

Pneumatic Single Action Positioner Model : VPE 04/05 User's Manual



Azbil Corporation

Copyright, Notices and Trademarks

© 2013 Azbil Corporation All Rights Reserved.

While this information is presented in good faith and believed to be accurate, Azbil Corporation disclaims the implied warranties of merchantability and fitness for a particular purpose and makes no express warranties except as may be stated in its written agreement with and for its customer.

In no event is Azbil Corporation liable to anyone for any indirect, special or consequential damages, The information and specifications in this document are subject to change without notice.

CONTENTS

	<u>Page</u>
I. DESCRIPTION	1
II. OPERATING PRINCIPLES	4
III. INSTALLATION	6
IV. ADJUSTMENT	11
V. MAINTENANCE	12

I. DESCRIPTION

1. General

Model VPE04/VPE05 Pneumatic Single-acting Positioner is used, in conjunction with Model HA1/HK1 Pneumatic Actuator, to position the valve plug of a control valve in response to a pneumatic control signal fed from a process controller. An external view of the VPE positioner is shown in Fig. 1-1.

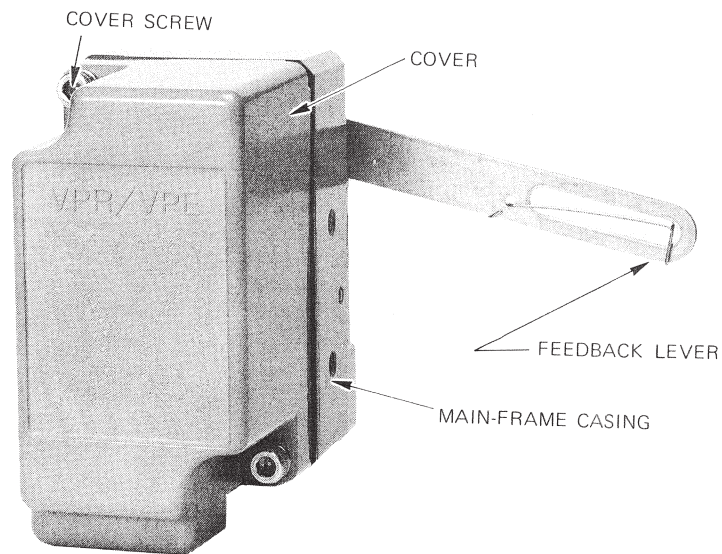
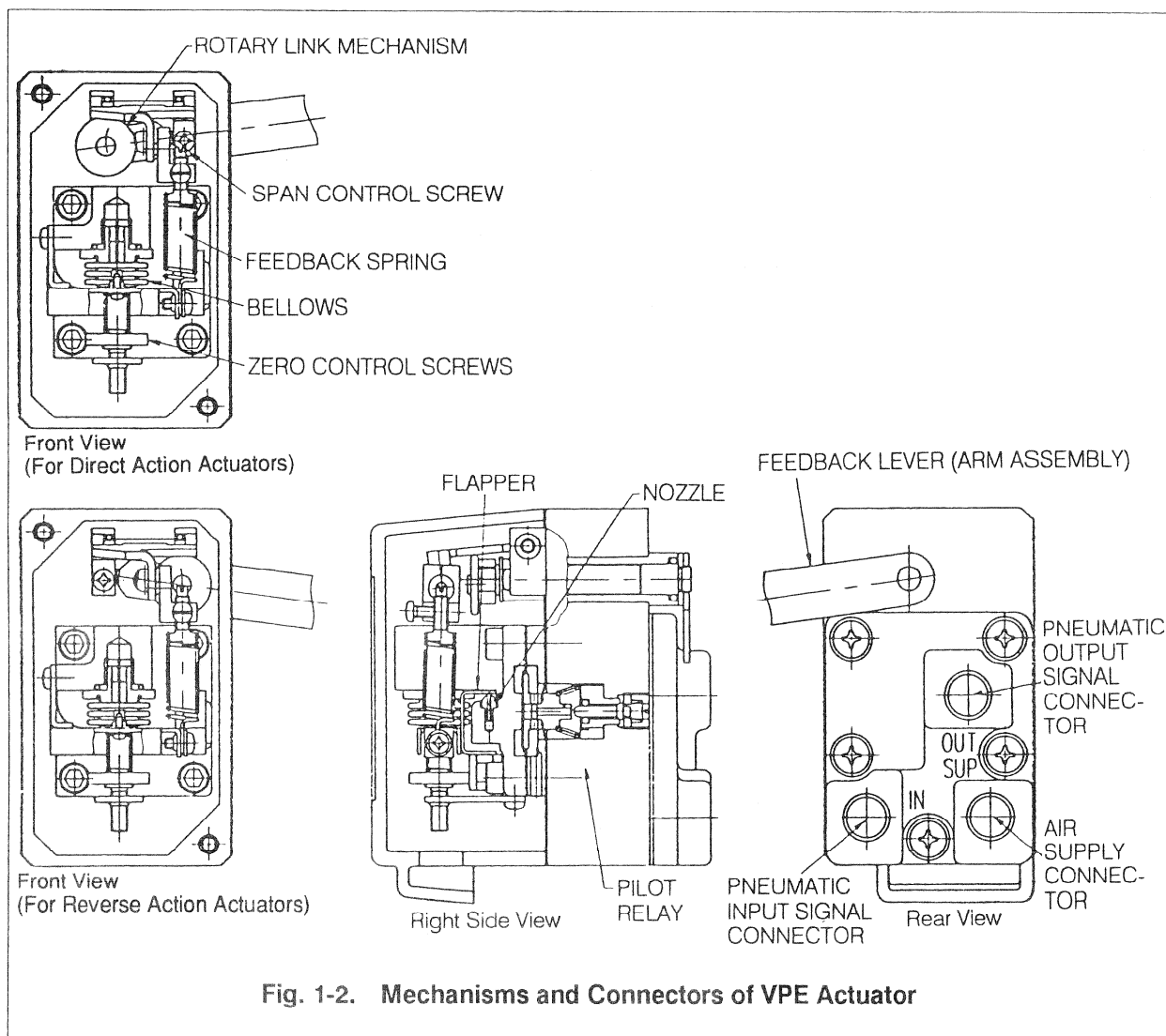


