

November 2021

Spence A Series Air-Adjusted Pilot



WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion, fire and/or chemical contamination causing property damage and personal injury or death.

Emerson regulator must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies, Inc. (Emerson) instructions.

If the regulator vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the A Series Air-Adjusted Pilots.

Introduction

Scope of the Manual

This manual provides instructions for installation, maintenance and parts information for the A Series air-adjusted pilot.

Product Description

The A Series air adjusted pilots, when combined with a Main Valve, will control a steady or varying inlet pressure to a constant delivery pressure. The pilots can control either pressure or temperature.

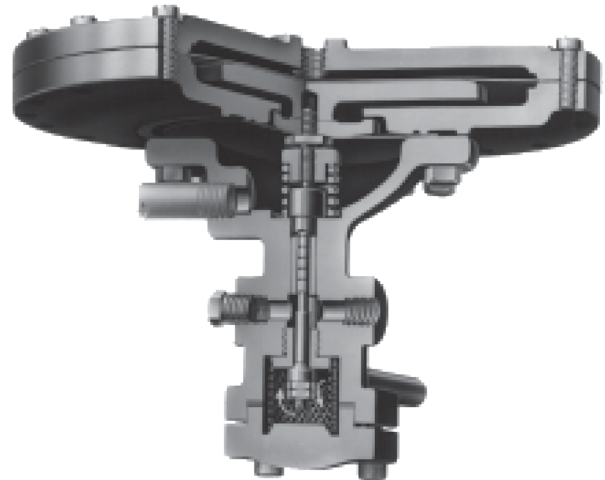


Figure 1. A Series Air-Adjusted Pilot

Pilot Types

- Type A for pressure control at low pressures. Delivery to loading pressure is 1 to 1 psi / 0.07 to 0.07 bar.
- Type A35 for pressure control at very low delivery pressures as in some heating system control. Delivery to loading pressure is 1/2 to 1 psi / 0.03 to 0.07 bar.
- Types A43 and A54 for pressure control at medium to high pressures. Delivery to loading pressure is 2-5/8 to 1 psi / 0.09 to 0.07 bar.
- Type A53 for pressure control at medium pressures. Delivery to loading pressure is 4 to 1 psi / 0.30 to 0.07 bar.
- Types A70 and A73 for pressure control at high delivery pressures when available loading air is at low pressure. Delivery to loading pressures are 15 and 6-2/3 (respectively) to 1 psi / 1.03 and 0.30 to 0.07 bar.
- Type A82 Vacuum for pressure control of very low pressure or systems varying between very low pressure and light vacuum. Delivery to loading pressure is 1 to 1 psi / 0.07 to 0.07 bar.



A Series

Specifications

The Specifications section gives some general specifications for the A Series pilot. The nameplates give detailed information for a specific pilot as built in the factory.

Available Configurations Type A35: Very Low Pressure Type A: Low Pressure Type A53: Medium Pressure Types A43 and A54: Medium to High Pressure Types A70 and A73: High Pressure Type A82: Vacuum Pressure Control Type A83: Vacuum Temperature Control	Maximum Temperature⁽¹⁾ Cast Iron: 450°F / 232°C Cast Steel: 600°F / 316°C
Maximum Inlet Pressure⁽¹⁾ Cast Iron: 250 psig / 17.2 bar Cast Steel: 600 psig / 41.4 bar	Material of Construction Body: Cast Iron, Cast Steel Stem, Disk, Seat and Diaphragm: Stainless Steel Gasket: Graphite Spring: Inconel®
	Options Integral Mount Air Filter Gauges Panel Board

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

- Type A83 Vacuum for temperature control. Delivery to loading pressure is 1 to 1 psi / 0.07 to 0.07 bar.
- Type A84 Vacuum for temperature control at lower delivery pressure features more gradual response. Delivery to loading pressure is 2% to 1 psi / 0.07 bar.
- Type A85 Vacuum for temperature, pressure and vacuum control. Delivery to loading pressure is 3% to 1 psi / 0.07 bar.
- Type A86 for pressure control at low pressures. Delivery to loading pressure is 1% to 1 psi / 0.07 bar.
- Type A87 Vacuum for temperature, pressure and vacuum control. Delivery to loading pressure is 8% to 1 psi / 0.07 bar.

Panel Board

Air adjustment panels are available in two models as illustrated in Figures 2 and 3.

- Type A includes an air adjusting valve incorporating it's own bleed and two gages: one for the supply air, the other to indicate the adjusting air. It is complete and ready to be mounted directly on a control board or box.
- Type B is the same as Model A with the exception that it has in addition, a gage indicating the delivery pressure. The air filter regulator bleeds only on a lowering of the pressure set point.

Principle of Operation

The regulator is operated by initial steam or fluid pressure. It is normally closed, being held so by initial pressure on the disk and by an internal main spring. When the pilot is opened, initial pressure flows through the pilot to the 8B tee. Bleedport 4A restricts the flow and pressure builds under the diaphragm and opens the main valve. The 5A restriction elbow steadies the operation of the regulator.

