ANDERSON GREENWOOD SERIES 9000 POSRV

INSTALLATION AND MAINTENANCE INSTRUCTIONS

Procedure-assembly-functional test and performance requirements

1 SCOPE

1.1
This document establishes the general procedure for assembly, functional testing and normal performance requirements of low pressure Series 9000 pilot operated relief valves.

1.2
This document applies to all Anderson, Greenwood Series 9000 pilot operated safety relief valves unless otherwise specified on the sales order.

1.3
Unless stated on the sales order all valves set 15 psig and above and assembled to and listed by series in this document shall bear the ASME "UV" Stamp. Capacity for each valve shall be stamped on the nameplate also. These capacities shall be furnished by Sales and are obtained from the appropriate document supplied by Engineering. These capacities are as listed in the "Safety Valve & Safety Relief Valve Relieving Capacities" book and are certified by the National Board.

2 CLEANING

2.1
Prior to assembly clean all parts and remove any metal shavings or foreign matter.

3 ASSEMBLY

3.1
Assemble valves in accordance with the applicable maintenance instructions.

3.2
Lubricate all straight threaded connections, except stainless to stainless, with Rutherford Slick Stuf #1 Bearing Compound & Lubricant. Lubricate all stainless to stainless connections with Hooker Chemicals Fluorolube LG-160.

3.3
Wrap pipe threads with one to two wraps of Teflon thread seal tape. The tape shall not cover the first thread. Lubricate all pipe threads, except stainless to stainless, with Rutherford Slick Stuf #4 General Purpose lubricant. Lubricate all stainless to stainless pipe threads with Hooker Chemicals Fluorolube LG-160.

3.4
During assembly observe that all moving parts are free to move throughout their full travel without any binding. Correct any binding found.

3.5
Assemble flareless tube fittings using procedure 05 9010 047.

4 WORKMANSHIP

4.1
Parts not per drawing shall not be used unless approved for use by NCR procedures.

5 PROOF TEST

5.1
Proof test shall be performed as required in applicable specifications on pressure containing parts. When proof test is required the procedure and test pressure shall be in accordance with the applicable proof test specification. Testing may be done in the component or assembled condition.

6 FUNCTIONAL TEST

6.1
Definitions of test pressures (unless otherwise specified on the Sales Order).

6.1.1 Set pressure: that inlet pressure at which the main valve seat begins to lift. This normally occurs when the pilot reduces the main valve dome pressure to 70% of the inlet pressure. This is the pressure to be stamped on the nameplate.

6.1.2 Crack pressure: that pressure at which first leakage occurs from the pilot on pilot operated valves or the main valve seat for weight loaded valves. On a Type 400 pilot that cannot be set as an assembly on a main valve test stand, crack pressure will be within 3% of set pressure.

6.1.3 Reseat pressure: that pressure at which discharge through the main valve stops on decreasing inlet pressure (zero leakage) for pressure relief valves, and on increasing inlet pressure (zero leakage) for vacuum relief valves.

6.1.4 Dome pressure: the pressure at dome connection of the pilot valve.

6.2
The test medium shall be ordinary shop air at ambient conditions.

6.3
Test gauge accuracy shall be + ½% of the full scale. Full scale of the gauge used shall not be greater than three times set pressure.

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7 PROCEDURE PILOT ONLY

On the test accumulator the following procedures shall be used in testing the pilot valve.

7.1
Install the pilot valve on the test fixture, per Figure 1 for Type 90 or 400A pressure pilots, Figure 2 for Type 400B pressure pilots or Figure 4 for vacuum pilots. The "Dome" port is connected to a pressure gauge to indicate the degree of dome pressure reduction in the pilot dome port.

7.2
Adjust the set pressure adjusting screw to obtain the correct set pressure. Set pressure is that inlet pressure where the dome pressure decreases to 70% of the inlet pressure. Clockwise rotation increases the set pressure.

NOTE
Set pressure of vacuum pilots is evidenced by the rapid change of dome pressure from atmospheric (zero gauge) to accumulator pressure.

Tighten the locknut after adjustment is completed.

7.3
Adjust the blowdown adjusting screw on Type 90 pilots to obtain the desired reseat pressure. Clockwise rotation will lengthen the blowdown. Tighten the locknut after adjustment is completed. A small interaction between set pressure and blowdown may occur. If so, readjust the set pressure.