Fig 1-1. Front View of VPE Positioner



2. Specifications

Casing Materials:	Body: Aluminium alloy Cover: Hard polyester resin
Finish:	Baked acryl paint, dark beige (smooth tone finish)
Pneumatic Input Signal:	20 – 100 kPa {0.2 – 1.0 kgf/cm ² }
Air Supply Pressure:	140 – 400 kPa {1.4 – 4.0 kgf/cm ² }
Air Consumption:	9 Nl/minute (at air supply pressure 350 kPa {3.5 kgf/cm ² })
Maximum Air Flow Rate:	88 Nl/minute (at air supply pressure 350 kPa {3.5 kgf/cm ² })
Air Piping Connectors:	Rc1/4
Ambient Temperature and Humidity:	–20°C to +70°C, 10% to 90% RH
Accuracy:	± 3% FS
Dead Zone:	< 0.3% FS

Applicable Stroke:	6 – 25 mm (with fixed span fine control mechanism)
Operation Speed:	6 mm/sec
Weight:	1.1 kg (including mounting brackets)

II. OPERATING PRINCIPLES

The VPE Positioner is a force balance type of instrument which positions the plug of a control valve in response to a pneumatic pressure signal fed from a process controller. A functional block diagram of the positioner is shown in Fig 2-1.

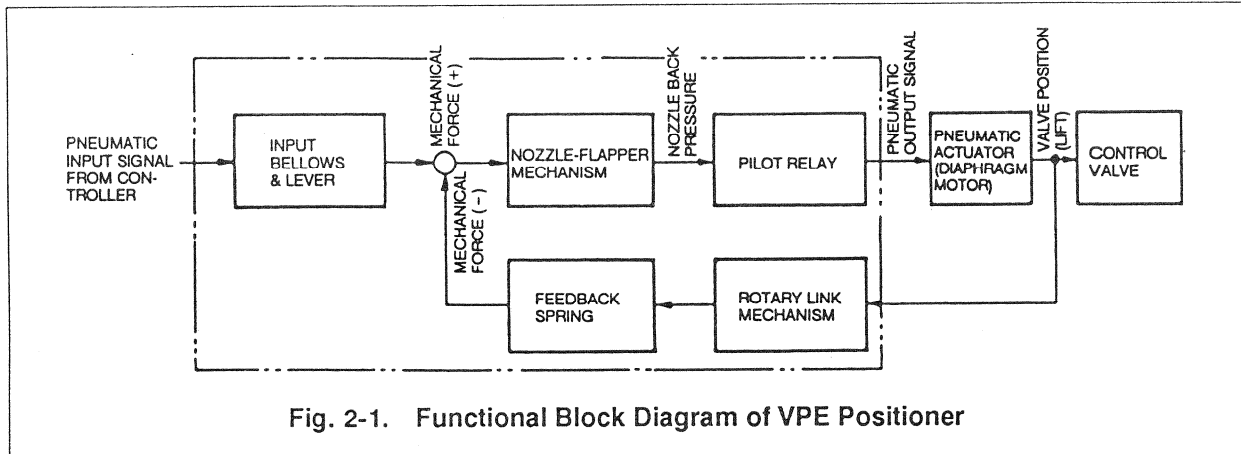


Fig. 2-1. Functional Block Diagram of VPE Positioner

The VPE positioner can be used in conjunction with either a direct action type (air-to-open type) or a reverse action type (air-to-close type) of pneumatic actuator. The operating principles of the positioner is explained in the following for the latter type of actuator. The same principles apply also to the former type of actuator, with the only difference that the directions of the feedback springs are in the reverse between the two types. For the procedure of coupling the positioner to an actuator, see Section III "INSTALLATION".

