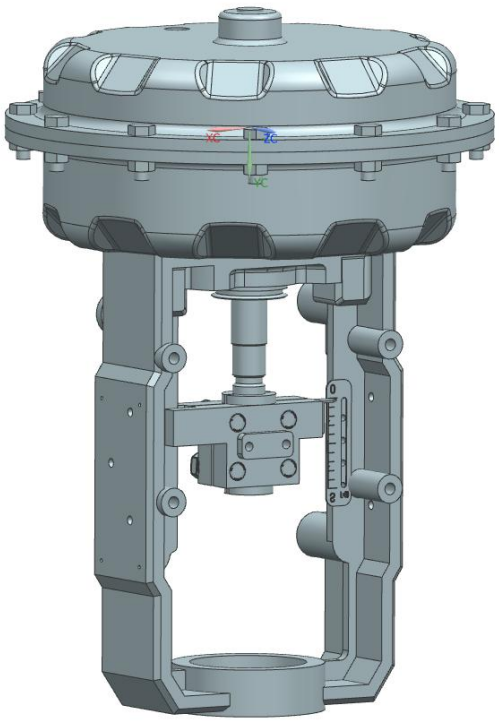
Product Manual

HA

Pneumatic Linear-stroke Diaphragm Actuator



Chongqing Chuanyi Control Valve Co., Ltd.

Preface

Introduction

- This manual applies to the instructions for the use of HA pneumatic linear-stroke diaphragm actuators. If combined with valves and control components, detailed information about their body construction, working principle, installation, and maintenance—such as valve and control elements—can be found in their respective manuals.
- Users are advised to thoroughly review and comprehend this Manual prior to operation. After successful commissioning, equipment operators and maintenance personnel shall retain this Manual in an accessible location for future reference.
- This Manual covers key topics, including the construction, working principle, technical parameters, installation, manual operation, maintenance, transportation, and storage.
- As research and improvements on actuators are ongoing, the contents of this instruction manual may not fully align with the specifications of the purchased product. Should you have any inquiries regarding the product or this Manual, please contact the following departments:

  Sales Department: TEL: 023-67032525, 67032526, 67032527 FAX: 023-67032523

Safety Precautions

- Thoroughly read and fully understand the safety precautions outlined in this Manual before operating the equipment.

Terms and Definitions:

Terms used in this Manual identify actions that, if ignored, may result in bodily injury or property damage.

WARNING
This term warns of potential hazards that could lead to significant personal injury if not properly addressed.

CAUTION
This term warns of potential hazards that may lead to minor injuries or undesirable outcomes if not properly addressed.

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1. Overview

The HA pneumatic linear-stroke diaphragm actuator features a multi-spring diaphragm design, offering benefits such as compact size, light weight, high performance, and significant output force. The actuator converts the output pressure of the pneumatic regulating instrument into push rod displacement variation. By appropriately connecting with the valve body of the control valve, the valve core moves to a position corresponding to the input signal. This provides a crucial driving solution for linear-stroke control valves.

2. Structure and Working Principle

According to the working principle, HA actuators are categorized as direct-acting and reverse-acting types, illustrated in Figures 1 and 2 below.

