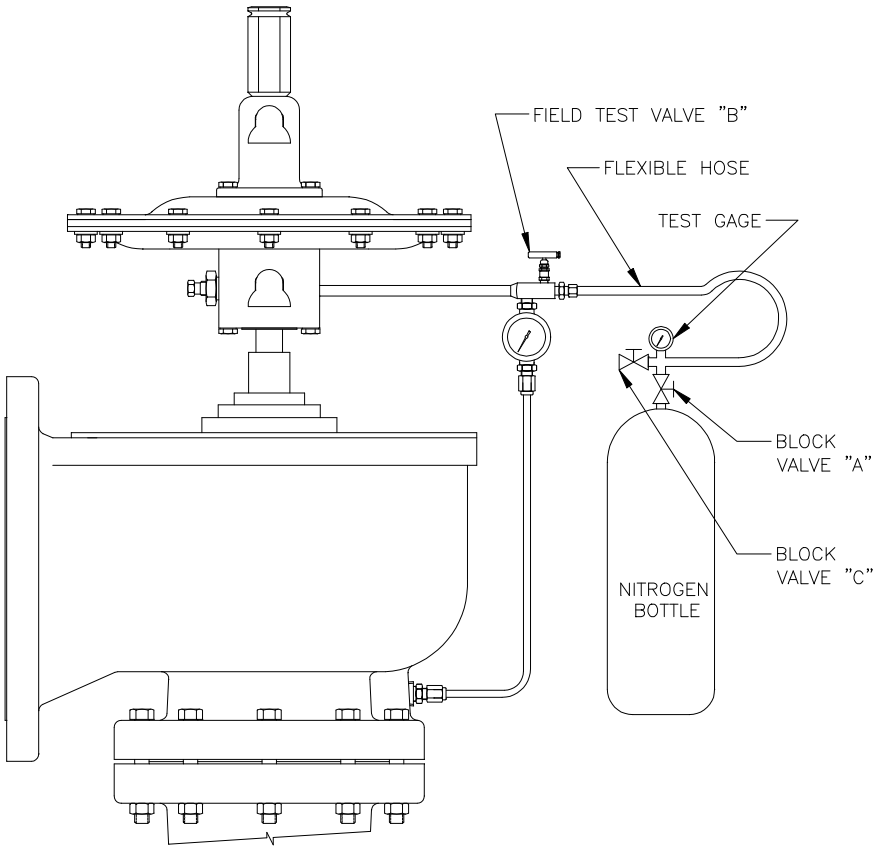


FIGURE 9

05-9040-080-FIG9.DWG

8.0 REPAIR KITS

Soft goods repair kits contain all the seals and seats to repair a valve. To order a kit, specify the base number and select the last three digits from the following tables. To ensure the purchase of the correct repair kit, the order should specify the valve model and serial number. For marine service the bolts in the main valve and pilot exposed to the environment should be replaced during routine maintenance or at least every five years.

Kit Base Number: 04-4744-XXX

MAIN VALVE

KIT TYPE	MATERIAL	2X3	3X4	4X6	6X8	8X10	10X12	12X16
SOFT GOODS	TEFLON	-120	-121	-122	-123	-124	-125	-126
BOLT	SST	-337	-338	-339	-340	-341	-341	-341

TYPE 91 PILOT
(COMPLETE KIT CONSISTS OF DIAPHRAGM PLUS SOFT GOODS)

KIT TYPE	MATERIAL	LOW PRESSURE BELOW 15 PSIG (103 KPAG)		MEDIUM PRESSURE
		VACUUM	PRESSURE	
SOFT GOODS	91 Marine	-001 (3)	-002 (3)	-003 (4)
	91 Standard	-004	-005	-003 (4)
BOLT	MARINE	-336	-336	-334

(3) TEFLON SENSE DIAPHRAGM. SST BOOST AND SPINDLE DIAPHRAGMS.
(4) HASTELLOY SENSE, TEFLON BOOST, AND SST SPINDLE DIAPHRAGM.

TYPE 94 PILOT

(COMPLETE KIT CONSISTS OF DIAPHRAGM PLUS SOFT GOODS)

KIT TYPE	MATERIAL	LOW PRESSURE BELOW 15 PSIG [103 KPAG]		MEDIUM PRESSURE
		VACUUM	PRESSURE	
SOFT GOODS	BUNA-N VITON EPR	-010 -013 -016	-011 -014 -017	-012 -015 -018
	BUNA-N (6) VITON (6) EPR (6)	-019 -021 -023	-020 -022 -024	-896 -897 -898
BOLT	SST	-342	-342	-343

(6) TEFLON DIAPHRAGMS.

BACKFLOW PREVENTER CHECK VALVE

KIT TYPE	TYPE	MATERIAL	ALL PRESSURES
SOFT GOODS	DIAPHRAGM	TEFLON	-781
	BALL	BUNA VITON EPR KALREZ	-344 -345 -346 -782
BOLT	DIAPHRAGM	SST	-335