The operating principles of the actuator are as shown in Fig. 2-2 and explained in the following.

Assume that pneumatic input signal (P_{in}) fed from the controller has increased. The input bellows ① expands, the expansion movement is conveyed via the lever ② to the nozzle-flapper mechanism ③, the nozzle-flapper gap is reduced, and the nozzle back pressure (P_n) increase. The increased nozzle back pressure is amplified by the pilot relay ④ in a quick response into a pneumatic output signal pressure (P_{out}) which is fed to the actuator. The P_{out} exercises its force on the actuator diaphragm ⑤, thereby moving upward the actuator stem ⑦ overcoming the force of the springs ⑥. The upward movement of the actuator stem ⑦ is fed back to the lever ② through the rotary link mechanism ⑧ and feedback spring ⑨, thereby applying to the lever a force which is in the negative direction with respect to the direction of the original movement of the lever and letting it balance in the position where the actuator stem position conforms with the pneumatic input signal pressure (P_{in}).

Due to the above feedback mechanism, even when the valve position (stem position) is disturbed by disturbances such as pressure change of the controlled flow medium, the valve position is automatically and rapidly restored to the original position (balanced position) by feeding the change back to the lever ② through the rotary link mechanism ⑧ and feedback spring ⑨.

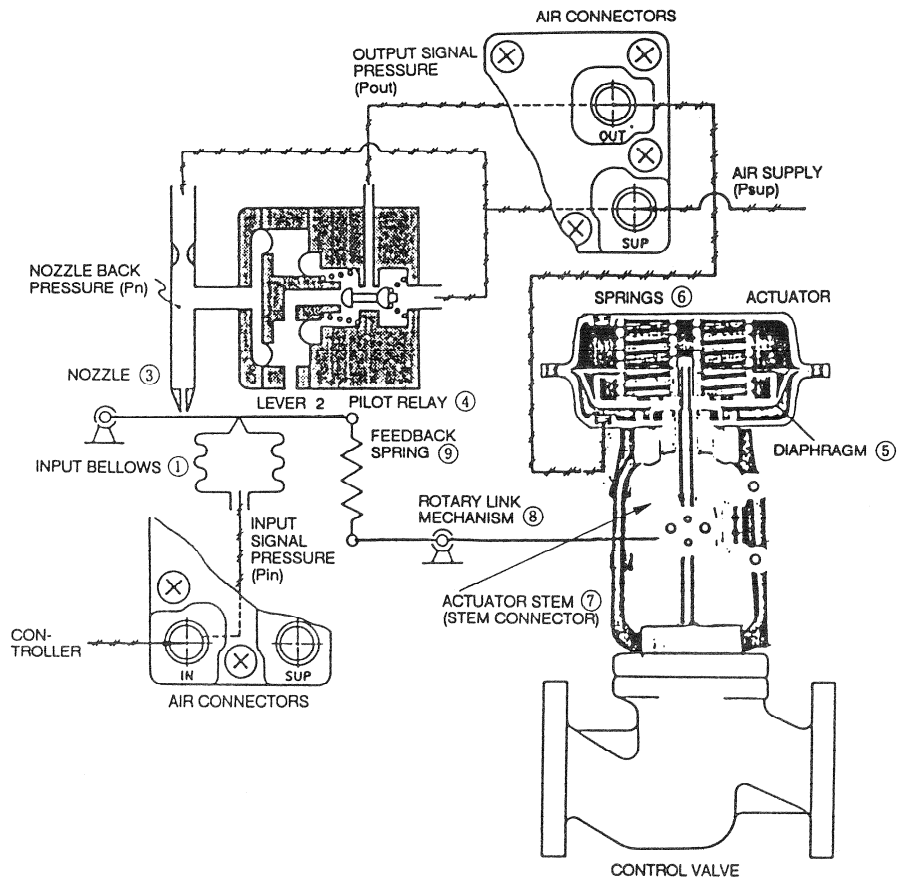


Fig. 2-2. Functional Schematic Diagram of VPE Positioner

III. INSTALLATION

When the VPE positioner is ordered together with a control valve, the positioner is delivered to you already installed on the control valve and adjusted. When the positioner is ordered separately, it should be installed on a control valve and adjusted for yourself as explained in this section and as explained in Section IV "ADJUSTMENT."