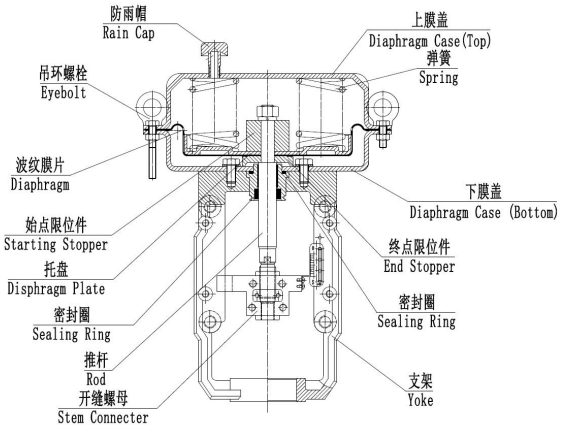


Figure 1 Reverse Action Structure Diagram

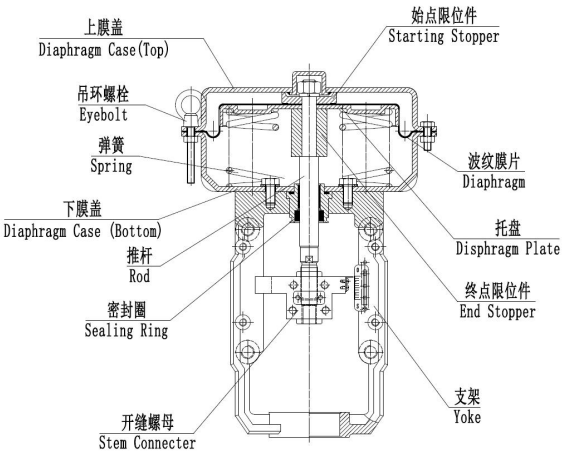


Figure 2 Direct Action Structure Diagram

Structure: It mainly consists of top and bottom diaphragm cases, diaphragms, diaphragm plate, rod, spring, end stopper, starting stopper, yoke, stem connector and other parts.

Working principle: Applicable exclusively to "upper opening and lower closing" linear-stroke valves

Reverse action: Compressed air enters the air chamber through the bottom diaphragm case, exerting an upward thrust on the diaphragm and diaphragm plate components, while simultaneously compressing the spring, causing upward movement. The push rod within the diaphragm plate component is connected to the valve stem using the stem connector, facilitating the valve's opening. Movement ceases when the end stopper contacts the top diaphragm case, indicating the valve is fully open. When the air supply is interrupted, the spring reverts to its initial state, applying downward thrust to the diaphragm and diaphragm plate components to close the valve. Full closure occurs when the valve core contacts the valve seat.

Direct action: Contrary to reverse action, compressed air enters the air chamber from the top diaphragm case, exerting a downward force on the diaphragm and diaphragm plate components, compressing the spring to move

downward together. The push rod attached to the diaphragm plate connects to the valve stem through the stem connector, thereby closing the valve. When the valve core contacts the valve seat, the valve is fully closed. When the air supply is cut off, the spring resets, generating an upward force on the diaphragm and diaphragm plate components, thereby opening the valve. When the starting stopper contacts the top diaphragm case, motion ceases, placing the valve in the fully open position.

3. Technical Parameters

Type	Pneumatic linear-stroke diaphragm actuator
Model	Direct action: HA11D, HA21D, HA31D, HA3XD, HA41D, HA42D, HA51D, and HA61D Reverse action: HA11R, HA21R, HA31R, HA3XR, HA41R, HA42R, HA51R, HA61R
Stroke	HA11：14.3mm；HA21：14.3~25mm；HA31：14.3~38mm；HA3X：14.3~50mm；HA41：14.3~75mm；HA42：14.3~75mm；HA51：50~100mm；HA61：75~120mm
Air source pressure	HA11~41: 300~500kPa; HA51~61: 300~550kPa, as per the nameplate specification
Ambient temperature	Standard type: -30°C to +70°C High temperature type: -15°C to +120°C Low temperature type: -40°C to +70°C Ultra-low temperature model: -52°~+70°C
Accessories	Positioner, air filter pressure reducer, lock-up valve, travel switch, etc.

4. Installation Requirements

4.1 Hoisting

WARNING

During hoisting operations, strictly adhere to these guidelines to prevent situations that may result in significant personal injury.

- The **lifting rings** on the actuator are solely for hoisting the actuator and must not be used for lifting the valve assembly as a whole;
- It is strictly forbidden to hoist the control elements or air source fittings located on the surface of the actuator.
- The hoisting machinery meeting the law of labor safety and health should be used for loading, unloading, and handling. Do not stand or operate the hoisting machinery under the hoisting objects.
- When hoisting or assembling the valve, operations must be performed with the air supply turned off, as working with the air supply on may result in safety hazards.

4.2 Installation

(1) The assembly of the actuator with the components of the body must follow the instructions of the valve manual. Make sure that the bolts are securely tightened when connecting to the valve or yoke, with no signs of loosening.

(2) The actuator must not be operated during installation to prevent potential injuries.

(3) Adequate space should be maintained above the actuator to facilitate its replacement.