NOTE
The reseat value of the complete valve (pilot plus main valve) with internal pressure pickup will be approximately 2% less than the reseat valve of the pilot only on snap action pilots due to pressure loss in the dipper tube (total pressure pickup).

NOTE
Blowdown adjustment is not required on Type 400 A and B pilots.

7.4
Cycle the pilot valve a minimum of five times to assure that dome pressure reduction at set pressure is consistent. Increase the pressure very slowly in order to obtain an accurate reading of the cracking pressure and to expose any erratic performance.

NOTE
Cracking pressure on vacuum pilots is that pressure at which the initial dome pressure change is noted.

7.5
Hold the pilot valve at set pressure to obtain the dome pressure reading. For modulating pilots, dome pressure shall also be read with the inlet at 105% of set pressure.

7.6
Record the following data on the check out form as a permanent record: The relief or set pressure, the bubble tight reseat pressure and the dome pressure as defined in paragraph 7.5.

7.7
Check the pilot valve exhaust for leakage in accordance with Figure 7. Below crack and reseat pressures tabulated in paragraph 8.1. No visible leakage shall occur for one minute.

7.8
For 400A and 400B Pilots. Check for leakage when the pilot is in the null position, between crack and reseat. Leakage less than 60 bubbles per minute is acceptable.

TYPE 90 AND TYPE 400A
Pilot test fixture

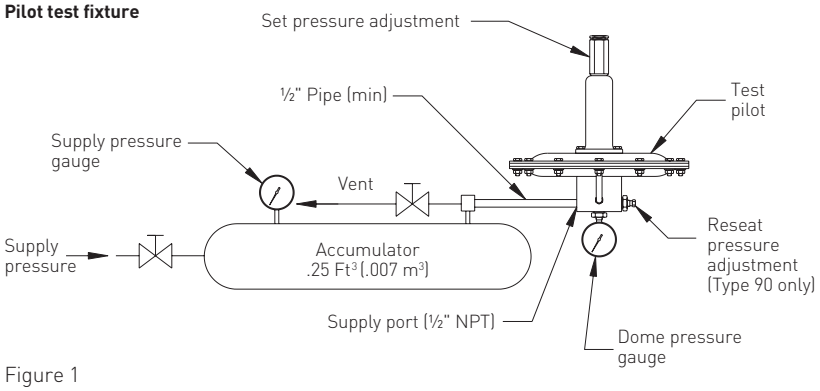

Figure 1

TYPE 400B
Pilot test fixture

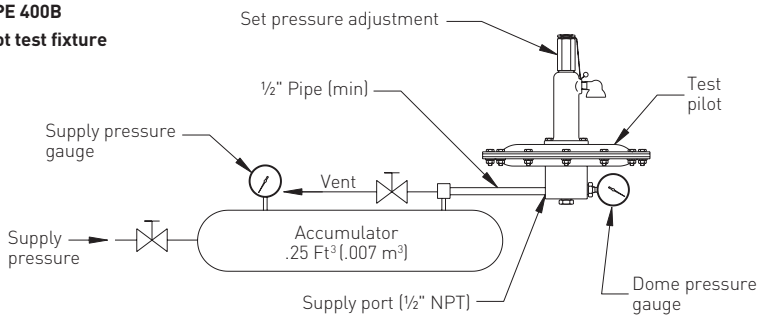

Figure 2

Pressure assembly checkout fixture

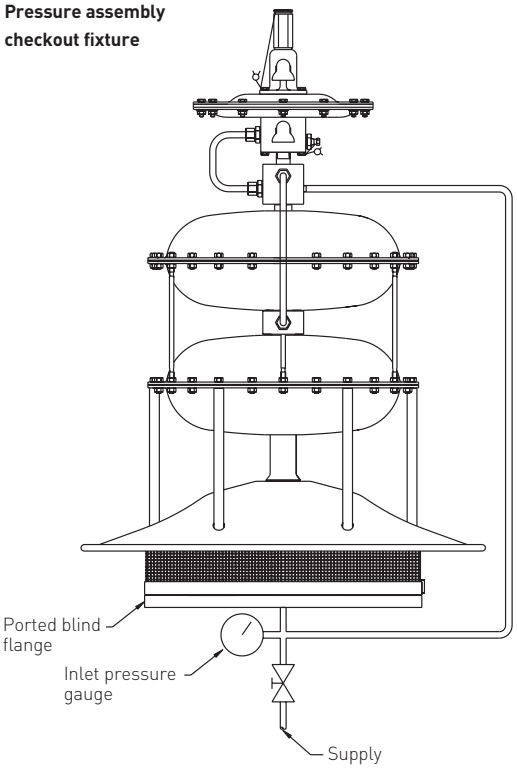

Figure 3

Vacuum pilot test fixture

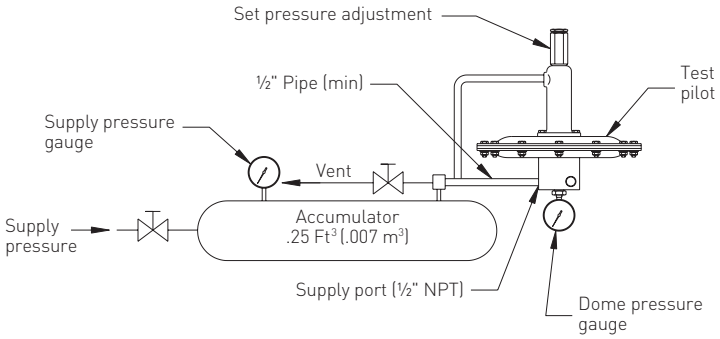

Figure 4

8 PERFORMANCE REQUIREMENTS

The following requirements shall be met unless otherwise specified on the sales order.

8.1 Pilot set pressure tolerances

NON-MARINE SERVICE

Pilot action[1]	Set pressure	Set pressure tolerance[2]	Minimum crack pressure as % of nameplate set — Pilot type			Supply pressure as % of set for dome pressure recovery[3] — Pilot type		