1. Mounting Kit

Be sure that the parts for mounting the positioner are present as indicated in Section 3.3 "Mounting Kit".

2. Installing the Positioner Arm

- (a) The procedure for mounting the positioner differs depending on whether the actuator is the direct action type or the reverse action type. Confirm the type referring to the nameplate of the actuator.
- (b) Remove the cover of the casing by removing its two hex socket head screws (M5) using a hex bar wrench. (See Fig. 1-1.)
- (c) Loosen the coupling between the arm assembly and the shaft by loosening the hex socket head screw (M3).
- (d) If the actuator is the direct action type, fix the mechanism with the hex socket head screw (M3) in the layout that the roller of the arm assembly is located on the left hand side of the shaft as viewed in the direction as shown in Fig. 3-1, if the actuator is the reverse action type, fix it in the layout that the roller is located on the right hand side.

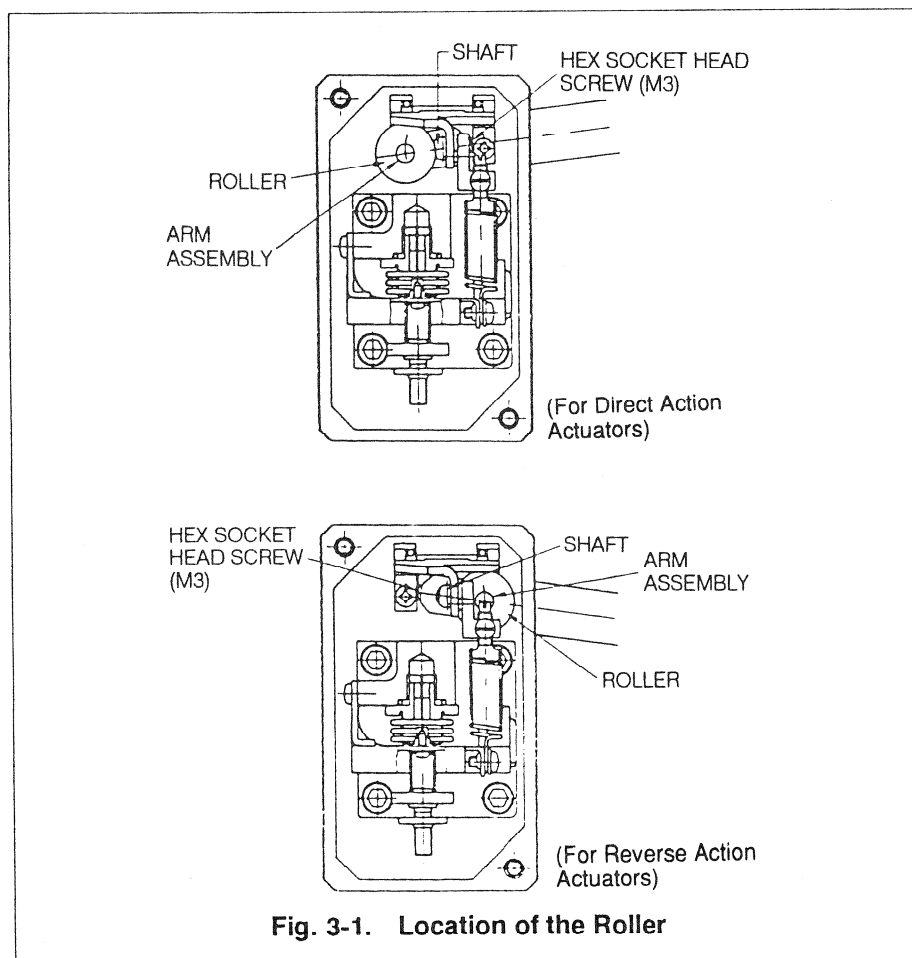


Fig. 3-1. Location of the Roller

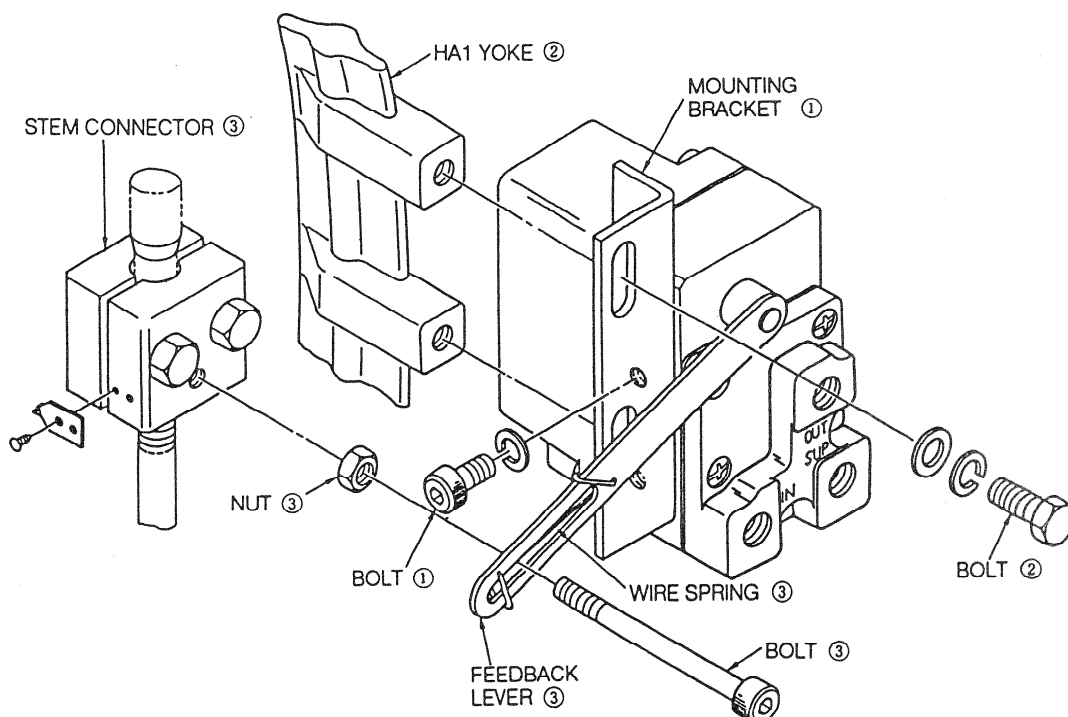
3. Mounting the Positioner on an Actuator

For the states of the positioner mounted on an actuator, see Fig 3-4 or 3-5.

3.1 Mounting the Positioner on an HA1 Actuator

3.1.1 Mounting Procedure

- ① Fix the mounting bracket with the two hex socket head bolts (M6, 14 mm long) and two washers onto the positioner side plane by means of its two screw-threaded holes (M6).
- ② Fix temporarily the positioner to the yoke seat of the actuator by means of the oblong holes of the mounting bracket and with two hex socket head bolts (M8, 16 mm long) and with a flat washer and spring washer for each bolt. (The positioner is to be fully tightened after its position adjustment is over.)
- ③ Pass the hex socket head bolt (M6, 75 mm long) through the oblong hole of the feedback lever and fix the bolt to the screw-threaded hole (M6) of the stem connector, in such layout that the wire spring of the feedback lever is positioned underside of the hex socket head bolt.



The numbers enclosed in the circlets denote the item numbers of the above text.