(4) The standard installation approach involves mounting the actuator vertically atop the valve. When installed horizontally, the diaphragm assembly's supporting force fully acts on the rod, which may lead to rod wear, abrasions, abnormal operational noises, immobilization, or seal damage resulting in air leakage (the larger the model, the greater the diaphragm assembly's weight, exacerbating these issues). For certain valves that require horizontal installation, utilizing supports can mitigate uneven wear on valve internals, actuator wear, abnormal noises, and air leakage, as detailed below:

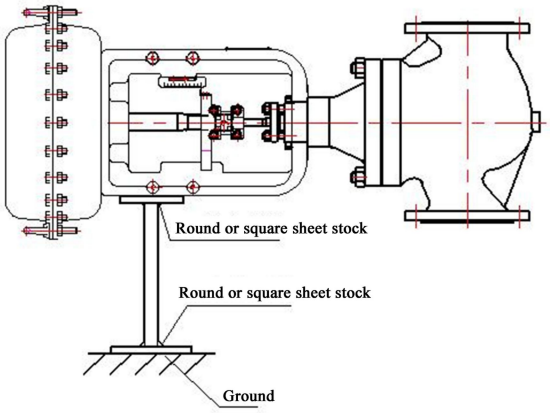


Figure 3: Schematic Diagram of HA1~4 Horizontal Installation Support

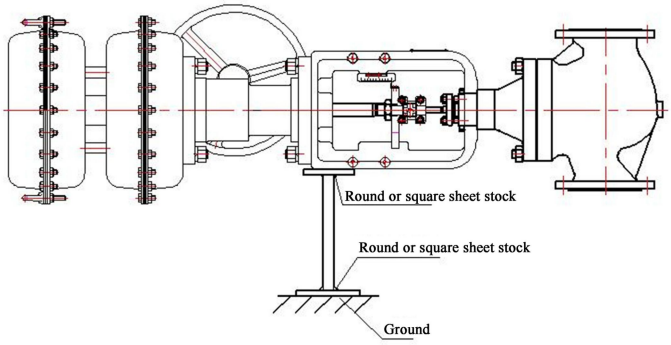


Figure 4: Schematic Diagram of HA42 Horizontal Installation Support

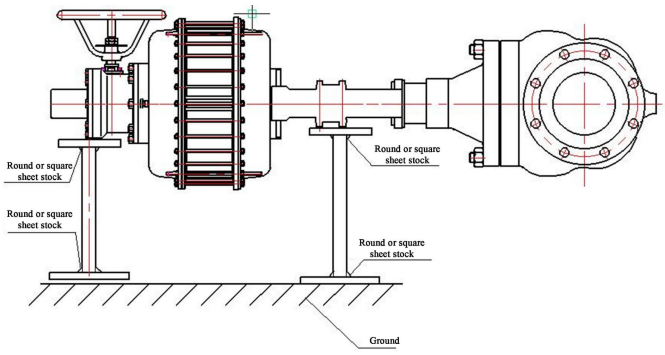


Figure 5: Schematic Diagram of HA5 Horizontal Installation Support

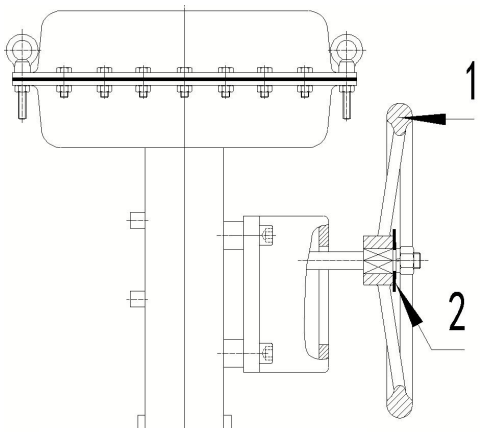
5. Manual Operation

5.1 SHM Side-mounted Handwheel

Before manual operation, disconnect the air supply. Manual mode and pneumatic mode cannot be

used simultaneously.