Delivery pressure feeds back through the control pipe to the pilot diaphragm. As this pressure approaches a balance with the air loading signal, the pilot throttles the loading pressure. In turn, the main valve takes a position established by the loading pressure where just enough steam flows to maintain the set delivery pressure. For temperature control, refer to SD for temperature pilot.

Installation



WARNING

Personal injury or system damage may result if this pilot is installed, without appropriate overpressure protection, where service conditions could exceed the limits given in the Specifications section and/or pilot nameplate.

Additionally, physical damage to the pilot may result in personal injury or property damage due to escaping

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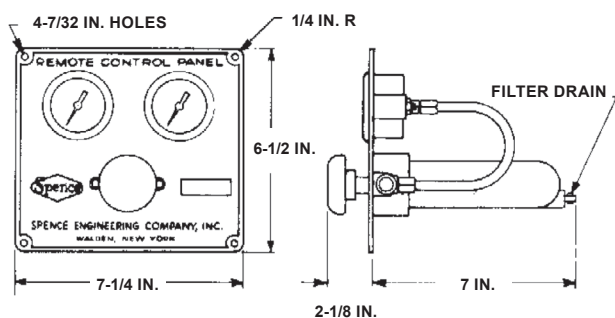


Figure 2. Type A Panel (cut out 5-1/4 in. high by 6 in. wide)

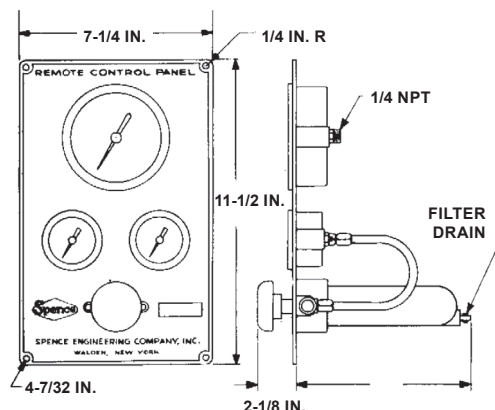


Figure 3. Type B Panel (cut out 10-1/4 in. high by 6 in. wide)

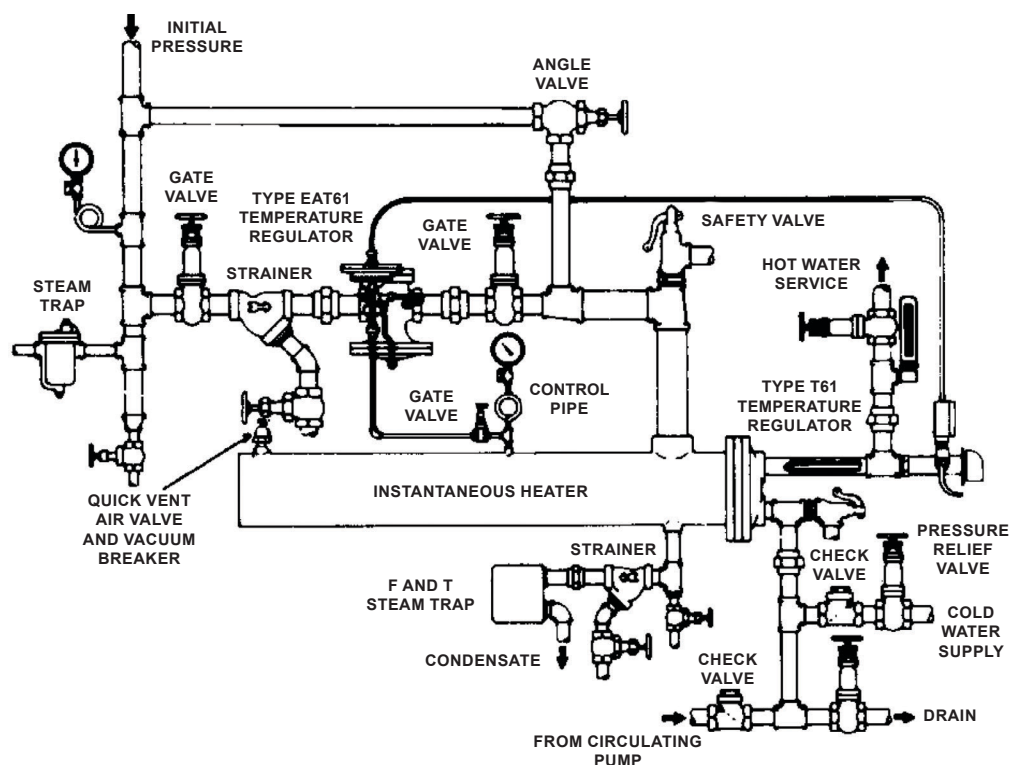


Figure 4. A Series Recommended Installation

of accumulated gas. To avoid such injury and damage, install the pilot in a safe location.