Fig. 3-2. Mounting the Positioner onto an HA1 Actuator

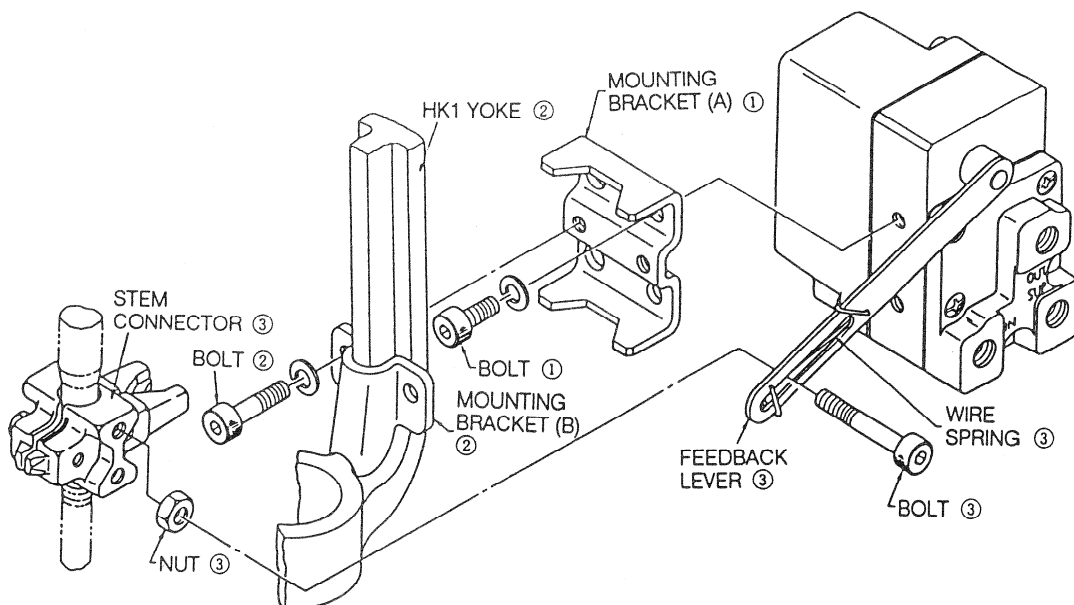
3.1.2 Position Adjustment

- ① Provide a pneumatic input signal source (employing a pressure regulator, for example) for the actuator. Do not connect any air piping to the actuator yet.
- ② Adjust the actuator lift to the 50% position by adjusting the input signal pressure. Under this state, adjust the vertical position of the positioner so that the feedback lever becomes horizontal (level). Fully tighten the hex socket head bolts (M8, 16 mm long) which has been fixed temporarily.
- ③ Disconnect the test air piping and connect the regular air piping.

3.2 Mounting the Positioner on an HK1 Actuator

3.2.1 Mounting Procedure

- ① Fix the mounting bracket (A) with the two hex socket head bolts (M6, 14 mm long) and two spring washers onto the positioner side plane by means of its two screw-threaded holes (M6).
- ② Fix temporarily the positioner to the actuator by clamping the yoke between the mounting brackets (A)/(B) and with the two hex socket head bolts (M6, 250 mm long) and two spring washers. (The positioner is to be fully tightened after its position adjustment is over.)
- ③ Pass the hex socket head bolt (M6, 38 mm long) through the oblong hole of the feedback lever and fix the bolt to the screw-threaded hole (M6) of the stem connector, in such layout that the wire spring of the feedback lever is positioned underside of the hex socket head bolt.



The numbers enclosed in the circlets denote the item numbers of the above text.