5.1.1 Direct Action (SHM)



Applicable to

Pneumatic → Manual (Note: Close clockwise, open counterclockwise)

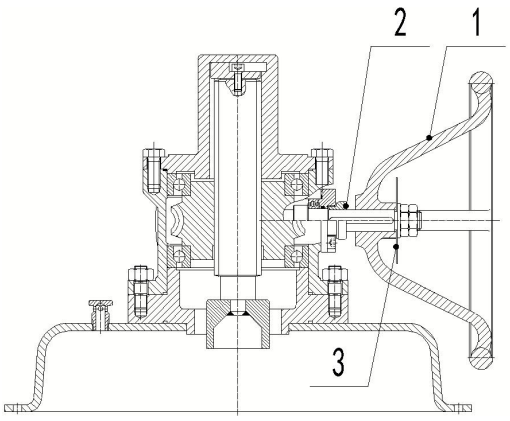
① Rotate the handwheel disk 1 in the direction indicated on the label plate 2 (clockwise). The handwheel disk moves downward along the slot until the operation force of the handwheel disk suddenly increases. At this moment, the valve is in manual operation mode.

② Continue rotating clockwise; The valve gradually moves to a fully closed position from open. Rotate counterclockwise to reset upward; under spring tension, the valve gradually reopens from closed to fully open.

Manual → Pneumatic

① Rotate the handwheel disk 1 counterclockwise upwards until the operating force of the handwheel disk suddenly decreases. At this moment, the indicator points to the highest scale mark on the travel plate (observable from the back of the handwheel).

② Continue rotating counterclockwise until motion stops. The operation is then complete and the pneumatic system can be activated.



Applicable to HA5

Pneumatic → Manual (Note: Close clockwise, open counterclockwise)

① Pull out the locking mechanism 2.

② Rotate the handwheel disk 1 clockwise until the handwheel disk operation force suddenly increases. At this moment, the valve is set to manual operation mode.

③ Continue to rotate clockwise; The valve will gradually close from open to fully shut. Rotate counterclockwise to reset upward; under the action of the spring, the valve will slowly open from closed to fully open.

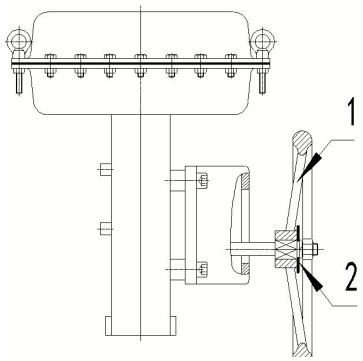
Manual → Pneumatic

① Rotate the handwheel disk 1 counterclockwise upwards until the operating force of the handwheel disk suddenly decreases. At this moment, the indicator points to the highest scale mark on the

travel plate (observable from the back of the handwheel).

②. Continue rotating counterclockwise until further movement is restricted. Then, reset by rotating half a turn clockwise, and reactivate locking device 2. The operation is then complete and the pneumatic system can be activated.

5.1.2 Reverse Action (SHM)



Applicable to HA2~4

Pneumatic → Manual (Note: Open clockwise, close counterclockwise)

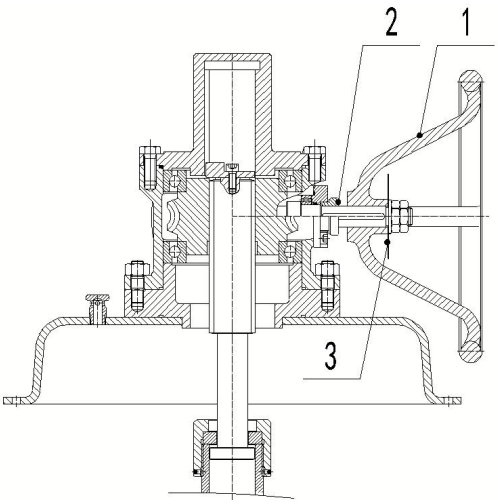
① Rotate the handwheel disc 1 as directed by the arrow on signboard 2 (clockwise). The handwheel disc moves upward along the slider track; upon a notable increase in operating resistance, the valve has entered the manual operation mode.

② Continue to rotate clockwise; The valve will gradually open upward from closed. Rotate counterclockwise to reset downward; under the action of the spring, the valve will slowly close downward from open.