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

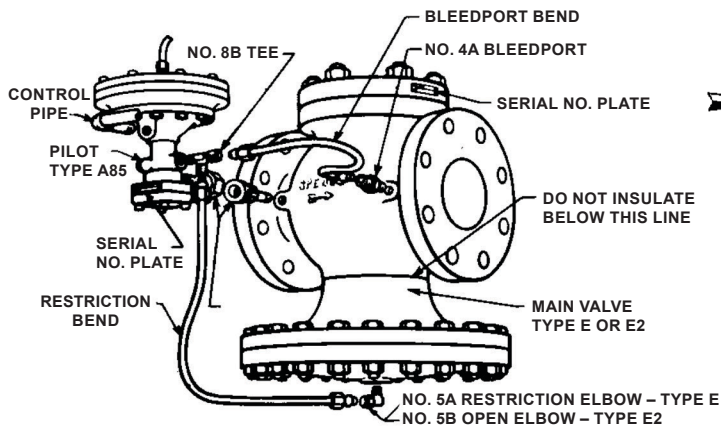


Figure 5. Tubing Bends Connection

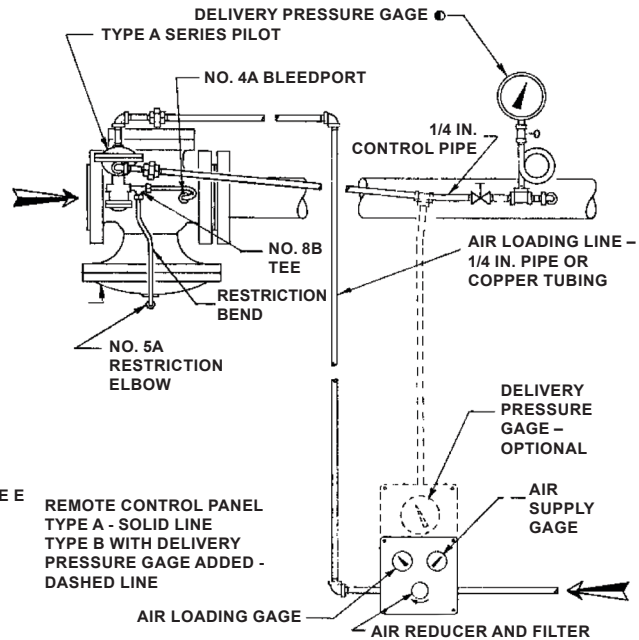


Figure 6. Remote Control Panel

Planning

1. Locate the regulator in a horizontal pipe.
2. Provide a trap ahead of the regulator to prevent water hammer and erratic operation.
3. Use strainer to protect the regulator and avoid damaging effects of scale and dirt in pipelines.
4. Provide a three valve bypass to facilitate inspection of the regulator without interrupting service.

Main Valve

1. Flush the main piping system thoroughly to clear it from welding beads, scale, sand, etc.
2. Mount main valve with diaphragm chamber down and arrow on body pointing in the direction of flow. Screwed end valve should be mounted in unions.

Pilot

1. Mount the pilot on either side of the main valve by means of a 1/4 in. / 6.35 mm nipple and union provided. Make this connection to the 1/4 in. / 6.35 mm pipe tap on the inlet of the main valve.
2. Screw 4A bleedport fitting into 1/8 in. / 3.18 mm pipe tap on the outlet of the main valve body.

Note

Bleed orifice in this fitting is vital to operation of regulator.

3. Screw 8B tee into 1/8 in. / 3.18 mm pipe tap in pilot. Select tap facing downstream.
4. Screw 5A elbow containing restriction orifice into 1/8 in. / 3.18 mm pipe tap on underside of main valve diaphragm chamber. If initial pressure or pressure drop is less than 15 psi / 1.03 bar, a 5B open elbow without orifice is used.
5. Connect tubing bends as illustrated in Figure 5.

Control Pipe

1. Use 1/4 in. / 6.35 mm pipe for this line which connects the pilot diaphragm chamber to the desired point of pressure control.
2. On instantaneous heaters with steam in the shell, tap the control pipe into shell. See Figure 3. Otherwise, enter delivery steam pipe at point of entrance to heater.
3. Pitch the control pipe away from the pilot and avoid water pockets.
4. Locate delivery pressure gage in control pipe to show pressure actually reaching pilot diaphragm. Use a compound gage.