Fig. 3-2. Mounting the Positioner onto an HK1 Actuator

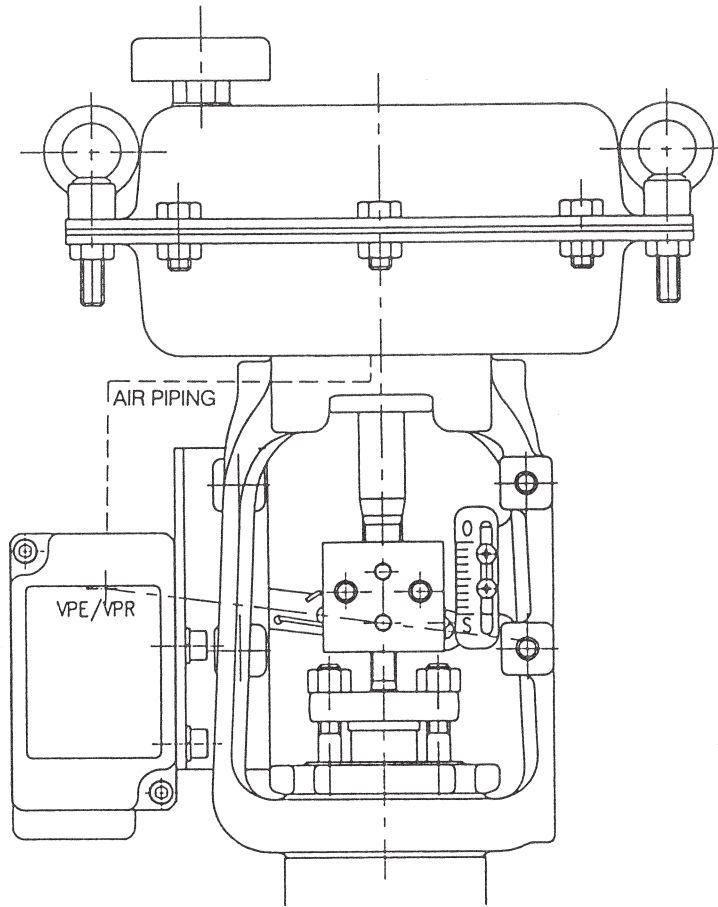


Fig. 3-4. VPE Positioner Mounted on HA1R Actuator

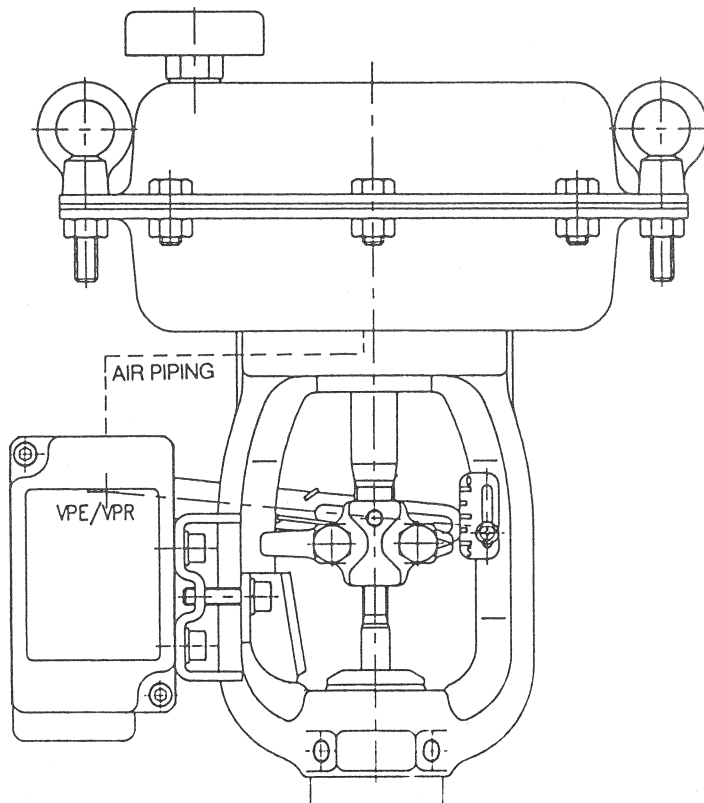


Fig. 3-5. VPE Positioner Mounted on HK1R Positioner

3.2.2 Position Adjustment

- ① Provide a pneumatic input signal source (employing a pressure regulator, for example) for the actuator. Do not connect any air piping to the actuator yet.
- ② Adjust the actuator lift to the 50% position by adjusting the input signal pressure. Under this state, adjust the vertical position of the positioner so that the feedback lever becomes level (horizontal). Fully tighten the hex socket head bolts (M8, 16 mm long) which have been fixed temporarily.
- ③ Disconnect the test air piping and connect the regular air piping.

3.3 Mounting Kit

The kits for mounting the positioner on an HA1 or HK1 positioner is shown in Table 3.1. These kits are supplied as optional items. These kits do not include pipes and elbows for pneumatic input signal piping from the controller to the positioner or for air supply piping.

Table 3.1

For HA1				For HK1			
Parts	Dwg. No.	Q'ty	Remarks	Parts	Dwg. No.	Q'ty	Remarks
Mounting bracket	82590215-101	1		Mounting bracket (A)	82590117-101	1	
Hex bolts	82592042-164	2	M8 × 16 l	Mounting bracket (B)	82590121-101	1	
Hex socket head bolts	82592093-164	2	M16 × 14 l	Hex socket head bolts	82592093-364	2	M6 × 25 l
Hex socket head bolt	82592628-164	1	M6 × 75 l	Hex socket head bolts	82592093-164	2	M6 × 14 l
Spring washers	82592133-164	2	M6 × 1.5 t	Hex socket head bolts	82592093-564	1	M6 × 38 l
Spring washers	82592133-264	2	M8 × 2 t	Spring washers	82592133-164	4	M6 × 1.5 t