Manual → Pneumatic

① Rotate the handwheel disc 1 counterclockwise until the operating force on the handwheel disc suddenly decreases. At this point, the indicator points to the lowest scale mark on the travel plate (observable from the back of the handwheel).

② Continue to rotate counterclockwise downward until it cannot be turned any further. The operation is then complete and the pneumatic system can be activated.



Applicable

Pneumatic → Manual (Note: Close clockwise, open counterclockwise)

① Pull out locking device 2

② Rotate the handwheel disc 1 counterclockwise until the operating force of the handwheel disc suddenly increases. At this point, the valve is set to manual operation mode.

③ Continue to rotate counterclockwise, allowing the valve to gradually open upward from its closed state. Reset by rotating clockwise downward. Under the spring's action, the valve will gradually close downward from its open state.

Manual → Pneumatic

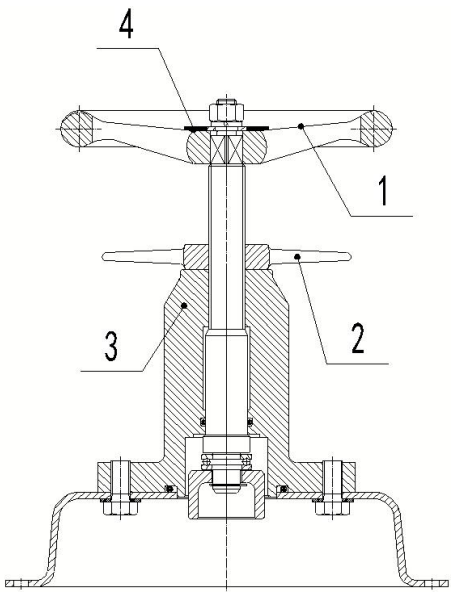
① Rotate the handwheel disc 1 clockwise downward until the operating force on the handwheel disc suddenly decreases. At this point, the indicator points to the lowest scale mark on the travel plate (observable from the back of the handwheel).

② Rotate clockwise downward 3–5 turns to reset locking device 2. The operation is then complete, and the pneumatic system can be activated.

5.2 THM Top-mounted Handwheel

Before manual operation, disconnect the air supply. Manual mode and pneumatic mode cannot be used simultaneously.

5.2.1 Direct Action (THM)



Pneumatic → Manual (Note: Close clockwise, open counterclockwise)

① Loosen the locking handle 2;

② Rotate the handwheel disc 1 clockwise downward until the operating force suddenly increases. At this time, the valve enters the manual operation mode;

③ Continue to rotate clockwise; The valve will gradually close from open to fully shut. Rotate counterclockwise to reset upward; under the action of the spring, the valve will slowly open from closed to fully open.

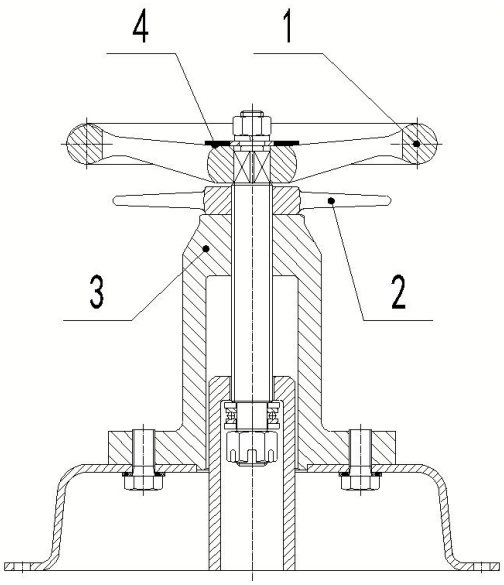
Manual → Pneumatic

① Rotate the handwheel disc 1 counterclockwise upward until the operating force suddenly decreases. At this moment, the indicator points to the highest scale mark on the travel plate (the yoke position is observable).

② Continue to rotate upward until it can no longer be turned, then turn it clockwise downward by a half-turn;

③ Tighten the locking handle 2 to complete the operation, making it ready for pneumatic activation.