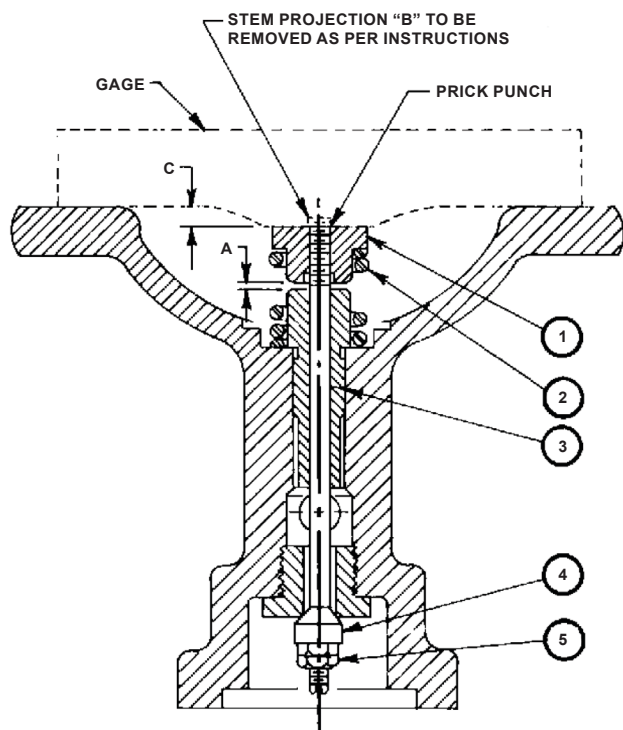


Figure 7. Travel Setting - All A Series Pilots except Type A

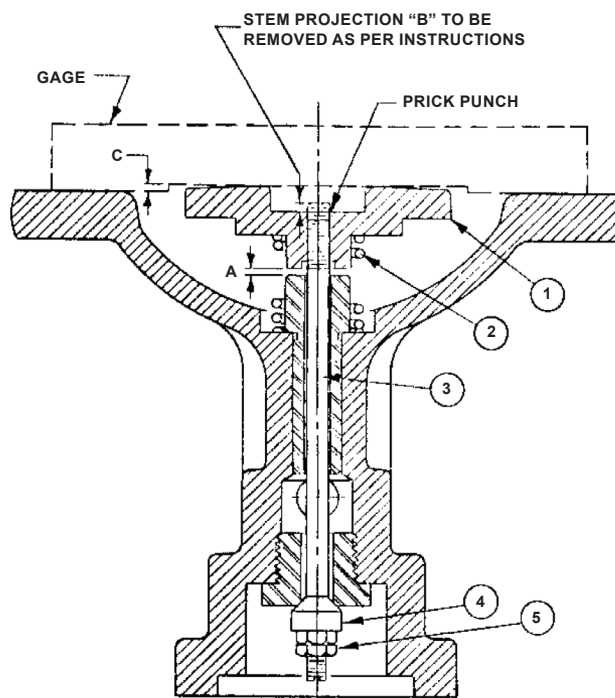


Figure 8. Travel Setting - Type A Pilot only

Insulation

Insulation may be applied to the upper portion (globe and flanges) of the main valve. Do not insulate the diaphragm chamber, condensation chamber (if used) or any part of pilot.

Start-up and Setting

WARNING

The pilot may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the valve.

For pressure reduction, refer to Type E or E2 Instruction Manuals covering the main valve (VCIMD-14961 or VCIMD-14935). The instructions for the A Series Pilots are the same except that they are air loaded instead of spring loaded. For temperature control, refer to the Types T14 and T14D, or Types T124 and T134 Instruction Manuals covering the temperature pilot (VCIMD-14973 or VCIMD-14980).

Maintenance

WARNING

To avoid personal injury, property damage or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the pilot from system pressure and relieving all internal pressure from the pilot.

Pilots that have been disassembled for repair must be tested for proper operation before being returned to service. Only parts manufactured by Emerson should be used for repairing this pilot.

Due to normal wear or damage that may occur from external sources, this pilot should be inspected and maintained periodically. The frequency of inspection and replacement of parts depends upon the severity of service conditions or the requirement of local, state and federal rules and regulations.

Dismantling

1. Remove diaphragm nuts and lift off cowl. Lift out diaphragm assembly.
2. Disassemble diaphragm assembly by removing diaphragm screw from pressure plate.
3. Remove blind flange bolts and take off blind flange. Remove screen and gasket.
4. Hold the pusher plate and remove stem nuts. Lift out stem assembly and valve spring. Drop off the disk.
5. If the seat ring requires replacement, remove it from pilot body with a socket wrench.

Assembly

1. Reassemble the pilot in the reverse of the procedure described on Dismantling section.
2. When replacing diaphragms, apply sealing compound (high temperature high pressure sealant) sparingly to the shoulder of the diaphragm screw. For steel pilots only, apply sealing compound to the diaphragm flange of the pilot body.
3. When replacing gaskets, be sure that any serrated sealing surfaces are cleaned of old gasket material.

Inspection

1. Examine the seat and disk sealing surfaces for nicks or other signs of damage by pipeline debris. Slight imperfections may be removed by lapping the surfaces together. Otherwise, replace the seat and disk.
2. Examine the stem for a buildup of pipeline contaminants or erosion. Remove any buildup with a wire brush and polish with very fine crocus cloth. Work carefully to avoid bending the stem.

Lapping Operations

1. Lap sparingly using 500 grit lapping compound and light pressure. Heavy grinding may cause galling, wide sealing surfaces and a grooved disk, all of which tend to produce leakage.
2. After the sealing surfaces are lapped in, disassemble and clean all parts.