			93T	93 / 95	400 A/B	93T	93 / 95	400 A/B
I*	4" WC - 7" WC	± .2" WC	75	75	-	90 ± 1	90 ± 1	-
	7" WC - 1.0 psig	± 3%	90	90	-	90 ± 1	90 ± 1	-
	> 1.0 psig	± 3%	92½	95	-	92½ ± ½	92½ ± ½	-
	-4" WC - –7" WC	± .2" WC	75	75	-	90 ± 1	90 ± 1	-
	-7" WC - –1.0 psi	± 3%	90	90	-	90 ± 1	90 ± 1	-
	-1.0 psi - –14.7	± 3%	92½	95	-	92½ ± ½	92½ ± ½	-
II*	4" WC - 7" WC	± .2" WC	75	75	97	100	100	94
	7" WC - 1.0 psig	± 3%	90	90	97	100	100	96
	> 1.0 psig	± 3%	92½	95	97	100	100	96
	-4" WC - -7" WC	± .2" WC	75	75	-	100	100	-
	-7" WC - -1.0 psig	± 3%	90	90	-	100	100	-
	-1.0 Psi - 14.7 psig	± 3%	92½	95	-	100	100	-

MARINE SERVICE

Pilot action[1]	Set pressure	Set pressure tolerance[2]	Minimum crack pressure as % of nameplate set — Pilot type			Supply pressure as % of set for dome pressure recovery[3] — Pilot type		
			93T	93 / 95	400 A/B	93T	93 / 95	400 A/B
III*	1 psi - 21 psi	± 10%	75	75	96	92 ± 2	92 ± 2	96
	22 psi - 42 psi	± 6%	75	75	96	92 ± 2	92 ± 2	96
	> 42 psi	± 3%	75	75	96	92 ± 2	92 ± 2	96

NOTES

I* **Snap**
II* **Modulating**
III* **Snap or modulating**

1. Snap Action - Dome pressure decreases rapidly with a "snap" to 15% + 10% of set pressure.
   Pilot seat should be bubble tight at dome pressure recovery.
   Modulating Action (Series 90) - Dome pressure decreases slowly to 30% + 5% of set pressure and recovers to 60% + 10% of set pressure at set pressure.
   Modulating Action (400 A/B) - Dome pressure decreases proportional to increase in inlet pressure.
   Full dome reduction (zero dome pressure) occurs < 6% over pressure.
2. Adjust set pressure on test stand to 101% + 1% of nameplate setting.
3. Pilot seat should be bubble tight at dome pressure recovery for "snap" pilot action and at 90% of set pressure for "modulating" pilot action for series 90 flowing pilots on non marine valves set above 7" WC.
   For valves set 7" WC and below, the pilot seat shall be bubble tight at 75% of set pressure.
   For all marine valves, the pilot seat shall be bubble tight at 75% of set.
   400 A/B pilots shall be bubble tight to 98% of set for non marine, and 96% for marine service.