5.2.2 Reverse Action (THM)



Pneumatic → Manual (Note: Close clockwise, open counterclockwise)

① Loosen the locking handle 2;

② Rotate the handwheel disc 1 counterclockwise upward until the operating force suddenly increases, indicating the valve is in manual operation mode;

③ Continue rotating counterclockwise to gradually open the valve from the closed position. Rotate it clockwise downward to reset, and under the Spring's action, the valve will gradually close downward from its open position.

Manual → Pneumatic

① Rotate the handwheel disc 1 clockwise downward until the operating force of the disc suddenly decreases. At this moment, the indicator points to the lowest scale mark on the travel plate (the yoke position is observable).

② Continue rotating downward until both the handwheel disc 1 and the locking handle 2 are near the handwheel body 3.

③ Tighten the locking handle 2 to complete the operation, making it ready for pneumatic activation.

6. Maintenance

6.1 Patrol Inspection and Regular Maintenance

6.1.1 Patrol Inspection

(1) Consult on-duty process operators to ascertain the operational status of valves and actuators.

(2) Inspect the auxiliary components of the actuator for irregularities in the supply of air or electricity.

(3) Check the valve and actuator for unusual noises or significant vibrations.

(4) Check the pipelines and connectors of the actuator for signs of looseness or corrosion.

(5) Check the flexibility of the valve and actuator, and ensure timely response to control signal variations.

(6) Promptly contact and address any identified issues.

(7) Document the patrol inspections and organize the records systematically.

6.1.2 Regular Maintenance

(1) Perform external cleaning tasks.

(2) Drain and clean the air supply system, and replace the pressure reducing valve if there is abnormal drainage.

6.2 Maintenance and Replacement of Seals

> ⚠ WARNING
>
> The assembly and disassembly of the actuator must adhere to the following instructions, as failure to do so may result in significant personal injury.
>
> ● Personnel involved in adjusting the pneumatic actuator must possess the necessary safety expertise. For example,
>
> always wear safety equipment suitable for fluids (such as protective clothing, oxygen masks, and safety gloves) in the valve installation area of the pipeline.

6.2.1 Disassembly of Actuator

Refer to Figures 1 and 2 for the dismantling process.

(1) Detach the air piping along with all control components.

(2) Separate the actuator and handwheel from the body as detailed in the valve manual.

(3) Remove the stem connector, indicator, and fastening nut.

(4) Lay the actuator flat on a horizontal workbench, then diagonally dismantle the hex bolts and nuts between the top and bottom diaphragm cases.

(5) Remove the lifting eye nut, and alternately loosen the left and right sides evenly by about 2–3 mm at a time until the spring force is fully released (note: it is essential to turn left and right alternately and evenly).

(6) Remove the diaphragm, diaphragm plate components, and spring from the bottom diaphragm case together. Loosen the fastening nut between the diaphragm plate and the rod, and remove the diaphragm.

(7) Loosen the screw bolts of the diaphragm case and the yoke; Remove the bottom diaphragm case and guide sleeve, and the sealing ring within the guide sleeve.

(8) Thoroughly clean the surfaces of the parts and the sealing ring groove, then arrange them neatly in order after completing the disassembly.

6.2.2 Replacement of Seals

Refer to Figures 1 and 2 to replace the diaphragm and sealing ring.

6.2.3 Actuator Assembly

Before assembly, ensure all parts are free from damage or deformation, the surfaces are clean and tidy, and edges have no sharp corners or burrs. Proceed to assemble in the following order.

(1) Apply a layer of lubricating grease of at least 2 mm thickness onto the inner surface bushing and the sealing ring's surface in the guide sleeve, then insert the guide sleeve into the yoke.

(2) Assemble the diaphragm, rod, diaphragm plate, starting stopper, end stopper, sealing ring, etc., into a

diaphragm assembly for standby use.

(3) Place the guide sleeve into the yoke, install the bottom diaphragm case and sealing ring onto the yoke, and secure them with screw bolts and sealing washers.

(4) Reverse action: Coat the surface of the rod with a layer of lubricating grease exceeding 2mm. Subsequently, place the diaphragm and diaphragm plate assembly wholly into the bottom diaphragm case, aligning the diaphragm holes with the flange holes of the bottom diaphragm case. Then assemble the spring seat and spring onto the diaphragm plate.