Seat, Disk and Stem Replacement

1. Clean the body threads of old sealing compound using a wire brush. Apply new sealing compound (high temperature high pressure sealant) to the shoulder of seat ring. Let stand until tacky before installing in pilot body.
2. Lap in stem to disk joint with lapping compound.
3. Secure disk (key 4) to stem (key 3) with a stem nut (key 5). Insert this assembly into pilot body (omit valve spring).
4. Apply lapping compound to the disk and lap in the seat to disk joint. The stem is slotted for rotation with a screwdriver.
5. Screw pusher plate (key 1) on stem (key 3). Holding disk against its seat, adjust the pusher plate so that dimension C = 11/64 in. / 4.4 mm (See Figure 7 or 8).
6. Remove stem nut, be careful not to disturb the pusher plate adjustment, and lift stem out the top of the pilot. Grind off stem Projection B flush with upper surface of the pusher plate.
7. Reinsert stem into pilot body. Install disk and stem nut. Check dimension C and, if correct, lock the adjustment by prick punching the thread at several points. Work carefully to avoid bending the stem.
8. Scrape away burs raised by prick punching. Upper surface of pusher plate must be smooth and flat.
9. Check that valve travel A = 3/64 in. / 1.2 mm. This need not be exact. Stem should move smoothly. Binding indicates a bent stem.

Parts Ordering

When ordering parts, it is essential that the pilot type, service and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

Parts List

Repair Parts Kit (See Table 1)

A Series Parts List (See Tables 2 to 4)



Table 1. Repair Parts Kit

PILOT TYPE	PART NUMBER	
	Iron	Steel
A	WAL08-08115-00	WAL08-10372-00
A35	WAL08-08552-00	-----
A82	WAL08-09107-00	-----
A83	WAL08-09108-00	WAL08-10360-00
A43, A46	WAL08-08175-00	WAL08-10370-00
A53	WAL08-08117-00	WAL08-10369-00
A70	WAL08-09106-00	WAL08-10362-00
A73	WAL08-08178-00	WAL08-10368-00
A84	WAL08-08179-00	WAL08-10367-00
A85	WAL08-08180-00	WAL08-10366-00
A86	WAL08-08181-00	WAL08-10365-00
A87	WAL08-08182-00	WAL08-10364-00

Table 2. Types A, A82 and A83 Parts List

KEY	PART NAME	MATERIAL	PART NUMBER
1	Diaphragm Nut	Steel	WAL05-02871-00
2	Hood, A and A83 Hood, A and A83 Hood, A and A83 Hood, A82	Iron Bronze Steel Iron	WAL04-02563-00 WAL04-02565-00 WAL04-02564-00 WAL04-02600-00
3	Body and Bushing, A and A83 Body and Bushing, A and A83 Body and Bushing, A and A83 Body and Bushing, A82 Body and Bushing, A82	Iron Bronze Steel Iron Bronze	WAL07-03514-00 WAL08-04265-00 WAL07-04267-02 WAL08-04698-00 WAL08-04699-00
4	Diaphragm Bolt Diaphragm Nut	Steel Steel	WAL05-04764-00 WAL05-02871-00
5*	Valve Spring	Inconel	WAL05-04985-00
6	Bushing (see item 3)	Stainless steel	WAL04-01080-00
7*	Stem	Stainless steel	WAL04-05229-00
8*	Gasket, Iron and Bronze Bodies Gasket, Steel Bodies	Garlock Flexitalic	WAL05-16183-00 WAL05-11718-00
9	Blind Flange Blind Flange Blind Flange	Iron Bronze Steel	WAL04-02151-00 WAL04-02153-00 WAL04-11678-00
10	Blind Flange Bolt, Iron and Bronze Bodies Blind Flange Bolt, Steel Bodies	Steel Steel	WAL05-04803-00 WAL05-11719-00
11*	Diaphragm, A (2 required)	Stainless steel	WAL04-01626-00
12*	Pusher Plate, A, Iron and Bronze Bodies Pusher Plate, A, Steel Bodies	Iron Steel	WAL04-03728-00 WAL04-09520-00
13*	Seat Ring	Stainless steel	WAL04-04057-90
14*	Disk	Stainless steel	WAL04-01772-90
15*	Stem Nut	Steel	WAL05-02888-00
16	Screen, Water Screen , Heavy Oil *Screen, Steam	Stainless Steel Stainless Steel Stainless Steel	WAL04-04701-00 WAL04-04702-00 WAL04-04700-00
17	Pipe Plug, 1/8 NPT (not shown) Pipe Plug, 1/8 NPT (not shown)	Steel Brass	WAL04-03769-00 WAL04-03770-00
18*	Diaphragm Screw Nut, A82 and A83	Steel	WAL04-02925-00
19*	Diaphragm Screw, A82 and A83	Steel	WAL04-04819-00
20*	Diaphragm, A82 (2 required) Diaphragm, A83 (2 required)	Stainless steel Stainless steel	WAL04-03927-00 WAL04-01623-00
21	Floating Plate, A82 Floating Plate, A83	Iron Iron	WAL04-03638-00 WAL04-03710-00
22*	Vacuum Spring, A82 and A83	Stainless steel	WAL05-05055-00
23*	Pusher Plate, A82 and A83	Steel	WAL04-08177-00