Vacuum assembly checkout fixture

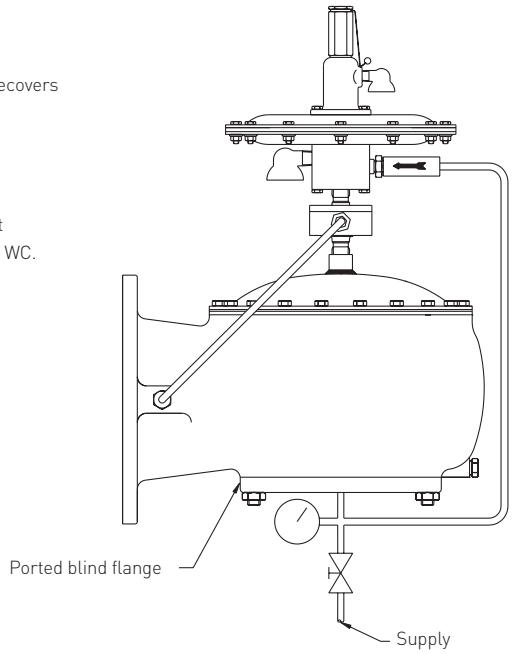

Figure 5

8.2 Weighted pallet valves
Set pressure of weighted valves (pressure or vacuum shall be as noted on nameplate + 15%.

8.3
The dome pressure on vacuum pilots shall be 75% or less of the tank pressure when the pilot valve is venting. (Series 90 flowing pilots only).

8.4 External leakage
Test for external leakage at 90% of set pressure on all connections and diaphragms with Sherlock Green Label Gas and Air Leak Detector (1) or equal. No leakage is permitted in one minute. On vacuum valves apply pressure equal to the positive reciprocal of the vacuum set pressure to all pilot ports including the bonnet up to a maximum of 5 psig.

9 PROCEDURE COMPLETE VALVE ASSEMBLY

9.1
Assemble the pilot valve on the main valve and attach the supply tube. The Type 93 pilot can be used on any series 9000 valve except a 9200C larger than 6". The type 400A pilot is used on all pressure only valves and the type 400B pilot is used on the pressure/vacuum combination valves. Any substitutions will be specified on the sales order, and/or the applicable assembly drawing. In all cases the valve type number and the capacity stamped on the nameplate shall be that of the main valve.

9.2
Connect the main valve inlet to a pressure source as shown in Figure 3 for pressure relief valves and Figure 5 for vacuum relief valves. A suitable vacuum pump shall be used on vacuum valves.

9.3 Proof test
Two proof tests may be performed. One to comply with the ASME Section VIII and XIII code and one to comply with specific customer requirements. These tests will be performed before the leakage tests of Para 9.4.

9.3.1 ASME Code requirements
The pressure containing parts of all production valves set 15 psig and above shall be pressure tested at 1.5 times the design rating found in accordance with 05.9045.092. Shop air or water may be used as the test media. All tests shall be conducted before assembly of the valve.

The secondary pressure zone of each Type 9300 valve shall also be pressure tested on air or other gas at a pressure of at least 30 psig. The secondary pressure zone is defined as that area downstream of the nozzle seat to the valve outlet. There shall be no visible sign of leakage. Shop air may be used as the test medium.

An alternate proof test of applying proof pressure simultaneously to the pressure containing parts in the valve assembled condition at 1.5 times the design rating is acceptable in place of above tests.

The design rating for Type 9300 ASME "UV" valves are listed in the table below. (All pressures in psig)

The design rating for Type 9200 valves is 5 psig for all sizes and materials.

9.3.2 Specific customer requirements
This test will normally be performed only when specified on the sales order. Unless otherwise noted the proof test described in paragraph 9.3.3 will be performed when only the word "hydrotest" or "Proof test" appears on the order.