Direct action: Assemble the spring seat and spring within the bottom diaphragm case. Apply a layer of lubricating grease exceeding 2mm onto the push rod's surface. Install the diaphragm and diaphragm plate assembly on the spring, aligning the holes of diaphragm with those of bottom diaphragm case.

(5) Install the top diaphragm case and securely tighten it using the eyebolts. Note: Tighten the left and right bolts alternately and evenly by approximately 2–3 mm each, until the distance between the top and bottom diaphragm cases is less than 5 mm.

(6) Install additional hex bolts and hex nuts, tightening them diagonally. Afterward, perform another tightening cycle (including the eyebolts), conduct the reverse action steps, and install the rain cap.

(7) Install the stem connector and the indicator.

(8) Inspect the overall installation position. Ensure air ventilation through the intake for operational testing. The installation is considered valid if no abnormal noise or jamming occurs.

(9) Conduct a pressure retention test for the actuator's air tightness, completing the assembly after replacing the sealing components.

6.3 Common Faults and Troubleshooting

Fault status	Main causes	Troubleshooting
The valve does not act or acts slowly	(1) Low air source pressure (2) Blockage or leakage of air piping (3) Actuator fault, such as piston air leakage (4) Abnormal accessories: positioner, solenoid valve, etc.	(1) Supply specified air pressure (2) Clean and reinforce the connecting parts before piping (3) Replace the O-ring (4) Apply the specified air pressure to the actuator air source interface without connecting accessories. If there is no abnormality, adjust the positioner again or check and replace other accessories.

Unstable motion with abnormal noises or vibrations	(1) The thrust force of the actuator is too small, and the change in medium pressure causes insufficient thrust force. (2) Spring issues including breakage, bending, or internal jamming (3) Positioner signal variation (4) Variation in supply pressure (5) Failure of pressure reducing valve	(1) Increase air intake pressure or replace with a larger actuator. (2) Dismantle, inspect, and replace the spring cylinder components. (3) Adjust various settings of the positioner and check the signal system. (4) Confirm or replace the diameter of air supply piping (5) Repair or replace the pressure reducing valve.

7. Transportation and Storage

7.1 Precautions for Safe Transportation and Lifting

Before storage and transportation, verify that all markings are complete, correct, and legible. Make sure that the packaging box is intact, securely fastened, and undamaged. Confirm that the packaging box and contents are safe and reliable.

During transportation, handle and position the items with care to avoid damage. Throwing, sliding, or collision is prohibited. Ensure all markings remain intact, and avoid exposure to moisture or damage to components.

7.2 Storage Requirements for Seals

Store the diaphragm and sealing ring in a light-protected environment with a temperature range of 15–25°C and a humidity level of 55–75%.

7.3. Storage

(1) Before installation onto the pipe, the valve must be packed and stored.

(2) Avoid safekeeping in:

a. Places with rain;

b. Places with temperature exceeding 60°C;

c. Places with much dust;

d. Places with high humidity;

(3) If packaging is removed for performance inspection during acceptance, ensure proper repackaging until installation begins;

(4) Please do not open the plugs and covers of air piping interfaces and electrical wiring interfaces before the commencement of air piping works and electrical wiring works.

8. Ordering Instructions

(1) Actuator specifications (including size, stroke, operation mode, spring specifications, etc.), control components (positioner, pressure reduction valve, etc.):

(2) Air supply pressure;

(3) The typical ambient temperature ranges are categorized as standard (-20°C to +80°C), low (-40°C to 80°C), and high (-15°C to 120°C). For special orders, remarks are required; for ultra-low temperatures, a bespoke selection should align with the product family.

(4) The standard model does not include a handwheel. If a side-mounted handwheel is required, please specify in the notes.

(5) Yokes and connecting pieces are not included for a standard offer. If required, please make remarks.

(6) Spare parts

Address: No. 879 Caihe Road, Caijiagang Town, Beibei District, Chongqing

Chongqing Chuanyi Control Valve Co., Ltd.

Business Contact: Sales Department

Tel: 023-67032525/27/26

Fax: 023-67032523

Post Code: 400707

Version No.: CY11-2025T-01