*These parts furnished in Repair Kit



A Series

Table 3. Type A35 Parts List

KEY	PART NAME	MATERIAL	PART NUMBER
1	Hood	Iron	WAL04-02623-00
2	Loading Pressure Plate	Iron	WAL04-03641-00
3	Diaphragm Nuts	Steel	WAL05-02871-00
4	Cowl	Iron	WAL04-01540-00
5	Body and Bushing Body and Bushing	Iron Bronze	WAL08-04698-00 WAL08-04699-00
6	Control Diaphragm Bolts Control Diaphragm Nuts	Steel Steel	WAL05-04764-00 WAL05-02871-00
7*	Diaphragm Screw	Steel	WAL04-04821-00
8*	Pusher Plate	Steel	WAL04-03718-00
9*	Valve Spring	Inconel	WAL05-04985-00
10	Bushing	Stainless steel	WAL04-01080-00
11*	Gasket	Graphite	WAL05-02378-00
12	Blind Flange Blind Flange	Iron Bronze	WAL04-02151-00 WAL04-02153-00
13	Blind Flange Bolts	Steel	WAL05-04803-00
14	Loading Diaphragm Bolts	Steel	WAL05-04832-00
15*	Loading Diaphragms (2 required)	Stainless steel	WAL04-01626-00
16*	Control Pressure Plate	Iron	WAL04-03684-01
17*	Control Diaphragm (2 required)	Stainless steel	WAL04-03927-00
18*	Stem	Stainless steel	WAL04-05229-00
19*	Seat Ring	Stainless steel	WAL04-04057-00
20*	Disk	Stainless steel	WAL04-01772-00
21*	Stem Nut	Steel	WAL05-02888-00
22	*Screen—Steam Screen—Heavy Oil Screen—Water	Stainless Steel Stainless Steel Stainless Steel	WAL04-04700-00 WAL04-04702-00 WAL04-04701-00
23	Pipe Plug 1/8 NPT (not shown) Pipe Plug 1/8 NPT (not shown)	Steel Brass	WAL04-03769-00 WAL04-03770-00

*These parts furnished in Repair Kit



Table 4. Types A43, A46, A53, A70, A73, A84, A85, A86 and A87 Parts List

KEY	PART NAME	MATERIAL	PART NUMBER
1	Loading and Control Diaphragm Bolt Control Diaphragm Bolts, A70	Steel Steel	WAL05-04809-00 WAL05-04837-00
2	Hood, A43, A84 Hood, A53, A85 Hood, A73, A87, A70 Hood, A46, A86	Iron Iron Iron Iron	WAL04-02622-00 WAL04-02621-00 WAL04-02620-00 WAL04-02624-00
3	Cowl, A43, A84, Iron and Bronze Bodies Cowl, A53, A85, Iron and Bronze Bodies Cowl, A73, A87, Iron and Bronze Bodies Cowl, A70, Iron and Bronze Bodies Cowl, A46, A86, Iron and Bronze Bodies Cowl, A43, A84, Steel Bodies Cowl, A53, A85, Steel Bodies Cowl, A73, A87, Steel Bodies Cowl, A46, A86, Steel Bodies Cowl, A70, Steel Bodies	Iron Iron Iron Iron Iron Duct. Iron Duct. Iron Duct. Iron Duct. Iron Duct. Iron	WAL04-01538-00 WAL04-01536-00 WAL04-01534-00 WAL04-01510-00 WAL04-01541-00 WAL04-01539-00 WAL04-01537-00 WAL04-01535-00 WAL04-04583-00 WAL04-01511-00
4*	Control Pressure Plate Control Pressure Plate, A70	Steel Steel	WAL04-03679-00 WAL04-08432-00
5*	Diaphragm Screw	Steel	WAL04-04821-00
6*	Pusher Plate	Steel	WAL04-03718-00
7*	Valve Spring Valve Spring, A70	Inconel Inconel	WAL05-04985-00 WAL05-05197-00
8	Bushing (see item 10)	Stainless steel	WAL04-01080-00
9*	Stem	Stainless steel	WAL04-05229-00
10	Body and Bushing Body and Bushing Body and Bushing Body and Bushing, A70 Body and Bushing, A70	Iron Bronze Steel Iron Steel	WAL07-03514-00 WAL08-04265-00 WAL07-04267-02 WAL08-04801-00 WAL08-04803-01
11*	Gasket, Iron and Bronze Bodies Gasket, Steel Bodies	Non-asbestos Flexitalic	WAL05-02378-00 WAL05-11718-00
12	Blind Flange Blind Flange Blind Flange	Iron Bronze Steel	WAL04-02151-00 WAL04-02153-00 WAL04-11678-00
13	Blind Flange Bolt, Iron and Bronze Bodies Blind Flange Bolt, Steel Bodies	Steel Steel	WAL05-04803-00 WAL05-11719-00
14*	Loading Diaphragm, A43, A46, A84, A86 (2 required) A53, A85 (2 required) A73, A87, A70 (2 required)	Stainless steel Stainless steel Stainless steel	WAL04-01629-01 WAL04-01632-00 WAL04-01635-00
15	Loading Pressure Plate, A43, A84 Loading Pressure Plate, A53, A85 Loading Pressure Plate, A70, A73, A87 Loading Pressure Plate, A46, A86	Iron Iron Iron Iron	WAL04-03641-00 WAL04-03640-00 WAL04-03639-00 WAL04-03642-00
16	Control Diaphragms (2 required) Control Diaphragms, A70 (4 required)	Stainless steel Stainless steel	WAL04-01623-00 WAL04-01620-00
17*	Seat Ring	Stainless steel	WAL04-04057-90
18*	Disk	Stainless steel	WAL04-01772-90
19*	Stem Nut	Steel	WAL05-02888-00
20	*Screen, Steam Screen, Heavy Oil Screen, Water	Monel Monel Monel	WAL04-04700-00 WAL04-04702-00 WAL04-04701-00
21	Pipe Plug, 1/8 NPT (not shown) Pipe Plug, 1/8 NPT (not shown)	Steel Brass	WAL04-03769-00 WAL04-03770-00
22*	Floating Plate, A84, A85, A86, A87	Steel	WAL04-03710-00
23*	Vacuum Spring, A84, A85 Vacuum Spring, A86 Vacuum Spring, A87	Stainless steel Stainless steel Stainless steel	WAL05-05055-00 WAL05-04970-00 WAL05-04968-00
24*	Pusher Plate, A84, A85, A86 Pusher Plate, A87	Steel Steel	WAL04-08177-00 WAL04-07070-00