9.3.3
The pressure containing parts of all production valves shall be pressure tested in accordance with 05.9045.092. There shall be no external leakage while checked with leak detector solution. Proof pressure shall be 1.50 x set pressure or any pressure specified on the sales order within the pressure limits in paragraph 9.3.1. Proof testing may be performed using water or air. If water is used, the valve shall be dried and cleaned before proceeding with the functional tests.

9.4 Leakage check - Pressure relief valves

9.4.1
Apply pressure to the inlet equal to 30% of the set pressure. For the Type 9300 check for leakage at the main valve seat in accordance with Figure 8. For the Type 9200 spray leak test solution around nozzle/seat area to locate a leak in accordance with Figure 9. No visible leakage shall occur in one minute in either case.

9.4.2
Increase the inlet pressure to 90% of the set pressure. Check for leakage at the cap seal, casting, pilot support pipe and supply tube and other applicable connections using leak test solution and at the main valve seat in accordance with Figure 8 and Figure 9. No visible leakage shall occur in one minute.

9.5 Leakage check - Vacuum relief valves
Valves equipped with vacuum pilots shall be leak tested per paragraph 9.4.1 and 9.4.2 on positive pressure with the set pressure equal to the reciprocal of the vacuum set pressure. Valves with weighted diaphragms shall be tested for leakage at 50% of their weighted set.

Type 9300	Aluminum or steel				
Size	**2" and 3"**	**4"**	**6"**	**8"**	**10" and 12"**
I*	50	50	50	50	30
II*	50	44	25	23	14