Flat washers	82592130-364	2	M8 × 1.6 t	Hex nut	82592113-164	1	M6 × 3.6 H
Hex nut	82592113-164	1	M6 × 3.6 H				

3.4 Air Connections

Three air connectors (IN, SUP, OUT) are provided on the rear of the positioner (see Fig. 1-2). These connectors are of Rc1/4. Connect copper tubes to these connectors using union joints.

Precaution: Use liquid packing for sealing of the connections. Do not use seal tape.

IV. ADJUSTMENT

When the VPE positioner is ordered together with a control valve, the positioner is delivered to you already installed on the control valve and adjusted. When the positioner is ordered separately, it should be installed on a control valve and adjusted for yourself as explained in Section III "INSTALLATION" and adjusted in the following procedure.

- ① Be sure that the positioner is mounted in the correct position (refer to Section III "INSTALLATION").
- ② Set the air supply pressure at a specified value (140 kPa {1.4 kgf/cm²}, for example).
- ③ Set the pneumatic input signal pressure fed from the controller at 20 kPa {0.2 kgf/cm²}. Adjust the mechanism with the ZERO ADJ screw so that the mechanism starts moving with this pressure.
- ④ Set the pneumatic input signal pressure fed from the controller at 100 kPa {1.0 kgf/cm²}. Check that the valve stem is at the full span of stroke. If it is not at this position, loosen the lock screw of the SPAN ADJ screw and adjust the span by turning the SPAN ADJ screw with a screwdriver.
- ⑤ Repeat the procedures of steps ③ and ④ until both requirements are met simultaneously (for a few times, typically).
- ⑥ After the above adjustment is over, tighten the lock screw of the SPAN ADJ screw.