*These parts furnished in Repair Kit



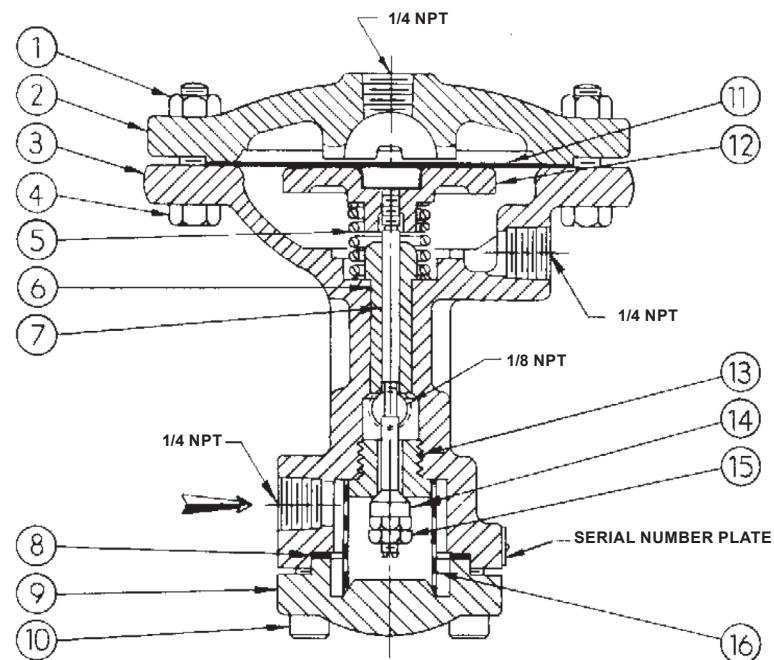


Figure 9. Type A Pilot Assembly

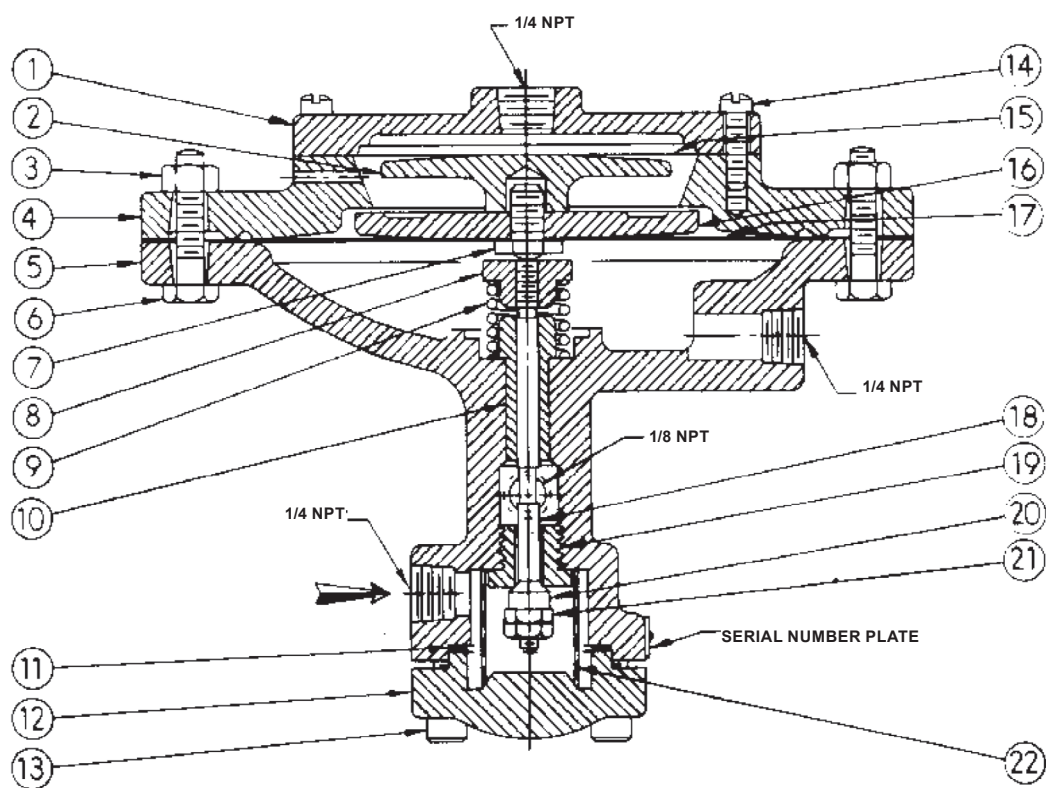


Figure 10. Type A35 Pilot Assembly



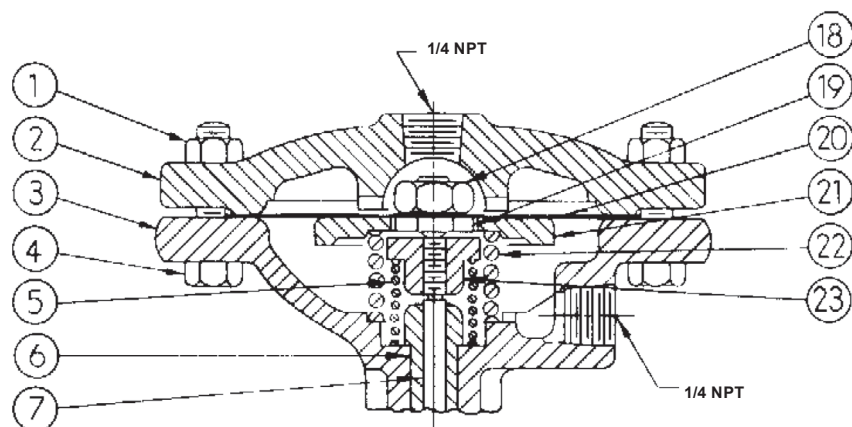