I* Steel cap
II* Aluminium cap

Insert sufficient foam packing material to hold seat in full lift position

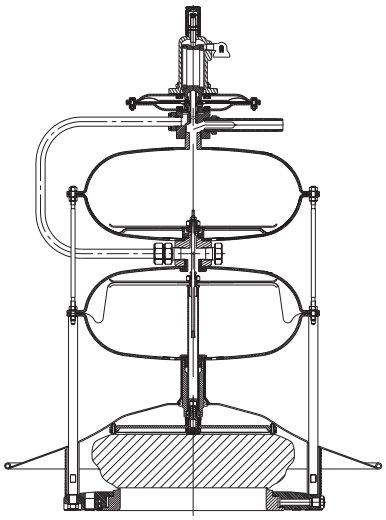

Figure 6

Pilot internal leakage test

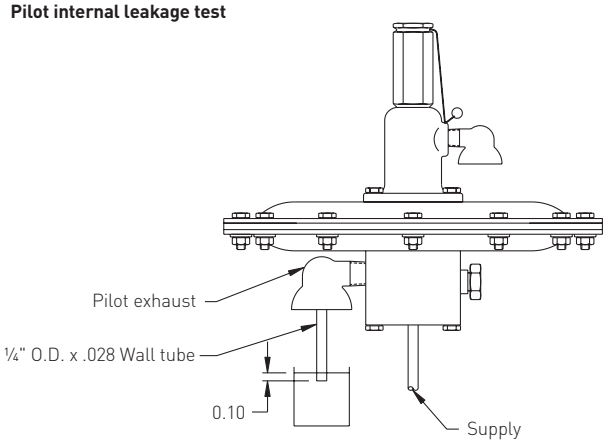

Figure 7

TYPE 9300
Main seat leakage test

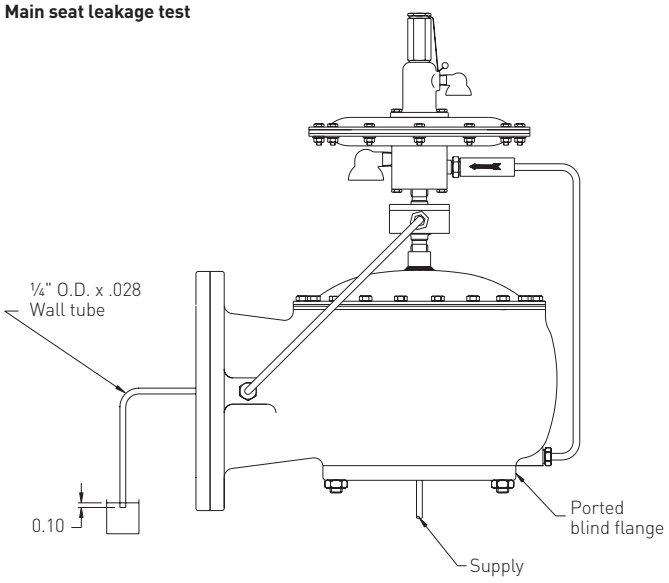

Figure 8

TYPE 9200
Main valve seat leakage test

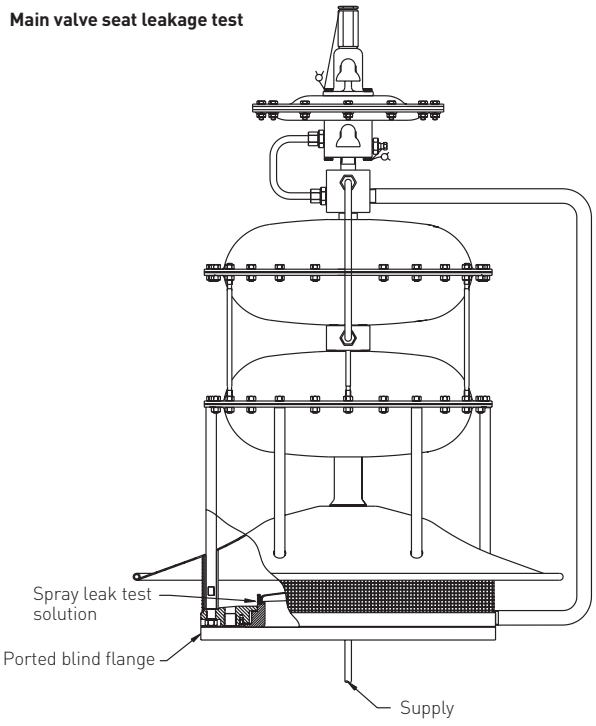

Figure 9

9.6 Back flow preventers and/or Field test
The use of some field test connections or back flow preventers necessitates the use of check valves. These valves shall be installed per the applicable assembly drawings and in the free flow direction shall open at less than 0.5 inches W.C. The check valves may be tested for forward flow either before or after assembly at the shop's option. The output check valve of back flow preventers shall be checked for zero leakage to atmosphere per paragraph 9.4.2.

9.7 Main valve function check
The main purpose of this test is to validate that the pilot and accessories are properly connected to the main valve.

CAUTION
This test must be performed at a slow rate of pressure/vacuum increase to insure that the main valve does not go into full lift. The pressure/vacuum applied to the inlet is not to exceed 105% of nameplate set for both pressure and vacuum relief valves.

After completing the high pressure leakage check of paragraph 9.4.2 slowly increase the inlet pressure/vacuum above 90% of set value. Continue increasing inlet pressure/vacuum until an audible discharge/ingress at the valve outlet/inlet verifies main valve opening. When an audible discharge/ingress is not possible due to low set values, the main valve opening can be verified by the seat plate movement, gauge reaction, or a bubble tester.

10 LOX CLEANED VALVES

10.1
Valve shall be cleaned as specified on the sales order.

10.2
After cleaning and assembly the valve must be tested in the Clean Room.

10.3
The test medium shall be clean, dry air or Nitrogen at ambient temperature, unless otherwise specified.

10.4
Functional test pilot and assembly per sections 8 and 9.

11 PREPARATION FOR SHIPMENT

11.1
After completing all functional testing, the retaining screws for the nozzle shall be hand tightened evenly to eliminate loose nozzle during transport, subsequent bench testing and installation. Final tightening is to be hard. Precaution is to be taken to avoid damage to seat film during this process.

IMPORTANT
All necessary precautions are to be taken in accordance with plant safety rules for personnel safety.

11.2
All series 9000 valves shall have the seat secured as shown in Figure 6 to prevent damage in shipment.
Red tag valve with following tag information:

IMPORTANT
Remove inlet and outlet protective covers and internal packing material before installation.

11.3
All valves shall have flange covers secured to the inlet and outlet flanges.

11.4
All unplated carbon steel main valve bodies shall be painted per 05 9070 019 "Procedure Painting, Carbon Steel Valves" unless otherwise specified on the sales order.