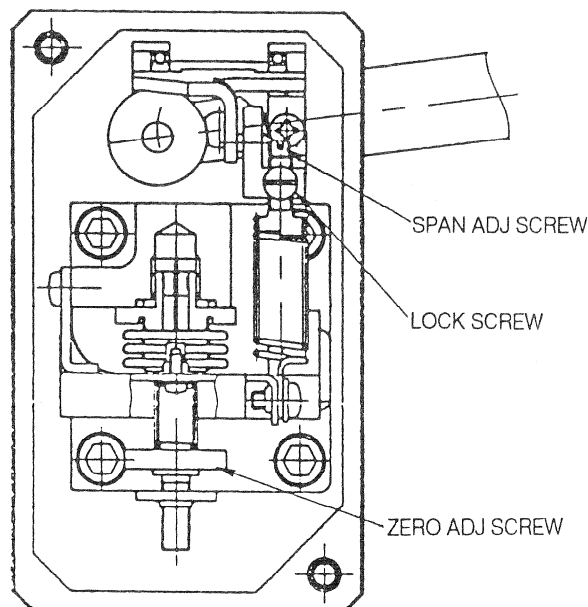


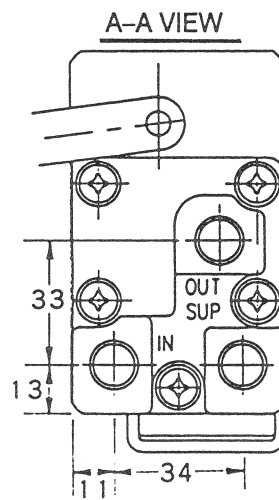
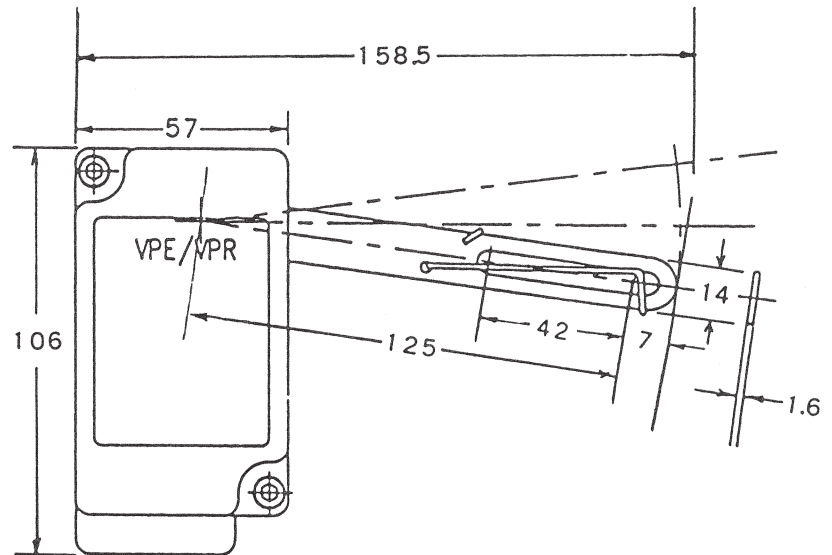
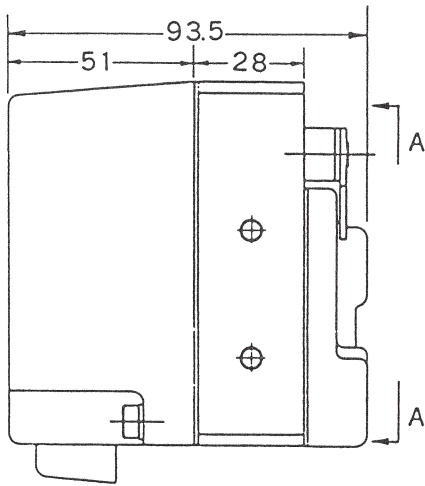
Fig. 4-1. Locations of ZERO ADJ and SPAN ADJ Screws

V. MAINTENANCE

To prevent troubles of the positioner, observe the following instructions:

1. For the air supply, provide a clean and dry compressed air. Note that dust and moisture contained in the air supply can cause malfunctioning of the nozzle-flapper mechanism and the pilot relay.
2. When the positioner is installed outdoors, installed the positioner in the upright direction to prevent ingress of water into the positioner casing.
3. Do not attempt to repair the nozzle-flapper, pilot relay, and other critical mechanisms of the positioner for yourself. Please order your Yamatake Corporation agent for repair.

DIMENSION DRAWINGS



Document Number :	OM2-8310-0410
Document Name :	Pneumatic Single Action Positioner Model : VPE 04/05 User's Manual

Date :	3rd edition: Mar. 2013
Issued / Edited by :	Azbil Corporation

Azbil Corporation