Figure 11. Types A82 and A83 Pilots Assembly

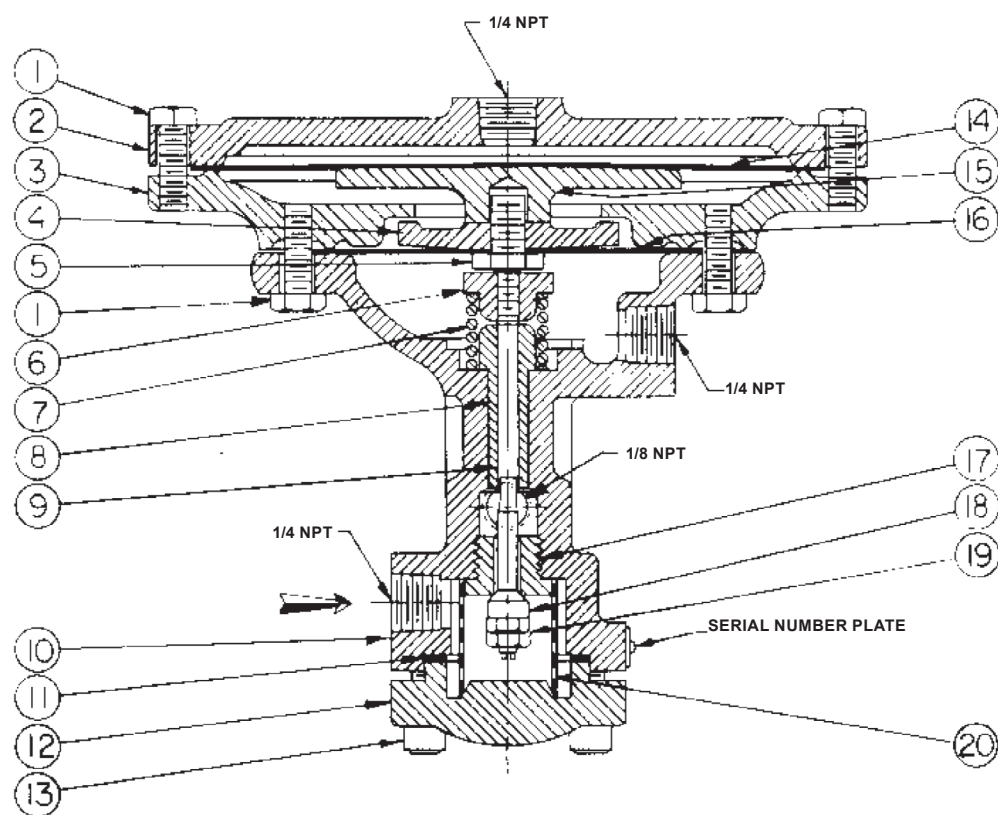


Figure 12. Types A43, A46, A53, A70, A73, A84, A85, A86 and A87 Pilots Assembly

A Series

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